Del Mar Bluffs Geotechnical Study

Part 1: **Geotechnical Evaluation**
Volume II

prepared for

N C T D
North County Transit District

prepared by

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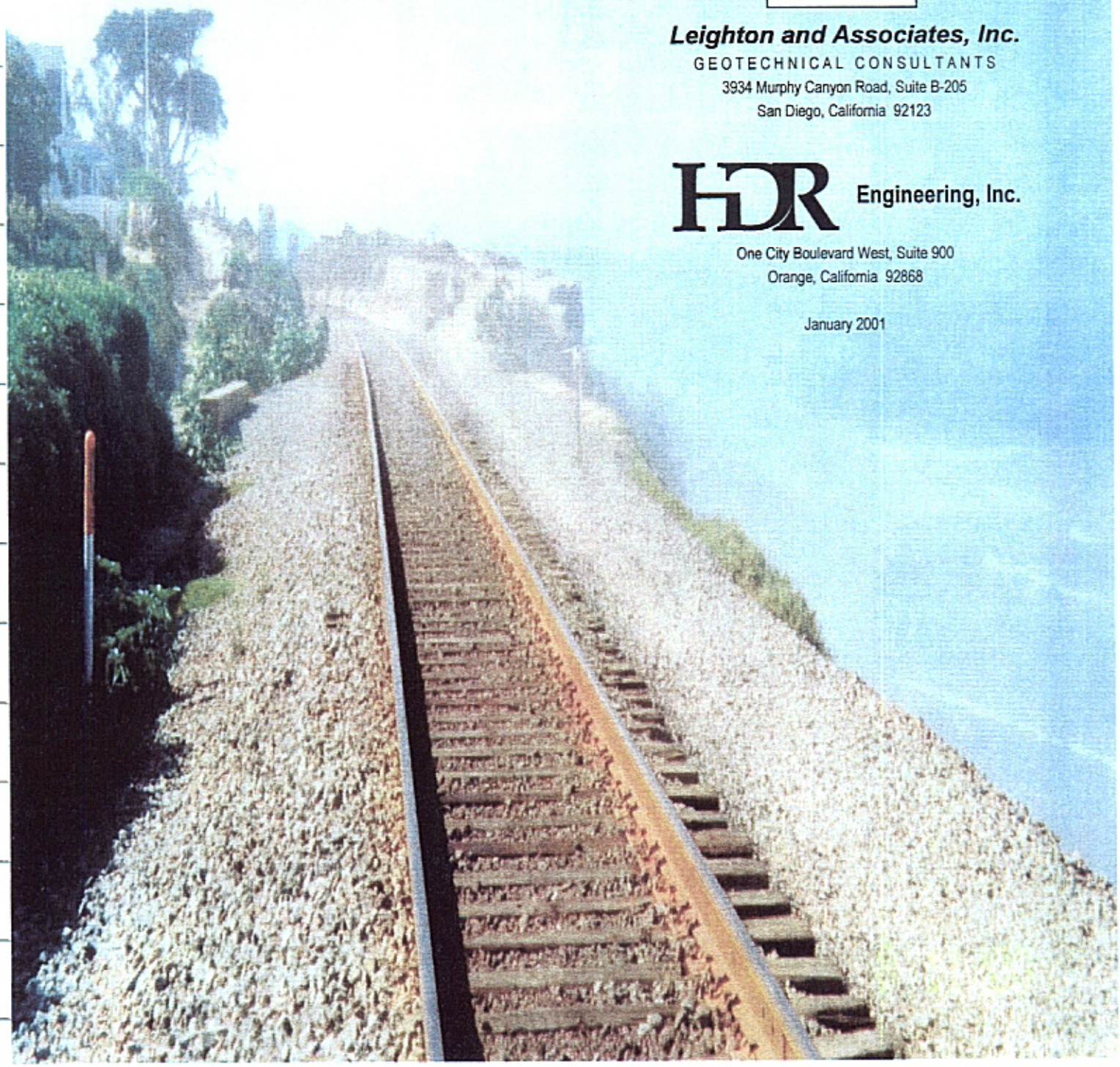

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PART 1 – VOLUME II

APPENDIX D

BORING LOGS

BORING LOGS FROM CURRENT INVESTIGATION

GEOTECHNICAL BORING LOG LB-1

Date 6-13-00 | Sheet 1 of 3
Project HDR/Del Mar | Project No. 040151-001
Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket
Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841#, 60'-90' 2,446# | Drop 12 in.
Elevation Top of Hole 63 ft. | Ref. or Datum See Map

Logged By KTS/RKW
Sampled By KTS

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								BAYPOINT FORMATION (Qbp)
			Bag-1 @2'-4'				SM	@ 0'-5': Light brown, mottled with reddish brown, moist to wet, medium dense, fine to medium SAND with few cobbles; caving, weakly cemented
5							ML	@ 5': Seepage at base of Baypoint Formation, very active
								DELMAR FORMATION (Td)
								@ 5': Light olive-gray, moist, slightly stiff, SILTSTONE
							SM-ML	@ 7': Blue-gray, very damp, slightly stiff to stiff, fine to medium sandy SILTSTONE
			Bag-2 @8'-10'				SM	@ 8.5': Blue-gray, very damp, stiff, silty CLAYSTONE; fractured; approximately 1/2' thick interbedded with gray medium SANDSTONE with subhorizontal laminations below
10			R-1	Push/8" 5/4"			ML/CL	@ 10': Bluish gray, damp, stiff to very stiff, silty CLAYSTONE @ 10.5': Silty CLAYSTONE becomes SILTSTONE
15								
							SM/ML	@ 19': Change in material to dark gray, very damp, dense, silty fine to medium SAND, interbedded with SILTSTONE between 19' and 20'
20			R-2	10			SM	@ 20'-23.5': Light maroon gray, very moist to wet at base, medium dense, medium SANDSTONE; thin clay lenses, subhorizontal laminations
			Bag-3 @21'-23'					@ 20': Light gray, moist, medium dense, silty fine to medium SANDSTONE; grades to slightly coarser sand at tip @ 21'-23': Material same as Sample R-2
								@ 23.5'-24.5': Interbed of dark gray, very damp, very stiff to hard, silty CLAYSTONE; 1' thick, subhorizontal contacts
25							ML/CL	@ 24.5'-26.5': Material same as between 20'-23.5' sand coarsens to base of unit, moisture increases to minor seepage at base. Rip-up clasts of blue-gray SILTSTONE within SANDSTONE
								@ 26': Blue-gray, very damp, slightly stiff, silty CLAYSTONE
							ML	@ 29'-33.5': Light blue/green-gray, damp, hard, very fine sandy SILTSTONE grades to coarse sandy SILTSTONE; iron-oxide mottled
30								

GEOTECHNICAL BORING LOG LB-1

Date 6-13-00 | Sheet 2 of 3
Project HDR/Del Mar | Project No. 040151-001
Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket
Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841#, 60'-90' 2,446# | Drop 12 in.
Elevation Top of Hole 63 ft. | Ref. or Datum See Map

Logged By KTS/RKW
Sampled By KTS

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			R-3	14			ML-SM	@ 32': Light blue gray, very damp to slightly moist, stiff/dense, fine SANDSTONE
								@ 33.5': Planar subhorizontal contact to blue-gray silty CLAYSTONE, fractured, iron-oxide on surfaces, few waxy surfaces, spalling material, possible minor seepage from fractures
35								@ 37': Localized cemented zones
40			R-4	6	110.1	16.6	ML	@ 40': Dark blue-gray, damp, stiff to very stiff, clayey SILTSTONE
								@ 41.5': Increased cementation, mottled yellow and red-brown, oxide staining
								@ 42.5': Blue-gray to dark blue-gray, damp, hard/very dense, very fine sandy SILTSTONE, moderately cemented, reddish oxide staining
45								@ 47'-61': Light gray to dark blue gray, damp, very stiff, clayey SILTSTONE; fractured, lacks continuation
50			R-5	9	110.2	17.0	ML-SM	@ 50': Dark blue-gray, damp, stiff to very stiff, clayey SILTSTONE; massive
55								
60								

LEIGHTON & ASSOCIATES

GEOTECHNICAL BORING LOG LB-1

Date 6-13-00 | Sheet 3 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841#, 60'-90' 2,446# | Drop 12 in.

Elevation Top of Hole 63 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged By KTS/RKW Sampled By KTS
60			R-6	28			ML-SM	@ 60': Light blue-gray, damp to very damp, stiff to very stiff, fine SANDSTONE
			Bag-4 @61'-63'				SM	@ 61': Light brown, medium SANDSTONE with subhorizontal laminations
								@ 62.5': Blue gray to dark blue-gray, damp, hard/very dense, very fine sandy SILTSTONE; moderately cemented
65							CL	@ 65': Light blue-gray, damp, hard silty CLAYSTONE; a few waxy, polished, fractured, surfaces; randomly oriented (Logged to 65')
							ML	
70			R-7	18	111.7	17.3		@ 70': Light blue gray, slightly damp, very stiff to slightly hard, clayey SILTSTONE; massive
								Total Depth = 70 Feet Backfilled/tamped 6/13/00 Upper 5 Feet slurry cap Active seepage at 5 Feet
75								
80								
85								
90								

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GEOTECHNICAL BORING LOG LB-2

Date 6-14-00 | Sheet 1 of 3
Project HDR/Del Mar | Project No. 040151-001
Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket
Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.
Elevation Top of Hole 58 ft. | Ref. or Datum See Map

Logged By KTS/MRS
Sampled By KTS

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							SM	BAYPOINT FORMATION (Qbp) @ 0'-1-1/2': Light brown, very dry, loose, SAND @ 1-1/2': Reddish brown and blue-gray, mottled, very damp to moist, loose to slightly dense, silty SAND
			Bag-1 @3'-5'					
5			R-1				SM	@ 5': Reddish brown, very moist to wet, loose to slightly dense, clayey fine to medium SAND, weakly cemented
							SM	@ 9': Grade to light reddish brown, very moist to wet, loose to slightly dense, very fine to medium SAND, with SILT
10								
							SM	@ 14'-15': Contact at base of Baypoint Formation is extremely undulatory, black staining, scoured/rip-ups of Td in Qbp DELMAR FORMATION (Td) @ 14'-28': Yellow, moist to wet at base, stiff, grades to very dense, silty, very fine SANDSTONE; grades to silty coarse SANDSTONE; seepage at base
15								
20			Bag-2 @20'-22'					@ 20'-22': Light yellow, moist, slightly dense to dense, silty fine to medium SANDSTONE
		GB:N85E, 10N	R-2	8				@ 22': Light yellow, wet, dense, silty fine to coarse SANDSTONE; massive @ 23': General bedding attitude on 4" thick lense of dark brown SAND
25		GB:N10E, 9N						@ 26': Pebbly sand lense, 2" thick, heavy free-flowing seepage, general bedding attitude on faint subhorizontal laminations
							ML/CL	@ 28': Slightly undulatory, irregular erosional contact with iron-oxide along contact, material below is gray-brown, damp, stiff, silty CLAYSTONE; iron-oxide, joints, moderately fractured
30								

LEIGHTON & ASSOCIATES

GEOTECHNICAL BORING LOG LB-2

Date 6-14-00 | Sheet 2 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.

Elevation Top of Hole 58 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged By KTS/MRS Sampled By KTS
30							ML	@ 30': Blue-gray, moist, stiff to very stiff, clayey SILTSTONE and siltstone; zones weak of cementation in SILTSTONE material
			Bag-3 @32'-34'					@ 32': Iron-oxide mottling (similar to staining above resistant beds seen in neighboring boreholes)
35								@ 35': Material becomes very hard and competent, cemented
		J:N60W, 33N					SM-ML	@ 39': Material change to blue-gray, very damp, very stiff to hard, clayey SILTSTONE to siltstone; randomly, fractured with waxy polished surfaces, non planar, slightly random, weakly cemented
40		J:N10E, 20S J:N55W, 42S						@ 40': Generalized joint/fracture attitudes, decrease in fractures below, more competent
45			R-3	9				@ 45': Blue-gray, damp, stiff to very stiff, SILTSTONE with clay; massive
50								Downhole logged to 50'
						▽		All tailings to T.D. are blue-gray clays and silts with iron-oxide bands, and extremely wet due to seepage above
55								
60								

GEOTECHNICAL BORING LOG LB-2

Date 6-14-00 | Sheet 3 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.

Elevation Top of Hole 58 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
60								Logged By KTS/MRS Sampled By KTS Total Depth = 60 Feet Backfilled and tamped 6/14/00 5 feet slurry cap Water at 27 feet; standing water at 53 feet at time of backfill
65								
70								
75								
80								
85								
90								

GEOTECHNICAL BORING LOG LB-3

Date 6-14-00 | Sheet 1 of 3
Project HDR/Del Mar | Project No. 040151-001
Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket
Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.
Elevation Top of Hole 59 ft. | Ref. or Datum See Map

Logged By KTS/MRS
Sampled By KTS

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							SM	BAYPOINT FORMATION (Qbp) @ 0'-10': Reddish brown, damp to wet at base, slightly dense, clayey medium SAND grades to silty medium to coarse sand at base; seepage at base, boring is belling
5			R-1	Push	103.0	12.0	SM-SC	@ 5': Reddish brown, very moist to wet, loose to slightly dense, clayey SAND; lacks cementation
		CS:N50E, 14N						@ 9'-10': Zone of generally undulatory contact, rip-ups of Td within Qbp (8" diameter, dark brown, rip-up 1' above contact), few cobbles, dark brown staining
10							ML	@ 10': Clay seam attitude, paper thin, along contact DELMAR FORMATION (Td) @ 9.5'-10.5': Light yellow, very moist to wet, slightly stiff, SILTSTONE; very weakly cemented, mottled iron-oxide
		J:N65W, 35S J:E-W, vertical						@ 10.5': Material change to green/blue-gray, very damp, soft to slightly stiff, silty CLAYSTONE; randomly oriented fractures, polished, waxy surfaces, iron-oxide on surfaces, seepage between fractures, material spalling, joint attitudes
15								@ 13.5': Gradual change to gray, damp, stiff, SILTSTONE
		J:N60W, 14S						
		S:N70E-60W, 25-35N					ML-CL	@ 18': Zone of CLAYSTONE with shears (remolded clay surfaces along similar orientation), iron-oxide on surfaces around portion of hole only, moisture in fractures, purple-brown staining (mottled), shear attitude, joint attitude
20		J:N34E, 38S					ML	@ 20': Blue-gray and yellowish gray, mottled SILTSTONE
		C:horizontal						@ 22': Horizontal contact to reddish brown, silty SAND, lenses of light sand at 25' and 27', 2" and 6" thick, respectively
25			R-2	8	117.4	11.5	ML-SM	@ 25': Blue-gray, damp, stiff to very stiff, SILTSTONE with very fine SAND; massive, weak to moderately cemented
								@ 26': Blue-green gray, damp, very stiff, silty CLAYSTONE; short, random non-planar; waxy fractures
		GB:N30E, 5N					SM	@ 28': General bedding attitude, blue-gray silty fine to medium SANDSTONE; 8" thick with dark green laminations
30							ML-CL	@ 29': Blue/green-gray very fine sandy SILTSTONE, grades to silty CLAYSTONE; randomly fractured with waxy, polished surfaces,

GEOTECHNICAL BORING LOG LB-3

Date 6-14-00 | Sheet 2 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.

Elevation Top of Hole 59 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged By KTS/MRS Sampled By KTS
30								iron-oxide, reddish mottled staining to 32.5'
							ML-SM	@ 32.5': Light blue-gray, moist to wet, hard, SILTSTONE; moderately cemented, dark blue streaks and random, discontinuous polished surfaces
35							ML	@ 36': Light blue-gray, moist, very stiff clayey SILTSTONE; iron oxide and waxy polished surfaces, short, randomly oriented fractures
							ML-CL	@ 38'-46': Blue-gray, very damp (to wet in fractures), very stiff to hard, SILTSTONE and silty CLAYSTONE, zones of random, waxy polished surfaces in clayier material, reddish brown mottled staining
40								
							SC	@ 44': Lense of sandy CLAYSTONE
45			R-3	12	124.7	9.8		@ 45': Blue-gray, damp, very stiff, fine SANDSTONE, minor iron-oxide mottling, weakly cemented
							SC-CL	@ 46': Blue-gray, very damp, stiff, CLAYSTONE, fractures with waxy, polished surfaces, iron-oxide
							SM	@ 47.5': Gray grades to blue/green-gray, moist to wet, dense to very dense, fine grades to coarse SANDSTONE; massive, weakly cemented
50								
							CL	@ 52': Dark gray silty CLAYSTONE, 7" thick, weakly cemented
							SM	@ 53': Brown, damp, slightly dense, fine to coarse SANDSTONE; non-planar, subhorizontal contacts
55							ML-CL	@ 54.5': Blue-gray, silty CLAYSTONE; waxy, polished fractures
							ML-SM	@ 56.5'-65': Gray and brown, mottled, damp, very stiff, sandy SILTSTONE; weakly cemented
60								

GEOTECHNICAL BORING LOG LB-3

Date 6-14-00 | Sheet 3 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.

Elevation Top of Hole 59 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
60								Logged By KTS/MRS Sampled By KTS
65			R-4	23	123.4	11.0		@ 65': Dark gray, dry to damp, hard, very fine SANDSTONE, moderately cemented
								Total Depth = 65 Feet Backfilled and Tamped 6/15/00 5 feet slurry cap Ground water encountered at 10, 12, 20, and 52 feet at time of drilling
70								
75								
80								
85								
90								

GEOTECHNICAL BORING LOG LB-4

Date 6-14-00 | Sheet 1 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841#, 60'-90' 2,446# | Drop 12 in.

Elevation Top of Hole 64 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged By KTS/MRS Sampled By KTS
0							SM-SC	BAYPOINT FORMATION (Qbp) @ 0'-14': Reddish brown, moist to wet at base, loose to slightly dense, SAND with CLAY; seepage at base
5								
10							SM	@ 12'-14': Moderate to active seepage and minor belling
15							SC-SM	DELMAR FORMATION (Td) @ 14'-64': Light yellowish gray, wet at top to moist with depth, soft at top grades to stiff, very fine sandy CLAY, grades to clayey, very fine SANDSTONE
							CL	@ 16': Light greenish gray; moist to wet (from fractures), slightly stiff, silty CLAYSTONE; randomly fractured, iron-oxide
							ML	@ 18': Material becomes cemented, yellowish gray, damp, hard SILTSTONE, mottled iron-oxide, lacks fractures @ 19'-20': Yellow-gray, wet, very dense, silty fine to medium SILTSTONE
20			R-1	6				@ 20': Blue-gray, damp, hard, clayey SILTSTONE; massive, moderately cemented, minor iron-oxide @ 20'-22': Mottled blue-gray CLAYSTONE and yellow-gray SANDSTONE; sheared zone (non-continuous), non-planar features, iron-oxide on surfaces, seepage from fractures @ 22'-25': Yellow-gray, moist to wet at base, dense, silty fine to medium SANDSTONE; weakly cemented, lense of dark gray clay, 2" thick, iron-oxide banding
							SM-ML	
25		J/S:N27W-40W, 32-40S J/S:N45W, 42N					CL	@ 25'-26.5': Greenish gray, very damp to moist, slightly stiff, CLAYSTONE; waxy, polished fractures with iron-oxide joint/shear attitudes on non-continuous features
		GB:N55W, 23S					SM	@ 26.5': Light gray, grades to blue-gray, moist to wet, very dense, very fine sandy SILTSTONE, cemented, general bedding attitude on yellow silt bed, lacks cementation, planar feature
30								

GEOTECHNICAL BORING LOG LB-4

Date 6-14-00 | Sheet 2 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841#, 60'-90' 2,446# | Drop 12 in.

Elevation Top of Hole 64 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged By KTS/MRS Sampled By KTS
30							CL-ML	@ 30': Clay lense in above unit, then coarse SAND at base of unit
		J:N45E, 35N						@ 31': Blue-gray CLAYSTONE with polished waxy surfaces, some iron-oxide, joint attitude, lacks visible voids
								@ 34': Mottled zones of increased SILT content and partial cementation
35		S:N62E, 31S						@ 36': Shear attitude on non-continuous, polished surface
							ML	@ 37'-40': Blue-gray, wet, very dense, SILTSTONE; weakly cemented
40			R-2	8	110.5	18.0		@ 40': Dark blue-gray and mottled reddish staining, damp, hard, CLAYSTONE and silty claystone; random waxy fracture, moderately cemented
								@ 42': Cemented SILTSTONE bed with reddish staining
							ML-CL	@ 44': Slightly fractured CLAYSTONE with polished non-planar surfaces, very weakly cemented
45		J:N20W, 65N						@ 46': Gray, moist to wet, very stiff to hard SILTSTONE; few joints with faint, non-continuous, polished surfaces, attitudes
		J:N20W, 77N						
50								@ 51': Color changes to light blue-gray
		S:N70W, 5-35S					CL	@ 52': Shear attitude, continuous around hole but 1/2 steepens, irregular paper-thin CLAY, fainty polished
55								
							ML-SM	@ 57': Blue-gray, moist, dense/hard, very fine sandy SILTSTONE; weakly to moderately cemented
								(Downhole logged to 59 feet)
60								

GEOTECHNICAL BORING LOG LB-4

Date 6-14-00 | Sheet 3 of 3
Project HDR/Del Mar | Project No. 040151-001
Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket
Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841#, 60'-90' 2,446# | Drop 12 in.
Elevation Top of Hole 64 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
60			R-3	20	112.7	16.4		Logged By KTS/MRS Sampled By KTS @ 60': Blue-gray, damp, very stiff, silty CLAYSTONE
65								Total Depth = 64 Feet Backfilled and tamped 6/15/00 5 feet slurry cap Ground water encountered at 12 and 20 feet at time of drilling
70								
75								
80								
85								
90								

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GEOTECHNICAL BORING LOG LB-5

Date 6-16-00 | Sheet 1 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.

Elevation Top of Hole 55 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged By KTS/MRS Sampled By KTS
0							SM	BAYPOINT FORMATION (Qbp) @ 0'-3.5': Reddish brown, moist (at base), loose to slightly dense, fine to medium SANDSTONE
		C:N40W, 4N					ML-SM	@ 3.5': Contact attitude, generalized non-planar, undulatory, rip-ups of clay in sandstone, light seepage
5								DELMAR FORMATION (Td) @ 3.5': Yellow-orange, very damp to slightly moist, stiff, silty very fine SANDSTONE (grades to silty medium to coarse sandy SILTSTONE), iron-oxide bands
		C:N7W, 6S						@ 6': Blue gray, damp, stiff to very stiff with depth, very fine sandy CLAYSTONE/SILTSTONE (zones); cementation increases with depth, very short, non-planar fractures, decrease at 10', iron-oxide in upper portions
10								
								@ 14': Light brown, moist to wet, dense, very fine to medium SANDSTONE lense, subhorizontal, grades to material above
15								@ 16': Dark blue-gray, very damp, stiff to very stiff, silty CLAYSTONE, few polished fracture surfaces, randomly oriented
		CS:N45E, 1N					ML-CL	@ 17.5': Clay seam attitude, paper thin clay seam, gently undulatory, material below is mottled (rip-ups?), dark gray CLAYSTONE and light gray, fine to medium SILTSTONE; very stiff
								@ 19.5': Interbedded blue-gray, fine to coarse SILTSTONE; wet (light seepage), dense to very dense (slightly cemented at base)
20							CL-ML	@ 20.5': Blue-gray, damp, very stiff to hard, silty CLAYSTONE and claystone; moderately fractured with polished, popouts (non-planar, short), zones of weak cementation
25								
		J/S:N10W, 37S						@ 28': Joint or shear attitude on non-continuous planar, polished surface within CLAYSTONE, black rootlet staining
30								

GEOTECHNICAL BORING LOG LB-5

Date 6-16-00 | Sheet 2 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.

Elevation Top of Hole 55 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged By KTS/MRS Sampled By KTS
30								
								@ 34': Moist zone, lacks continuation below, light seepage
35							ML	@ 35': Paleo-root, black charcoal branch, material below is blue-gray, very damp, slightly stiff, sandy SILTSTONE; massive
								@ 39': Dark gray lense of SILTSTONE with charcoal pieces
40								@ 40': 4" sand lense then organic banded interbedded very fine SAND and CLAY, some charcoal pods, subhorizontal, minor seepage
							ML-SM	@ 41.5'-44.5': Blue-gray, moist to wet at base, stiff, SILTSTONE, grades to very fine sandy SILTSTONE; zones of cementation, seepage
45							SM	@ 44.5'-45.5': Zone similar to 40'; organized banded lenses of SANDSTONE; slightly moist
							ML-SM	@ 45.5': Blue/green, slightly damp, stiff, sandy SILTSTONE
								@ 48.5': Blue-gray, damp, slightly stiff CLAYSTONE; iron-oxide fractures, waxy, polished surface, randomly oriented
50								@ 49': Blue/green, slightly damp, stiff, SILTSTONE
								@ 51.5': Blue-green gray, damp, stiff to hard, silty CLAYSTONE; few waxy fractures with iron-oxide, cemented
55								
60								

GEOTECHNICAL BORING LOG LB-5

Date 6-16-00 | Sheet 3 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.

Elevation Top of Hole 55 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
60								Logged By KTS/MRS Sampled By KTS Total Depth = 60 Feet Backfilled and tamped 6/16/00 5 feet slurry cap Ground water encountered at 20, 34, 44 feet at time of drilling
65								
70								
75								
80								
85								
90								

GEOTECHNICAL BORING LOG LB-6

Date 6-19-00 | Sheet 1 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841#, | Drop 12 in.

Elevation Top of Hole 51 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged By KTS/MRS Sampled By KTS
0							SM-SC	BAYPOINT FORMATION (Qbp) @ 0'-2': Reddish brown, damp, slightly dense, clayey fine to medium SANDSTONE; weakly cemented, non-planar, gradual contact with Td, rip-ups of SILTSTONE, iron-oxide pods, pods of CLAY
							ML	DELMAR FORMATION (Td) @ 2': Mottled gray and light brown in blocky pattern, very damp, slightly stiff, very fine sandy SILTSTONE; increase in cementation with depth
5							SM	@ 6': Mottled blue gray and light brown in blocky pattern, wet, dense, fine to medium SANDSTONE; iron-oxide staining in light brown portions, very minor seepage
		J:N10-50W, 36-43S					ML-CL	@ 8': Green/blue-gray, very damp to wet in fractures, slightly stiff CLAYSTONE with SILT; polished waxy fracture surfaces, non-planar, joint attitudes are range of typical fracture planes
10							SM	@ 9.5': Non-horizontal, non-planar contact with light gray and blue-gray, silty fine to medium SANDSTONE; weakly cemented
		S:N73W, 47N					ML-CL	@ 12': Shear contact attitude at base of 55', below is blue-green CLAYSTONE that immediately grades to gray, very damp, soft to slightly stiff SILT/SILTSTONE; grades to incresed cementation of stiffness below
15								@ 15': Reddish mottled staining
								@ 16': Blue-gray, very damp, slightly hard/dense, silty very fine SANDSTONE/very fine SILTSTONE; moderately cemented
20			R-1	9	120.3	7.1		@ 19.5'-20': Concretion, continuous @ 20': Yellowish gray, very damp, dense, silty fine to coarse SANDSTONE; massive, cemented @ 21': Undulatory contact between blue-gray material and yellowish gray material, weaker cementation at contact, slightly dense to dense, silty fine SANDSTONE, grades to fine to coarse SANDSTONE
25		GB:N30E, 16S						@ 26': General bedding attitude on pebble lense, mostly continuous, possibly offset in portion? minor seepage in lense
		S:N55E, 40S						@ 28': Shear attitude, material is blue-green CLAYSTONE with waxy polished fractures, partially discontinuous, random
30								

GEOTECHNICAL BORING LOG LB-6

Date 6-19-00 | Sheet 2 of 3

Project HDR/Del Mar | Project No. 040151-001

Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket

Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841#, | Drop 12 in.

Elevation Top of Hole 51 ft. | Ref. or Datum See Map

Logged By KTS/MRS

Sampled By KTS

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30							ML-CL	@ 30': Blue and gray mottled, silty CLAYSTONE/SILTSTONE, very moist to wet, mottled, stiff and very stiff, iron-oxide, gradual increase in cementation to 35', some red staining, moderately fractured with few randomly oriented polished surfaces
35								@ 35': Dark blue/green-gray, SILTSTONE; wet, very stiff, reddish staining
							SM-ML	@ 36': Reddish brown, fine SANDSTONE @ 36.5': Same as at 35'
							SM	@ 39': Irregular contact to gray damp, very dense, silty fine to medium SANDSTONE
40			R-2	15	119.7	13.7		@ 40': Blue-gray, very damp, hard/dense, very fine SANDSTONE; massive, weakly to moderately cemented
							CL	@ 41': CLAYSTONE; few random polished surfaces
							CL	@ 44': Mottled red and blue-gray, very hard CLAYSTONE with few random polished surfaces
45								
							SC	@ 49': Very hard in areas, with sand, very few fractures
50								
							SC-SM	@ 51': Increase in sand, very dense, no fractures
55								
60								

GEOTECHNICAL BORING LOG LB-6

Date 6-19-00 | Sheet 3 of 3
Project HDR/Del Mar | Project No. 040151-001
Drilling Co. San Diego Drilling | Type of Rig E-120 Bucket
Hole Diameter 24 in. | Drive Weight 0'-30' 4,991#, 30'-60' 3,841# | Drop 12 in.
Elevation Top of Hole 51 ft. | Ref. or Datum See Map

Depth (feet)	Graphic Log	Attitudes	Sample No.	Blows Per Foot	Dry Density (pcf)	Moisture Content (%)	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
60			R-3	7/6" 27/12"	124.4	10.1		Logged By KTS/MRS Sampled By KTS @ 60': Blue-gray, damp, hard, fine SANDSTONE Total Depth = 60 Feet Backfilled and Tamped 6/19/00 5 feet slurry cap Ground water encountered at 6, 8, 27 feet at time of drilling
65								
70								
75								
80								
85								
90								

505A(11/77)

LEIGHTON & ASSOCIATES

PREVIOUS BORING LOGS BY LEIGHTON AND ASSOCIATES

EXPLANATION OF GEOTECHNICAL BORING LOG

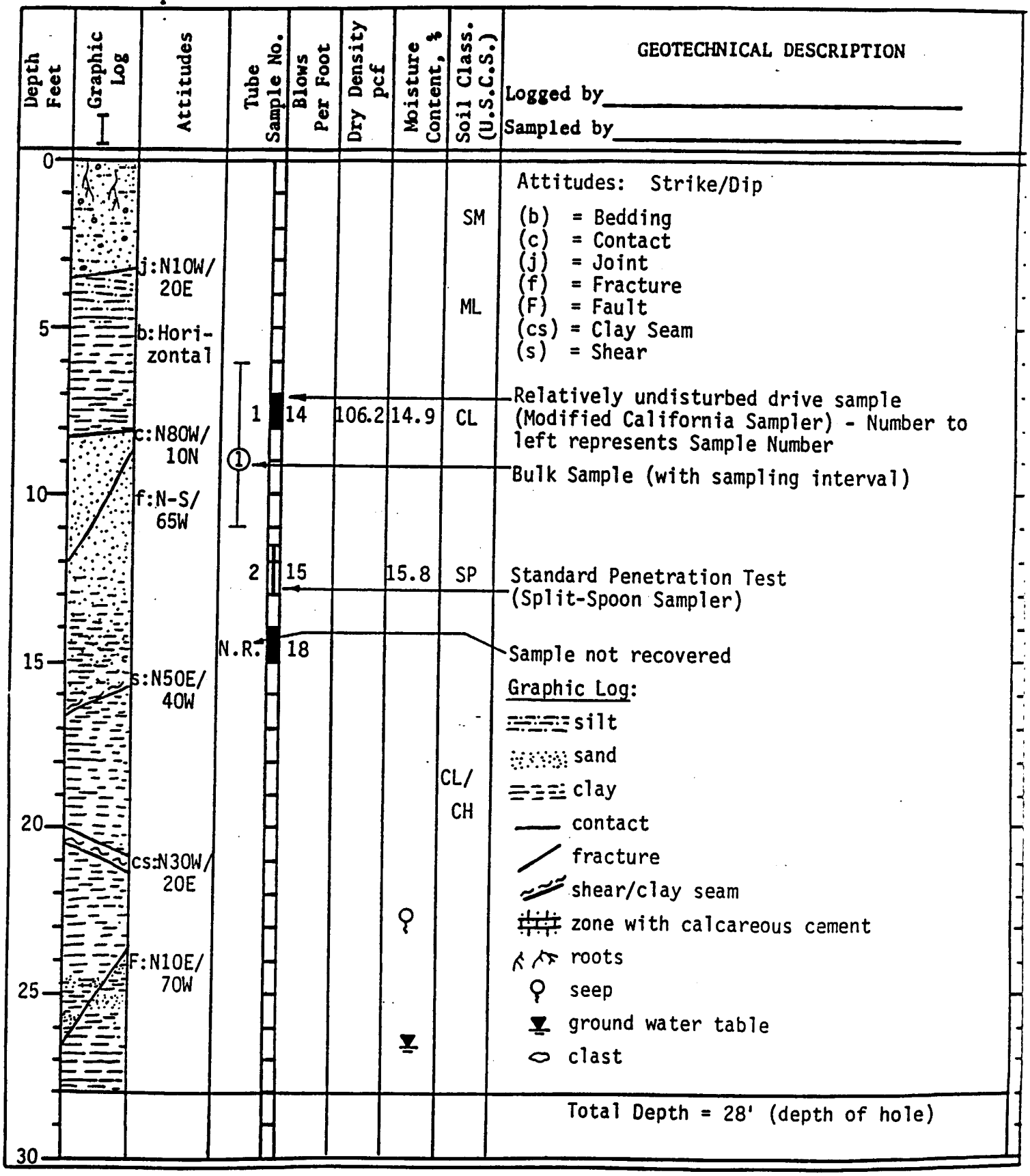
Date_____ Drill Hole No. _____ Sheet__of__

Project_____ Job No._____

Drilling Co._____ Type of Rig_____

Hole Diameter_____ Drive Weight_____ Drop_____in.

Elevation Top of Hole Ref. or Datum



GEOTECHNICAL BORING LOG

Date 1/20/78 Drill Hole No. P1 Sheet 1 of 2 -

Project Santa Fe Railroad Job No. 478008-1

Drilling Co. Pioneer Type of Rig B-53 Flite

Hole Diameter ____ Drive Weight 140 lb. Drop 30 in.

Elevation Top of Hole 63.0 Ref. or Datum

Logged by WH - DLH

Sampled by WH

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							SM-SC	Fill-cinders, silty-clayey sand.
			1	17/6" 29/6"	119.4	11.3	SM	Dark orange, moist, medium dense, silty medium grained sand.
5								Moist-wet.
								Fill?
			2	9/19	111.4	14.1		Loose, medium, dense, natural ground, wet, dark orange mottled with gray 200=15-20%.
10			3	20/35	108.2	14.1	SM	Dark orange, brown, wet-saturated, medium.
								Terrace Deposit (Qt)
			4	55/6"	102.2	12.7	SC	Pale yellow, moist, wet, dense, clayey coarse to medium sand - (Ted) Del Mar Formation bedrock.
15								
			5	41/6" 60/4"	106.0	21.3	ML	Light gray ground, clayey silt, moist, dense.
								@ 17.5': Increased density, very dense now light green color.
20								@ 17 - 22': Less dense, moist.
			6	61/6"	110.6	13.8		
25								@ 26': Less density, increased moisture.
			7	60/5"	96.3	20.5		@ 27.5': Clean fine sand in sample.
30								

GEOTECHNICAL BORING LOG

Date 1/20/78 Drill Hole No. P1 Sheet 2 of 2

Project Santa Fe Railroad Job No. 478008-1

Drilling Co. Pioneer Type of Rig B-53 Flite

Hole Diameter _____ Drive Weight 140 lb. Drop 30 in.

Elevation Top of Hole 63.0 Ref. or Datum

Logged by WH

Sampled by WH

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30							ML	As above.
			8	60/5"	100.8	14.0		Coarse grained sand in sample tube.
35			①					@ 36': Very dense. @ 36.5': Less dense but still very hard.
			9	42/6" 60/4.5"	105.8	18.8		
40								
			10	63/6"	102.2	13.9		@ 43': Drilling becoming difficult moist material sticks to auger hard to clear cuttings from hole.
45			②					
			11	61/6"	99.3	18.2		
50								@ 53': Slight decrease in density.
55								T.D. 54' No water - No Caving
60								

GEOTECHNICAL BORING LOG

Date 1/20/78 Drill Hole No. P2 Sheet 1 of 1-

Project Santa Fe Railroad Job No. 478008-1

Drilling Co. Pioneer Type of Rig B-53 Flite

Hole Diameter ____ Drive Weight 140 lb. Drop 30 in.

Elevation Top of Hole 63.0 Ref. or Datum

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by WH Sampled by WH
0							SW	Track Bed - Sandy gravel, medium brown, m
							SM	Fill - Dark orange, silty sand, fine to c grained, pebbly, moist, dense.
			12	18/6" 27/6"	117.8	6.7		@ 3': Less pebble, very moist, orange br to brown sand, somewhat silty.
5			13	16/6" 27/5"	122.6	7.8		
							SM	@ 5.5': Orange brown, sand, fine-coarse grained (natural) very moist to wet, dense Terrace Deposit (Qt)
			14	20/6"	112.8	14.9		
			15	13/6" 34/6"	87.2	14.1		@ 8': Somewhat denser.
10								
			16	60/5"	103.4	13.3		
							SM	@ 12.7': Tan, sand, fine-medium grained, moist, dense, Del Mar Formation (Ted) bedrock.
15								
			17	30/6" 60/6"	105.3	22.4	ML	@ 16': Light gray grained, clayey silt, moist, dense (bedrock).
								T.D. 17' No Water - No Caving
20								
25								
30								

GEOTECHNICAL BORING LOG

Date 1/20/78 Drill Hole No. P 3 Sheet 1 of 1

Project Santa Fe Railroad Job No. 478008-1

Drilling Co. Pioneer Type of Rig B-53 Flite

Hole Diameter ____ Drive Weight 140 lb. Drop 30 in.

Elevation Top of Hole 63.0 Ref. or Datum

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by WH Sampled by WH
0			18	9/6"	107.2	14.0	SM/ SC	Fill-Grayish brown to orange brown, sand, fine-coarse grained, moist, pebbles in upper foot, with gravel.
				26/6'			SM	@ 2.8': Brown to orange brown sand, fine-coarse grained, moist, dense, terrace deposit (Qt)
5			19	18/6'				
				32/6'	109.5	15.6		
			20	23/6'				
				31/6'				
10			21	24/6'	109.1	16.4		
				42/6'				
15							SC	Tan, sand, fine-medium grained, moist, dense. Note: Upper contact approximate Del Mar Formation (Ted) bedrock.
				25/6"				
			22	60/5'	102.9	21.5	ML	Light gray grained, clayey silt, moist, dense.
20								T.D. 17.5' No Water - No Caving
25								
30								

GEOTECHNICAL BORING LOG

Date 1/20/78 Drill Hole No. P 4 Sheet 1 of 1

Project Santa Fe Railroad Job No. 478008-1

Drilling Co. Pioneer Type of Rig B-53 Flite

Hole Diameter ____ Drive Weight 140 lb. Drop 30 in.

Elevation Top of Hole 63.5 Ref. or Datum

Logged by WH

Sampled by WH

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							SM/SC	Fill-Brown, silty sand, fine-medium grain, very moist, medium dense.
			23	9/6" 18/6"	112.3	13.6		@ 2-3': Old road bed.
							SM	@ 3': Orange brown, sand, fine-coarse grain (natural) very moist, dense. Terrace Deposi (Qt)
5			24	17/6" 24/6"	111.1	13.2		
			25	11/6" 20/6"	109.0	14.4		
10			26	62/6"	104.5	13.6		
							SC	@ 12.7': Tan, sand, fine-coarse, moist, den Del Mar Formation (Ted) bedrock.
15			27	29/6" 51/6"	103.7	11.2		
							ML	@ 16.7': Light gray grained, clayey silt, moist, dense, (bedrock).
20								T.D. 18' No Water - No Caving
25								
30								

PREVIOUS BORING LOGS BY OTHERS

APPENDIX A

Field Mapping and Subsurface Exploration Logs

Geologic Units and Feature Identification

The Site Plan and Geologic Map (in pocket) was prepared based upon information supplied by the client, or others, along with MAHG's field measurements and observations. Site geology including surficial units, bedrock units, measurement of bedrock structure, contacts, areas of notable seepage and springs as well as the approximate locations of exploratory borings and trenches associated with this field investigation are presented on the Geotechnical Map. In addition, ten geologic cross sections were prepared to enable the evaluation of slope stability at selected locations and these sections are presented in Appendix D.

General Field Procedures

The Boring and Trench Logs on the following pages depict or describe the subsurface (soil and water) conditions encountered at the specific exploration locations on the date that the exploration was performed. Subsurface conditions may differ between exploration locations and within areas of the site that were not explored. The subsurface conditions may also change at the exploration locations over the passage of time.

Boring and Test Trench Elevations

The ground surface elevations reported on the field logs were established from interpolation of elevations and contours illustrated on the Site Plan and Geologic Map.

Boring and Test Trench Locations

All subsurface exploration locations were located on-site based on visual observation and measurement from existing improvements. The locations are shown on the Geotechnical Map. Subsurface exploration locations reported for this study should be considered accurate only to the degree implied by the method used in determining them.

Water Level Measurement

The water levels reported on the Boring Logs represent the depth to the piezometric water surface measured at the conclusion of the drilling operation after a short wait, or in monitoring wells that were constructed within selected boreholes. Water levels are expected to show seasonal and long-term fluctuations consistent with historical trends in the area.

Field Sampling and Testing Procedures

Drilling was performed between April 27 and April 30, 1998, utilizing Mobile B-53 and B-61 truck-mounted rigs equipped with 8-inch-diameter, continuous-flight, hollow-stem augers. Trenches were excavated with a rubber tire mounted backhoe provided by the client.

The field operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) designation D 420 entitled "Standard Guide for Sampling Soil and Rock" and/or other relevant specifications. Soil samples were preserved and transported to our laboratory in general accordance with the procedures recommended by ASTM designation D 4220 entitled "Standard Practice for Preserving and Transporting Soil Samples". Brief descriptions of the sampling and testing procedures are presented below:

Ring-Lined Barrel Sampling - (ASTM D 3550)

In this procedure, a barrel sampler constructed to receive a stack of 1-inch-high brass rings is used to collect soil samples for classification and laboratory testing. Ring samples were collected from closely spaced intervals in all of the hollow-stem auger borings. Each hollow-stem rig was equipped with a 140-pound wireline downhole hammer, manually operated to fall an approximate distance of 30 inches. An 18-inch or 24-inch-long barrel fitted with 2.5-inch-diameter rings was subsequently driven a distance of 18 inches or to practical refusal (considered to be 50 blows for 6 inches).The method provides relatively undisturbed samples that fit directly into laboratory test instruments without additional handling and disturbance.

Raw blow count data were recorded for each 6-inch increment of the 18-inch drive. The sum of blows required to drive the sampler the final 12 inches, or fraction thereof, is noted on the Field Logs, presented in this Appendix, as an uncorrected N-value. Penetration resistance of the initial 6-inch seating interval is not shown, except in the instance of total penetration of 6 inches or less. The raw blow count values, presented as *N=XX*, do not have exact equivalency with Standard Penetration Test "N-values" as determined by ASTM D 1586. However, it is commonly accepted that general correlations can be applied to obtain approximately equivalent (uncorrected) Standard Penetration Test N-values and their respective consistency and relative density classifications according to the following tables.

Table A-1
Blow Count/Density Relationships for Granular Soils

Ring Sample Blow Count	SPT Blow Count	Description
0 - 5	0 - 4	Very loose
5 – 13	4 - 10	Loose
13 – 38	10 - 30	Medium dense
38 – 63	30 - 50	Dense
> 63	> 50	Very dense

Table A-2
Blow Count/Consistency Relationships for Fine-Grained Soils

Ring Sample Blow Count	SPT Blow Count	Description
0 - 3	0 - 2	Very soft
3 - 5	2 - 4	Soft
5 - 10	4 - 8	Firm/Medium stiff
10 - 19	8 - 15	Stiff
19 - 38	15 - 30	Very stiff
>38	>30	Hard

Bulk Sample

A relatively large volume of soil is collected with a shovel or trowel. The sample is transported to the materials laboratory in a sealed plastic bag or bucket.

Classification of Samples

Excavated soils and discrete soil samples were visually-manually classified, based on texture and plasticity, in general accordance with the Unified Soil Classification System (ASTM D 2488-75). The classifications are reported on the field logs. Plasticity noted on the field logs reflects soil conditions at field moisture contents, and may not correlate with achievable plasticity at differing moisture contents.

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 1P

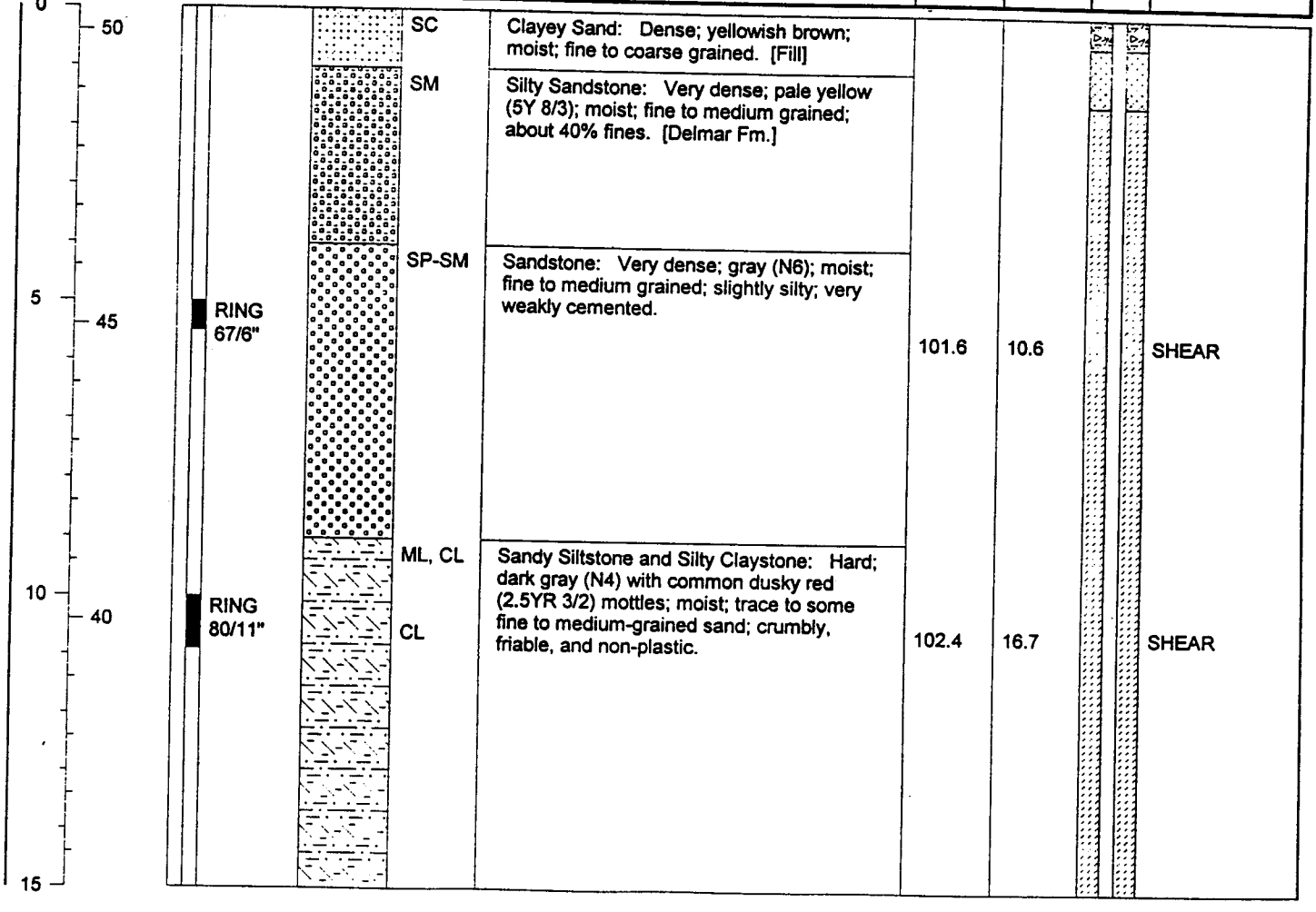
Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/27/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**51.0 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**50.4 Ft.**

Comments: Located at south end of project alignment.



Continued on next sheet.

FIG. A-1

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 1P

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	35	RING 83/6"		SM	Silty Sandstone and Siltstone: Very dense or hard; mostly gray (N6), with few small reddish FeO mottles; fine to medium grained sand; thinly bedded.	98.9	13.1		
				CL	Silty Claystone: Hard; dark gray (N4); moist; crumbly, friable, and non-plastic.				
20	30	RING 60/3"		SP-SM	Sandstone: Very dense; brownish yellow (10YR 6/6); moist; fine to coarse grained; uncemented. Much thinner than in adjacent bluff face.	99.5	9.8		SHEAR
25	25	RING 76/6"		ML, CL ML	Sandy Siltstone and Silty Claystone: Hard; mostly gray (N5), with some reddish FeO mottles to 1" across; moist; sand proportion mostly fine-grained; faintly plane laminated.	98.3	14.4		
30	20	RING 59/6"		CL	Silty claystone, as above; dark gray (N4).	101.9	17.5		SHEAR
35									

Continued on next sheet.

FIG. A-2

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 1P

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35	15	RING 80/6"		ML	Sandy Siltstone and Silty Claystone: Hard; mostly gray (N5), with some reddish FeO mottles to 1" across; moist; sand proportion mostly fine-grained; faintly plane laminated.	101.2	12.7		
				SP-SM	Sandstone: Very dense; dark gray (N4); moist; fine to medium grained; very weakly cemented with trace of clay.				
40	10	RING 80/6"		CL	← Sandy claystone, dark gray (N4), texture of small slickensided granules. Local lens.	108.4	14.3		
				CL	Silty Claystone: Hard; dark gray (N4), abundantly mottled with dusky red (2.5YR 3/2) iron oxides; moist; very silty, with occasional trace of fine-grained sand; massive and non-plastic. Harder drilling.				
45	5	RING 60/6"		CL	← Silty claystone, as above.	N/R	N/R		
50	0	RING 80/6"		CL	← Silty claystone, as above.	102.8	15.3		SHEAR

Bottom of boring at 51.0 feet.
No groundwater encountered.
Piezometer installed as depicted in well completion column..

FIG. A-3

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 2

Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/27/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**40.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**51.4 Ft.**

Comments: Located at Andersen Canyon embankment fill.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
0	50			SM	Gravelly Sand with Silt: Dense; dark brown (7.5YR 4/2); moist; fine to coarse grained; estimated 20-25% fine to coarse-grained gravel ballast; trace of clay. [Fill]				
5	45	RING N=47		SP-SC	Clayey Sand: Dense; dark yellowish brown (10YR 4/4); moist; mostly fine to medium grained, with trace of gravel and silt. [Fill]	100.3	7.4		
10	40	RING N=14		SP-SC	Becomes medium dense; very moist.	108.6	13.0		CONS
15									

Continued on next sheet.

FIG. A-4

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 2

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	35	RING, N=13		SP-SC	Clayey Sand: Medium dense; dark yellowish brown (10YR 4/4); very moist; fine to medium grained; trace of silt. [Fill]	114.6	12.9		CONS
					— Trace FeO mottling.				
20	30	RING, N=18		SP-SC	— Becomes wet; slightly sticky.	115.0	14.5		
25	25	RING, N=17		SP-SC	— Contains few yellowish siltstone fragments; moist.	114.1	10.2		CONS
30	20	RING, N=23		ML, CL	Clayey Siltstone and Sandy Claystone: Very stiff; mottled pale yellow, dark brown, and dark gray; wet; consists mostly of small intact sedimentary fragments in clayey silt matrix. [Fill]	94.6	24.2		
35					Abrupt contact.				
				SP-SM	Sandstone: Very dense; pale brownish yellow (10YR 6/6); wet; fine to medium grained; massively bedded. [Delmar Fm.]				

Continued on next sheet.

FIG. A-5

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 2

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35		RING 62/6"		SP-SM	Sandstone: Very dense; pale brownish yellow (10YR 6/6); wet; fine to medium grained; massively bedded. [Delmar Fm.]	113.6	17.5		
15				ML	Clayey Silt: Hard; mottled dark gray (N4) and dusky red (2.5YR 2/3); moist; crumbly, friable, and non-plastic.				
40		RING 53/6"		ML		98.9	12.6		

Bottom of boring at 40.5 feet.
Perched groundwater encountered in zone from approximately 33.0 to 38.0 feet.
No groundwater encountered below 38.0 feet.
Boring backfilled with soil cuttings.

FIG. A-6

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 3

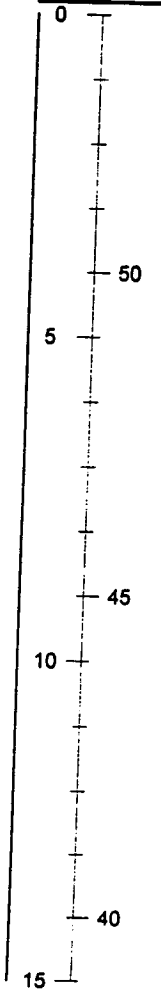
Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/27/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**35.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**54.0 Ft.**

Comments: Located north of Andersen Canyon.



DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
0						SP-SC	Clayey Sand: Medium dense; dark yellowish brown (10YR 4/4); moist; fine to medium grained; trace of silt. [Fill]	105.3	7.3		
5				RING N=23		SP	Sand: Medium dense; pale yellow; moist; fine to coarse grained, with trace of silt. [Fill]				
10				RING N=18		SP, ML, CL	Clayey Silt and Sand: Medium dense or stiff mottled mixture of yellowish sand and grayish clayey silt; moist; common fragmentary silty claystone. [Fill]	94.7	13.9		
15				RING N=55		ML, SM	Sandy Siltstone and Silty Sandstone: Hard or very dense; mostly yellowish brown (2.5YR 6/4); moist; sand component predominantly fine-grained; thinly bedded and closely fractured; fine-grained strata are non-plastic. [Delmar Fm.]	N/R	N/R		

Continued on next sheet.

FIG. A-7

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 3

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15				ML, SM	Sandy Siltstone and Silty Sandstone: Hard or very dense; yellowish brown abruptly becoming dark gray (N4) at 16 feet; moist; sand mostly fine-grained; thinly bedded; fine-grained strata are non-plastic.				
	35	RING 55/6"		SM	— Silty sandstone, fine to medium grained, very silty.	108.2	13.2		
20									
		RING 56/6"		ML	— Clayey siltstone, gray (5Y 6/1), trace of fine-grained sand, friable and non-plastic.	98.6	16.0		
	30				Grades increasingly clayey.				
25									
		RING 65/6"		ML	← Clayey siltstone, dark gray (N4), trace of sand.	105.4	16.1		
	25				Becomes harder drilling.				
30									
		RING 62/6"		ML	— Siltstone, lacks clay. Trace of coal.	98.4	15.1		
	20								
35									

Continued on next sheet.

FIG. A-8

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 3

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35						SP	Sandstone: Very dense; color and moisture undetermined; well-cemented with calcium carbonate. Bluff exposure is erosion-resistant, lenticular ledge about 14" thick. Very hard drilling.				

Refusal encountered at 35.5 feet.
No groundwater encountered.
Boring backfilled with soil cuttings.

FIG. A-9

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 4P

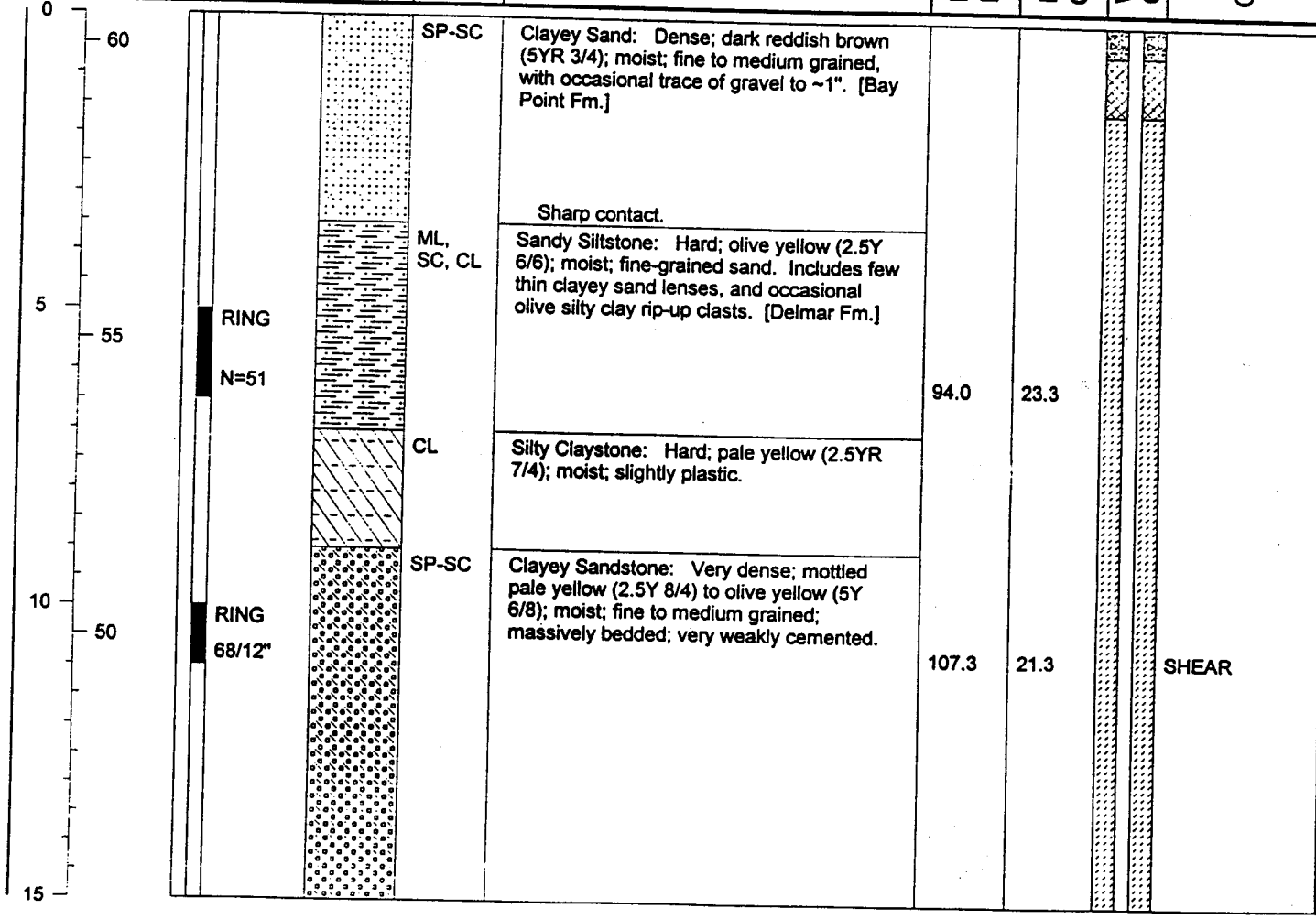
Sheet 1 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	4/27/98	Logged By:	M. Doerschlag
Drilled By:	California-Pacific	Total Depth:	55.5 Ft.
Rig Make/Model:	Mobile B-61	Hammer Type:	Wireline downhole
Drilling Method:	Hollow-stem Auger	Hammer Weight/Drop:	140 Lb./±30 In.
Hole Diameter:	8 In.	Surface Elevation:	60.5 Ft.

Comments: Groundwater seepage noted along nearby bluff face.



DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
0	60			SP-SC	Clayey Sand: Dense; dark reddish brown (5YR 3/4); moist; fine to medium grained, with occasional trace of gravel to ~1". [Bay Point Fm.]				
					Sharp contact.				
				ML, SC, CL	Sandy Siltstone: Hard; olive yellow (2.5Y 6/6); moist; fine-grained sand. Includes few thin clayey sand lenses, and occasional olive silty clay rip-up clasts. [Delmar Fm.]				
5	55	RING N=51				94.0	23.3		
				CL	Silty Claystone: Hard; pale yellow (2.5YR 7/4); moist; slightly plastic.				
				SP-SC	Clayey Sandstone: Very dense; mottled pale yellow (2.5Y 8/4) to olive yellow (5Y 6/8); moist; fine to medium grained; massively bedded; very weakly cemented.				
10	50	RING 68/12"				107.3	21.3		SHEAR
15									

Continued on next sheet.

FIG. A-10

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 4P

Sheet 2 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	45	RING 80/9"		ML, SP	Sandy Siltstone and Sandstone: Hard or very dense; siltstone light gray (2.5Y 7/2), and sandstone yellow (2.5Y 8/6); moist; fine to medium-grained sand; fine-grained strata contain trace of clay and are non-plastic.	100.5	18.0		SHEAR
					Abrupt contact.				
				CL	Silty Claystone: Hard; very dark gray (5YR 3/1); moist; friable and non-plastic, with granular texture.				
20	40	RING 50/6"				105.8	16.9		SHEAR
					Grades less clay; color lightens.				
25	35	RING 66/6"		ML, SM	Siltstone and Silty Sandstone: Hard or very dense; mostly light gray (2.5Y 8/1) to gray (N6), with local orange mottling; moist; sands fine to medium grained.	102.4	13.1		
30	30	RING 50/3"		SM	Very silty fine to medium-grained sandstone; gray (N5).	110.0	11.5		
35				CL, ML	Silty Claystone: Hard; gray (N5); moist; very silty; non-plastic and friable.				

Continued on next sheet.

FIG. A-11

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 4P

Sheet 3 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35	25	RING 85/6"		CL	Silty Claystone: Hard; gray (N5); moist; very silty; non-plastic; becomes commonly mottled with dusky red iron oxide staining and small hematitic concretions.	92.0	18.6		SHEAR
40	20	RING 56/6"		CL	— Silty claystone, as above.	105.2	19.3		
				ML	Sandy Siltstone: Hard; gray (N6); moist; mostly fine-grained sand; generally massive in recovered samples.				
45	15	RING 100/6"		ML	← Sandy siltstone, as above.	116.2	10.3		
50	10	RING 50/3"		ML	← Sandy siltstone, as above.	107.3	13.7		
55									

Continued on next sheet.

FIG. A-12

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 4P

Sheet 4 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
55											
5			■	57/6"		CL	Silty Claystone: Hard; dark gray (N4), abundantly mottled with dusky red (2.5YR 3/2) iron oxides; moist; very silty; massive and non-plastic.	102.1	17.5		SHEAR

Bottom of boring at 55.0 feet.
No groundwater encountered.
Piezometer installed as depicted in well completion column..

FIG. A-13

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 5

Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	4/28/98	Logged By:	M. Doerschlag
Drilled By:	California-Pacific	Total Depth:	51.0 Ft.
Rig Make/Model:	Mobile B-61	Hammer Type:	Wireline downhole
Drilling Method:	Hollow-stem Auger	Hammer Weight/Drop:	140 Lb./±30 In.
Hole Diameter:	8 In.	Surface Elevation:	59.5 Ft.

Comments:

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
0				SP-SC	Clayey Sand: Dense; dark reddish brown (5YR 3/2); moist; fine to coarse grained, with trace of gravel to ~2" diameter. [Bay Point Fm.]				
					Sharp contact.				
				ML, CL	Clayey Siltstone and Silty Claystone: Hard; dark to very dark gray (N4-N3), locally becoming black (N2), moist; friable and non-plastic, non-cemented. Bluff outcroppings contain common coal-bearing lenses to ~6" thick. [Delmar Fm.]				
5	55	RING 50/6"		ML	← Clayey siltstone, as above.	106.7	14.1		
	50								
10		RING 65/6"		CL	← Silty claystone, black (N2).	104.7	16.1		
				SP-SM	Silty Sandstone: Very dense; dark gray (N5) apparently mottled with shades of yellow; moist to locally very moist; fine to coarse grained. Interval inferred from bluff exposure.				
	45								
15									

Continued on next sheet.

FIG. A-14

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 5

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	40	RING 70/6"		SP-SM	Silty Sandstone: Very dense; dark gray (N5); moist to locally very moist; fine to coarse grained. Locally contains sandy siltstone drapes and partings.	107.3	14.1		
20		RING 55/6"		ML	Sandy Siltstone: Hard; gray (N5); moist; sand component fine to medium grained; apparently massively bedded; non-plastic and mostly lacks clay. Sample @ 20 ft. found to have plane and convolute lamination, with estimated 30-40% sand. Increasingly sandy with depth.	111.2	12.2		
					Color becomes 10YR 5/1, possibly grading to silty sandstone.				
25	35	RING 67/6"		ML	← Sandy siltstone, mottled with reddish brown (2.5YR 3/4) oxidation color.	101.9	15.0		
				ML	Clayey Siltstone: Hard; mottled gray (10YR 6/1) and yellow (10YR 7/6); moist; trace of fine-grained sand; non-plastic. Harder drilling.				
30	30	RING 62/6"		ML	← Sandy siltstone, as above.	110.7	15.8		
35	25								

Continued on next sheet.

FIG. A-15

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 5

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35		RING 58/6"		ML	Clayey Siltstone: Hard; color mostly olive gray (5Y 5/2); moist.	96.6	17.1		
40	20	RING 80/6"		ML	Sandy Siltstone: Hard; dark gray (N5); moist; contains estimated 20-30% fine to medium-grained sand. Little or no clay; non-plastic.	117.4	10.6		
45	15	RING 55/6"		ML	Siltstone, trace of fine-grained sand.	102.0	17.2		
50	10	RING 112/12"		ML	Siltstone, as above.	108.8	18.6		

Bottom of boring at 51.0 feet.
Groundwater seepage reported by driller somewhere in upper 20 feet of boring; interpreted to be from basal portion of sandstone interval located from 13 to 19 feet.
Boring backfilled with soil cuttings.

FIG. A-16

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 6P

Sheet 1 of 2

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	4/28/98	Logged By:	M. Doerschlag
Drilled By:	California-Pacific	Total Depth:	28.0 Ft.
Rig Make/Model:	Mobile B-61	Hammer Type:	Wireline downhole
Drilling Method:	Hollow-stem Auger	Hammer Weight/Drop:	140 Lb./±30 In.
Hole Diameter:	8 In.	Surface Elevation:	64.3 Ft.

Comments: Groundwater seepage apparent from nearby bluff.

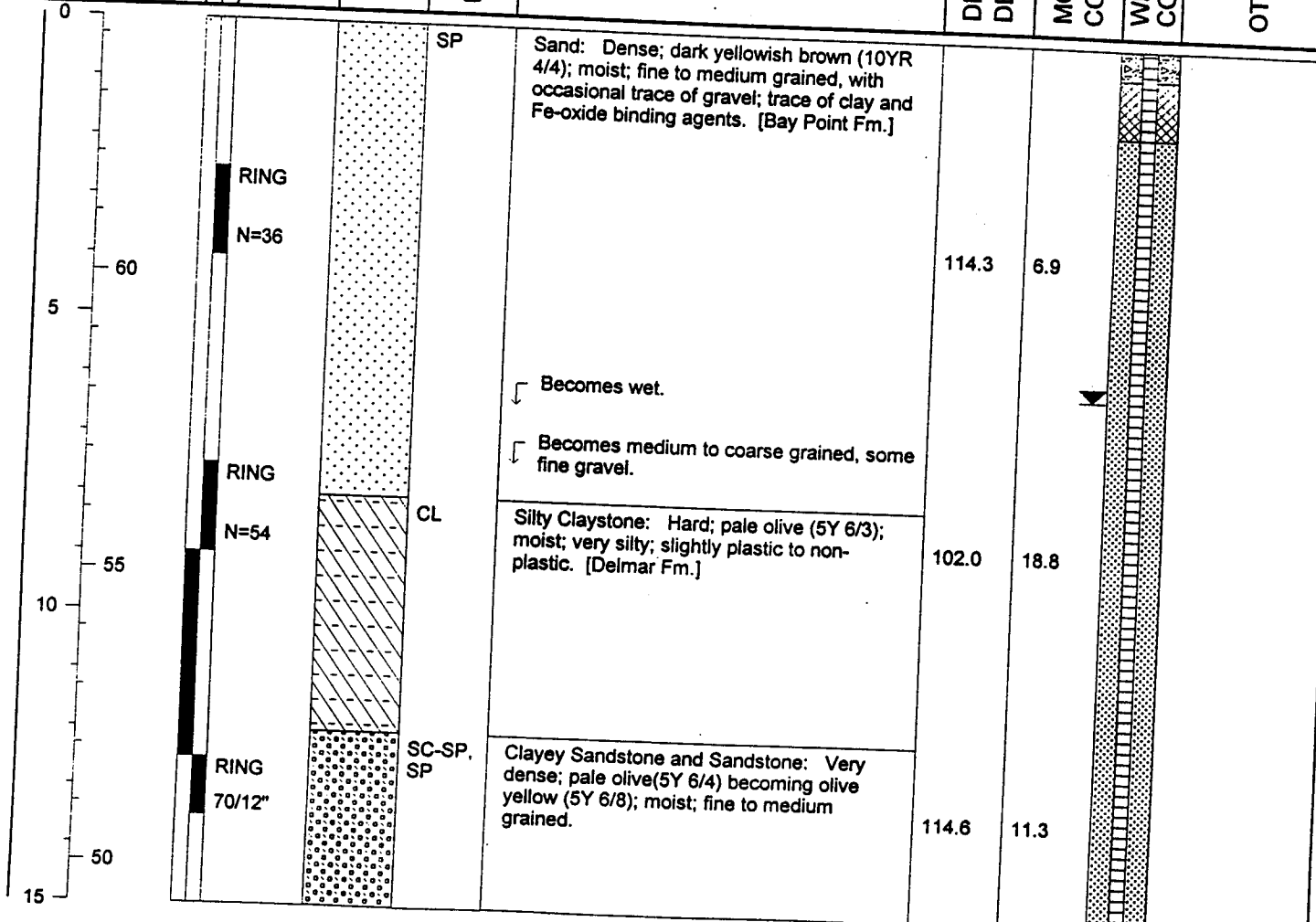


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FIG. A-17

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 6P

Sheet 2 of 2

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15				SP	Clayey Sandstone and Sandstone: As before; grades primarily SP classification.				
				ML	Sandy Siltstone: Hard; mostly gray (5Y 5/1); moist; fine to medium grained sand, and trace of clay; apparently massively bedded.				
		RING 50/6"		ML		110.7	16.6		
45									
20					Becomes harder drilling.				
		RING 76/6"		ML, SM	Sandy siltstone with clay, and some thinly bedded silty fine to medium-grained sandstone; color dark gray (N6) with abundant dusky red mottles; slightly sticky when wet.	117.7	14.3		
40									
25		RING 82/6"		ML	← Sandy siltstone with clay.	110.9	15.4		

Boring terminated at 28.0 feet due to very slow progress.
Perched groundwater encountered in zone from approximately 6.0 to 8.0 feet (base of Bay Point Fm.).
Piezometer installed as depicted in well completion column..

FIG. A-18

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 7

Sheet 1 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	4/28/98	Logged By:	M. Doerschlag
Drilled By:	California-Pacific	Total Depth:	56.0 Ft.
Rig Make/Model:	Mobile B-61	Hammer Type:	Wireline downhole
Drilling Method:	Hollow-stem Auger	Hammer Weight/Drop:	140 Lb./±30 In.
Hole Diameter:	8 In.	Surface Elevation:	61.3 Ft.

Comments:

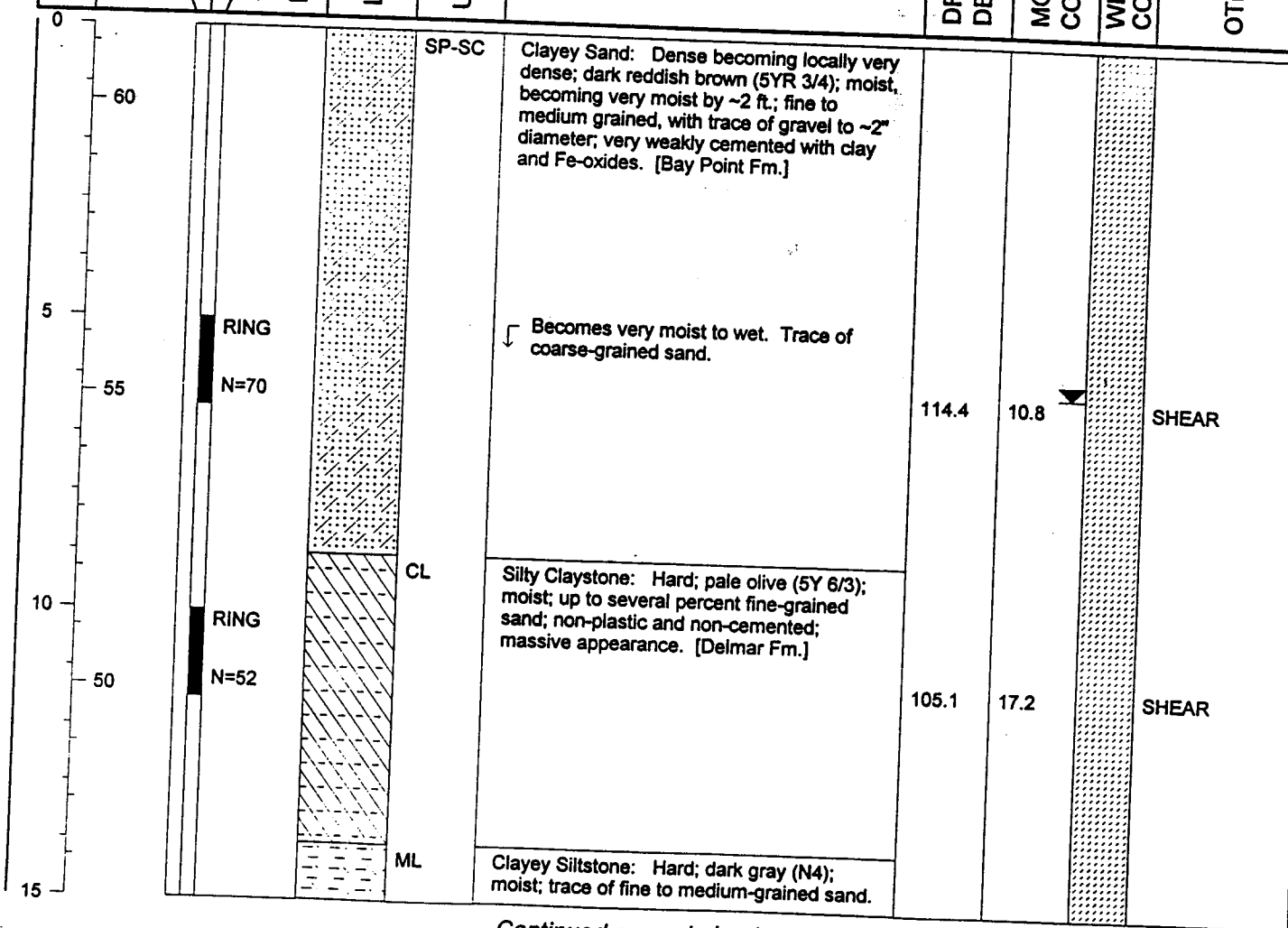

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FIG. A-19

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 7

Sheet 2 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	45	RING 80/12"		ML	Clayey Siltstone: Hard; dark gray (N4); moist; trace of fine to medium-grained sand; texture locally comprises small granules somewhat loosely bound together; non-plastic.	106.5	21.2		
20	40	RING 67/6"		ML	Sandy Siltstone: Hard; gray (N5); moist; sand component fine to medium grained; apparently massively bedded; non-plastic and mostly lacks clay. Increasingly sandy with depth.	108.1	12.8		SHEAR
25	35	RING 50/3"			Unit contains subordinate thin layers of silty, fine to medium-grained sandstone.	111.8	12.9		
30	30	RING 100/6"			← Very fine-grained silty sandstone.	105.9	12.1		SHEAR
					← 6-inch-thick well-cemented layer, hard drilling.				
35				SP	Sandstone: Very dense; very pale brown (10YR 7/4); wet; fine to coarse grained.				

Continued on next sheet.

FIG. A-20

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 7

Sheet 3 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35		RING 100/5"		SP	Sandstone: Very dense; very pale brown (10YR 7/4); wet; fine to coarse grained; massively bedded.	104.7	9.9		SHEAR
	25								
40		RING 90/6"		SP, SP-SM		N/R	N/R		
	20	RING 70/6"		SP-SM	— Color gray (N6). Abrupt lower contact.				
				ML	Clayey Siltstone: Hard; gray (N5), with few dusky red mottles to about 1/2" across; moist; trace of fine-grained sand; non-plastic.	102.4	23.2		
45		RING 66/6"				109.7	17.7		SHEAR
	15								
50		RING 90/10"		ML, SC	← Sample with some clayey sandstone layer(s) to 6-8" thick.	106.3	15.1		
	10								
55									

Continued on next sheet.

FIG. A-21

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 7

Sheet 4 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
55		RING 55/6"		ML, CL	Clayey Siltstone: As before; grading to silty claystone.	105.9	19.2		SHEAR

Bottom of boring at 56.0 feet.
Perched groundwater encountered in zone from approximately 6.0 to 9.0 feet (base of Bay Point Fm.); also, sandstone aquifer encountered from 34 to 43 feet.
Boring backfilled with soil cuttings.

FIG. A-22

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 8

Sheet 1 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	4/29/98	Logged By:	M. Doerschlag
Drilled By:	California-Pacific	Total Depth:	61.0 Ft.
Rig Make/Model:	Mobile B-53	Hammer Type:	Wireline downhole
Drilling Method:	Hollow-stem Auger	Hammer Weight/Drop:	140 Lb./±30 In.
Hole Diameter:	8 In.	Surface Elevation:	60.5 Ft.

Comments:

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
0	60					SP	Sand: Dense; strong brown (7.5YR 4/6); moist, becoming very moist by ~2 ft.; fine to medium grained; estimated 3-5% clay and Fe-oxide binder. [Bay Point Fm.]				
							Becomes wet.				
5	55		RING	61/12"		CL	Knife-sharp contact. Silty Claystone: Hard; pale olive (5Y 6/4) to yellow (2.5Y 7/6); moist; up to several percent fine-grained sand; non-plastic and non-cemented; granulated appearance. [Delmar Fm.]	106.1	17.0		
10	50		RING	50/6"		SP-SM, ML	Silty Sandstone and Siltstone: Very dense or hard; mostly yellow (2.5Y 8/6); moist; apparently thinly bedded; siltstone beds with trace of clay; fine to medium-grained sandstone.	100.3	11.5		
15											

Continued on next sheet.

FIG. A-23

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 8

Sheet 2 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	45	RING 55/6"		ML	Clayey Siltstone: Hard; gray (N5); moist; trace of fine-grained sand; non-plastic; massively bedded.	112.7	12.4		
20	40	RING 62/6"		ML, SM ML	Sandy Siltstone: Hard; gray (N5); moist; sand component fine to medium grained; apparently massively bedded; non-plastic and mostly lacks clay. Increasingly sandy with depth. Sample @ 15 ft. classified as clayey siltstone with sand.	102.9	9.5		
25	35	RING 54/3"		ML	← Very sandy siltstone, trace of clay.	110.4	12.0		
30	30	RING 62/6"		SM	Silty Sandstone: Very dense; dark gray (N4), with some small dusky red mottles; moist; fine to coarse grained. Inferred upper contact from harder drilling performance.	102.3	9.2		
35				ML, CL	Sandy Siltstone and Silty Claystone: Hard; dark gray (N4); moist; typically 5-10% fine to medium-grained sand; spotted with reddish Fe oxides along discontinuities. Mostly crumbly, friable, non-plastic, and often with granulated appearance.				

Continued on next sheet.

FIG. A-24

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 8

Sheet 3 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35	25			RING 50/5"		ML, CL	Sandy Siltstone and Silty Claystone: Hard; dark gray (N4), frequently spotted with reddish Fe oxides along discontinuities; moist; trace of mostly fine-grained sand; non-plastic, granulated appearance.	104.1	15.4		
40	20			RING 80/9"		CL	← Silty claystone, color very dark gray (5Y 3/1), crumbly texture.	102.3	16.2		
45	15			RING 50/6"		CL	← Silty claystone.	104.7	16.9		
50	10			RING 55/6"		CL	Silty Claystone: Hard; gray (5Y 5/1); moist; non-plastic. Near 50-ft. depth, contains some very thin (~1") layers of silty sandstone. Not mottled.	107.1	11.0		
55											

Continued on next sheet.

FIG. A-25

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 8

Sheet 4 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
55	5			RING 85/7"		CL	Silty Claystone: Hard; gray (5Y 5/1); moist; non-plastic. Sample @ 55 ft. intensely fractured, with marble-size granules bounded by random slicks.	114.6	10.2		
60	0			RING 62/6"			← Trace of reddish FeO mottling; few traces of carbonized organic matter.	95.8	13.8		

Bottom of boring at 61.0 feet.
Perched groundwater encountered in zone from approximately 4.0 to 5.5 feet (base of Bay Point Fm.).
Boring backfilled with soil cuttings.

FIG. A-26

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 9P

Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/29/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**45.5 Ft.**
Rig Make/Model:	**Mobile B-53**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**59.3 Ft.**

Comments: Groundwater seepage and dense arundo cane at nearby bluff.

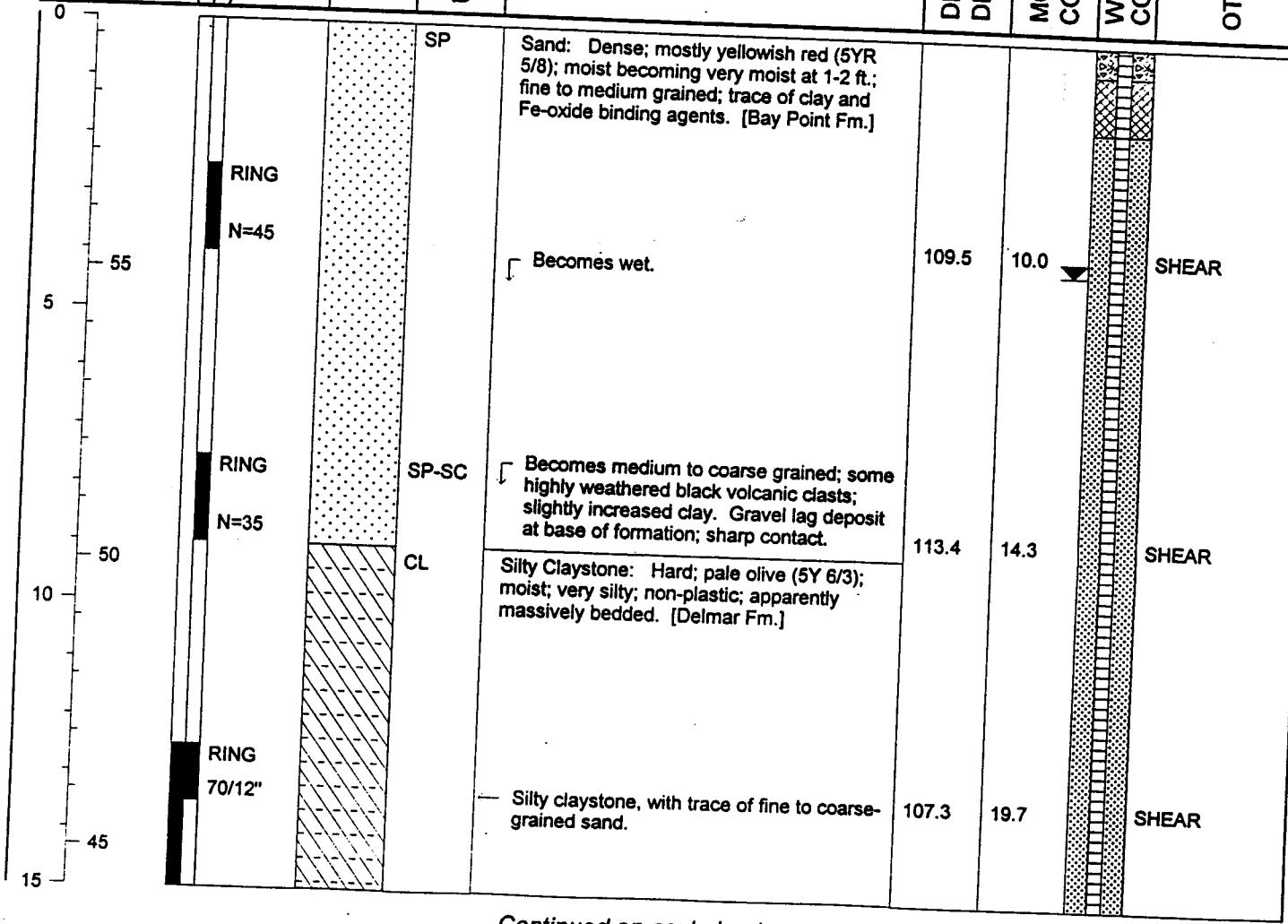

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FIG. A-27

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 9P

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15				CL	Silty Claystone: Hard; pale olive (5Y 6/3); moist; very silty; non-plastic. Trace of fine to coarse-grained sand.				
	40	RING 73/12"		ML, CL	Clayey Siltstone and Silty Claystone: Hard; pale yellow (5Y 7/4) and olive (5Y 6/3), with yellow (5Y 7/8) mottles and laminae; moist; non-plastic.	115.2	11.9		SHEAR
20									
		RING 75/12"		ML	Clayey siltstone, with 1" wide, vertical clay-filled fracture (?) in sample. Abruptly becomes dark gray (N5 to 5Y 5/1).	117.4	10.4		
	35								
25									
		RING 50/6"		SM	Silty Sandstone: Very dense; dark gray (N4); moist; fine to medium grained, with trace of clay; uncemented.	114.5	7.6		SHEAR
	30								
30									
		RING N=45		ML	Clayey Siltstone: Hard; dark gray (10YR 4/1); moist; non-plastic; texture of loosely bound granules. Hard drilling.	108.0	12.9		SHEAR
	25								
35									

Continued on next sheet.

FIG. A-28

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 9P

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35				ML	Clayey Siltstone: Hard; dark gray (10YR 4/1); moist; non-plastic. Approximate lower contact.				
		RING 72/6"		SM	Silty Sandstone: Very dense; gray (N5); moist; fine to coarse grained; appears massively bedded. Very weakly cemented, but hard drilling.	105.8	8.4		SHEAR
20									
40									
		RING 55/6"			← Silty sandstone with trace of clay.	116.5	8.2		
15				CL	Silty Claystone: Hard; dark gray (N4), with abundant dusky red mottles; moist; texture of small, hard granules; non-plastic.				
45		RING 65/6"				110.8	12.1		SHEAR

Boring terminated at 45.5 feet due to slow drilling progress and overheating equipment.
Perched groundwater encountered in zone from approximately 4.0 to 9.0 feet (base of Bay Point Fm.).
Piezometer installed as depicted in well completion column..

FIG. A-29

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 10

Sheet 1 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/29/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**56.0 Ft.**
Rig Make/Model:	**Mobile B-53**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**62.0 Ft.**

Comments: Groundwater seepage from nearby bluff exposures.

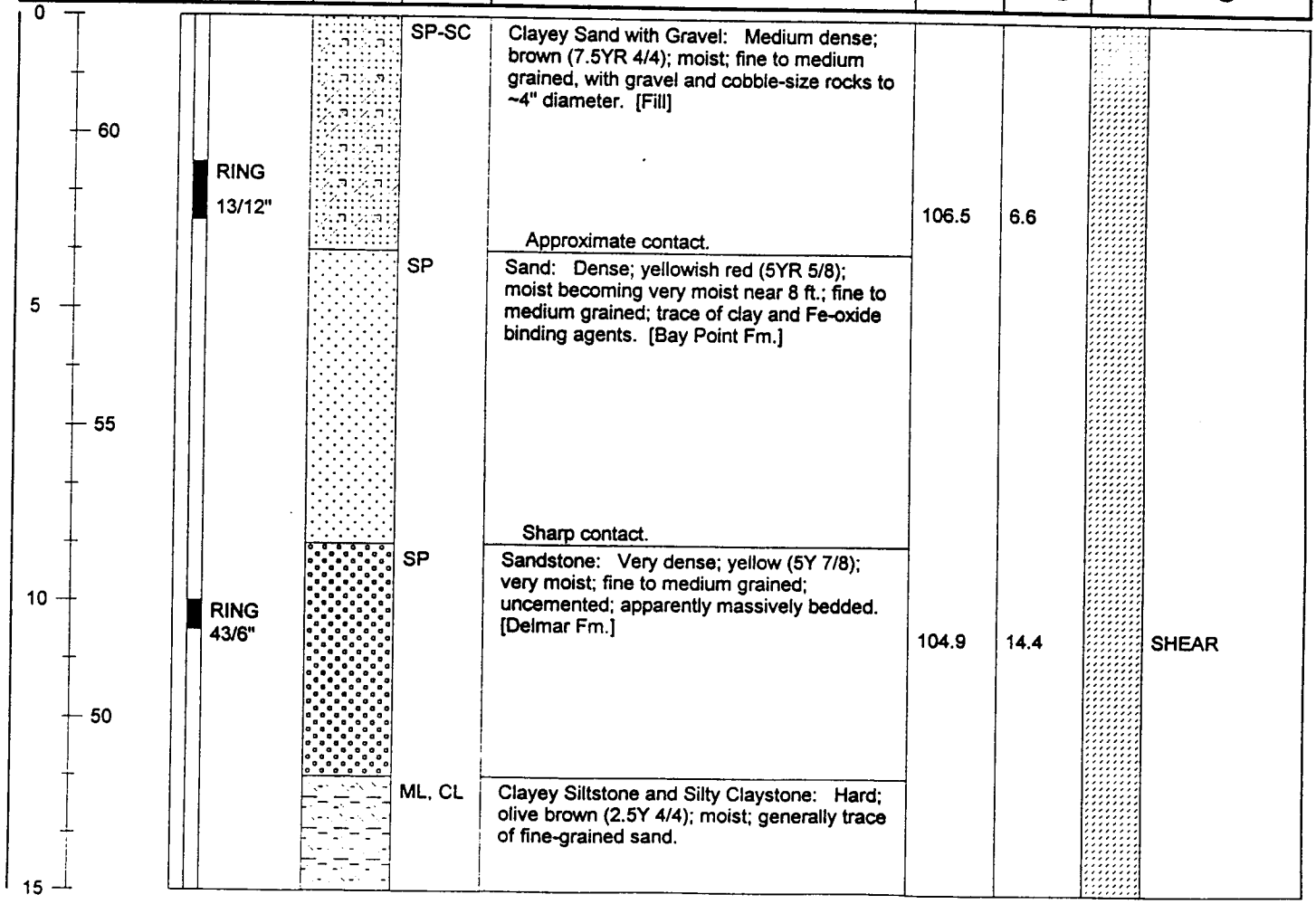

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FIG. A-30

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 10

Sheet 2 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	45					ML, CL	Clayey Siltstone and Silty Claystone: Hard; pale olive (5Y 6/3); moist; non-plastic. Trace of fine-grained sand. — Cuttings dusky red (2.5YR 3/2) from about 17-18 ft.				
20	40		RING 73/6"			SP-SM	Silty Sandstone: Very dense; dark reddish brown (5YR 2.5/2); wet; fine-grained. Thinly bedded in bluff exposures.	105.8	19.2		
25	35					ML	Siltstone and Silty Sandstone: Hard or very dense; dark gray (N4); moist; fine to medium grained sand; siltstones commonly with trace of clay; uncemented.				
30	30		RING 60/6"			SM	← Fine-grained, very silty sandstone.	107.6	11.9		
35											

Continued on next sheet.

FIG. A-31

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 10

Sheet 3 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35				ML	Clayey Siltstone: Hard; mostly gray (5Y 5/1), occasionally mottled with dusky red Fe-oxide staining; moist; non-plastic.				
25									
40		RING 40/6"		ML	Sandy siltstone, gray (5Y 5/1), slight granulated texture, some Fe-oxide mottling.	111.0	12.9		
20									
45									
15									
50		RING 65/6"		ML	Clayey siltstone with trace of sand, slight granulated texture, non-plastic.	103.1	15.5		
10									
55									

Continued on next sheet.

FIG. A-32

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 10

Sheet 4 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
55			RING 52/6"			ML	Sandy Siltstone: Hard; gray (N5); moist; fine-grained sand.	111.8	15.5		SHEAR

Bottom of boring at 56.0 feet.
Perched groundwater encountered in sandstone member from approximately 19.0 to 25.0 feet.
Boring backfilled with soil cuttings.

FIG. A-33

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 11P

Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/29/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**51.0 Ft.**
Rig Make/Model:	**Mobile B-53**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**60.2 Ft.**

Comments: Surface water in adjacent drainage.

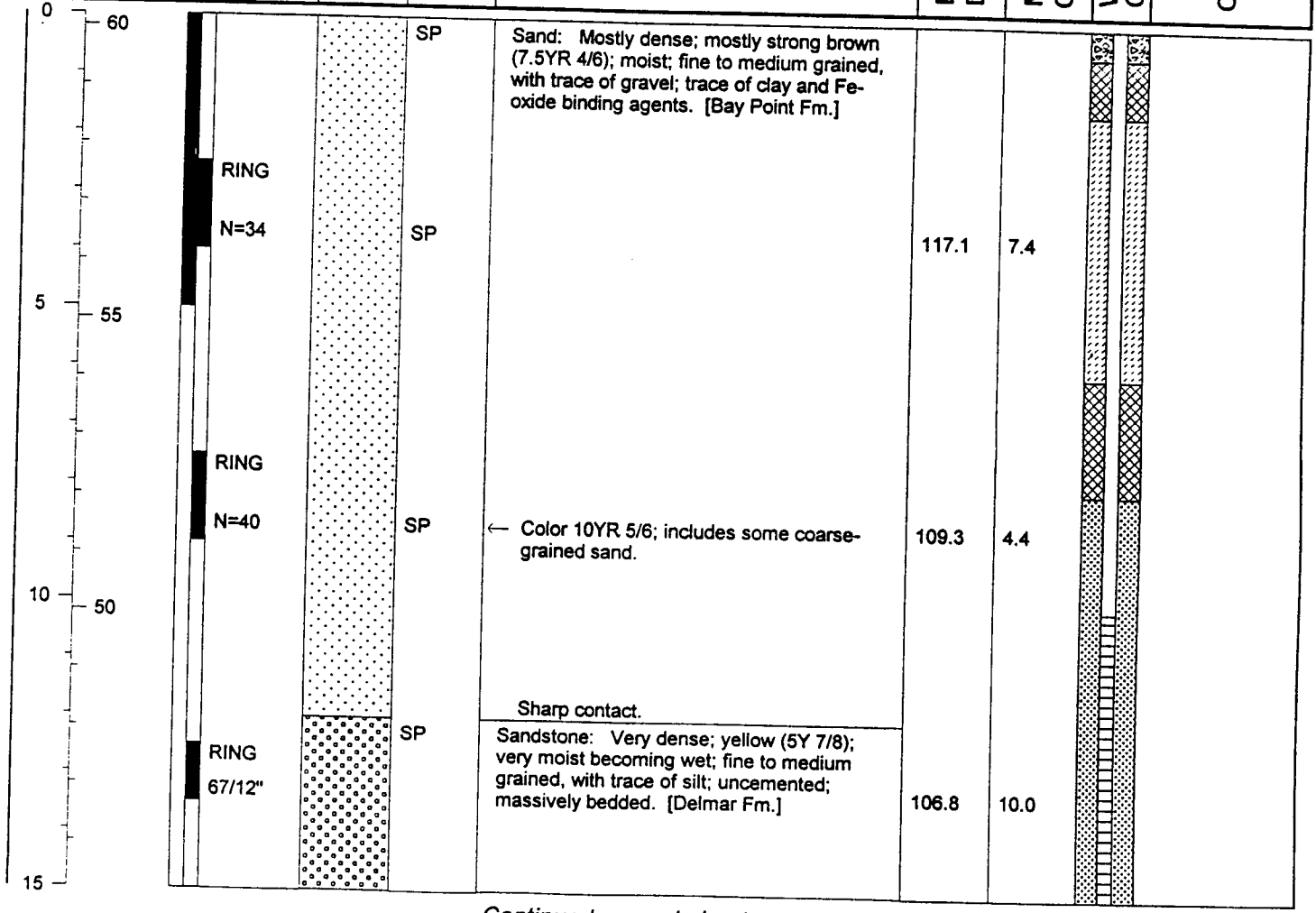

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FIG. A-34

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 11P

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

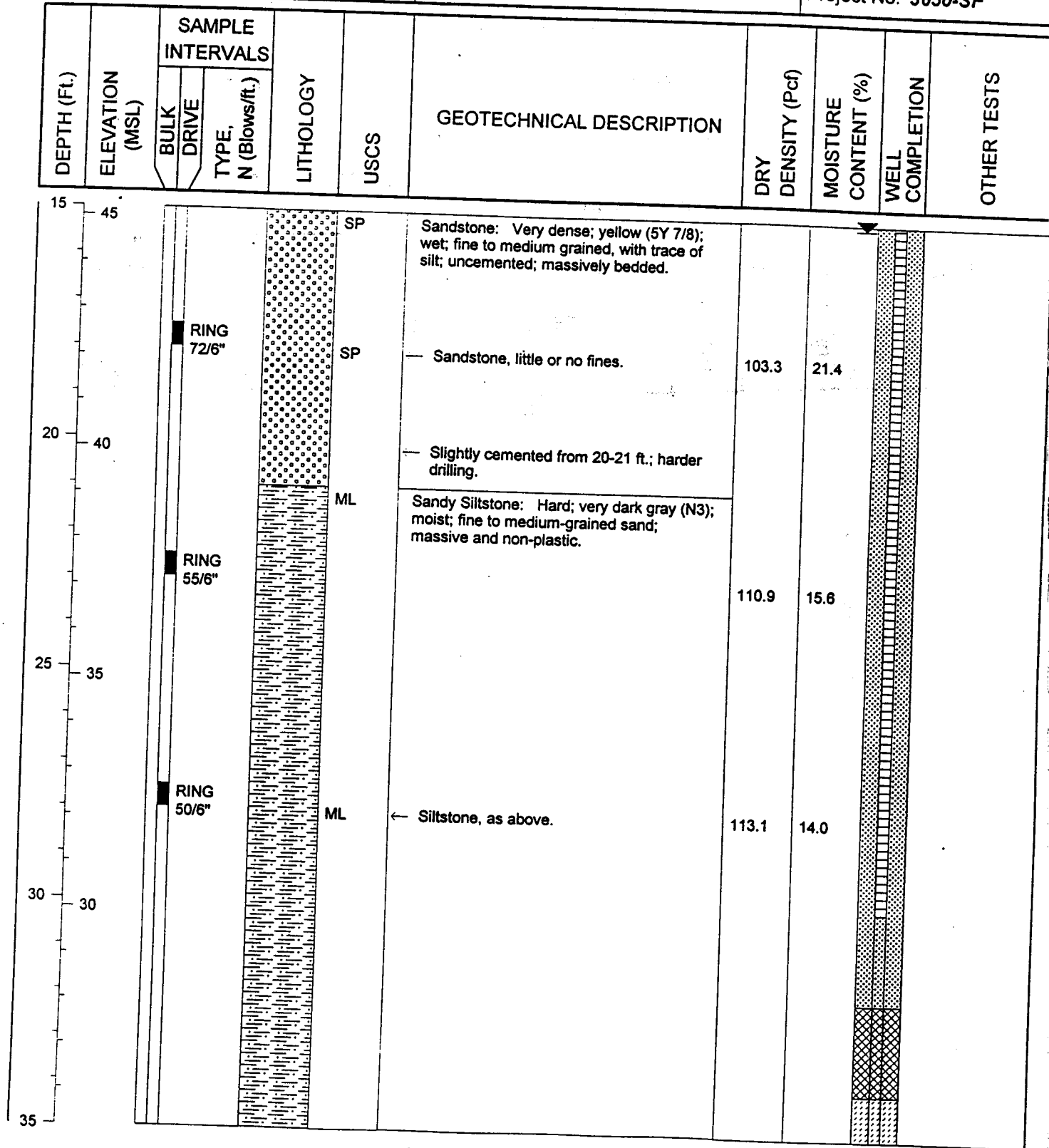

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FIG. A-35

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 11P

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35	25	RING 53/6"		ML, SM	Sandy Siltstone: As before; some very silty sandstone.	103.5	13.5		
				SP-SM	Silty Sandstone: Very dense; gray (N5); moist; fine to coarse grained; apparently massively bedded. Slightly cemented from 36 to 37 ft., and hard drilling. Becomes siltier with depth.				
40	20			SM	Becomes easier drilling; interpreted silty sandstone.				
					Approximate contact.				
				ML	Clayey Siltstone: Hard; olive gray (5Y 4/2); moist; trace of sand; non-plastic, with some granulated textures.				
45	15	RING 56/6"			← Clayey siltstone, as above.	107.4	15.8		
50	10	RING 58/6"		ML, SM	← Mixed clayey siltstone and thin silty sandstone, with common dusky red mottles	109.0	10.9		

Bottom of boring at 51.0 feet.
Perched groundwater encountered in zone from approximately 14.0 to 21.0 feet, measured depth of 15.1 feet after well installation. No groundwater encountered below 21.0 feet.
Piezometer installed as depicted in well completion column..

FIG. A-36

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 12

Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/30/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**50.0 Ft.**
Rig Make/Model:	**Mobile B-53**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**60.5 Ft.**

Comments: Boring located in rail cut.

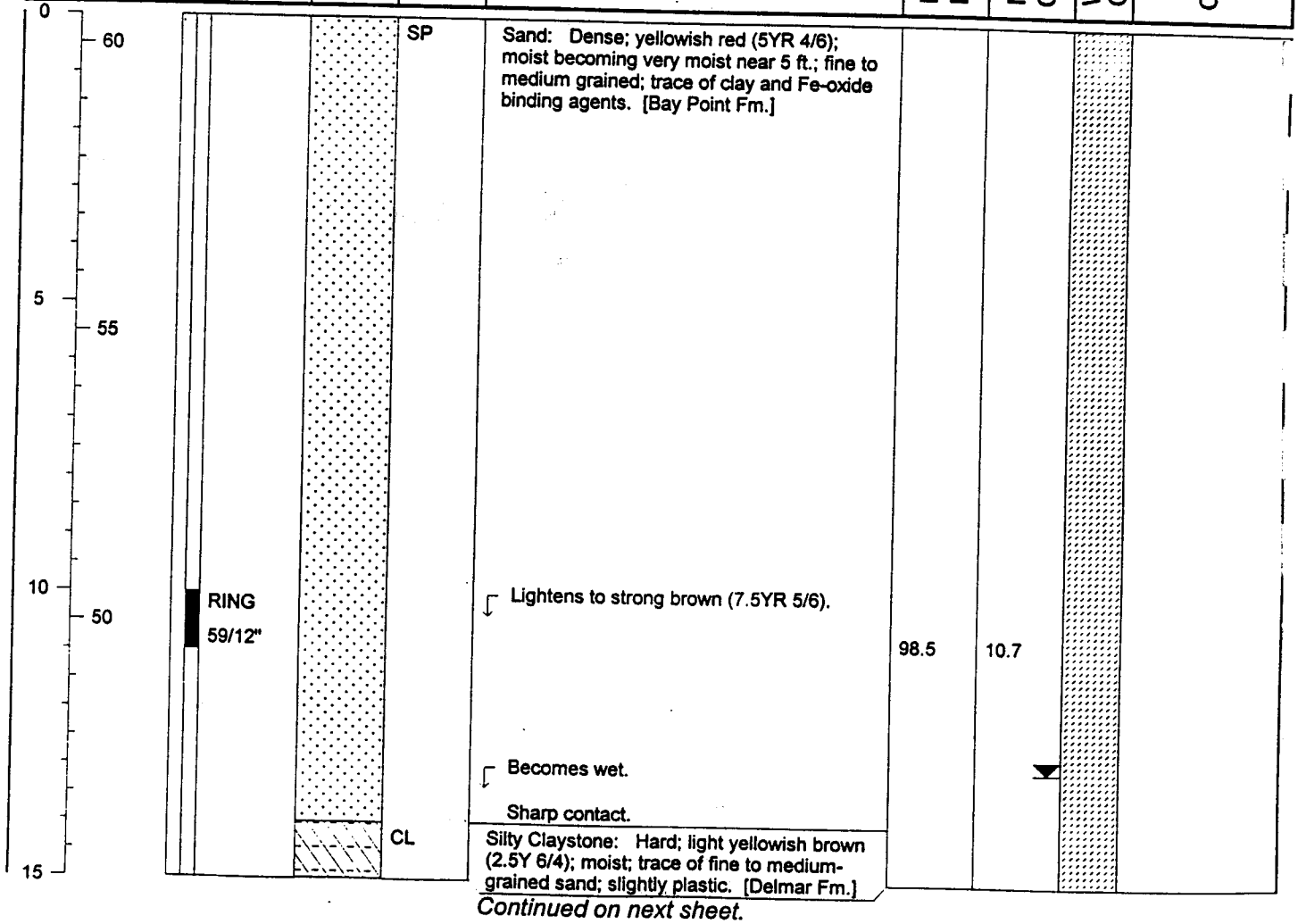

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FIG. A-37

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 12

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	45			CL	Silty Claystone: Hard; light yellowish brown (2.5Y 6/4); moist; trace of fine to medium-grained sand; slightly plastic.				
				SM	Silty Sandstone: Very dense; dark gray (5YR 4/1); moist; fine to medium grained and very silty. Apparently massively bedded.				
20	40	RING 60/6"			← Silty sandstone, as above.	104.7	12.3		
				ML, CL	Clayey Siltstone and Silty Claystone: Hard; dark gray (N4); moist; occasional trace of fine to medium-grained sand; non-plastic. Increasing sand content with depth.				
25	35								
30	30	RING 60/6"		SM	← Local very fine-grained, very silty sandstone; light gray (5YR 6/1).	113.5	8.8		
					⌐ Very clayey from about 33 to 35 feet.				
35									

Continued on next sheet.

FIG. A-38

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 12

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35	25					SM, SP-SM	Silty Sandstone: Very dense; gray (N5); moist; fine to medium grained. Inferred from cuttings.				
40	20		RING 91/9"			ML	← Sandy siltstone, gray (N5), trace of clay, massive texture. Thin, local layer.	95.3	9.2		
45	15					CL	Silty Claystone: Hard; dark gray (N4) and dusky red (10R 3/3); moist; non-plastic and friable, with pronounced granulated texture. Hard drilling.				
50			RING 56/6"			ML	← Grades to clayey siltstone, olive gray, slight granulated texture.	102.3	14.4		

Bottom of boring at 50.0 feet.
Slight groundwater seepage inferred to originate from approximately 13.0 to 14.0 feet (base of Bay Point Fm.).
Boring backfilled with soil cuttings.

FIG. A-39

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 13

Sheet 1 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/30/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**56.0 Ft.**
Rig Make/Model:	**Mobile B-53**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**57.6 Ft.**

Comments: Groundwater seepage visible at bluff face.

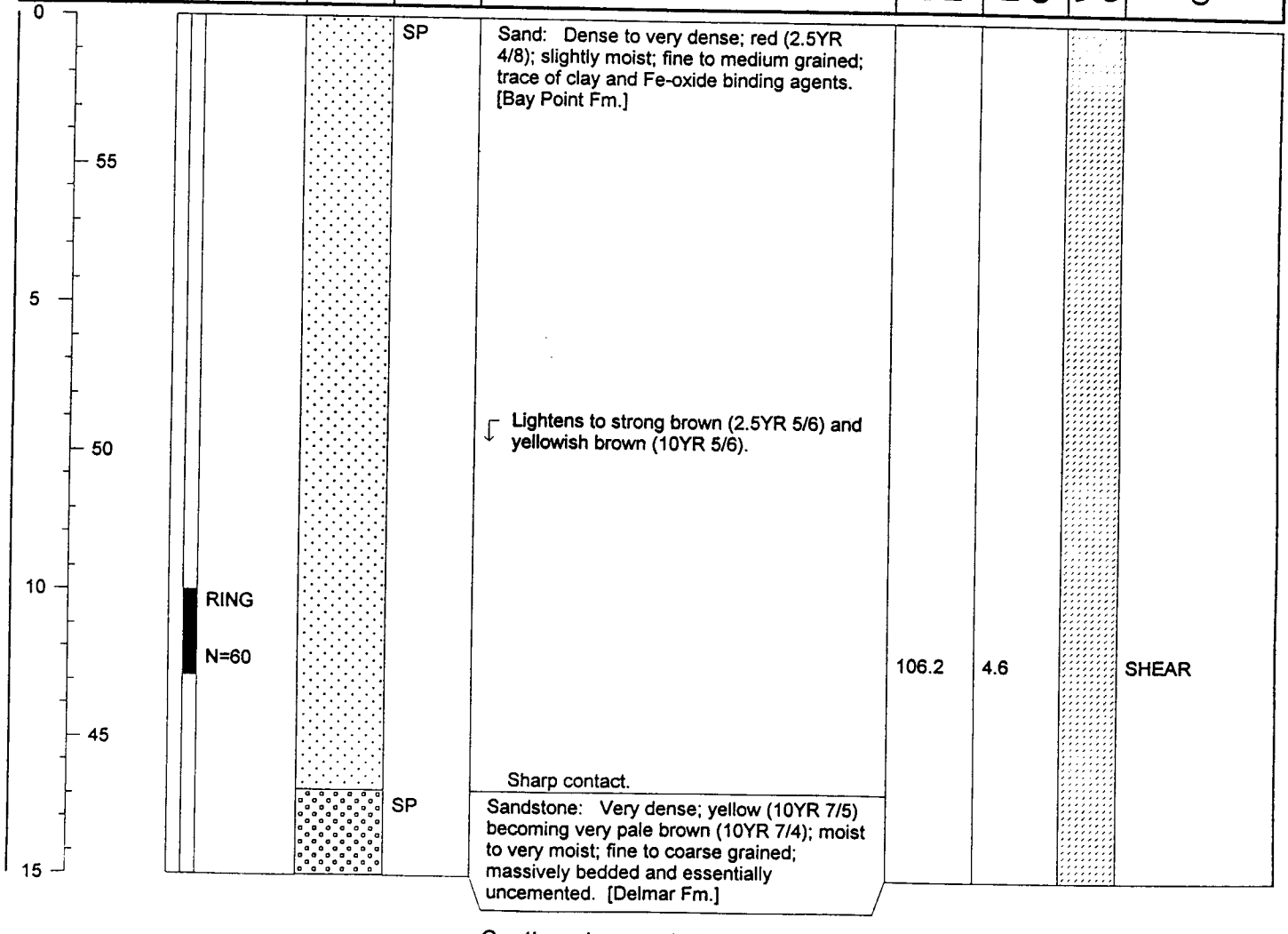

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FIG. A-40

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 13

Sheet 2 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15		RING 55/6"		SP	Sandstone: Very dense; very pale brown (10YR 7/4); moist to very moist; fine to coarse grained; massively bedded.	118.4	11.9		SHEAR
40									
20		RING 57/6"		SP	← Sandstone, as above.	111.3	11.8		
				ML	Clayey Silt: Hard; very pale brown (10YR 7/4); moist; non-plastic.				
35				SP	Sandstone: Very dense; very pale brown (10YR 7/4); moist; fine to coarse grained; uncemented.				
25		RING 65/6"		SP	← Sandstone, as above.	107.8	19.2		SHEAR
30				CL	Silty Claystone: Hard; dark gray (10YR 4/1); moist; trace of fine-grained sand; non-plastic.				
30		RING 70/6"		CL	← Silty claystone, as above.	111.9	16.9		SHEAR
25									
35									

Continued on next sheet.

FIG. A-41

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 13

Sheet 3 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35		RING 60/6"		ML, CL	Clayey Siltstone and Silty Claystone: Hard; gray (10YR 6/1) at 35 feet becoming mostly dark gray (N4) at greater depths; moist; non-plastic. Variably granulated textures, ranging from massive to intensely fractured.	116.4	12.8		SHEAR
40	20	RING 59/9"		ML	← Clayey siltstone, dark gray (N4) with some dusky red Fe oxide mottling, trace of sand, granulated texture.	106.2	15.7		
45	15	RING 50/6"		ML	← Clayey siltstone, less clay than above, and only slightly granulated texture.	111.8	17.2		SHEAR
50	10	RING 65/6"		ML	← Very clayey siltstone, abundant dusky red mottles, intensely fractured.	107.7	19.9		
55	5								

Continued on next sheet.

FIG. A-42

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 13

Sheet 4 of 4

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
55			RING 56/6"			ML	Clayey Siltstone and Silty Claystone: As before at 50 ft.	112.6	18.1		SHEAR

Bottom of boring at 56.0 feet.
Perched groundwater encountered in sandstone unit from approximately 23.0 to 28.0 feet; no groundwater encountered below 28.0 feet.
Boring backfilled with soil cuttings.

FIG. A-43

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 14P

Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/30/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**51.0 Ft.**
Rig Make/Model:	**Mobile B-53**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**52.8 Ft.**

Comments:

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
0	50					SP-SC	Clayey Sand: Dense; red (2.5YR 3/6); moist; fine to medium grained, with rare gravel clasts to 1/2"; trace of Fe-oxide binding agent. [Bay Point Fm.]				
5	45		RING 57/12"			SP-SC	← Color locally pale brown (10YR 6/3).	113.1	9.9		
							Sharp contact.				
10	40		RING 55/6"			SP	Sandstone: Very dense; yellow (10YR 7/6); moist to very moist; fine to coarse grained, with trace of silt; uncemented; massively bedded. [Delmar Fm.]	115.3	15.5		
15											

Continued on next sheet.

FIG. A-44

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 14P

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15		RING 56/6"		SP	Sandstone: Very dense; color becoming pale brown (10YR 8/3); becomes wet at 15 feet; mostly medium to coarse grained, with trace of silt; uncemented; massively bedded.	108.3	17.5		
	35			SM	Grades silty, fine-grained.				
20		RING 50/6"		ML	Clayey Siltstone: Hard; dark gray (N4); moist; trace of fine to medium-grained sand; massive and non-plastic.	112.4	15.4		SHEAR
	30								
25		RING 43/6"		ML	← Clayey siltstone, as above.	99.3	17.6		
	25								
30		RING 50/6"		ML	← Siltstone, little to no clay, massively bedded.	111.8	15.5		SHEAR
	20								
35									

Continued on next sheet.

FIG. A-45

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 14P

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35		RING 60/6"		ML, SM	Siltstone and Silty Sandstone: Hard or very dense; dark to very dark gray (N3-N4); slightly moist to moist; sandy layers mostly fine to medium grained. Classified silty sandstone at 35 ft. depth.	99.3	11.6		SHEAR
40	15	RING 55/6"		ML	← Sandy siltstone, little to no clay, massive.	106.2	14.8		
45	10	RING 72/6"		SM	Silty Sandstone: Very dense; dark gray (N4); moist; fine to medium grained; apparently massively bedded. Exposed at toe of bluffs.	102.5	10.5		SHEAR
50	5	RING 42/6"		ML	Clayey Siltstone: Hard; dark gray (N5) with common dusky red mottles; moist; local trace of sand; non-plastic, locally with some granulated textures. ← Clayey siltstone, as above.	107.3	14.9		SHEAR

Bottom of boring at 51.0 feet.
Perched groundwater encountered in zone from approximately 15.0 to 17.0 feet, at base of sandstone member.
No groundwater encountered below 17.0 feet.
Piezometer installed as depicted in well completion column..

FIG. A-46

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 15

Sheet 1 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/30/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**43.0 Ft.**
Rig Make/Model:	**Mobile B-53**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**50.3 Ft.**

Comments:

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
0	50					SP-SC	Clayey Sand with Gravel: Dense; dark red (2.5YR 3/6); moist; fine to medium grained. [Fill]				
						SP-SC	Clayey Sand: Dense; dark red (2.5YR 3/6); moist becoming very moist at about 4 ft.; fine to medium grained; very weakly cemented with clay and Fe oxides. [Bay Point Fm.]				
5	45						Becomes wet.				
							Sharp contact.				
						CL	Silty Claystone: Hard; yellow (10YR 8/6); moist to very moist; non-plastic. [Delmar Fm.]				
10	40					ML	Sandy Siltstone: Hard; yellow (10YR 7/6); moist; fine-grained sand; non-plastic.				
			RING 55/12"					108.8	16.0		
						SM	Silty Sandstone: Very dense; yellow (10YR 7/6); moist; fine to medium grained. Interval deduced from bluff face exposure.				
15											

Continued on next sheet.

FIG. A-47

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 15

Sheet 2 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	35			SM	Silty Sandstone: Very dense; yellow (10YR 7/6); moist; fine to medium grained. Interval deduced from bluff face exposure.				
		RING 74/12"		ML	Clayey Siltstone: Hard; mostly dark gray (N4) with frequent dusky red mottles; moist; small amounts of fine to medium-grained sand; variably massive to intensely fractured or granulated.	104.6	17.7		
20	30								
		RING 74/12"		ML	← Clayey siltstone, as above, granulated texture.	99.7	16.4		
25	25								
		RING N=27		ML	← Clayey siltstone with sand, olive gray (5Y 5/2) with red (10R 3/6) mottles.	97.6	18.8		
30	20				Siltstone: Hard; dark gray (5Y 4/1); moist; non-plastic; trace of clay and fine-grained sand. Mostly massive to lightly granular texture.				
35									

Continued on next sheet.

FIG. A-48

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 15

Sheet 3 of 3

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
35	15				Siltstone: Hard; dark gray (5Y 4/1) and gray (N5); moist; non-plastic; trace of clay; mostly massive and without granular texture.				
		RING 53/6"		ML	← Siltstone, as above.	107.8	16.0		
40	10								
		RING 72/6"		ML	← Very sandy siltstone, gray (N5), massive	103.8	15.8		

Bottom of boring at 43.0 feet.
Perched groundwater encountered in zone from approximately 7.0 to 9.0 feet (base of Bay Point Fm.).
Boring backfilled with soil cuttings.

FIG. A-49

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 16

Sheet 1 of 2

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

Dates(s) Drilled:	**4/30/98**	Logged By:	**M. Doerschlag**
Drilled By:	**California-Pacific**	Total Depth:	**29.5 Ft.**
Rig Make/Model:	**Mobile B-53**	Hammer Type:	**Wireline downhole**
Drilling Method:	**Hollow-stem Auger**	Hammer Weight/Drop:	**140 Lb./±30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**46.5 Ft.**

Comments: Located at north end of project alignment.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	SAMPLE INTERVALS: TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
0	45					SP-SC	Clayey Sand with Gravel: Dense; dark red (2.5YR 3/6); moist; fine to coarse grained. [Fill]				
5	40					SP-SC	Clayey Sand: Dense; yellowish red (5YR 4/6); moist; fine to medium grained; very weakly cemented with clay and Fe oxides. [Bay Point Fm.] Sharp contact.				
10	35					SP	Sandstone: Very dense; yellow (5Y 8/6); moist; fine to coarse grained; local trace of silt; uncemented; massively bedded. [Delmar Fm.] Becomes yellow (5Y 7/7).				
15						CL, ML	Silty Claystone and Clayey Siltstone: Hard; yellow (10YR 8/6) to pale brown (10YR 7/3); moist; trace of fine to medium-grained sand; slightly plastic from 13-16 feet.				

Continued on next sheet.

FIG. A-50

Medall, Aragon, Higley Geotechnical, Inc.

FIELD LOG OF BORING B - 16

Sheet 2 of 2

Project: *NORTH COUNTY TRANSIT DISTRICT*

Location: *DEL MAR, CALIFORNIA* | Project No. *3650-SF*

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, N (Blows/ft.)	LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
15				ML	Clayey Siltstone: Hard; yellow (10YR 8/6) to pale brown (10YR 7/3); moist; trace of fine to medium-grained sand; non-plastic below about 16 feet.				
	30								
20		RING 69/12"			Abruptly becomes gray (5Y 5/1).				
				ML	← Clayey siltstone, non-plastic, slight granulated texture.	109.9	15.0		
	25								
25									
	20								
		RING 48/6"		ML	← Clayey siltstone, very pale brown (10YR 7/4) with dusky red mottles, massively bedded.	101.3	20.8		

Bottom of boring at 29.5 feet.
No groundwater encountered.
Boring backfilled with soil cuttings.

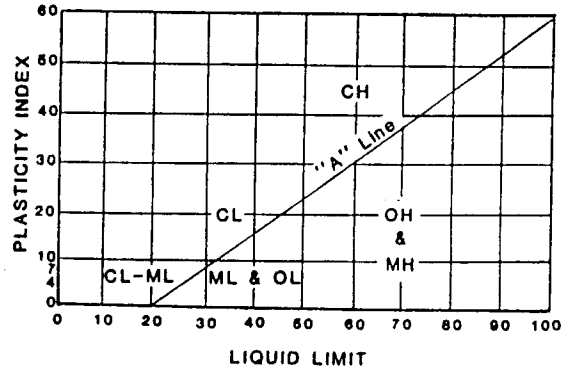
FIG. A-51

MAJOR DIVISIONS		SOIL CLASS.	TYPICAL NAMES
COARSE GRAINED SOILS (More than 1/2 of soil > no. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > no. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction < no. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (More than 1/2 of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

CLASSIFICATION CHART
(Unified Soil Classification System)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

GRAIN SIZE CHART



PLASTICITY CHART

METHOD OF SOIL CLASSIFICATION

APPENDIX E

WAVE DATA

Appendix E
Coastal Processes

The coastal processes that impact the bluffs include: tides, storms, climactic events, sea level rise, waves and wave runup. In this section of the report we provide general base data for the effects of coastal processes on the bluffs for future design and decision making. The following subsections on tides, storm surge, extreme water and waves, sea level rise and wave runup provides minimum coverage of coastal processes that impact the bluffs.

Tides and water levels:

The level of the ocean plays an important role in coastal processes and shoreline erosion. As the sea level rises, the shoreline moves inland and this enables the waves to erode the shoreline further back on the beach profile. The sea level is primarily influenced by the tides and secondarily by storms. The mean tide range is about 3.7 feet, with extreme water levels given in the following table.

Water Levels at Scripps Pier, La Jolla, California		
Occurrence	Feet from MLLW (feet)	Feet from NGVD (feet)
Highest Observed Water Level, Nov. 13, 1997	7.97	5.41
Mean High Water Level (MHWL)	4.62	2.06
Mean Sea Level (MSL)	2.75	0.19
National Geodetic Vertical Datum (NGVD)	2.56	0.00
Mean Low Water Level (MLW)	0.93	-1.63
Mean Lower Low Water Level (MLLW)	0.00	-2.56
Lowest Observed Water Level, Dec. 11, 1993	-2.60	-5.16

Source: USFWS, 2000

Sea levels also vary with El Nino and in 1982-83 the sea level was about 0.85 feet higher than normal for over a year.

Storm Surge:

Strong winds, high waves and low atmospheric pressure systems can elevate the sea level and these combined effects are termed the storm surge.

Storm Surge at Scripps Pier, La Jolla, California	
Return Period (years)	Storm Surge (feet)
5	2.0
10	2.1
25	2.2
50	2.3
100	2.4

Source: NOAA, 1980

Extreme water or storm surge still water levels:

When storm surge occurs at the same time as high tide, the combination results in a statistical extreme water elevation. This extreme water elevation is the storm surge still water level and is used to design coastal structures according to the return period of the design.

Extreme Still Water Level (SWL) at Scripps Pier La Jolla, California	
Return Period (years)	Extreme SWL (feet above MSL)
5	4.06
10	4.16
25	4.26
50	4.36
100	4.46

Source: NOAA, 1980

Sea Level Rise:

It has been reported that the sea level has risen 0.7 feet over the last 100 years according Flick and Cayan, as reported in the Coast of California Storm and Tidal Waves Study Annual report 1983. The sea level is expected to rise about 0.2 feet over the next 25 years as a result of global warming. (USACE 1989, 1991)

Waves:

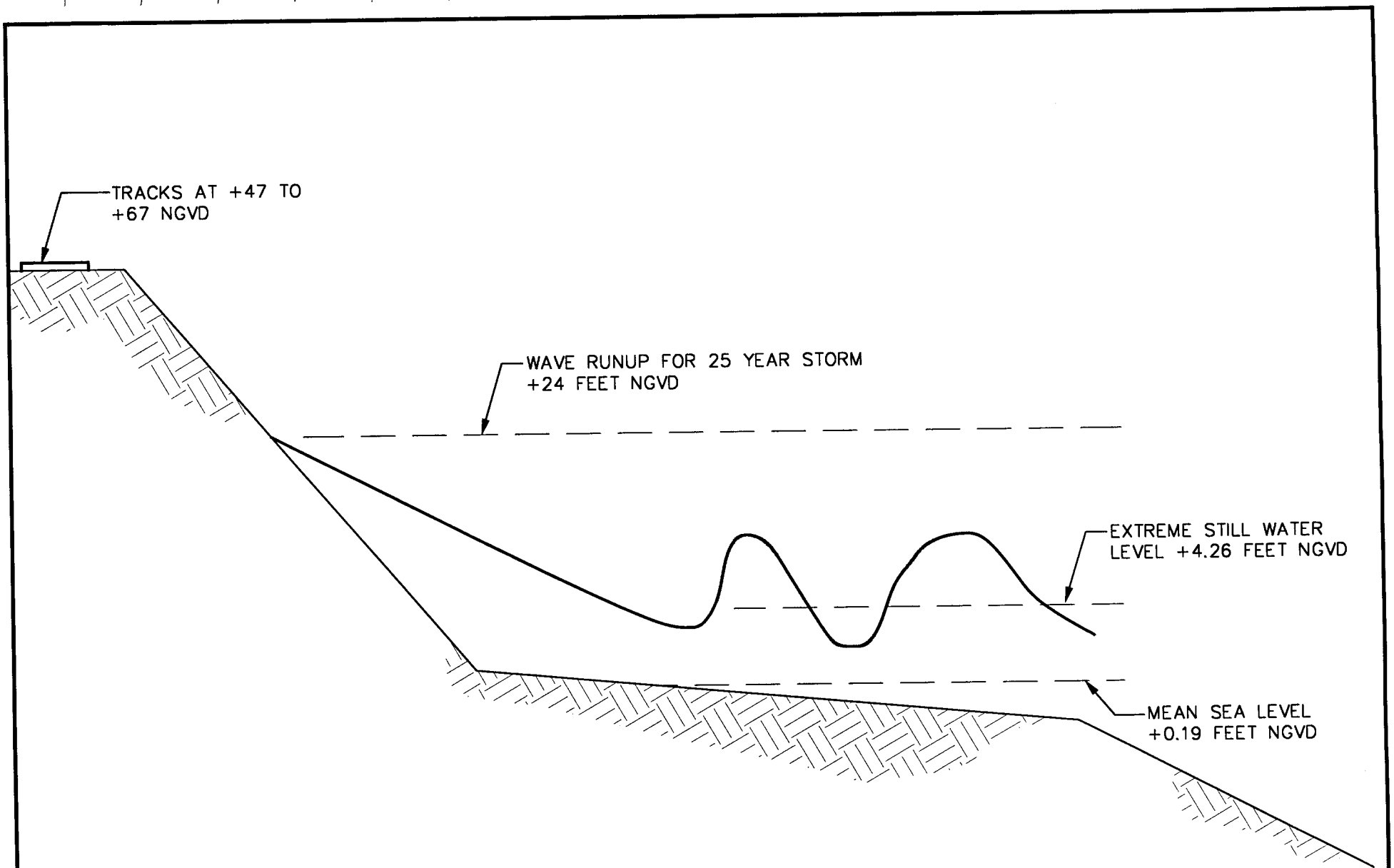
Significant waves now travel over this extreme water elevation and arrive at the coast line. The waves are pushed up by the sea bottom, break and then runup the beach and bluffs. The wave runup is calculated using the bottom profile and the significant wave height. The majority of shoreline erosion occurs during these infrequent storms as the large waves crash up the beach and into the bluffs, particularly at high tide.

Significant Wave Heights at Del Mar	
Return Period (years)	Significant Wave Height (feet)
5	13.0
10	14.5
25	16.5
50	18.0
100	19.4

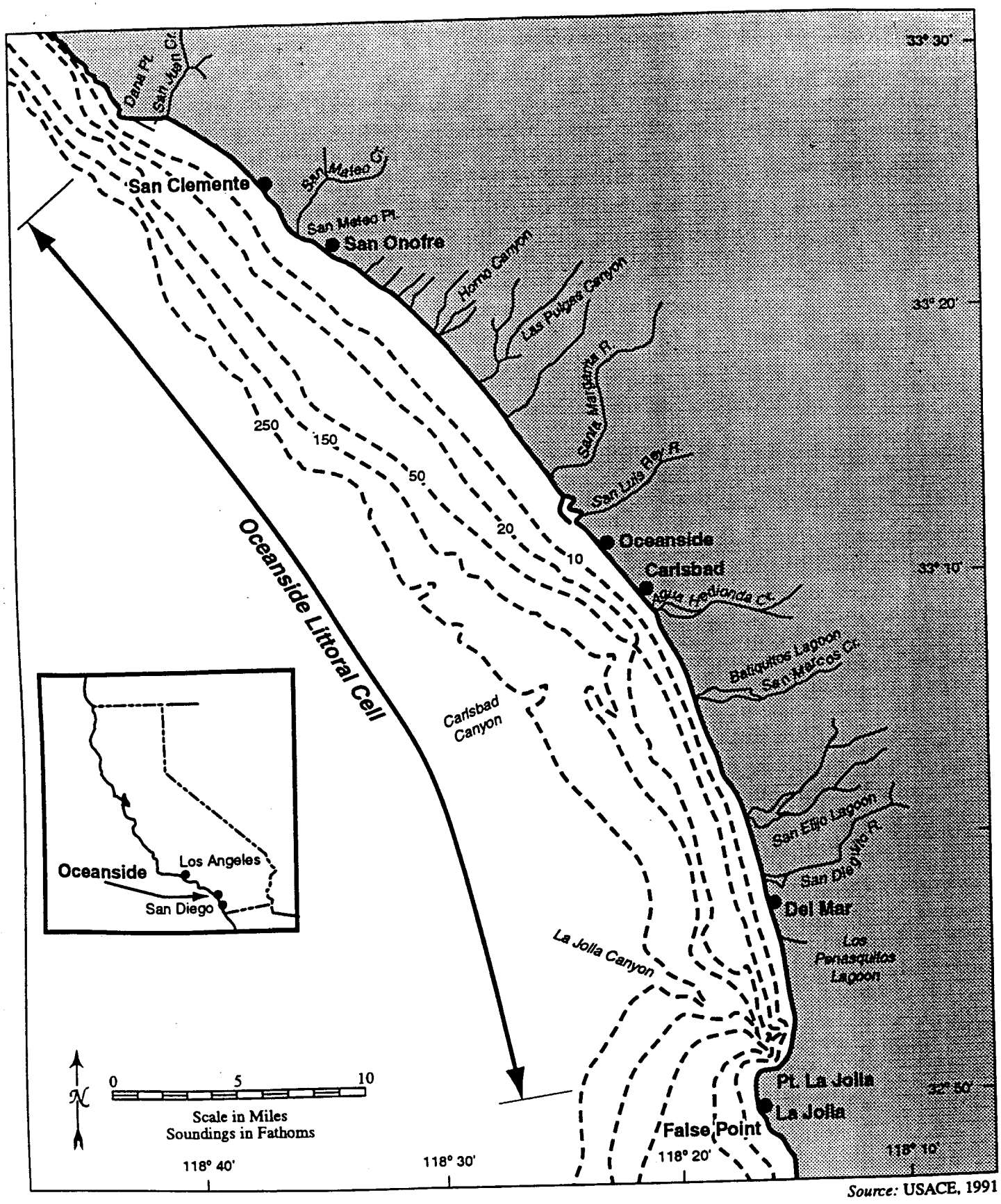
Source: USACE, 1991

Wave Runup:

The wave runup has been calculated using the USACE Shore Protection Manual 1984 using the following assumptions based on information from NCTD and Mr. Hany Elwany of Coastal Environments: A wave period of 16 seconds, a breaking wave height of 6 feet (this assumes that larger waves will break offshore with a lesser wave height at the bluff toe), and a still water level of +4.26 feet. Using these assumptions, the wave runup on the Del Mar Bluffs will be in the order of 14 to 24 feet above msl depending on the recurrence interval and the toe protection structure built. More detailed wave and sediment studies will be done as part of the final design stage.



LEIGHTON AND ASSOCIATES, INC.
3934 Murphy Canyon Road
Suite B-205
San Diego, CA 92123



Source: USACE, 1991

Figure 3.2-9. Oceanside Littoral Cell

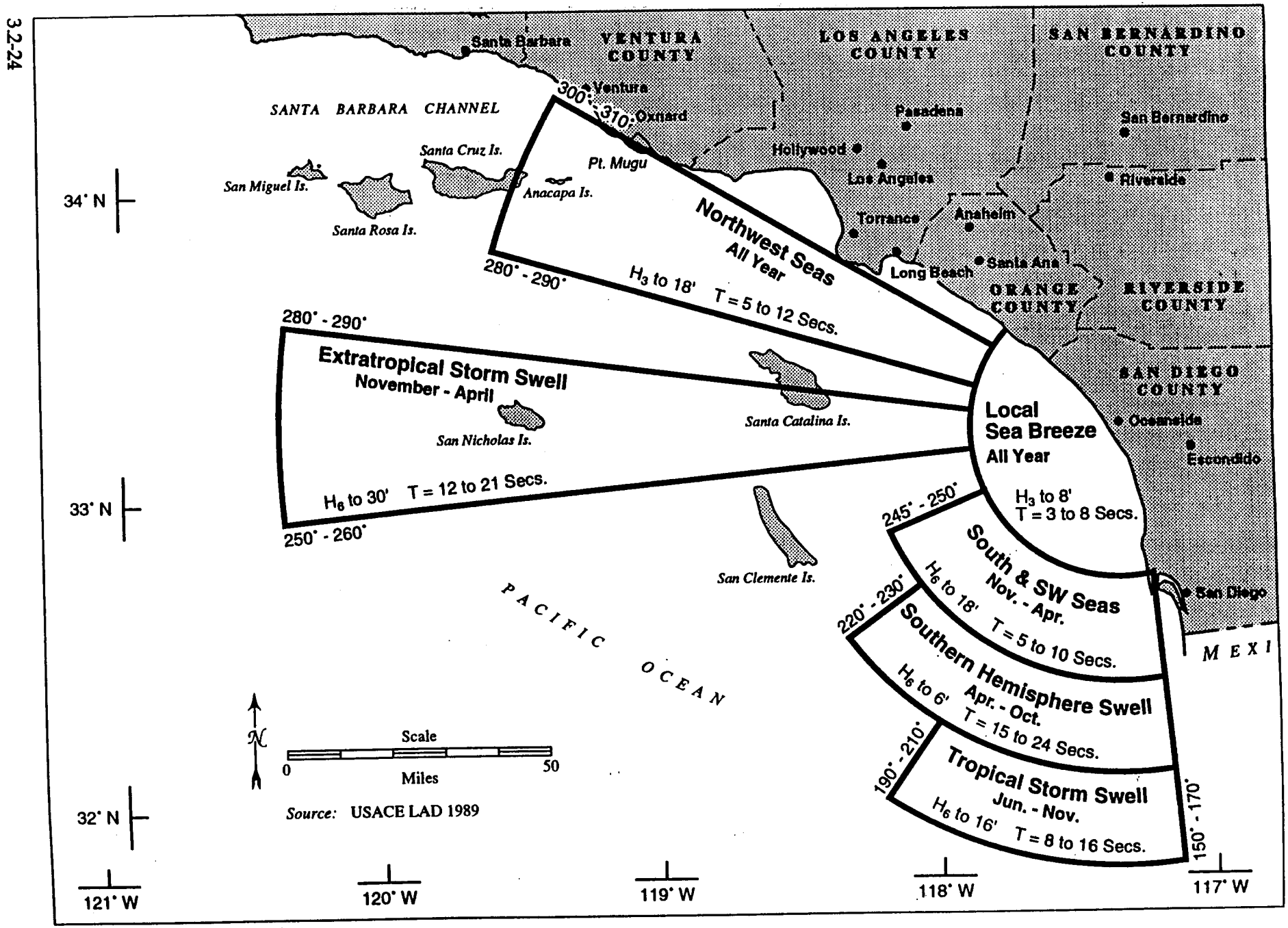


Figure 3.2-10. Wave Exposure for the San Diego Region

Historical Beach Profile Data in the Vicinity of Del Mar

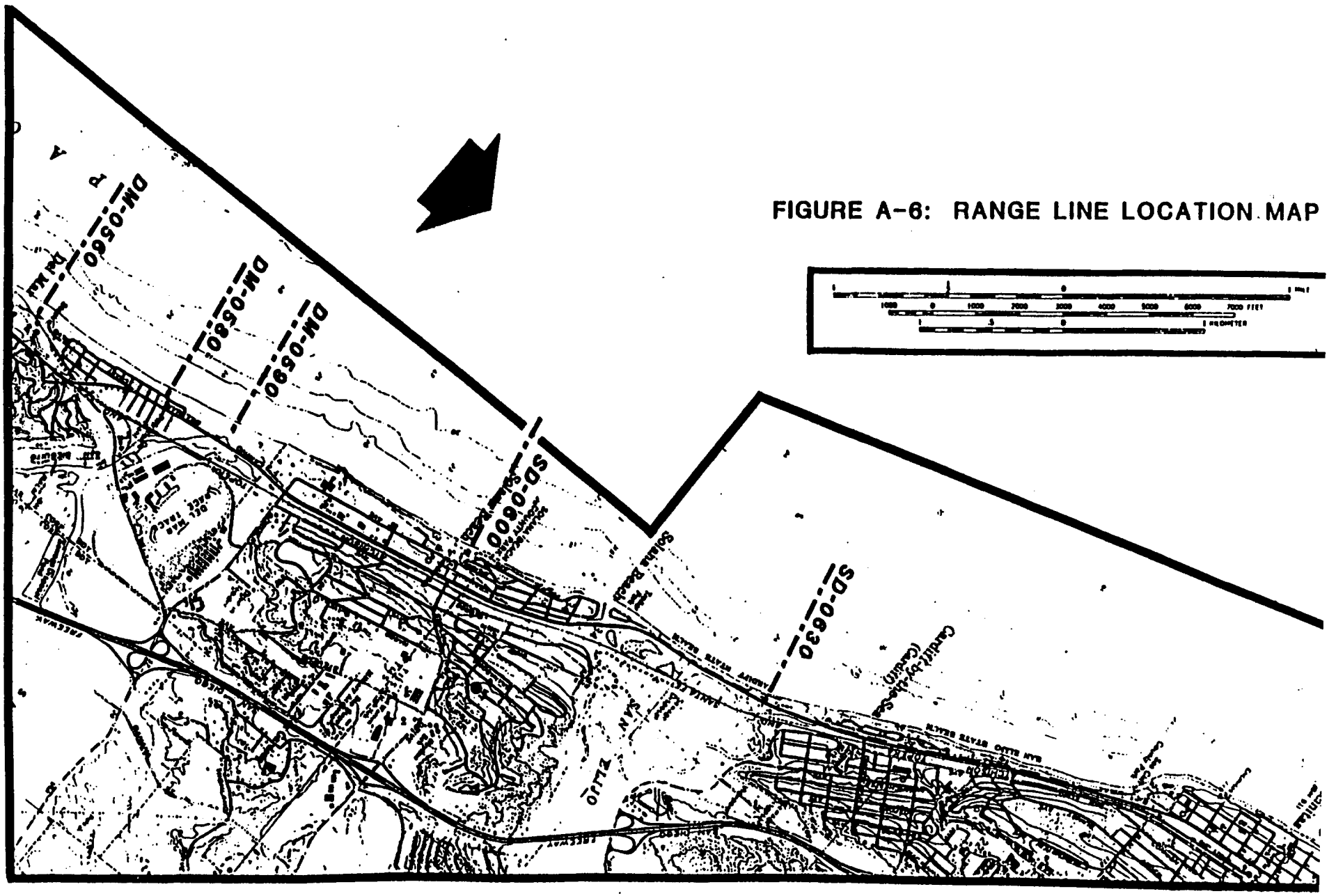
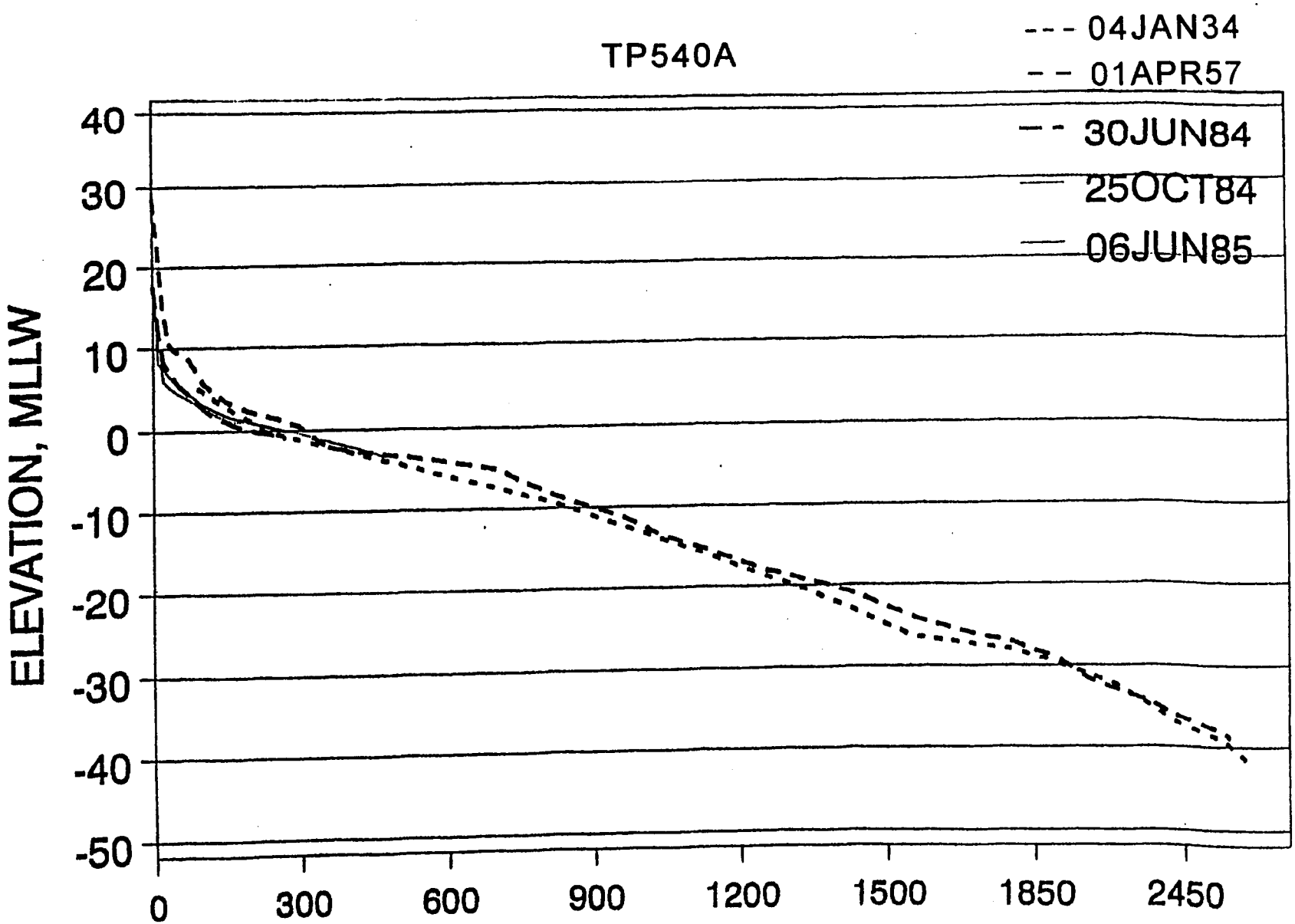
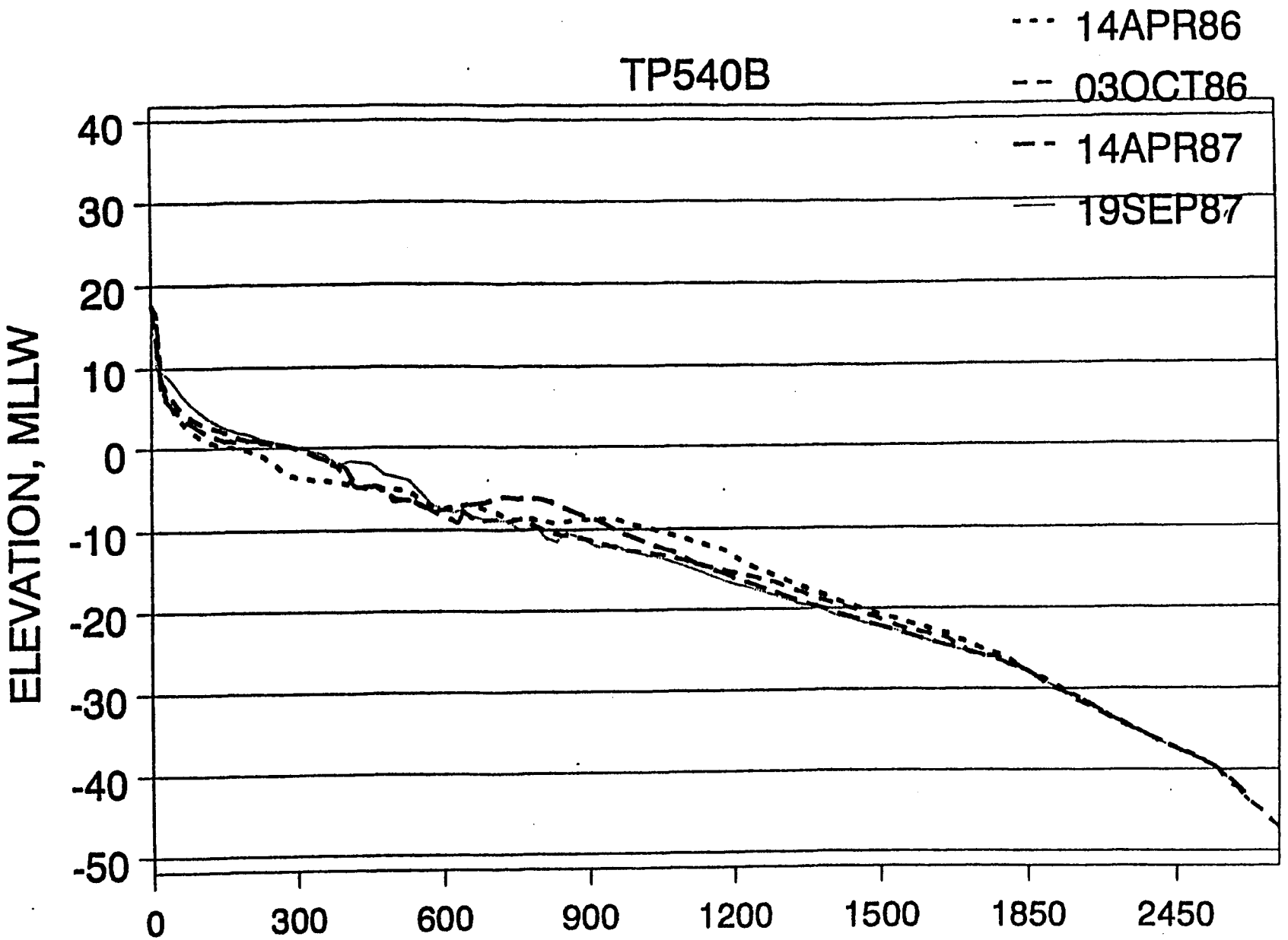
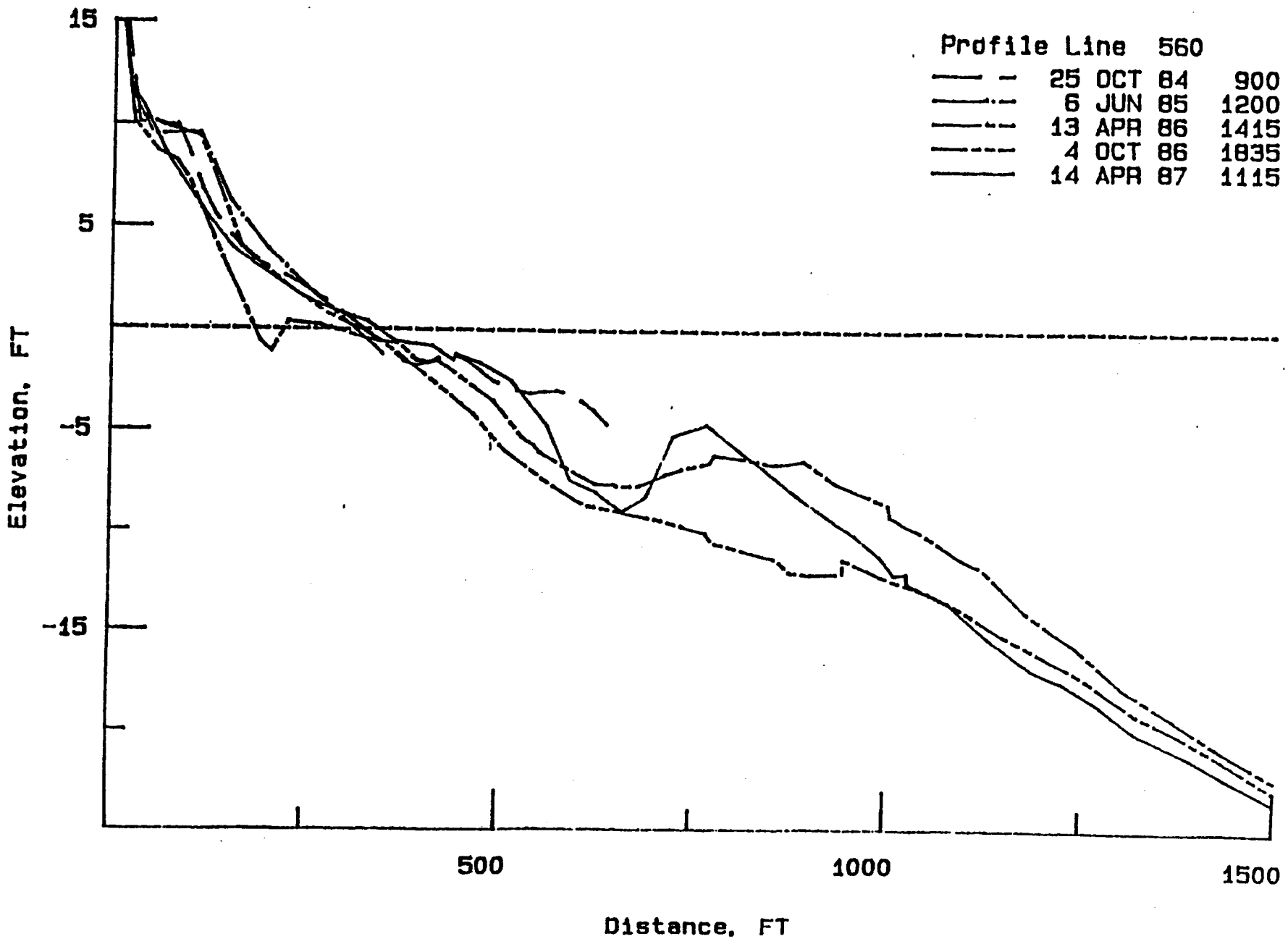


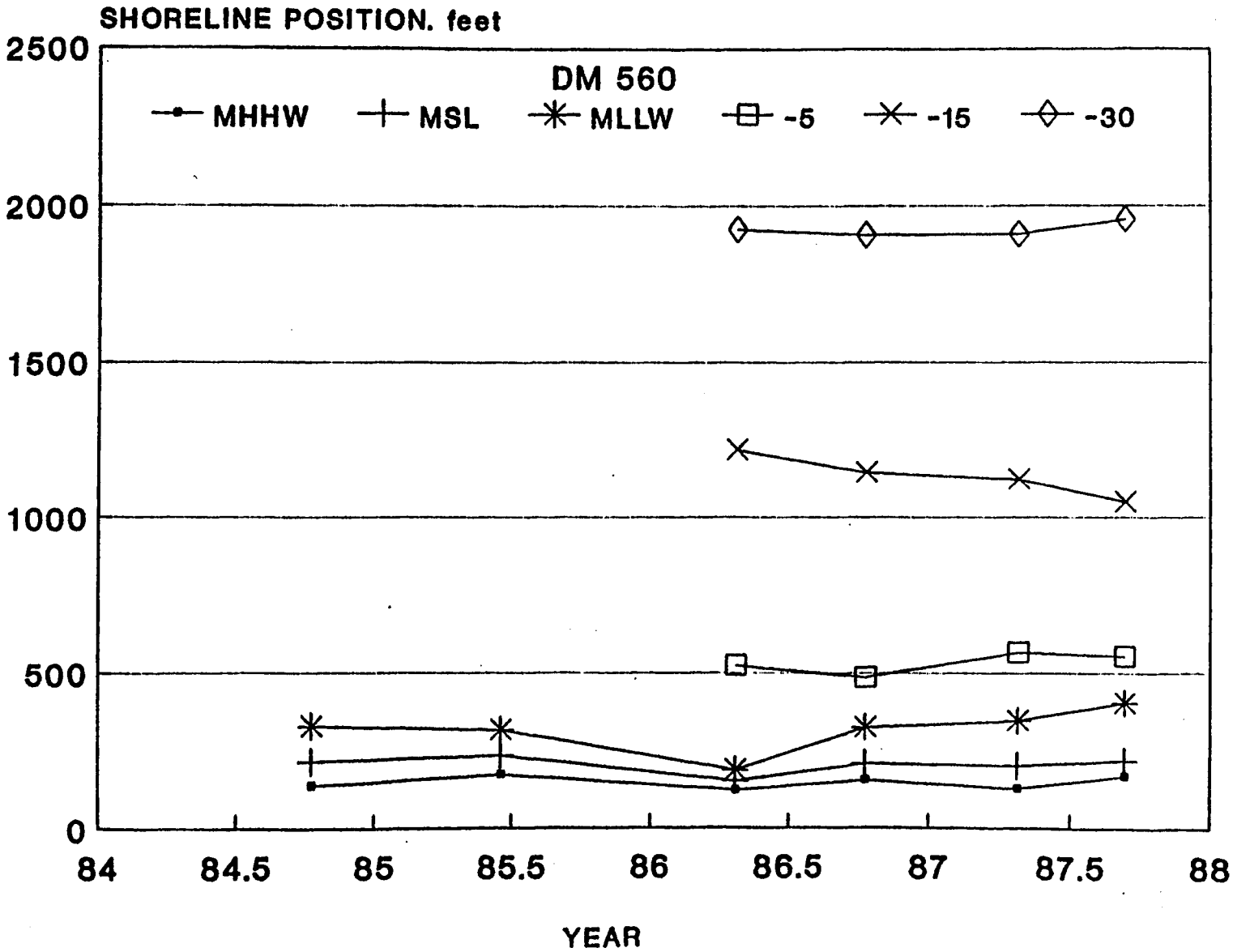
FIGURE A-6: RANGE LINE LOCATION MAP

FIGURE A-5: RANGE LINE LOCATION MAP NO. 4


TP540A
--- 04JAN34
- - 01APR57
— - 30JUN84
— 25OCT84
— 06JUN85
ELEVATION, MLLW
40
30
20
10
0
-10
-20
-30
-40
-50
0
300
600
900
1200
1500
1850
2450


TP540B
14APR86
03OCT86
14APR87
19SEP87
ELEVATION, MLLW
40
30
20
10
0
-10
-20
-30
-40
-50
0
300
600
900
1200
1500
1850
2450


Profile Line 560
25 OCT 84 900
6 JUN 85 1200
13 APR 86 1415
4 OCT 86 1835
14 APR 87 1115
15
5
-5
-15
Elevation, FT
500
1000
1500
Distance, FT


SHORELINE POSITION. feet
DM 560
MHHW
MSL
MLLW
-5
-15
-30
2500
2000
1500
1000
500
0
84
84.5
85
85.5
86
86.5
87
87.5
88
YEAR

Storm Wave Data

EXTREME WAVE EPISODES EXCEEDING 6 M.
1900 - 1984

DATE	SIG.HT. (m)	MAX. PERIOD	DIRECTION
13 MAR 05	8.8	15	247
03 FEB 15	7.5	14	235
01 FEB 26	6.9	15	257
28 DEC 31	7.4	18	288
06 JAN 39	7.9	19	285
26 JAN 58	6.8	14	259
05 APR 58	7.7	18	289
09 FEB 60	8.1	19	295
17 FEB 80	6.1	18	249
28 JAN 81	7.0	17	262
01 DEC 82	6.4	14	295
18 DEC 82	6.4	20	288
25 JAN 83	6.1	17	278
27 JAN 83	7.3	22	279
10 FEB 83	6.7	25	281
01 MAR 83	8.2	20	258
03 DEC 83	7.0	17	285
25 FEB 84	6.4	17	300

Table B-1. Hindcast (1900-84) waves exceeding 6 m height near 35° N (Seymour et al, 1984). From USACOE, 1986 (CCSTWS 86-1)

Scripps Institution of Oceanography
Recurrence Intervals

Location	Mean H_s (feet)	Significant Wave Height (feet) 5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Mission Bay Buoy	7.3	15.0	17.2	20.0	21.9	23.8
Begg Rock	11.9	22.6	25.1	28.6	31.0	33.1
Scripps Pier	4.9	9.3	10.5	12.1	13.2	14.3
Mission Bay Entrance	7.0	14.0	16.0	18.8	20.7	22.7
Del Mar	6.2	13.0	14.5	16.5	18.0	19.4
Oceanside Beach	5.1	9.3	10.3	11.7	12.4	13.6
San Clemente	5.1	11.0	12.3	14.3	15.8	17.0

Table B-2. Significant wave heights at Del Mar (shallow water), and other deep and shallow water stations, based on wave gauge data and hindcasting. . From USACOE, 1991 (CCSTWS 91)

APPENDIX F

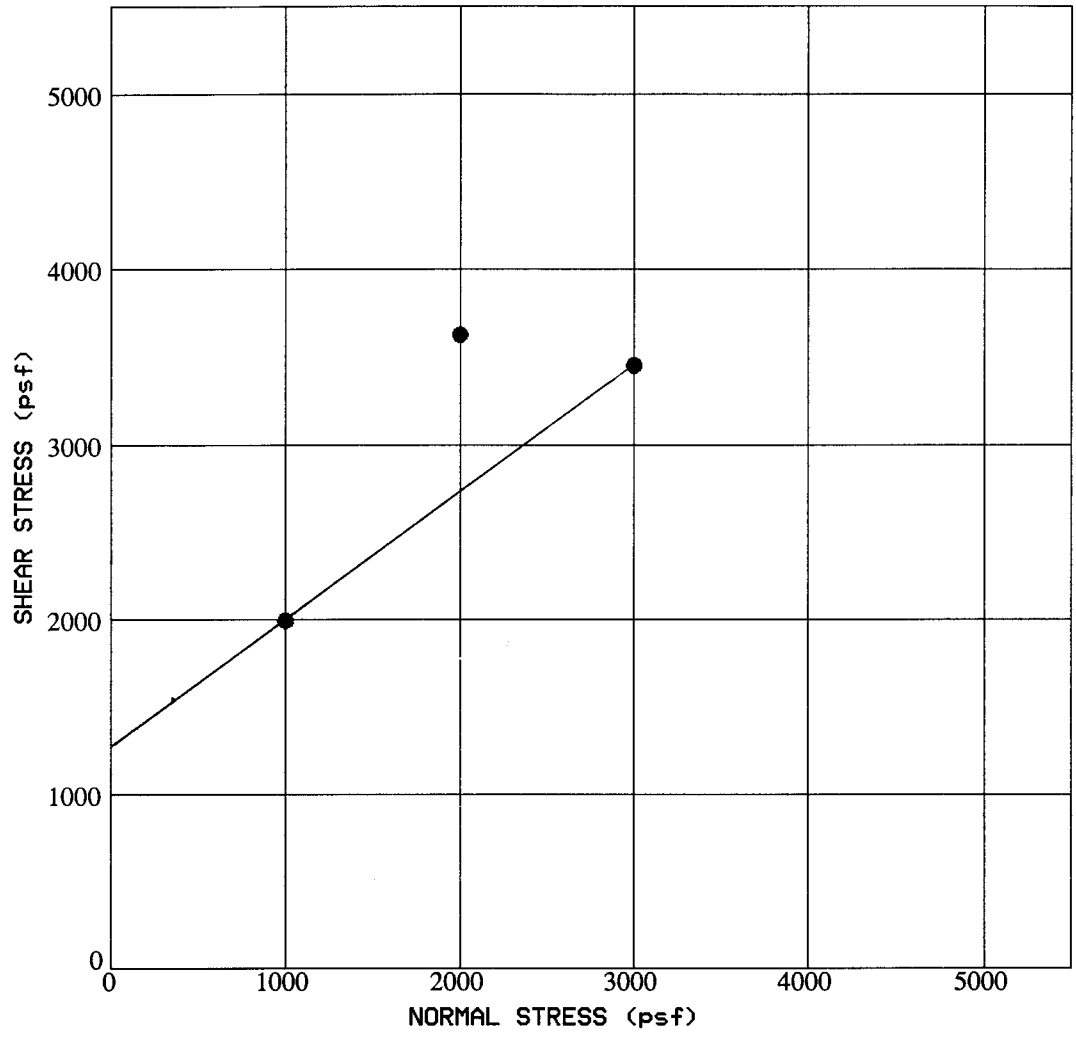
LABORATORY TESTING

APPENDIX F

Laboratory Testing Procedures and Test Results

Moisture and Density Determination Tests: Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings and/or trenches. The results of these tests are presented in the boring and/or trench logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

Shear Tests: Direct shear tests were performed on selected undisturbed samples that were soaked under a surcharge equal to the applied normal force during testing. The samples were tested under various normal loads, a motor-driven, stain-controlled, direct-shear testing apparatus at a strain rate of 0.001 to 0.012 inches per minute. The "peak" shear resistance was obtained from the maximum recorded shear resistance.



Boring No.	LB-1	Depth (ft)	10.5
Sample No.	R-1	Soil Type	Siltst.
Type of Sample	Ring		

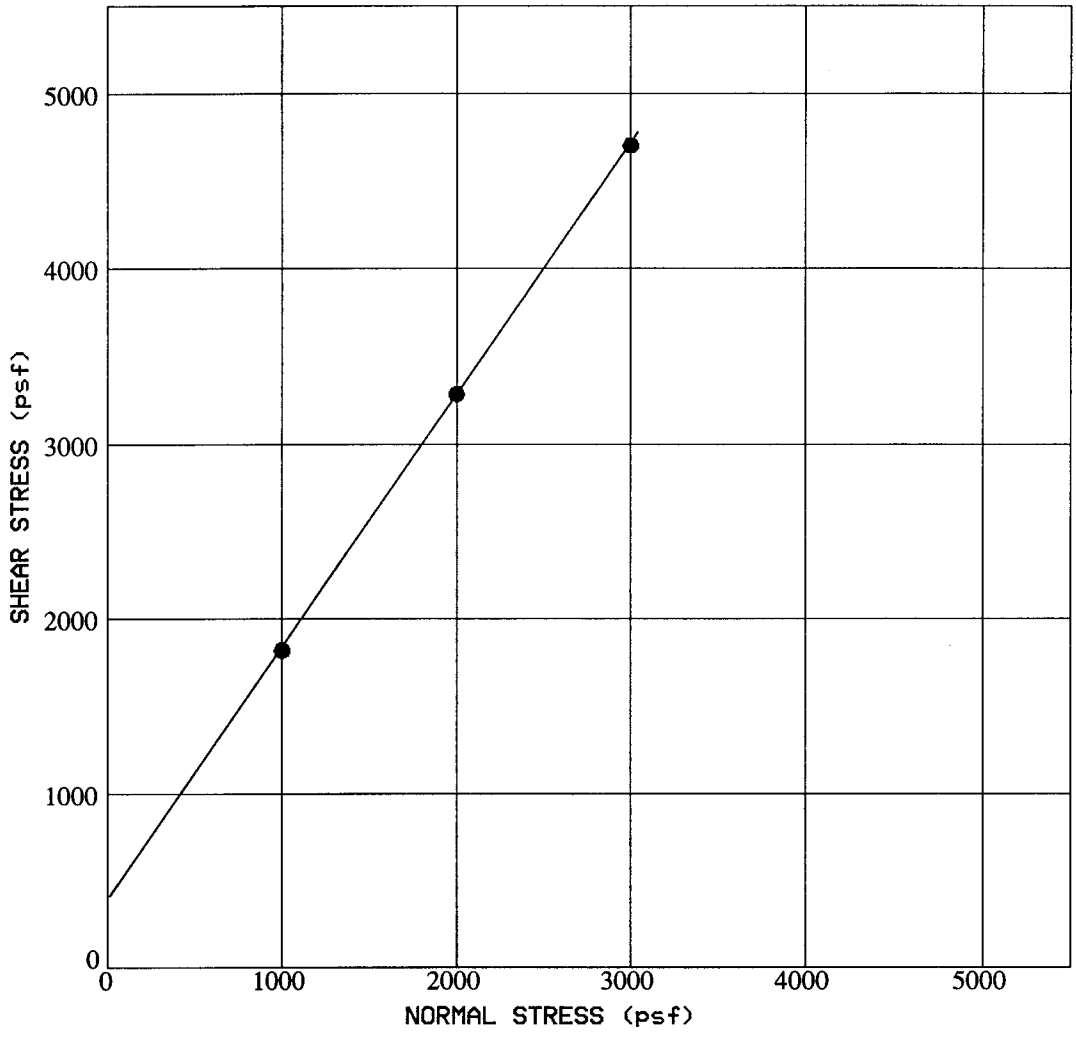
Friction Angle (deg.)	36
Cohesion (psf)	1250

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-1



Boring No. LB-1 Depth (ft) 20.5

Sample No. R-2 Soil Type Sandst.

Type of Sample Ring

Friction Angle (deg.) 55.5

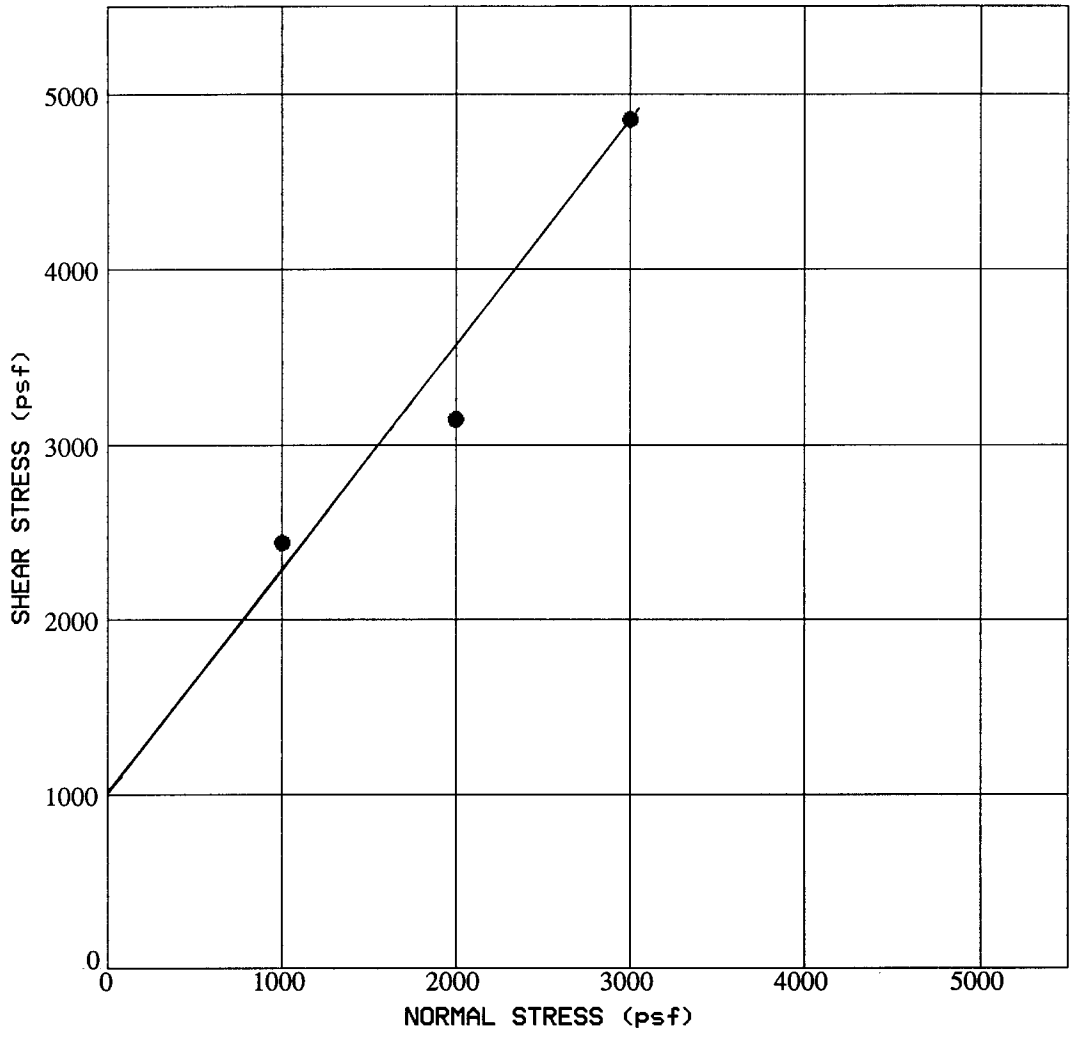
Cohesion (psf) 350

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-2



Boring No. LB-1 Depth (ft) 30.5

Sample No. R-3 Soil Type Sandst.

Type of Sample Ring

Friction Angle (deg.) 51

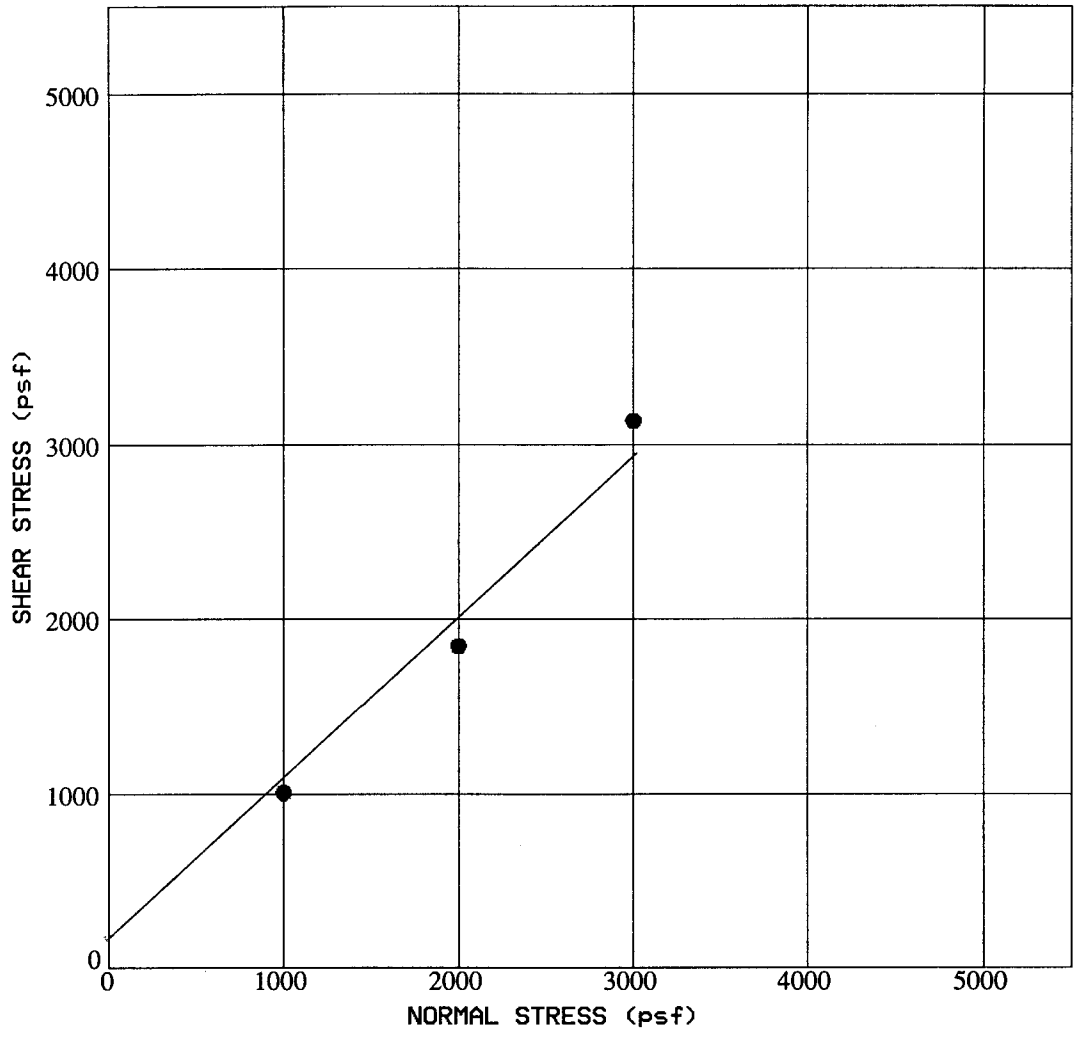
Cohesion (psf) 1000

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-3

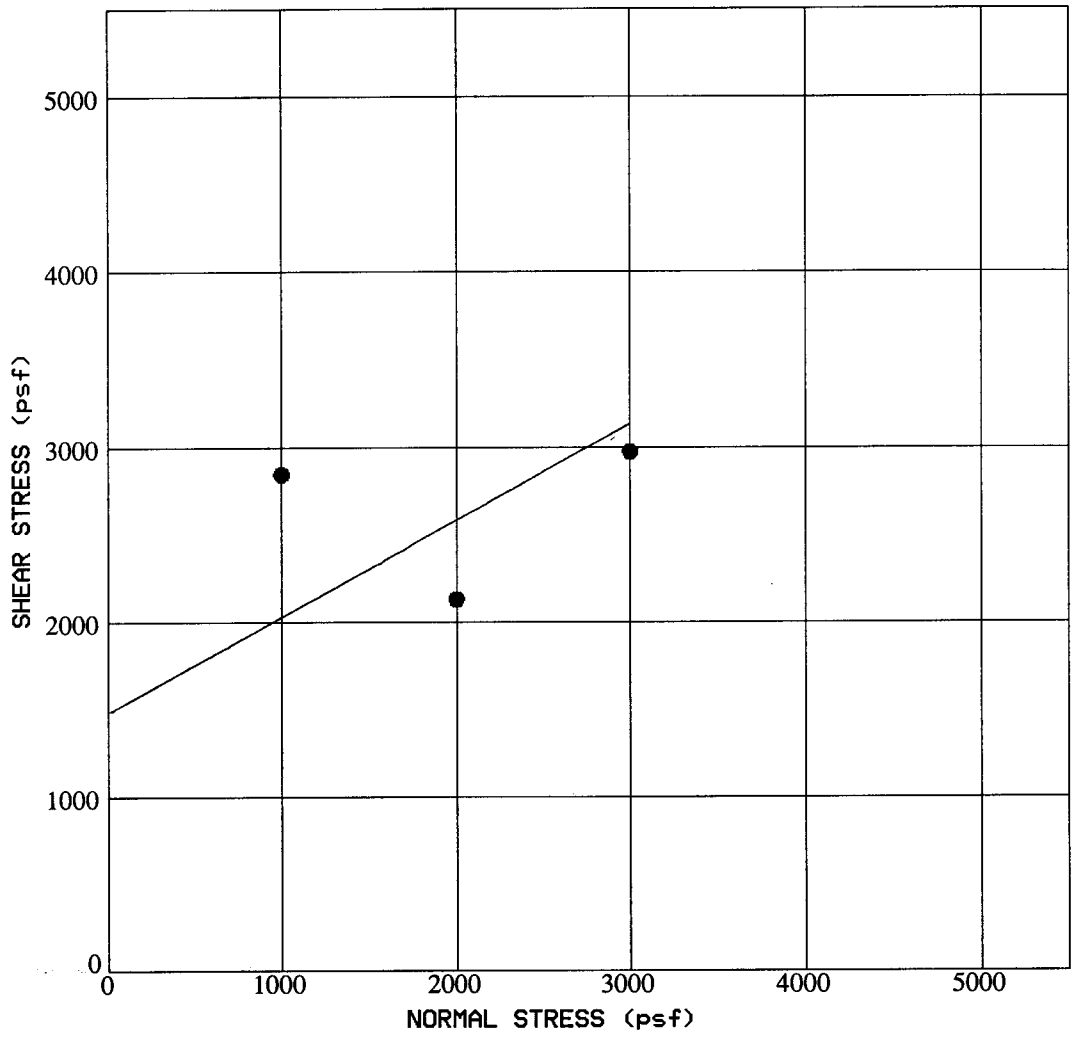


Boring No.	LB-1	Depth (ft)	40.5
Sample No.	R-4	Soil Type	Clayst.
Type of Sample	Ring		

Friction Angle (deg.)	42
Cohesion (psf)	100

DIRECT SHEAR TEST RESULTS

Project No.	040151-001
Project Name	HDR/Del Mar
Date	7/17/00
Figure No.	D-4



Boring No. LB-1 Depth (ft) 60.5

Sample No. R-6 Soil Type Sandst.

Type of Sample Ring

Friction Angle (deg.) 28

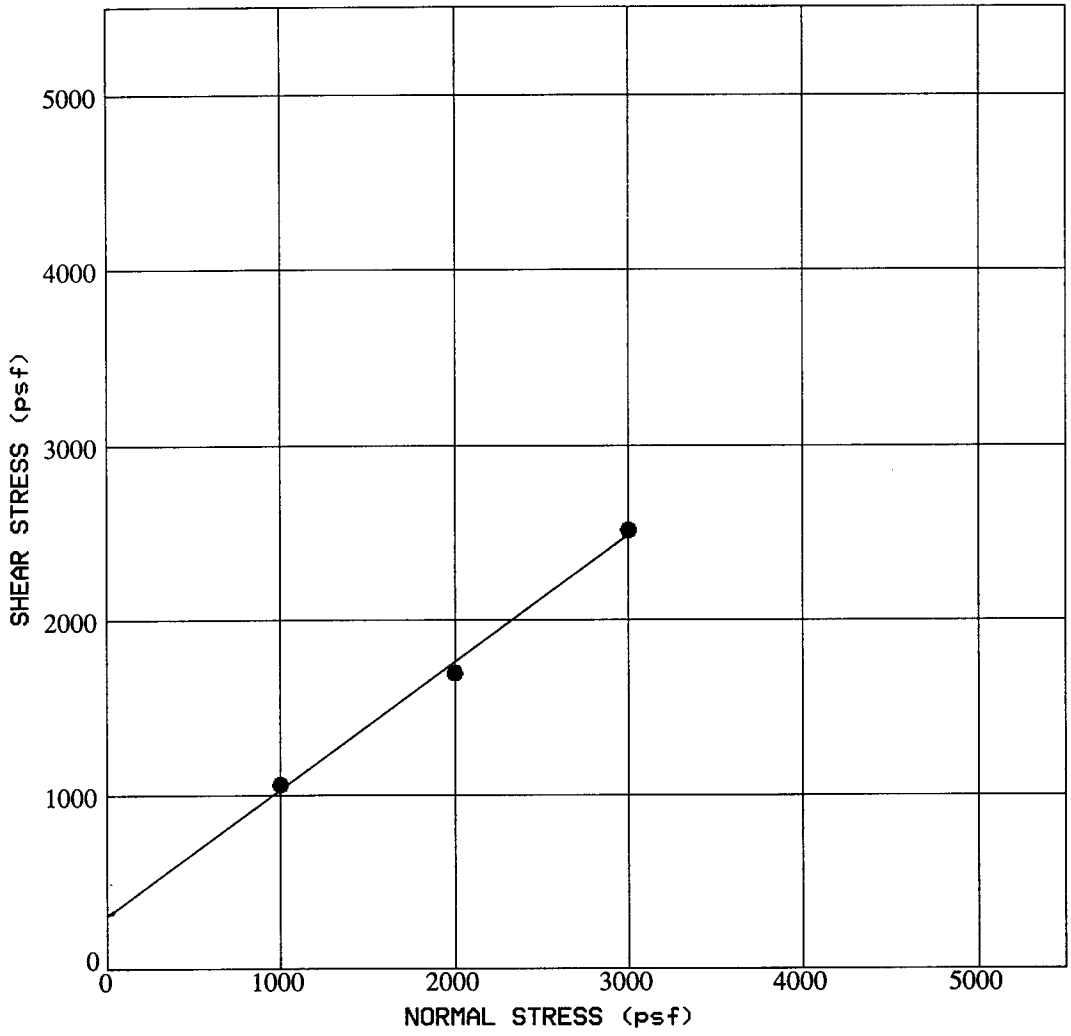
Cohesion (psf) 1500

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-5

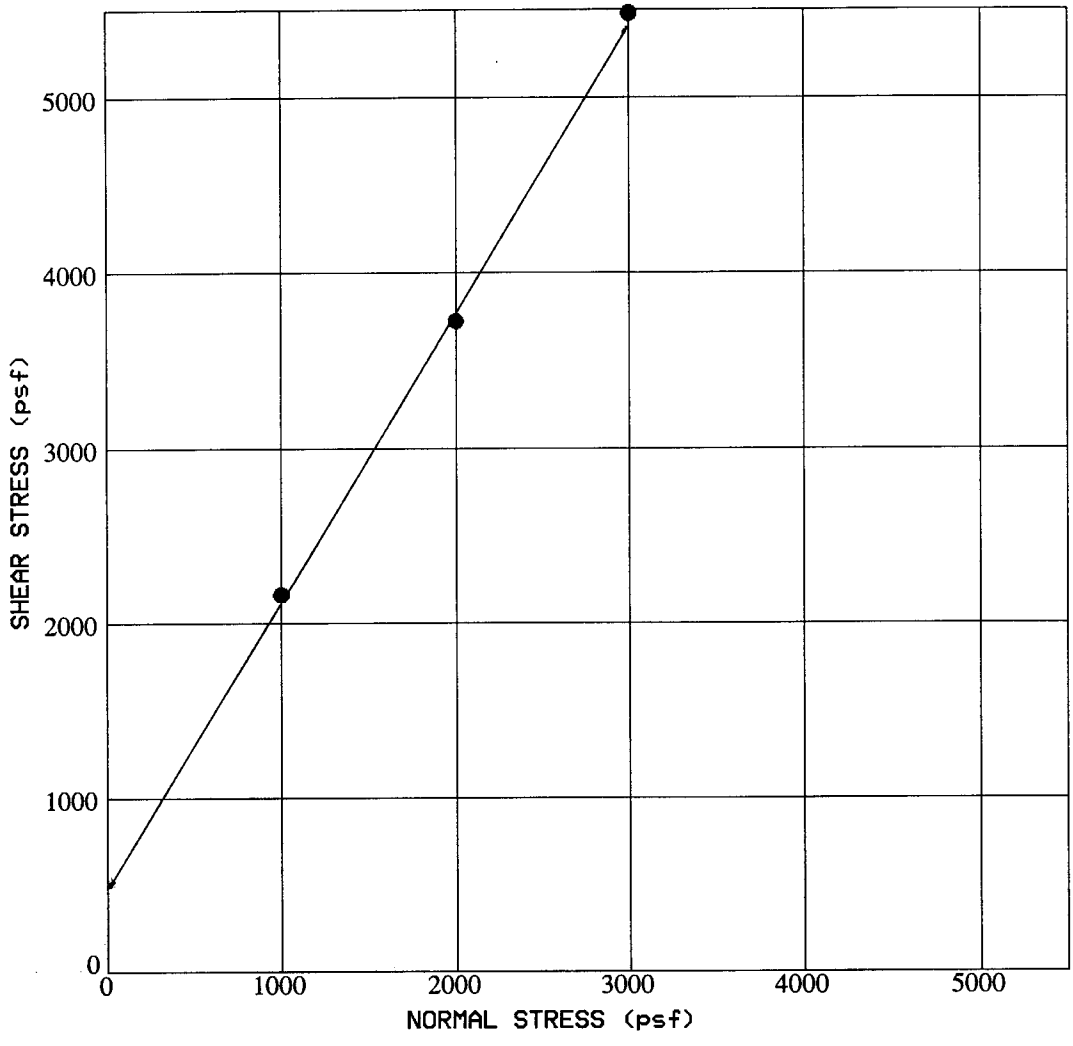


Boring No.	LB-2	Depth (ft)	5.5
Sample No.	R-1	Soil Type	SP-SM
Type of Sample	Ring		

Friction Angle (deg.)	36
Cohesion (psf)	300

DIRECT SHEAR TEST RESULTS

Project No.	040151-001
Project Name	HDR/Del Mar
Date	7/17/00
Figure No.	D-6



Boring No. LB-2 Depth (ft) 22.5

Sample No. R-2 Soil Type Sandst.

Type of Sample Ring

Friction Angle (deg.) 58.5

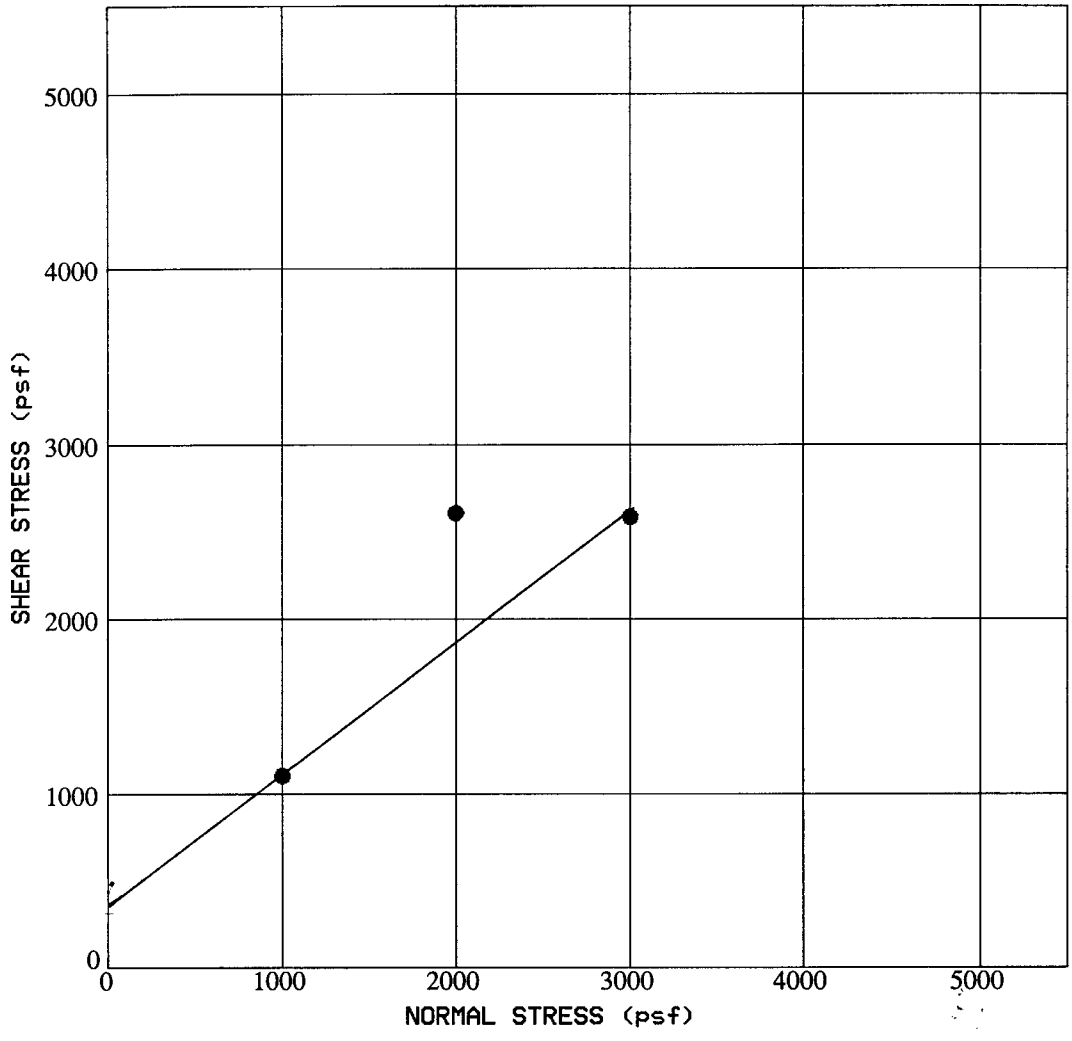
Cohesion (psf) 500

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-7



Boring No. LB-2 Depth (ft) 45.5

Sample No. R-3 Soil Type Siltst.

Type of Sample Ring

Friction Angle (deg.) 37.5

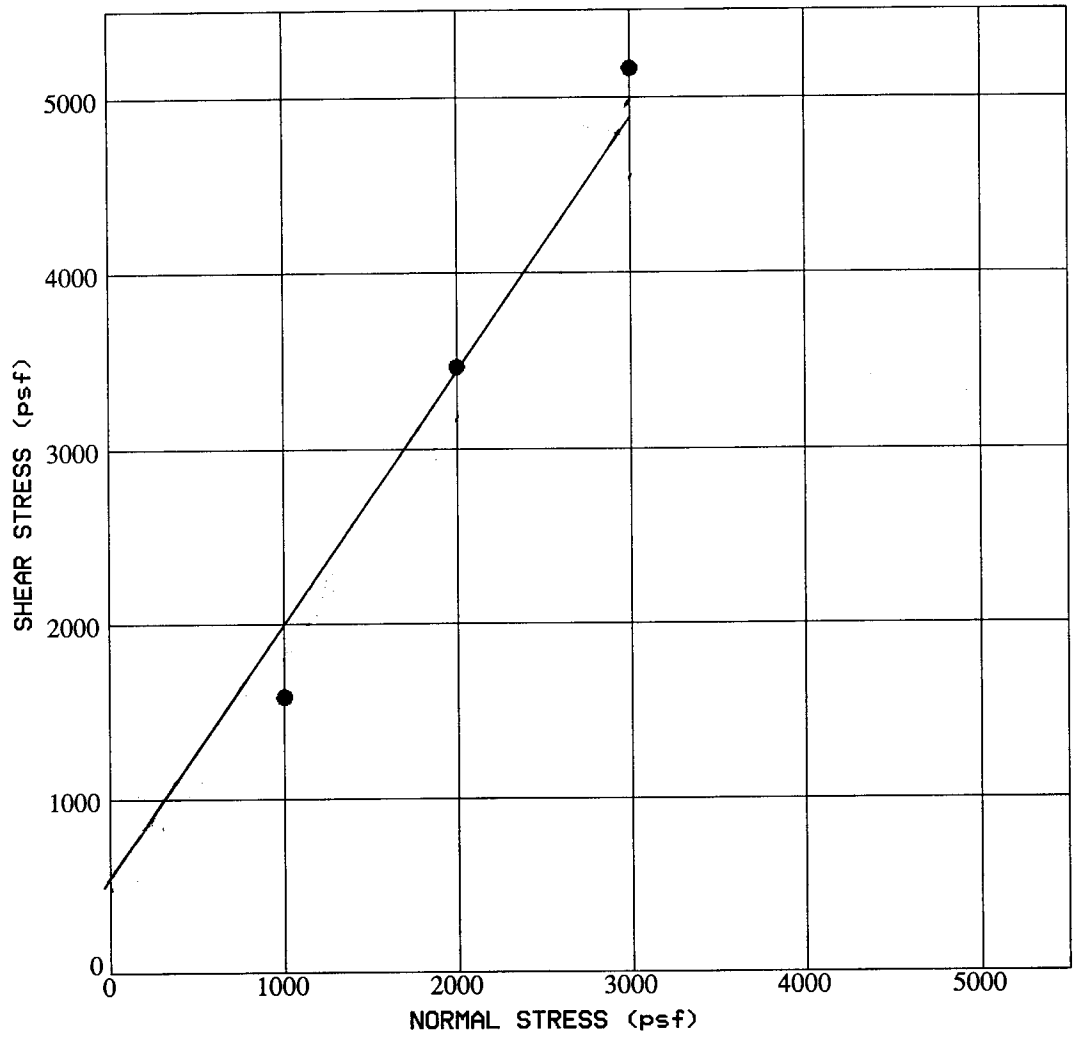
Cohesion (psf) 400

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-8



Boring No. LB-4 Depth (ft) 20.5

Sample No. R-1 Soil Type Sandst.

Type of Sample Ring

Friction Angle (deg.) 54

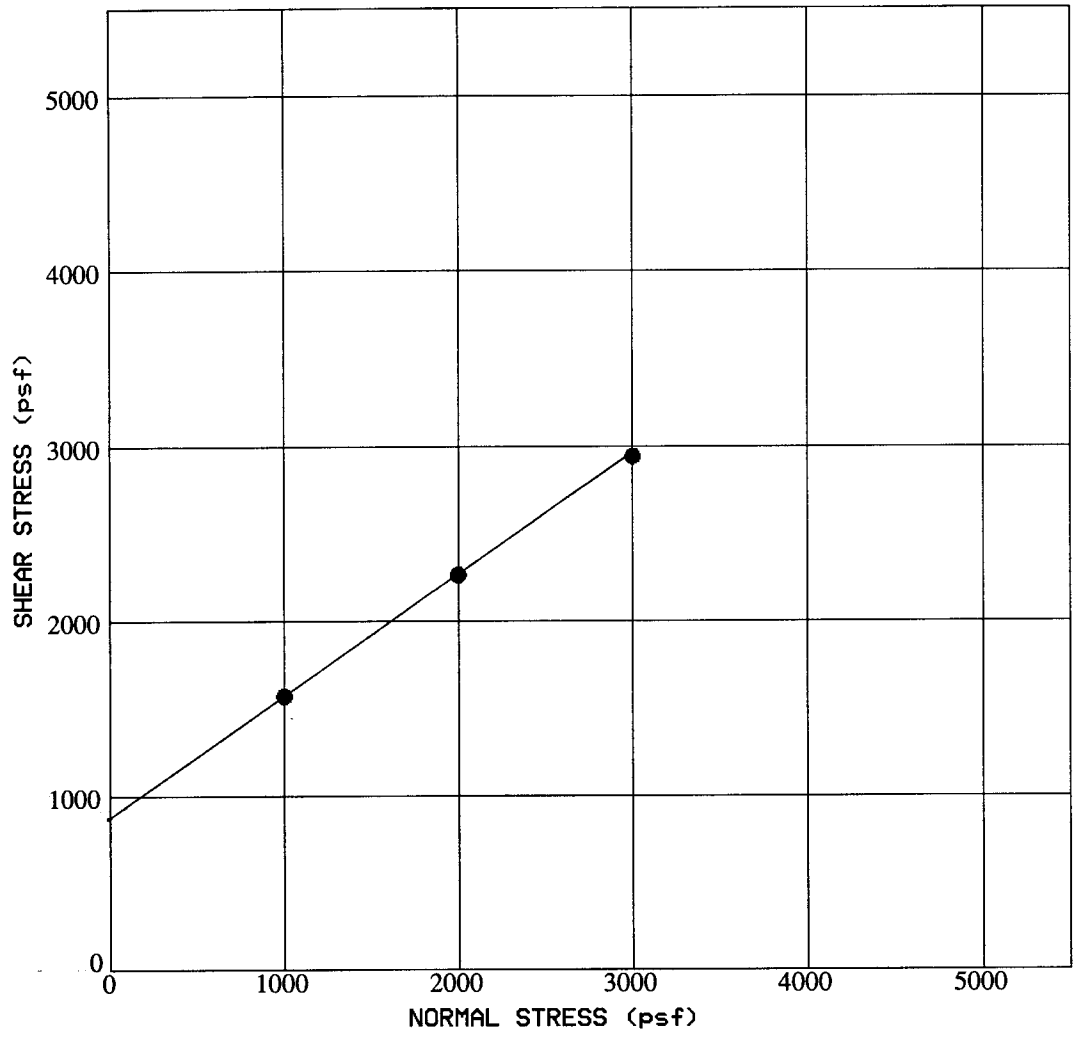
Cohesion (psf) 500

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-9



Boring No. LB-4 Depth (ft) 40.5

Sample No. R-2 Soil Type Clayst.

Type of Sample Ring

Friction Angle (deg.) 34

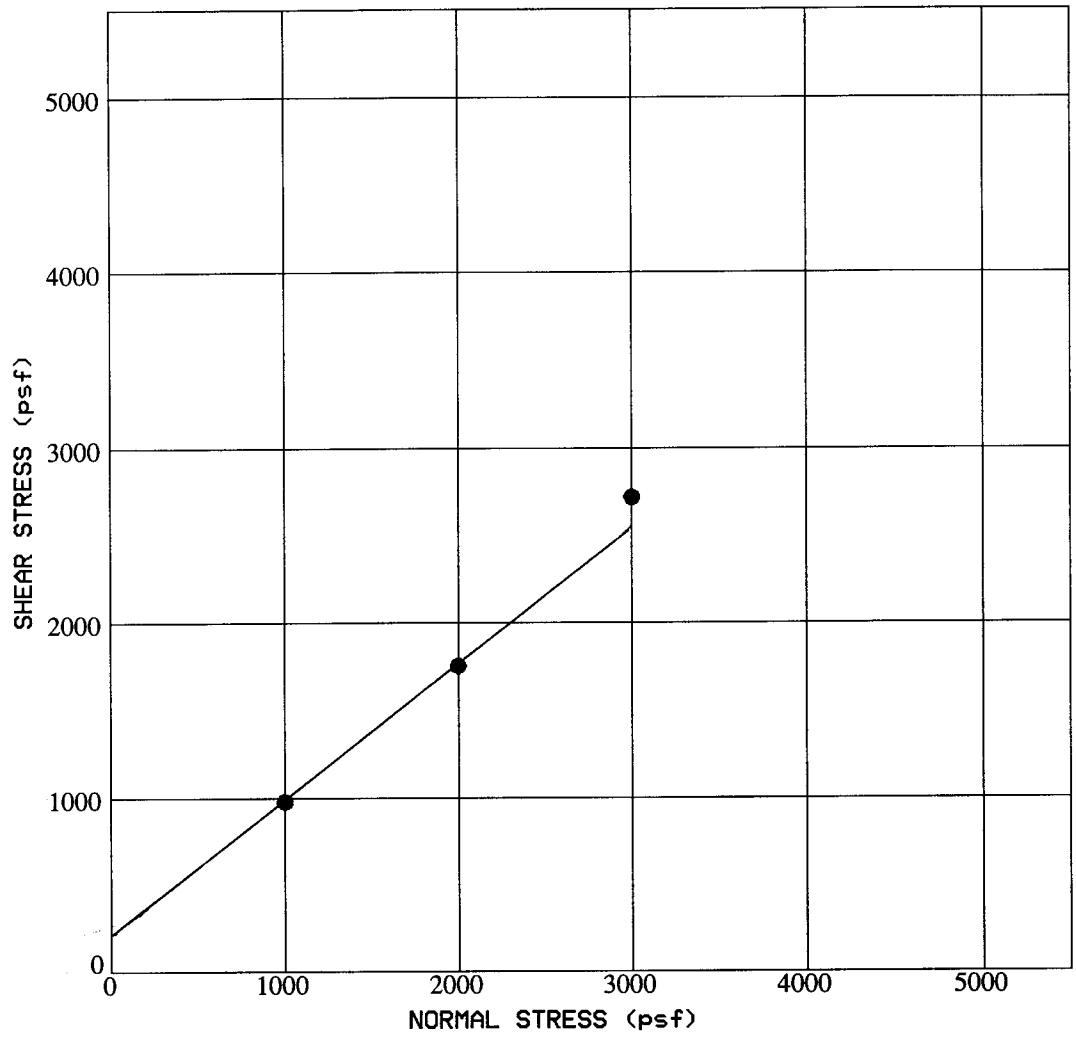
Cohesion (psf) 900

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-10



Boring No. LB-4 Depth (ft) 60.5

Sample No. R-3 Soil Type Clayst.

Type of Sample Ring

Friction Angle (deg.) 38

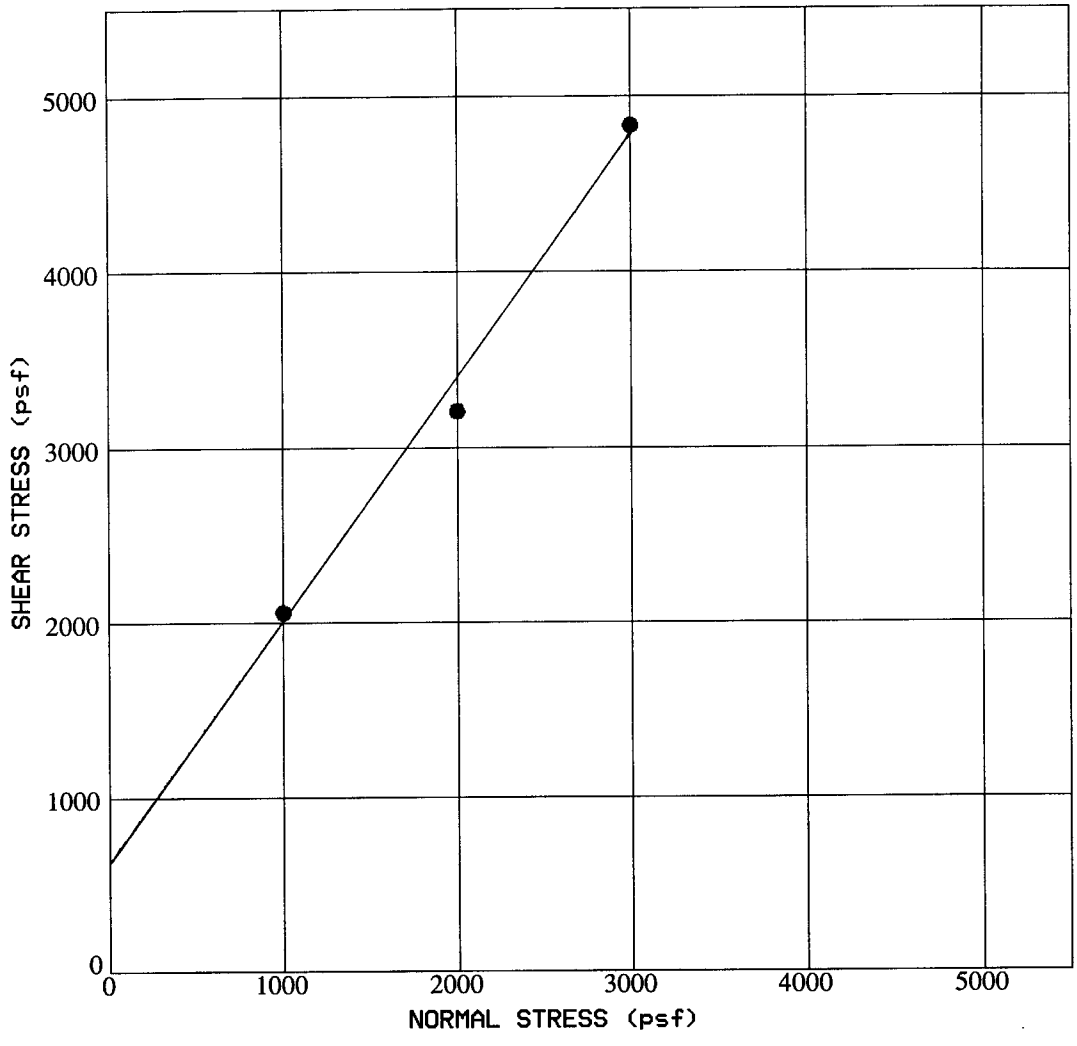
Cohesion (psf) 200

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-11



Boring No. LB-6 Depth (ft) 20.5

Sample No. R-1 Soil Type Sandst.

Type of Sample Ring

Friction Angle (deg.) 54

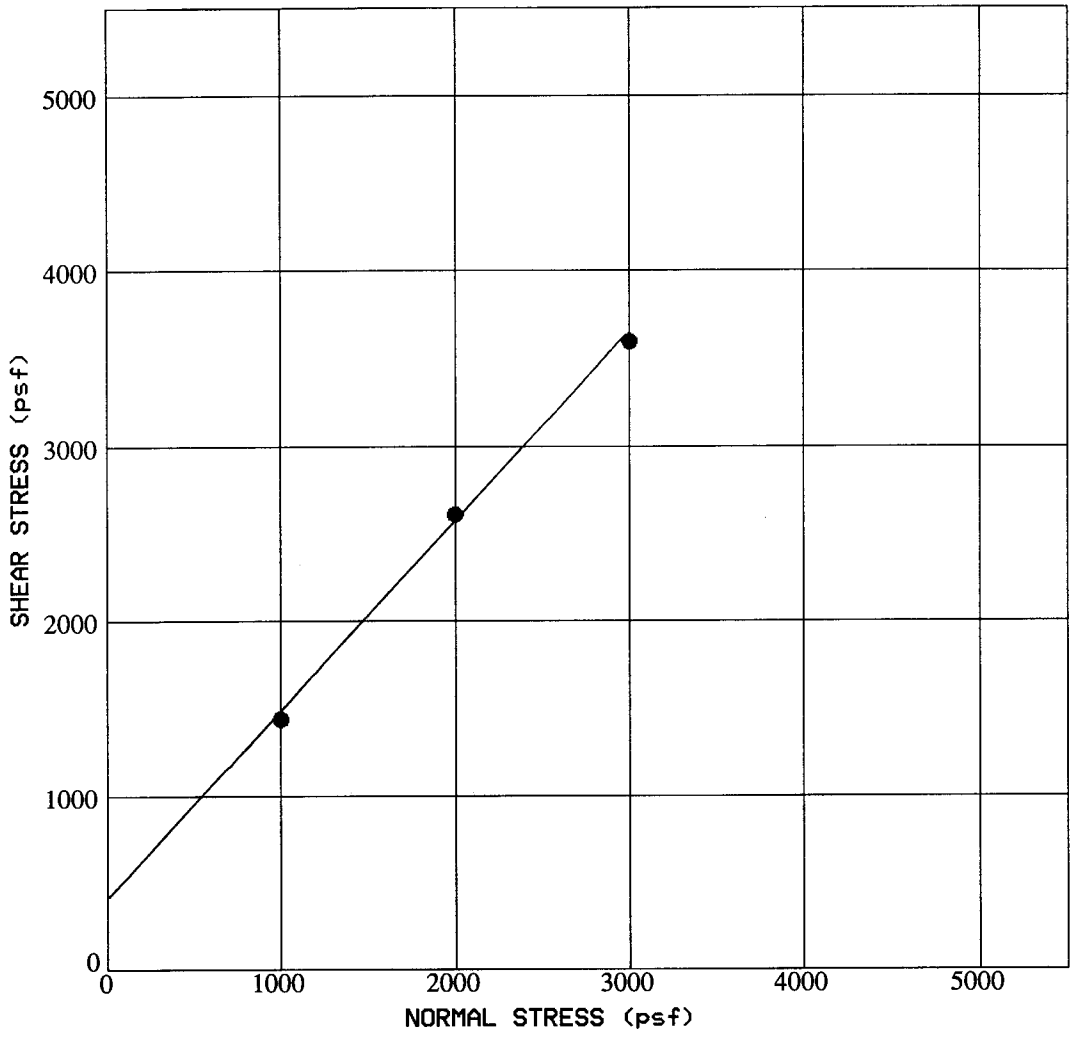
Cohesion (psf) 600

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D12



Boring No. LB-6 Depth (ft) 60.5

Sample No. R-3 Soil Type Sandst.

Type of Sample Ring

Friction Angle (deg.) 46.5

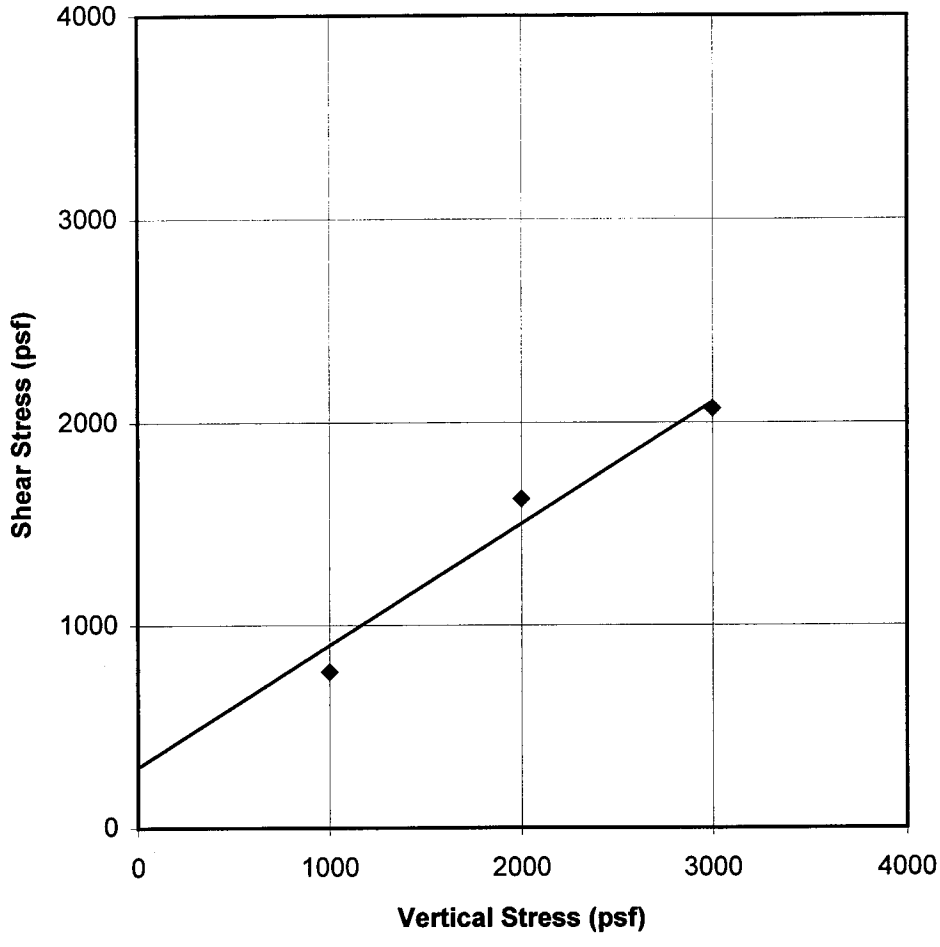
Cohesion (psf) 400

DIRECT SHEAR TEST RESULTS

Project No. 040151-001

Project Name HDR/Del Mar

Date 7/17/00 Figure No. D-13



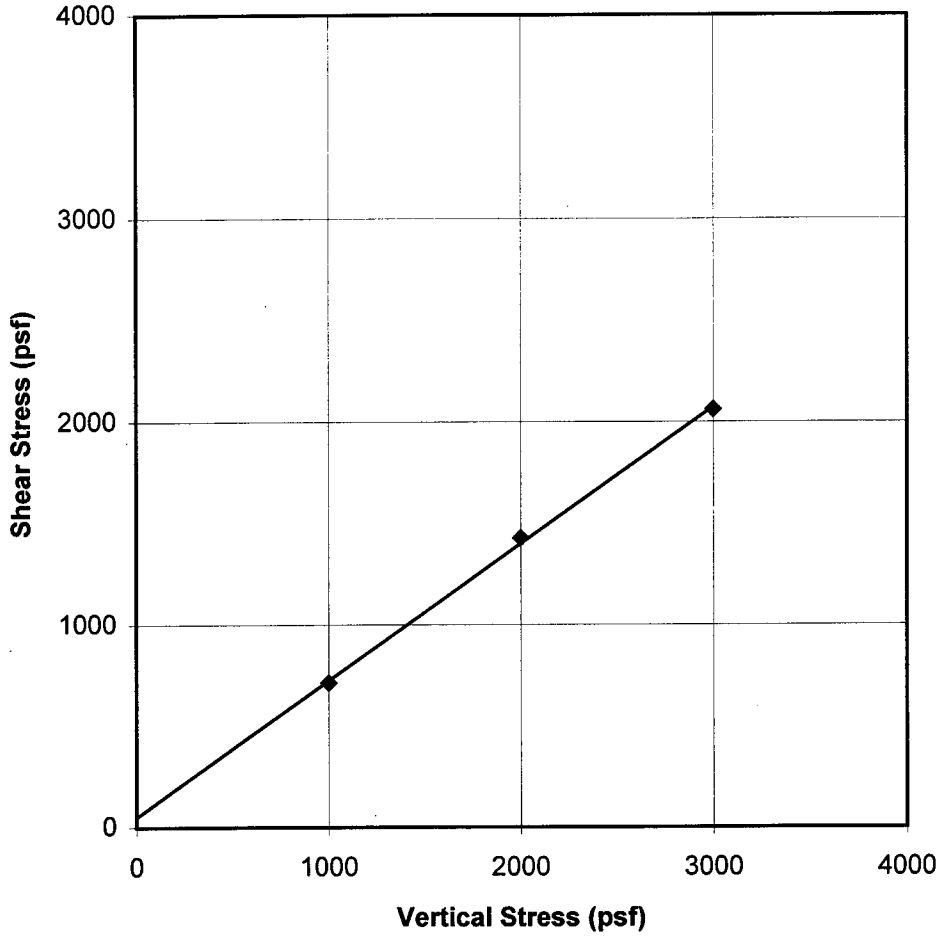
Boring Location	**LB-1**
Sample Depth (feet)	**10**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**31**
Cohesion, c_{ult} (psf)	**300**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-14**



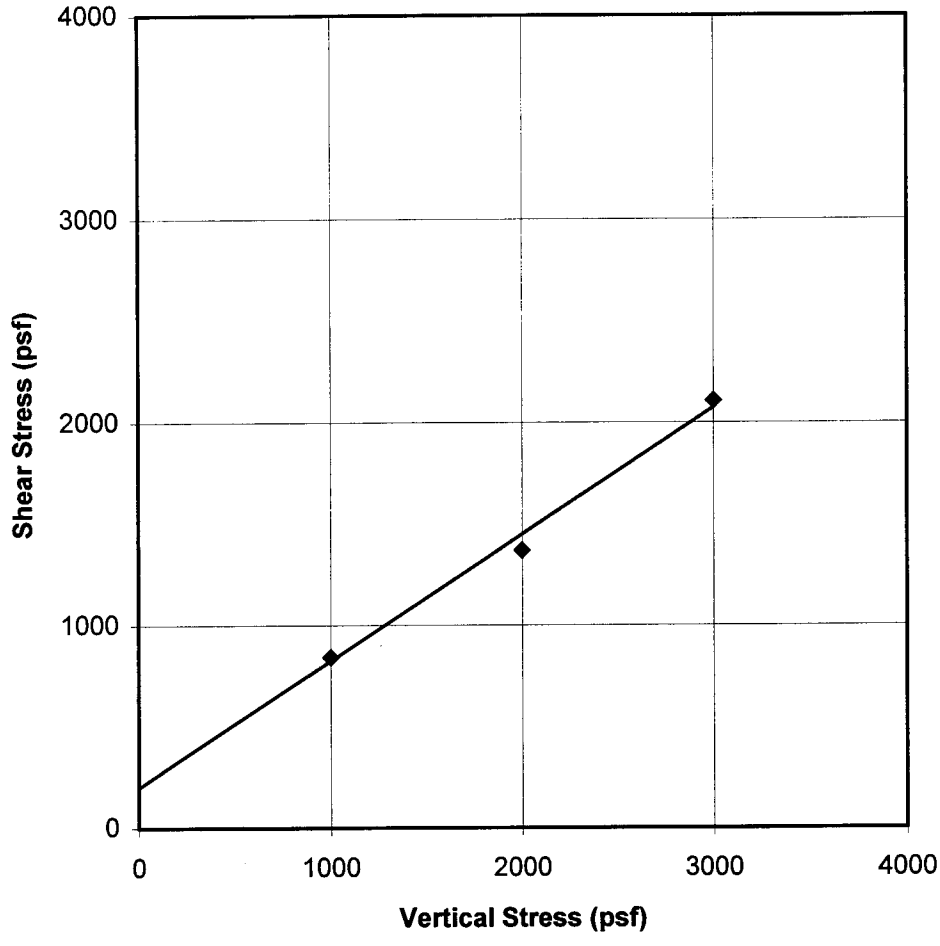
Boring Location	**LB-1**
Sample Depth (feet)	**20**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**34**
Cohesion, c_{ult} (psf)	**50**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-15**



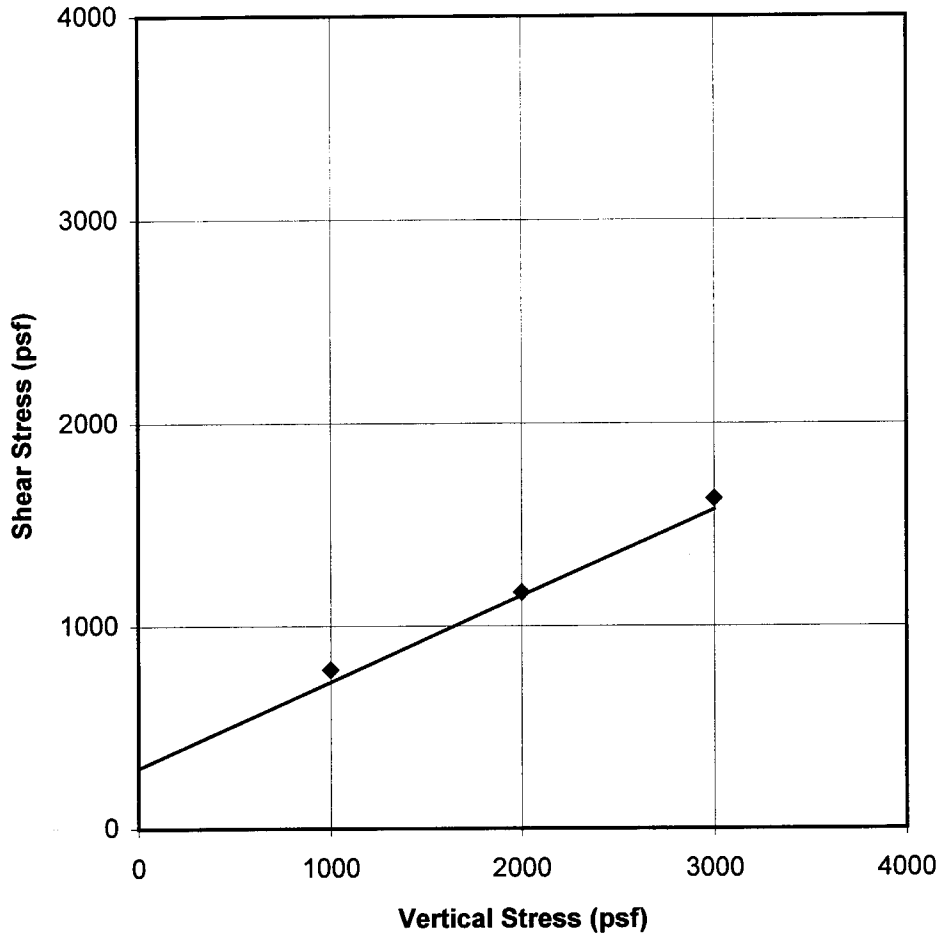
Boring Location	**LB-1**
Sample Depth (feet)	**30**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**32**
Cohesion, c_{ult} (psf)	**200**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-16**



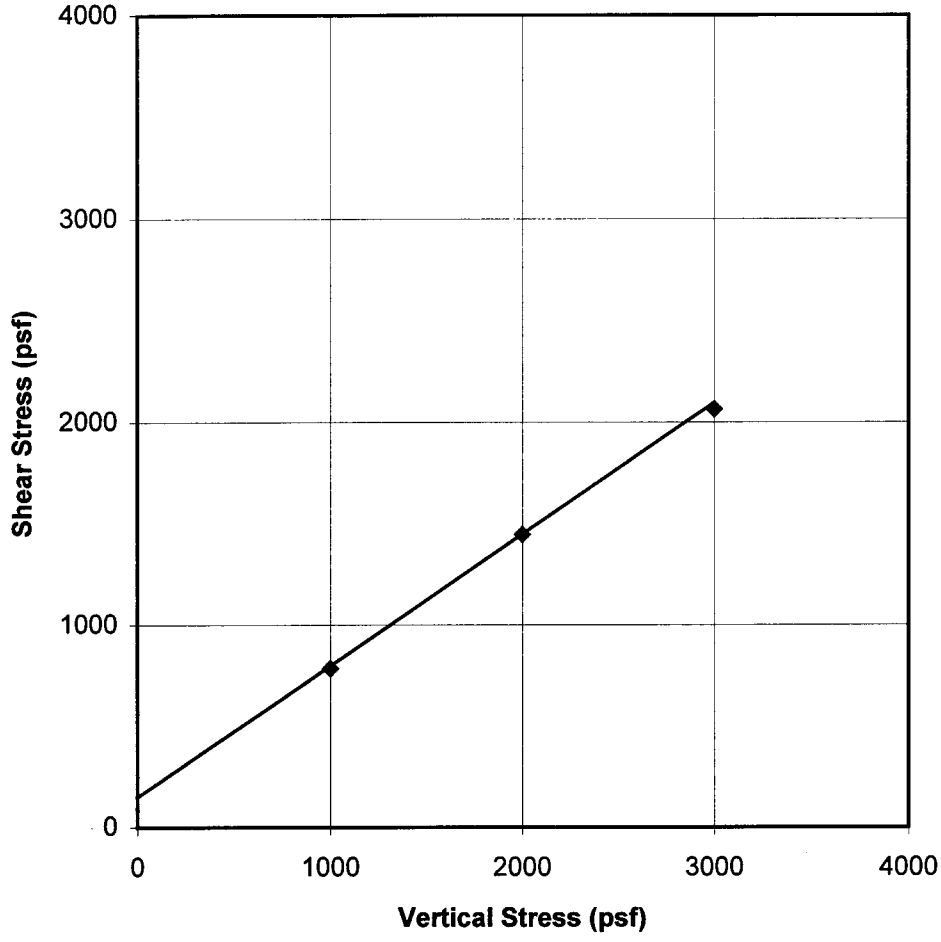
Boring Location	**LB-1**
Sample Depth (feet)	**40**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**23**
Cohesion, c_{ult} (psf)	**300**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-17**



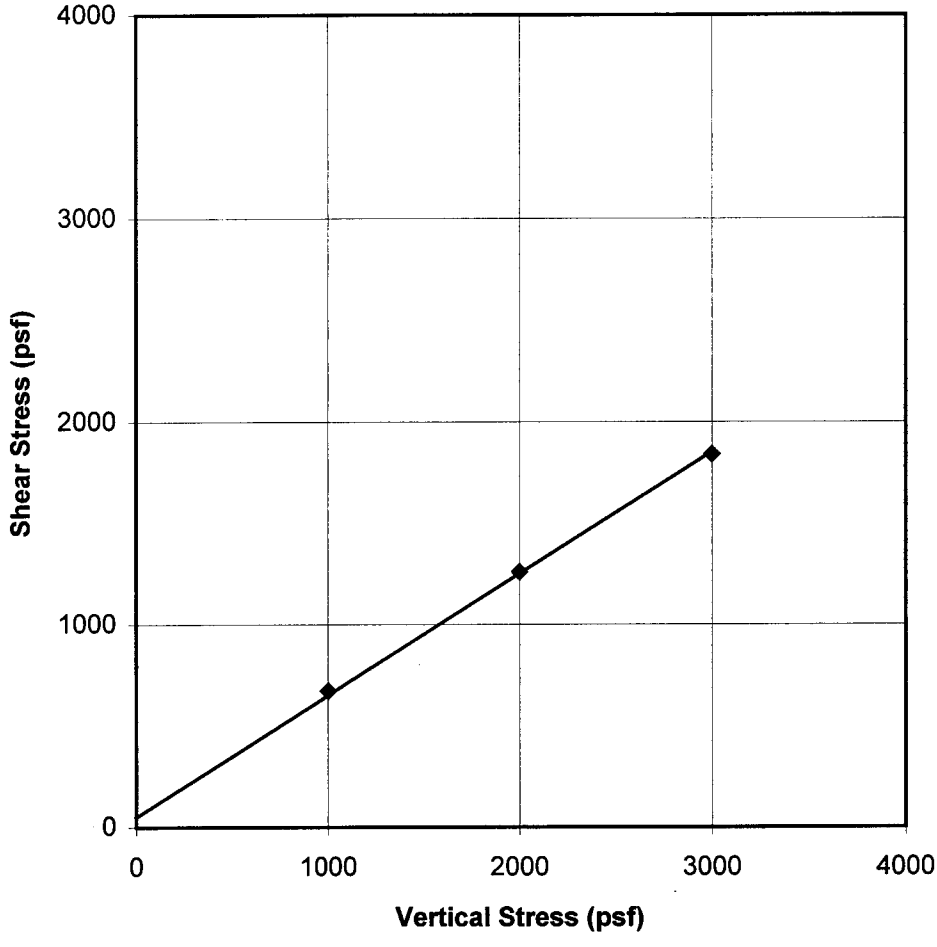
Boring Location	**LB-1**
Sample Depth (feet)	**60**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**33**
Cohesion, c_{ult} (psf)	**150**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-18**



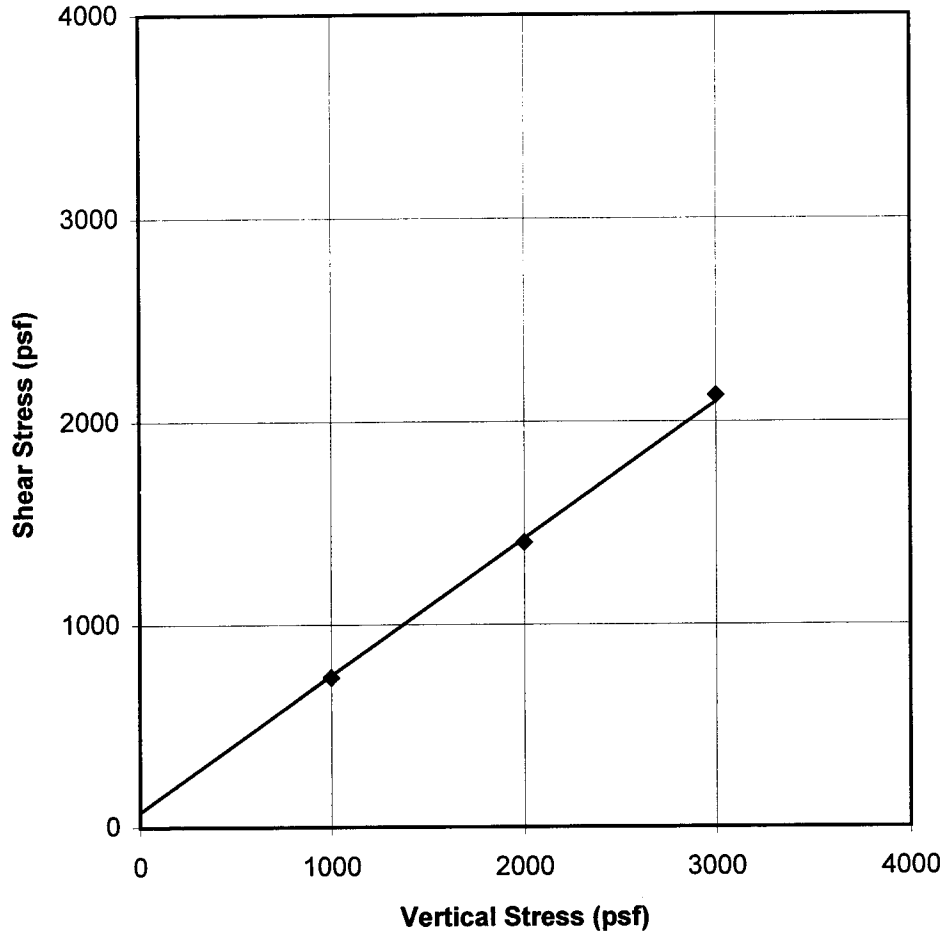
Boring Location	**LB-2**
Sample Depth (feet)	**5**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**31**
Cohesion, c_{ult} (psf)	**50**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-19**



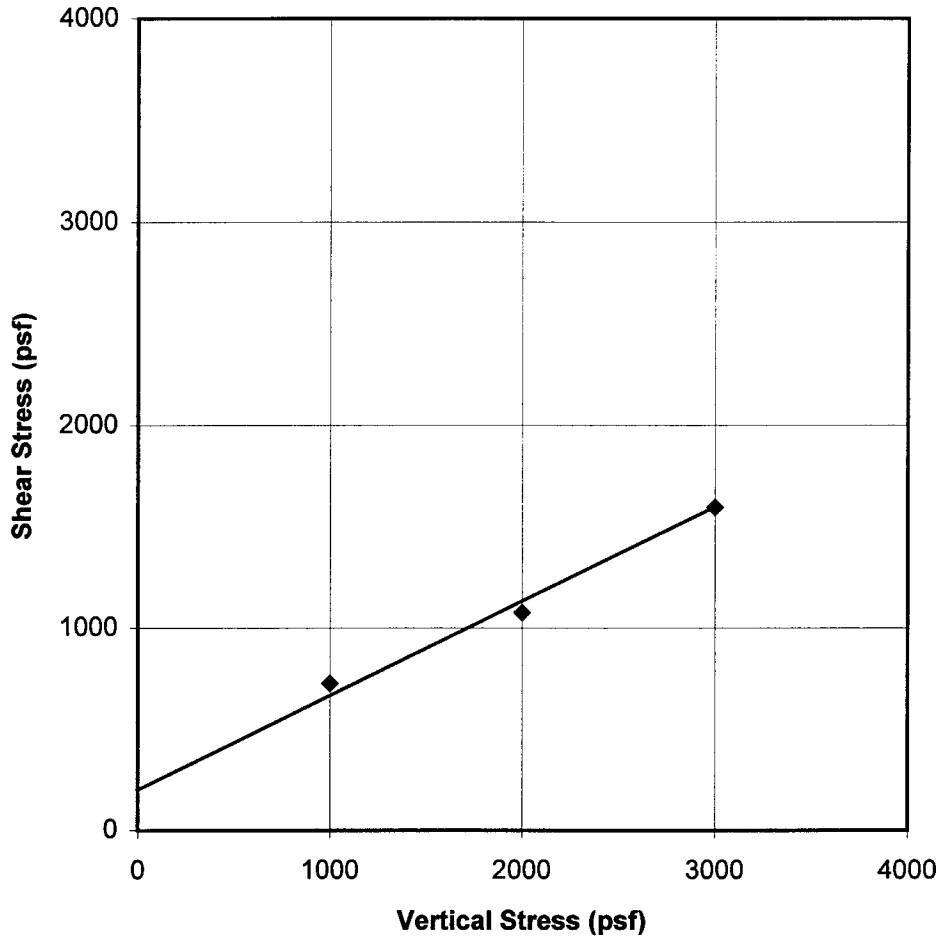
Boring Location	**LB-2**
Sample Depth (feet)	**22**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**34**
Cohesion, c_{ult} (psf)	**75**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-20**



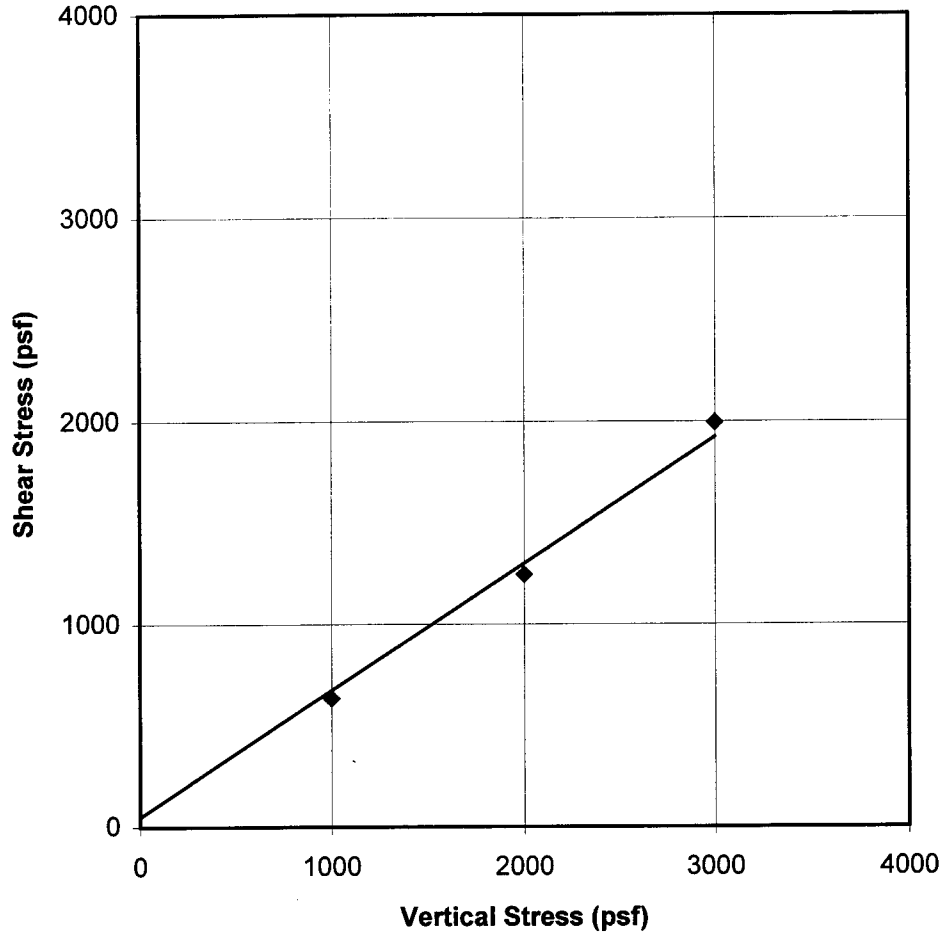
Boring Location	**LB-2**
Sample Depth (feet)	**45**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**25**
Cohesion, c_{ult} (psf)	**200**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-21**



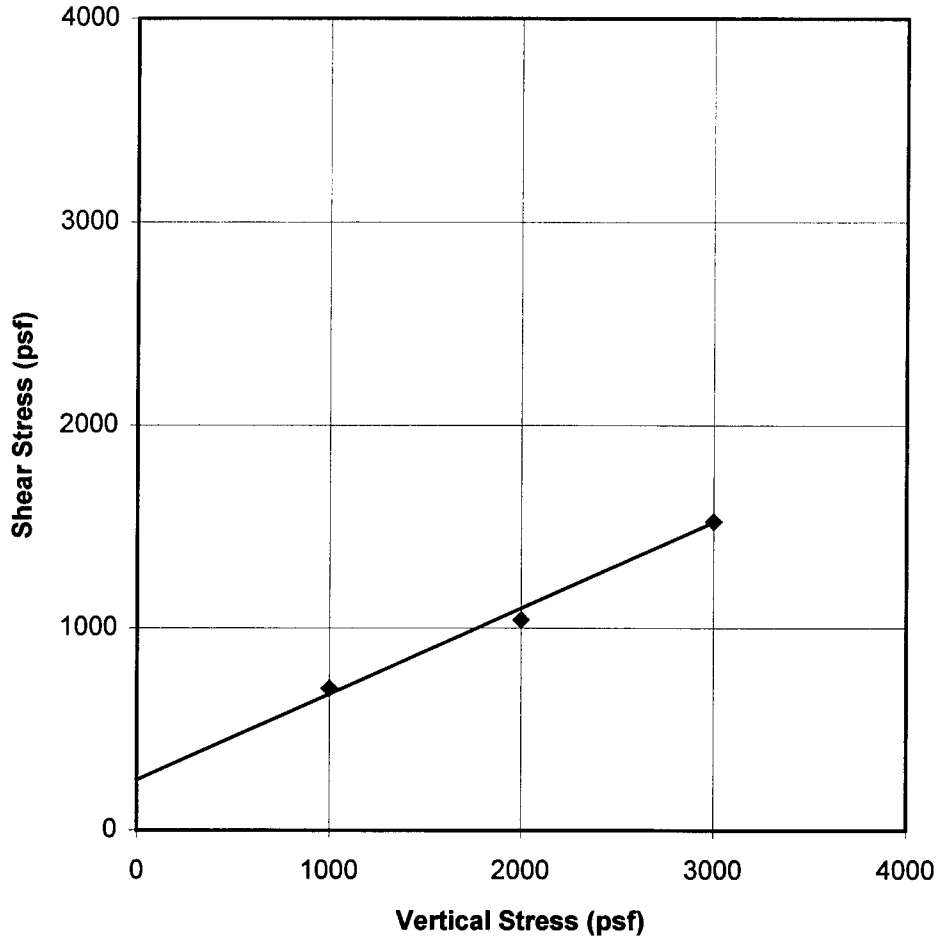
Boring Location	**LB-4**
Sample Depth (feet)	**20**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**32**
Cohesion, c_{ult} (psf)	**50**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-22**



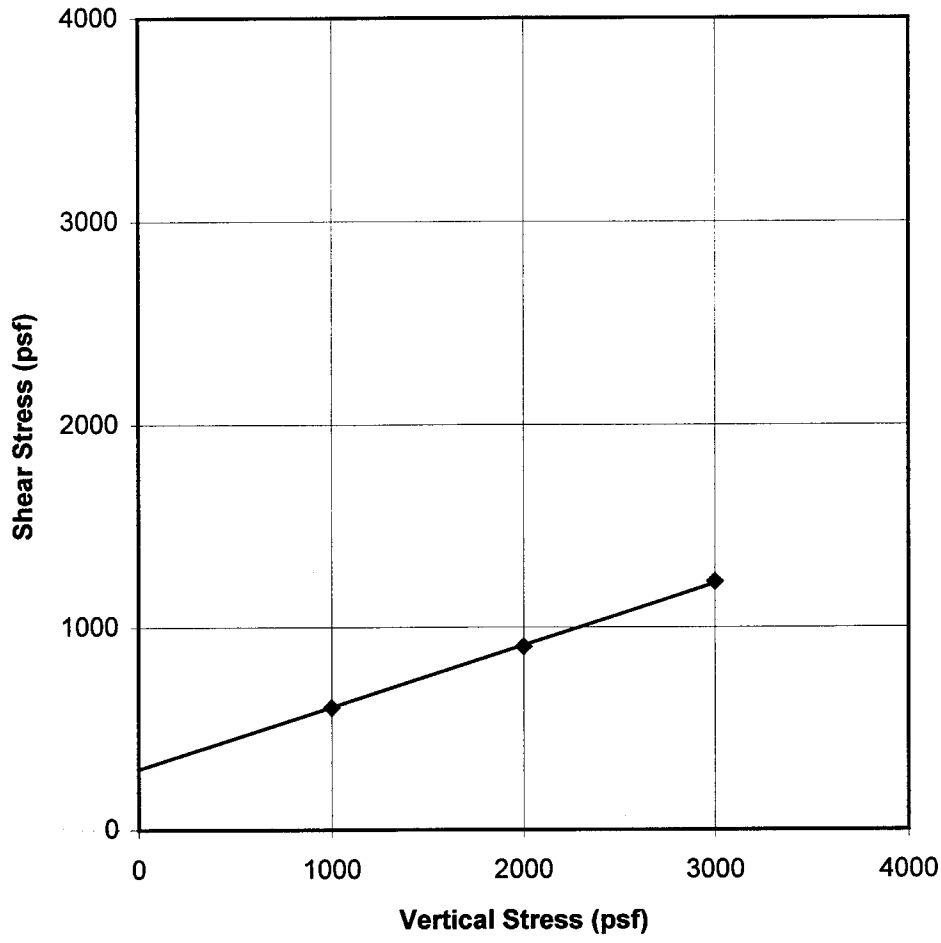
Boring Location	**LB-4**
Sample Depth (feet)	**40**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**23**
Cohesion, c_{ult} (psf)	**250**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-23**



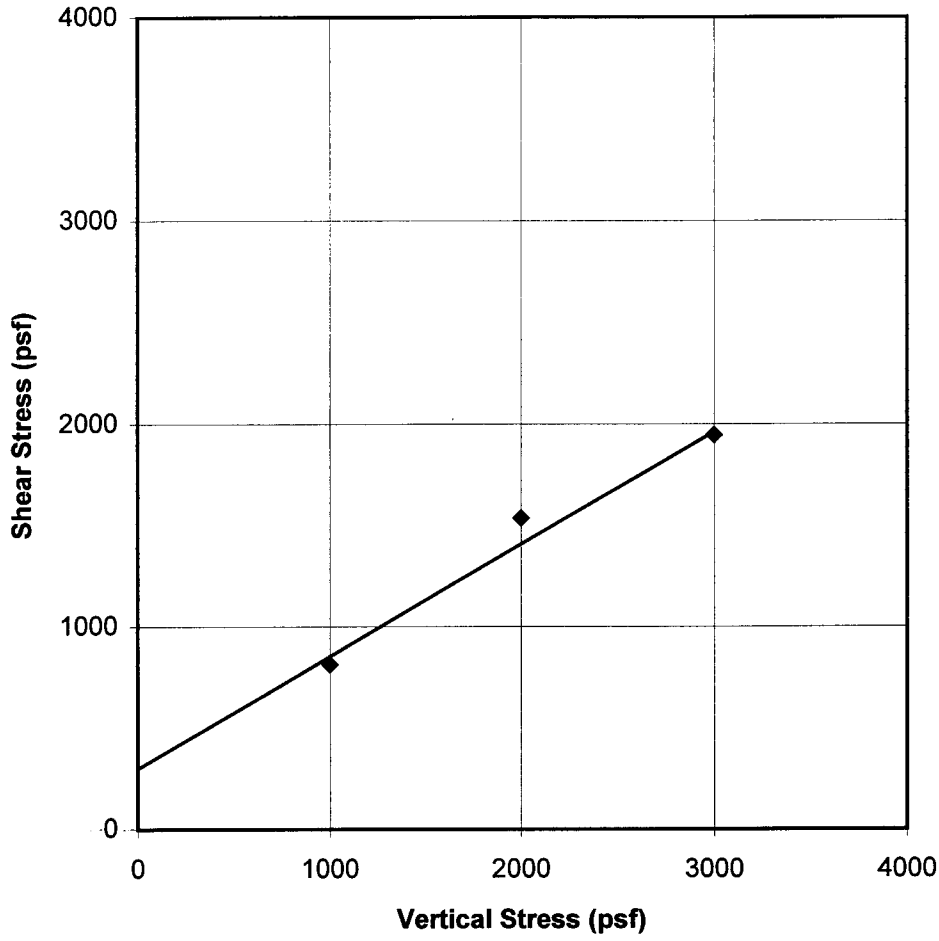
Boring Location	**LB-4**
Sample Depth (feet)	**60**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**17**
Cohesion, c_{ult} (psf)	**300**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-24**



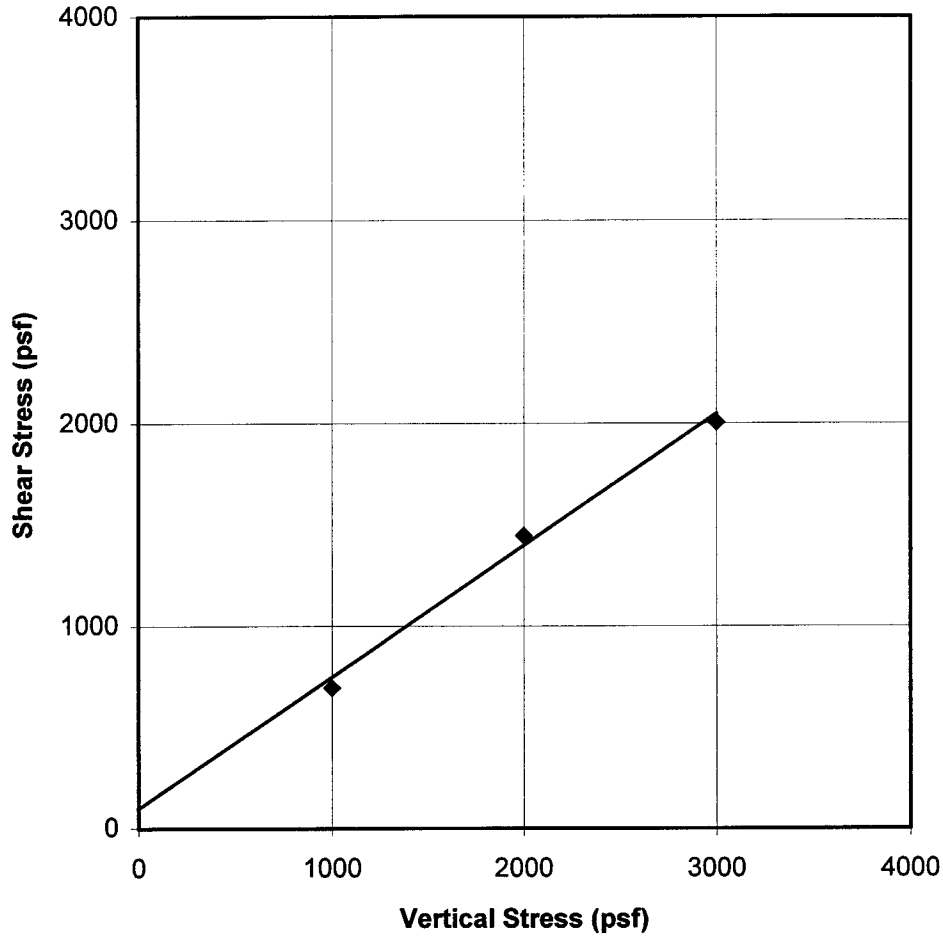
Boring Location	**LB-6**
Sample Depth (feet)	**20**

Average Ultimate Strength Values

Friction Angle, ϕ_{ult} (deg)	**29**
Cohesion, c_{ult} (psf)	**300**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-25**



Boring Location	**LB-6**
Sample Depth (feet)	**60**

Average Ultimate Strength Values

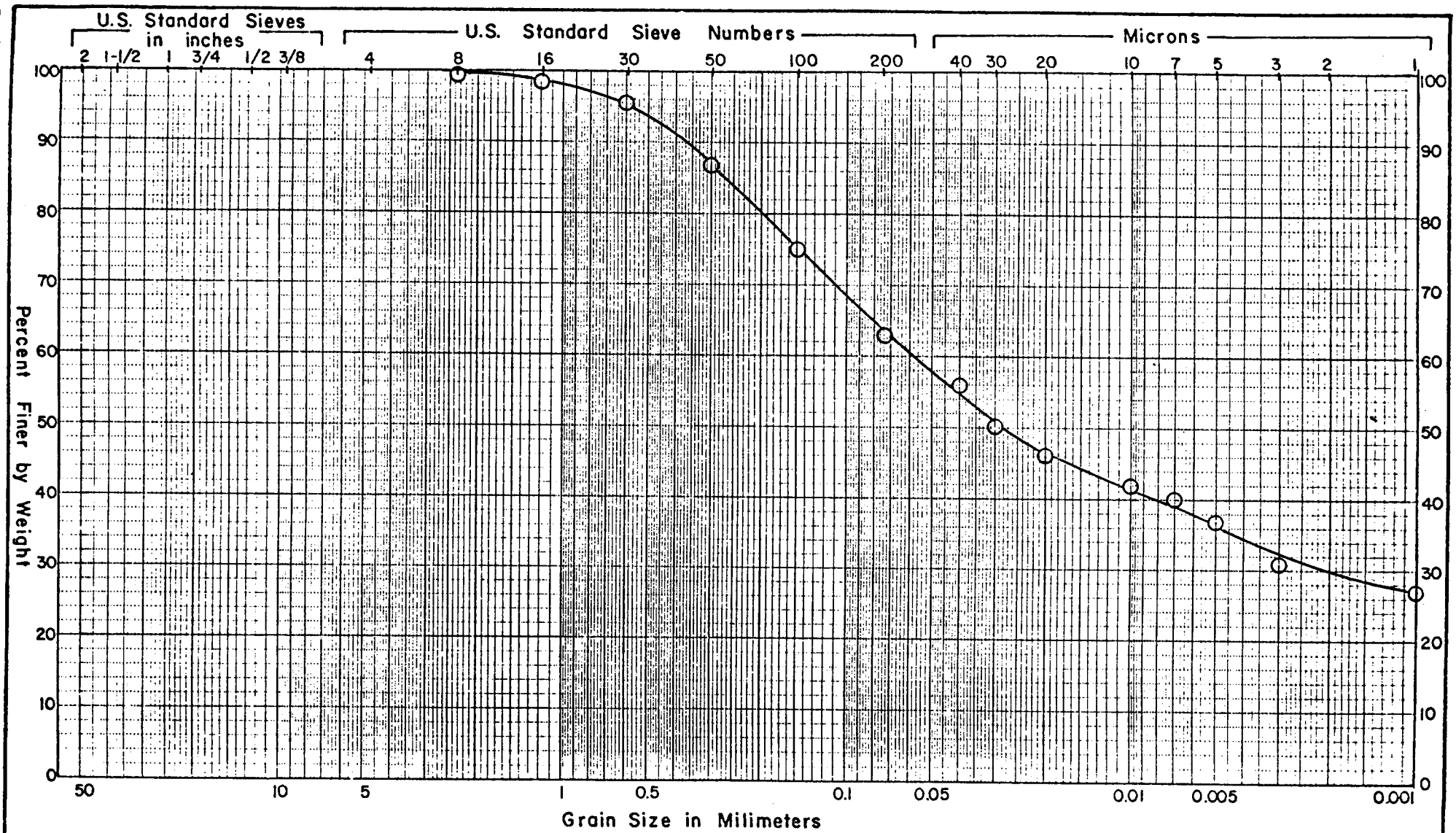
Friction Angle, ϕ_{ult} (deg)	**33**
Cohesion, c_{ult} (psf)	**100**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**D-26**

PREVIOUS LABORATORY TESTING BY LEIGHTON AND ASSOCIATES

Project No.: 4780081



Gravel		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

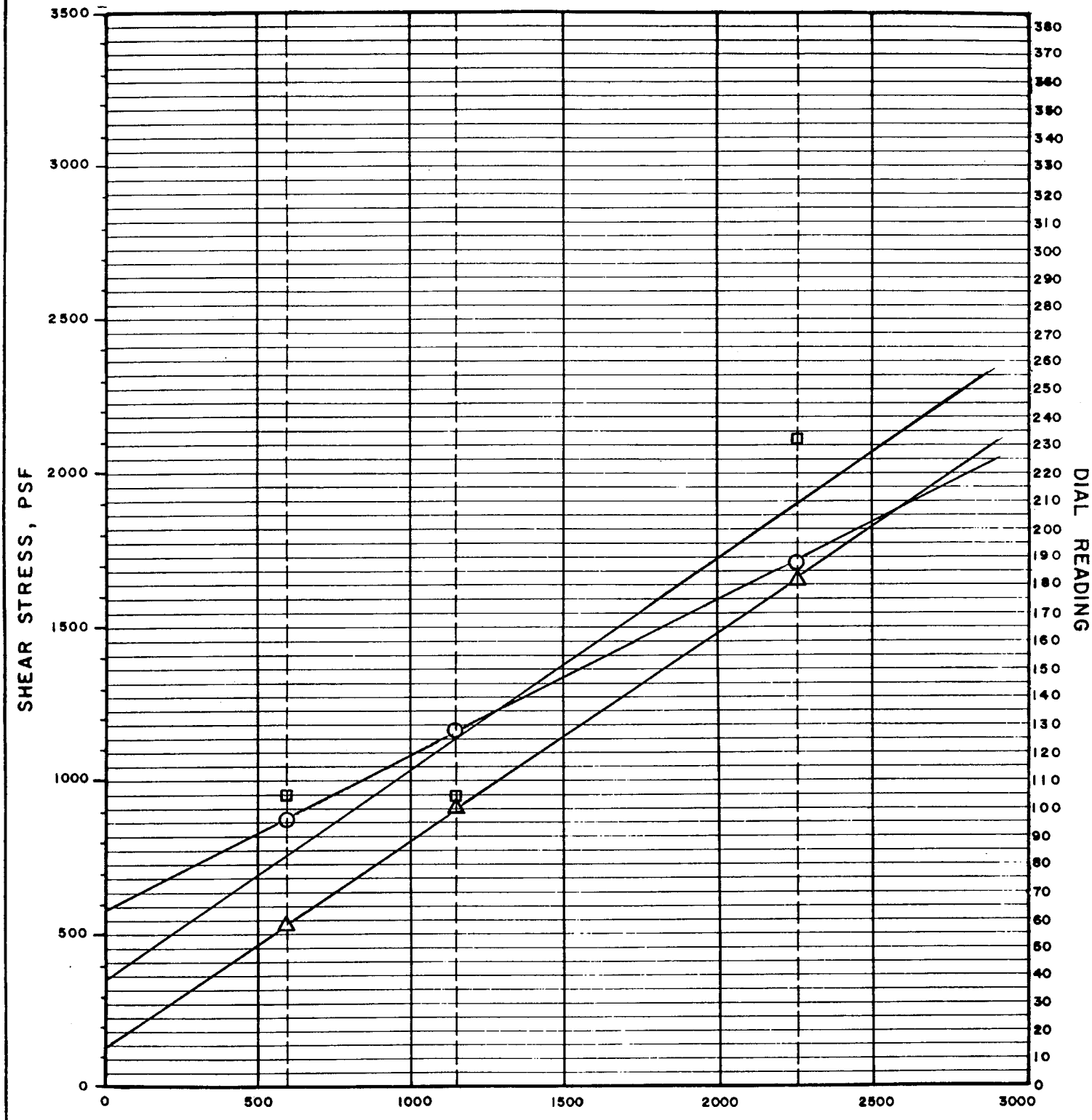
Symbol	Hole No.	Sample No.	Depth or Elev.	Field Moisture (%)	LL (%)	PI (%)	Activity PI/-2μ	Cu D_{60}/D_{10}	Cc $\frac{(D_{30})^2}{D10 \times D60}$	Percent Passing No. 200	Percent Passing 2μ	U.S.C.S.
○	1	1	35'		41	23						CL
	CLAY @ TOE OF SLOPE				47	15						ML

GRADATION TEST RESULTS

B-1
Leighton & Associates

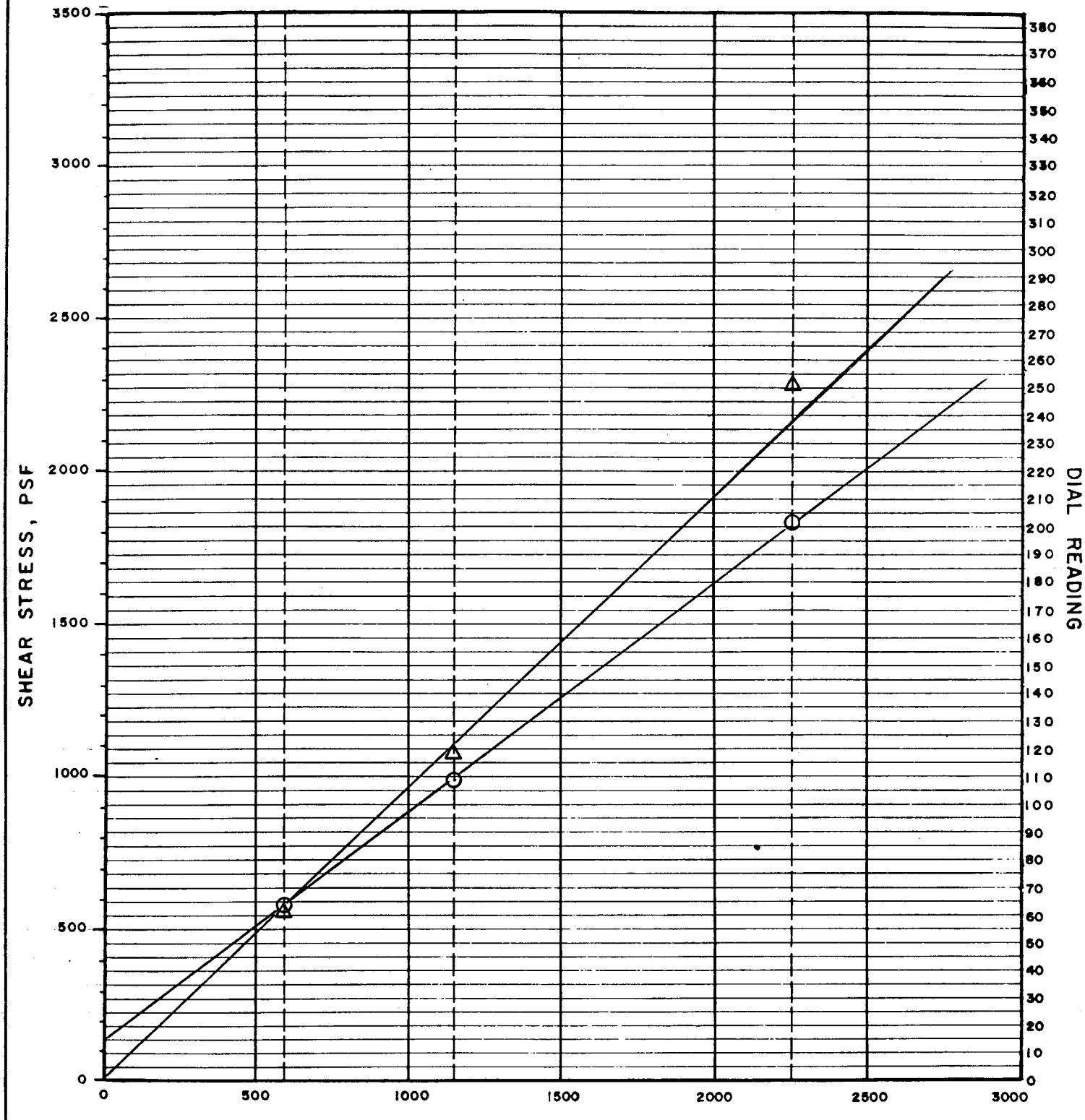
Plate No.:

DIRECT SHEAR SUMMARY



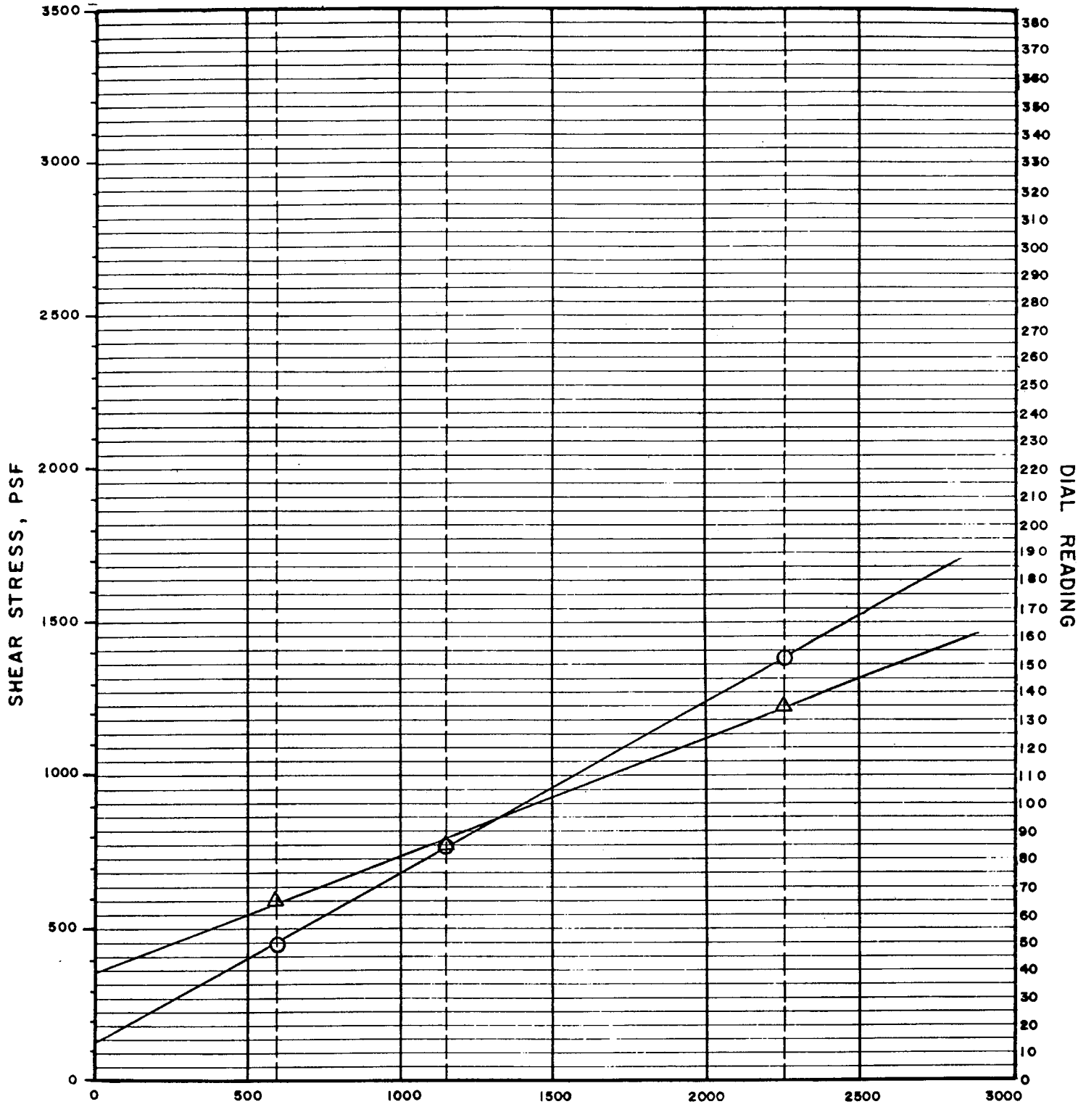
Boring	Depth	Symbol	Friction Angle	Cohesion	Remarks
1	6'	△	34°	140 psf	
1	12'	○	27°	580 psf	
1	17½'	□	35°	360 psf	

DIRECT SHEAR SUMMARY



Boring	Depth	Symbol	Friction Angle	Cohesion	Remarks
1	33'	△	43°	0 psf	
2	8'	○	37°	140 psf	

DIRECT SHEAR SUMMARY



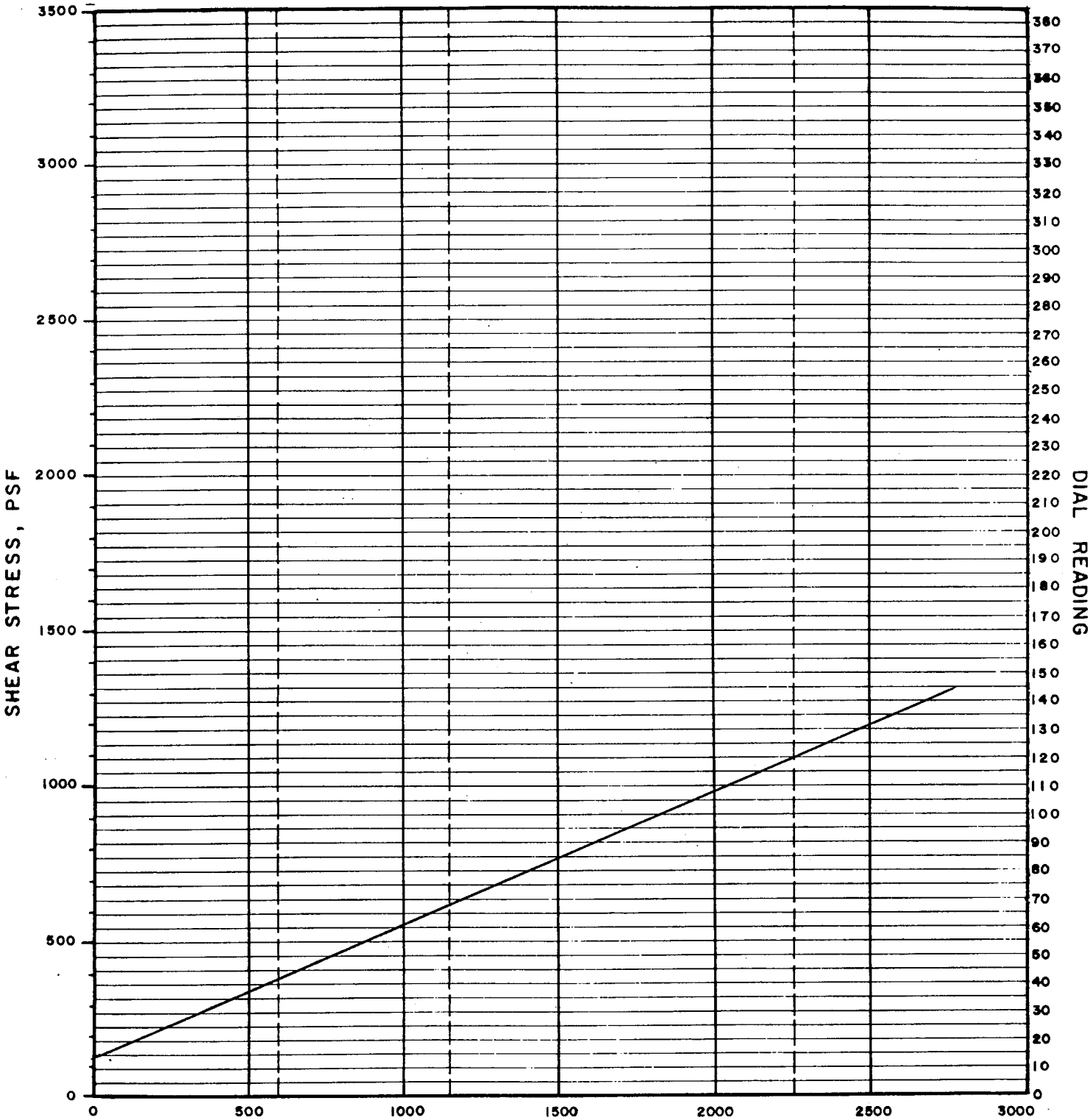
Boring	Depth	Symbol	Friction Angle	Cohesion	Remarks
1	35'	△	21°	350 psf	REMOLDED TO 90%
SURFACE SAMPLE	SURFACE	○	29°	130 psf	REMOLDED TO 90%

Project No.: 478008-1

Leighton & Associates

Plate No.:

DIRECT SHEAR SUMMARY



Boring	Depth	Symbol	Friction Angle	Cohesion	Remarks
2	16°		23°	125 psf	RESIDUAL

PREVIOUS LABORATORY TESTING BY OTHERS

APPENDIX B

Laboratory Testing

Moisture-Density Determinations

The dry unit weight and field moisture content were determined for each of the recovered barrel samples. The moisture-density information provides a gross indication of soil consistency and can assist in delineating local variations. The information can also be used to correlate soils or weakly lithified bedrock found on this site with soils on other sites in the general area. Sample locations and the corresponding test results are illustrated on the Boring Logs in Appendix A.

Compaction Tests

Representative bulk soil samples were tested to determine their maximum dry densities and optimum moisture contents per the ASTM D 1557-91 (Method A) procedure. The test method uses 25 blows of a 10-pound hammer falling 18 inches on each of 5 soil layers in a 1/30 cubic foot cylinder. Soil samples are tested at varying moisture contents to create a curve illustrating achieved dry density as a function of moisture content. The table in the following page presents the test results.

Table B-1
Maximum Density - Optimum Moisture Content Determinations

Soil Classification	*Location*	*Maximum Dry Density (pcf)*	*Optimum Moisture Content (%)*
Sandy Silt (ML)	B - 1P 20-30 ft.	120.5	10.0
Clayey Sand (SP-SC)	B - 2 5-10 ft.	130.0	8.5
Silty Clay (CL)	B - 6P 9-12½ ft.	119.5	13.0
Sandy Silt (ML)	B - 7 20-25 ft.	118.0	16.0
Silty Clay (CL)	B - 9P 12½-17½ ft	112.5	17.0
Sand (SP)	B - 11P	127.0	10.0

Soil Classification	Location	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
Clayey Sand (SP-SC)	0-5 ft. B - 14P 5-10 ft.	123.5	10.0

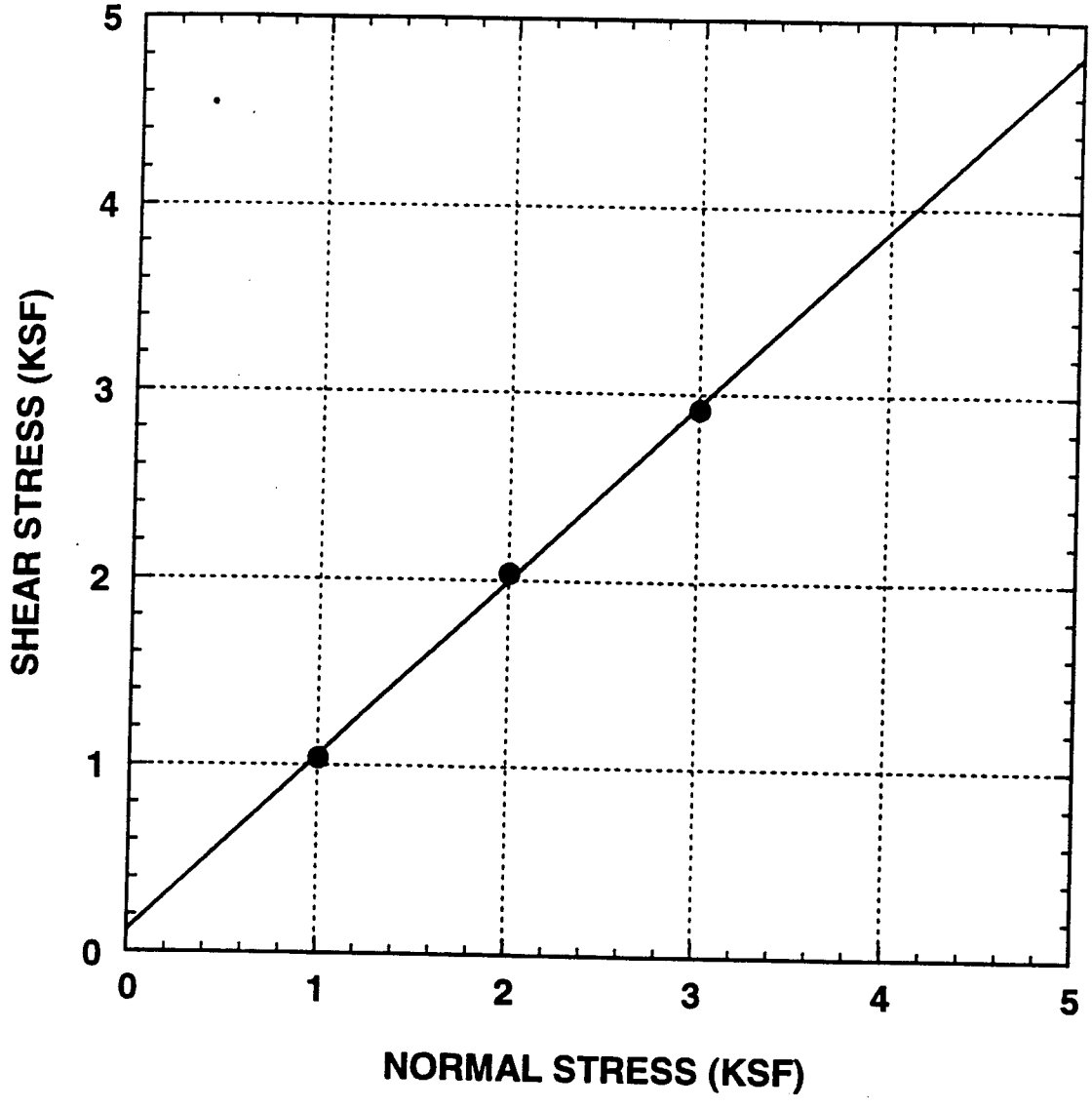
Strength Tests

Direct shear tests were performed on undisturbed samples collected from varying depths within representative Borings. The samples were tested at field moisture contents, and tested in a direct shear machine of the strain control type. Test samples are retained within standard one-inch-high brass rings. Samples were tested at increasing normal loads to determine the Mohr-Coulomb shear strength parameters presented on Figures B-1 through B-39.

Consolidation Tests - (ASTM D 2435)

In this procedure, a series of cumulative vertical loads are applied to a small, laterally confined soil sample. The apparatus is designed to accept a one-inch-high brass ring containing an undisturbed or remolded soil sample. During each load increment, vertical compression (consolidation) of the sample is measured and recorded at selected time intervals. Porous stones are placed in contact with both sides of the specimen to permit the ready addition or release of water. Undisturbed samples were initially at field moisture content, and were subsequently inundated at a load near the existing overburden pressure to determine soil behavior under saturated conditions. The test results are plotted graphically on Figures B-40 through B-42.

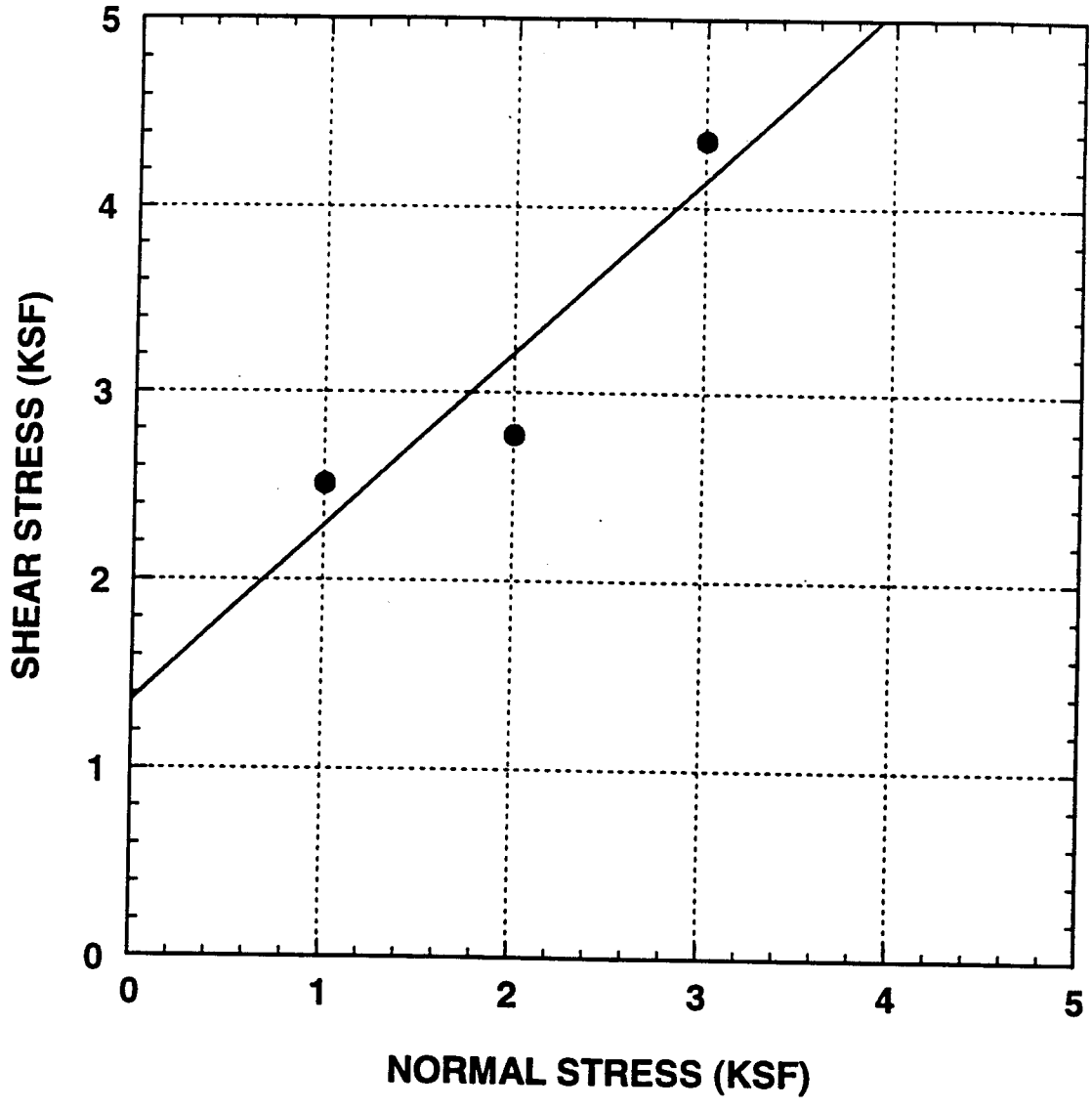
DIRECT SHEAR TEST DIAGRAM



C = 100 psf $\phi = 43^{\circ}$

Test Condition: Undisturbed at Field Moisture	Location: B - 1P	Depth: 5'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 1**	

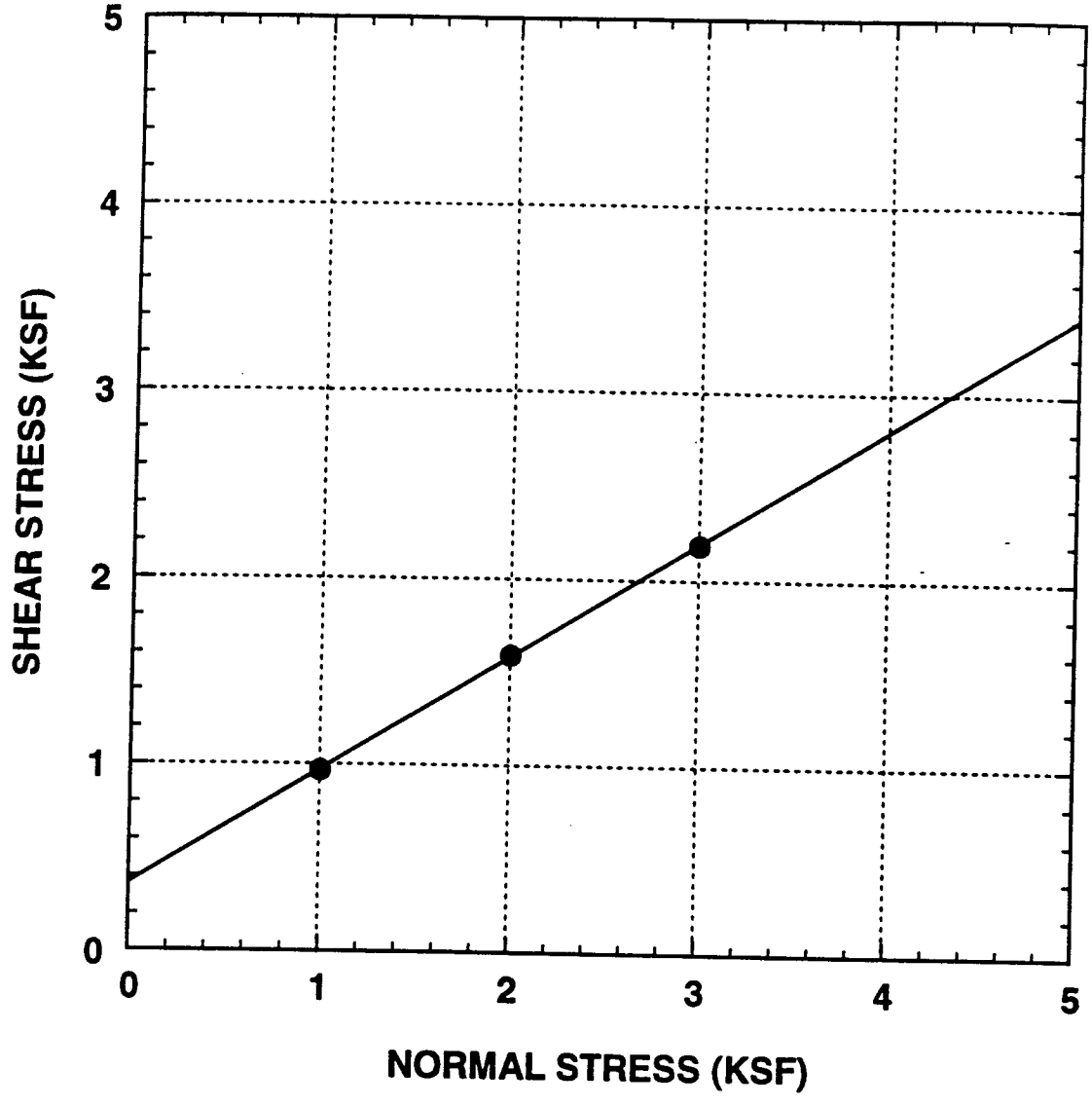
DIRECT SHEAR TEST DIAGRAM



C = 1400 psf $\phi = 42^{\circ}$

Test Condition: Undisturbed at Field Moisture	Location: B - 1P	Depth: 10'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 2**	

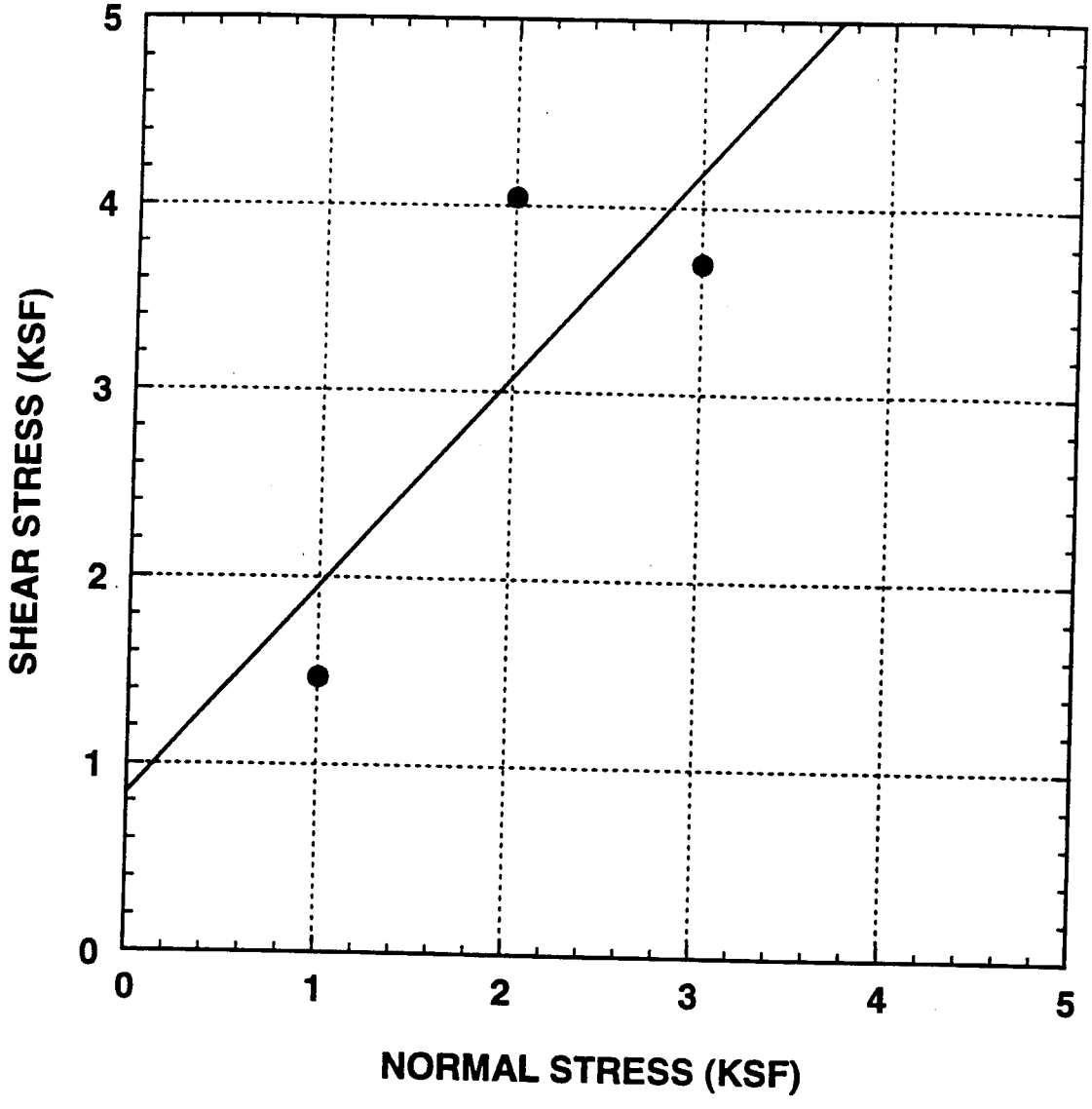
DIRECT SHEAR TEST DIAGRAM



C = 375 psf ϕ = 31°

Test Condition: Undisturbed at Field Moisture	Location: B - 1P	Depth: 20'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 3**	

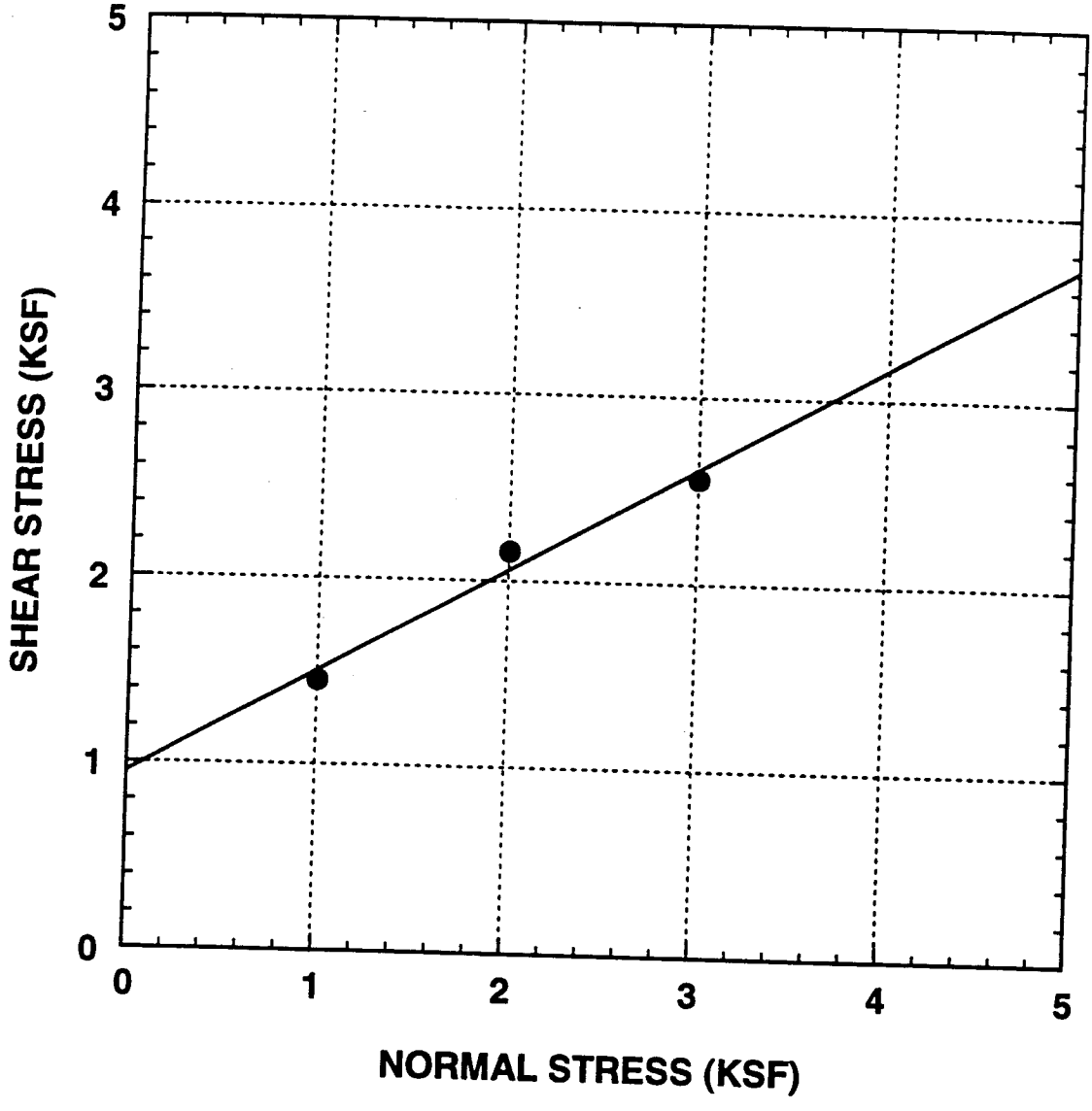
DIRECT SHEAR TEST DIAGRAM



C = 850 psf $\phi = 48°$

Test Condition: Undisturbed at Field Moisture	Location: B - 1P	Depth: 30'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 4**	

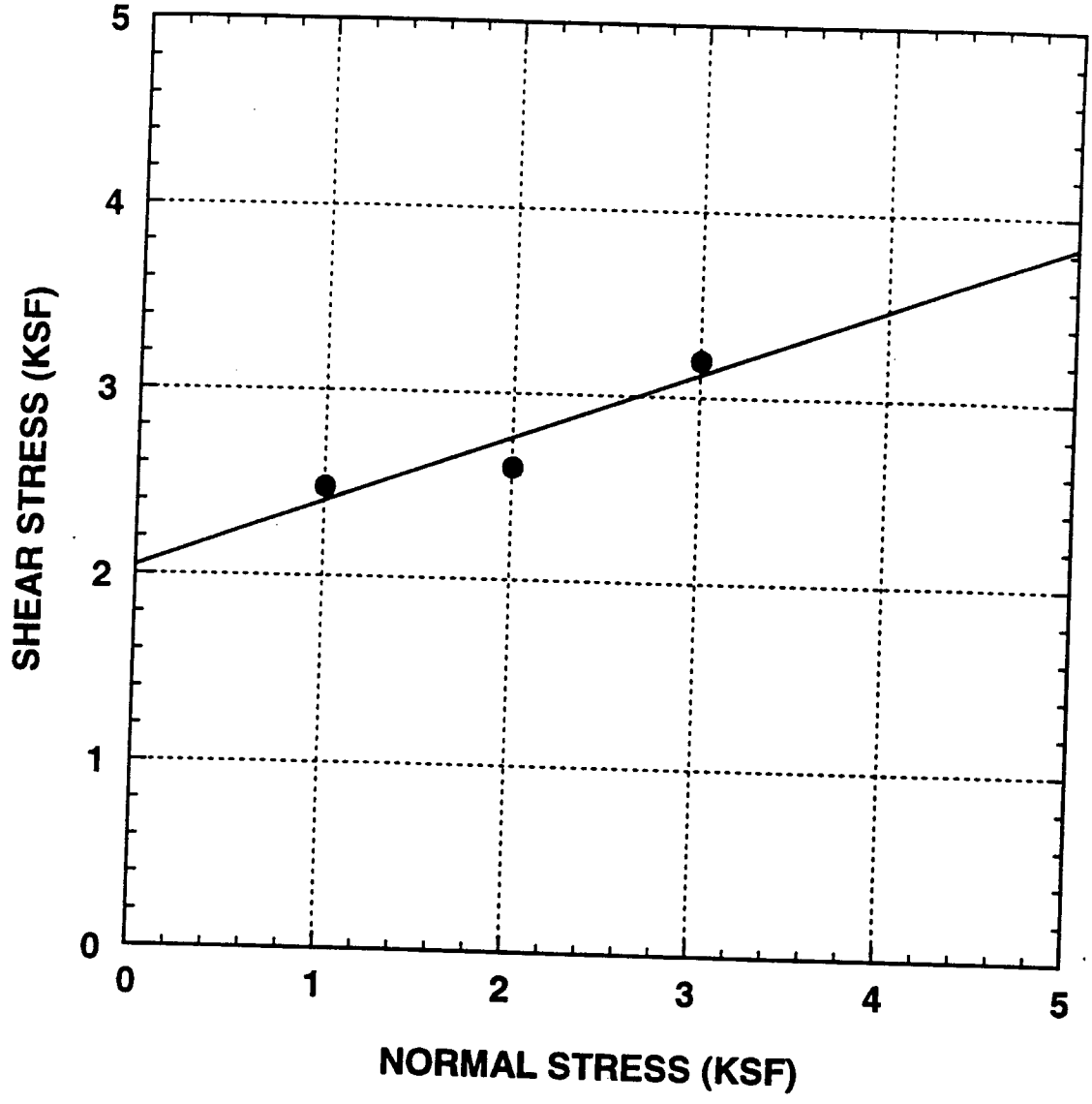
DIRECT SHEAR TEST DIAGRAM



C = 950 psf ϕ = 29°

Test Condition: Undisturbed at Field Moisture	Location: B - 1P	Depth: 50'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 5**	

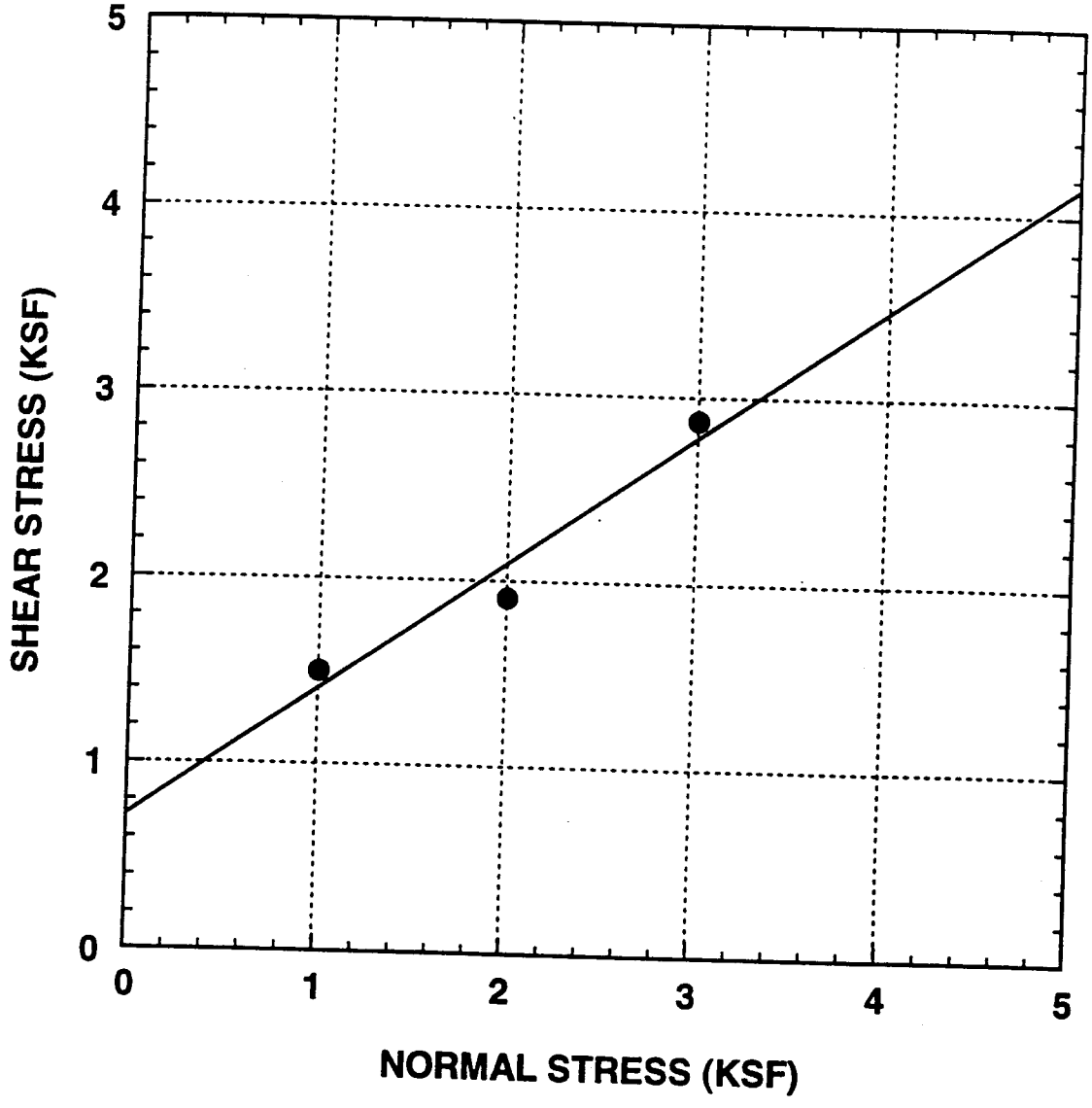
DIRECT SHEAR TEST DIAGRAM



C = 2050 psf ϕ = 20°

Test Condition: Undisturbed at Field Moisture	Location: B - 4P	Depth: 10'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 6**	

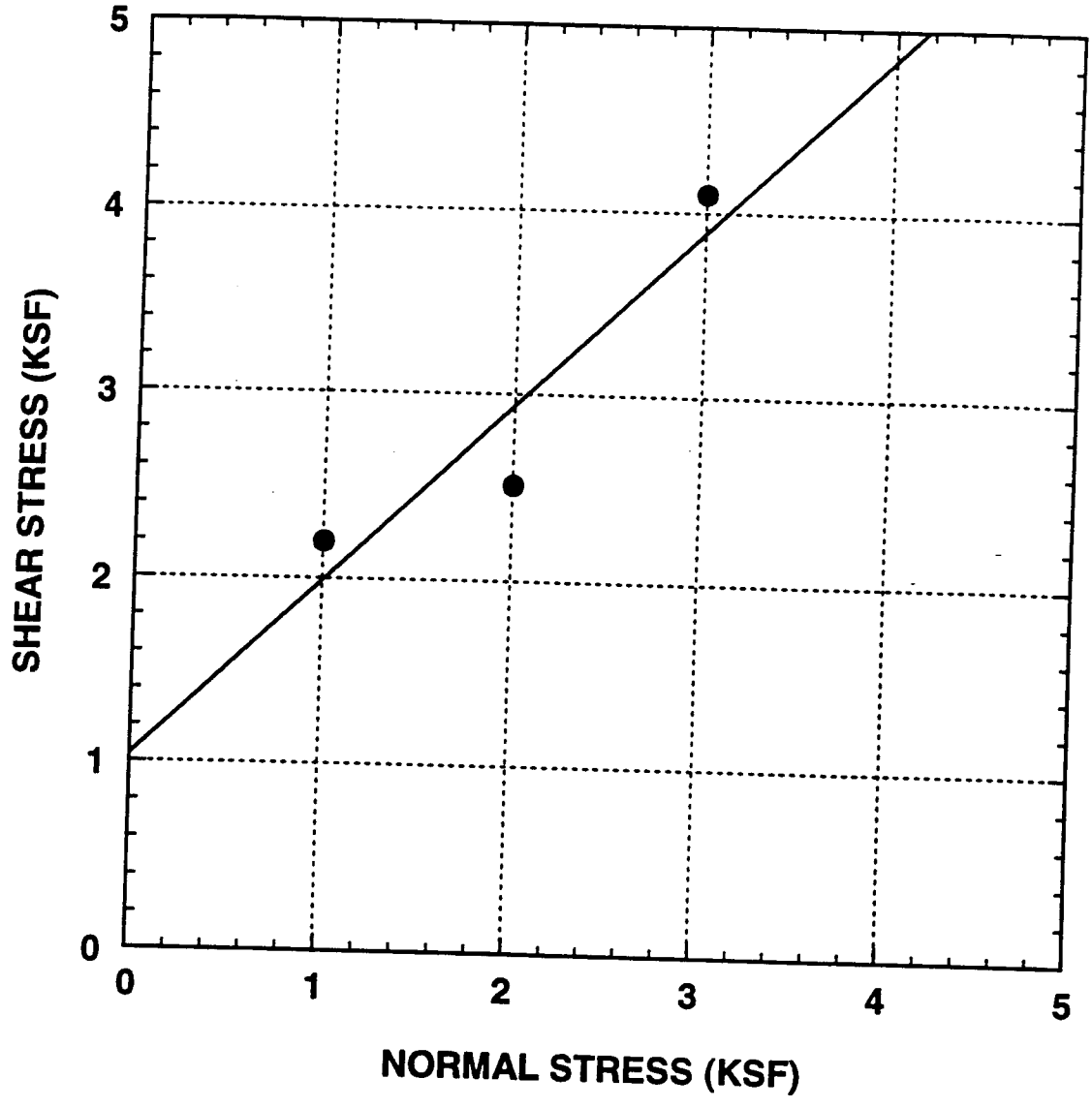
DIRECT SHEAR TEST DIAGRAM



C = 700 psf $\phi = 34°$

Test Condition: Undisturbed at Field Moisture	Location: B - 4P	Depth: 15'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 7**	

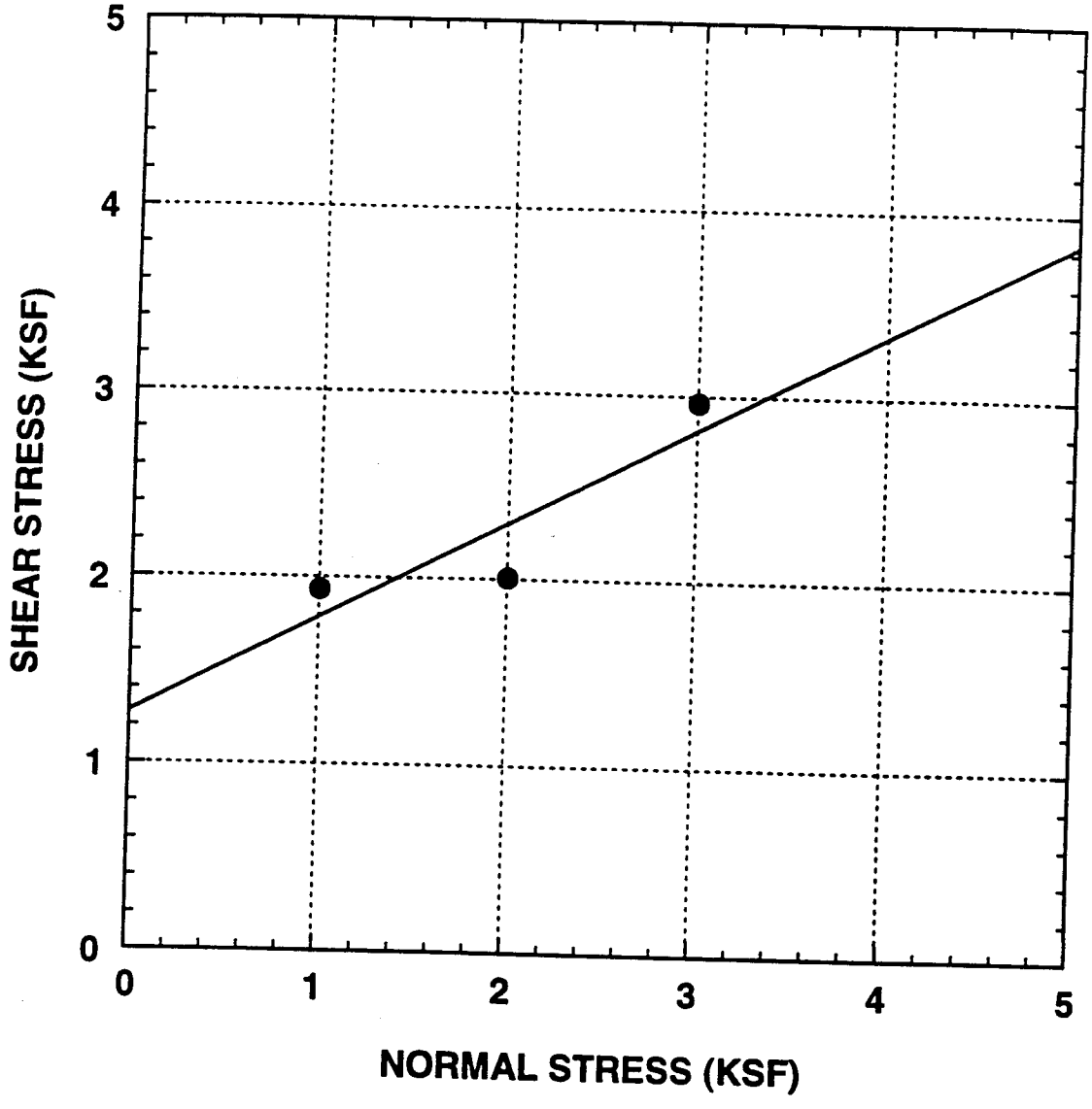
DIRECT SHEAR TEST DIAGRAM



C = 1050 psf ϕ = 43°

Test Condition: Undisturbed at Field Moisture	Location: B - 4P	Depth: 20'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 8**	

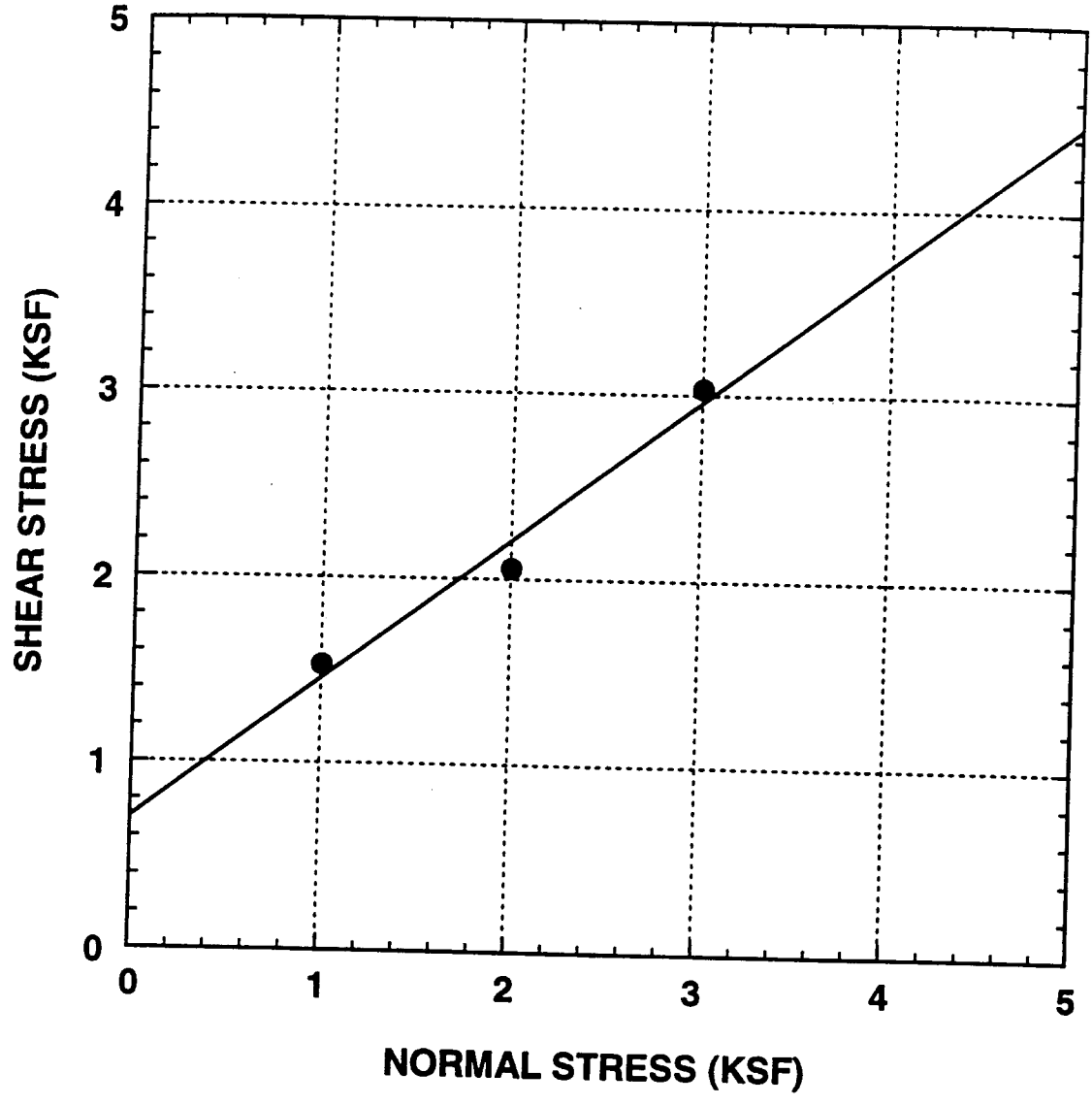
DIRECT SHEAR TEST DIAGRAM



C = 1250 psf ϕ = 27°

Test Condition: Undisturbed at Field Moisture	Location: B - 4P	Depth: 35'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 9**	

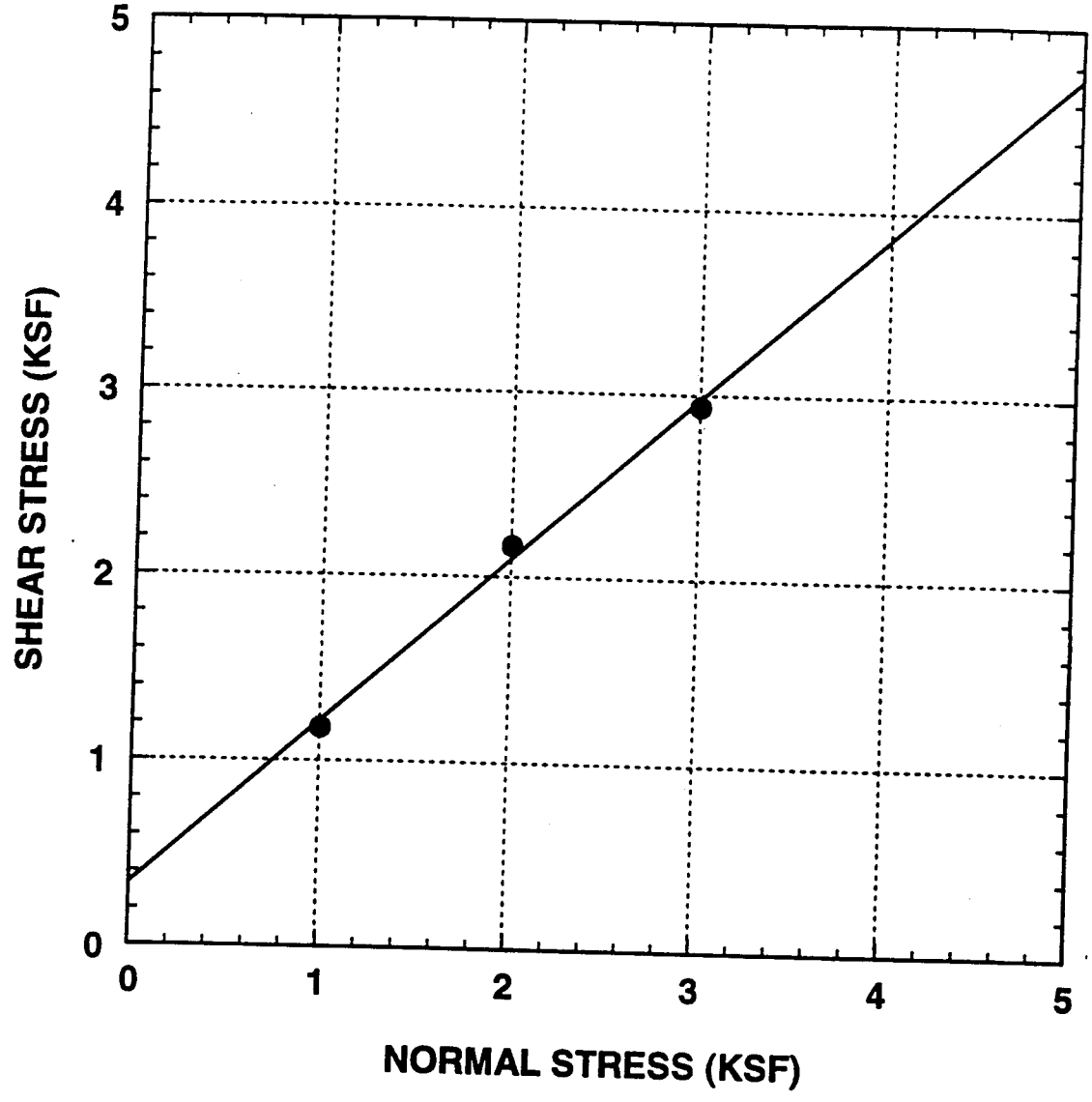
DIRECT SHEAR TEST DIAGRAM



C = 750 psf $\phi = 35^{\circ}$

Test Condition: Undisturbed at Field Moisture	Location: B - 4P	Depth: 55'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 10**	

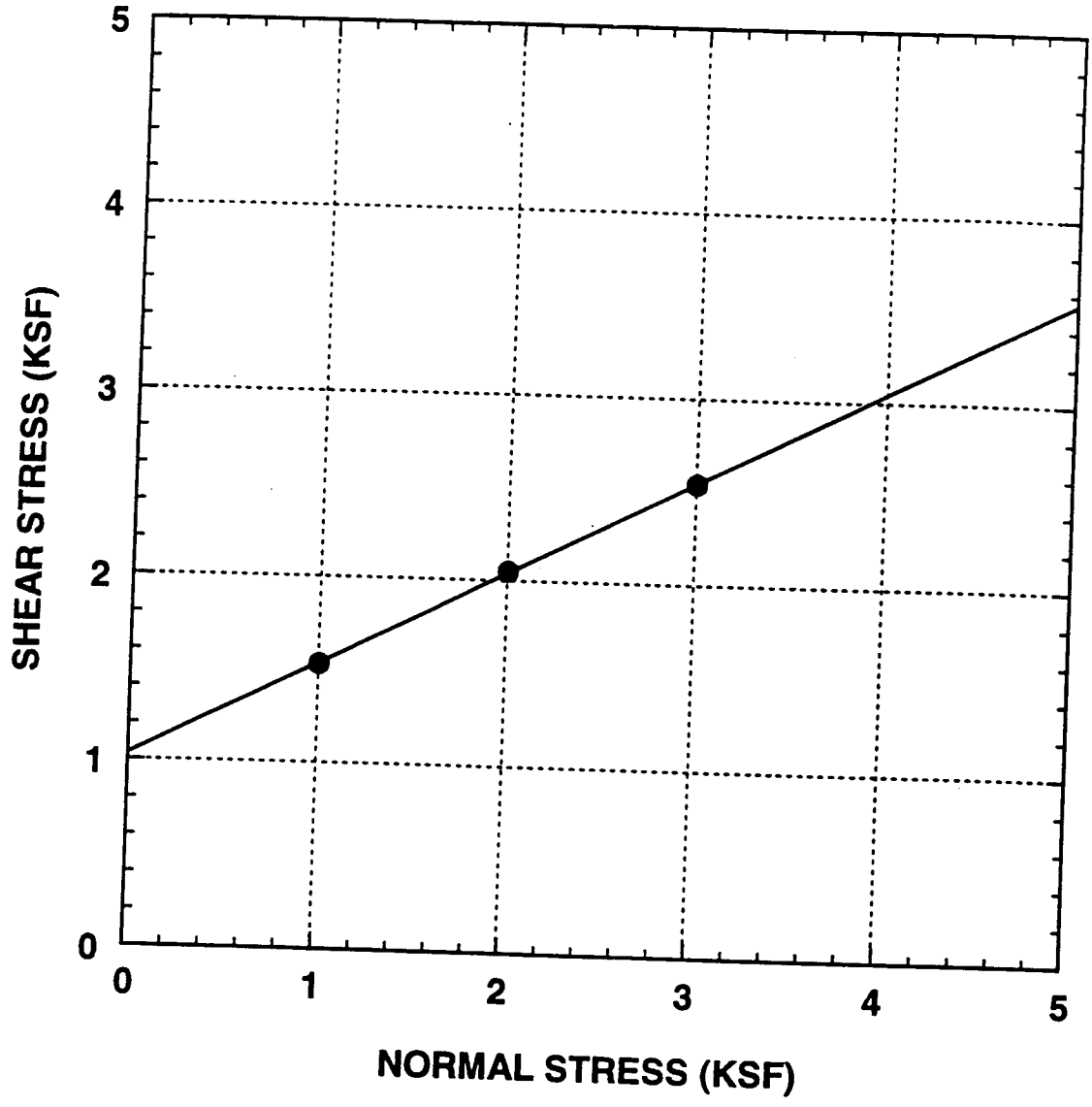
DIRECT SHEAR TEST DIAGRAM



C = 350 psf ϕ = 41°

Test Condition: Undisturbed at Field Moisture	Location: B - 7	Depth: 5'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 11**	

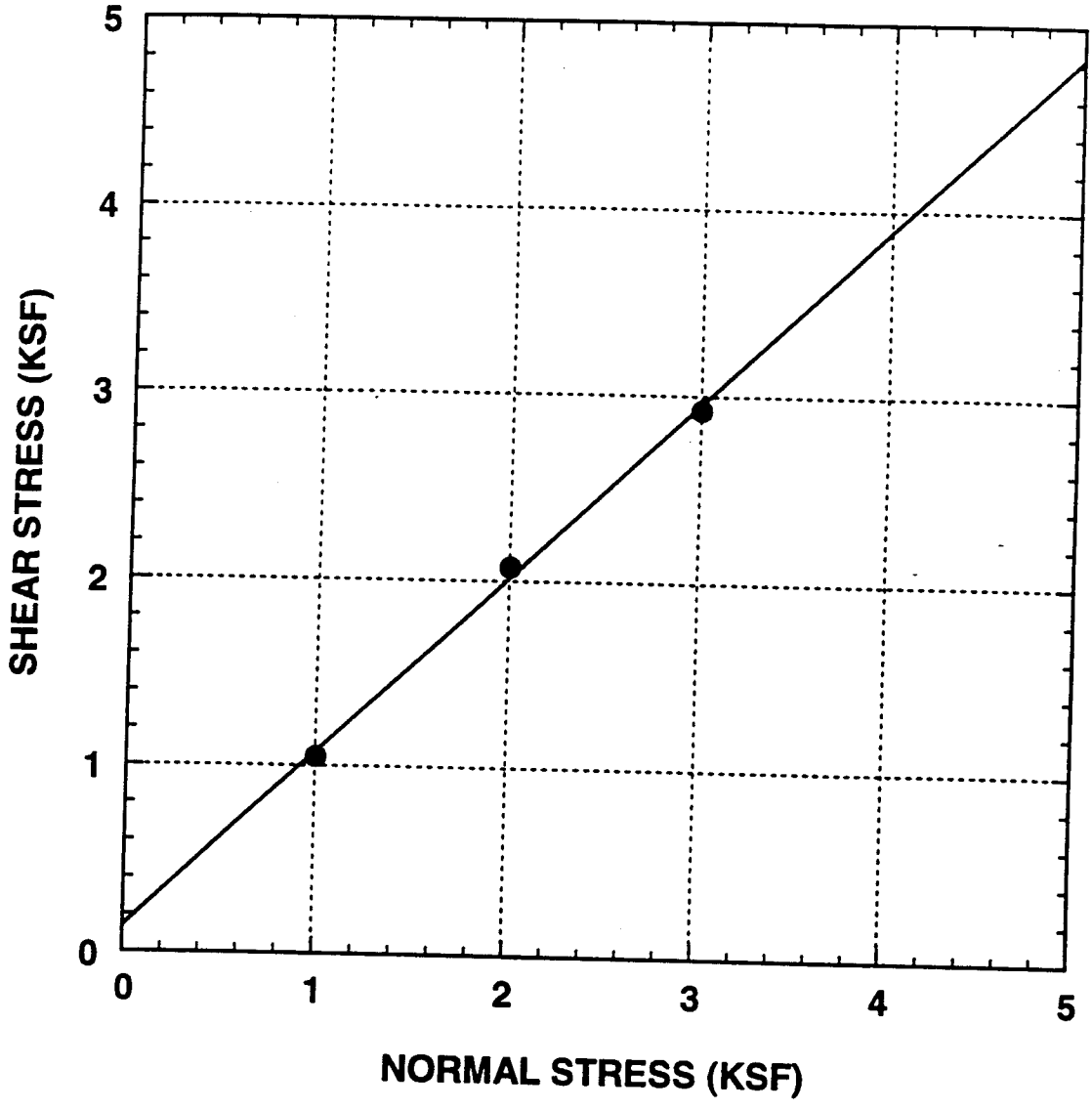
DIRECT SHEAR TEST DIAGRAM



C = 1025 psf $\phi = 27°$

Test Condition: Undisturbed at Field Moisture	Location: B - 7	Depth: 10'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 12**	

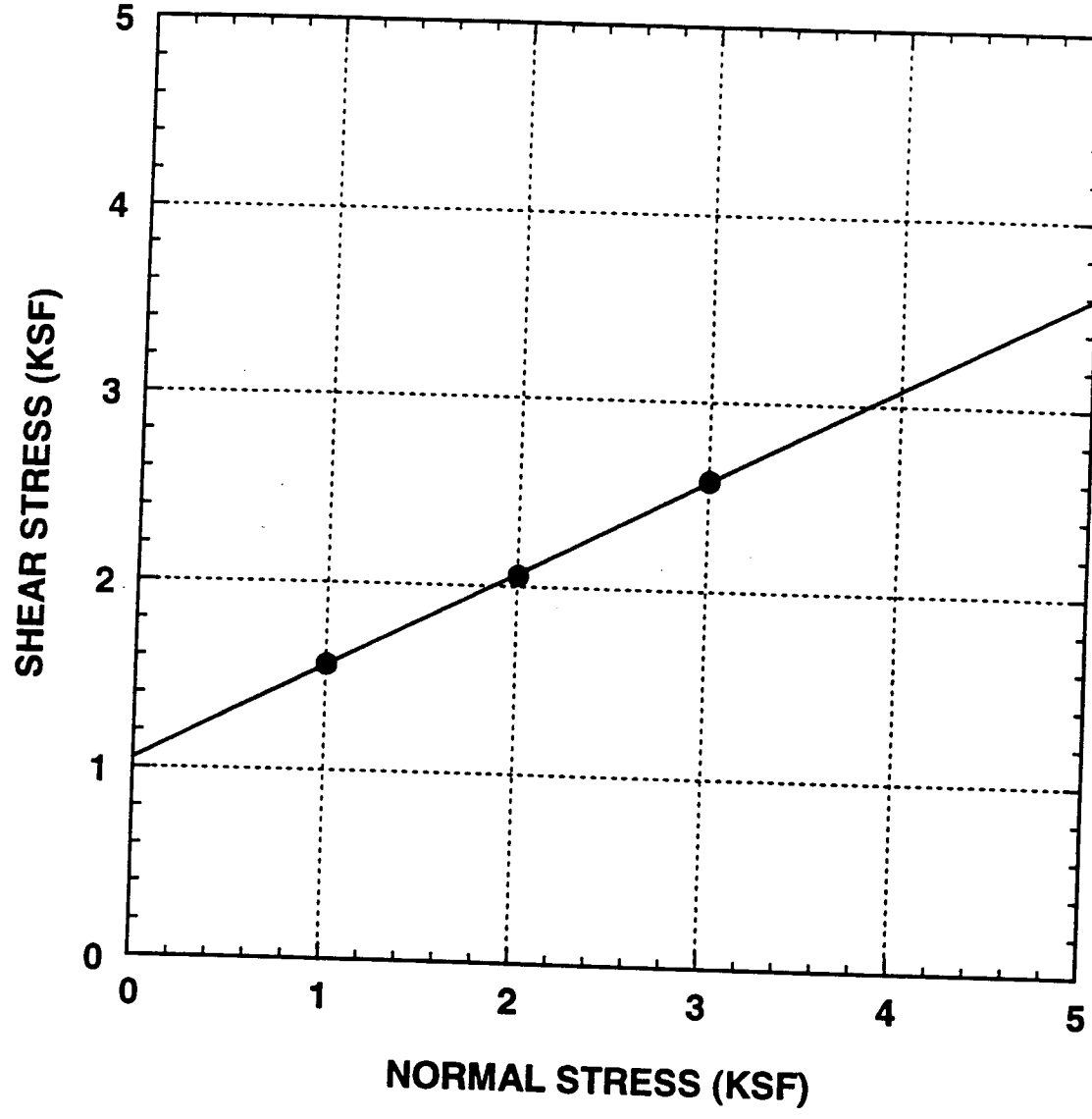
DIRECT SHEAR TEST DIAGRAM



C = 125 psf $\phi = 43°$

Test Condition: Undisturbed at Field Moisture	Location: B - 7	Depth: 20'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 13**	

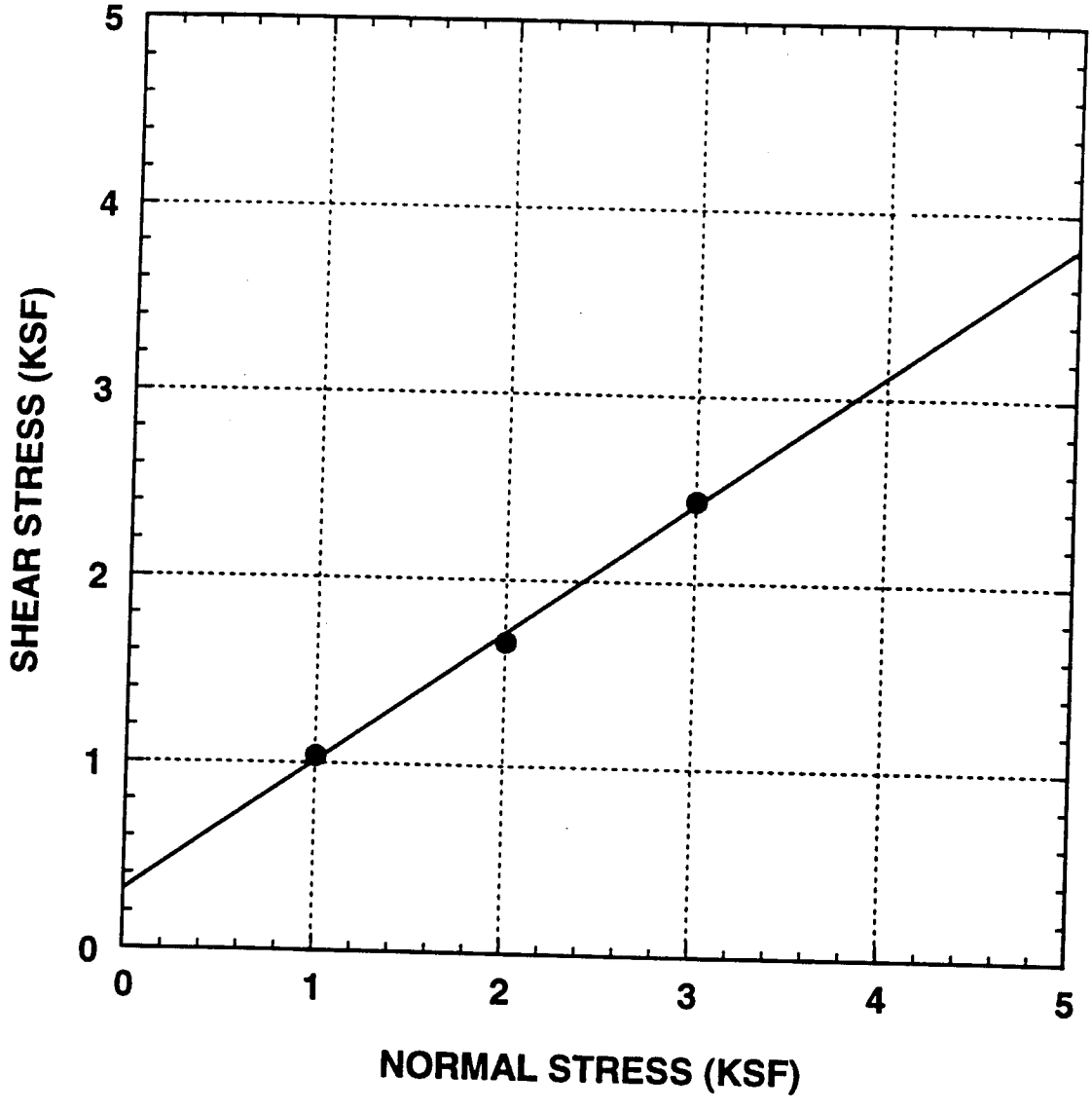
DIRECT SHEAR TEST DIAGRAM



C = 1050 psf ϕ = 27°

Test Condition: Undisturbed at Field Moisture	Location: B - 7	Depth: 30'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 14**	

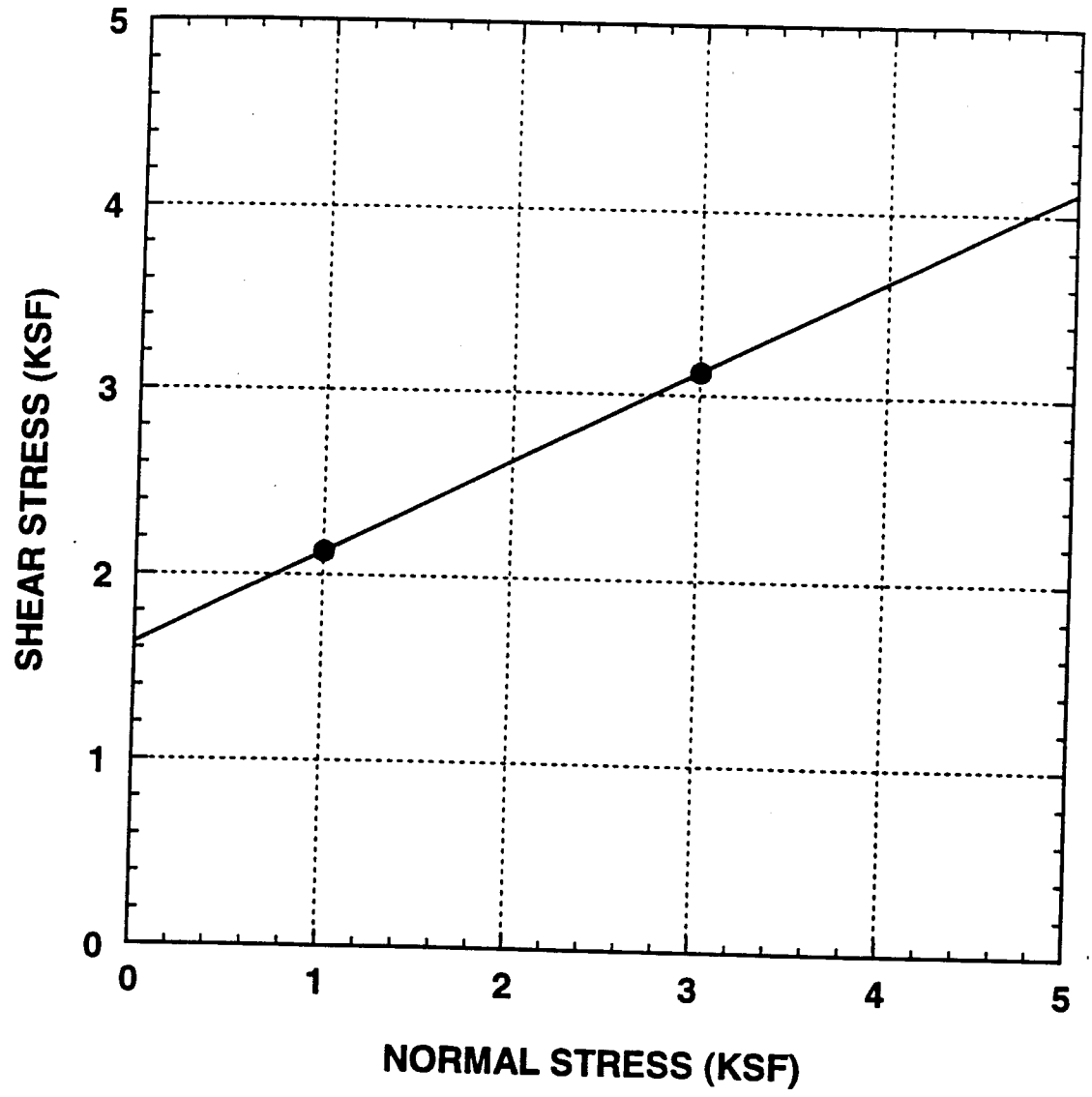
DIRECT SHEAR TEST DIAGRAM



C = 300 psf $\phi = 35°$

Test Condition: Undisturbed at Field Moisture	Location: B - 7	Depth: 35'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 15**	

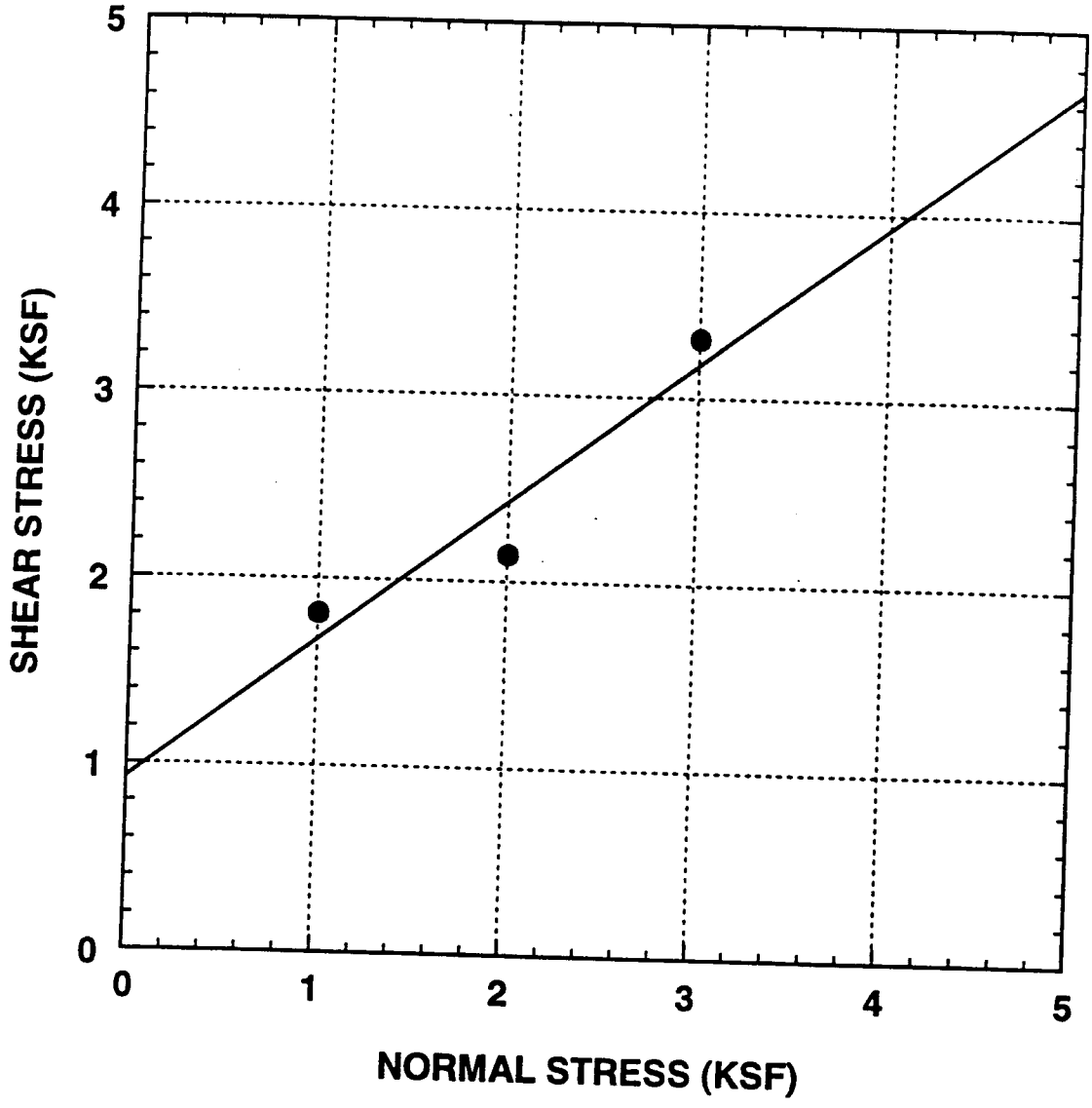
DIRECT SHEAR TEST DIAGRAM



C = 1625 psf ϕ = 26°

Test Condition: Undisturbed at Field Moisture	Location: B - 7	Depth: 45'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 16**	

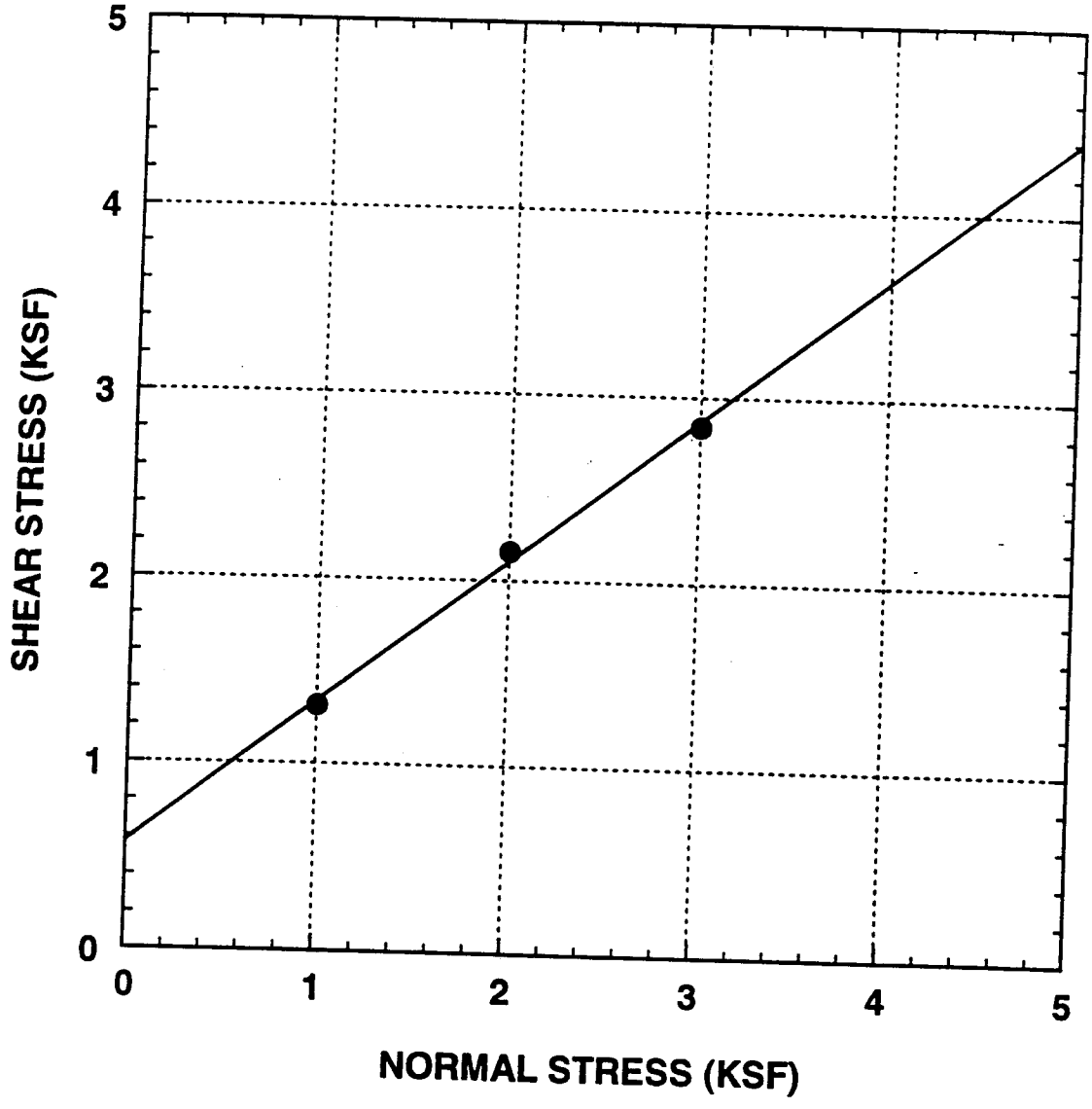
DIRECT SHEAR TEST DIAGRAM



C = 925 psf $\phi = 37°$

Test Condition: Undisturbed at Field Moisture	Location: B - 7	Depth: 55'
roject Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 17**	

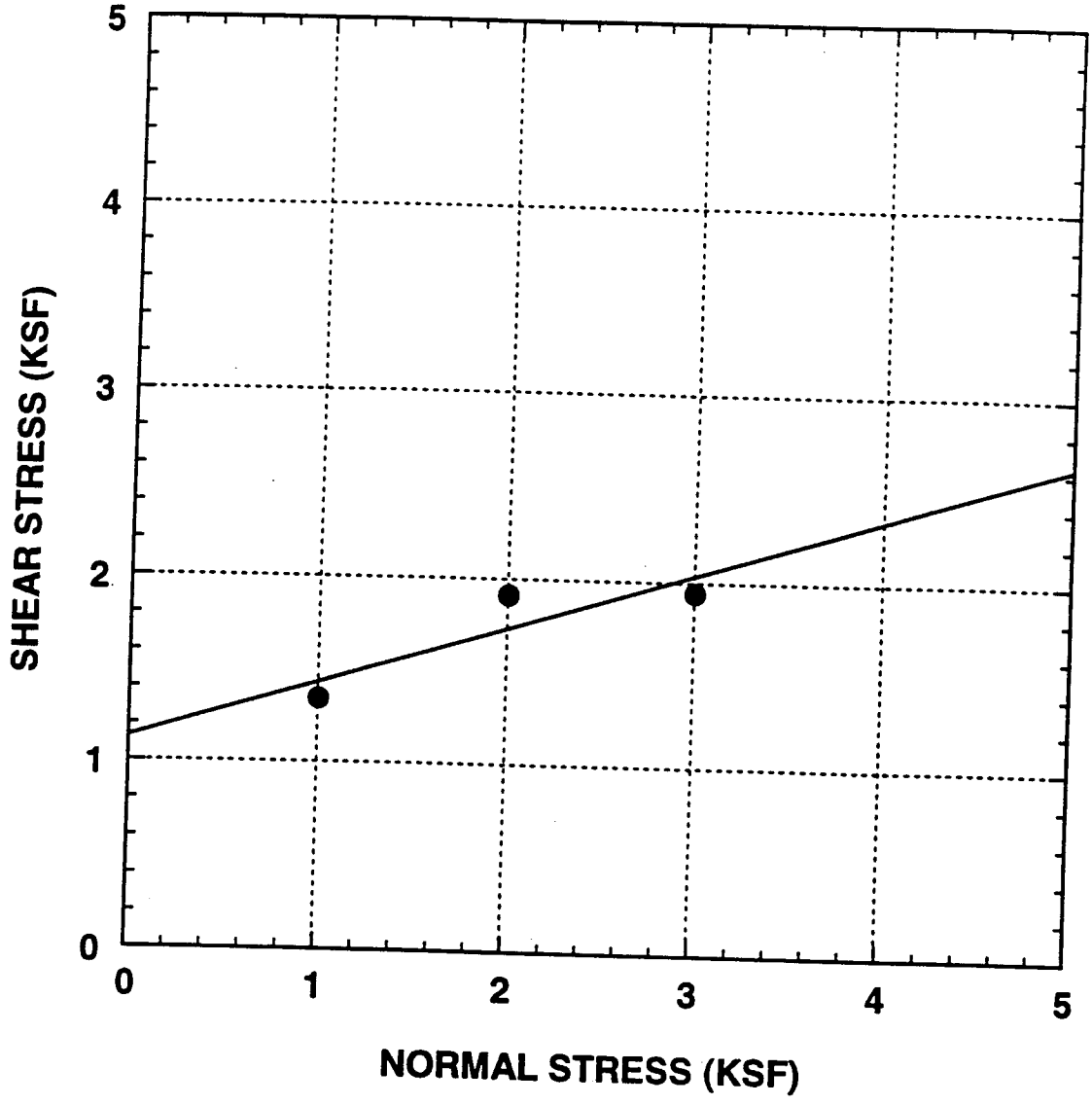
DIRECT SHEAR TEST DIAGRAM



C = 575 psf ϕ = 37°

Test Condition: Undisturbed at Field Moisture	Location: B - 9P	Depth: 2.5'
roject Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 18**	

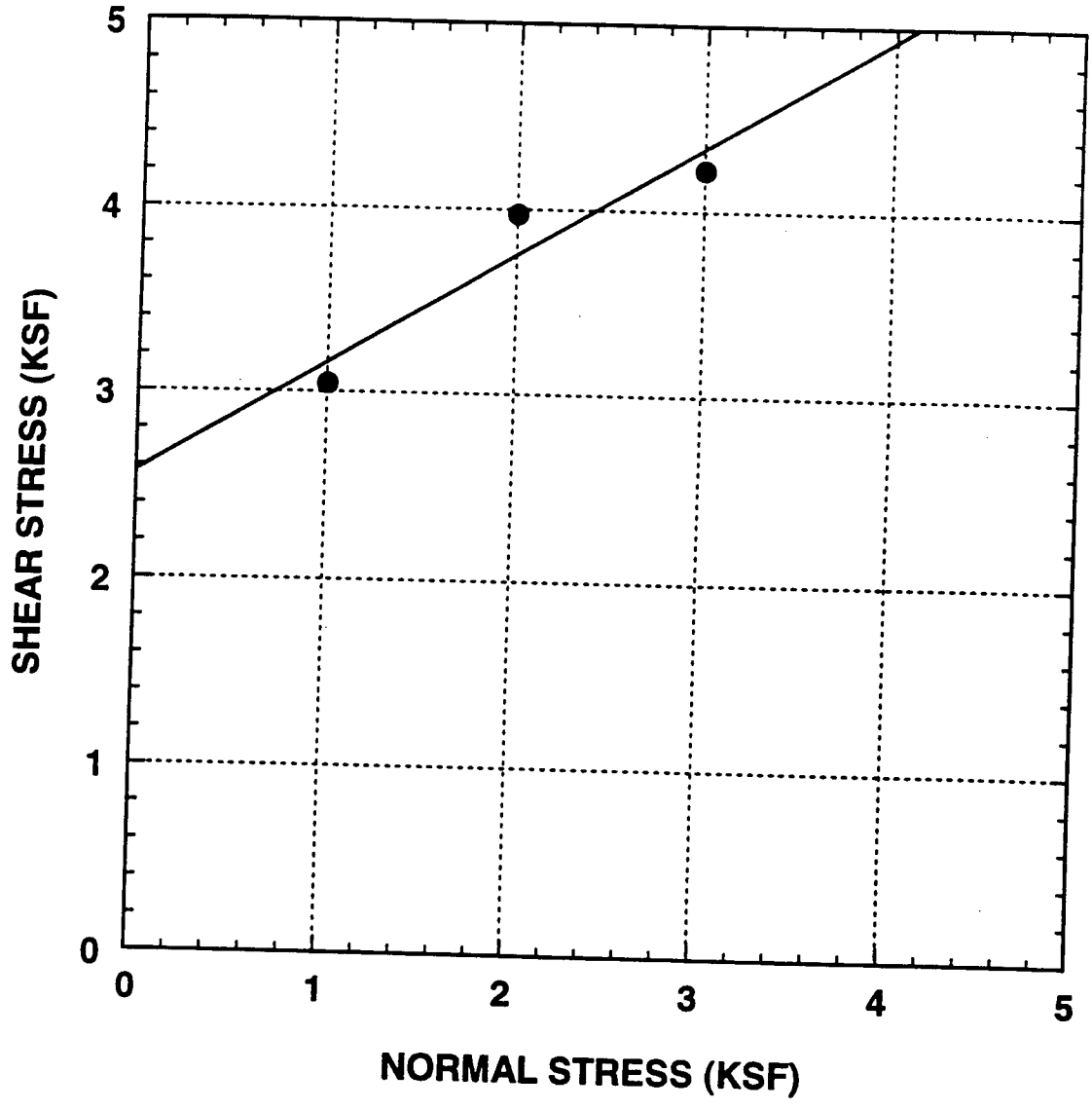
DIRECT SHEAR TEST DIAGRAM



C = 1125 psf ϕ = 17°

Test Condition: Undisturbed at Field Moisture	Location: B - 9P	Depth: 7.5'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 19**	

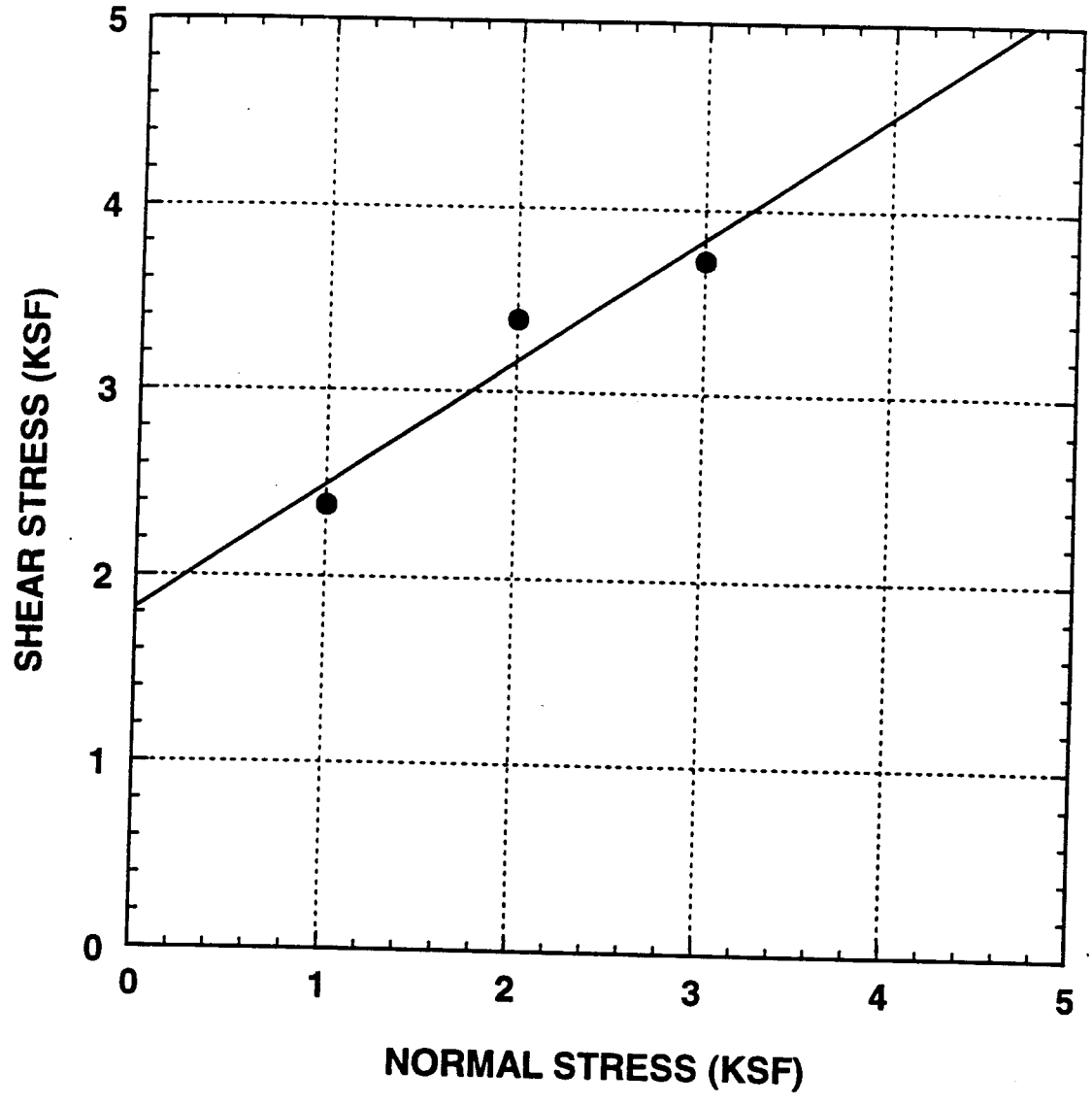
DIRECT SHEAR TEST DIAGRAM



C = 2575 psf $\phi = 30°$

Test Condition: Undisturbed at Field Moisture	Location: B - 9P	Depth: 12.5'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 20**	

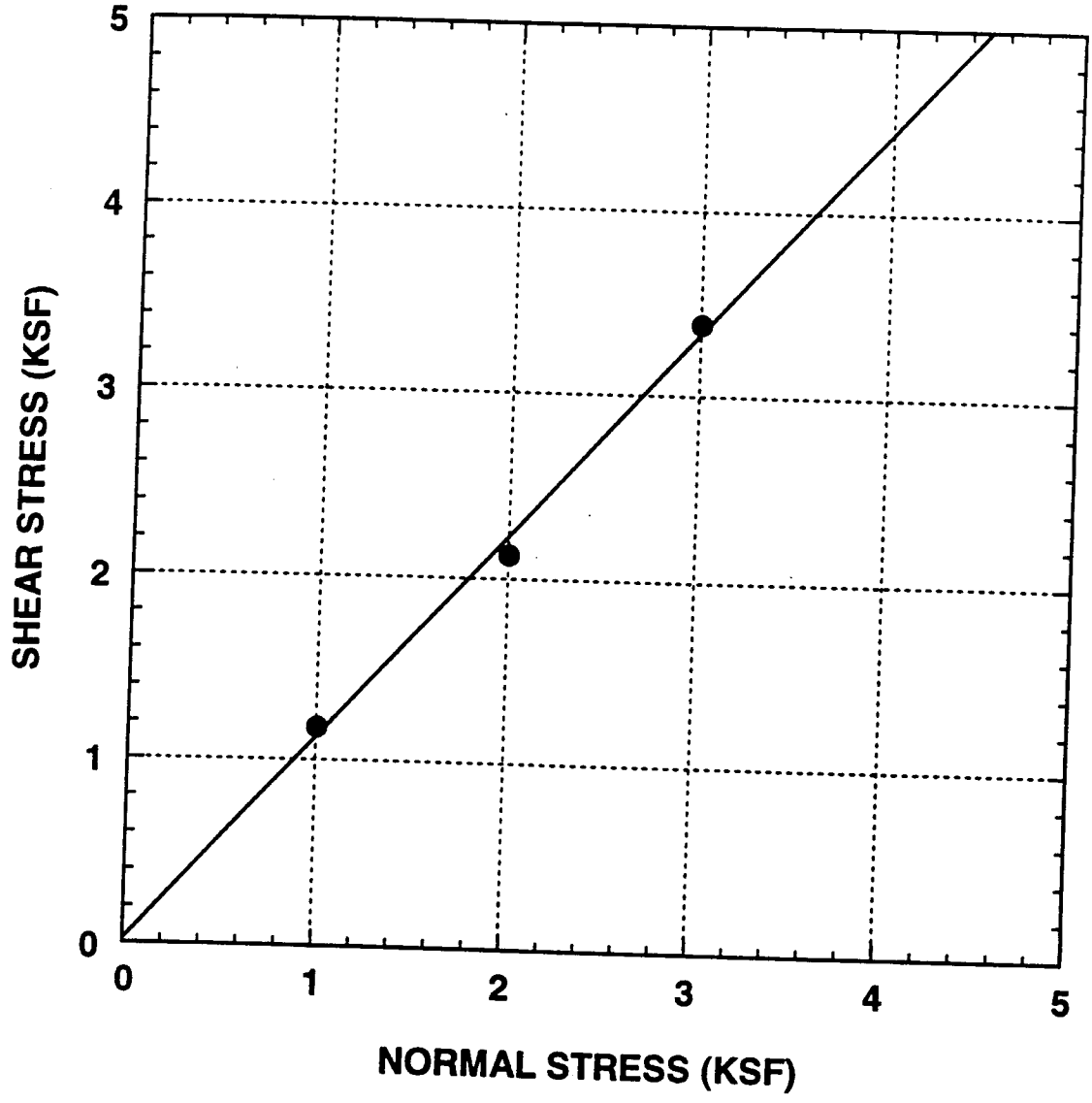
DIRECT SHEAR TEST DIAGRAM



C = 1825 psf $\phi = 34°$

Test Condition: Undisturbed at Field Moisture	Location: B - 9P	Depth: 17.5'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 21**	

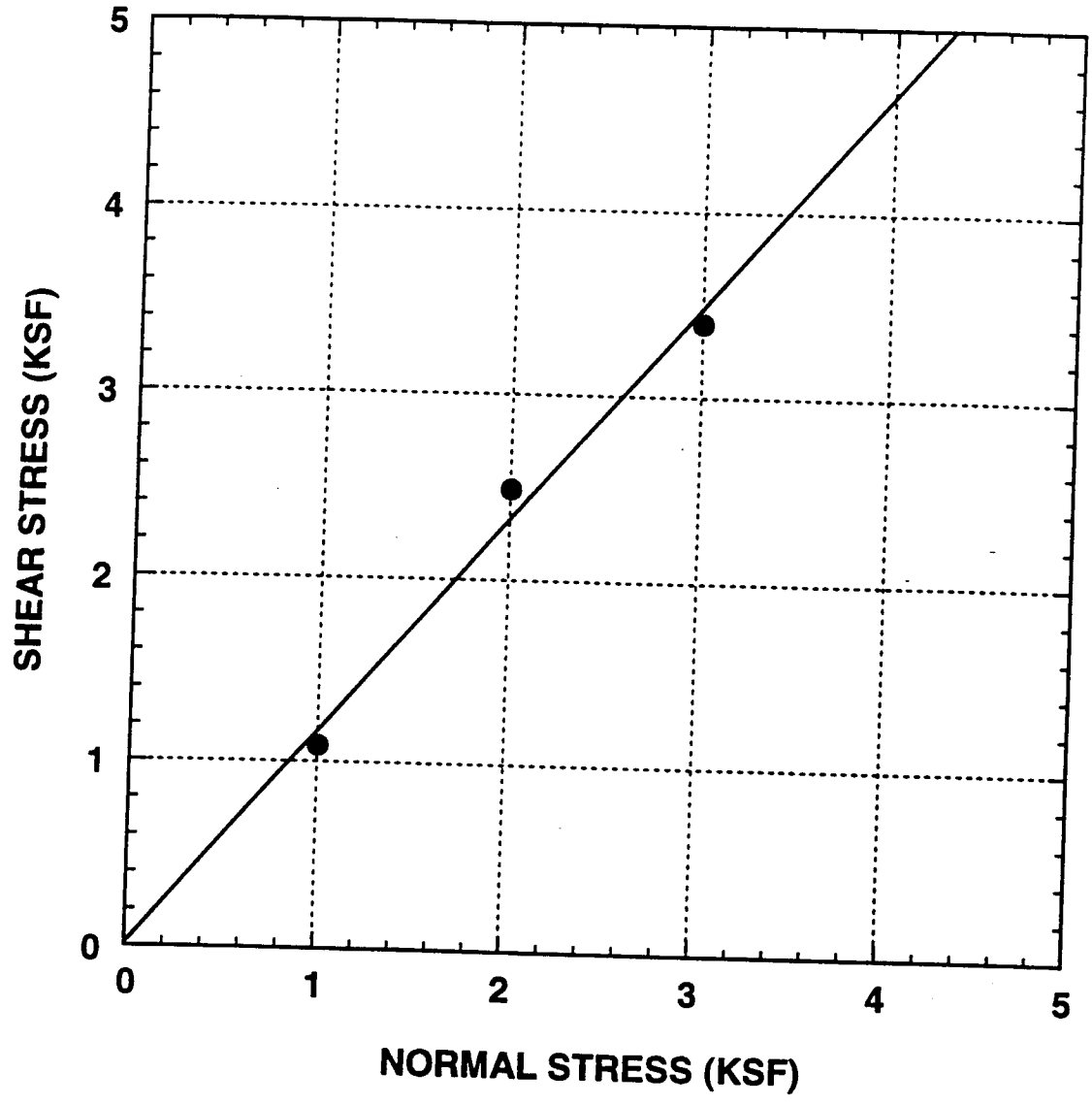
DIRECT SHEAR TEST DIAGRAM



C = 0 psf ϕ = 48°

Test Condition: Undisturbed at Field Moisture	Location: B - 9P	Depth: 27.5'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 22**	

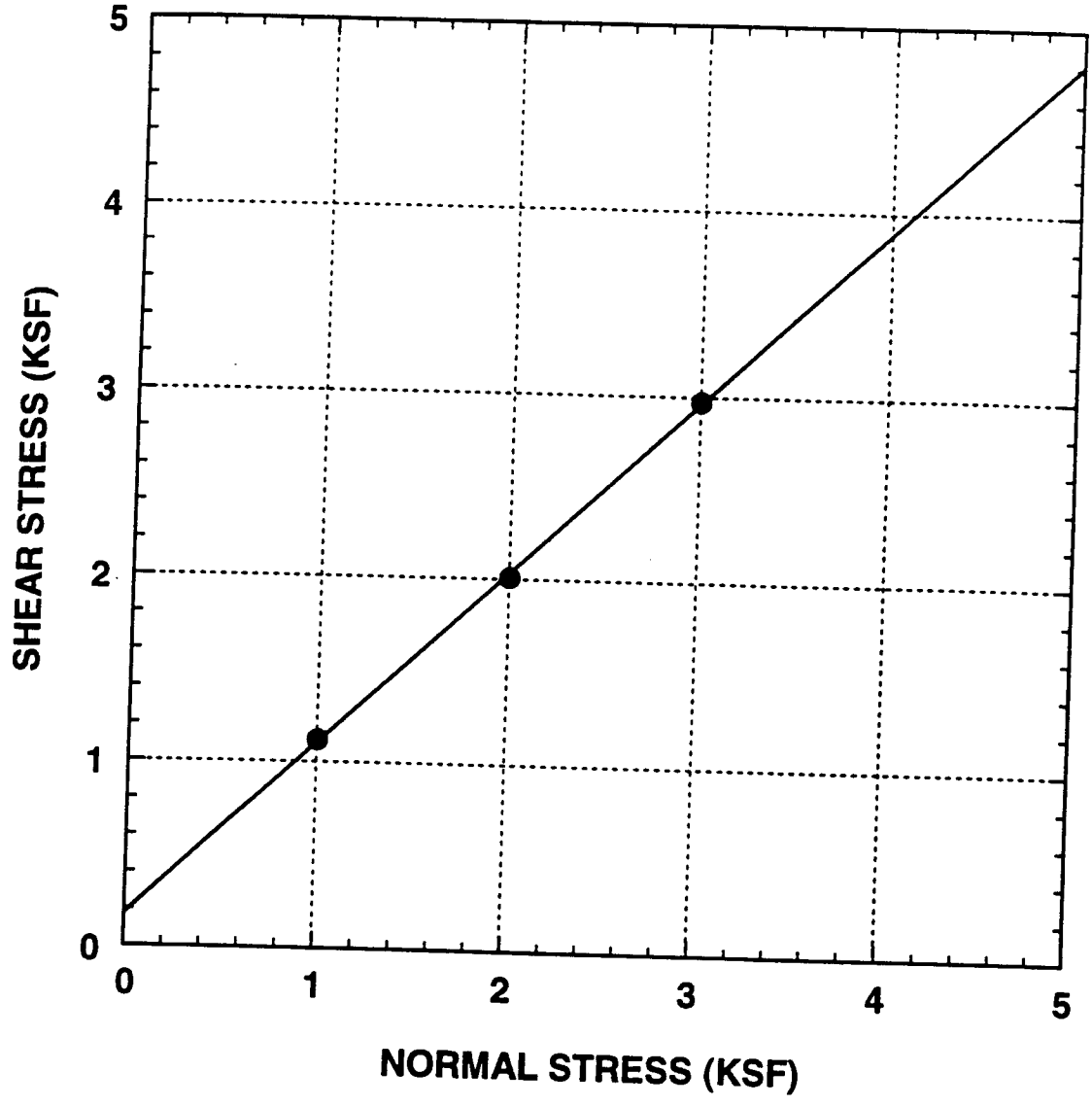
DIRECT SHEAR TEST DIAGRAM



C = 0 psf ϕ = 49°

Test Condition: Undisturbed at Field Moisture	Location: B - 9P	Depth: 32.5'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 23**	

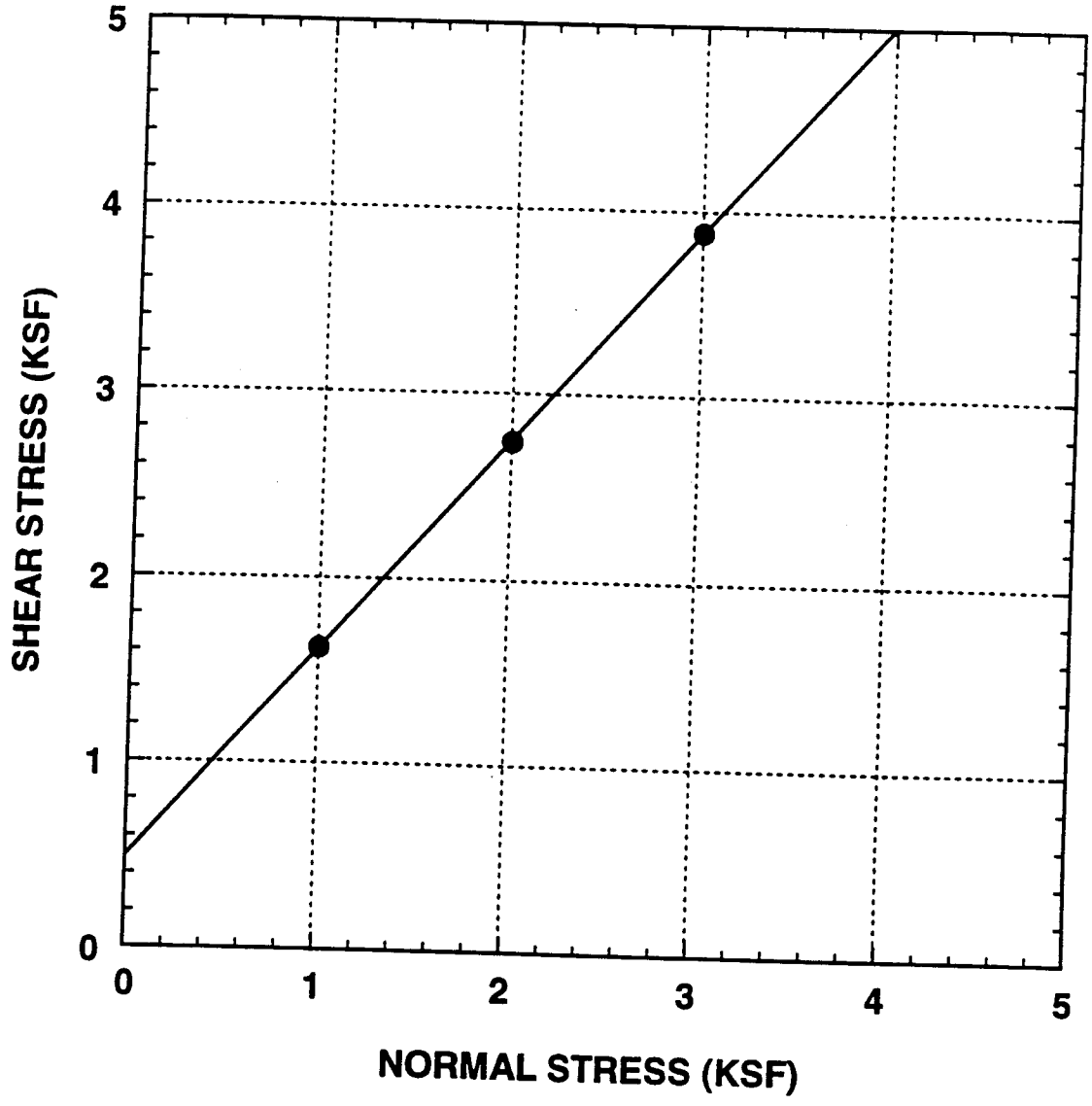
DIRECT SHEAR TEST DIAGRAM



C = 175 psf ϕ = 43°

Test Condition: Undisturbed at Field Moisture	Location: B - 9P	Depth: 37.5'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 24**	

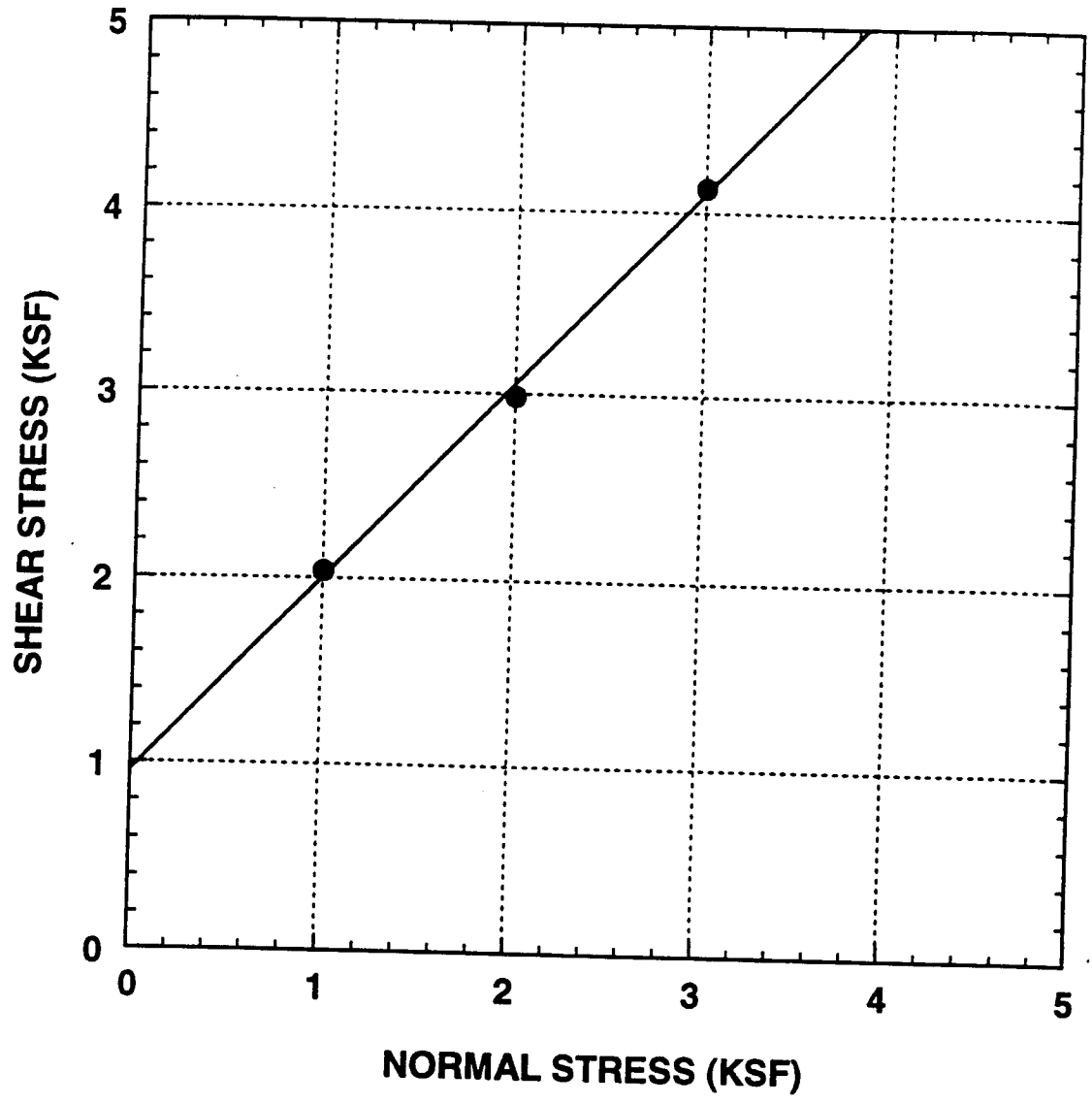
DIRECT SHEAR TEST DIAGRAM



C = 500 psf ϕ = 48°

Test Condition: Undisturbed at Field Moisture	Location: B - 9P	Depth: 45'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 25**	

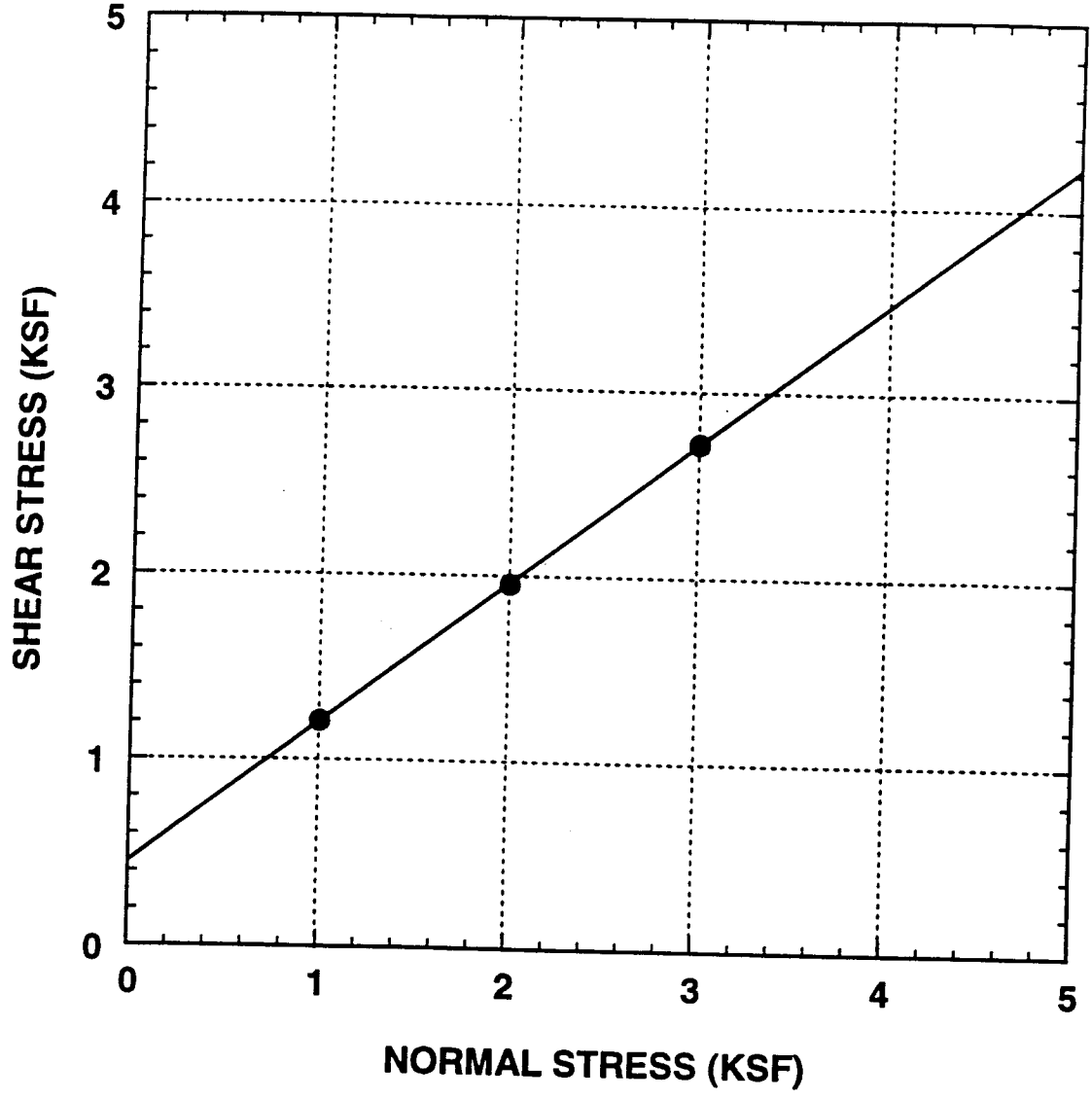
DIRECT SHEAR TEST DIAGRAM



C = 950 psf ϕ = 46°

Test Condition: Undisturbed at Field Moisture	Location: B - 10	Depth: 10'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 26**	

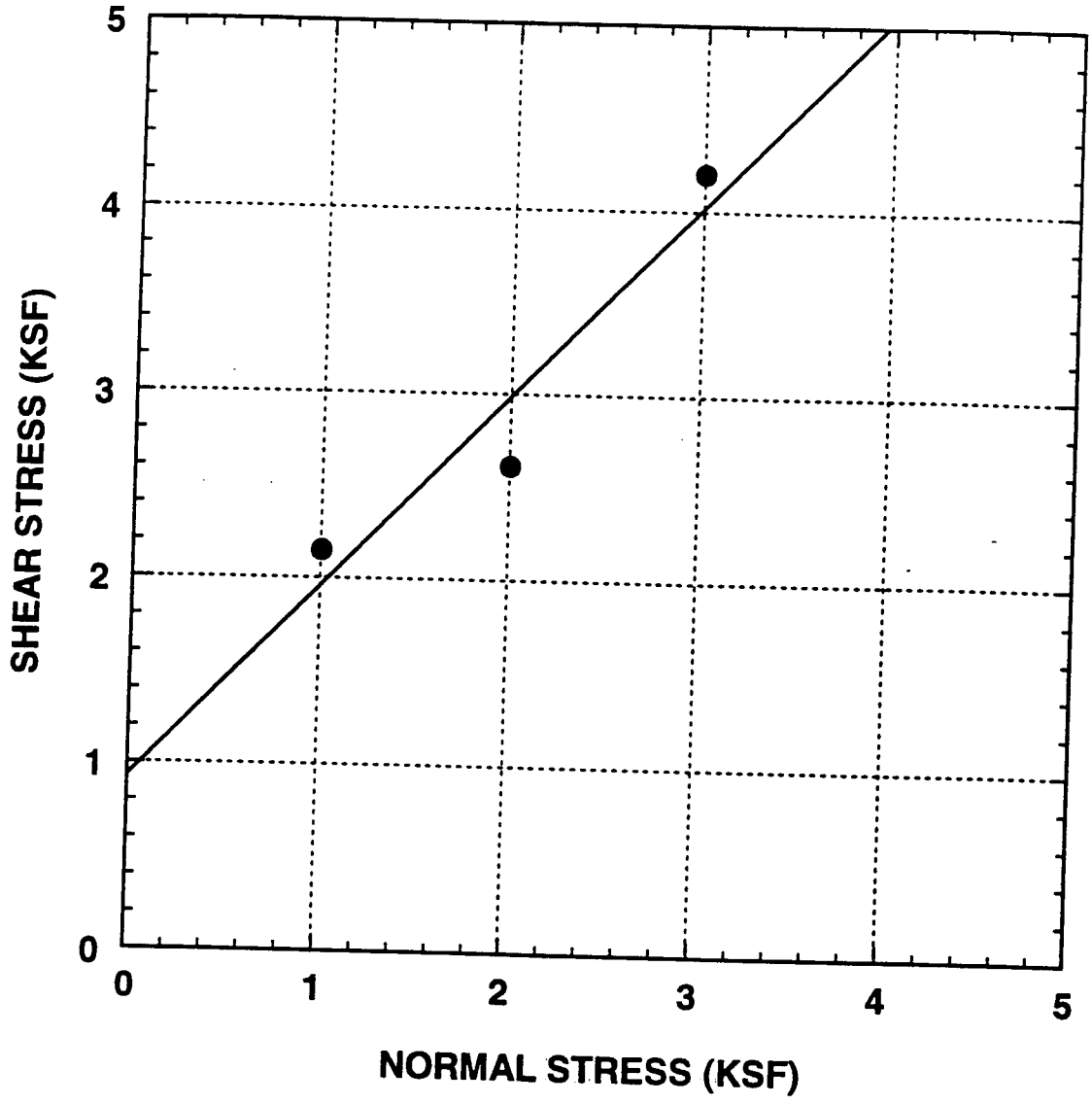
DIRECT SHEAR TEST DIAGRAM



C = 450 psf ϕ = 37°

Test Condition: Undisturbed at Field Moisture	Location: B - 13	Depth: 10'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 27**	

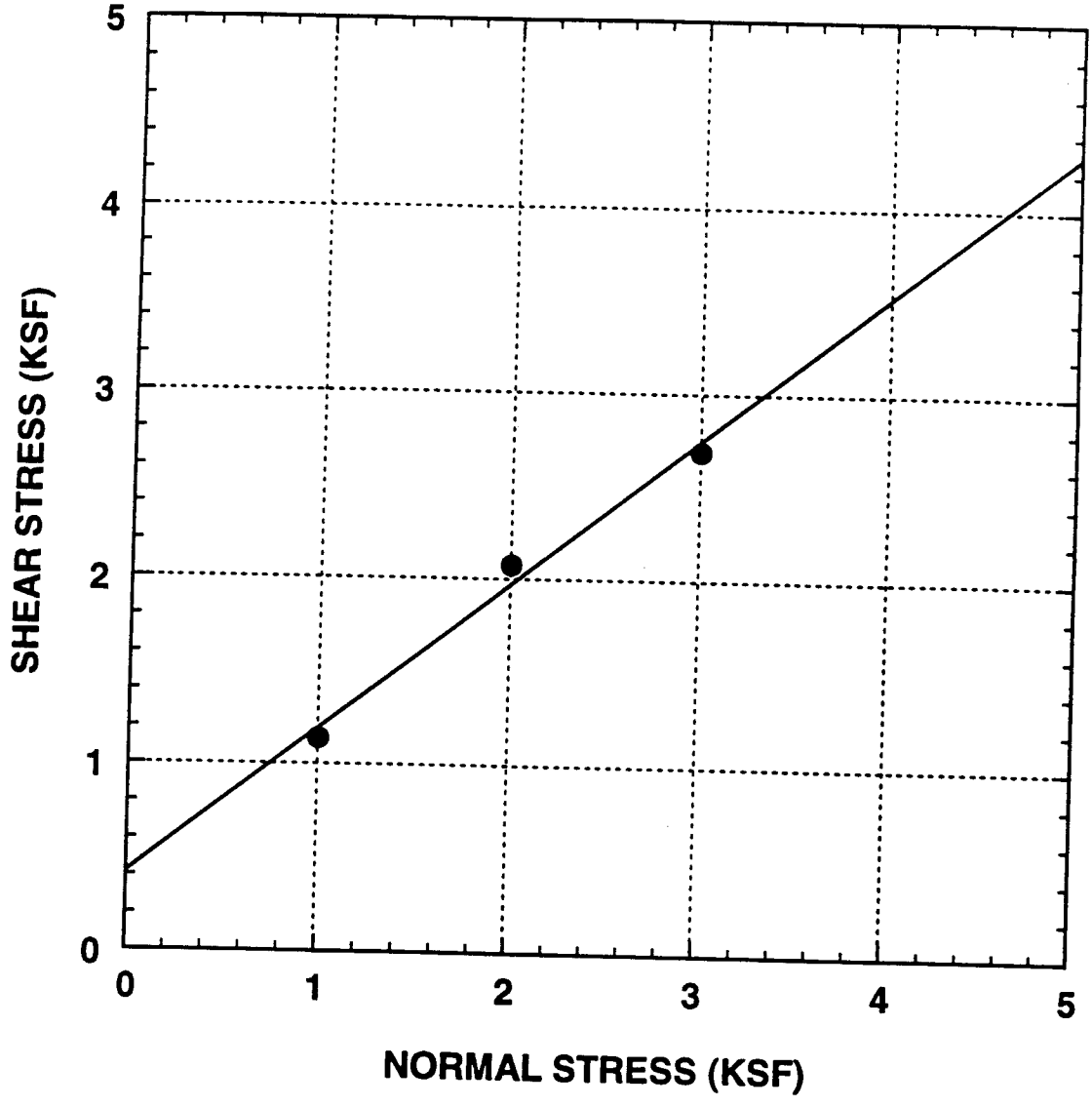
DIRECT SHEAR TEST DIAGRAM



C = 925 psf $\phi = 46°$

Test Condition: Undisturbed at Field Moisture	Location: B - 13	Depth: 15'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 28**	

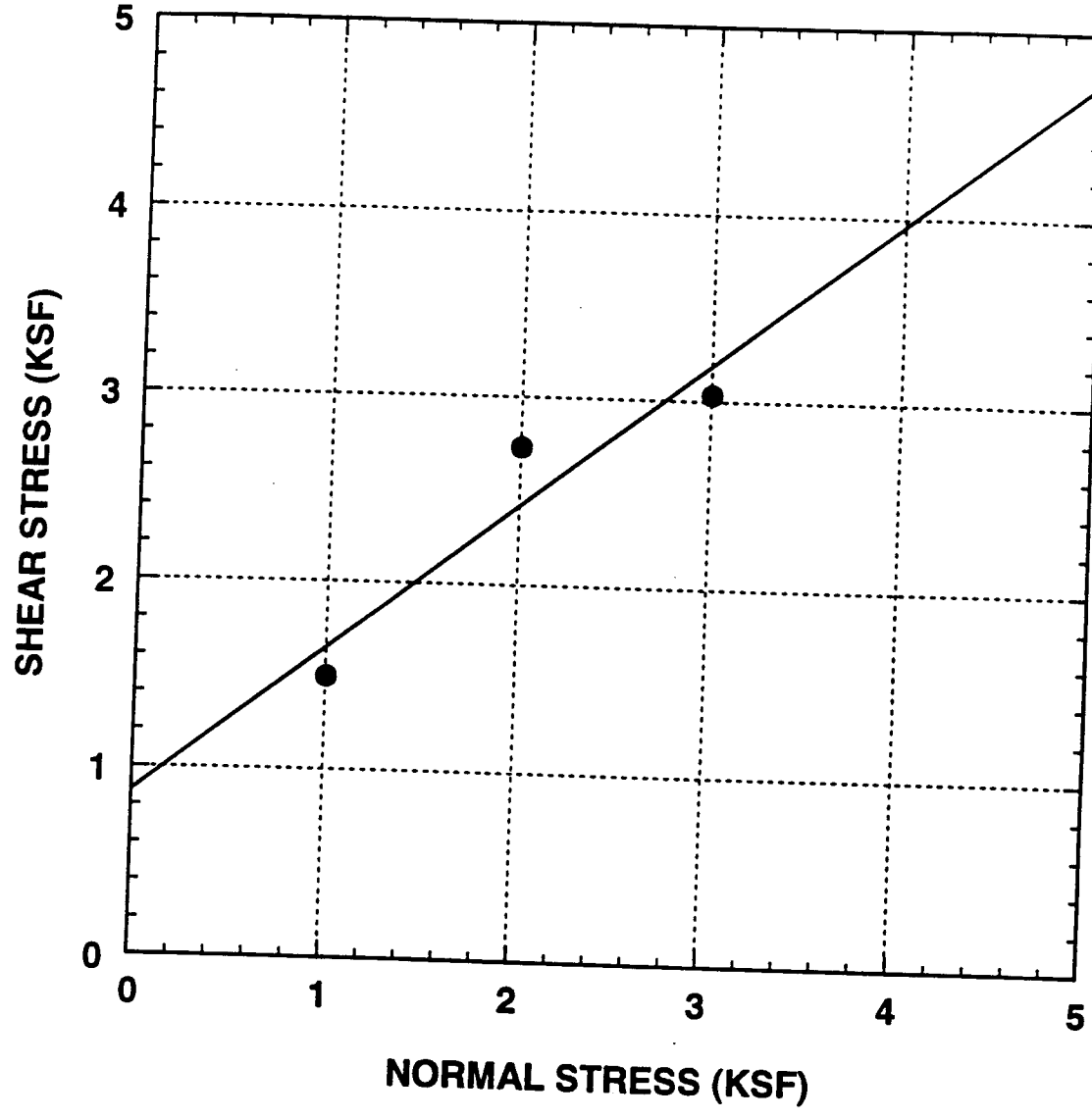
DIRECT SHEAR TEST DIAGRAM



C = 400 psf $\phi = 38°$

Test Condition: Undisturbed at Field Moisture	Location: B - 13	Depth: 25'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 29**	

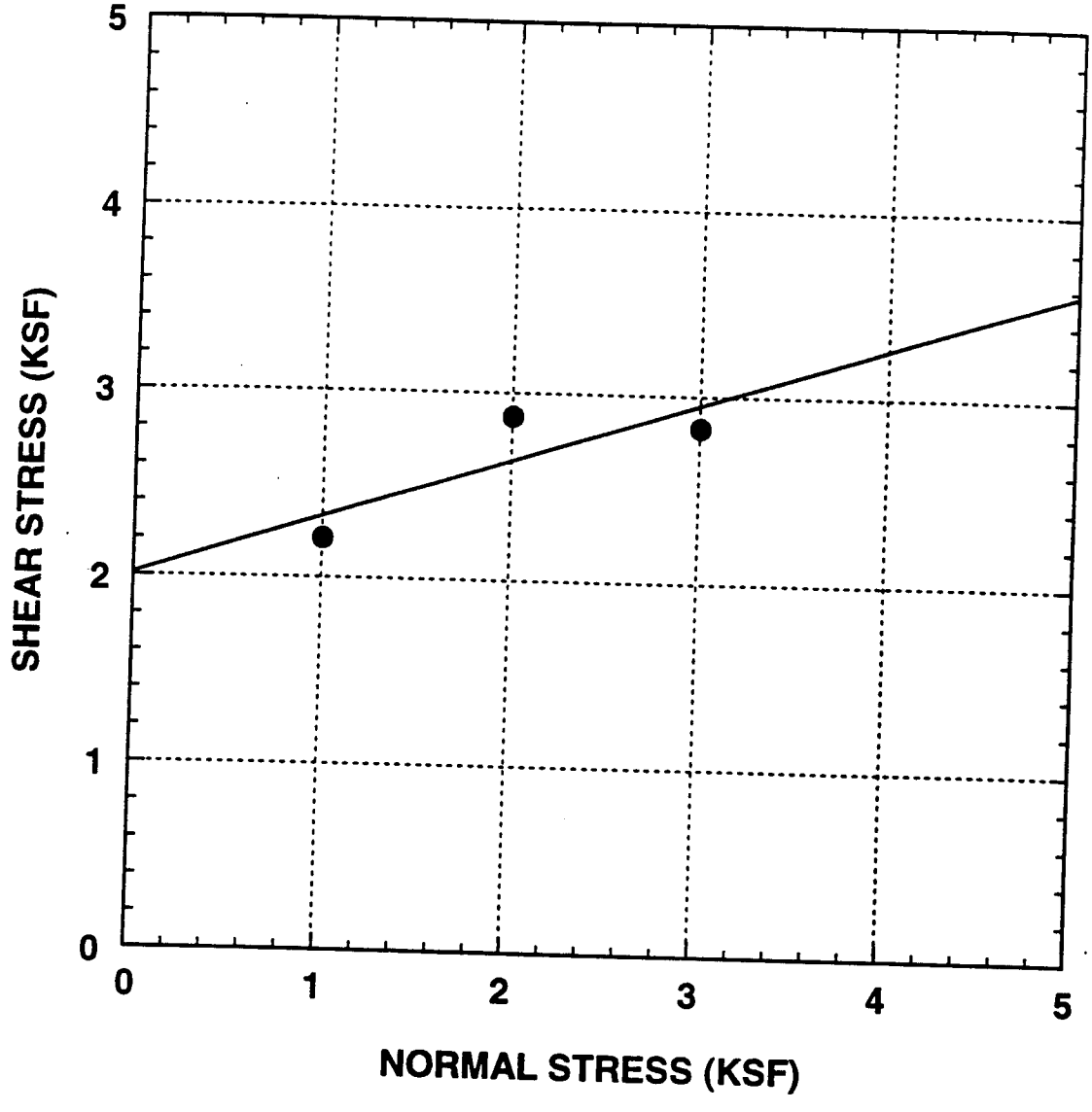
DIRECT SHEAR TEST DIAGRAM



C = 875 psf ϕ = 38°

Test Condition: Undisturbed at Field Moisture	Location: B - 13	Depth: 30'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 30**	

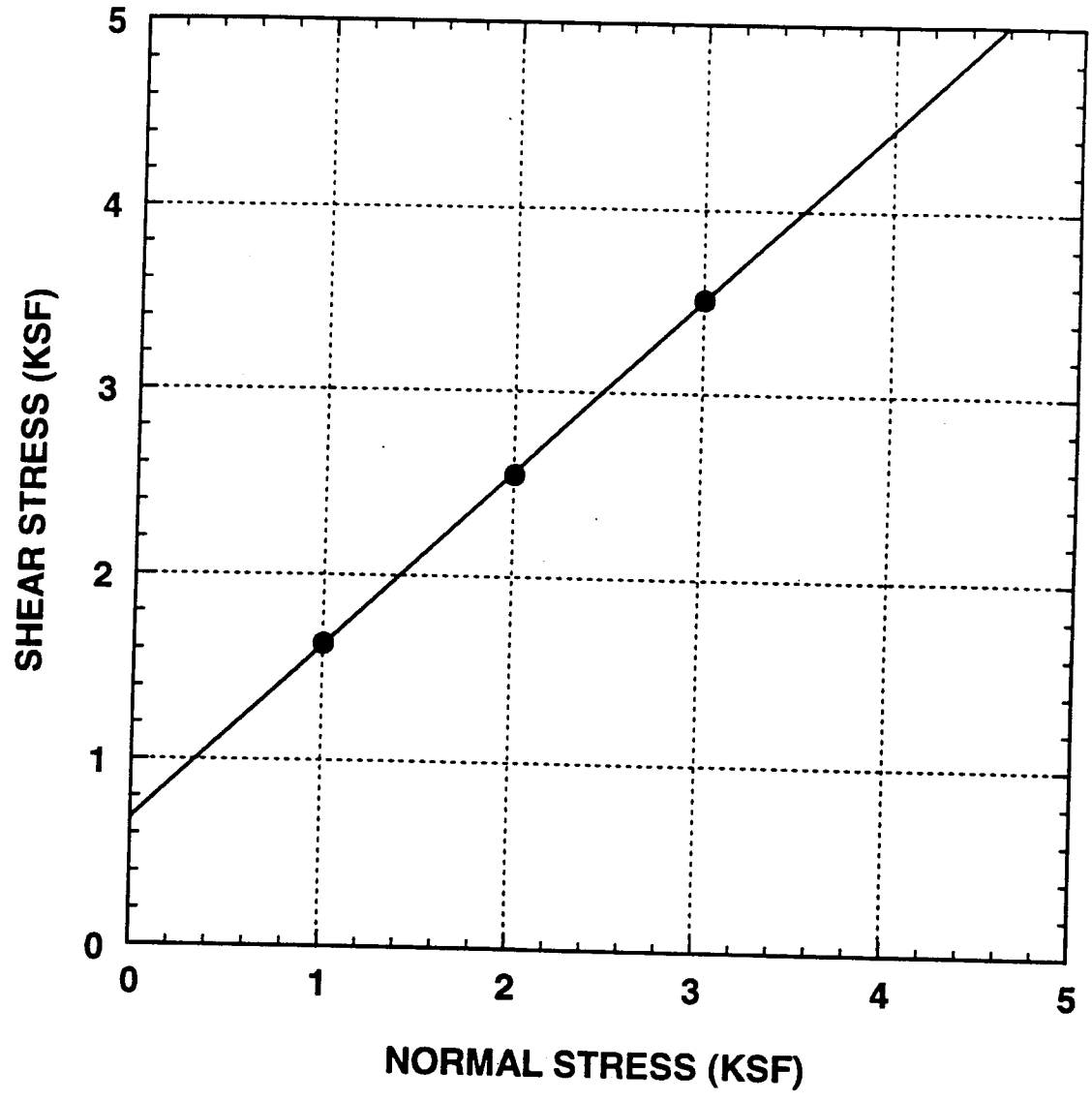
DIRECT SHEAR TEST DIAGRAM



C = 2000 psf ϕ = 17°

Test Condition: Undisturbed at Field Moisture	Location: B - 13	Depth: 35'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 31**	

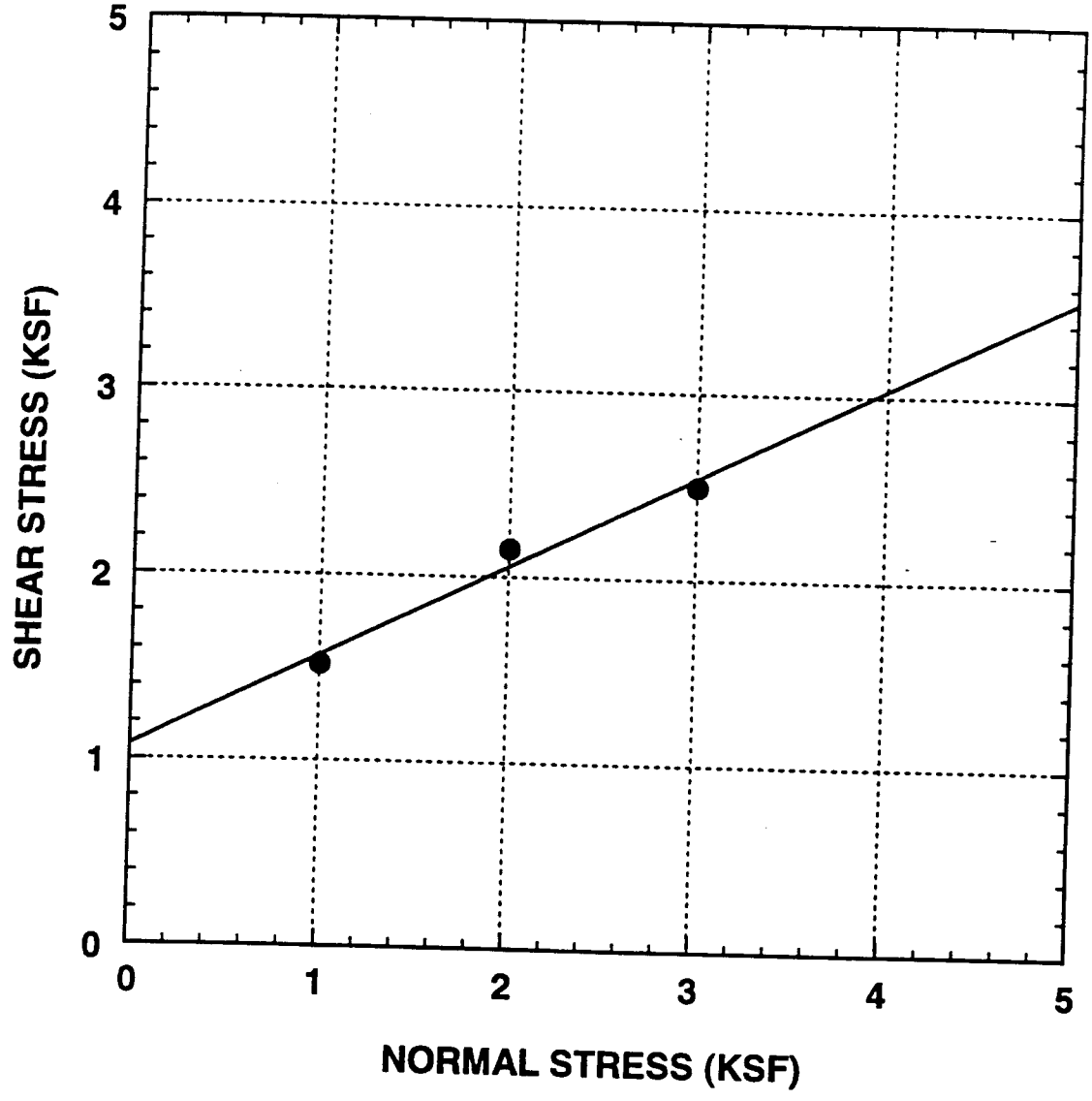
DIRECT SHEAR TEST DIAGRAM



C = 675 psf $\phi = 43°$

Test Condition: Undisturbed at Field Moisture	Location: B - 13	Depth: 45'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 32**	

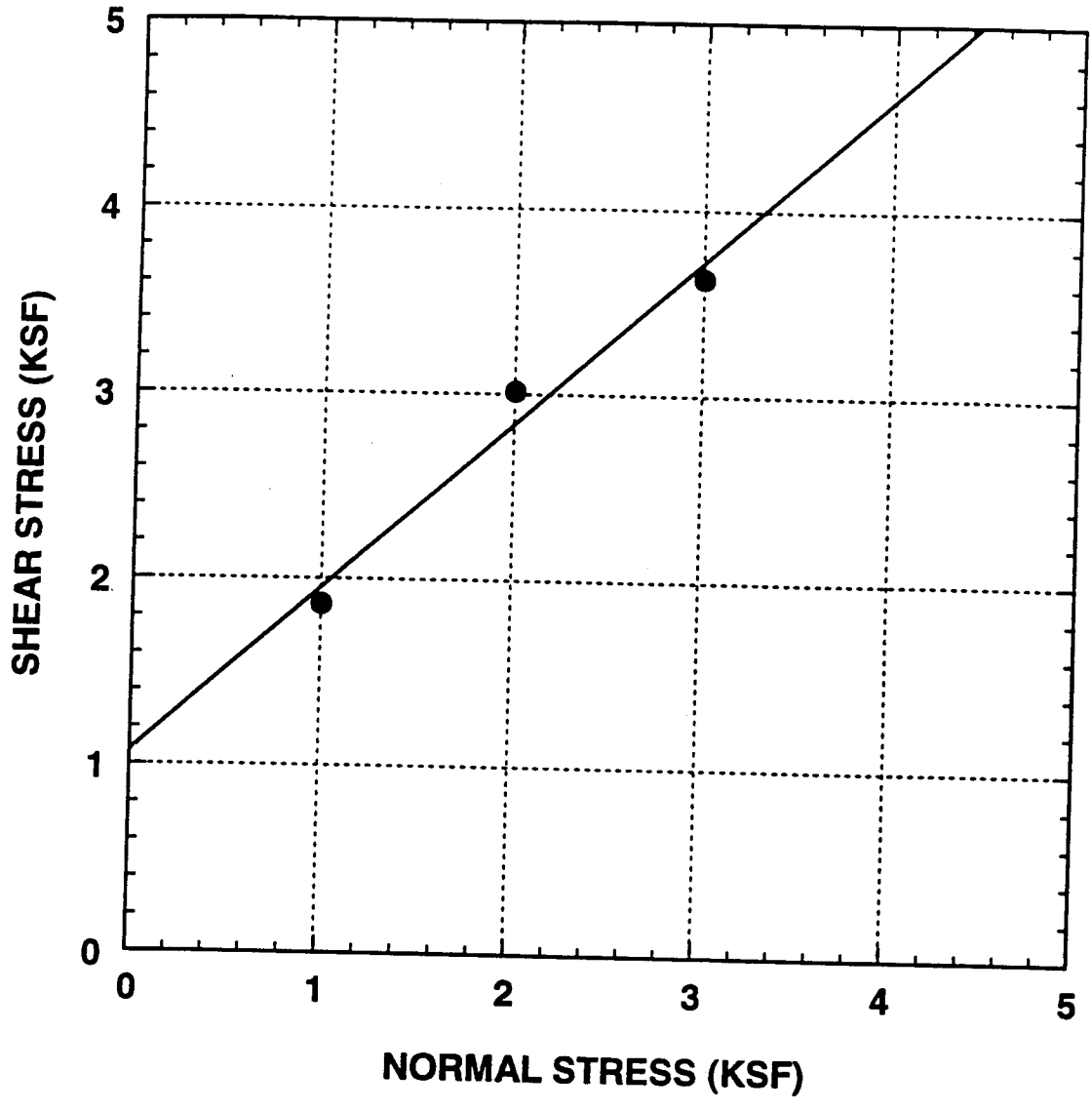
DIRECT SHEAR TEST DIAGRAM



C = 1075 psf ϕ = 26°

Test Condition: Undisturbed at Field Moisture - Residual	Location: B - 13	Depth: 45'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 33**	

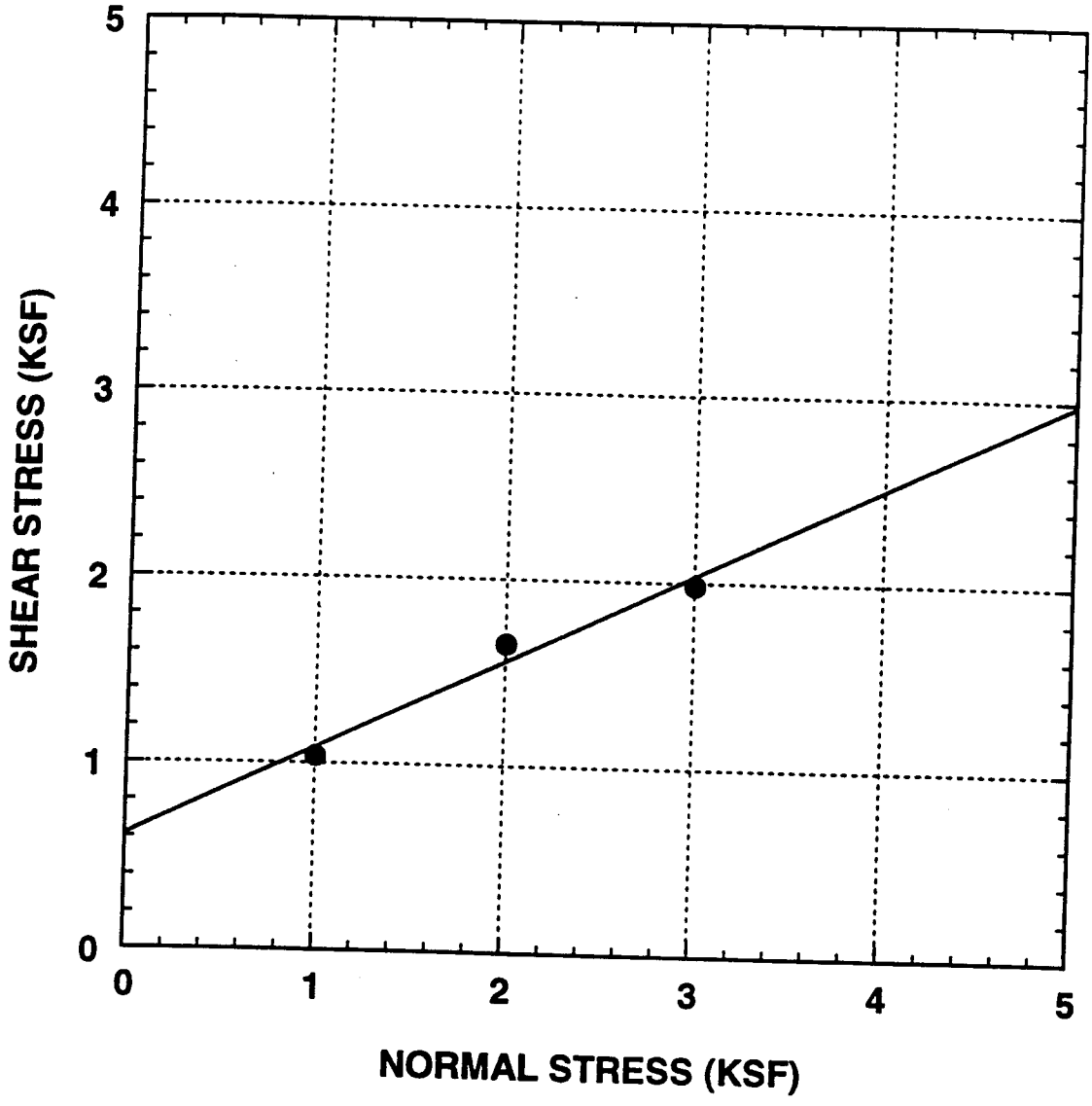
DIRECT SHEAR TEST DIAGRAM



C = 1075 psf ϕ = 41°

Test Condition: Undisturbed at Field Moisture	Location: B - 13	Depth: 55'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 34**	

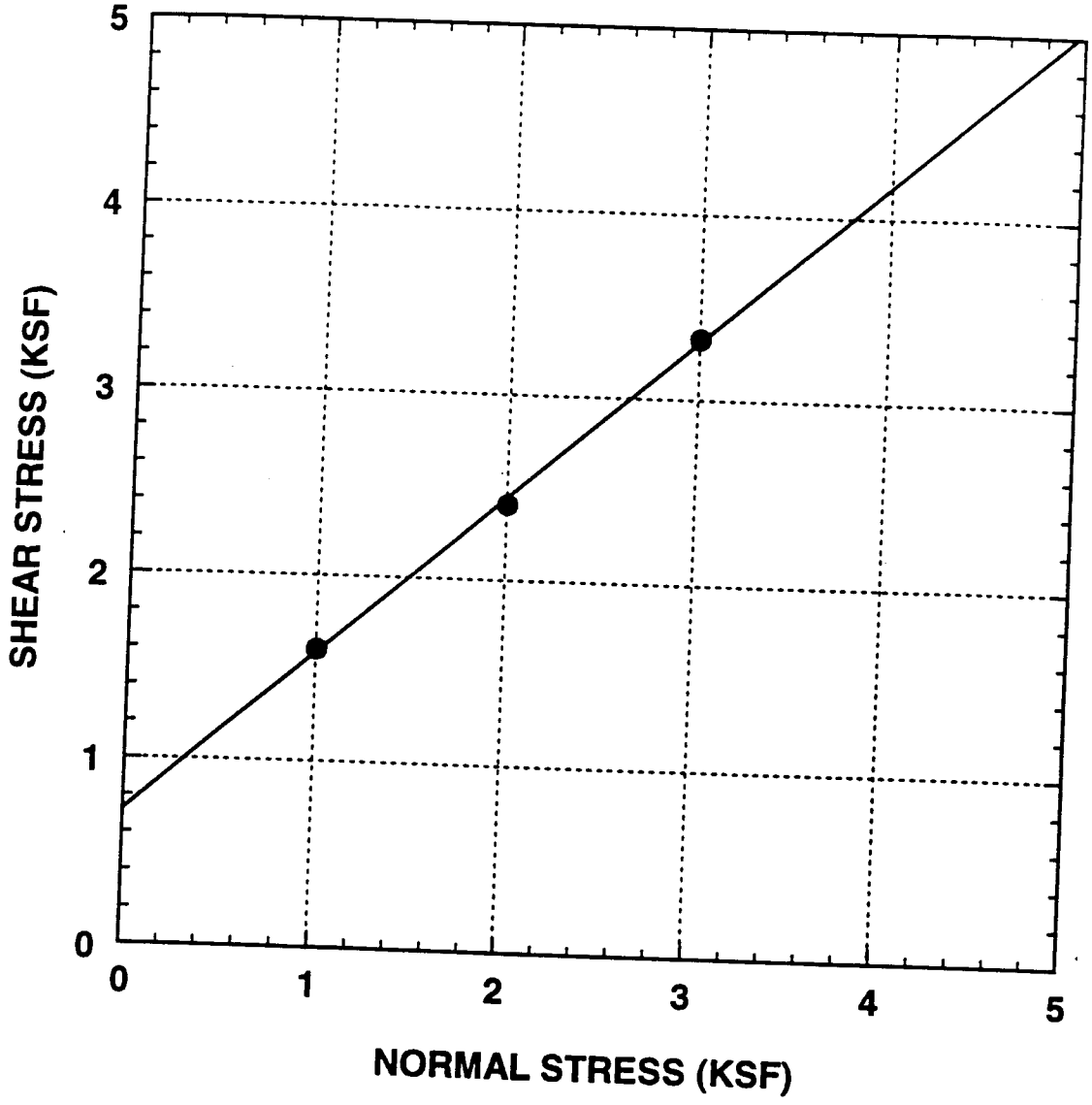
DIRECT SHEAR TEST DIAGRAM



C = 600 psf $\phi = 25°$

Test Condition: Undisturbed at Field Moisture - Residual	Location: B - 13	Depth: 55'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 35**	

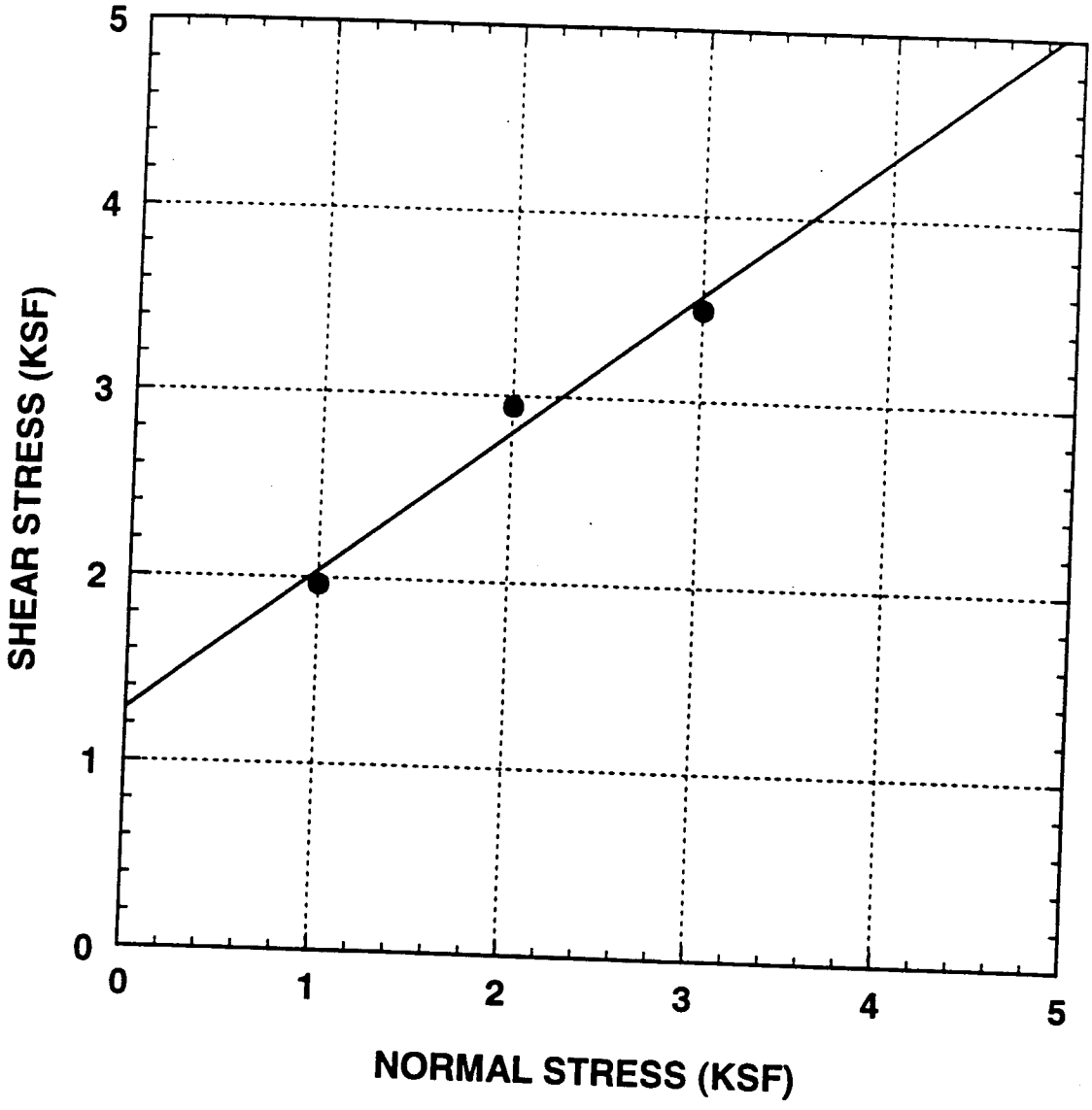
DIRECT SHEAR TEST DIAGRAM



C = 725 psf ϕ = 40°

Test Condition: Undisturbed at Field Moisture	Location: B - 14	Depth: 20'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 36**	

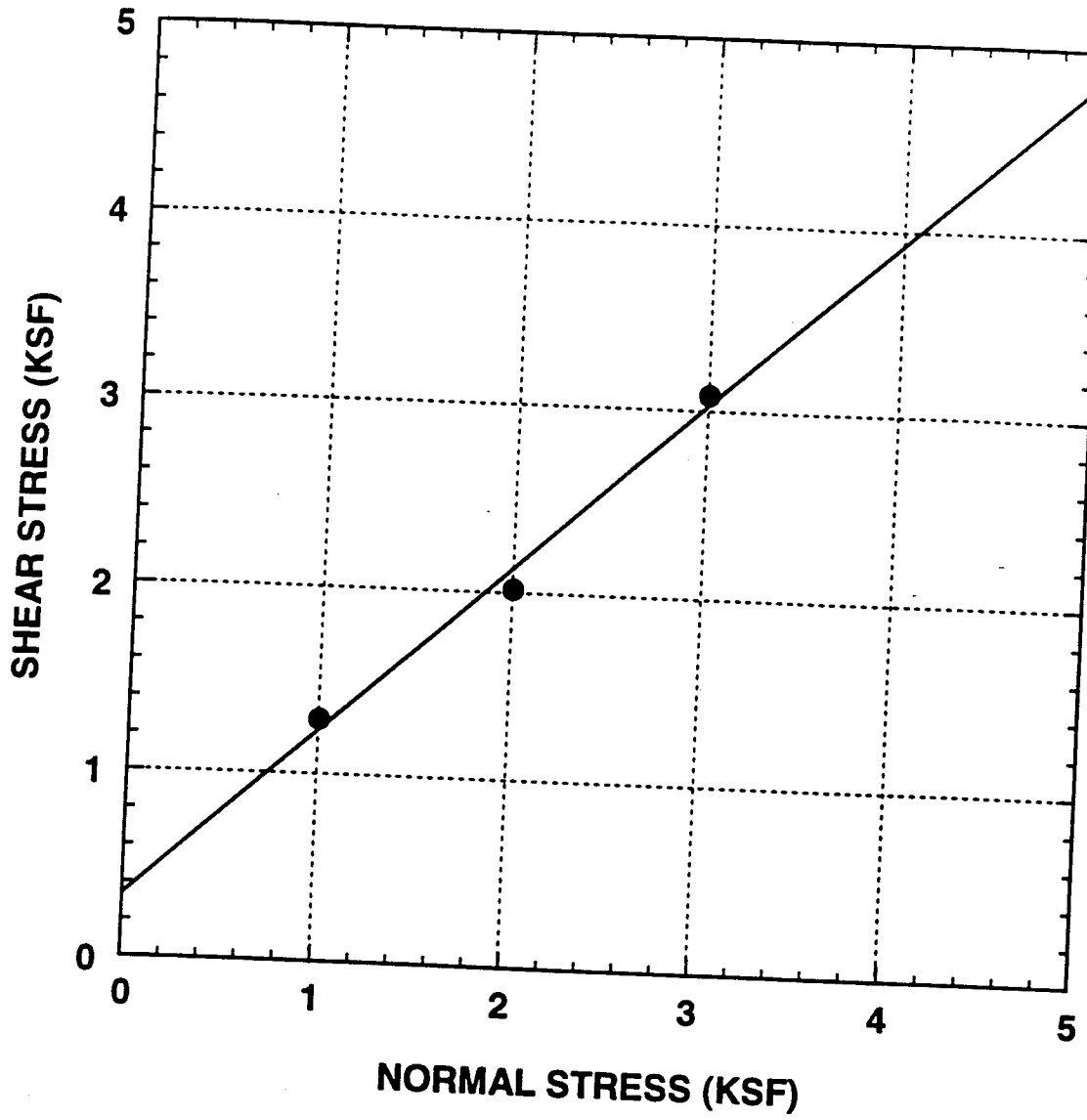
DIRECT SHEAR TEST DIAGRAM



C = 1275 psf ϕ = 37°

Test Condition: Undisturbed at Field Moisture	Location: B - 14	Depth: 30'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 37**	

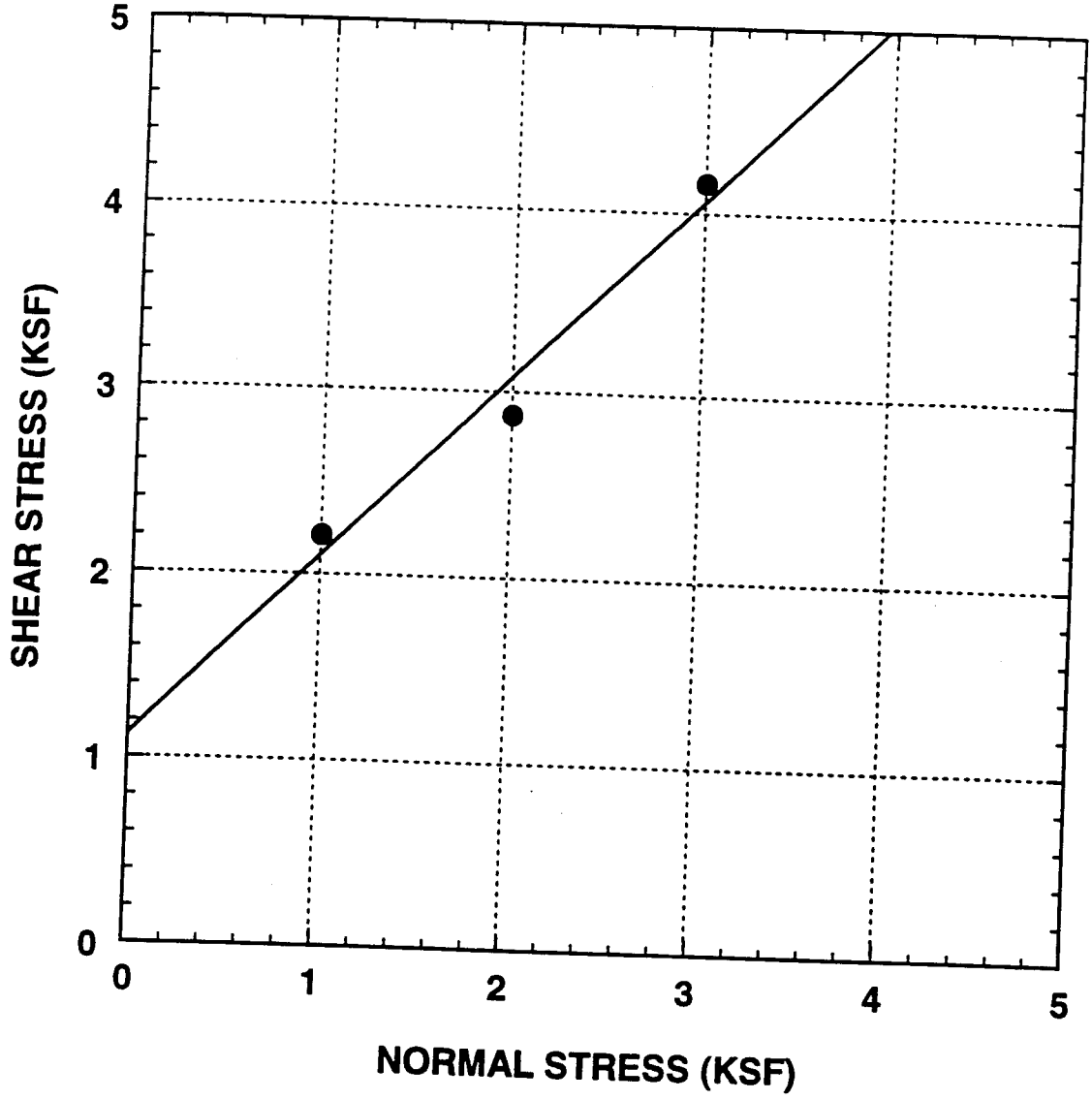
DIRECT SHEAR TEST DIAGRAM



C = 350 psf ϕ = 42°

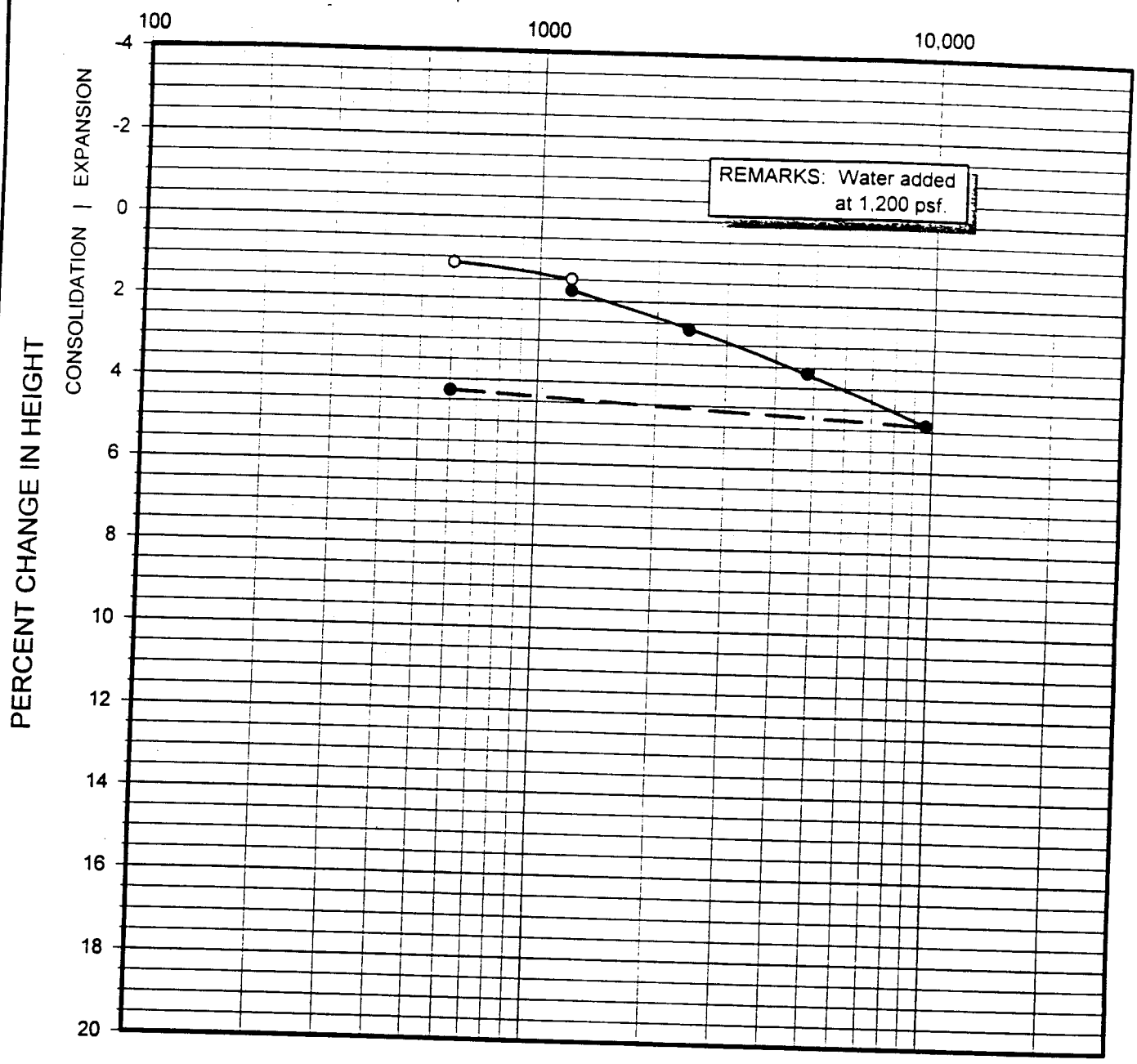
Test Condition: Undisturbed at Field Moisture	Location: B - 14	Depth: 45'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 38**	

DIRECT SHEAR TEST DIAGRAM



C = 1125 psf ϕ = 44°

Test Condition: Undisturbed at Field Moisture	Location: B - 14	Depth: 50'
Project Name: North County Transit District - Del Mar	Project No.: 3650 - SF	
Medall, Aragón, Higley, Geotechnical, Inc.	**Figure: B - 39**	



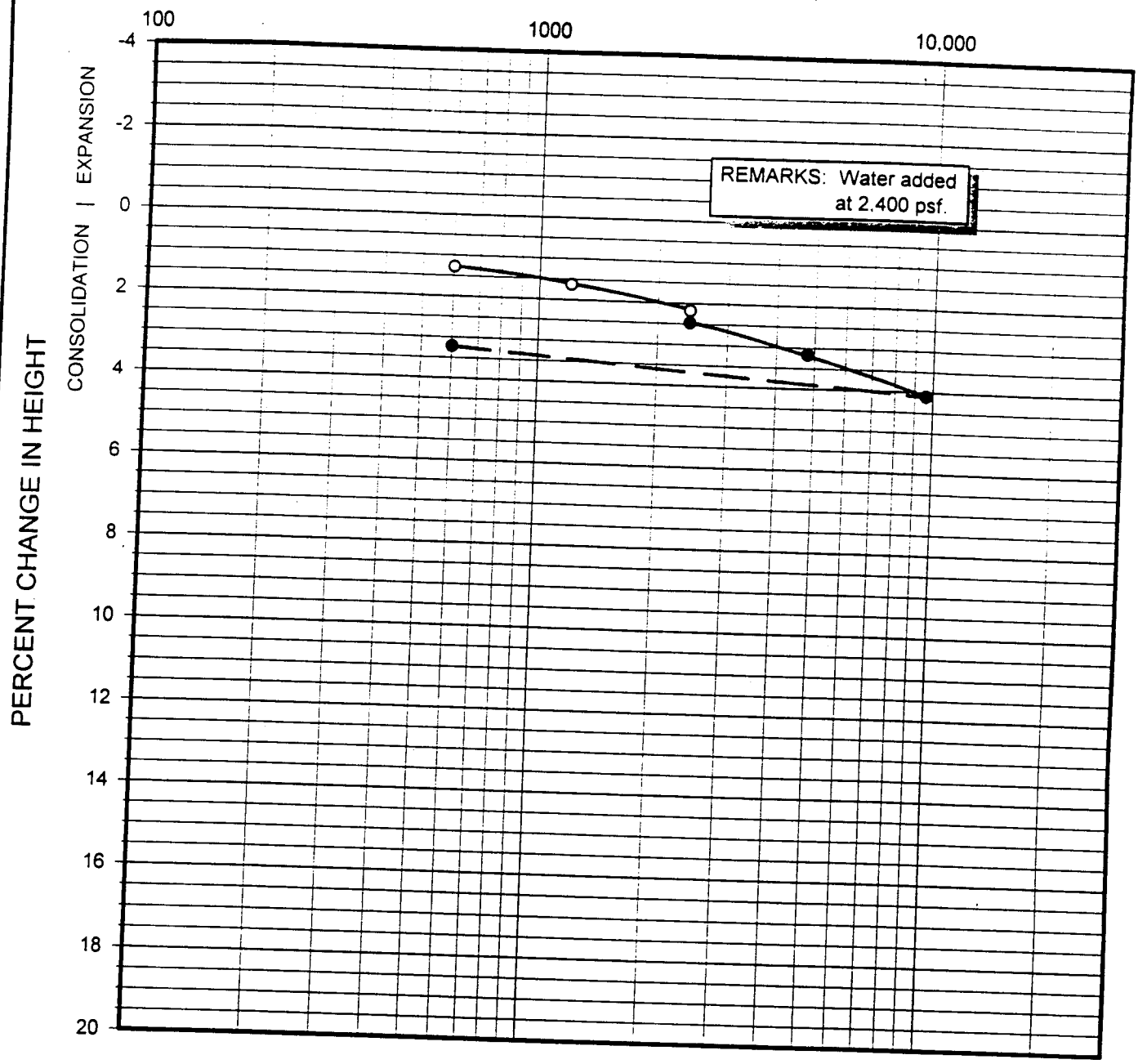
Boring: B - 2	Depth (ft.): 10.0	Dry Density (pcf): 108.6	Moisture (%): 13.0	Saturation (%): 66
Sample Description: Clayey Sand (SP-SC), fine to medium grained. [Fill]				

Medall, Aragon, Higley Geotechnical, Inc.

CONSOLIDATION CURVE

NORTH COUNTY TRANSIT DISTRICT, DEL MAR RAIL LINE

PROJECT NO. 3650-SF	DATE: 6/18/98	**FIG. B-40**



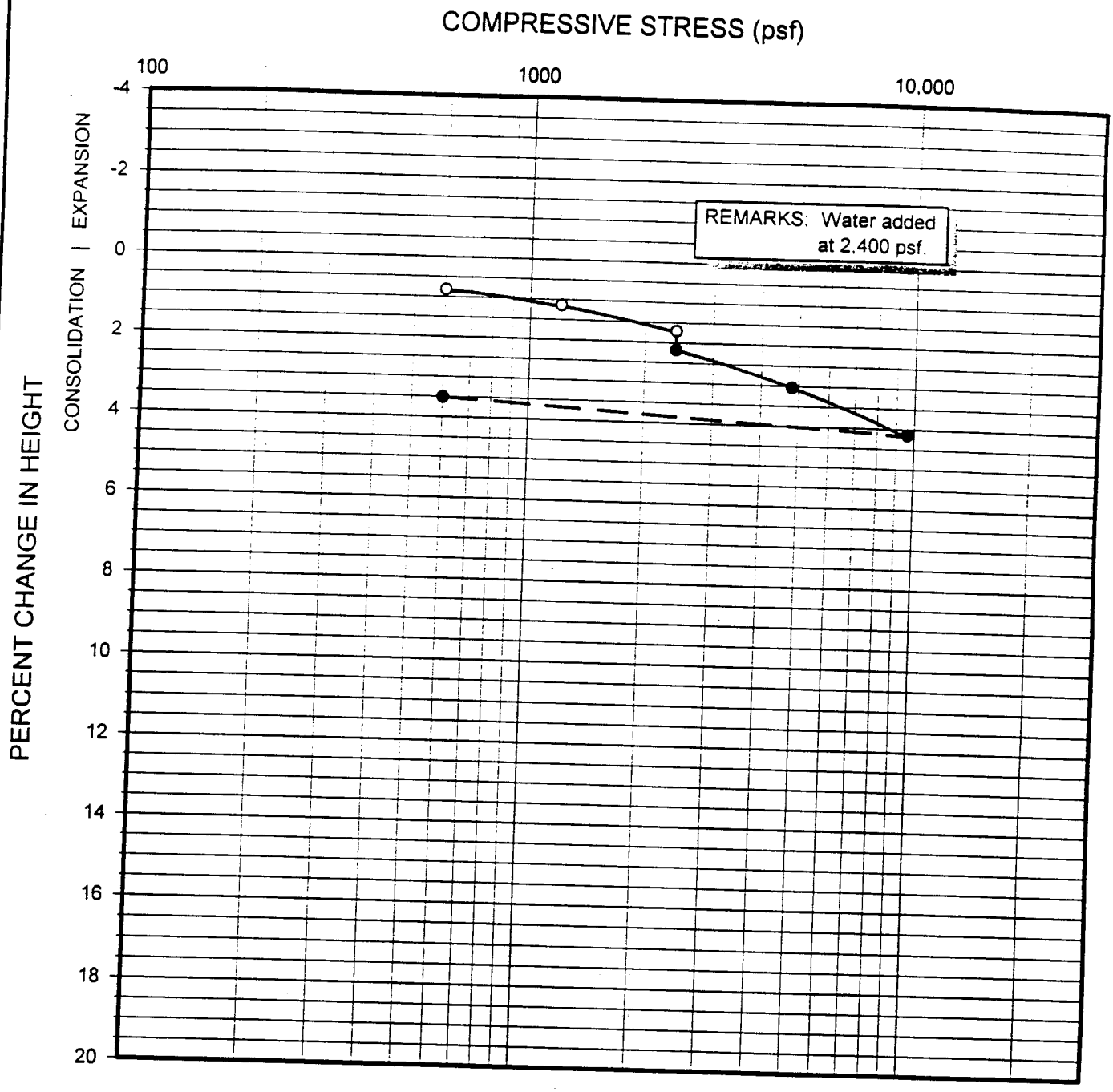
Boring: B - 2	Depth (ft.): 15.0	Dry Density (pcf):114.6	Moisture (%): 12.9	Saturation (%): 77
Sample Description: Clayey Sand (SP-SC), fine to medium grained. [Fill]				

Medall, Aragon, Higley Geotechnical, Inc.

CONSOLIDATION CURVE

NORTH COUNTY TRANSIT DISTRICT, DEL MAR RAIL LINE

PROJECT NO. 3650-SF	DATE: 6/18/98	**FIG. B-41**



Boring: B - 2	Depth (ft.): 25.0	Dry Density (pcf):114.1	Moisture (%): 10.2	Saturation (%): 60
Sample Description: Clayey Sand (SP-SC), fine to medium grained. [Fill]				

Medall, Aragon, Higley Geotechnical, Inc.

CONSOLIDATION CURVE

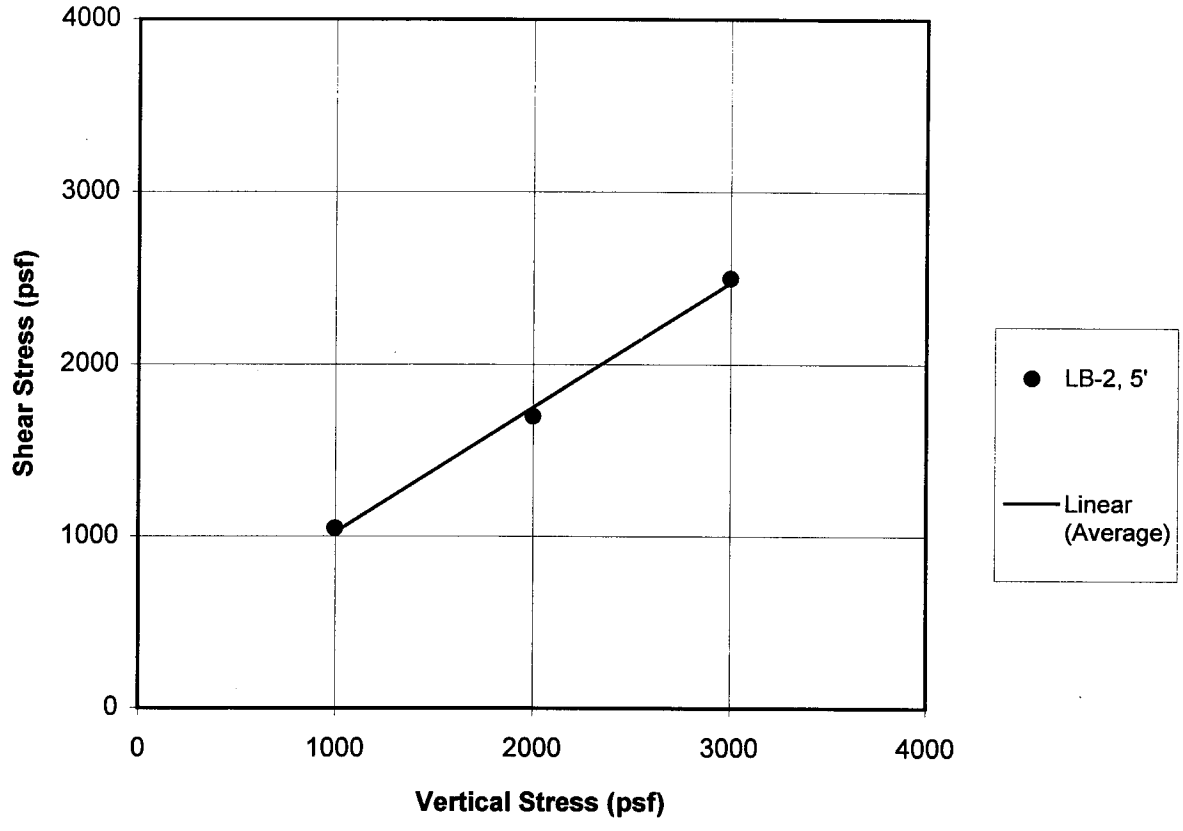
NORTH COUNTY TRANSIT DISTRICT, DEL MAR RAIL LINE

PROJECT NO. 3650-SF	DATE: 6/18/98	**FIG. B-42**

APPENDIX G

SLOPE STABILITY

Peak Direct Shear on Bay Point Samples by Leighton & Associates 2000



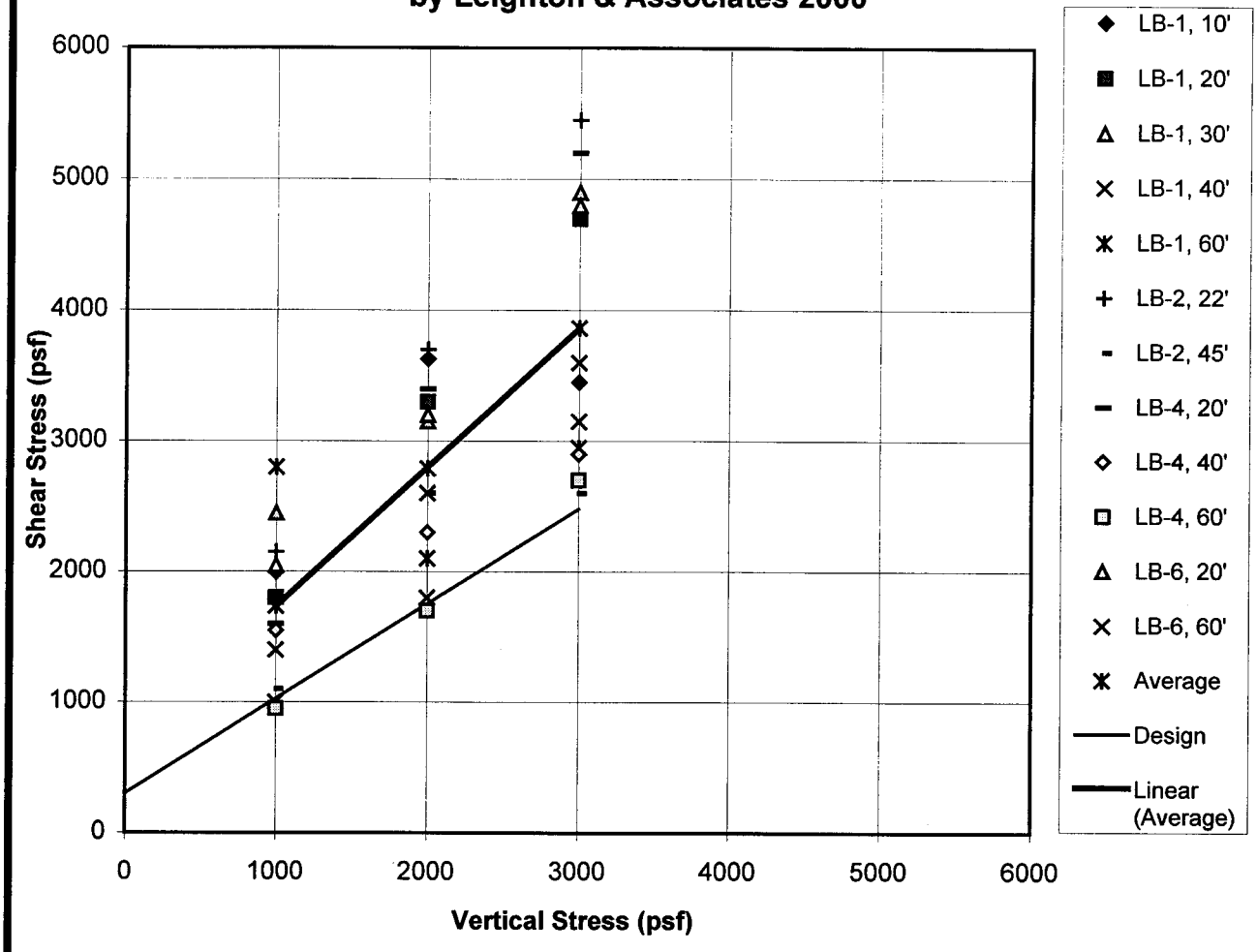
Average Strength Values

Friction Angle, ϕ (degrees)	**36**
Cohesion, c (psf)	**300**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-1**

Peak Direct Shear on Delmar Formation Samples by Leighton & Associates 2000



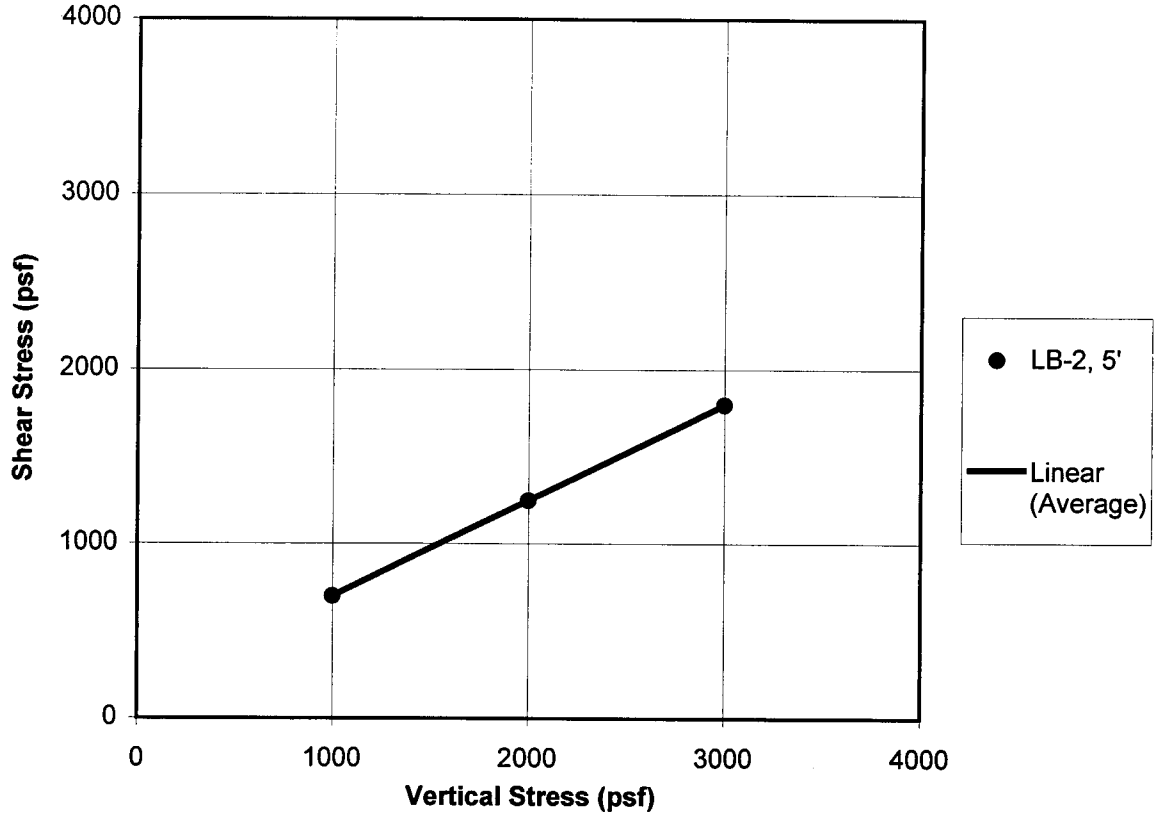
Average Strength Values

Friction Angle, ϕ (degrees)	**47**
Cohesion, c (psf)	**650**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-2**

Ultimate Direct Shear on Bay Point by Leighton & Associates 2000



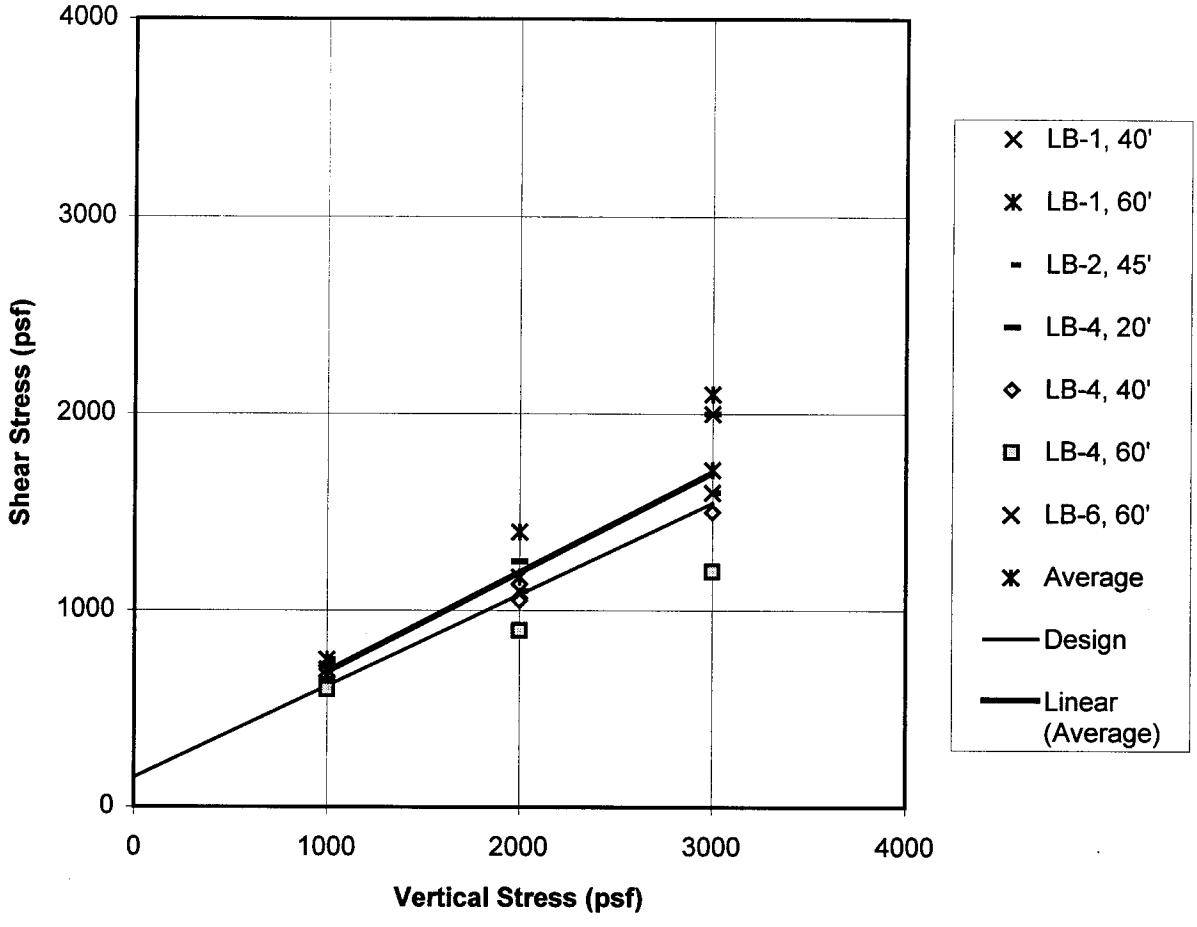
Average Strength Values

Friction Angle, ϕ (degrees)	**29**
Cohesion, c (psf)	**150**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-3**

Composite of Ultimate Direct Shear on Fine-Grained Samples of Delmar Formation by Leighton & Associates 2000



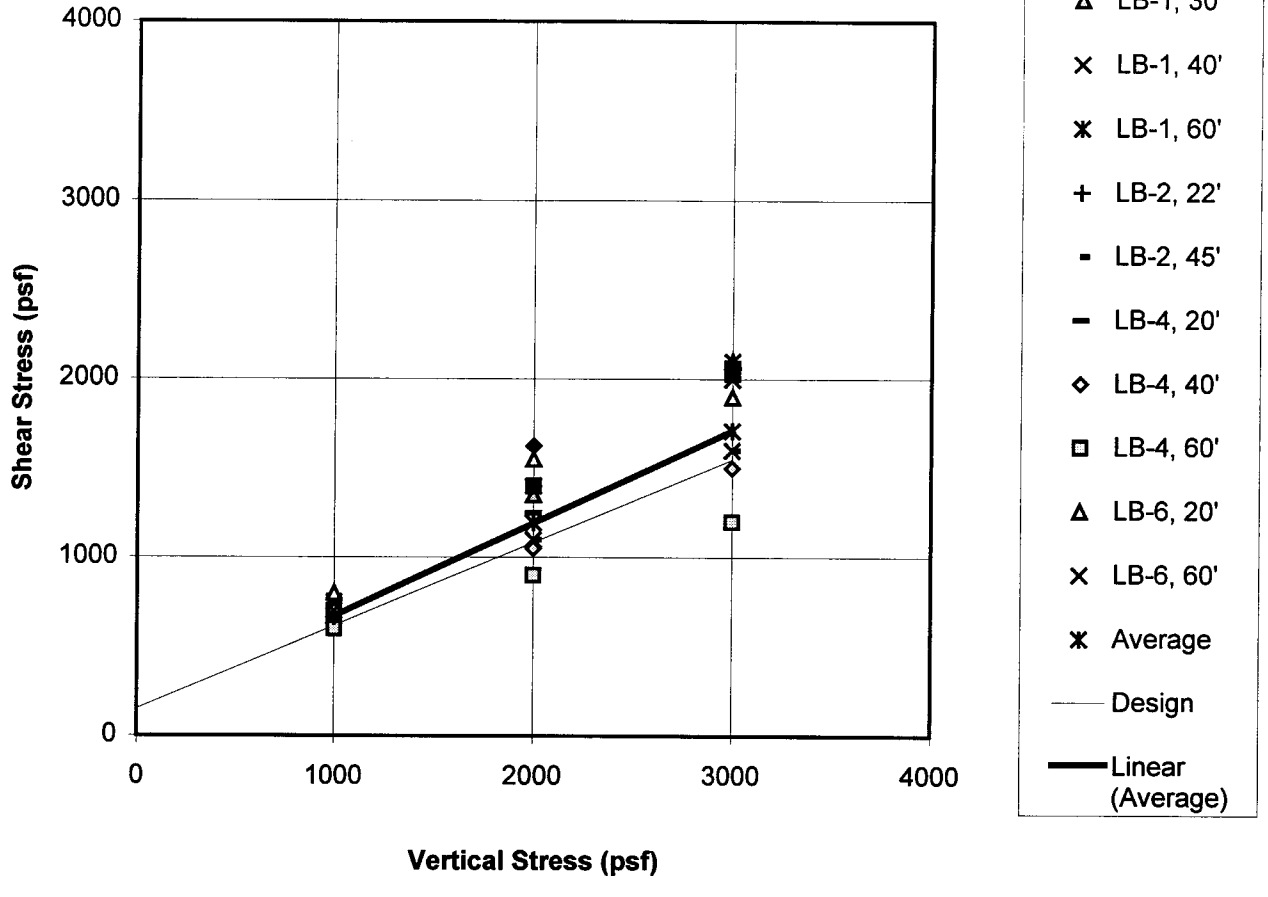
Average Strength Values

Friction Angle, ϕ (degrees)	**27**
Cohesion, c (psf)	**170**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-4a**

Composite of Ultimate Direct Shear on Delmar Formation by Leighton & Associates 2000



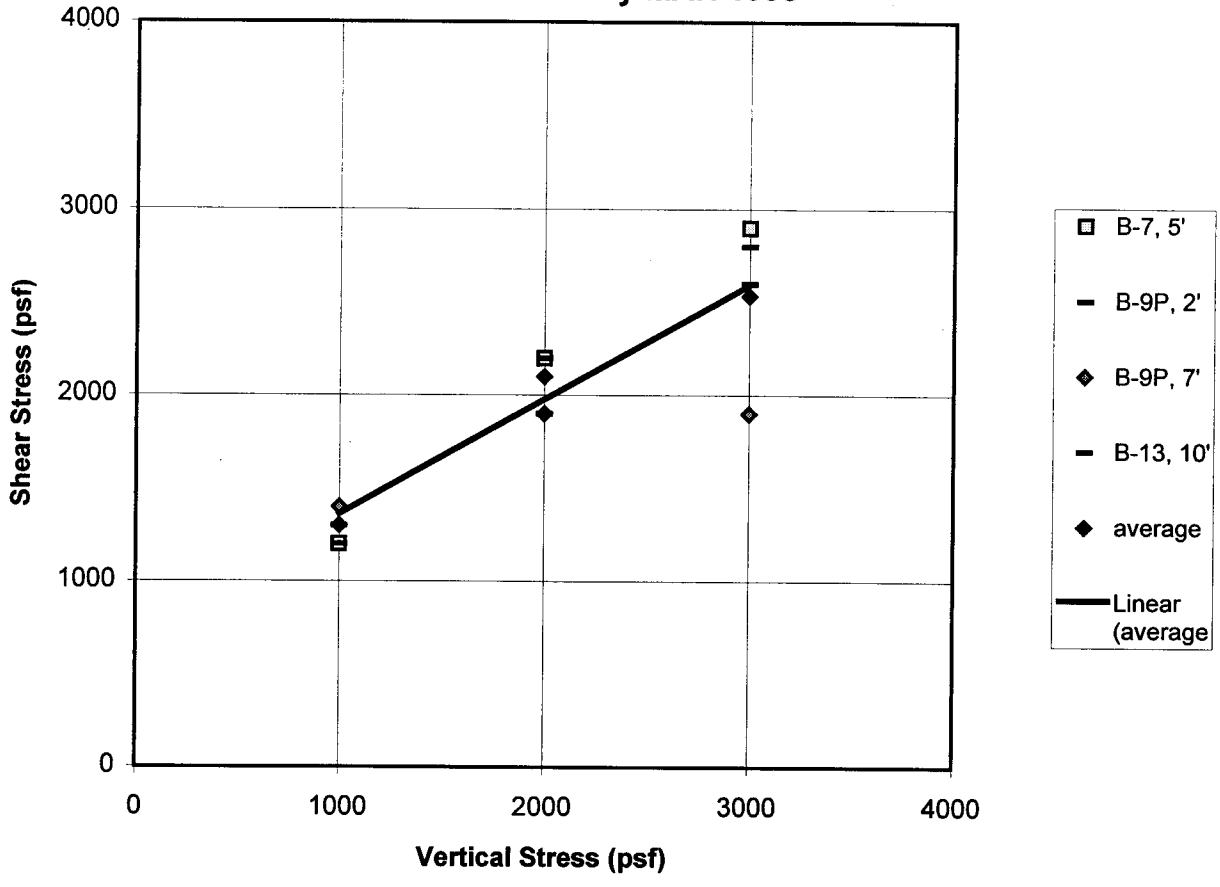
Average Strength Values

Friction Angle, ϕ (degrees)	**29**
Cohesion, c (psf)	**150**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-4**

Composite of Peak Direct Shear Results Tested on Bay Point Formation at Field Moisture by MAH 1998



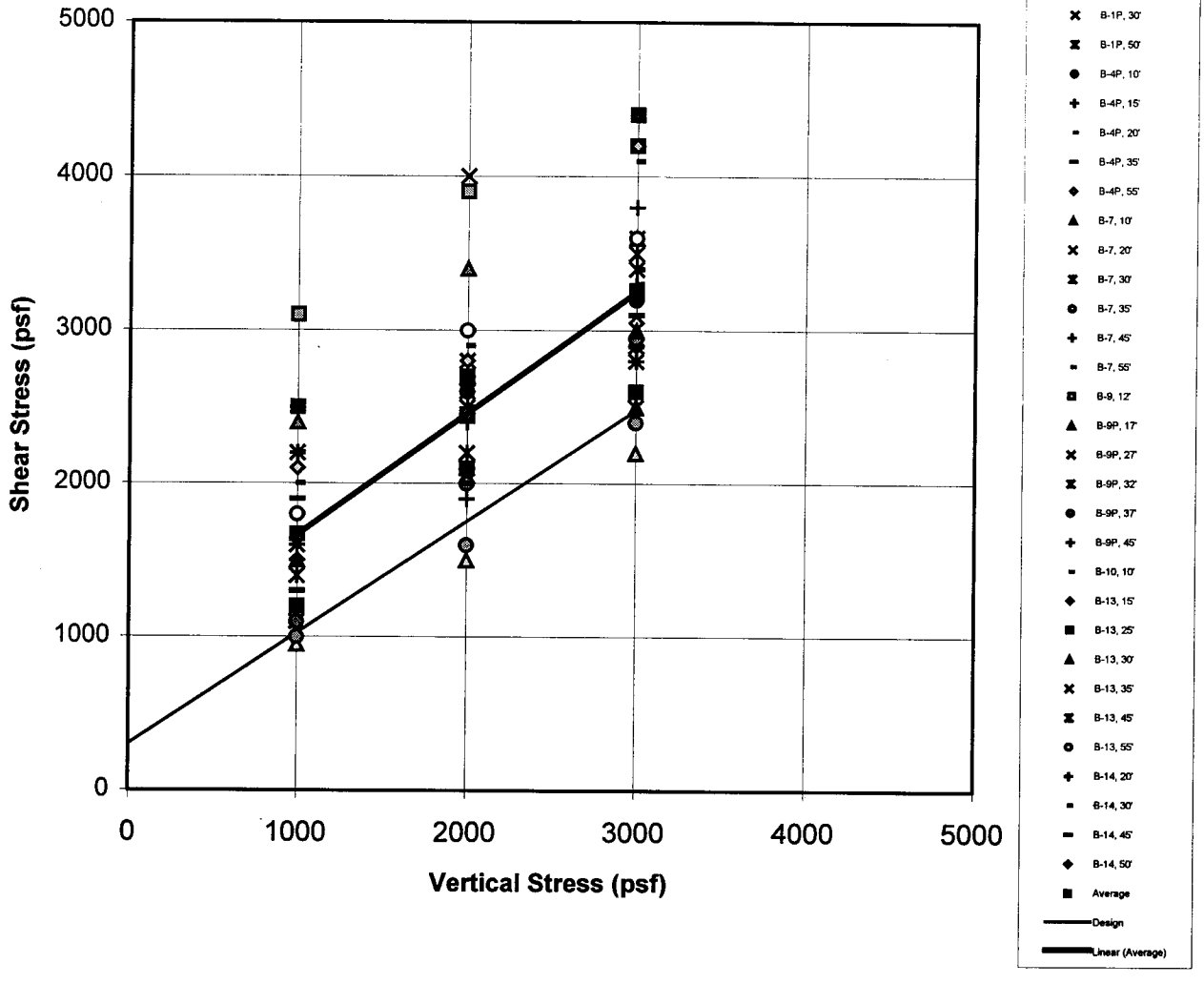
Average Strength Values

Friction Angle, ϕ (degrees)	**32**
Cohesion, c (psf)	**700**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-5**

Composite of Peak Direct Shear Results on Delmar Formation Tested at Field Moisture by MAH 1998



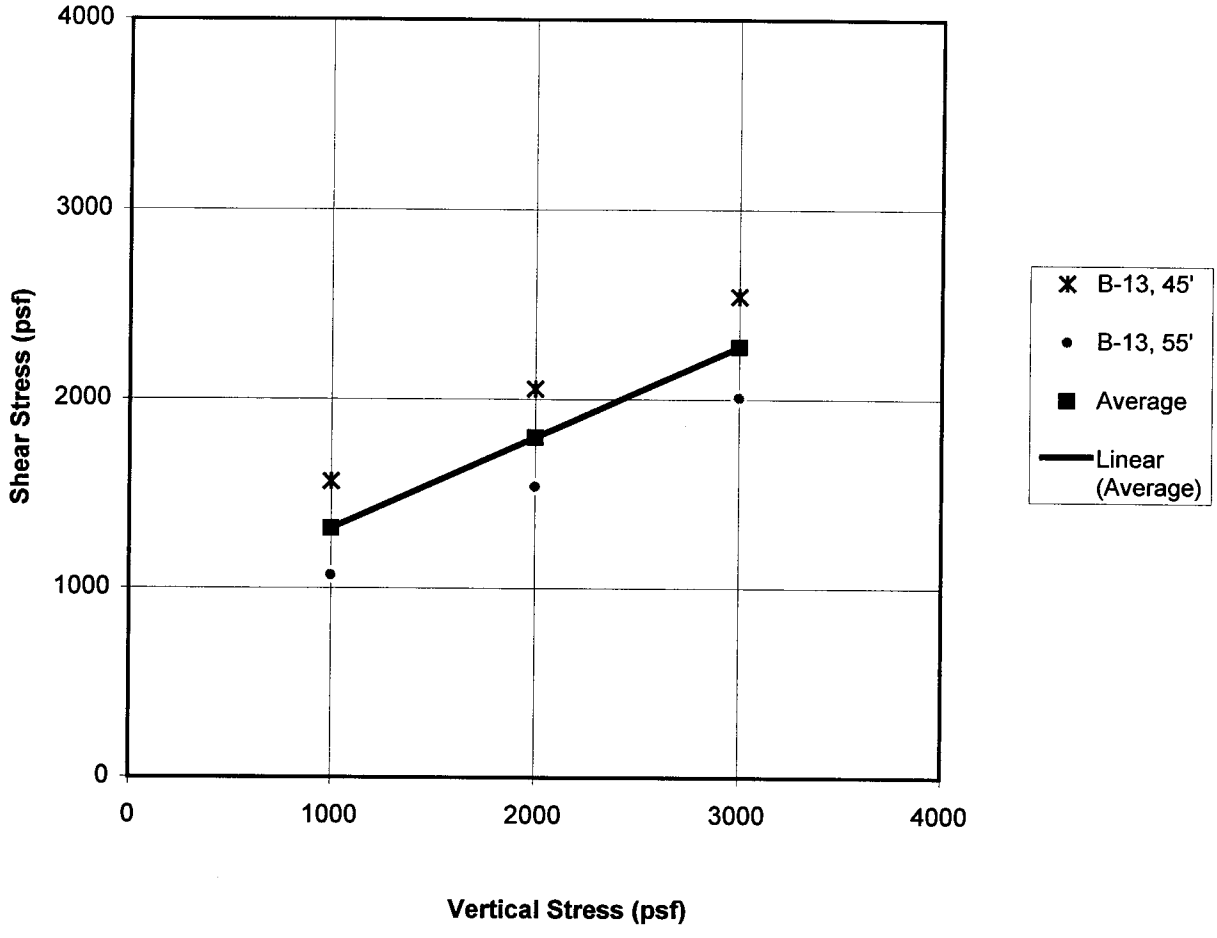
Average Strength Values

Friction Angle, ϕ (degrees)	**38**
Cohesion, c (psf)	**900**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-6**

Composite of Residual Direct Shear Results on Delmar Formation Tested at Field Moisture by MAH 1998



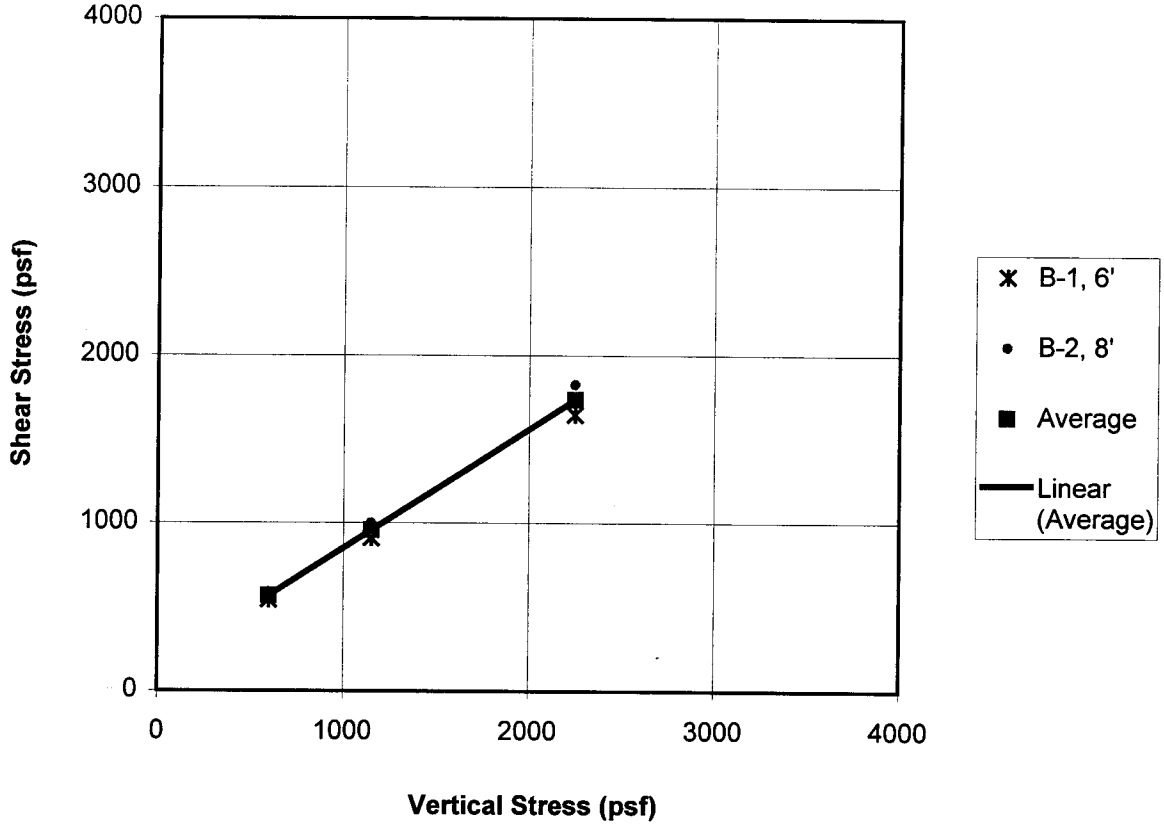
Average Strength Values

Friction Angle, ϕ (degrees)	**26**
Cohesion, c (psf)	**800**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-7**

Composite of Peak Direct Shear Results on Bay Point Formation Tested by Leighton & Associates 1978



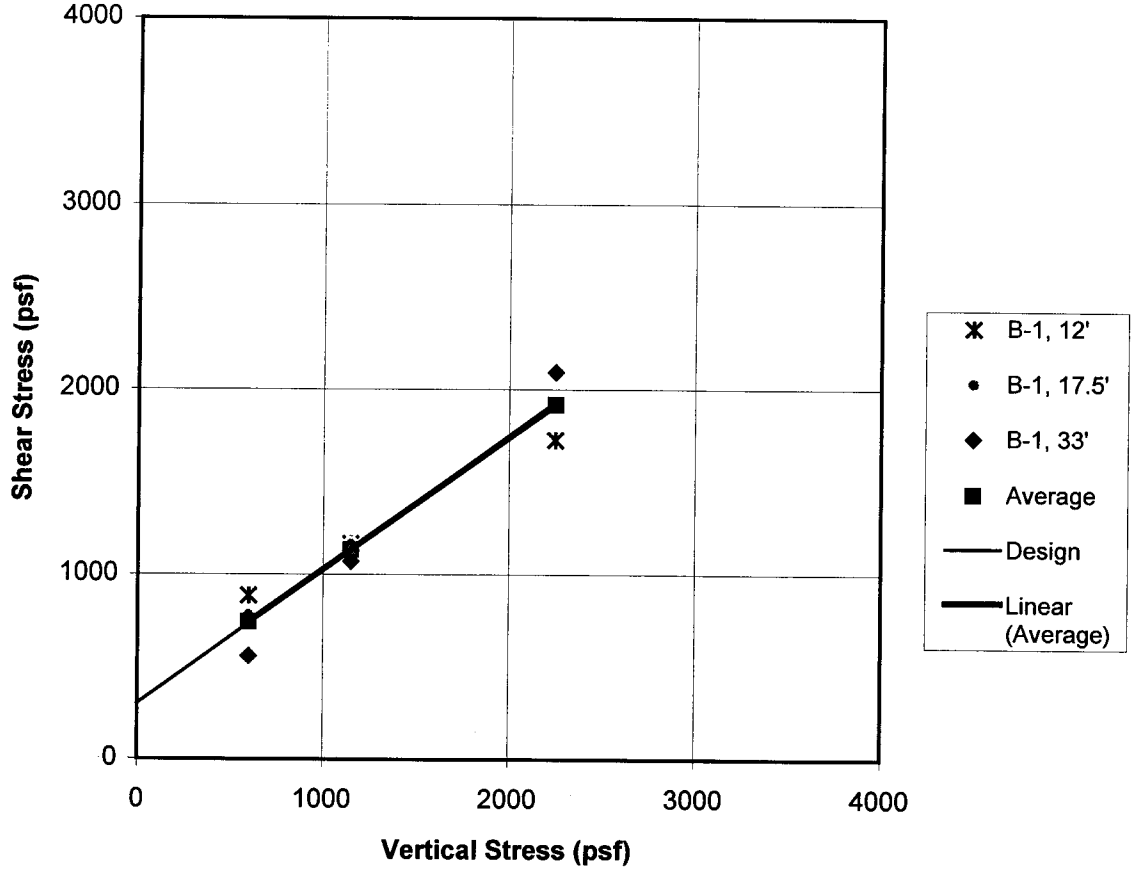
Average Strength Values

Friction Angle, ϕ (degrees)	**35**
Cohesion, c (psf)	**140**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-8**

Composite of Peak Direct Shear Results on Delmar Formation Tested by Leighton & Associates 1978



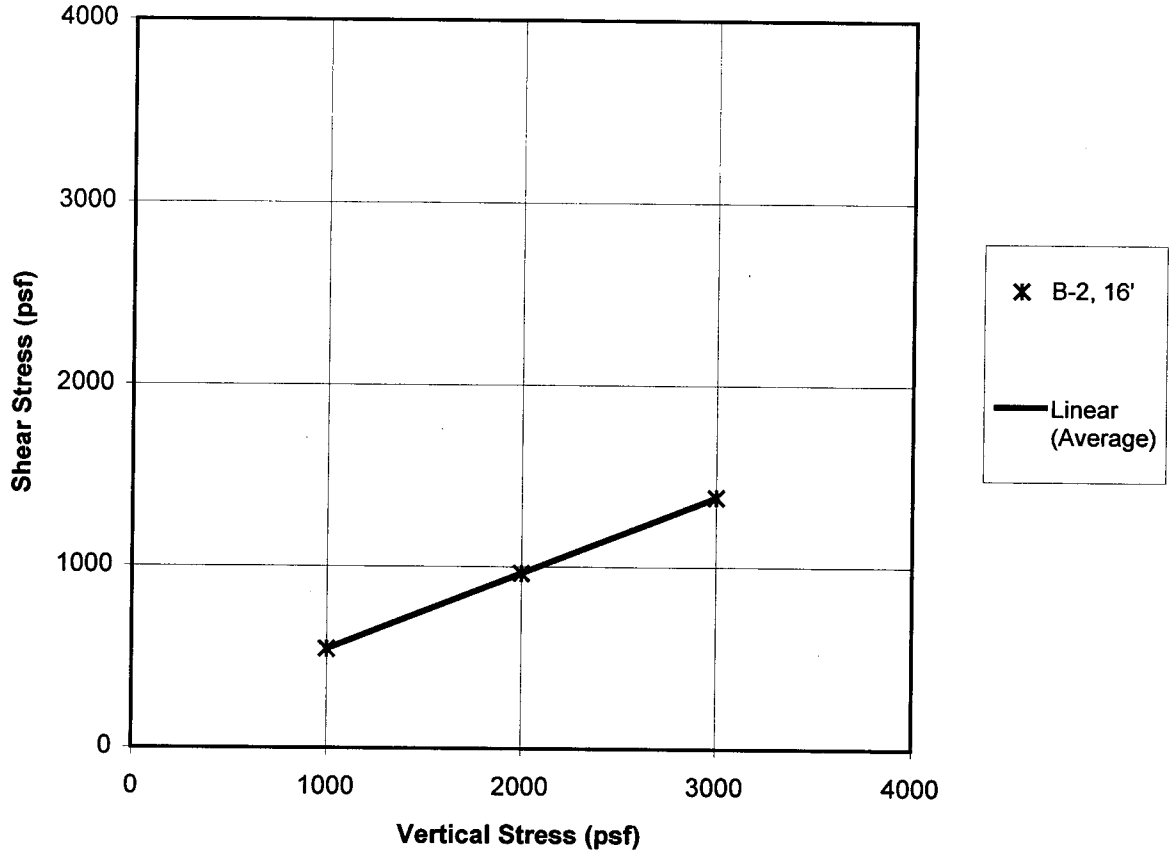
Average Strength Values

Friction Angle, ϕ (degrees)	**36**
Cohesion, c (psf)	**300**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-9**

Residual Direct Shear Results on Delmar Formation Tested by Leighton & Associates 1978



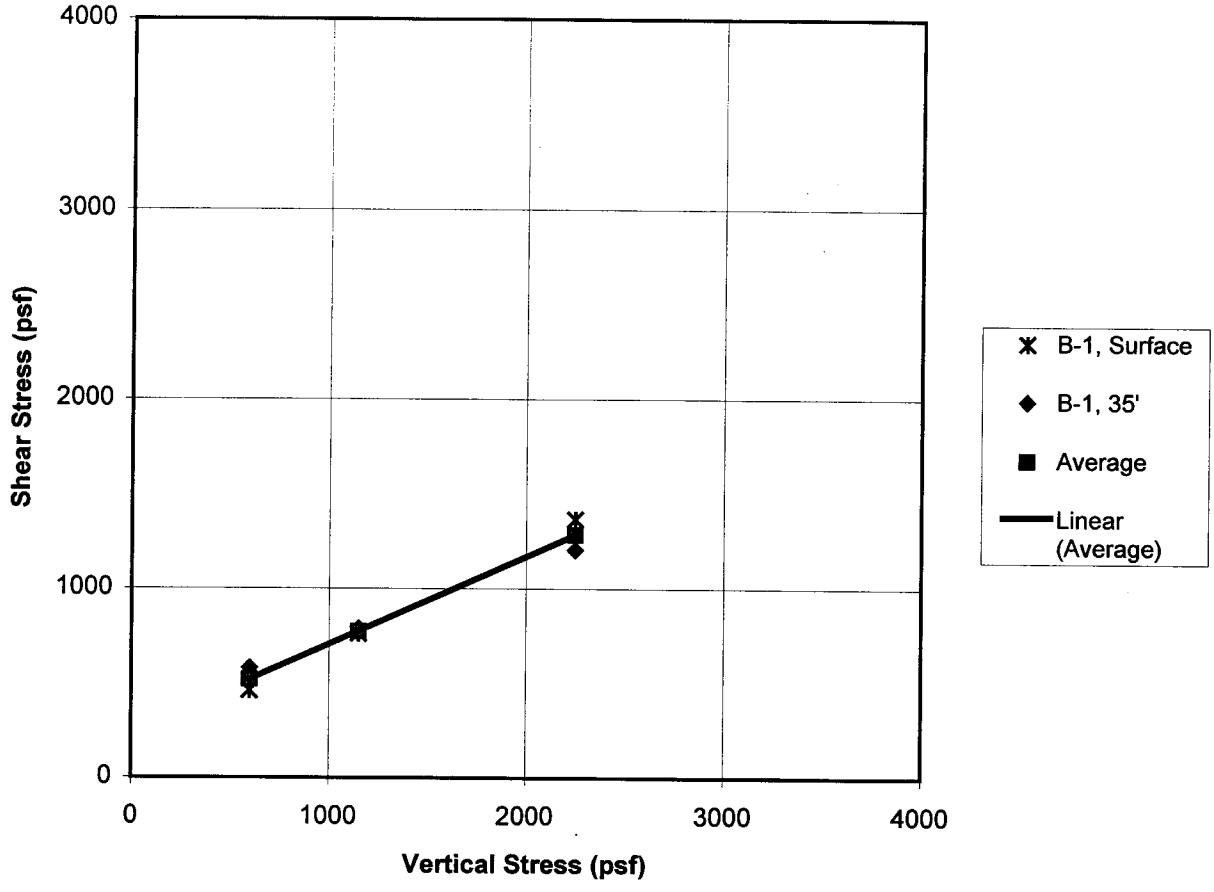
Average Strength Values

Friction Angle, ϕ (degrees)	**23**
Cohesion, c (psf)	**125**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-10**

Peak Direct Shear Results on Remolded Samples Tested by Leighton & Associates 1978



Average Strength Values

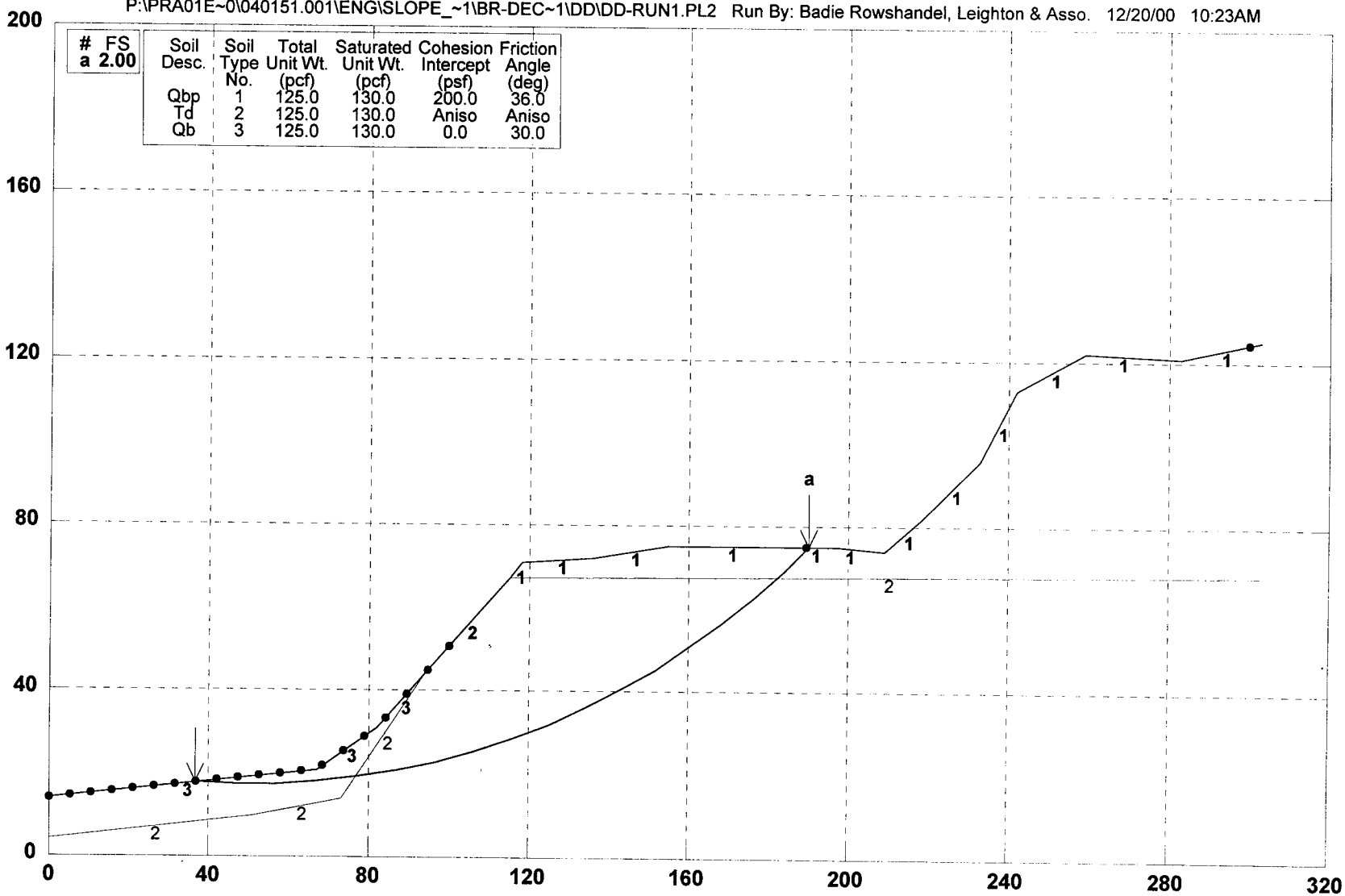
Friction Angle, ϕ (degrees)	**25**
Cohesion, c (psf)	**240**

DIRECT SHEAR SUMMARY

Project No.	**040151-001**
Project Name	**HDR/Del Mar**
Figure No.	**G-11**

Cross Section (D-D'), Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\DD\DD-RUN1.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 10:23AM



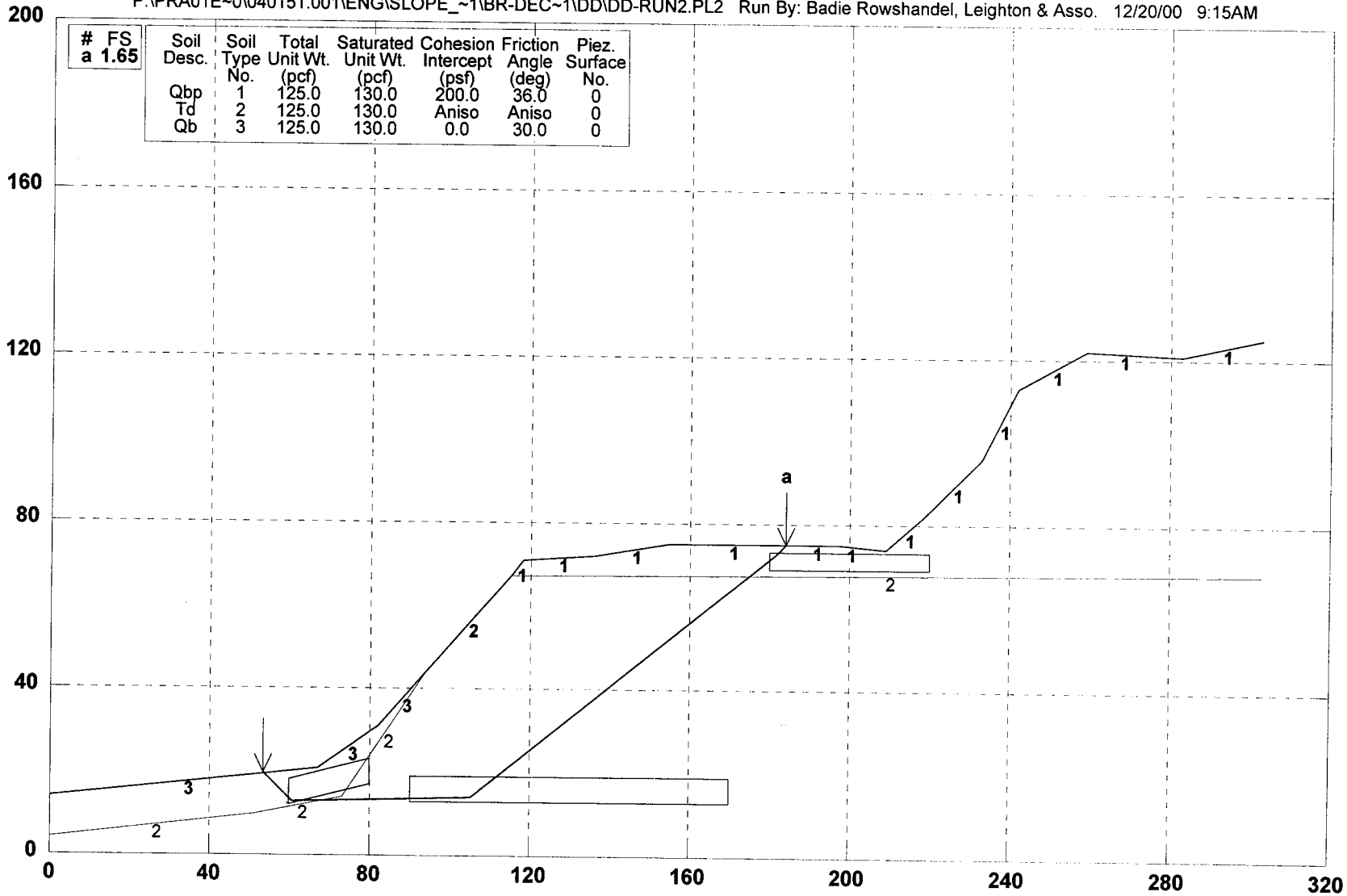
GSTABL7 FSmin=2.00

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (D-D'), Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\DD\DD-RUN2.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 9:15AM



# FS a 1.65	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
	Qbp	1	125.0	130.0	200.0	36.0	0
	Td	2	125.0	130.0	Aniso	Aniso	0
	Qb	3	125.0	130.0	0.0	30.0	0

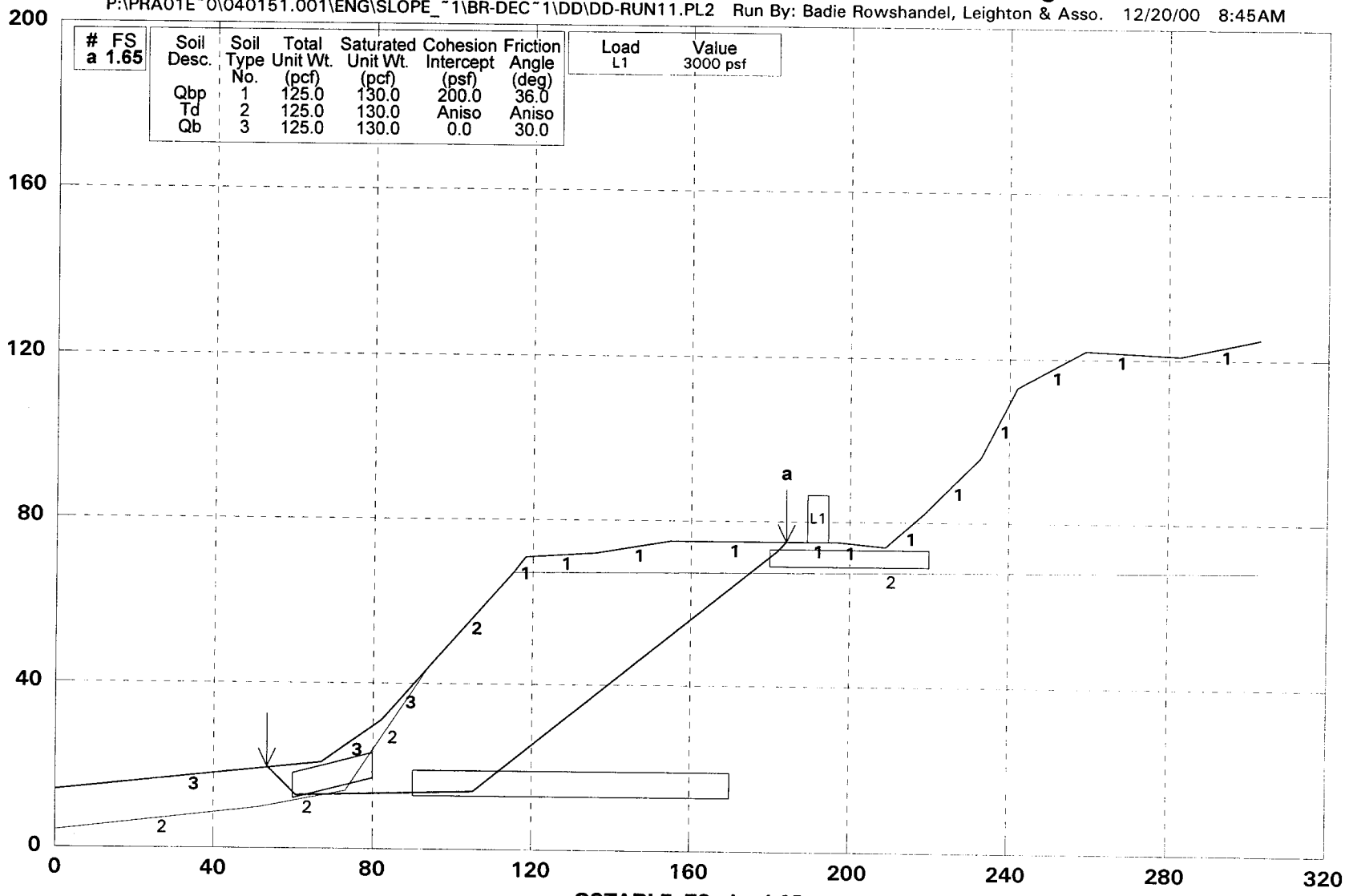
GSTABL7 FSmin=1.65

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (D-D'), Del Mar Bluffs, Static w/ Surcharge

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\DD\DD-RUN11.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 8:45AM



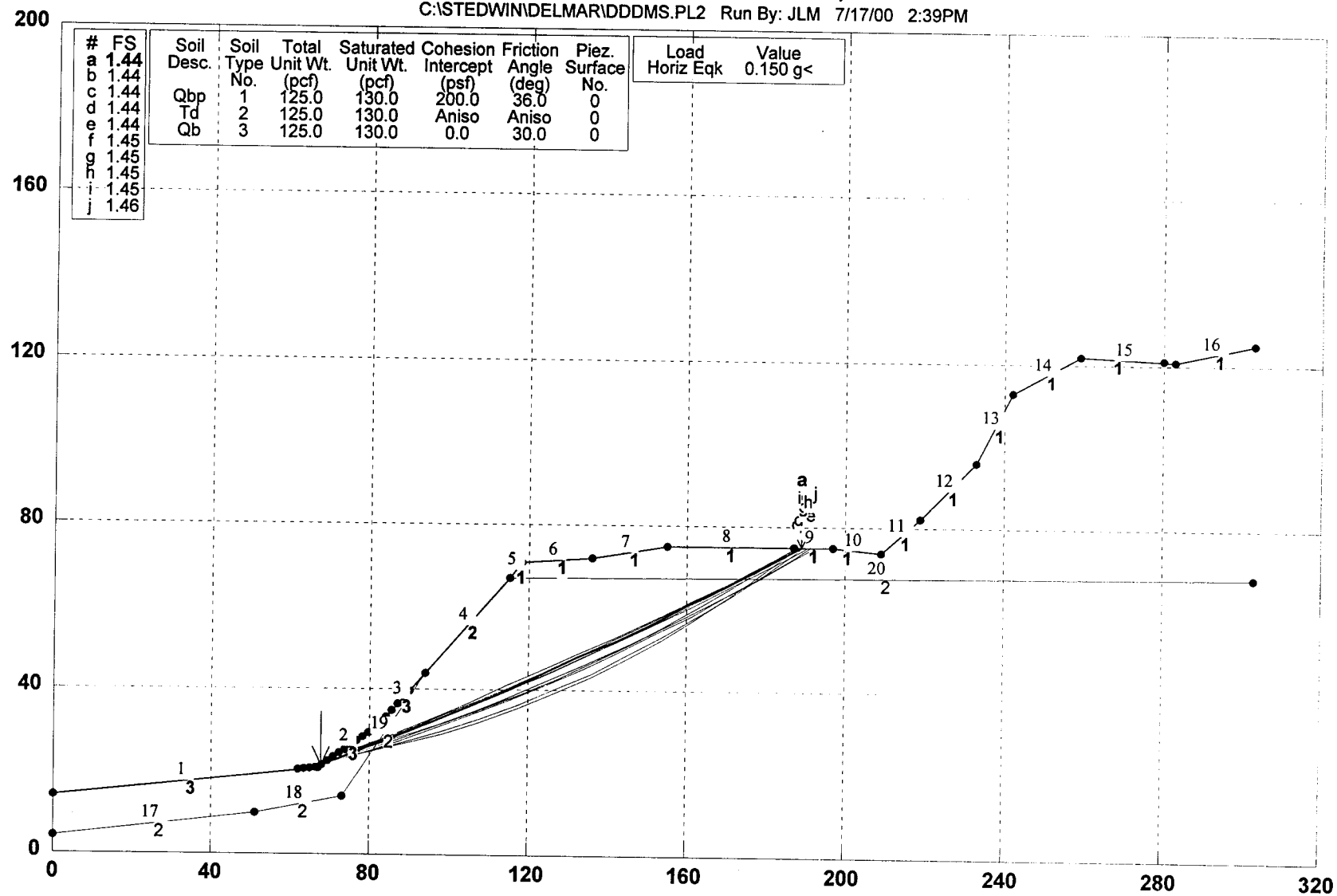
GSTABL7 FSmin=1.65

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (D-D'), Del Mar Bluffs, Pseudostatic

C:\STEDWIN\DELMAR\DDDMS.PL2 Run By: JLM 7/17/00 2:39PM



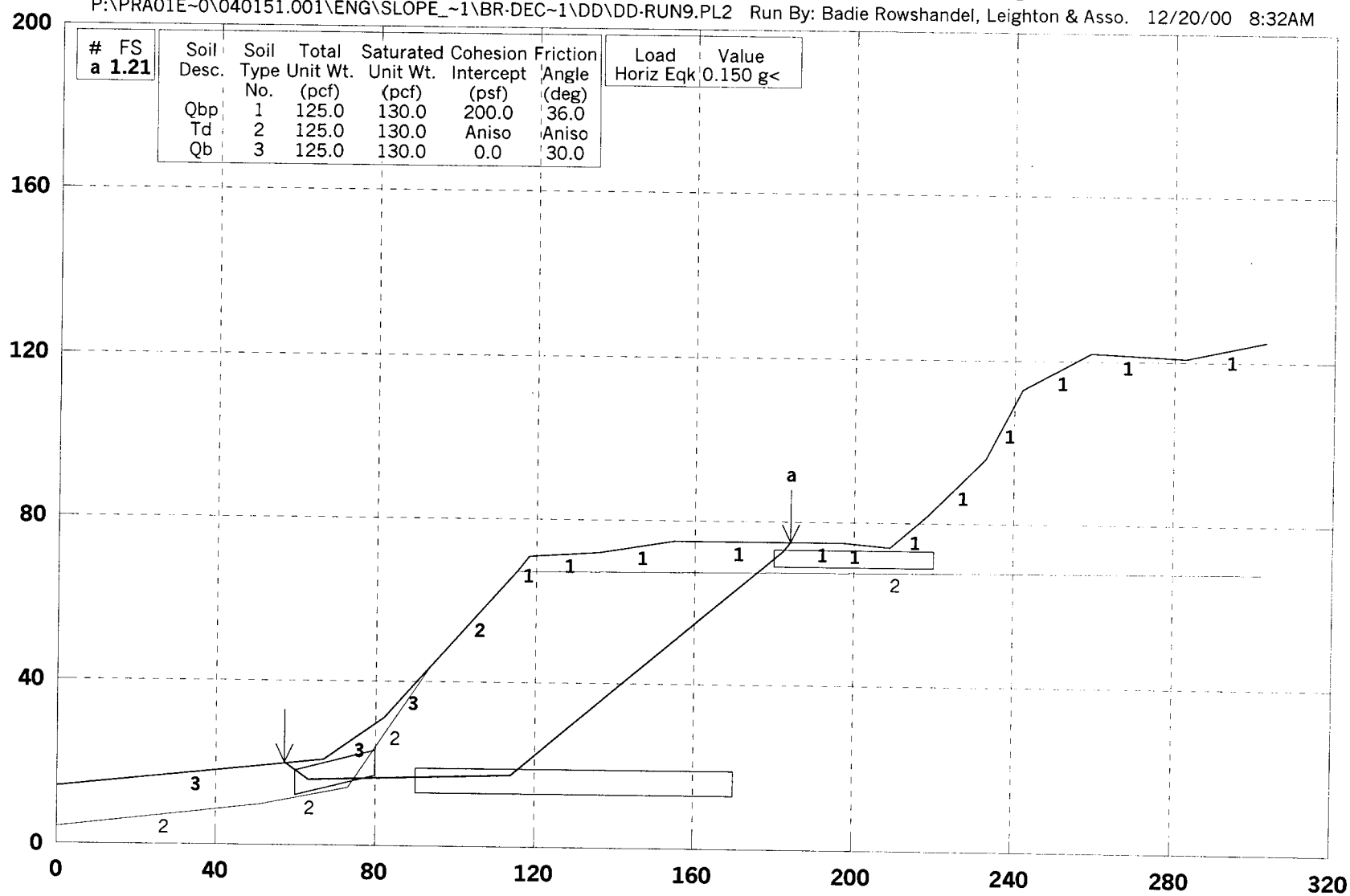
GSTABL7 FSmin=1.44

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (D-D'), Del Mar Bluffs, Pseudo-Static @ 0.15

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\DD\DD-RUN9.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 8:32AM



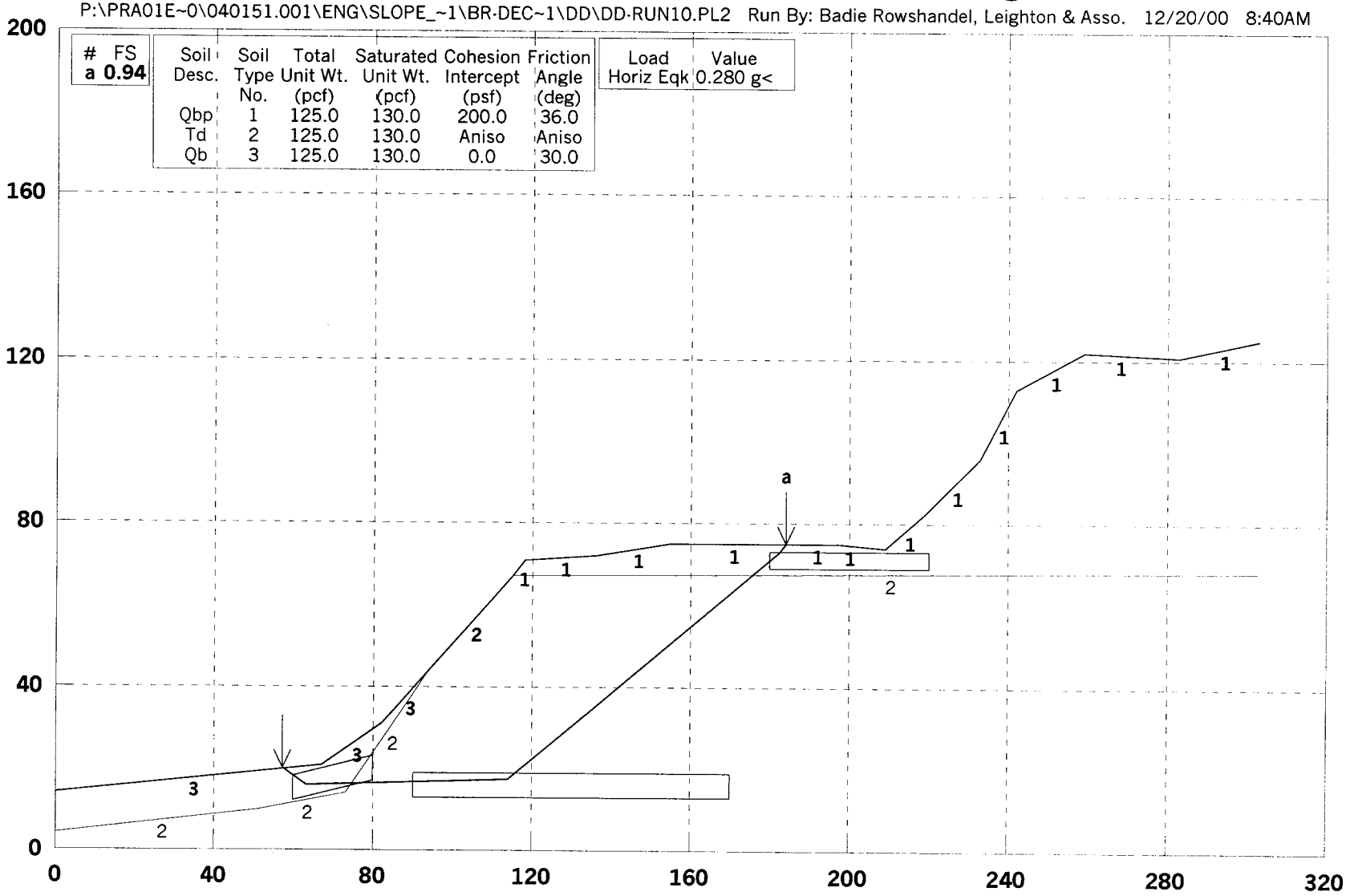
GSTABL7 FSmin=1.21

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (D-D'), Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\DD\DD-RUN10.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 8:40AM



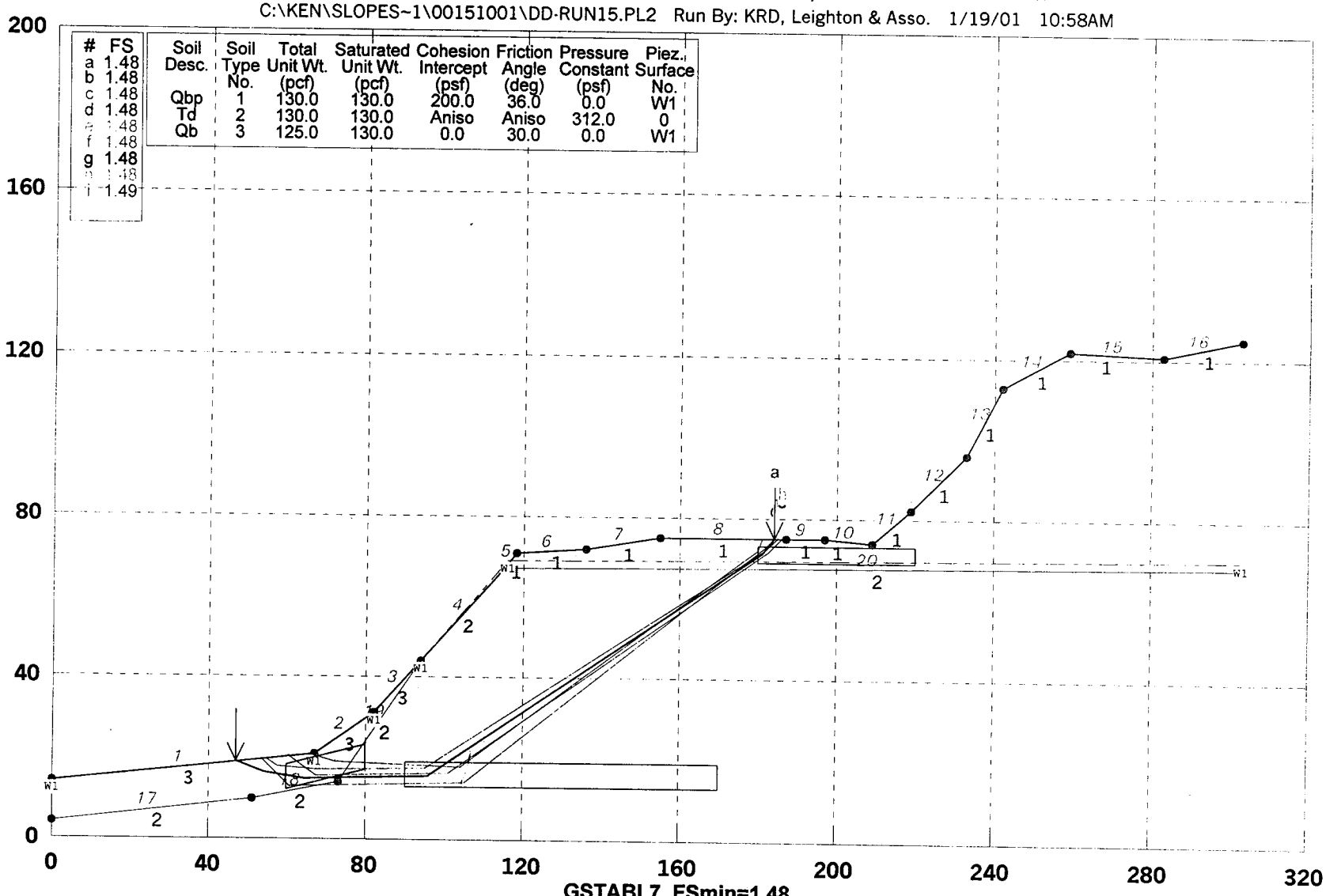
GSTABL7 FSmin=0.94

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (D-D'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\DD-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 10:58AM



GSTABL7 FSmin=1.48

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

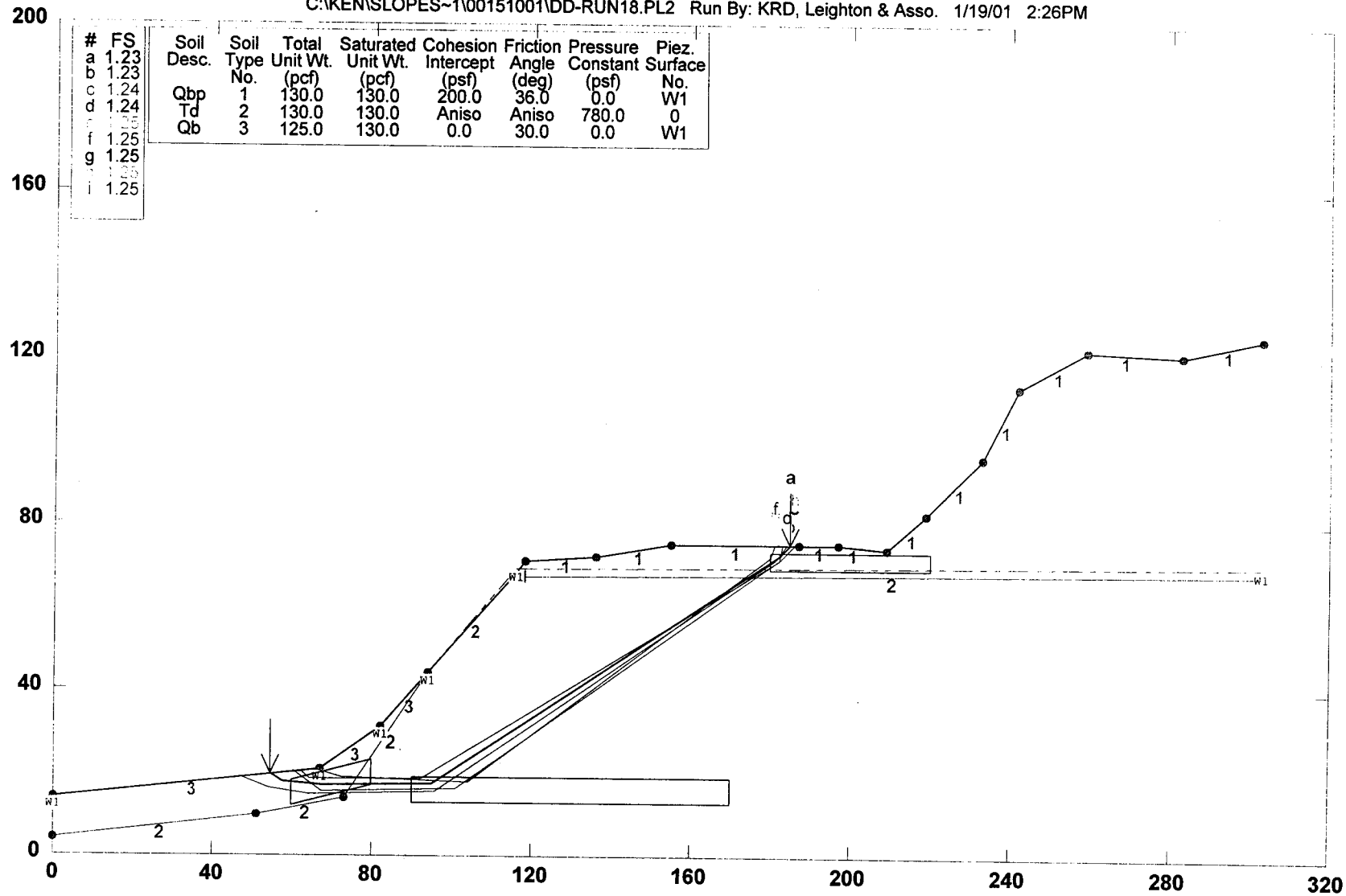
STED

Cross Section (D-D'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\DD-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/19/01 2:26PM

#	FS
a	1.23
b	1.23
c	1.24
d	1.24
f	1.25
g	1.25
i	1.25

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1



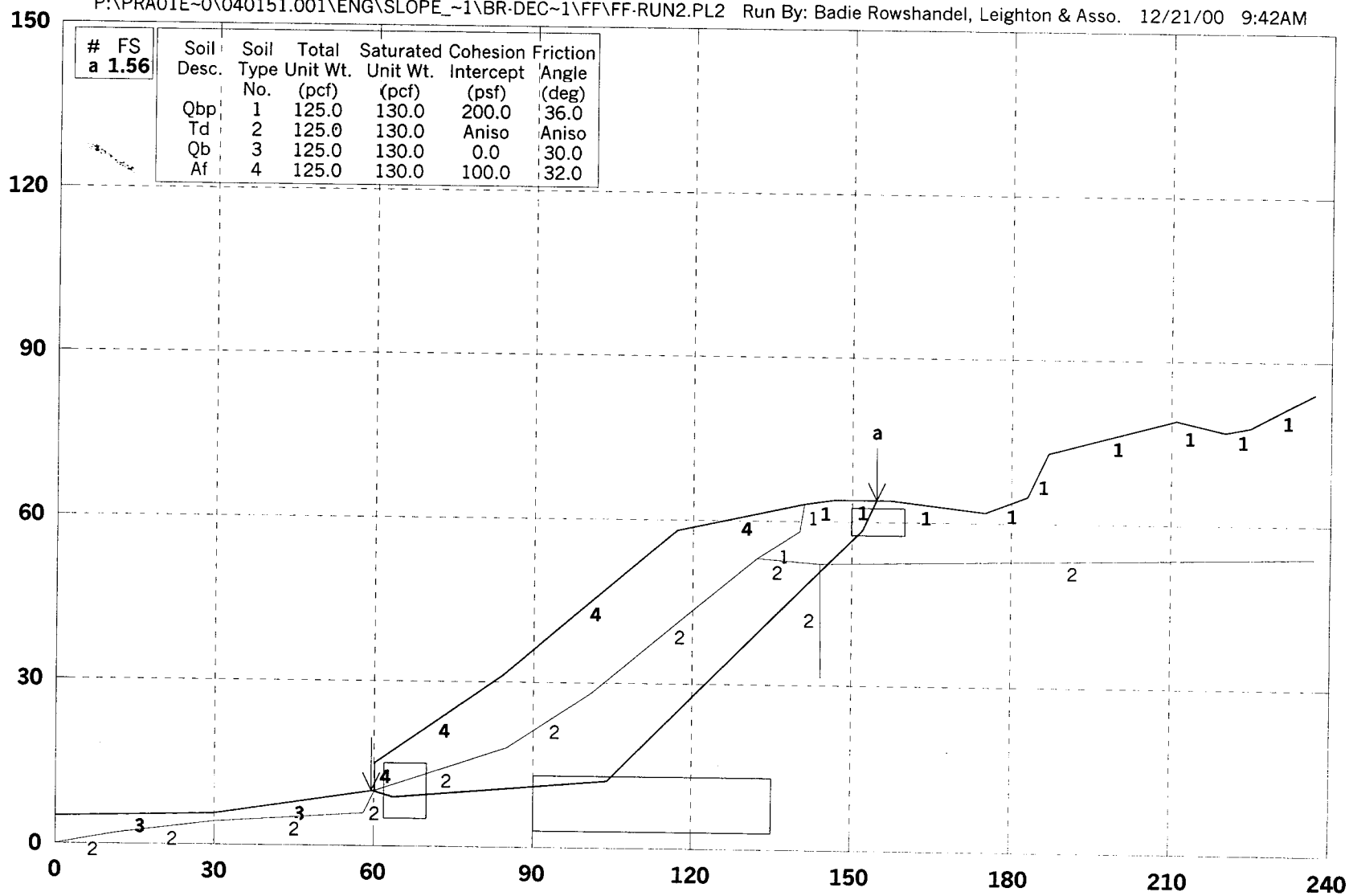
GSTABL7 FSmin=1.23

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (F-F'), Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\FF\FF-RUN2.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 9:42AM



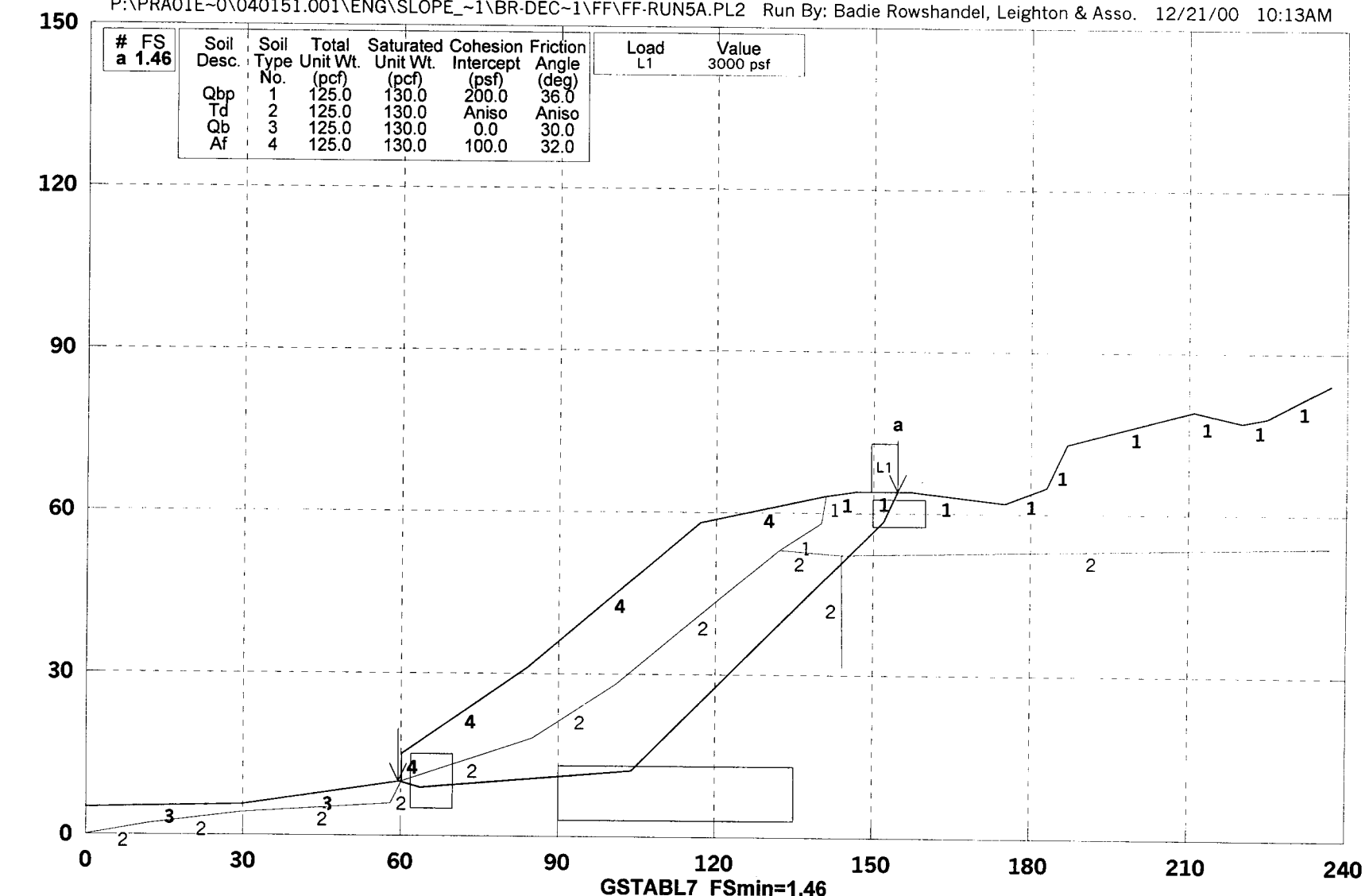
GSTABL7 FSmin=1.56

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (F-F'), Del Mar Bluffs, Static w/ Surcharge

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\FF\FF-RUN5A.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 10:13AM



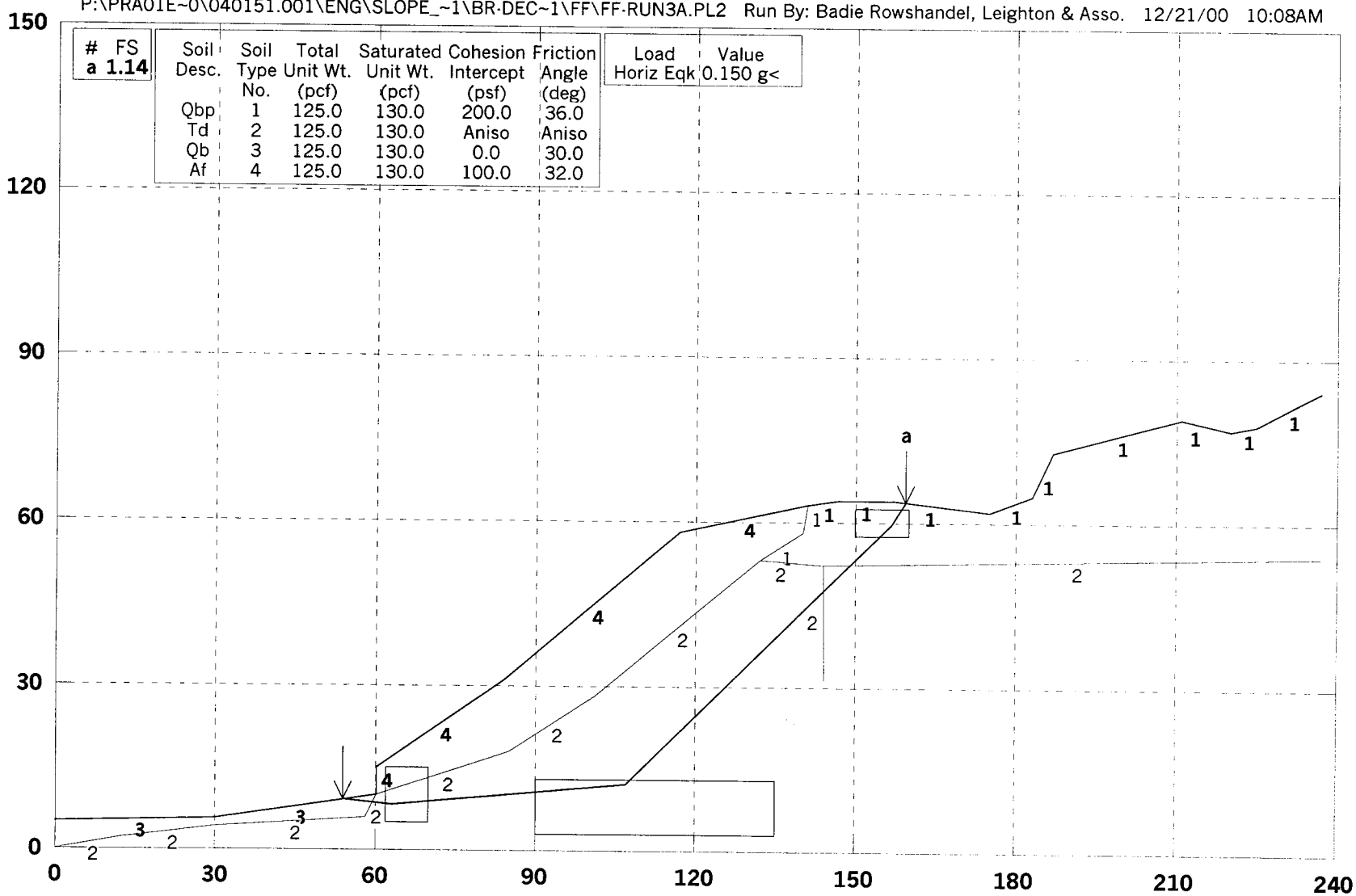
GSTABL7 FSmin=1.46

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (F-F'), Del Mar Bluffs, Pseudo-Static @ 0.15

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\FF\FF-RUN3A.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 10:08AM



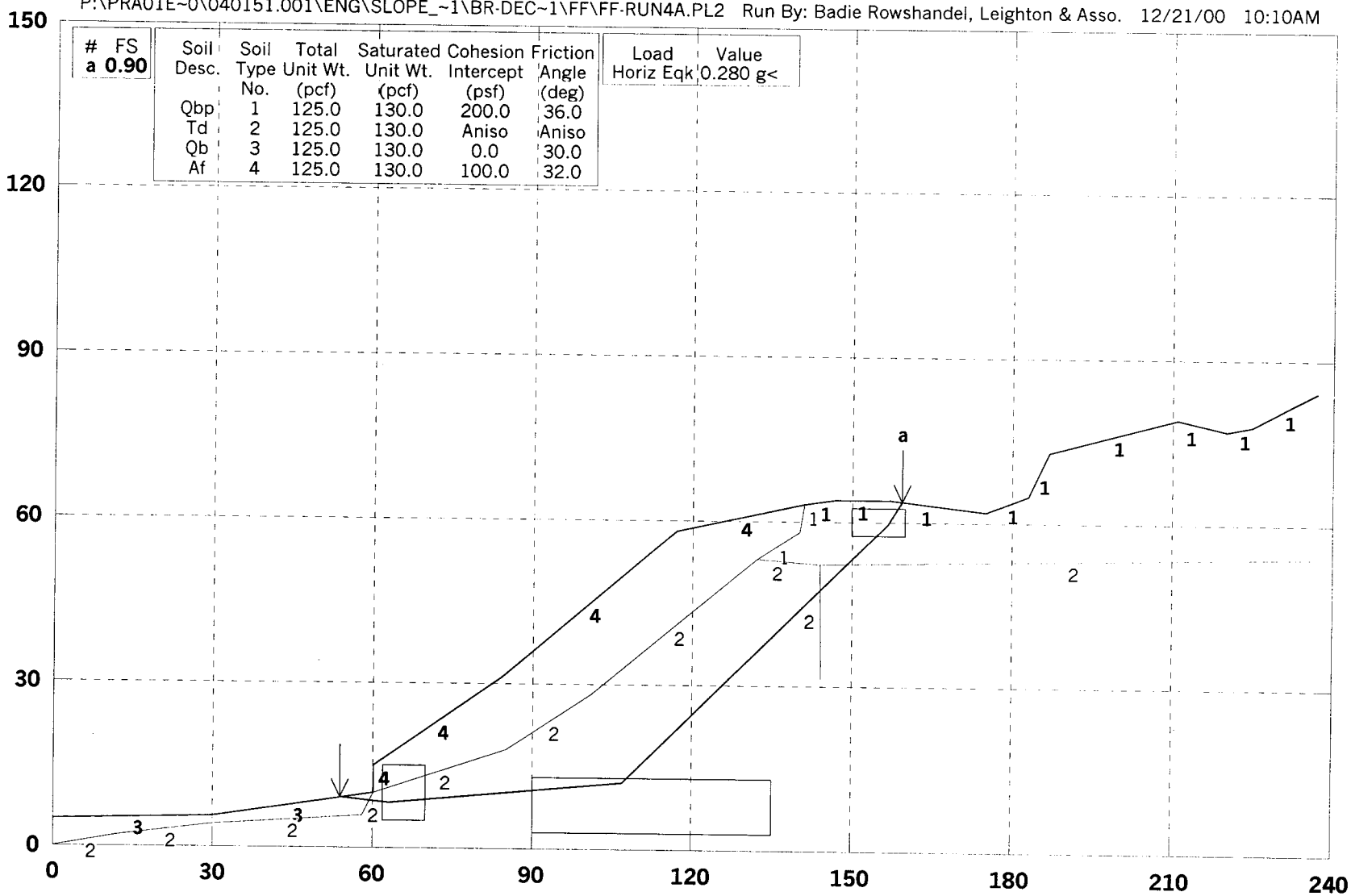
GSTABL7 FSmin=1.14

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (F-F'), Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\FF\FF-RUN4A.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 10:10AM



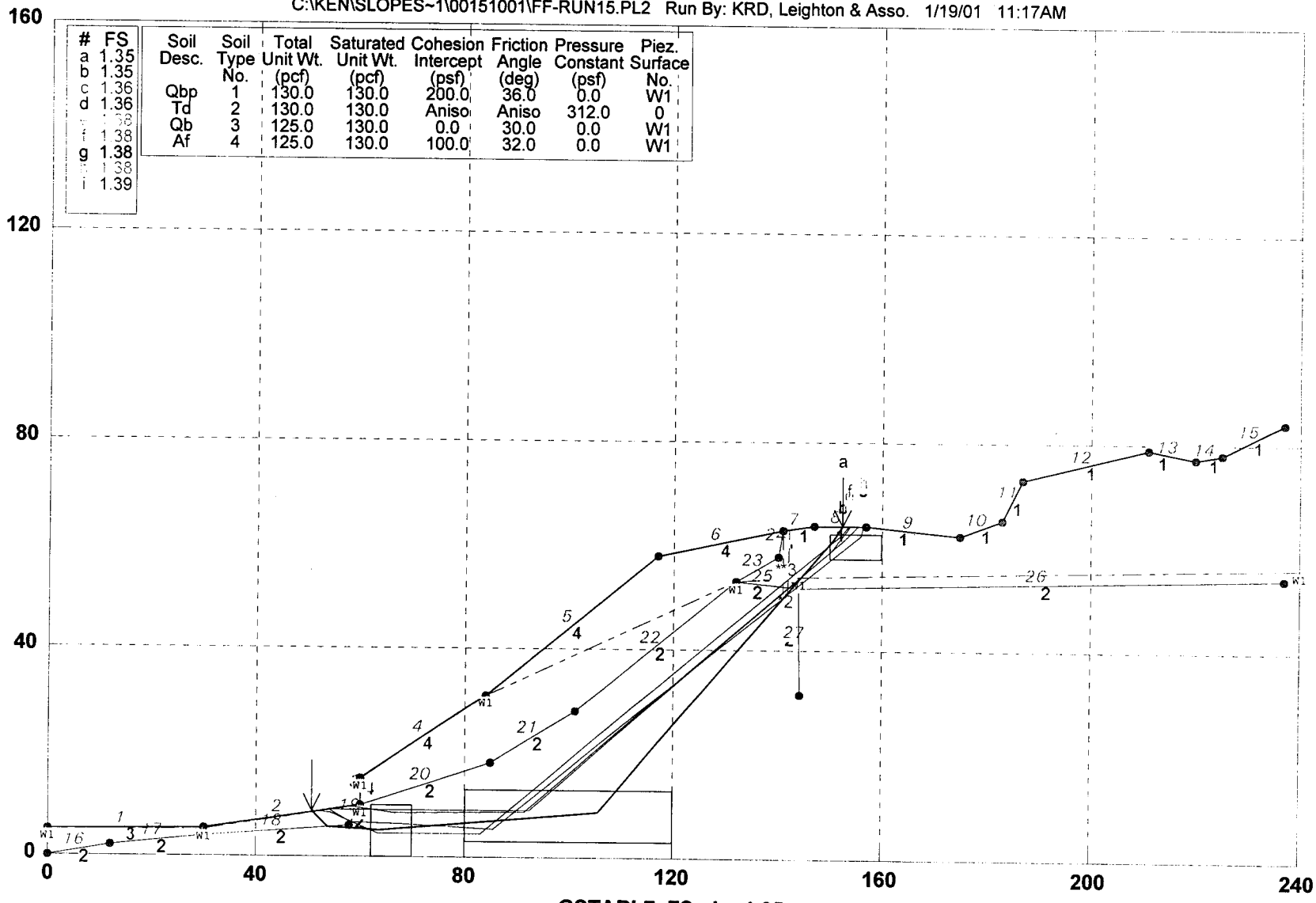
GSTABL7 FSmin=0.90

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (F-F'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\FF-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 11:17AM



GSTABL7 FSmin=1.35

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

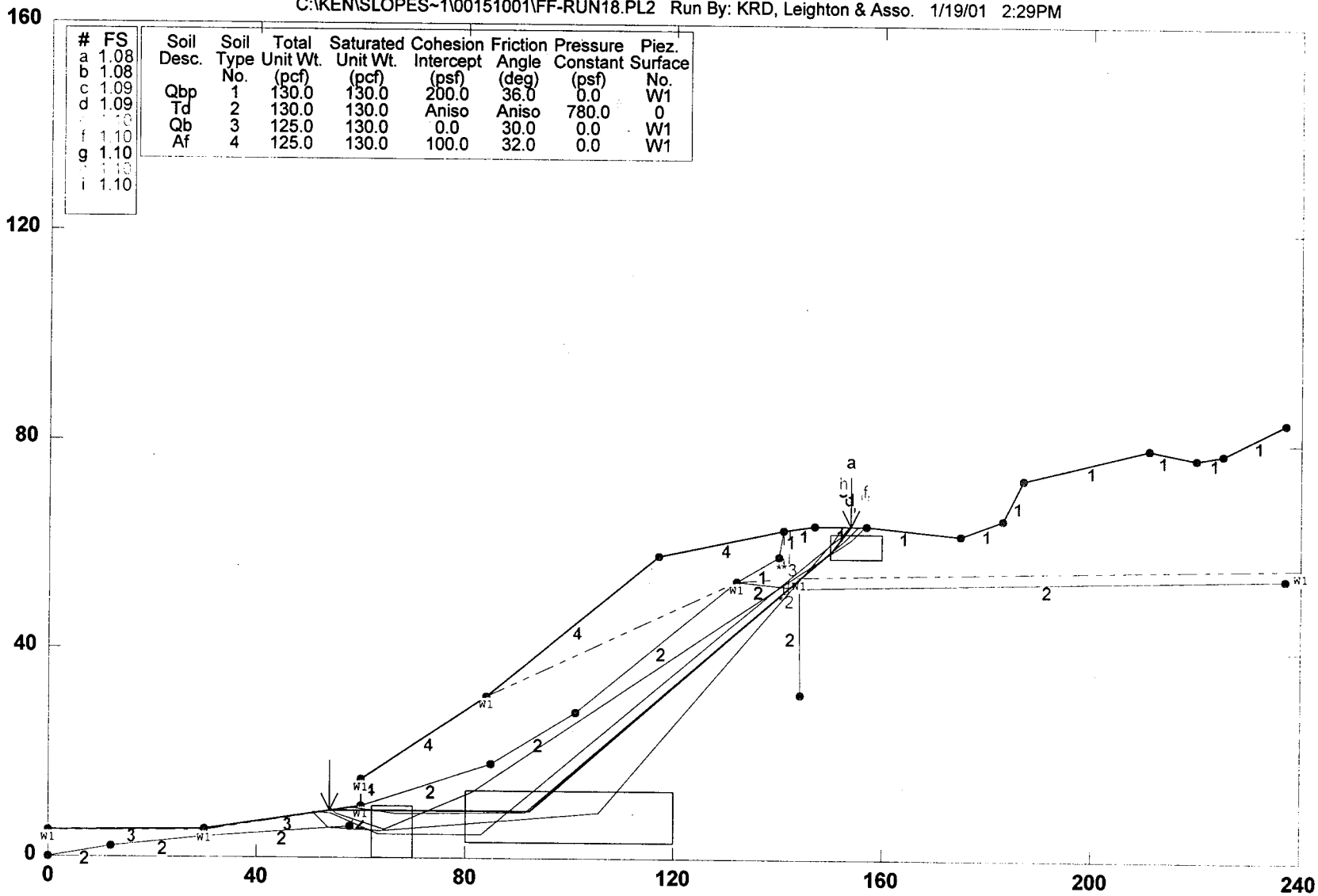
STED

Cross Section (F-F'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\FF-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/19/01 2:29PM

#	FS
a	1.08
b	1.08
c	1.09
d	1.09
e	1.10
f	1.10
g	1.10
h	1.10
i	1.10

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Af	4	125.0	130.0	100.0	32.0	0.0	W1



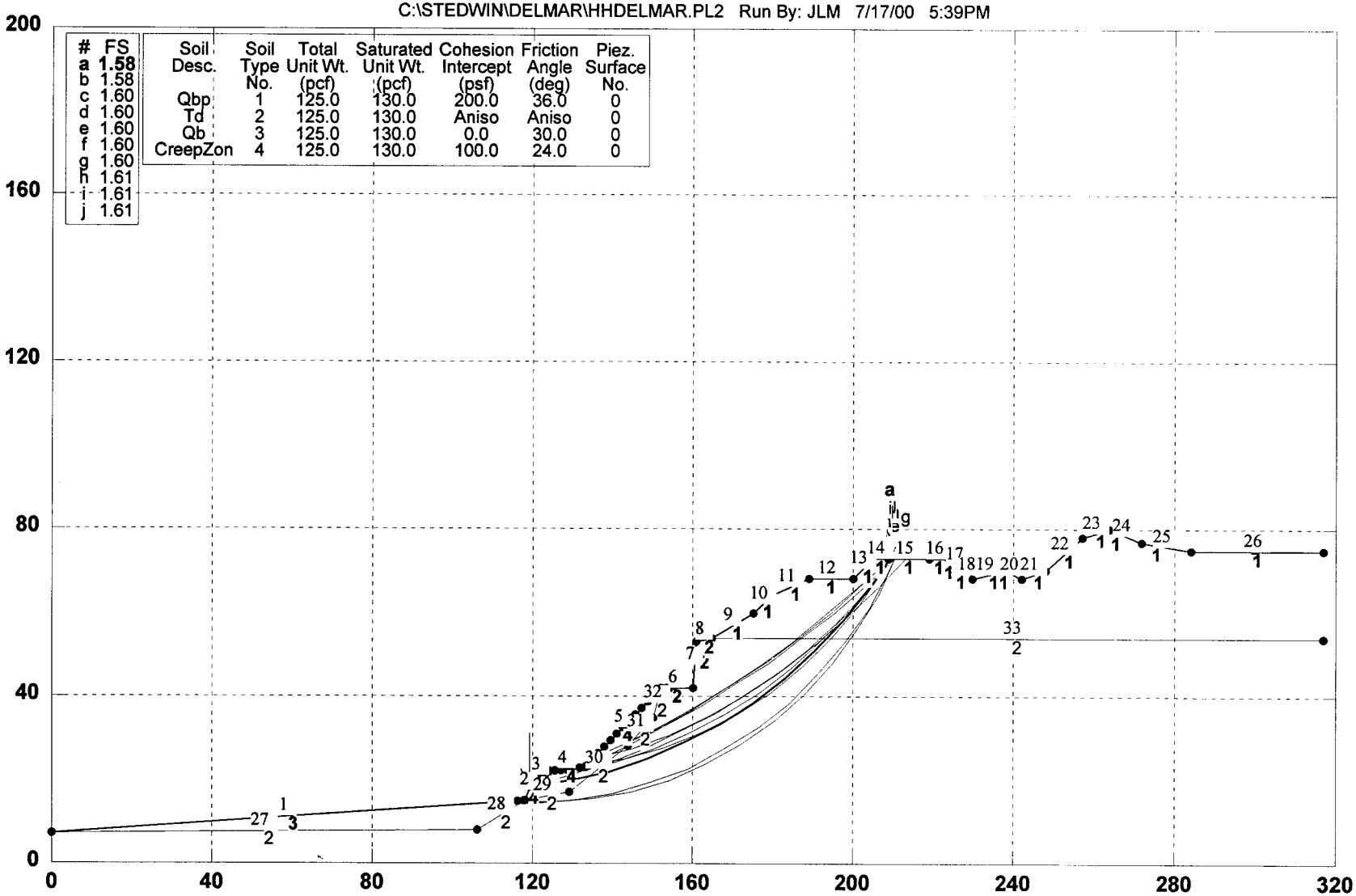
GSTABL7 FSmin=1.08

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (H-H'), Del Mar Bluffs

C:\STEDWIN\DELMAR\HHDELMAR.PL2 Run By: JLM 7/17/00 5:39PM



#	FS
a	1.58
b	1.58
c	1.60
d	1.60
e	1.60
f	1.60
g	1.60
h	1.61
i	1.61
j	1.61

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
CreepZon	4	125.0	130.0	100.0	24.0	0

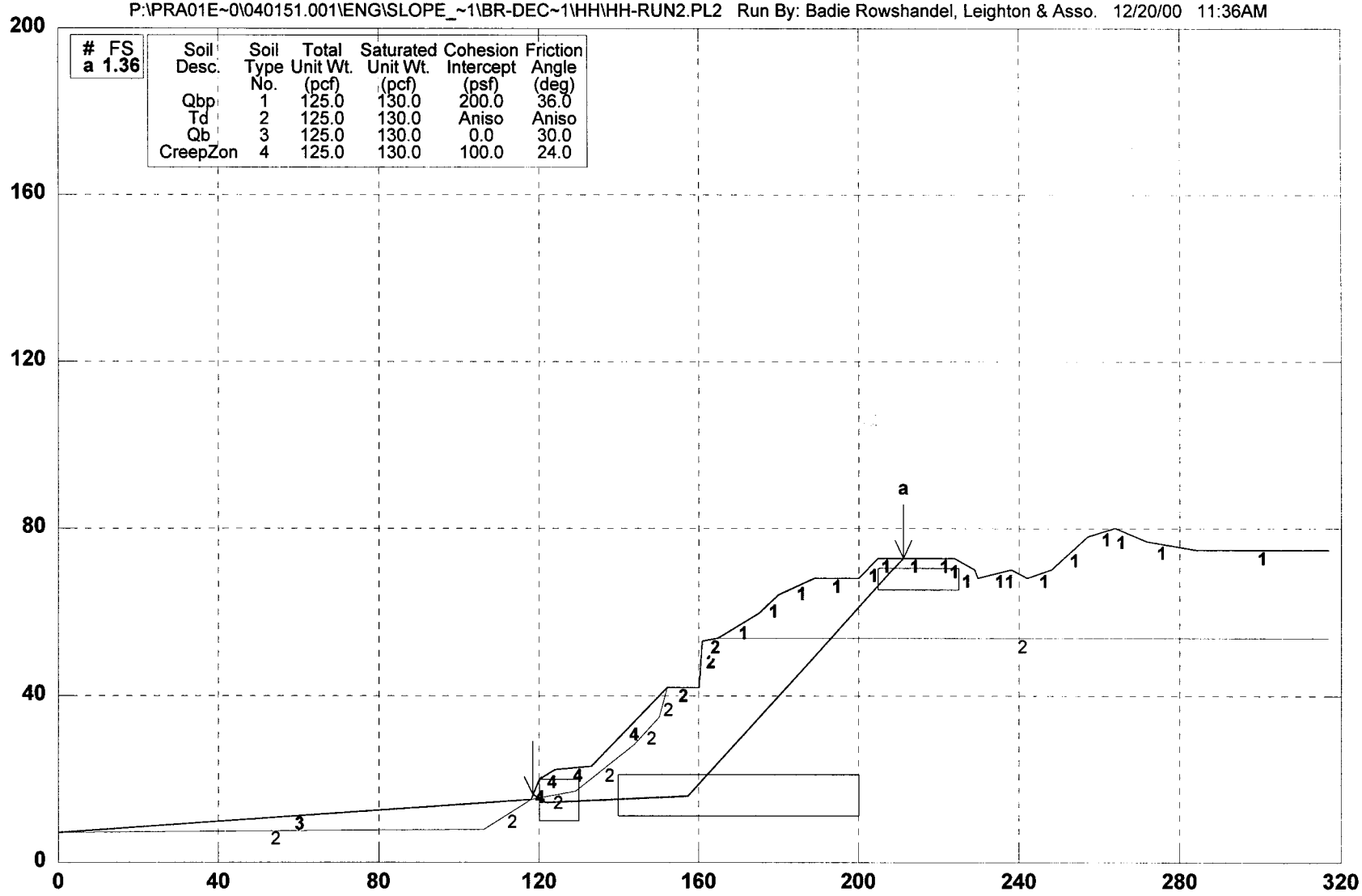
GSTABL7 FSmin=1.58

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (H-H'), Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\HH\HH-RUN2.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 11:36AM



# FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
a 1.36	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0
	CreepZon	4	125.0	130.0	100.0	24.0

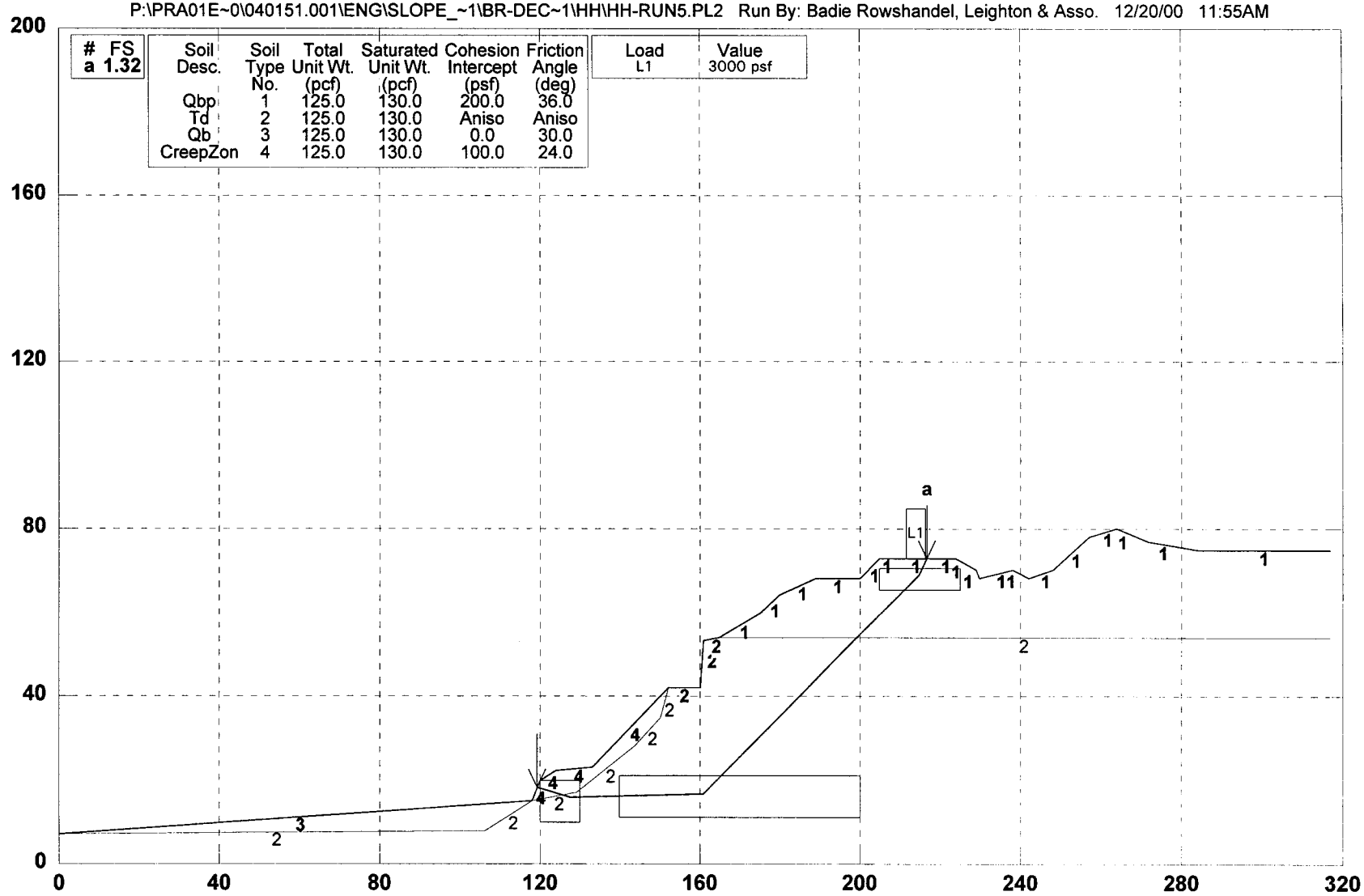
GSTABL7 FSmin=1.36

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross Section (H-H'), Del Mar Bluffs, Static w/ Surcharge

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\HH\HH-RUN5.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 11:55AM



# FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
a 1.32	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0
	CreepZon	4	125.0	130.0	100.0	24.0

Load	Value
L1	3000 psf

GSTABL7 FSmin=1.32

Safety Factors Are Calculated By The Simplified Janbu Method

STED

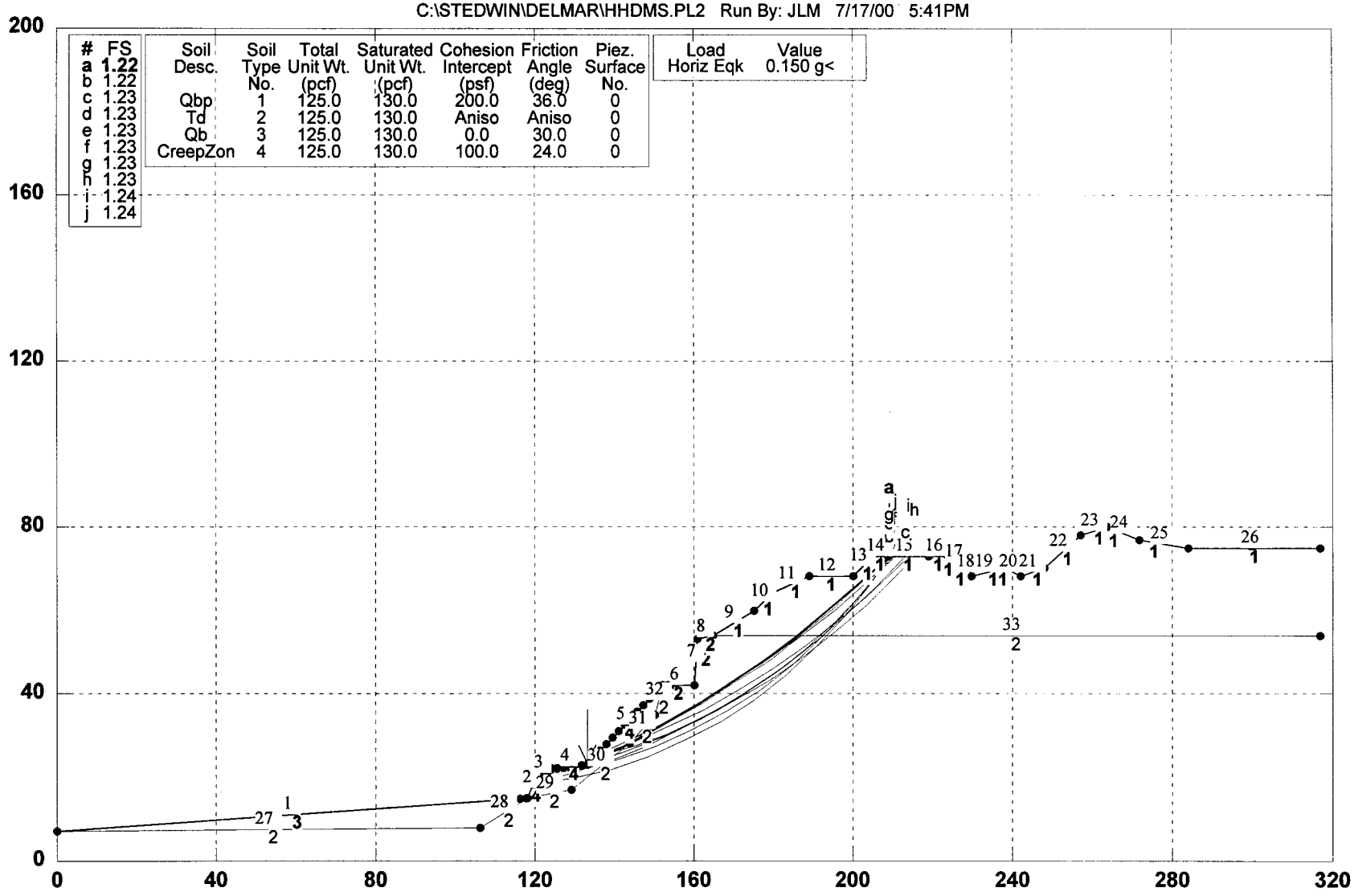
Cross Section (H-H'), Del Mar Bluffs, Pseudostatic

C:\STEDWIN\DELMAR\HHDMS.PL2 Run By: JLM 7/17/00 5:41PM

#	FS
a	1.22
b	1.22
c	1.23
d	1.23
e	1.23
f	1.23
g	1.23
h	1.23
i	1.24
j	1.24

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
CreepZon	4	125.0	130.0	100.0	24.0	0

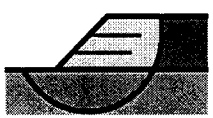
Load	Value
Horiz Eqk	0.150 g<



GSTABL7 FSmin=1.22

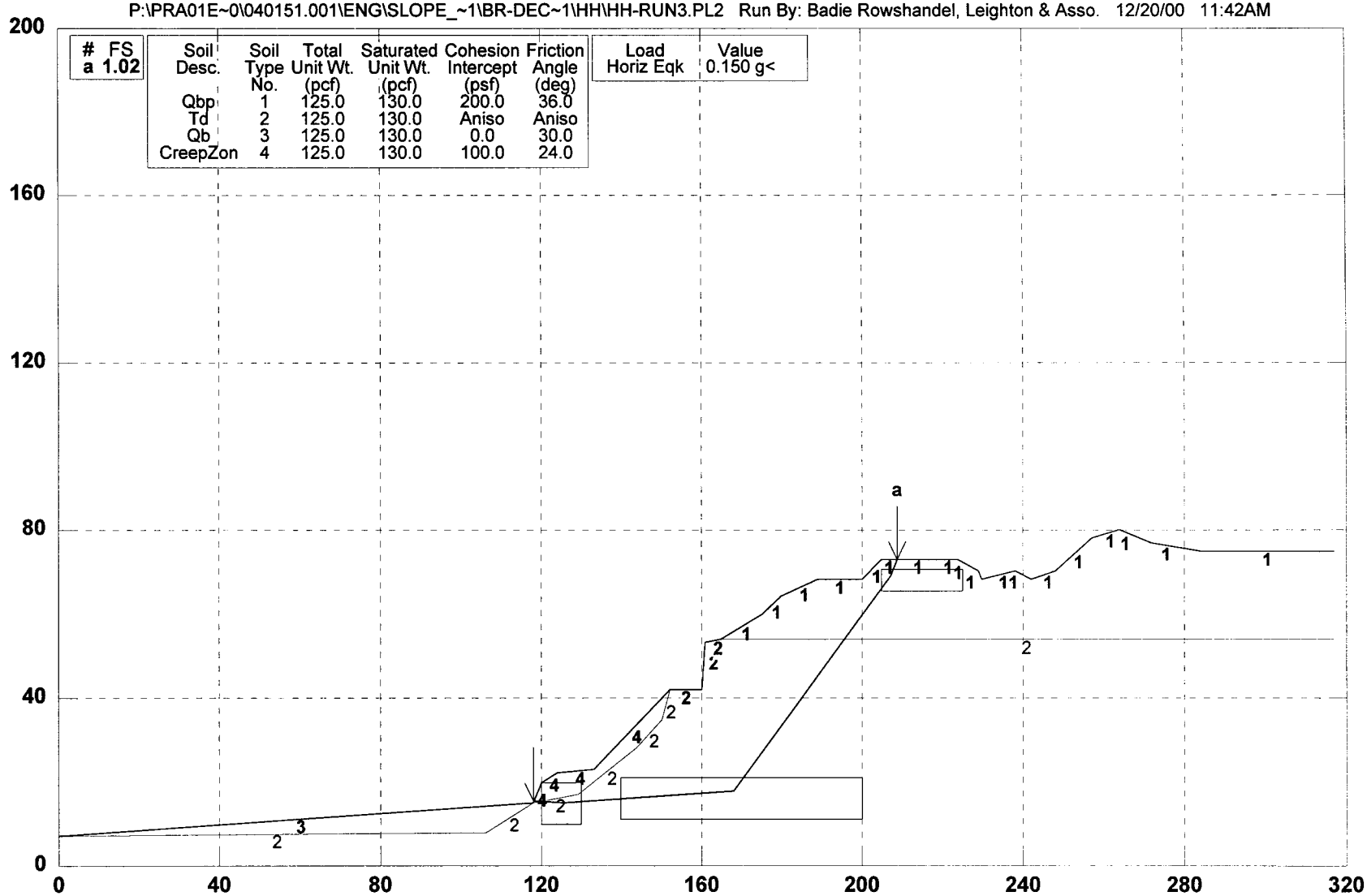
Safety Factors Are Calculated By The Modified Bishop Method

STED



Cross Section (H-H'), Del Mar Bluffs, Pesudo-Static @ 0.15

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\HH\HH-RUN3.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 11:42AM



# FS a 1.02	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0
	CreepZon	4	125.0	130.0	100.0	24.0

Load	Value
Horiz Eqk	0.150 g<

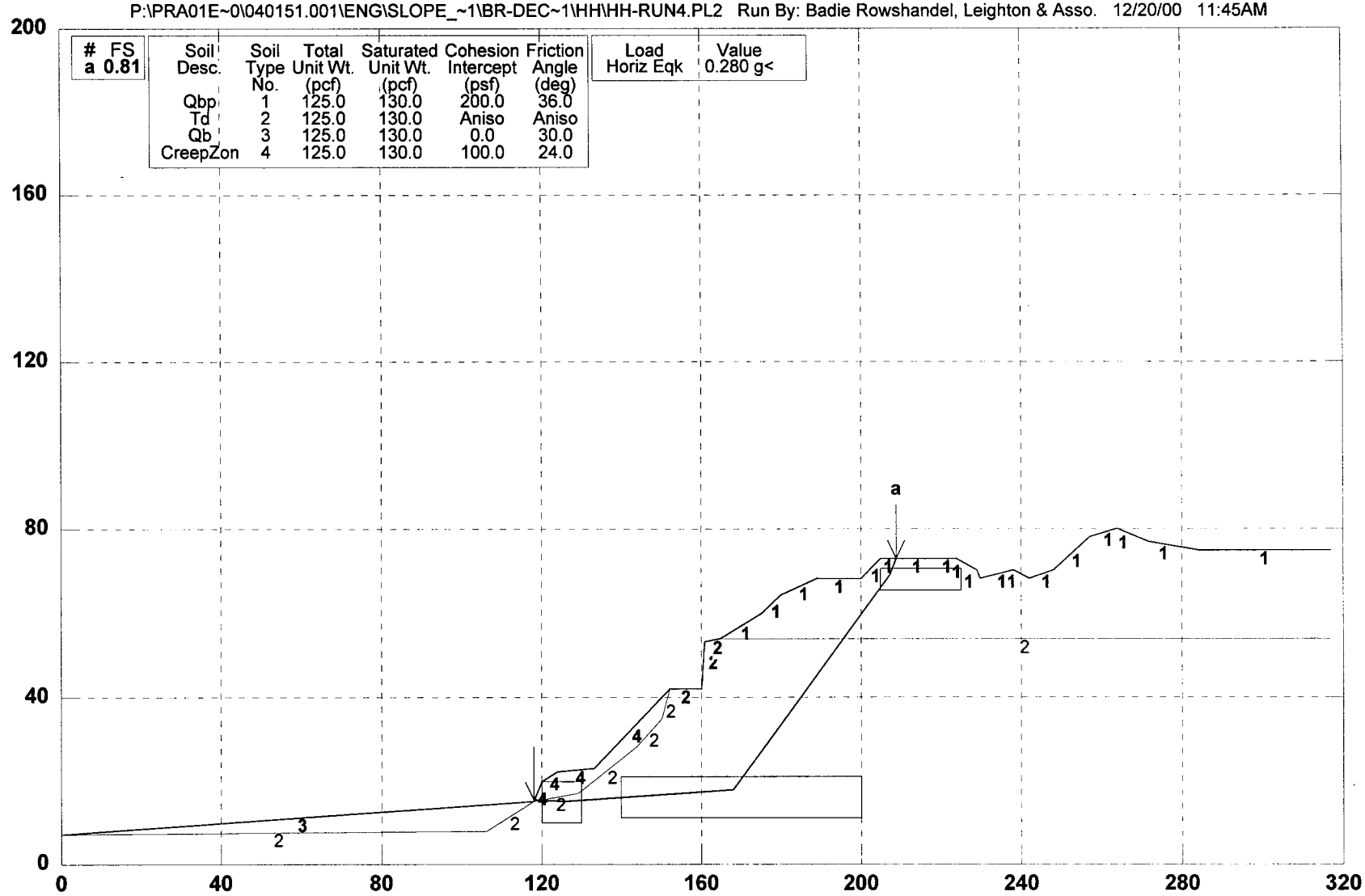
GSTABL7 FSmin=1.02

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross Section (H-H'), Del Mar Bluffs, Pesudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\HH\HH-RUN4.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 11:45AM



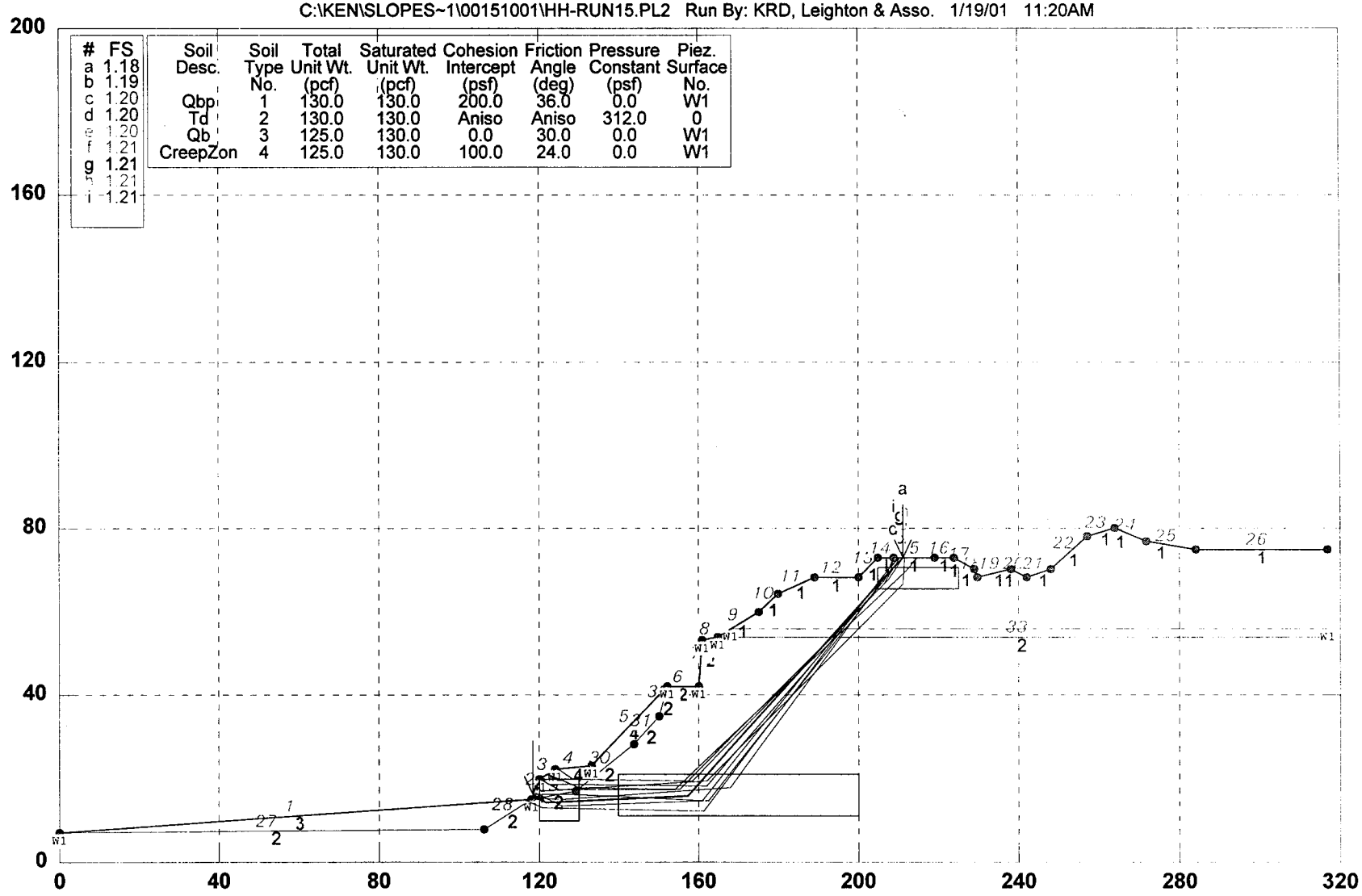
GSTABL7 FSmin=0.81

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross Section (H-H'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\HH-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 11:20AM



#	FS
a	1.18
b	1.19
c	1.20
d	1.20
e	1.20
f	1.21
g	1.21
h	1.21
i	1.21

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
CreepZon	4	125.0	130.0	100.0	24.0	0.0	W1

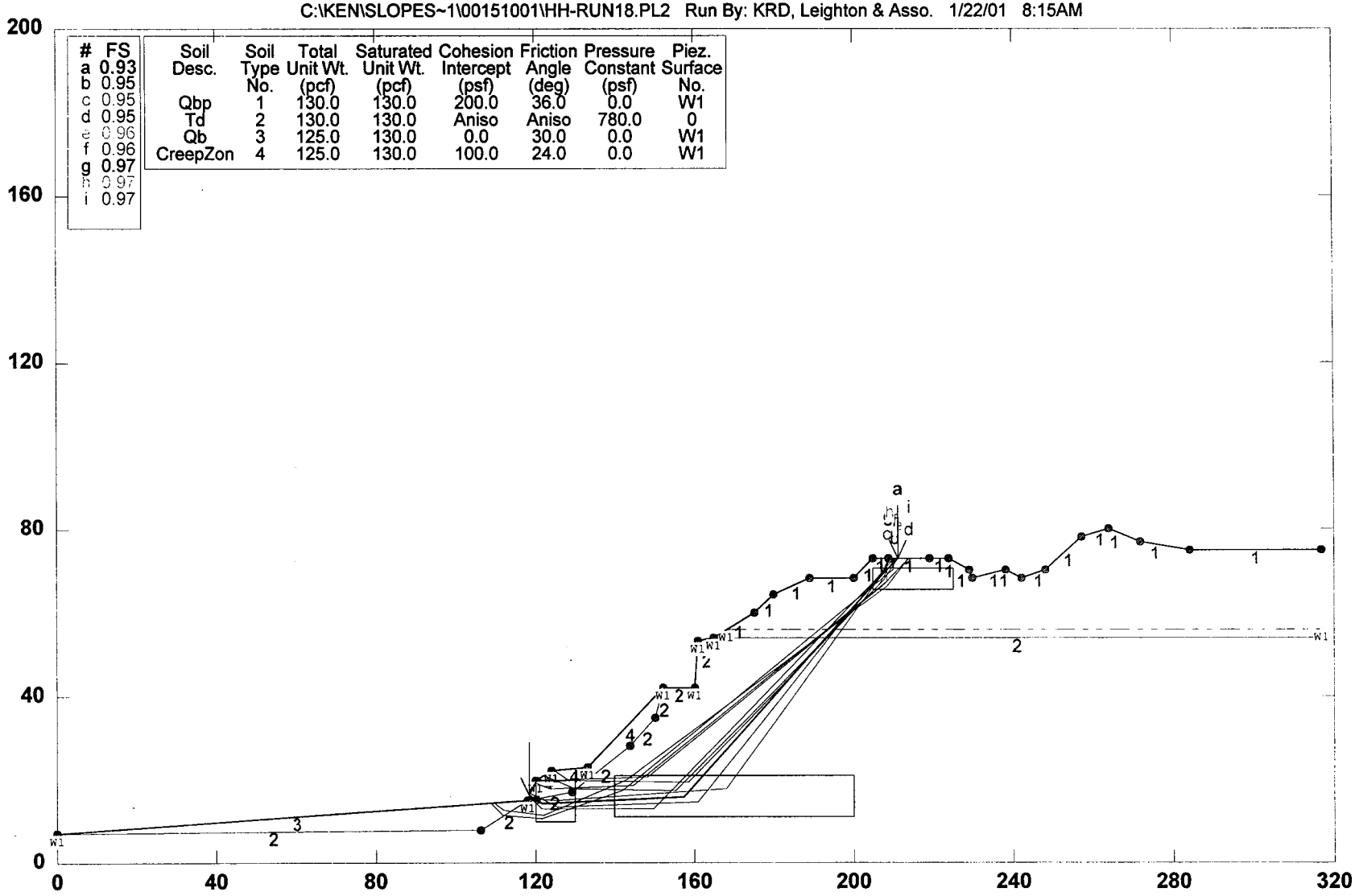
GSTABL7 FSmin=1.18

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross Section (H-H'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\HH-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 8:15AM



#	FS
a	0.93
b	0.95
c	0.95
d	0.95
e	0.96
f	0.96
g	0.97
h	0.97
i	0.97

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
CreepZon	4	125.0	130.0	100.0	24.0	0.0	W1

GSTABL7 FSmin=0.93

Safety Factors Are Calculated By The Simplified Janbu Method

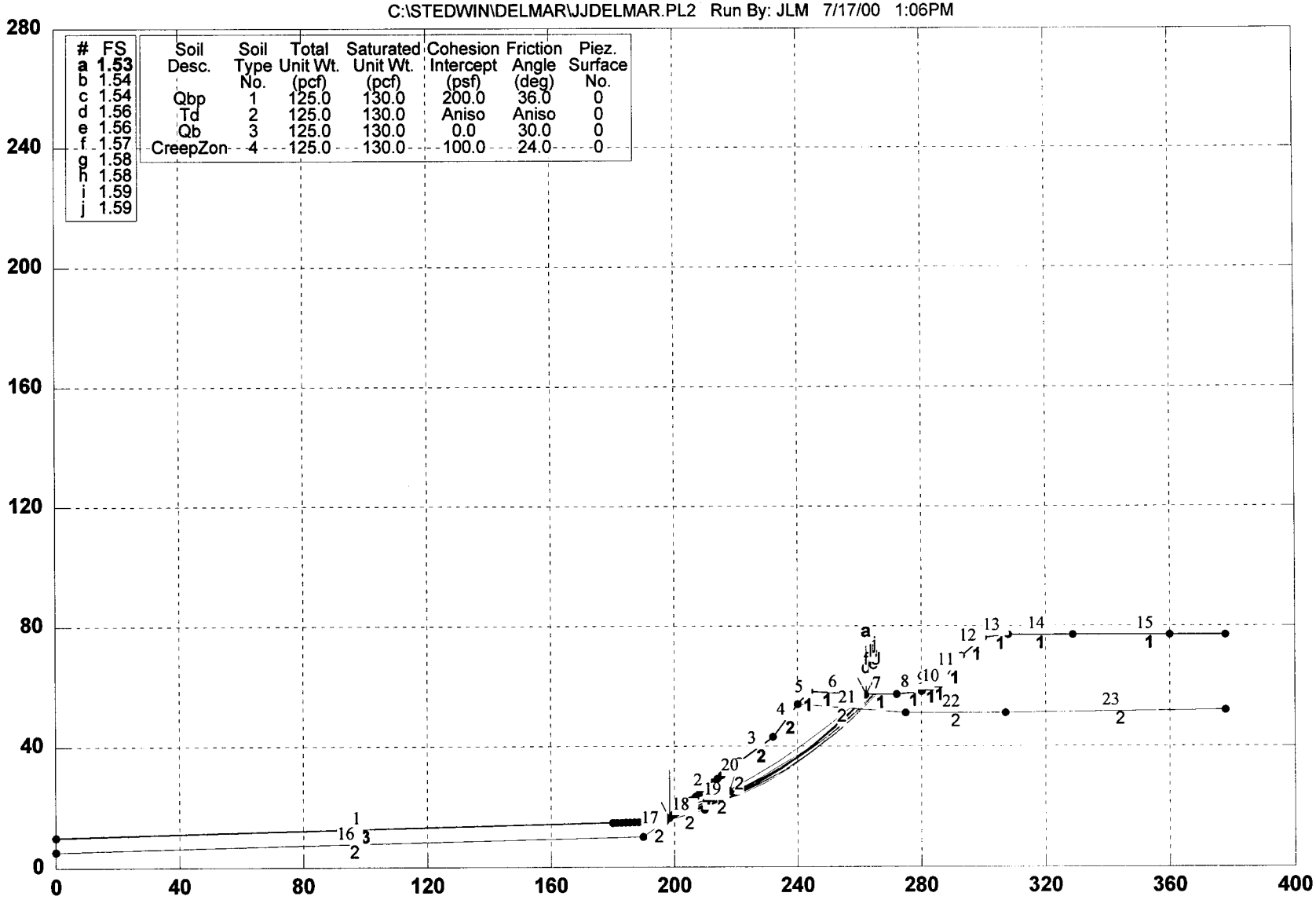
STED

Cross Section (J-J'), Del Mar Bluffs

C:\STEDWIN\DELMAR\JJDELMAR.PL2 Run By: JLM 7/17/00 1:06PM

#	FS
a	1.53
b	1.54
c	1.54
d	1.56
e	1.56
f	1.57
g	1.58
h	1.58
i	1.59
j	1.59

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
CreepZon	4	125.0	130.0	100.0	24.0	0



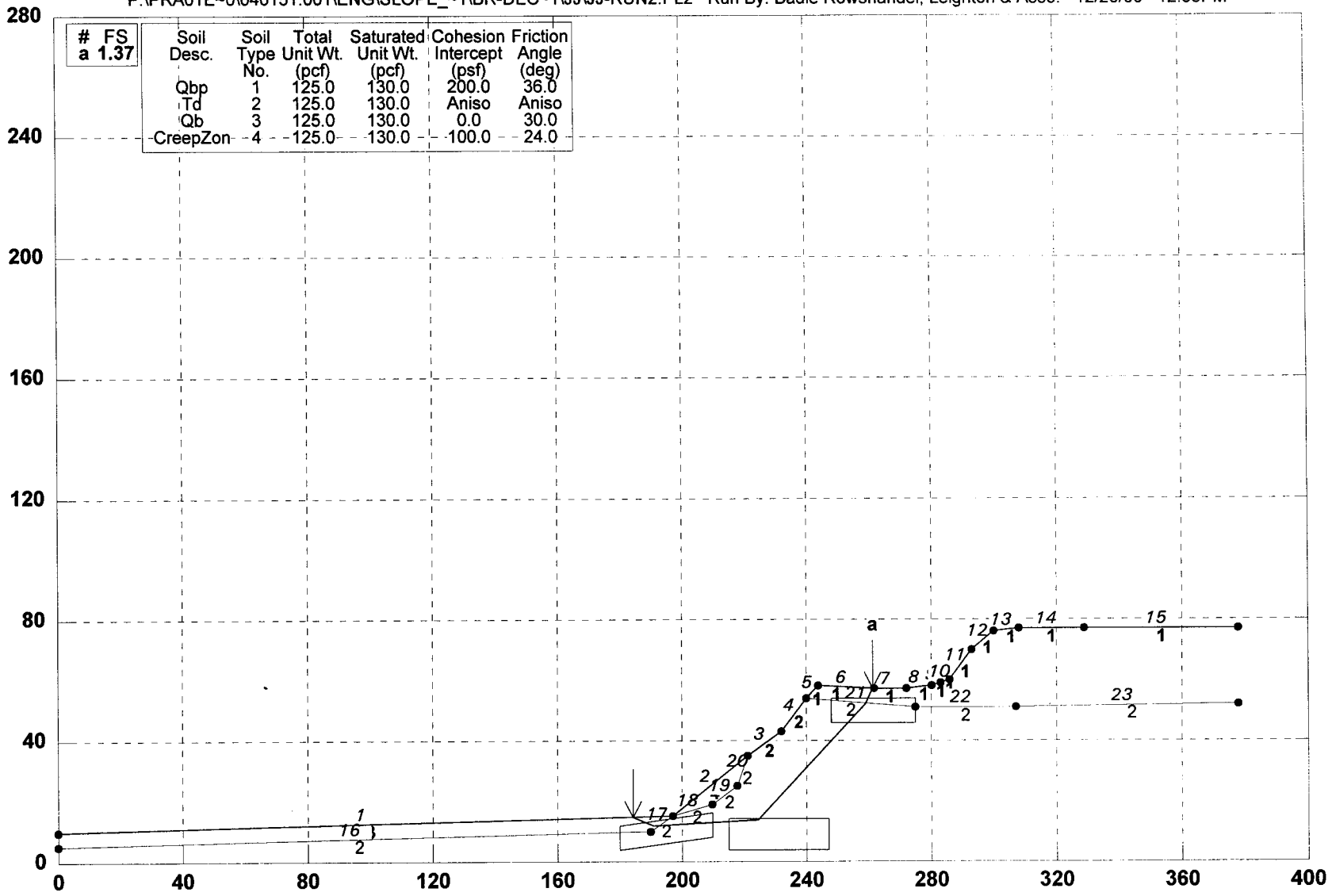
GSTABL7 FSmin=1.53

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (J-J'), Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\JJ\JJ-RUN2.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 12:55PM



GSTABL7 FSmin=1.37

Safety Factors Are Calculated By The Simplified Janbu Method

STED

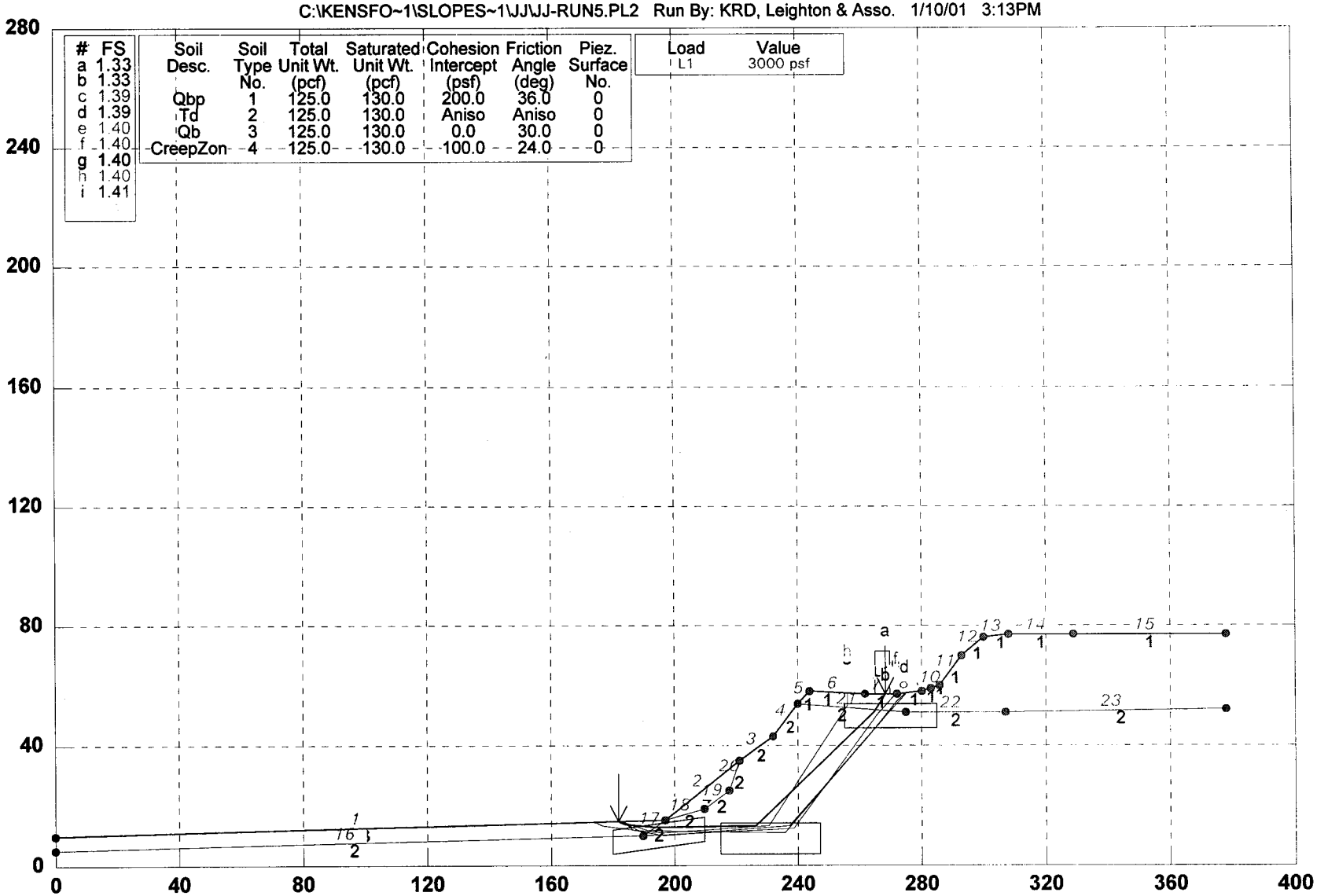
Cross Section (J-J'), Del Mar Bluffs, Static w/ Surcharge

C:\KENSFO~1\SLOPES~1\JJ\JJ-RUN5.PL2 Run By: KRD, Leighton & Asso. 1/10/01 3:13PM

#	FS
a	1.33
b	1.33
c	1.39
d	1.39
e	1.40
f	1.40
g	1.40
h	1.40
i	1.41

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
CreepZon	4	125.0	130.0	100.0	24.0	0

Load	Value
L1	3000 psf



GSTABL7 FSmin=1.33

Safety Factors Are Calculated By The Simplified Janbu Method

STED

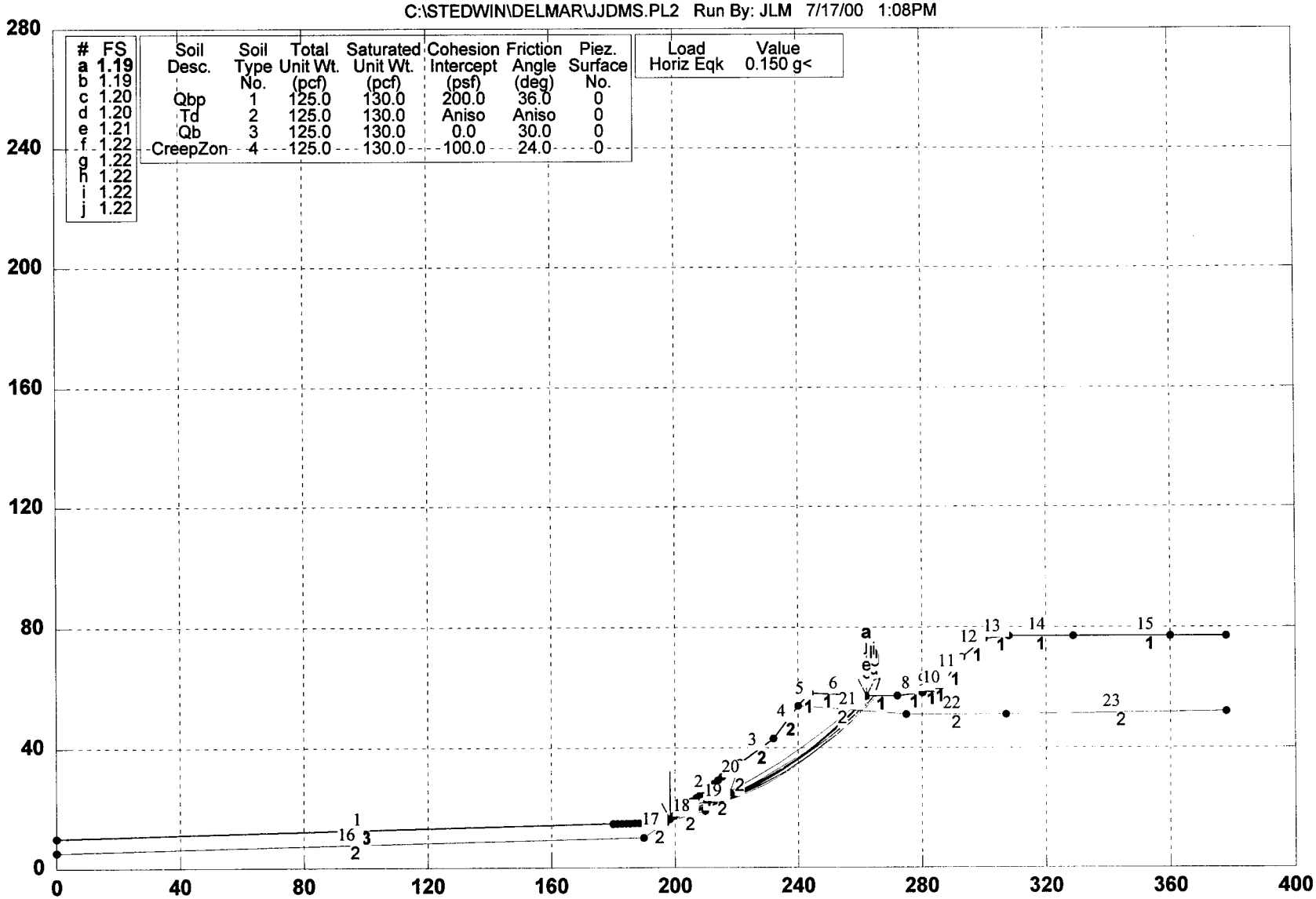
Cross Section (J-J'), Del Mar Bluffs, Pseudostatic

C:\STEDWIN\DELMAR\JJDMS.PL2 Run By: JLM 7/17/00 1:08PM

#	FS
a	1.19
b	1.19
c	1.20
d	1.20
e	1.21
f	1.22
g	1.22
h	1.22
i	1.22
j	1.22

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
CreepZon	4	125.0	130.0	100.0	24.0	0

Load	Value
Horiz Eqk	0.150 g<



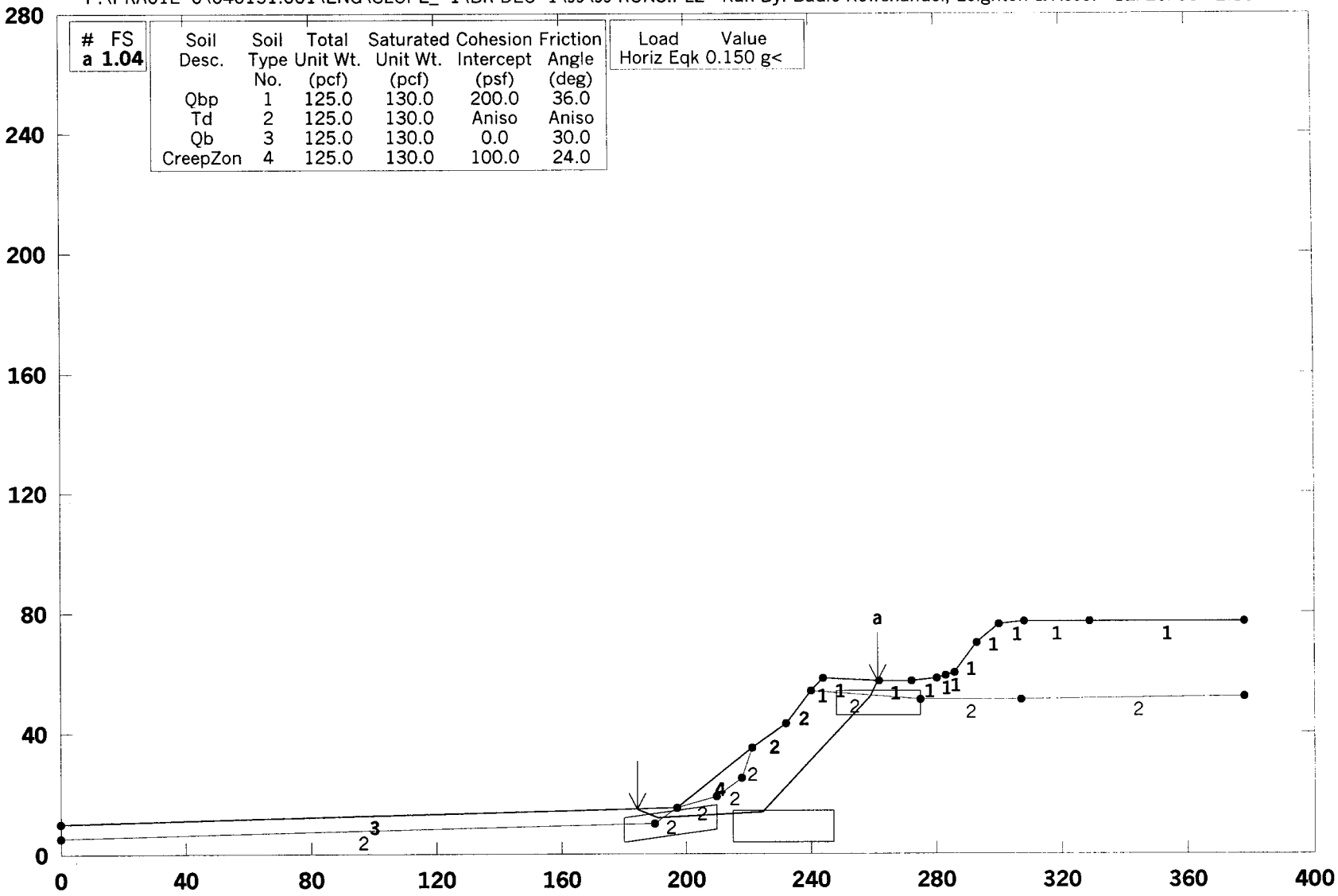
GSTABL7 FSmin=1.19

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (J-J'), Del Mar Bluffs, Pseudo-Static @ 0.15

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\JJ\JJ-RUN3.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 2:26PM



# FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
a 1.04	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0
	CreepZon	4	125.0	130.0	100.0	24.0

Load	Value
Horiz Eqk	0.150 g<

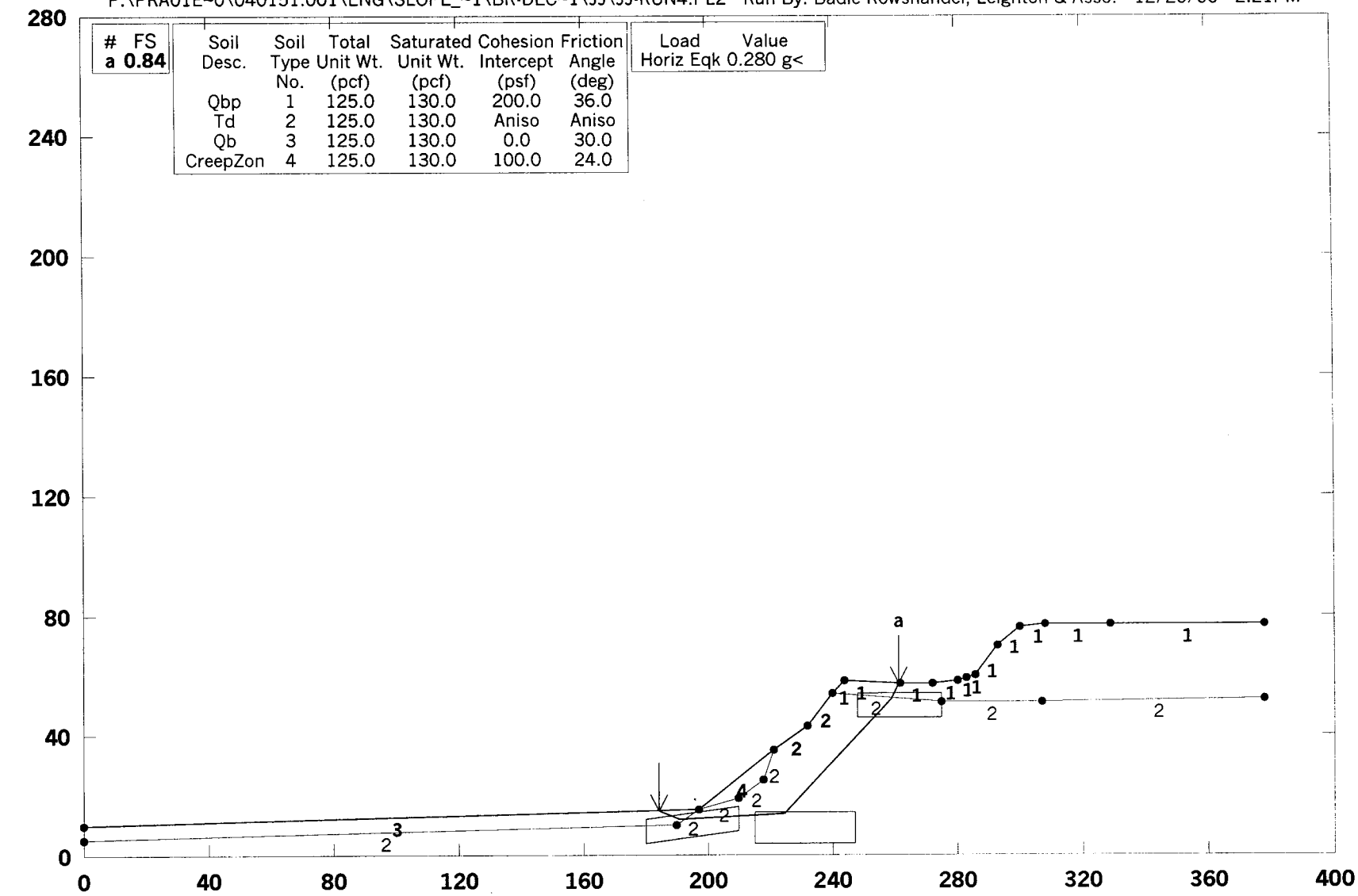
GSTABL7 FSmin=1.04

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross Section (J-J'), Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\JJ\JJ-RUN4.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 2:21PM



# FS a 0.84	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0
	CreepZon	4	125.0	130.0	100.0	24.0

Load	Value
Horiz Eqk	0.280 g<

GSTABL7 FSmin=0.84

Safety Factors Are Calculated By The Simplified Janbu Method

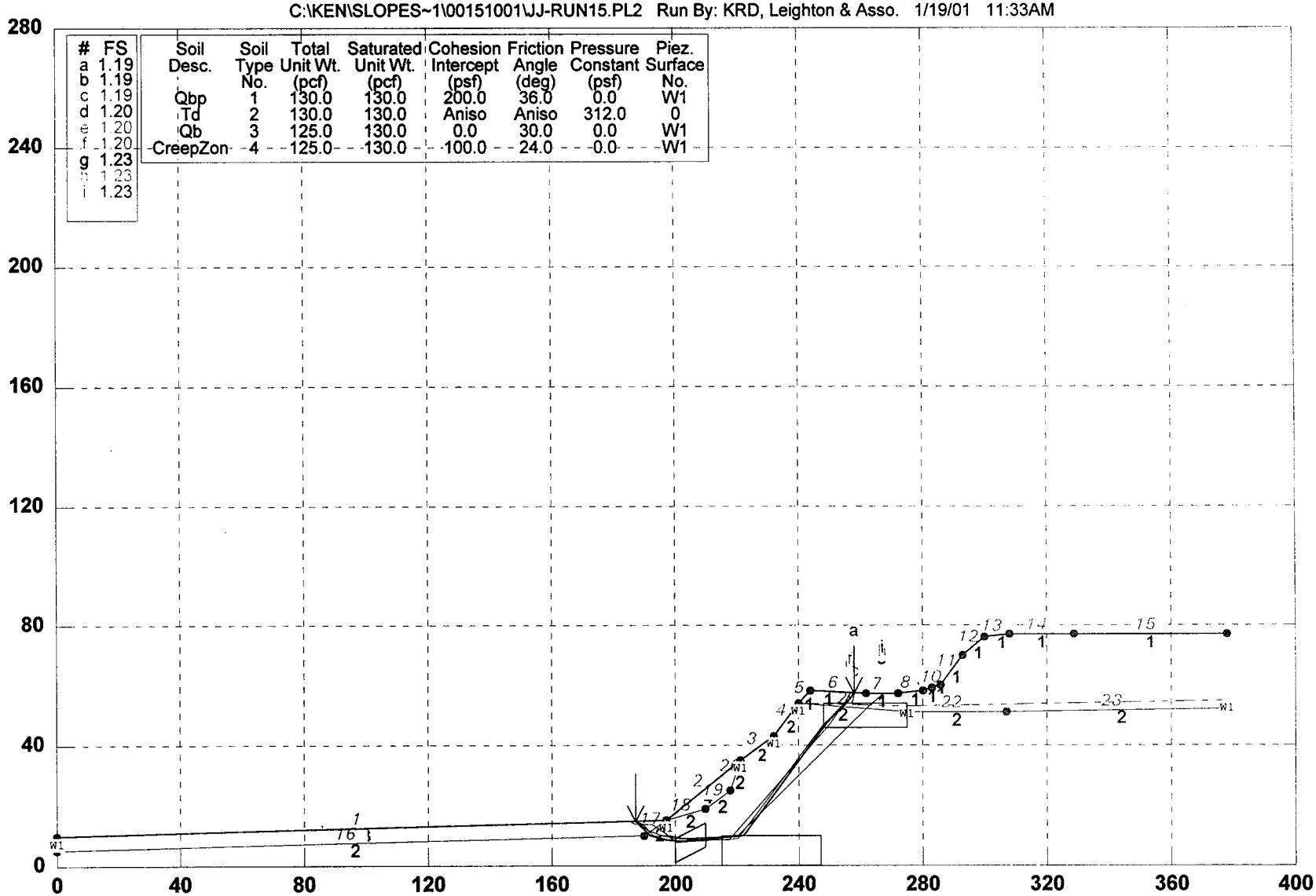
STED

Cross Section (J-J'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\JJ-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 11:33AM

#	FS
a	1.19
b	1.19
c	1.19
d	1.20
e	1.20
f	1.20
g	1.23
h	1.23
i	1.23

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
CreepZon	4	125.0	130.0	100.0	24.0	0.0	W1



GSTABL7 FSmin=1.19

Safety Factors Are Calculated By The Simplified Janbu Method

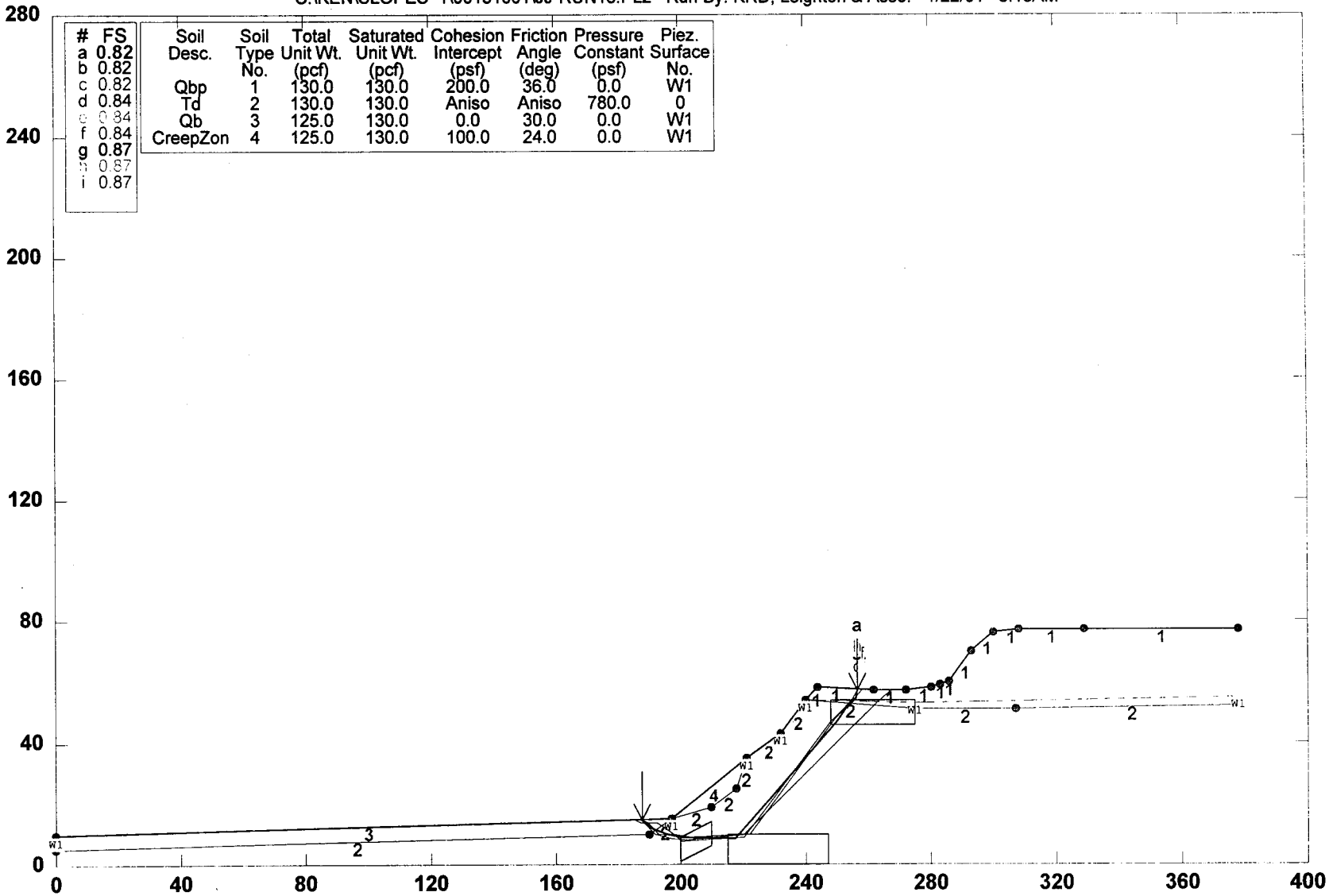
STED

Cross Section (J-J'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\JJ-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 8:18AM

#	FS
a	0.82
b	0.82
c	0.82
d	0.84
e	0.84
f	0.84
g	0.87
h	0.87
i	0.87

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
CreepZon	4	125.0	130.0	100.0	24.0	0.0	W1



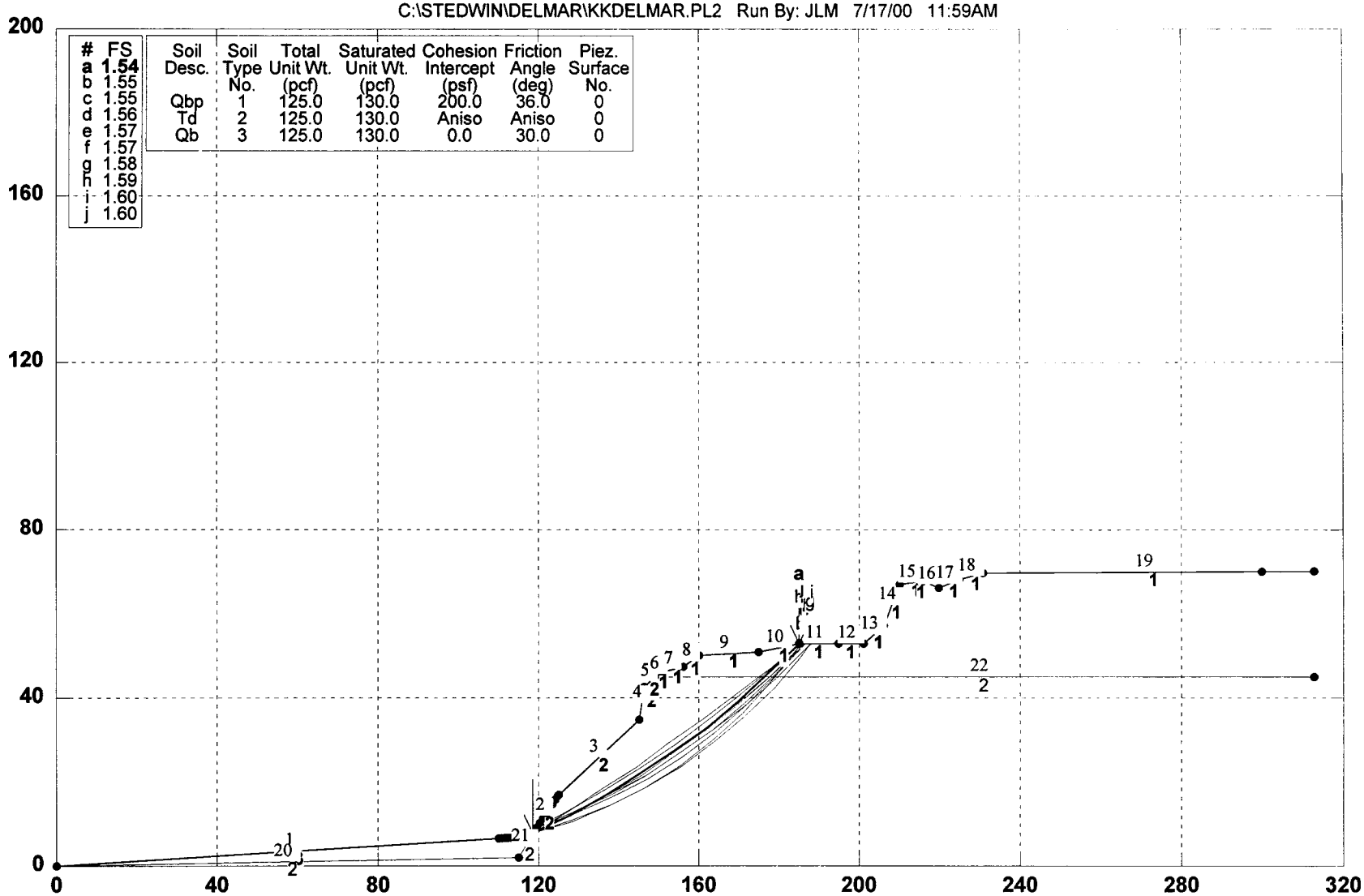
GSTABL7 FSmin=0.82

Safety Factors Are Calculated By The Simplified Janbu Method

STED

X section (K-K') Del Mar Bluffs

C:\STEDWIN\DELMAR\KKDELMAR.PL2 Run By: JLM 7/17/00 11:59AM



#	FS
a	1.54
b	1.55
c	1.55
d	1.56
e	1.57
f	1.57
g	1.58
h	1.59
i	1.60
j	1.60

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0

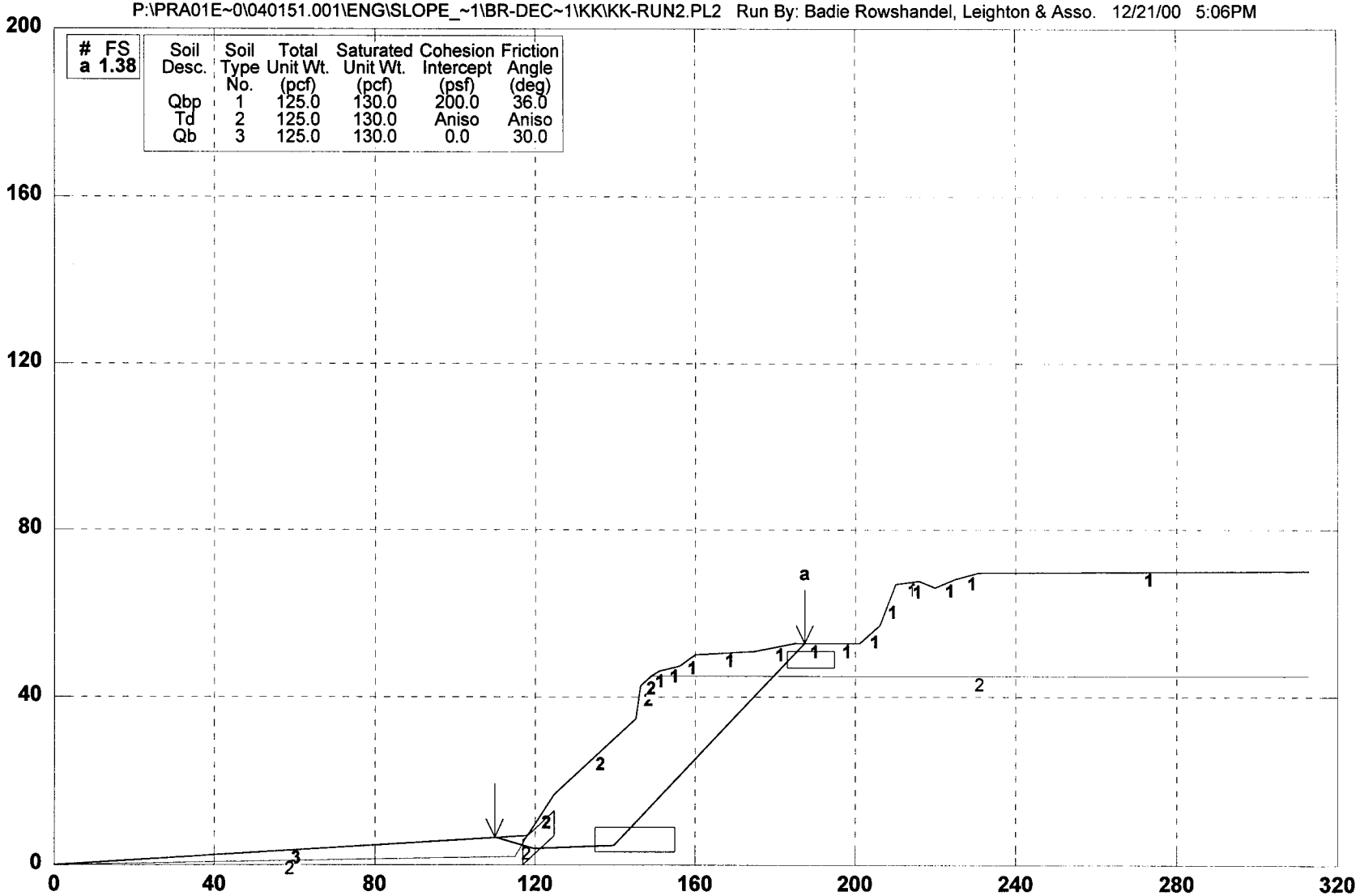
GSTABL7 FSmin=1.54

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (K-K') Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\KK\KK-RUN2.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 5:06PM



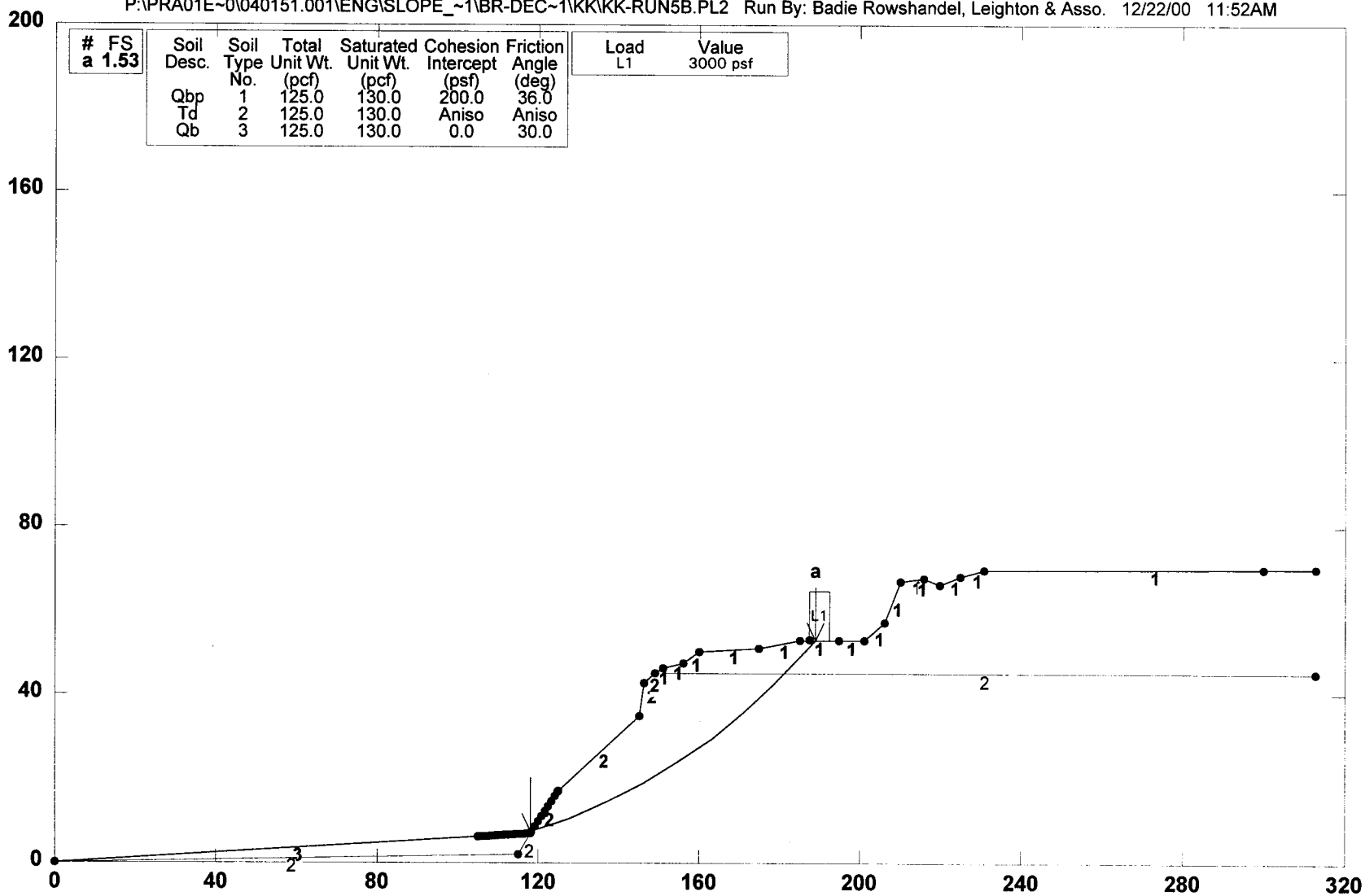
GSTABL7 FSmin=1.38

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (K-K') Del Mar Bluffs, Static w/ Surcharge

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\KK\KK-RUN5B.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/22/00 11:52AM



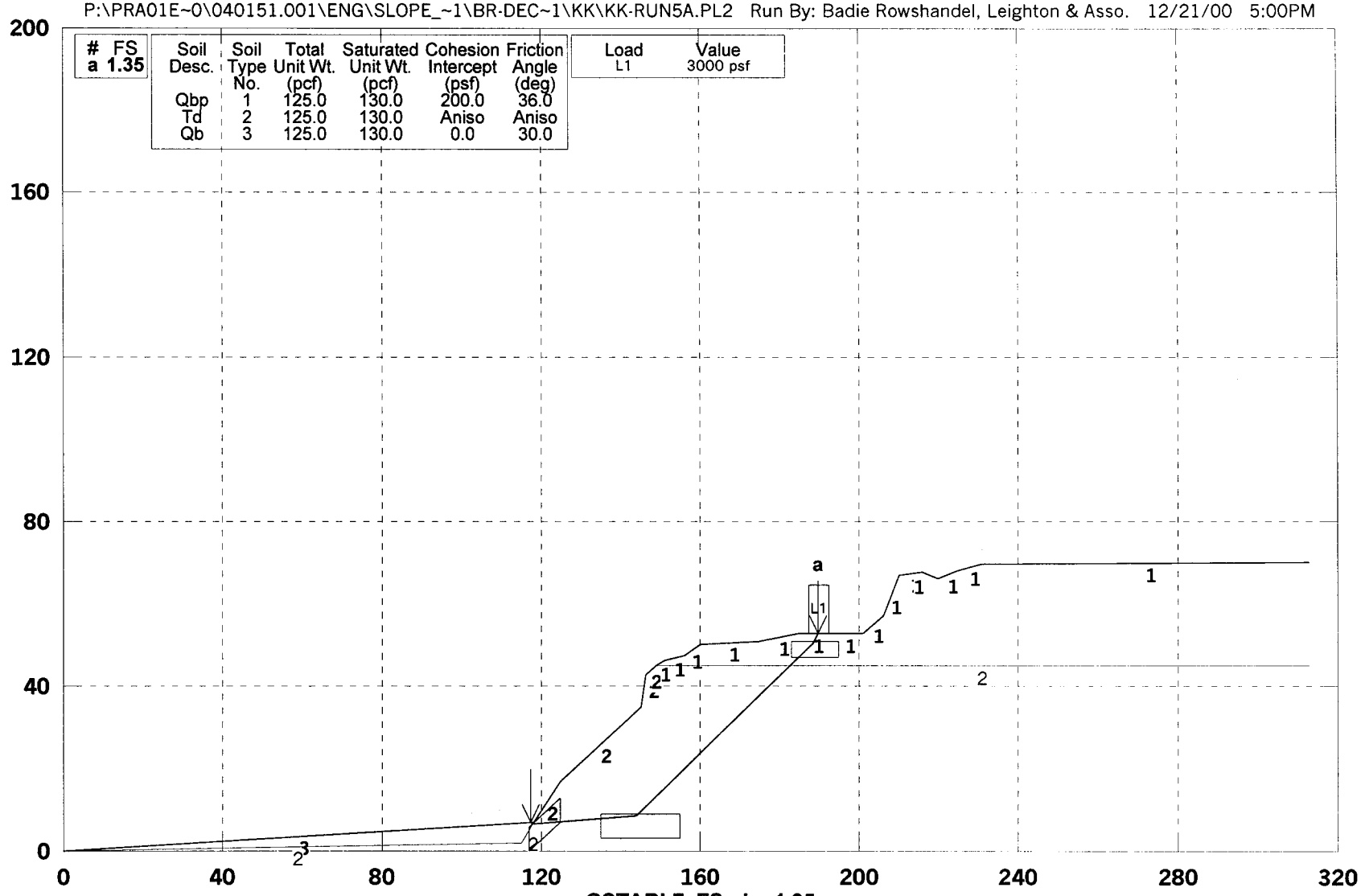
GSTABL7 FSmin=1.53

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (K-K') Del Mar Bluffs, Static w/ Surcharge

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\KK\KK-RUN5A.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 5:00PM



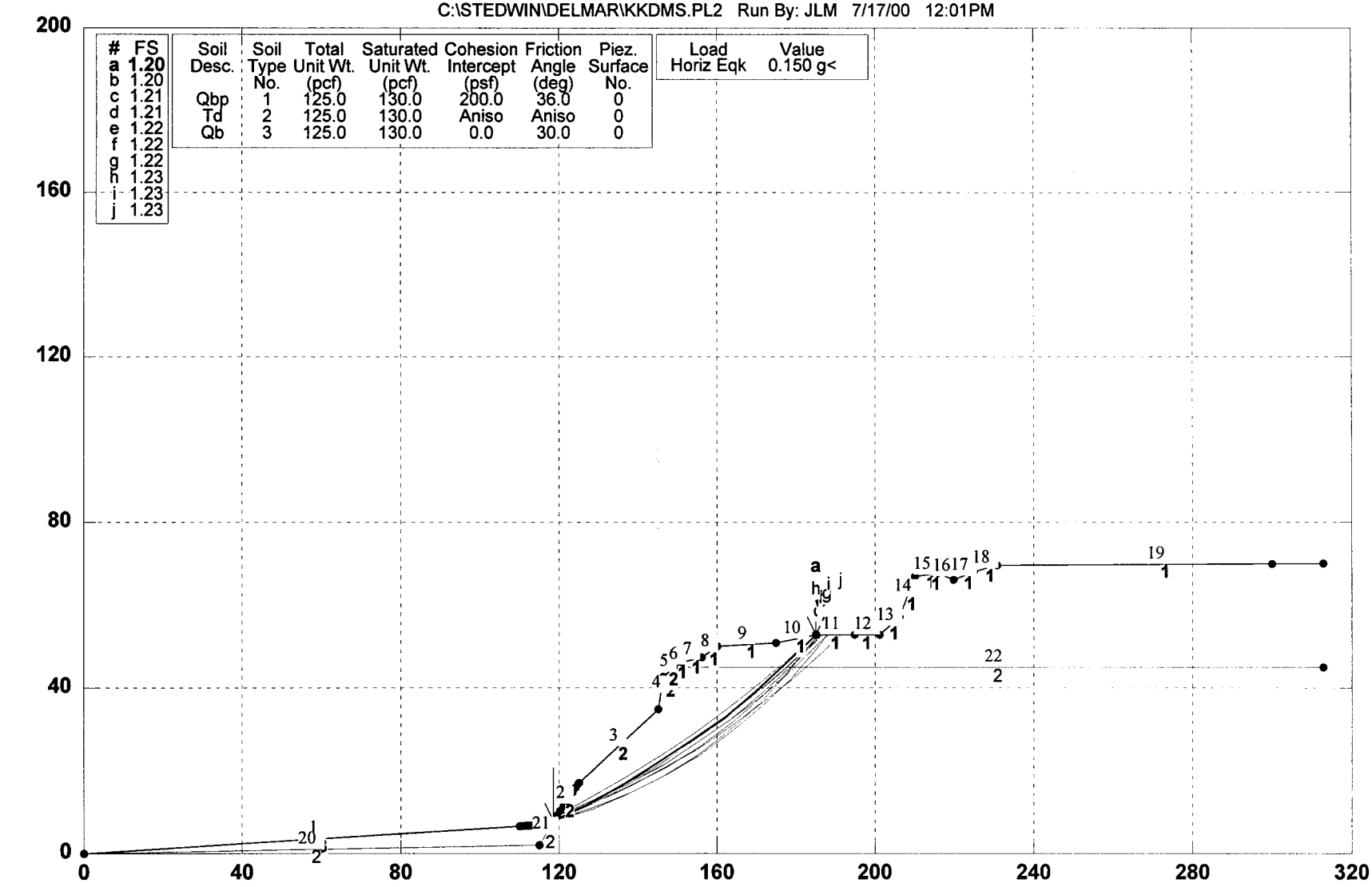
GSTABL7 FSmin=1.35

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

X section (K-K') Del Mar Bluffs, Pseudostatic

C:\STEDWIN\DELMAR\KKDMS.PL2 Run By: JLM 7/17/00 12:01PM



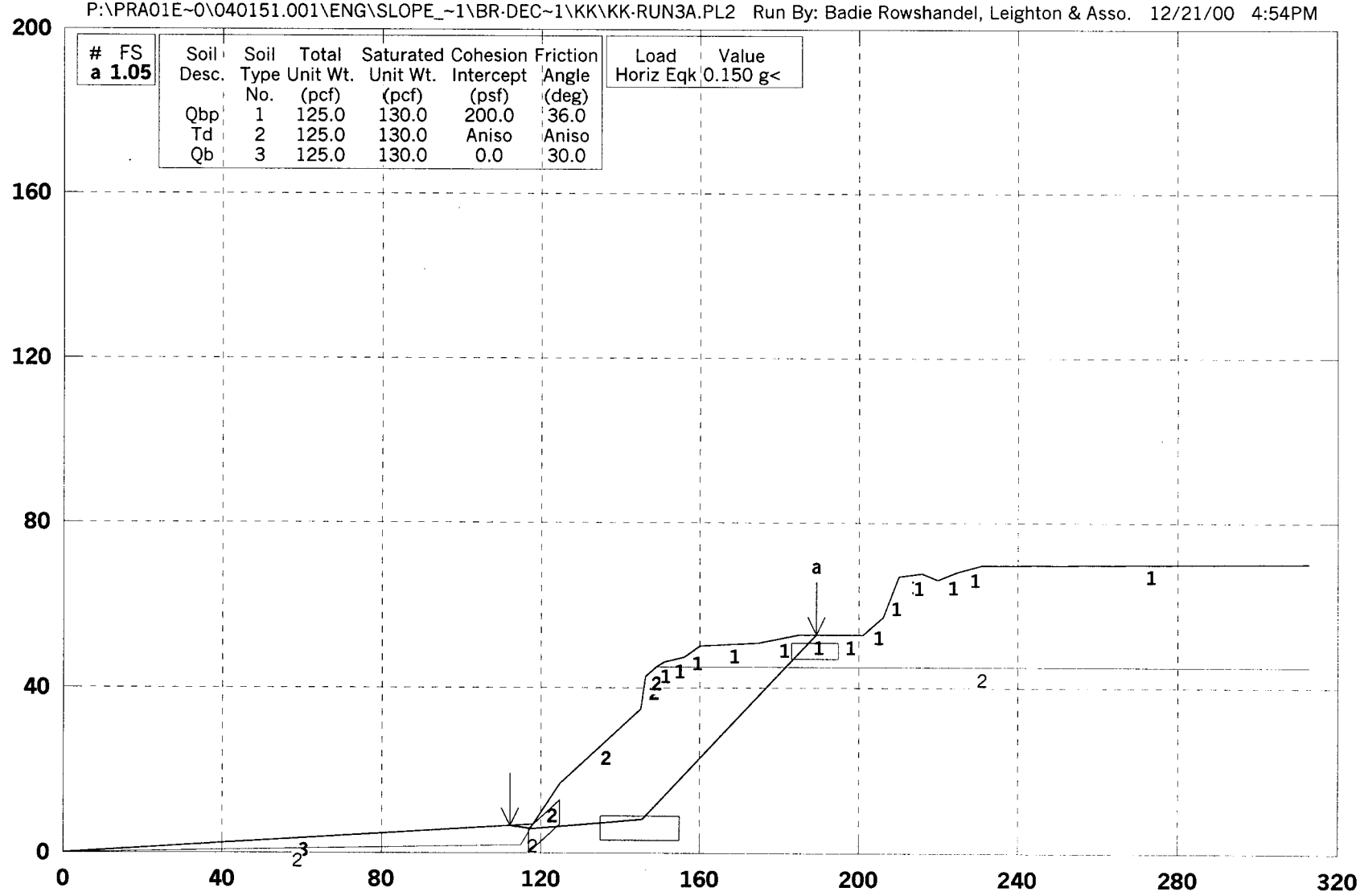
GSTABL7 FSmin=1.20

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (K-K') Del Mar Bluffs, Pseudo-Static @ 0.15

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\KK\KK-RUN3A.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 4:54PM



# FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
a 1.05	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0

Load	Value
Horiz Eqk	0.150 g<

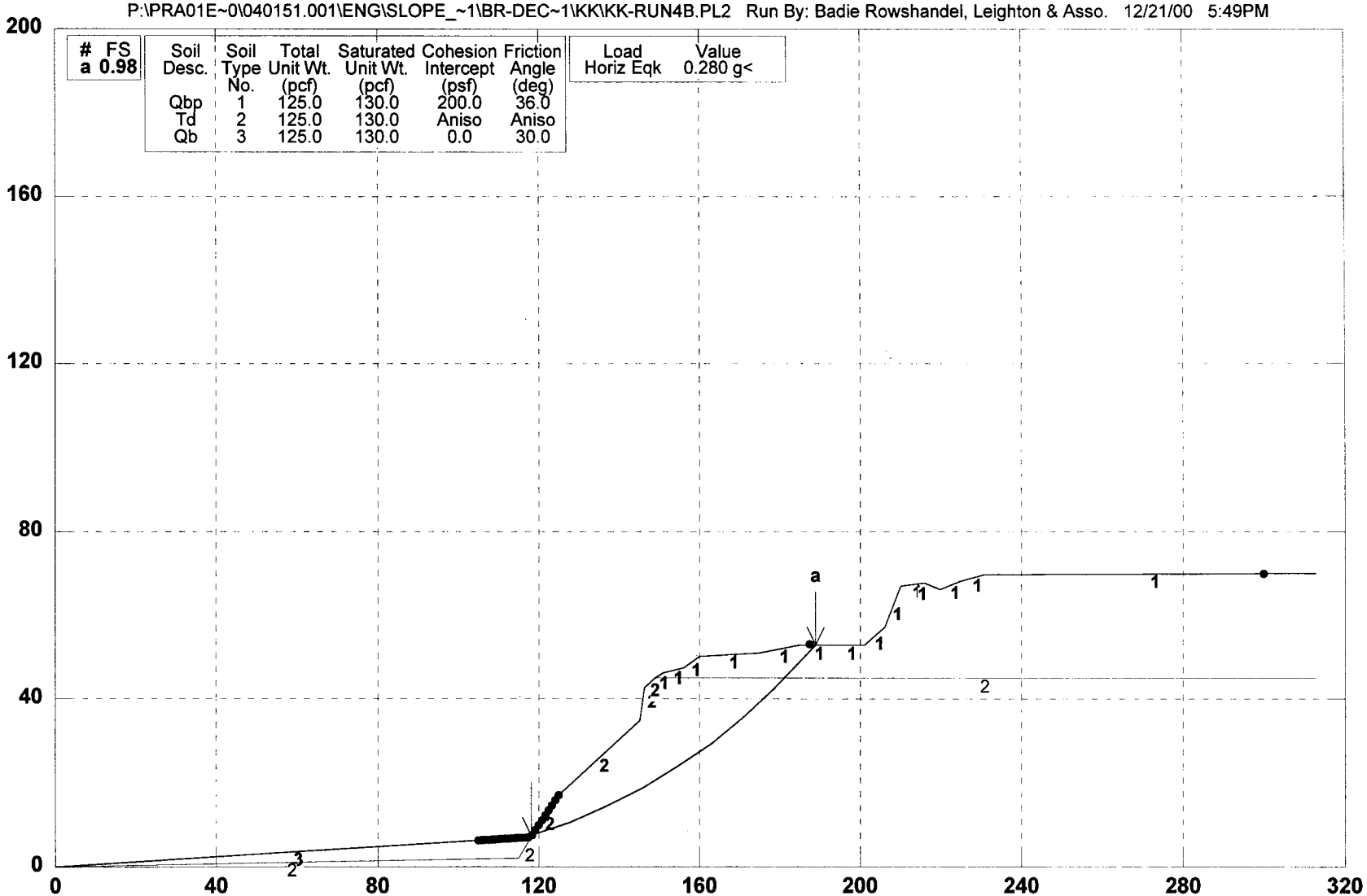
GSTABL7 FSmin=1.05

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (K-K') Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\KK\KK-RUN4B.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 5:49PM



# FS a 0.98	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0

Load	Value
Horiz Eqk	0.280 g<

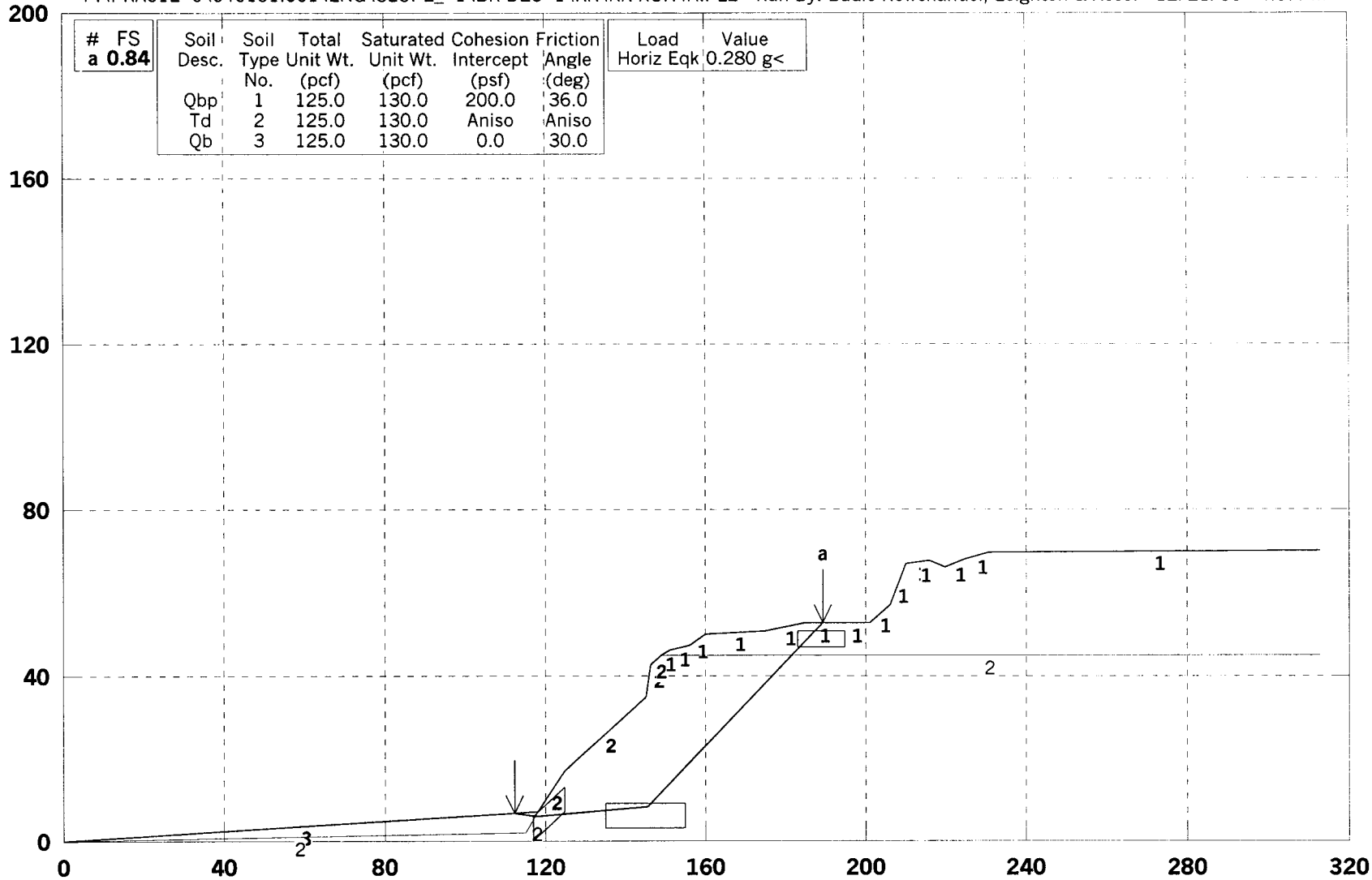
GSTABL7 FSmin=0.98

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (K-K') Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\KK\KK-RUN4A.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/21/00 4:57PM



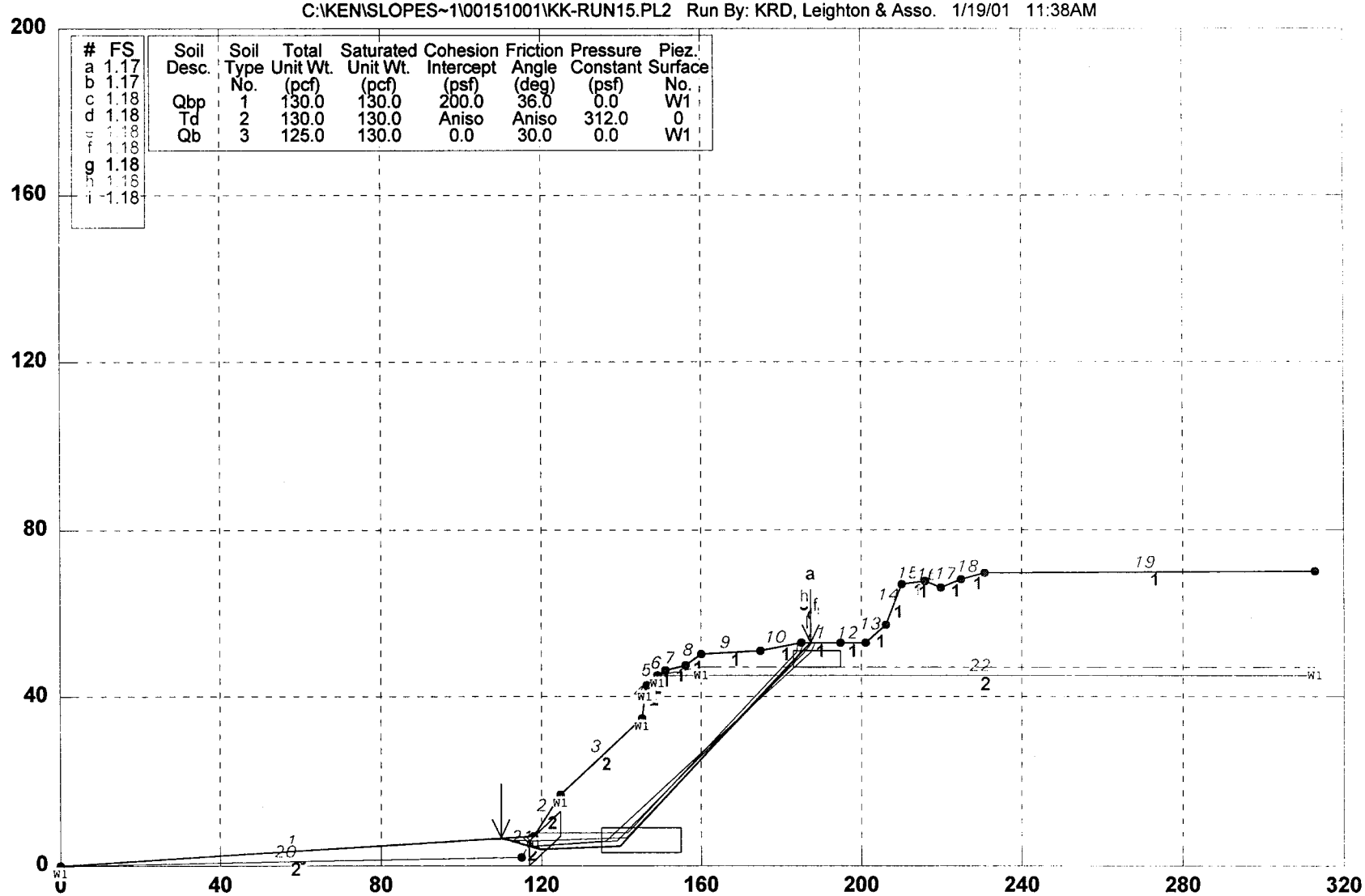
GSTABL7 FSmin=0.84

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (K-K') Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\KK-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 11:38AM



#	FS
a	1.17
b	1.17
c	1.18
d	1.18
e	1.18
f	1.18
g	1.18
h	1.18
i	1.18

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1

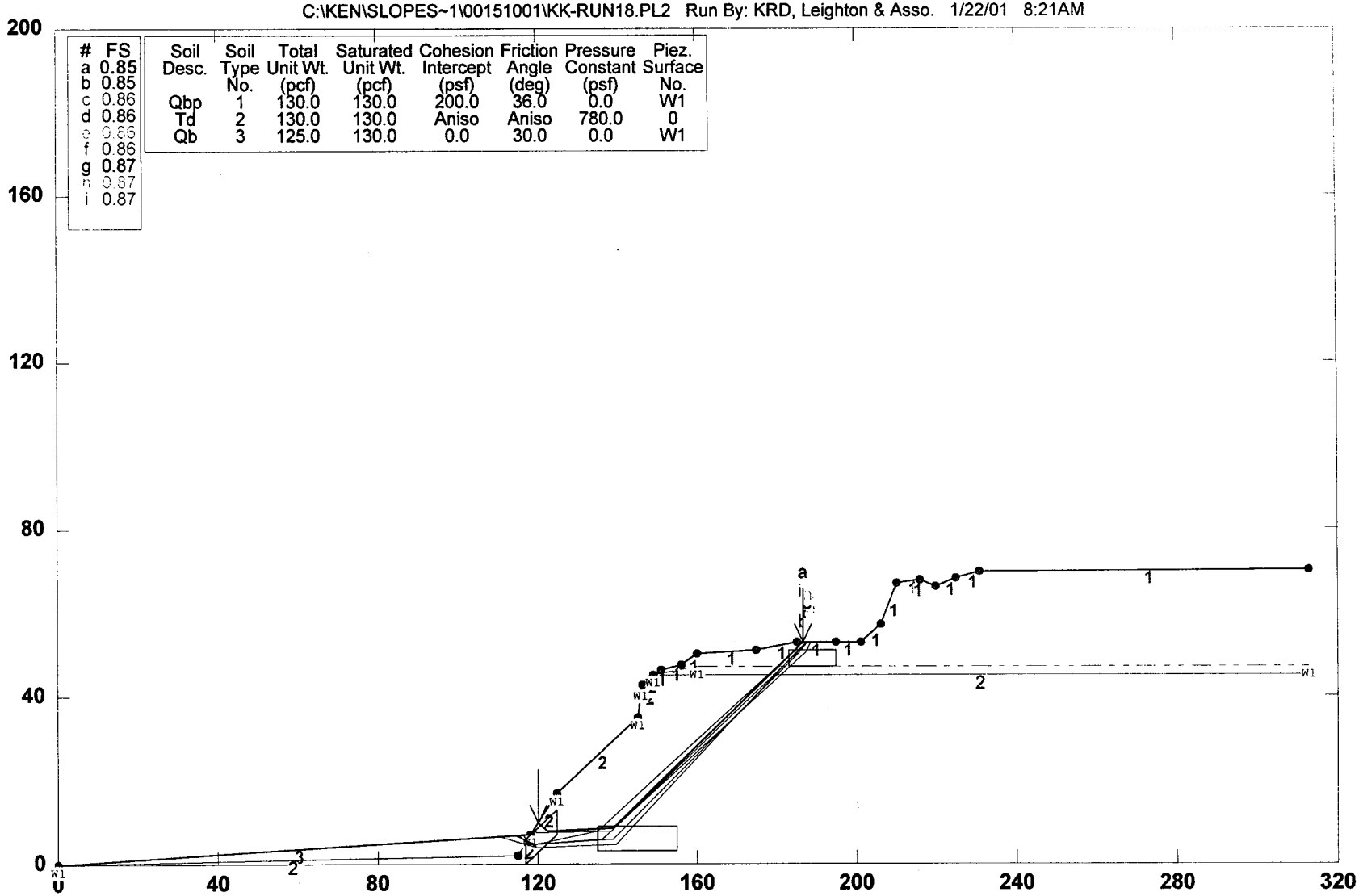
GSTABL7 FSmin=1.17

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (K-K') Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\KK-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 8:21AM



#	FS
a	0.85
b	0.85
c	0.86
d	0.86
e	0.86
f	0.86
g	0.87
h	0.87
i	0.87

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1

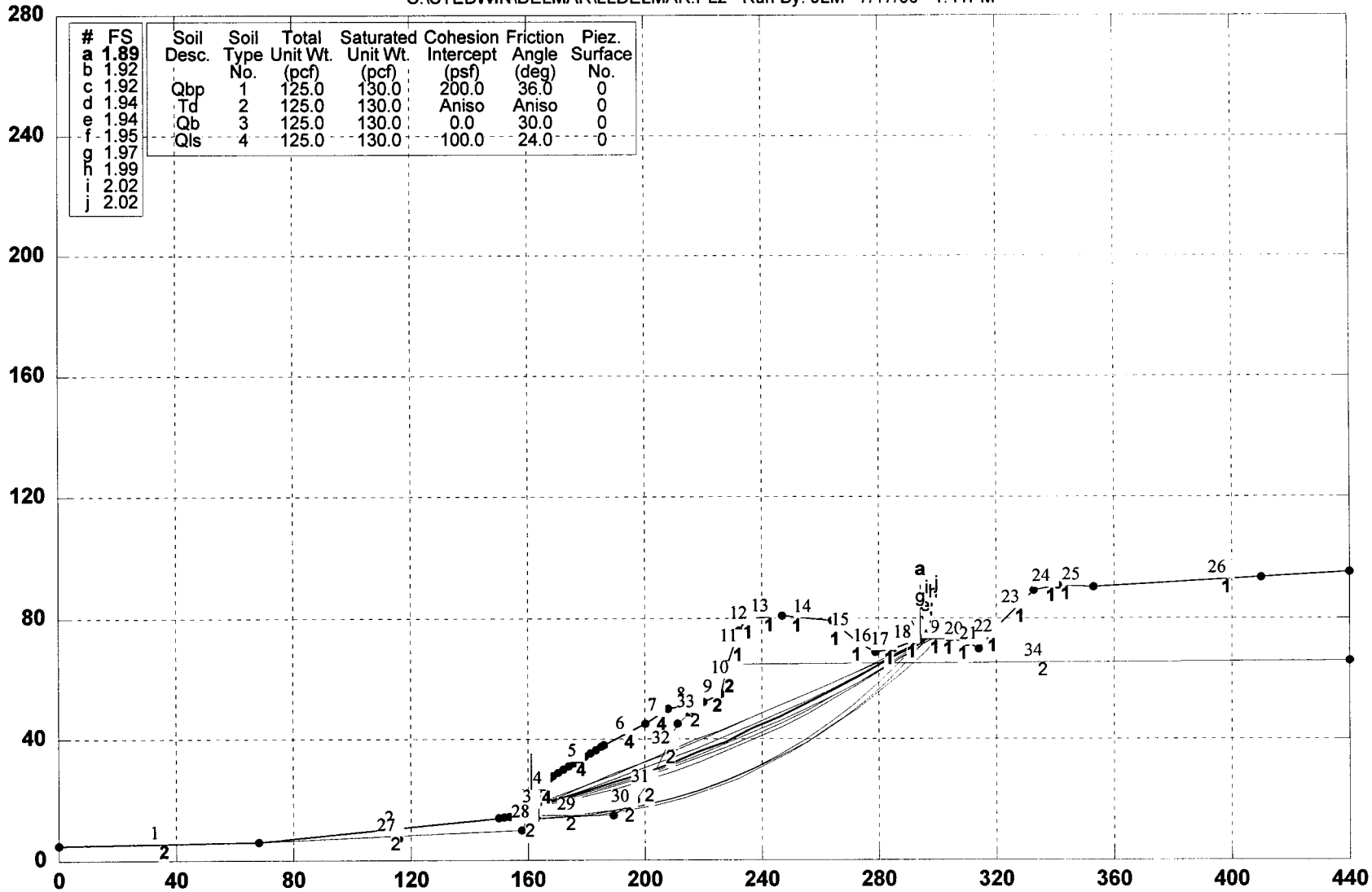
GSTABL7 FSmin=0.85

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross Section (L-L') Del Mar Bluffs

C:\STEDWIN\DELMAR\LLDELMAR.PL2 Run By: JLM 7/17/00 1:41PM



#	FS
a	1.89
b	1.92
c	1.92
d	1.94
e	1.94
f	1.95
g	1.97
h	1.99
i	2.02
j	2.02

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0

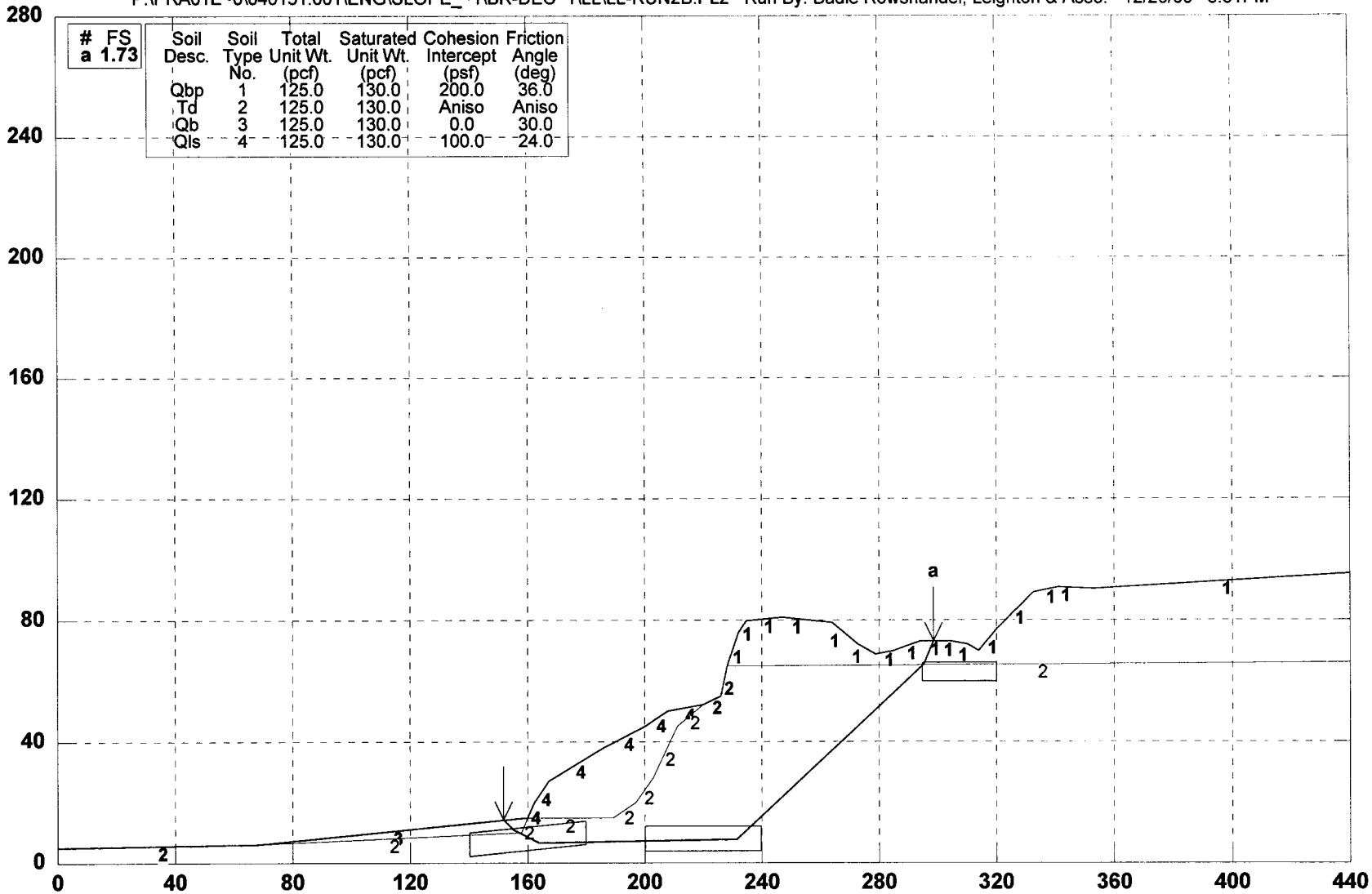
GSTABL7 FSmin=1.89

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (L-L') Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\LL\LL-RUN2B.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 5:31PM



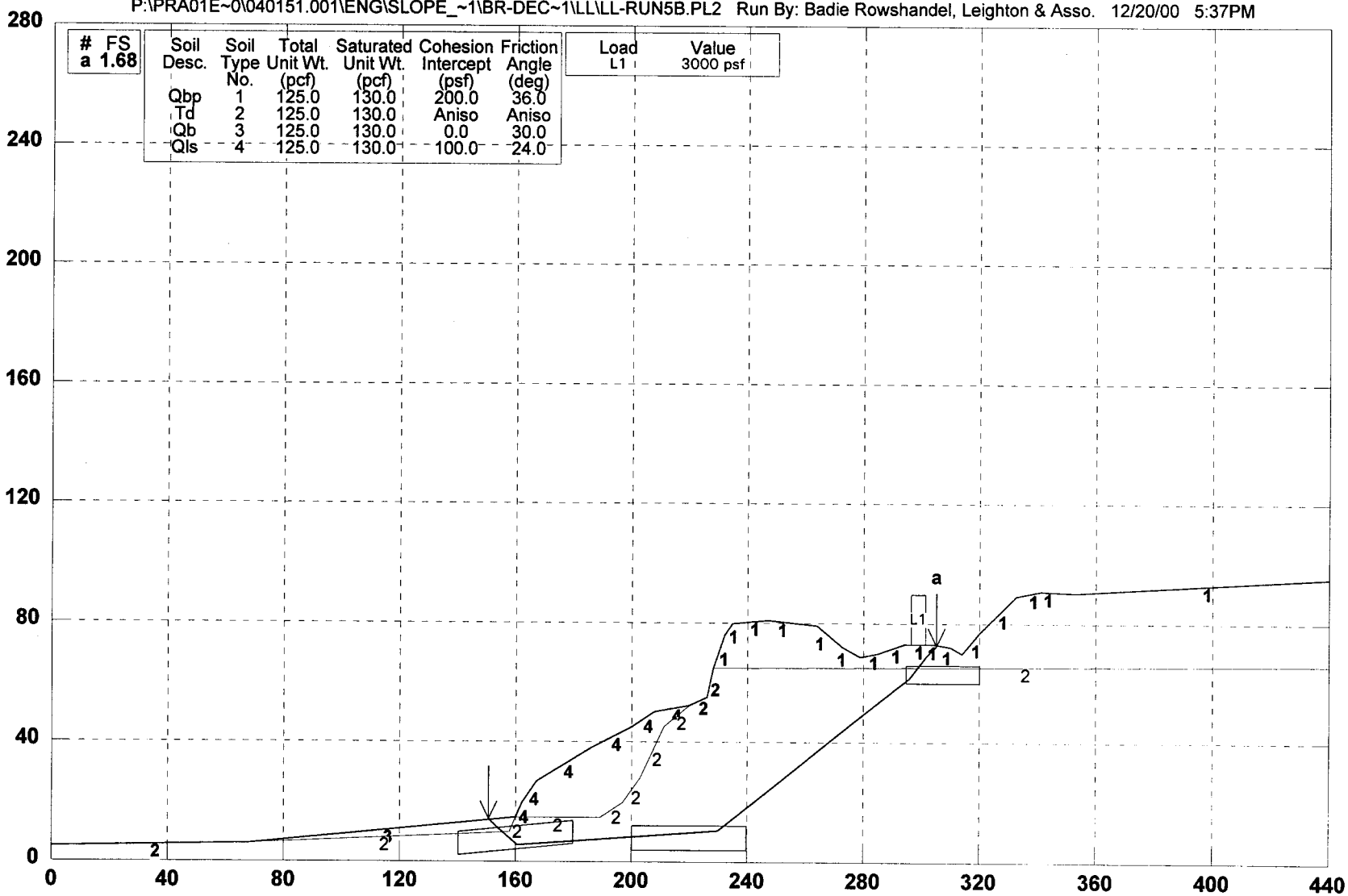
GSTABL7 FSmin=1.73

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross Section (L-L') Del Mar Bluffs, Static w/ Surcharge

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\LL\LL-RUN5B.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 5:37PM



GSTABL7 FSmin=1.68

Safety Factors Are Calculated By The Simplified Janbu Method

STED

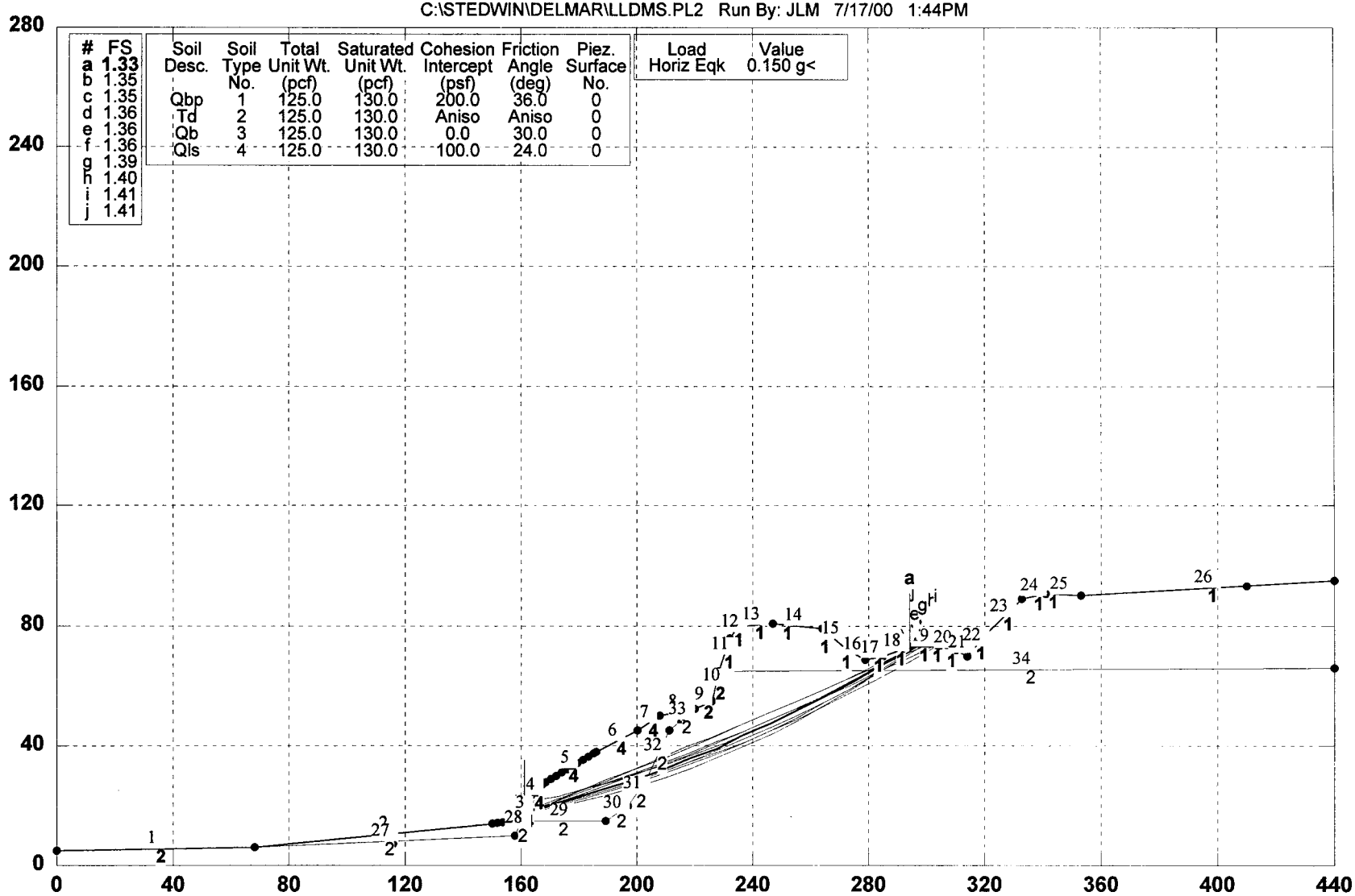
Cross Section (L-L') Del Mar Bluffs, Pseudostatic

C:\STEDWIN\DELMAR\LLDMS.PL2 Run By: JLM 7/17/00 1:44PM

#	FS
a	1.33
b	1.35
c	1.35
d	1.36
e	1.36
f	1.36
g	1.39
h	1.40
i	1.41
j	1.41

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0

Load	Value
Horiz Eqk	0.150 g<



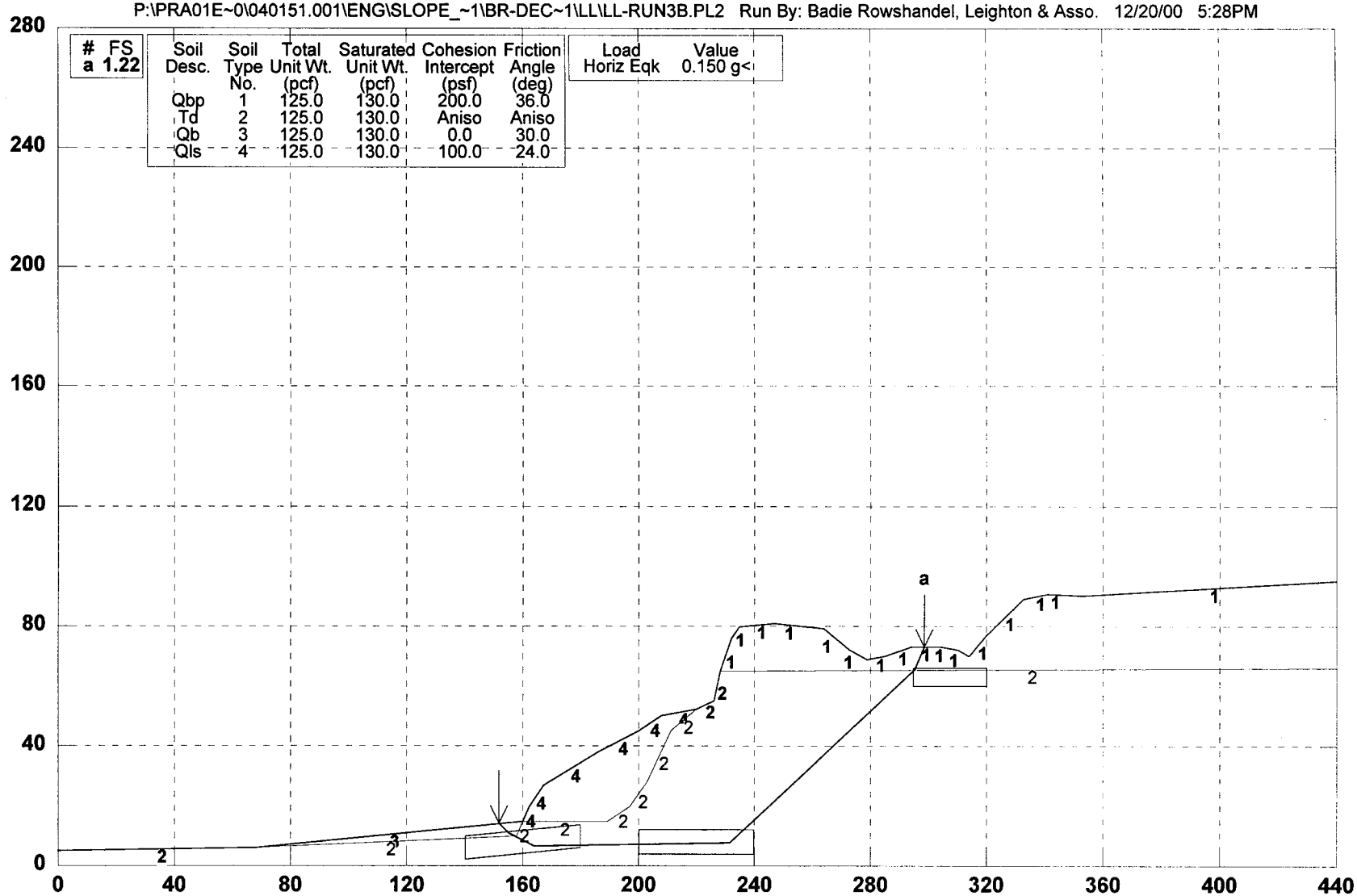
GSTABL7 FSmin=1.33

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross Section (L-L') Del Mar Bluffs, Pseudo-Static @ 0.15

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\LL\LL-RUN3B.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 5:28PM



# FS a 1.22	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0
	Qls	4	125.0	130.0	100.0	24.0

Load	Value
Horiz Eqk	0.150 g<

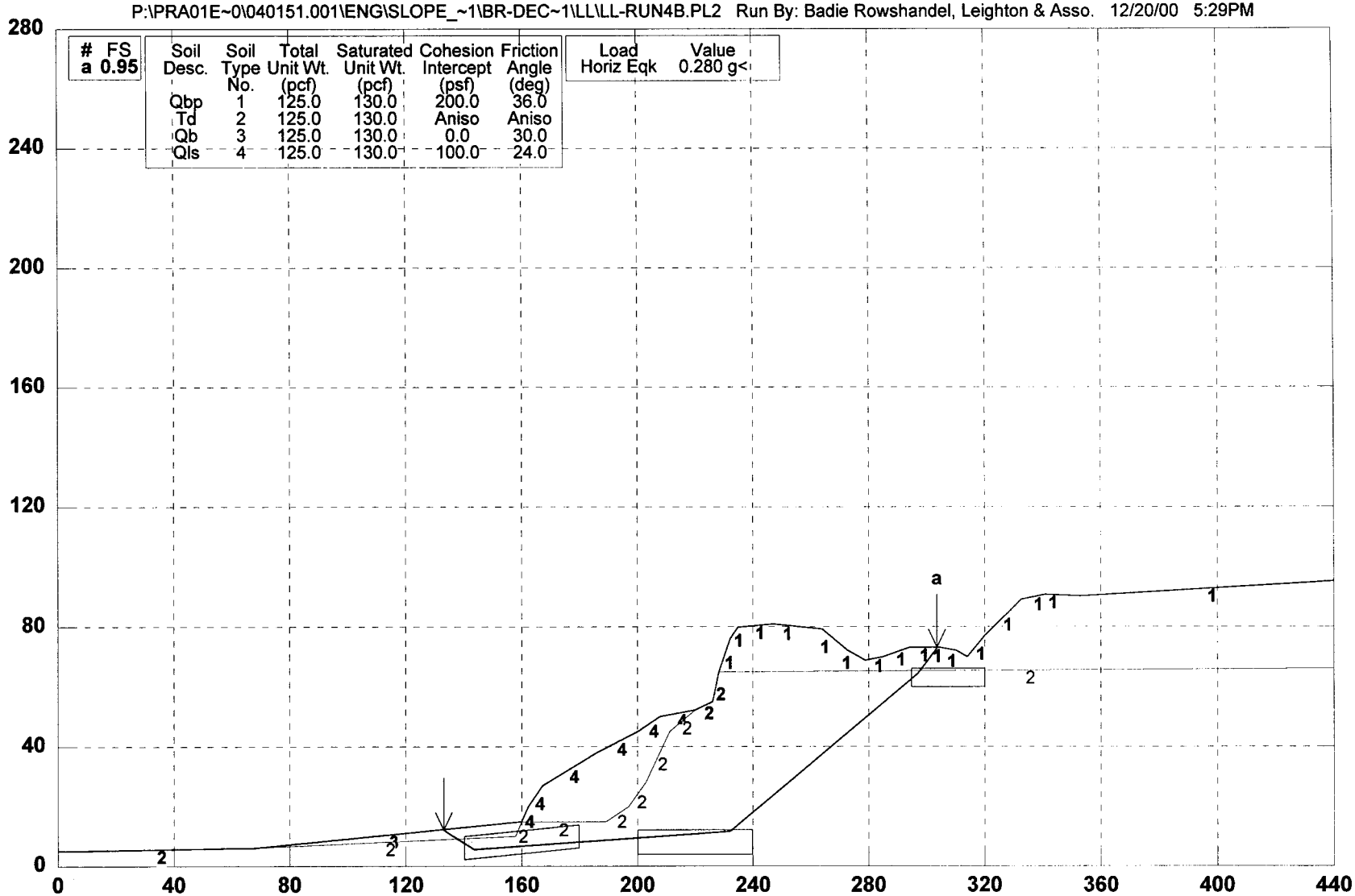
GSTABL7 FSmin=1.22

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross Section (L-L') Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\LL\LL-RUN4B.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 5:29PM



GSTABL7 FSmin=0.95

Safety Factors Are Calculated By The Simplified Janbu Method

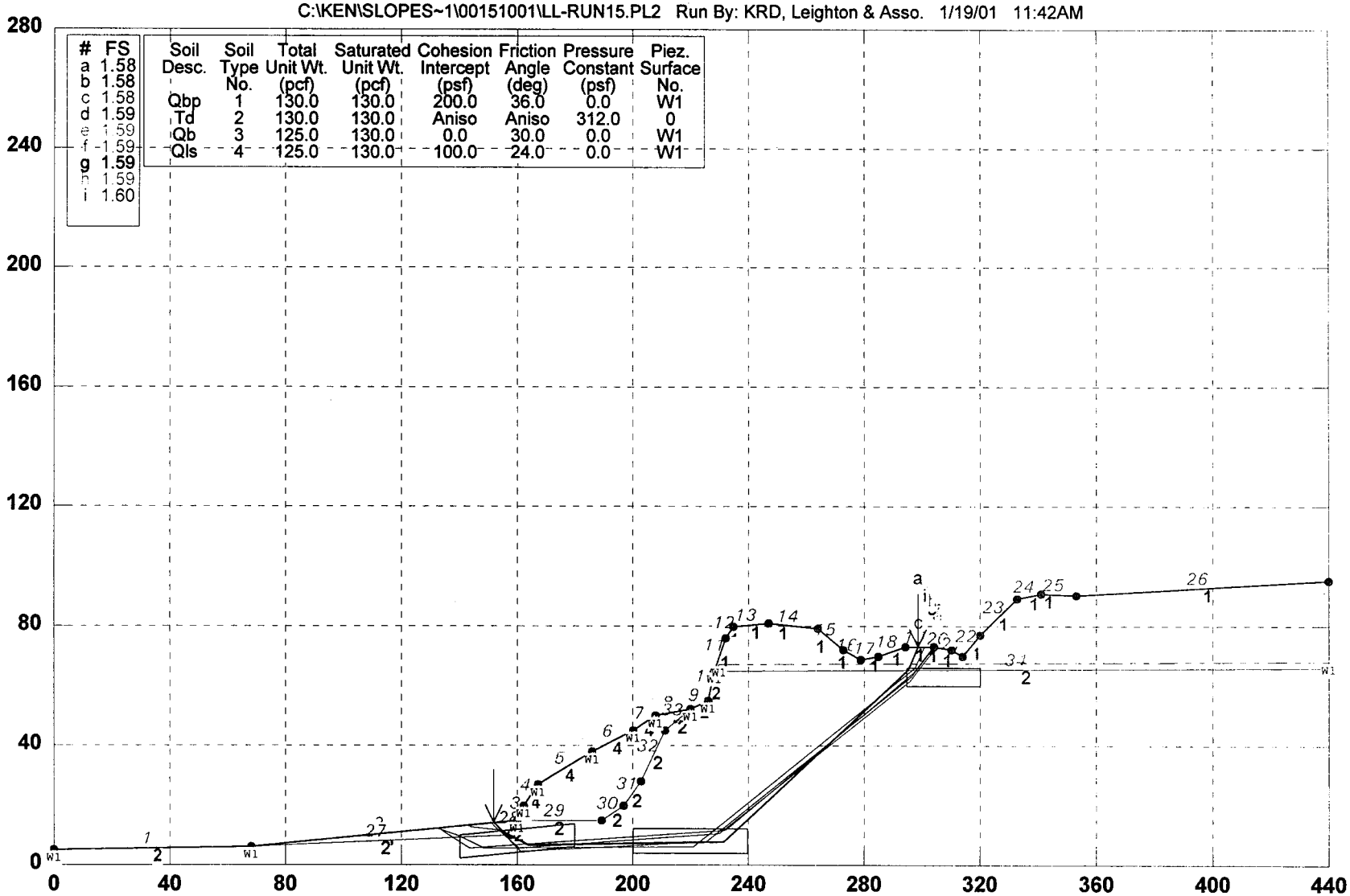
STED

Cross Section (L-L') Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\LL-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 11:42AM

#	FS
a	1.58
b	1.58
c	1.58
d	1.59
e	1.59
f	1.59
g	1.59
h	1.59
i	1.60

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1



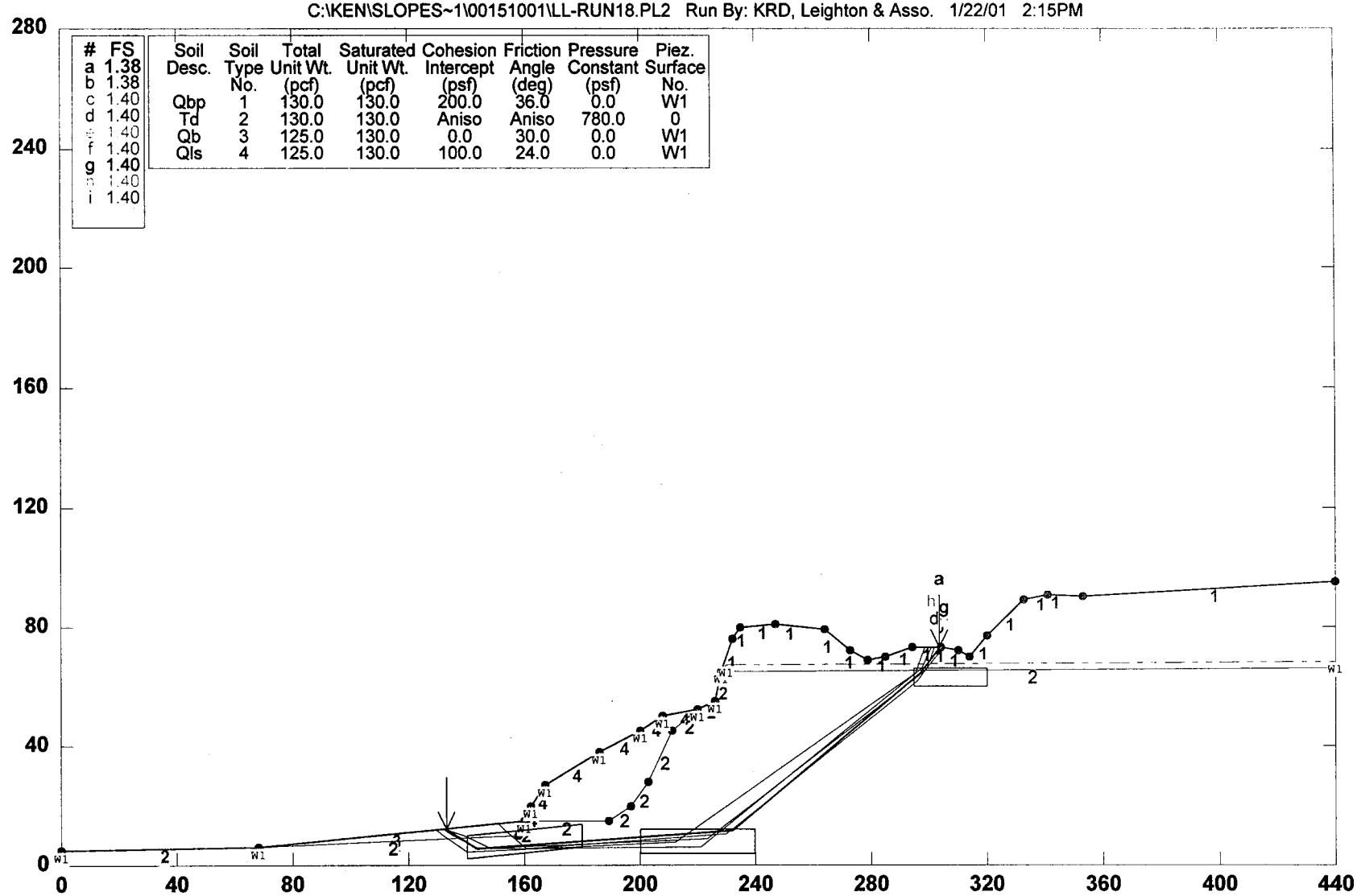
GSTABL7 FSmin=1.58

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross Section (L-L') Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\LL-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 2:15PM



#	FS
a	1.38
b	1.38
c	1.40
d	1.40
e	1.40
f	1.40
g	1.40
h	1.40
i	1.40

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1

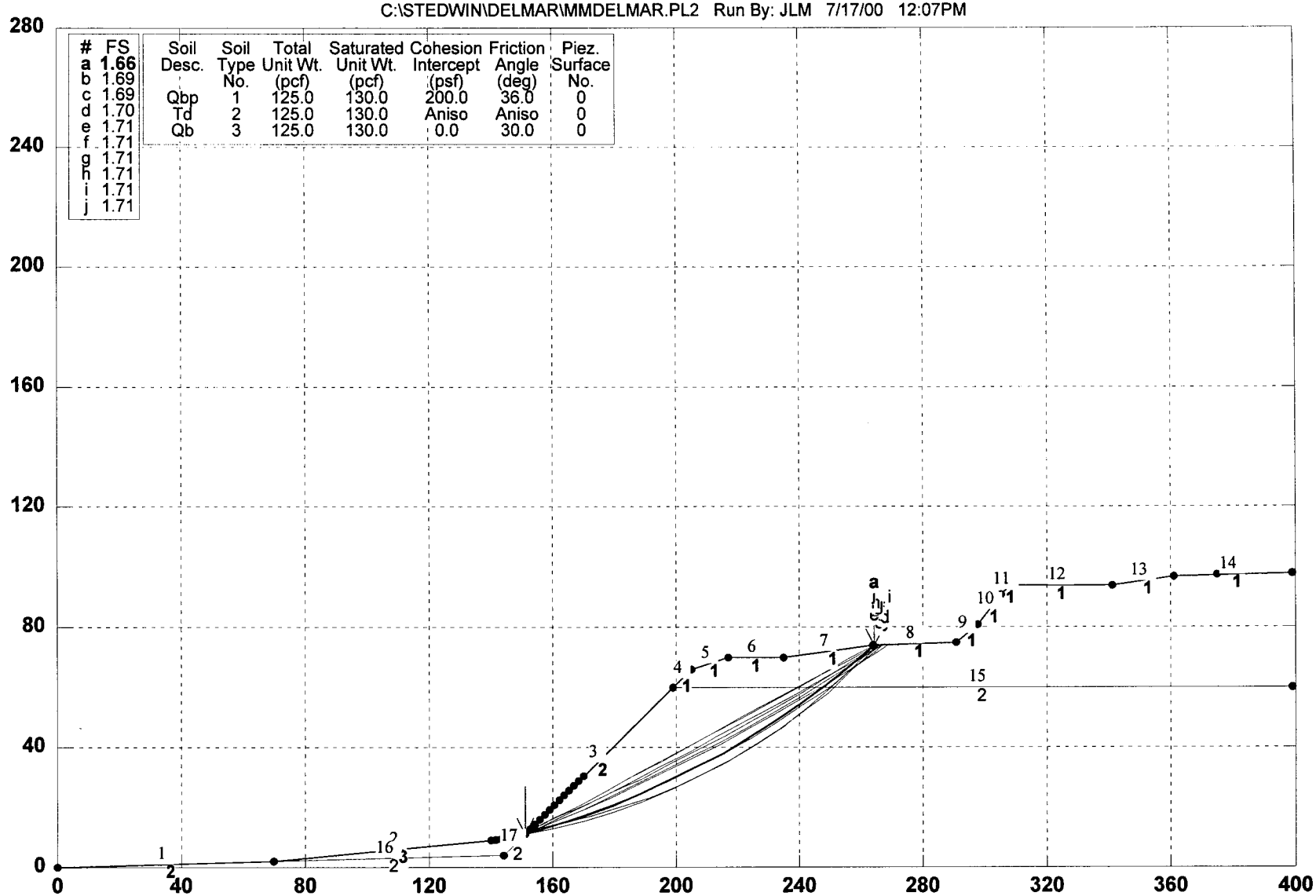
GSTABL7 FSmin=1.38

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross-Section (M-M'), Del Mar Bluffs

C:\STEDWIN\DELMAR\MMDELMAR.PL2 Run By: JLM 7/17/00 12:07PM



#	FS
a	1.66
b	1.69
c	1.69
d	1.70
e	1.71
f	1.71
g	1.71
h	1.71
i	1.71
j	1.71

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0

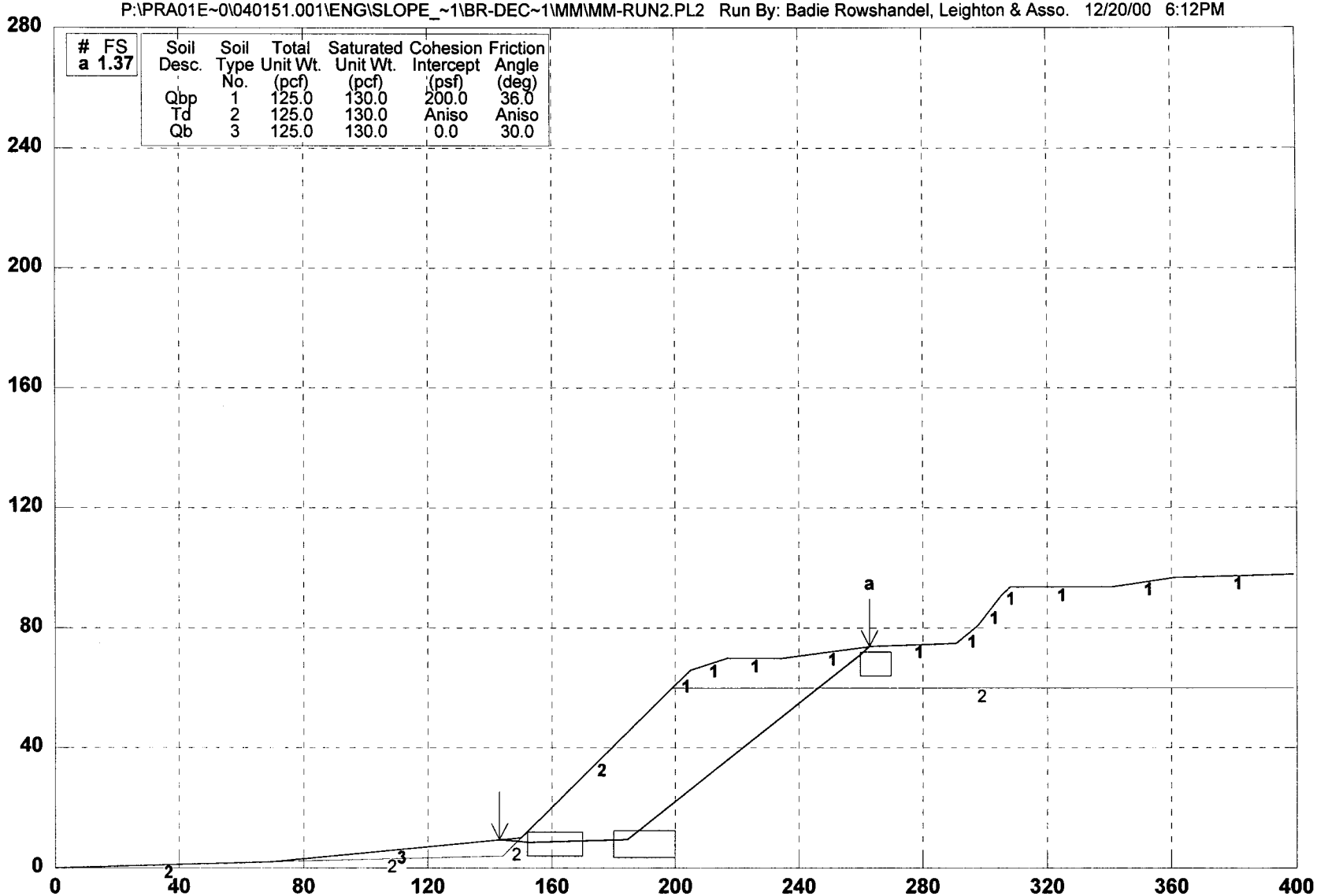
GSTABL7 FSmin=1.66

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (M-M'), Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\MM\MM-RUN2.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 6:12PM



# FS a 1.37	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
	Qbp	1	125.0	130.0	200.0	36.0
	Td	2	125.0	130.0	Aniso	Aniso
	Qb	3	125.0	130.0	0.0	30.0

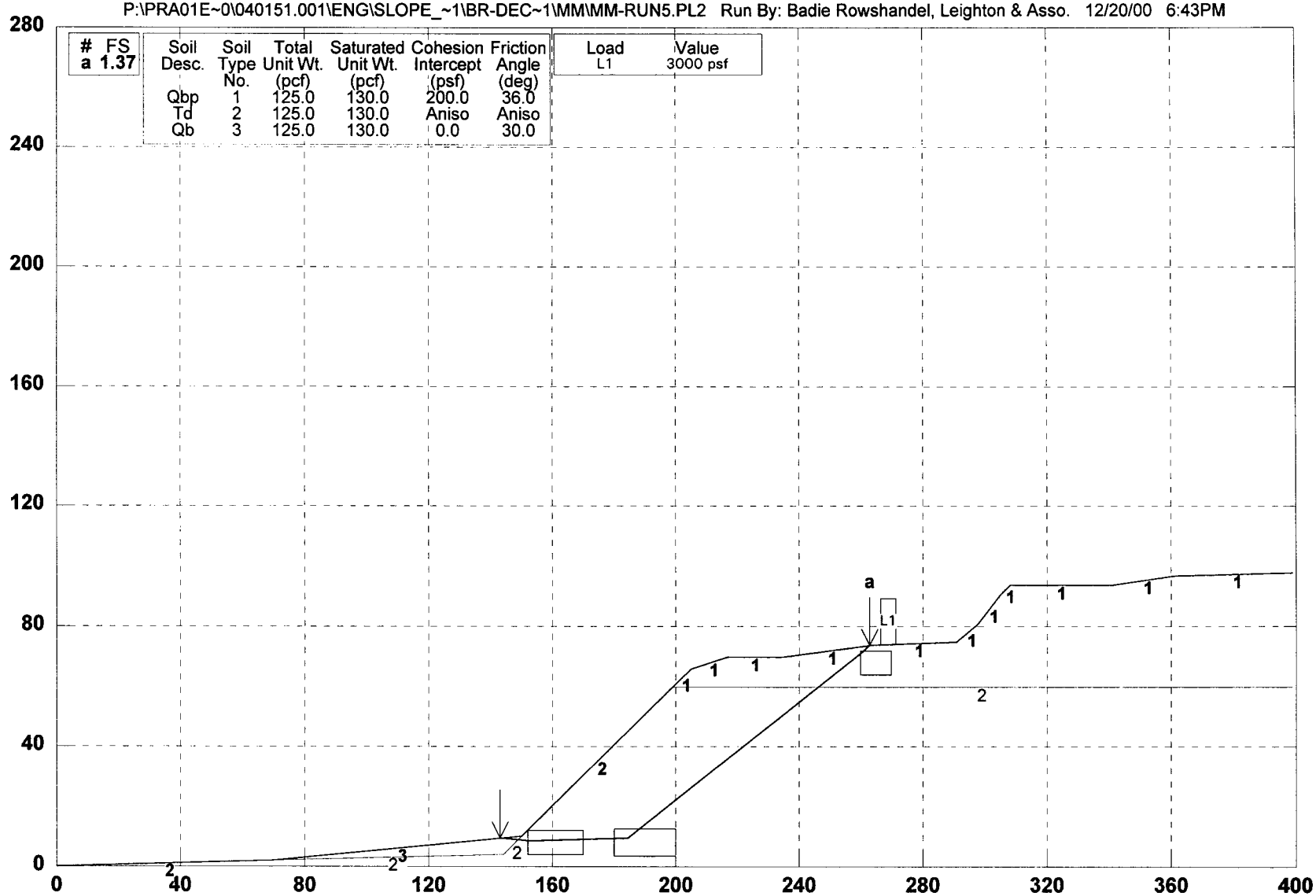
GSTABL7 FSmin=1.37

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross-Section (M-M'), Del Mar Bluffs, Static w/ Surcharge

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\MM\MM-RUN5.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 6:43PM



GSTABL7 FSmin=1.37

Safety Factors Are Calculated By The Simplified Janbu Method

STED

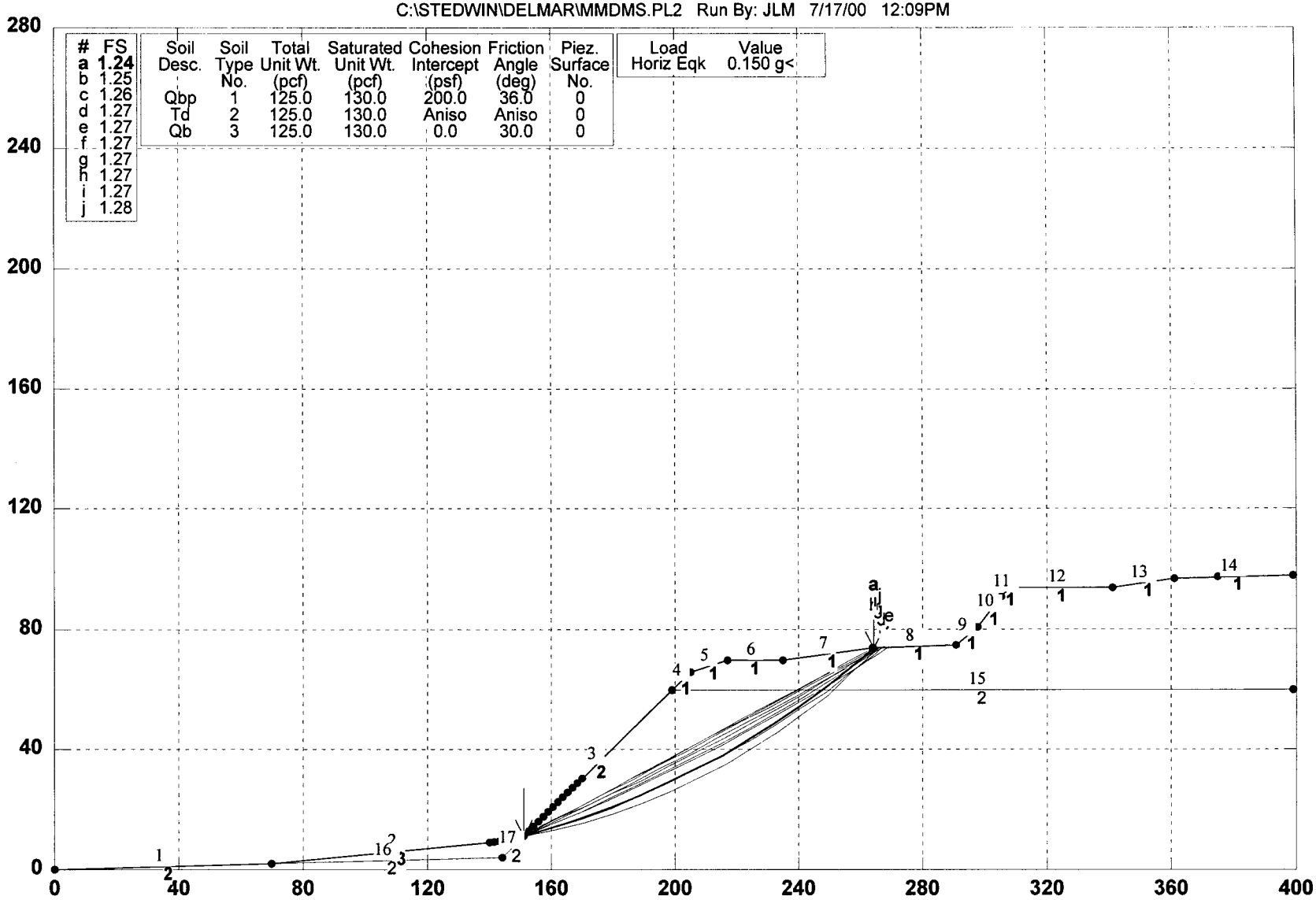
Cross-Section (M-M'), Del Mar Bluffs, Pseudostatic

C:\STEDWIN\DELMAR\MMDMS.PL2 Run By: JLM 7/17/00 12:09PM

#	FS
a	1.24
b	1.25
c	1.26
d	1.27
e	1.27
f	1.27
g	1.27
h	1.27
i	1.27
j	1.28

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0

Load	Value
Horiz Eqk	0.150 g<



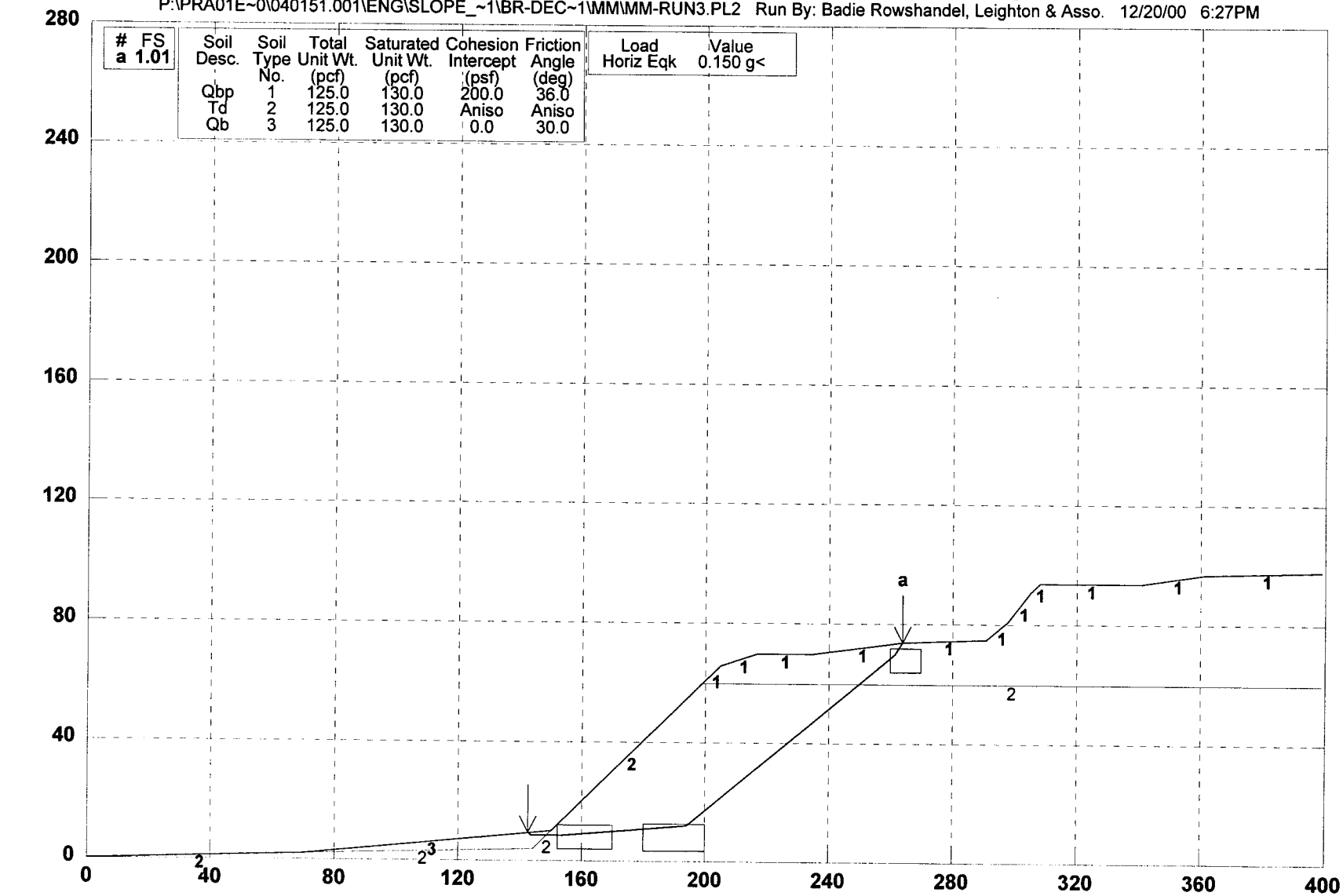
GSTABL7 FSmin=1.24

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (M-M'), Del Mar Bluffs, Pseudo-Static @ 0.15

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\MM\MM-RUN3.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 6:27PM



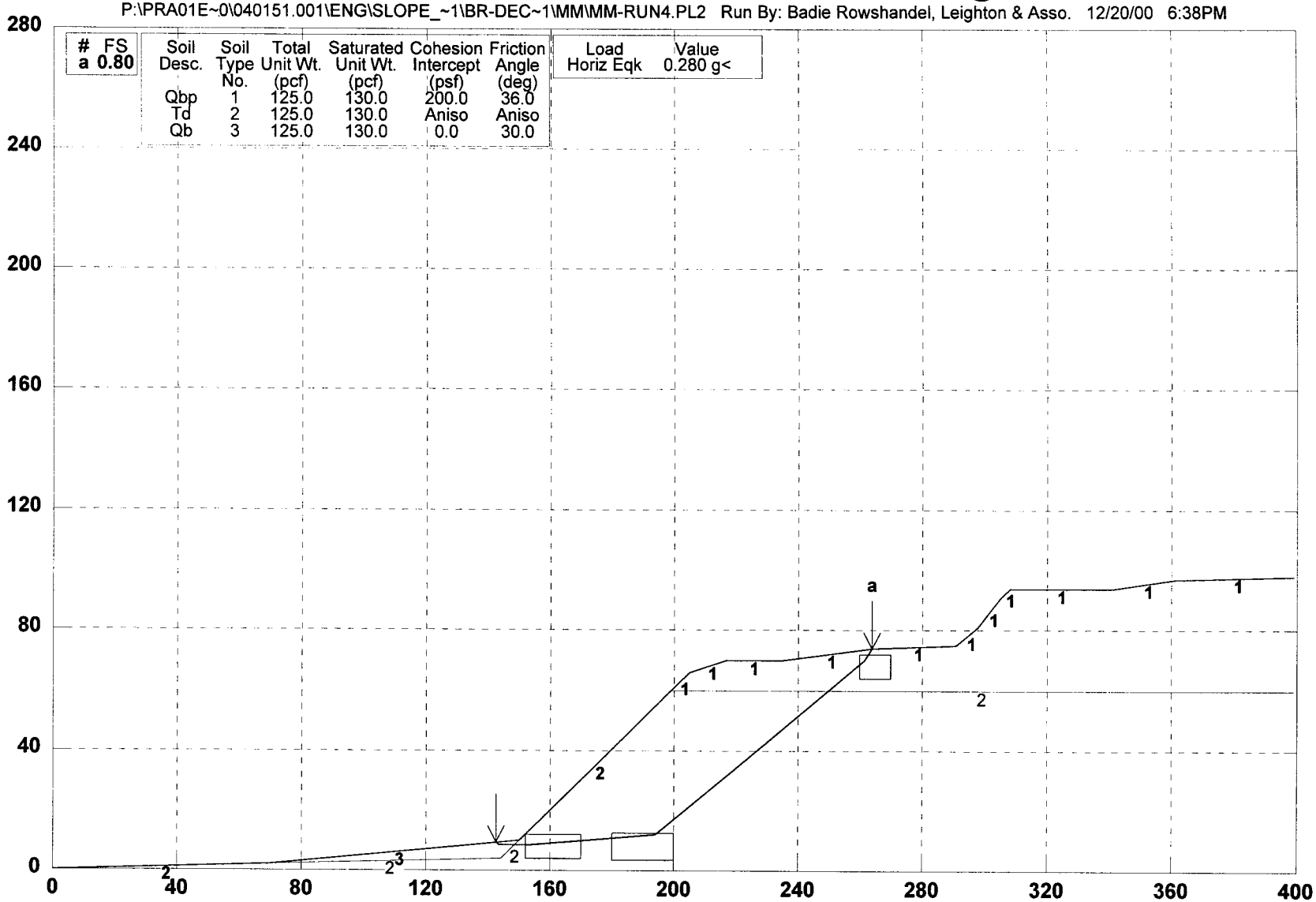
GSTABL7 FSmin=1.01

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross-Section (M-M'), Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\MM\MM-RUN4.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/20/00 6:38PM



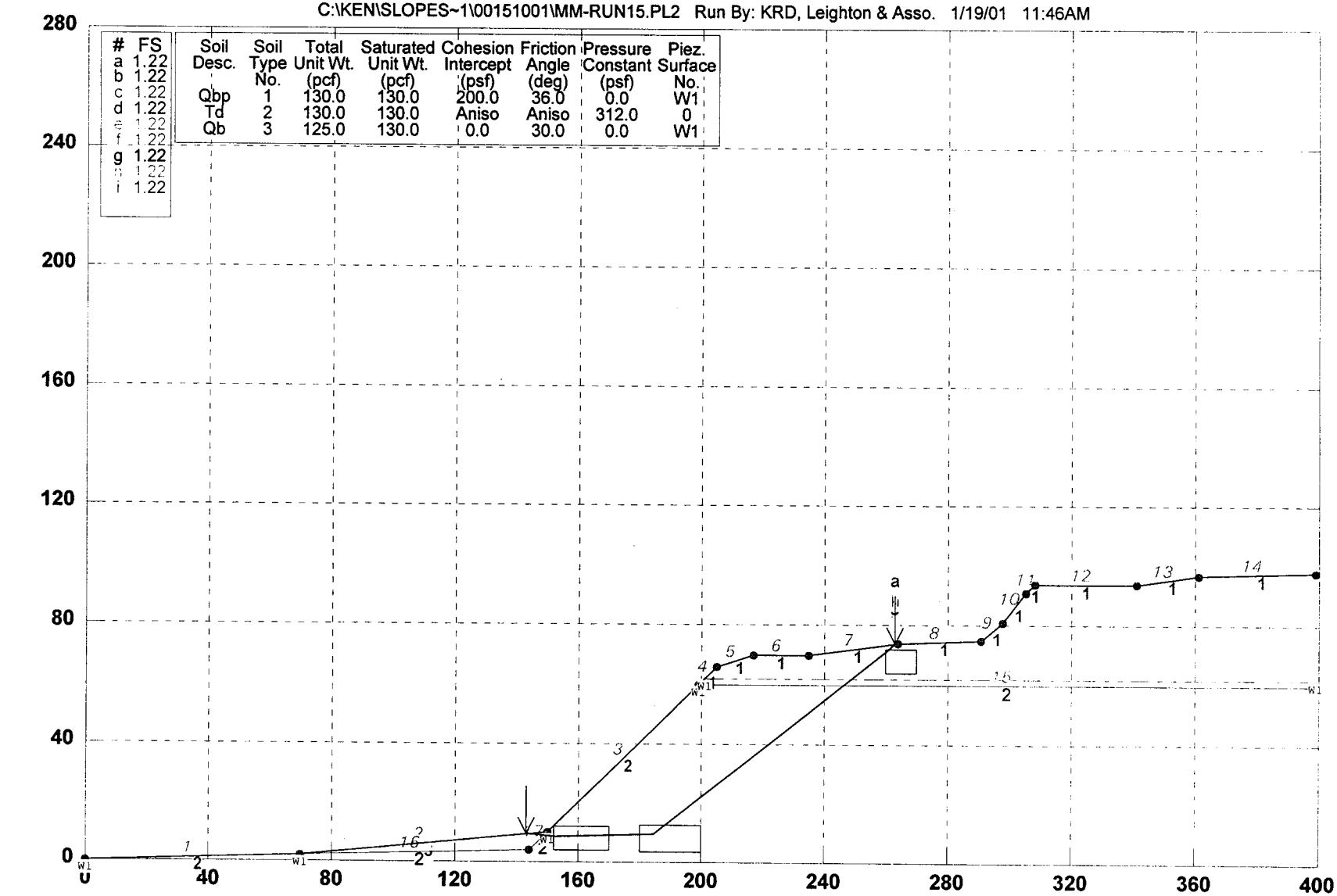
GSTABL7 FSmin=0.80

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross-Section (M-M'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\MM-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 11:46AM



#	FS
a	1.22
b	1.22
c	1.22
d	1.22
e	1.22
f	1.22
g	1.22
h	1.22
i	1.22

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1

GSTABL7 FSmin=1.22

Safety Factors Are Calculated By The Simplified Janbu Method

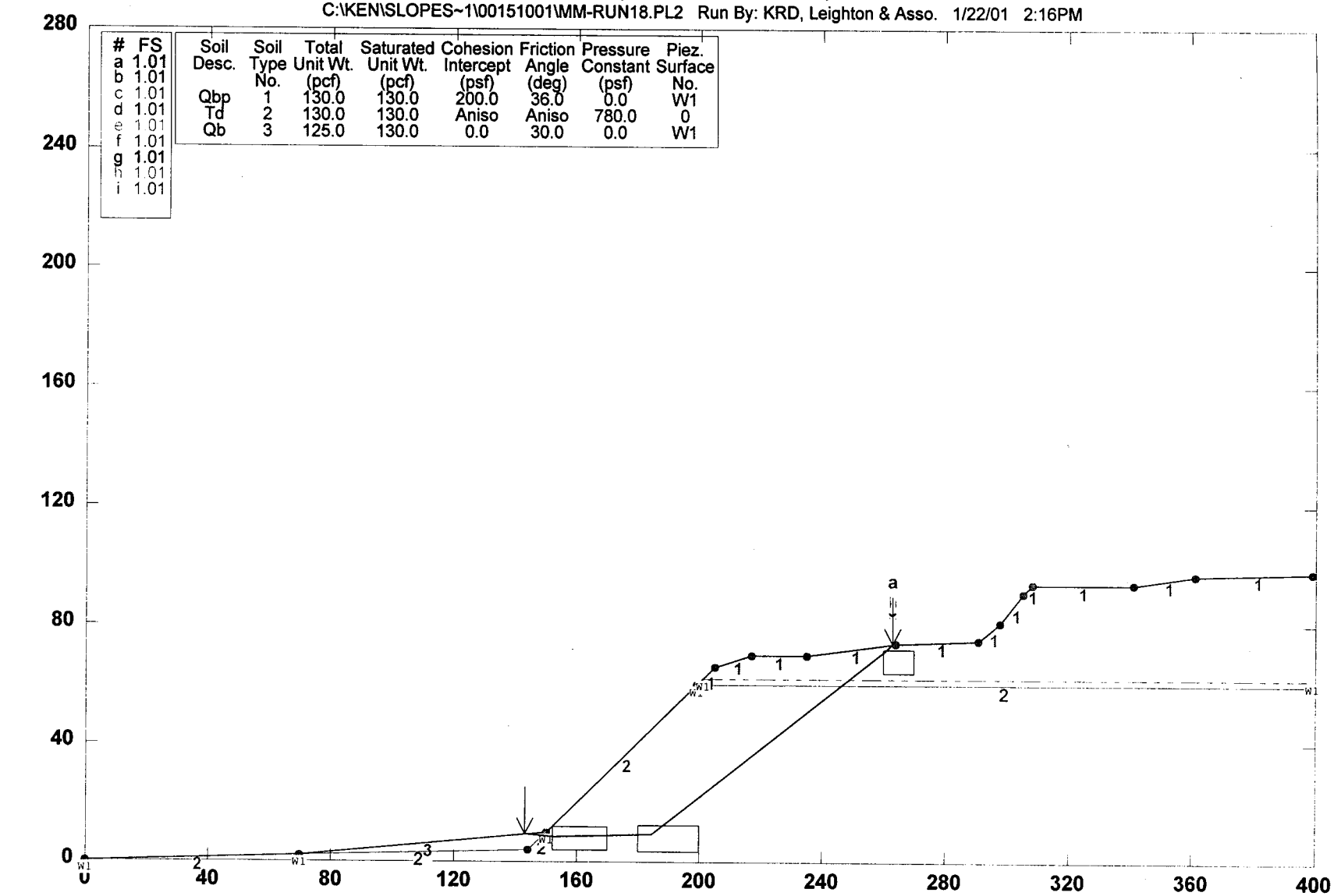
STED

Cross-Section (M-M'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\MM-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 2:16PM

#	FS
a	1.01
b	1.01
c	1.01
d	1.01
e	1.01
f	1.01
g	1.01
h	1.01
i	1.01

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1



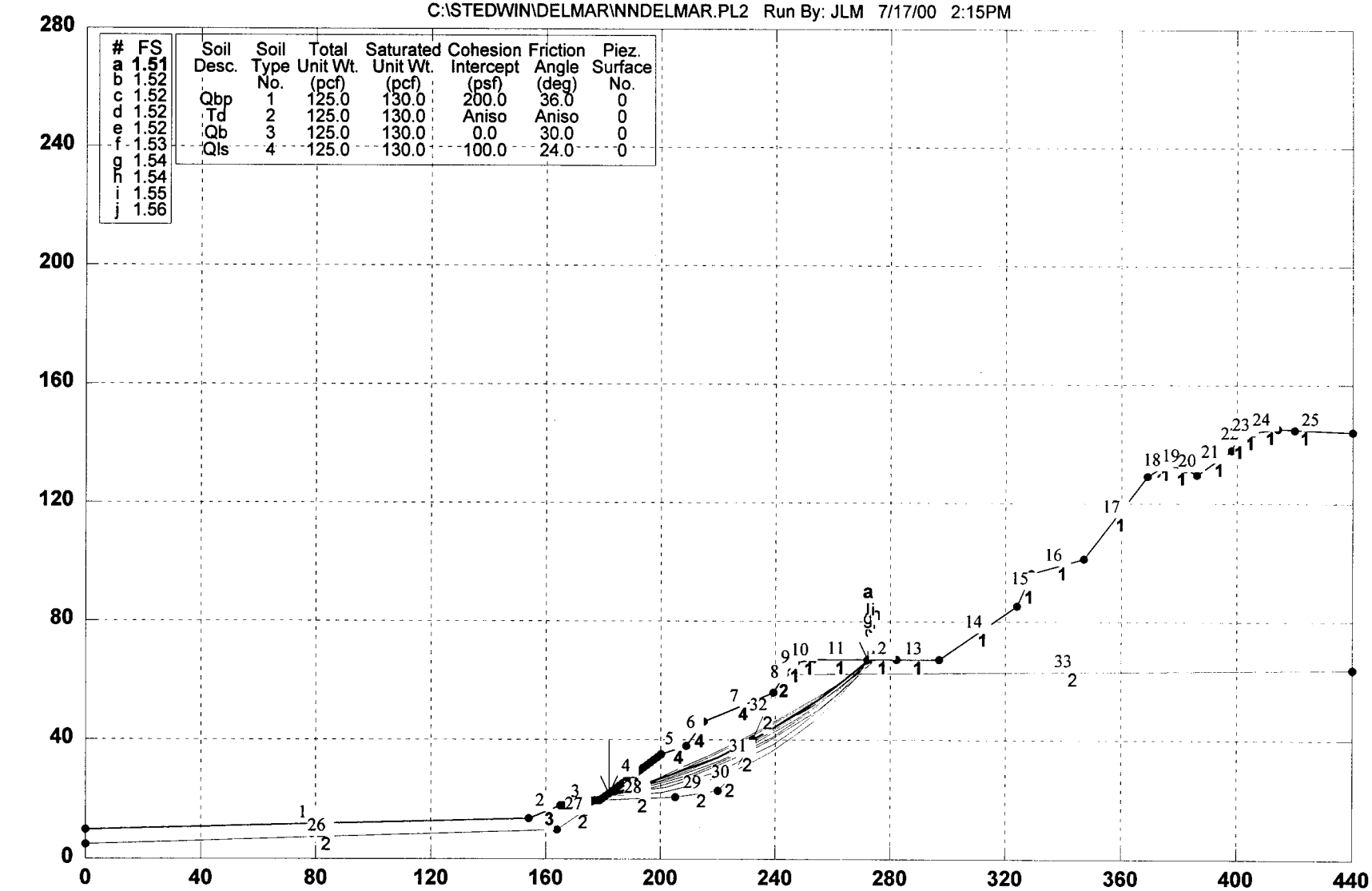
GSTABL7 FSmin=1.01

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross-Section (N-N'), Del Mar Bluffs

C:\STEDWIN\DELMAR\NNDELMAR.PL2 Run By: JLM 7/17/00 2:15PM



#	FS
a	1.51
b	1.52
c	1.52
d	1.52
e	1.52
f	1.53
g	1.54
h	1.54
i	1.55
j	1.56

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0

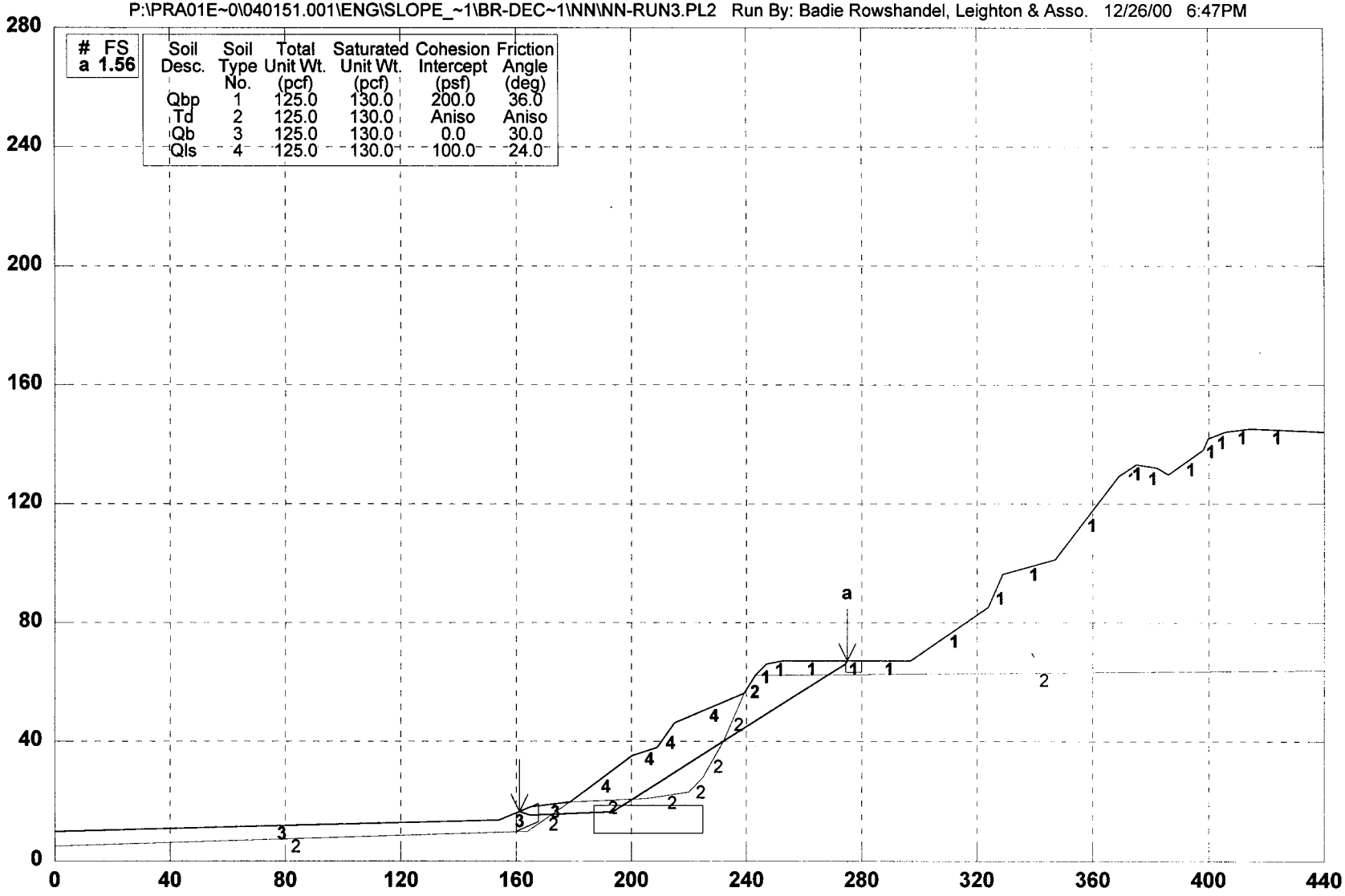
GSTABL7 FSmin=1.51

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (N-N'), Del Mar Bluffs, Static

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\NN\NN-RUN3.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/26/00 6:47PM



GSTABL7 FSmin=1.56

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

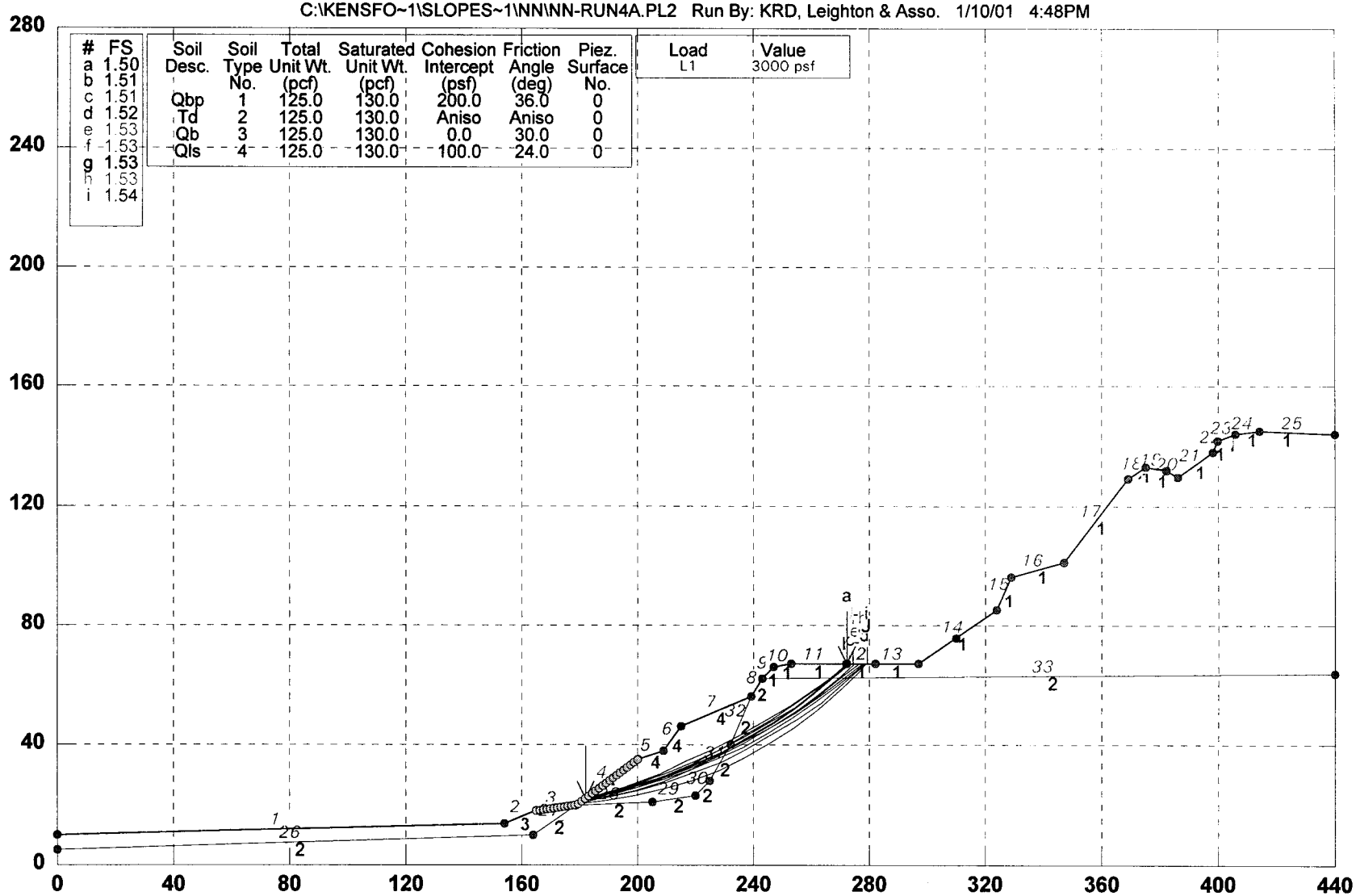
Cross-Section (N-N'), Del Mar Bluffs, Static w/ Surcharge

C:\KENSFO~1\SLOPES~1\NN\NN-RUN4A.PL2 Run By: KRD, Leighton & Asso. 1/10/01 4:48PM

#	FS
a	1.50
b	1.51
c	1.51
d	1.52
e	1.53
f	1.53
g	1.53
h	1.53
i	1.54

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0

Load	Value
L1	3000 psf



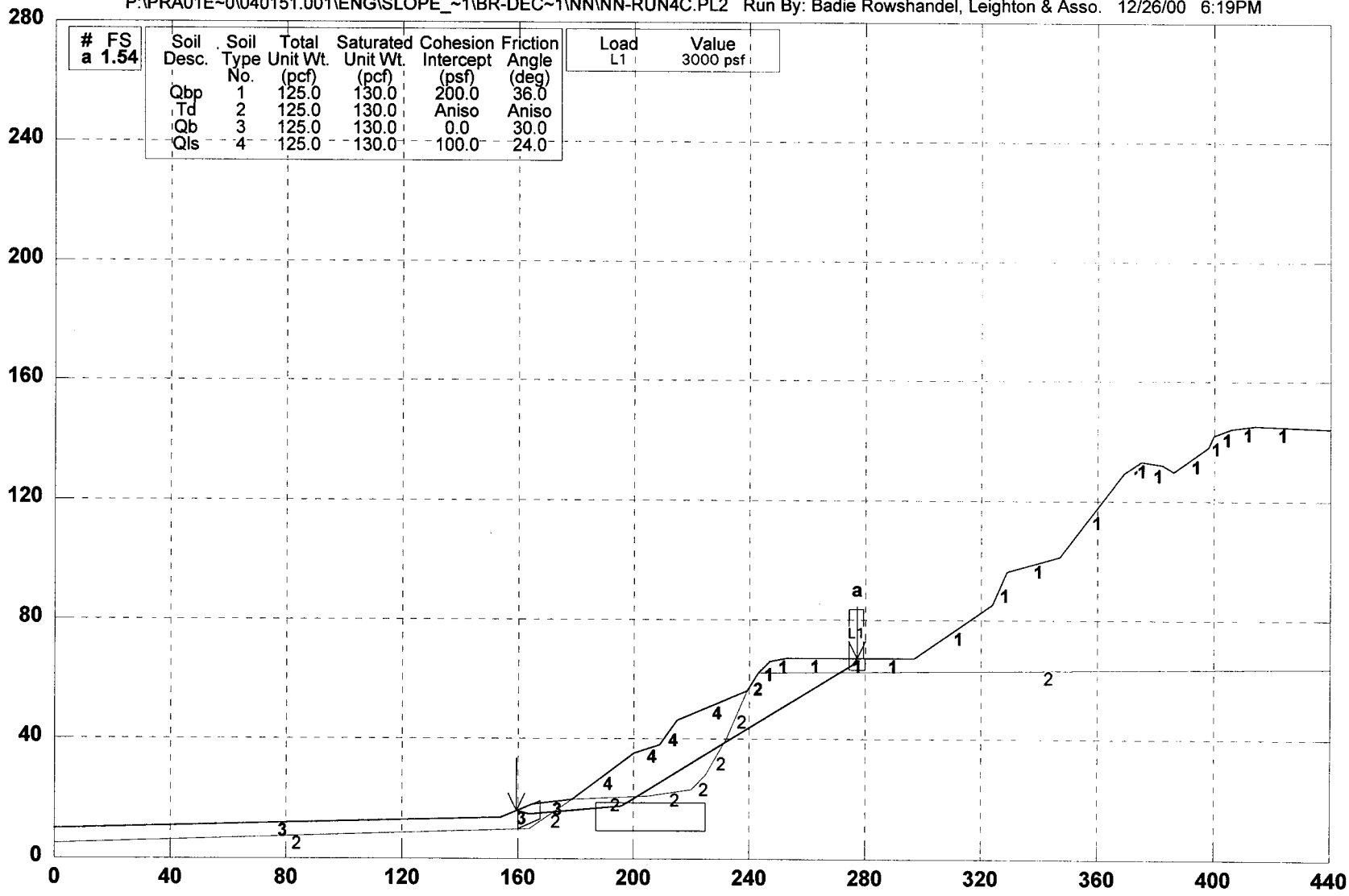
GSTABL7 FSmin=1.50

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (N-N'), Del Mar Bluffs, Static w/ Surcharge

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\NN\NN-RUN4C.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/26/00 6:19PM



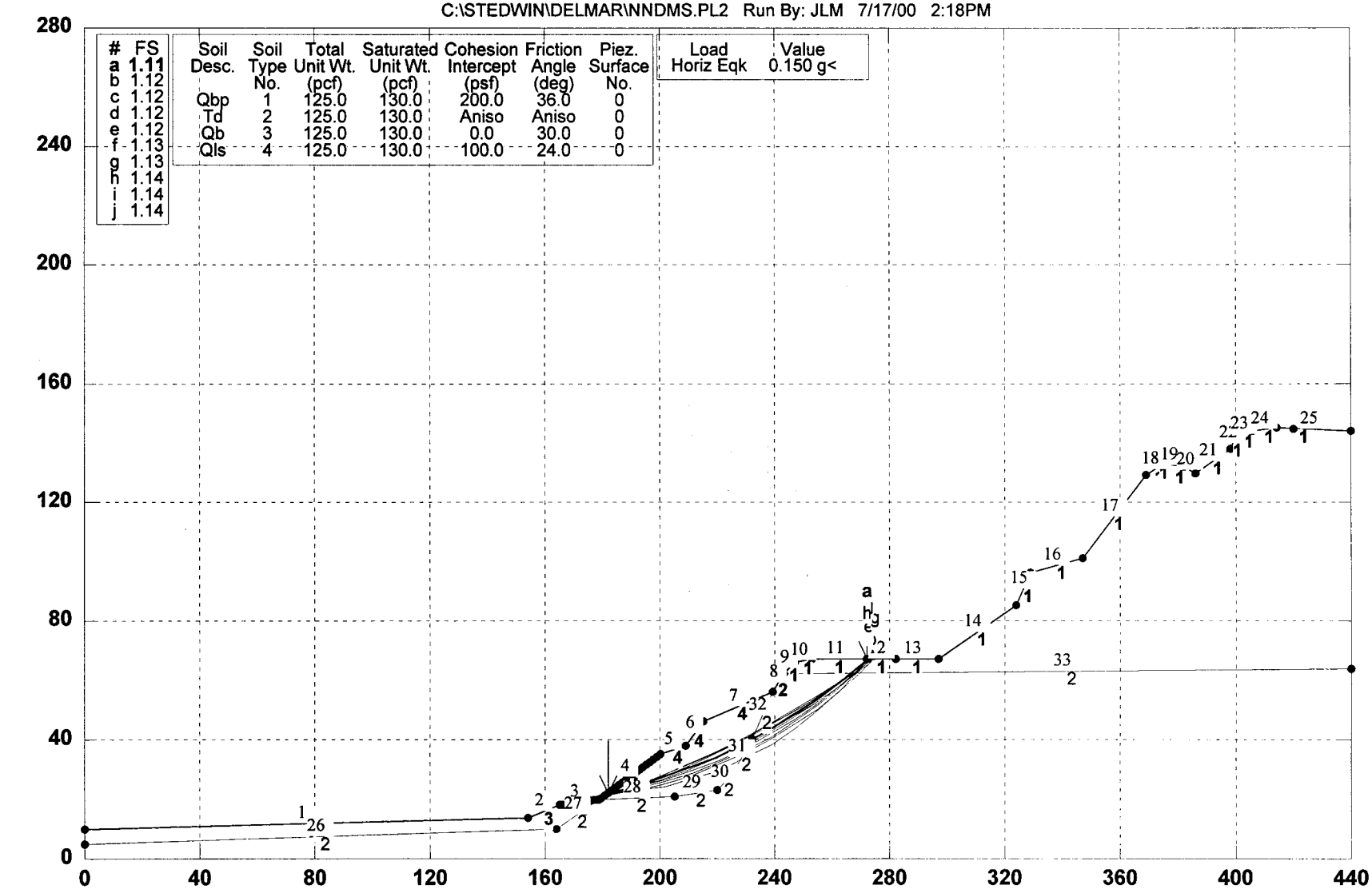
GSTABL7 FSmin=1.54

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross-Section (N-N'), Del Mar Bluffs, Pseudostatic

C:\STEDWIN\DELMAR\NNDMS.PL2 Run By: JLM 7/17/00 2:18PM



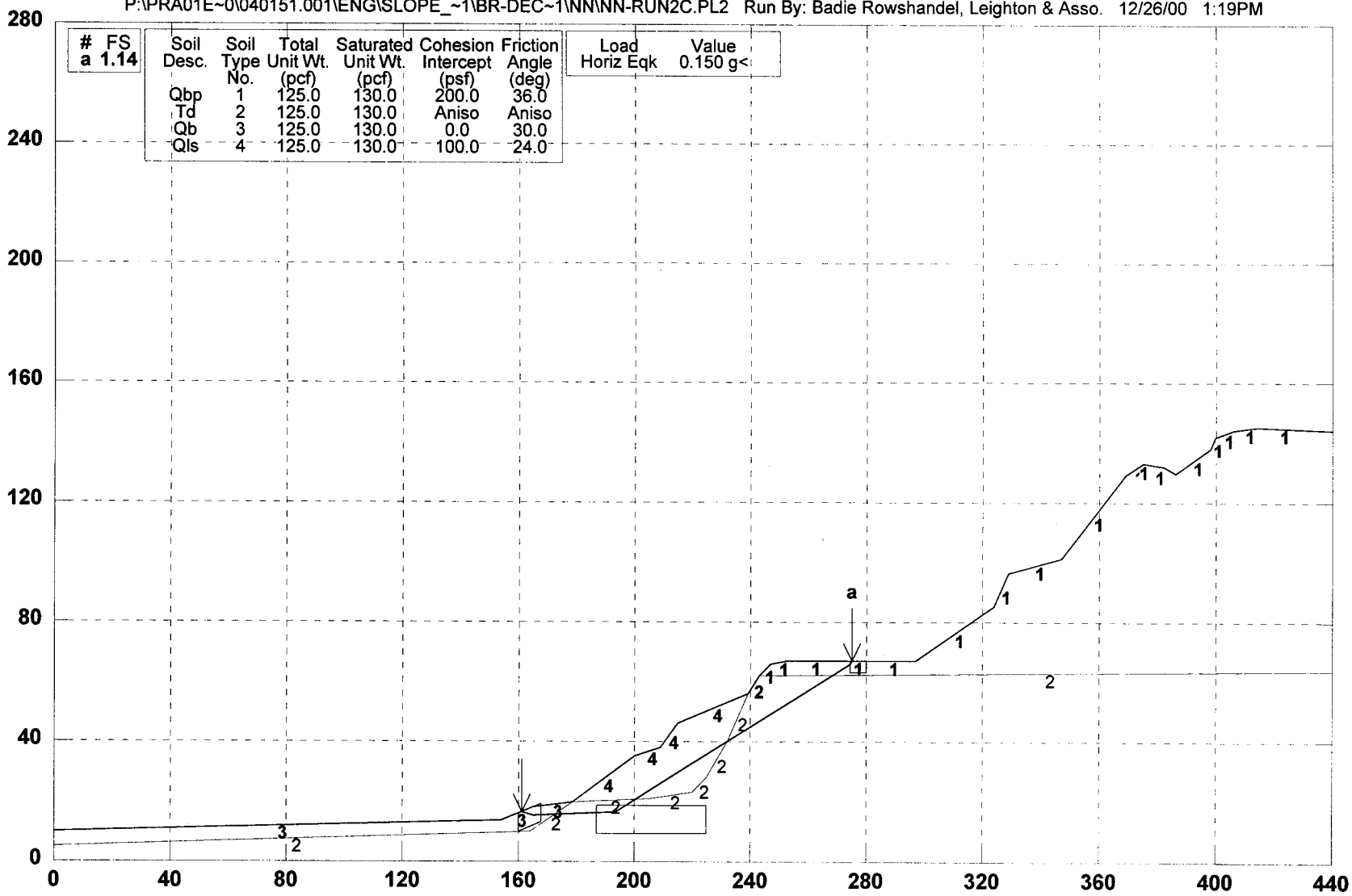
GSTABL7 FSmin=1.11

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (N-N'), Del Mar Bluffs, Pseudo-Static @ 0.15

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\NN\NN-RUN2C.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/26/00 1:19PM



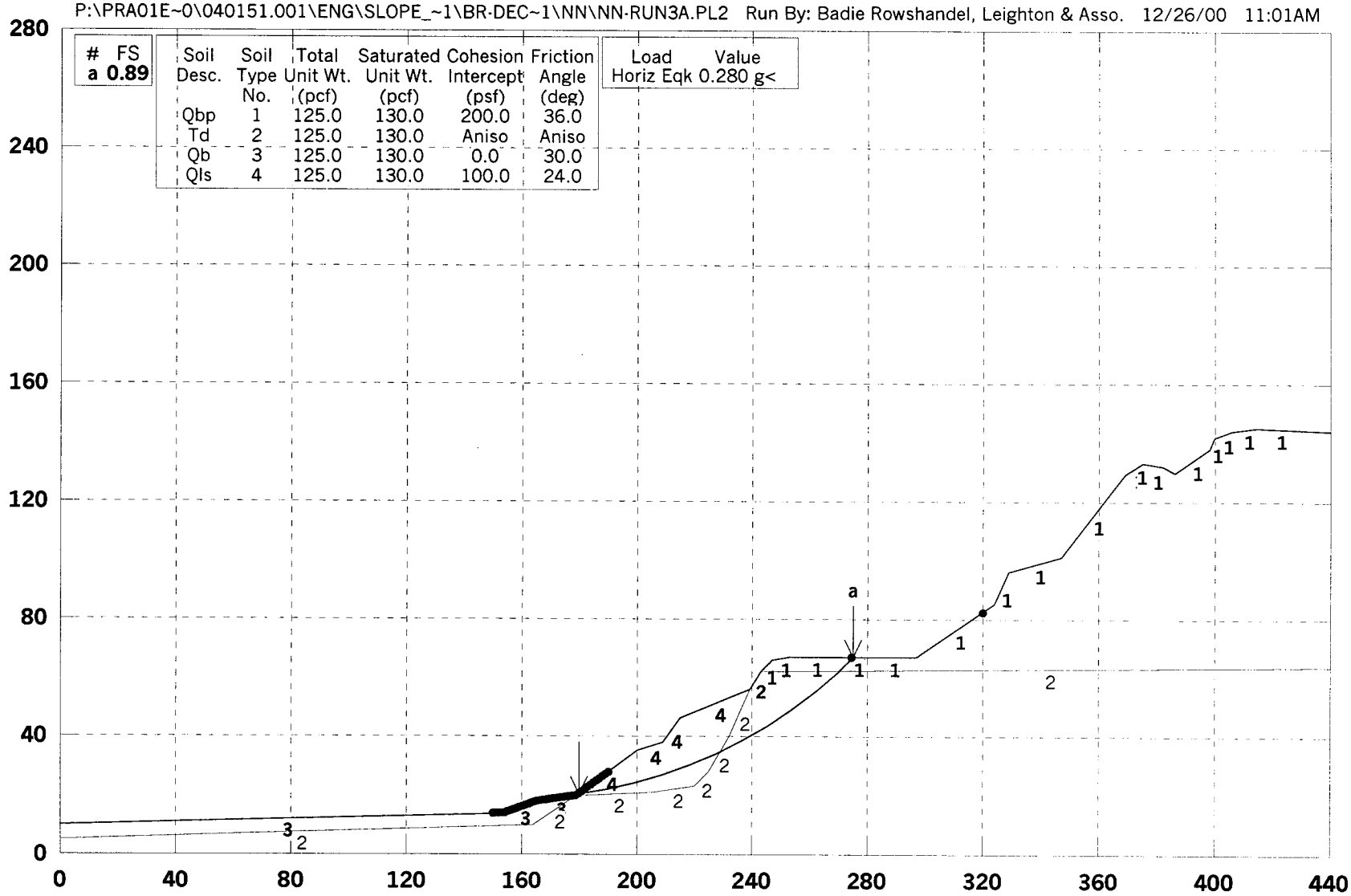
GSTABL7 FSmin=1.14

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

STED

Cross-Section (N-N'), Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\NN\NN-RUN3A.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/26/00 11:01AM



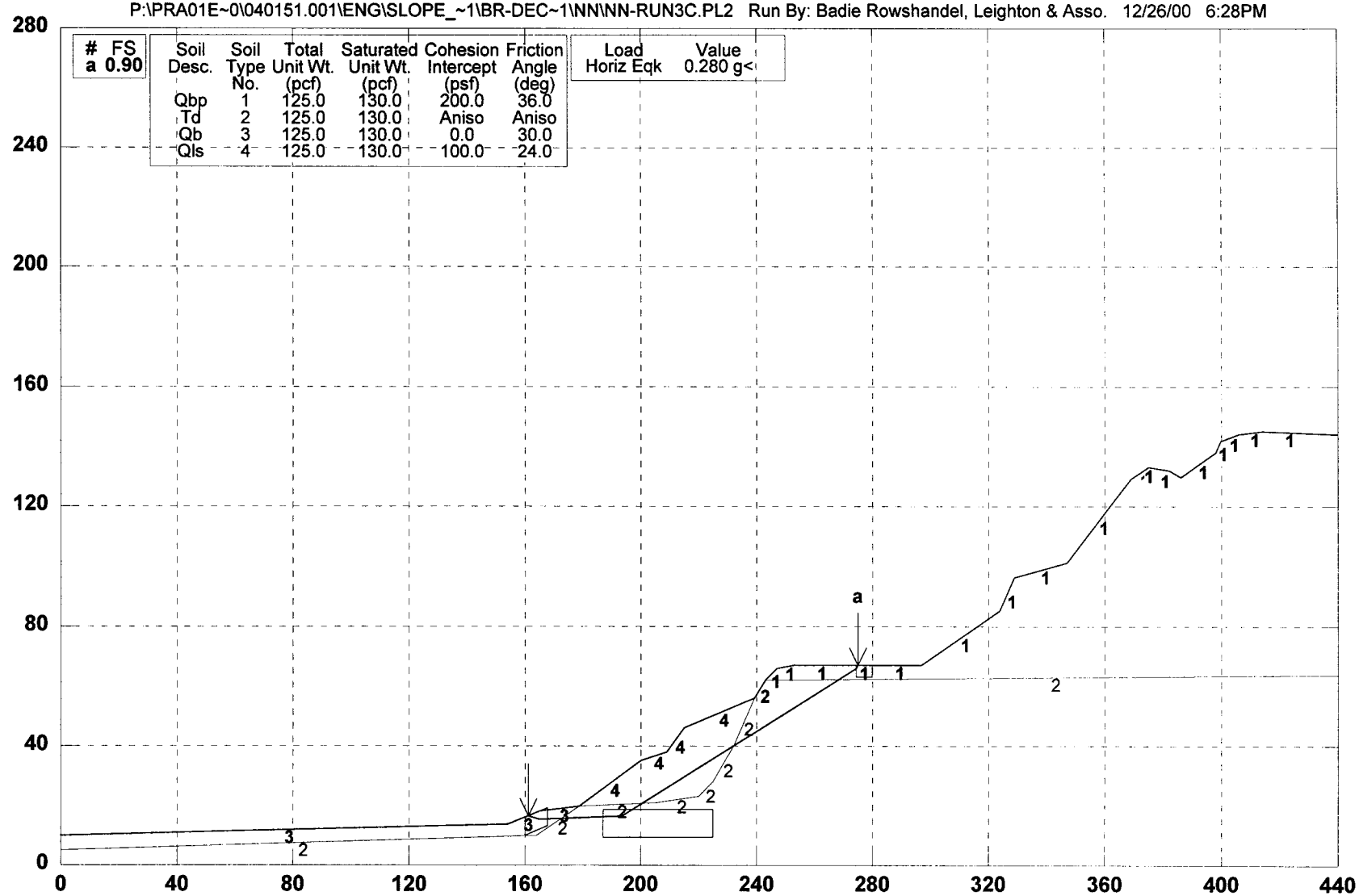
GSTABL7 FSmin=0.89

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (N-N'), Del Mar Bluffs, Pseudo-Static @ 0.28

P:\PRA01E~0\040151.001\ENG\SLOPE_~1\BR-DEC~1\NN\NN-RUN3C.PL2 Run By: Badie Rowshandel, Leighton & Asso. 12/26/00 6:28PM



GSTABL7 FSmin=0.90

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

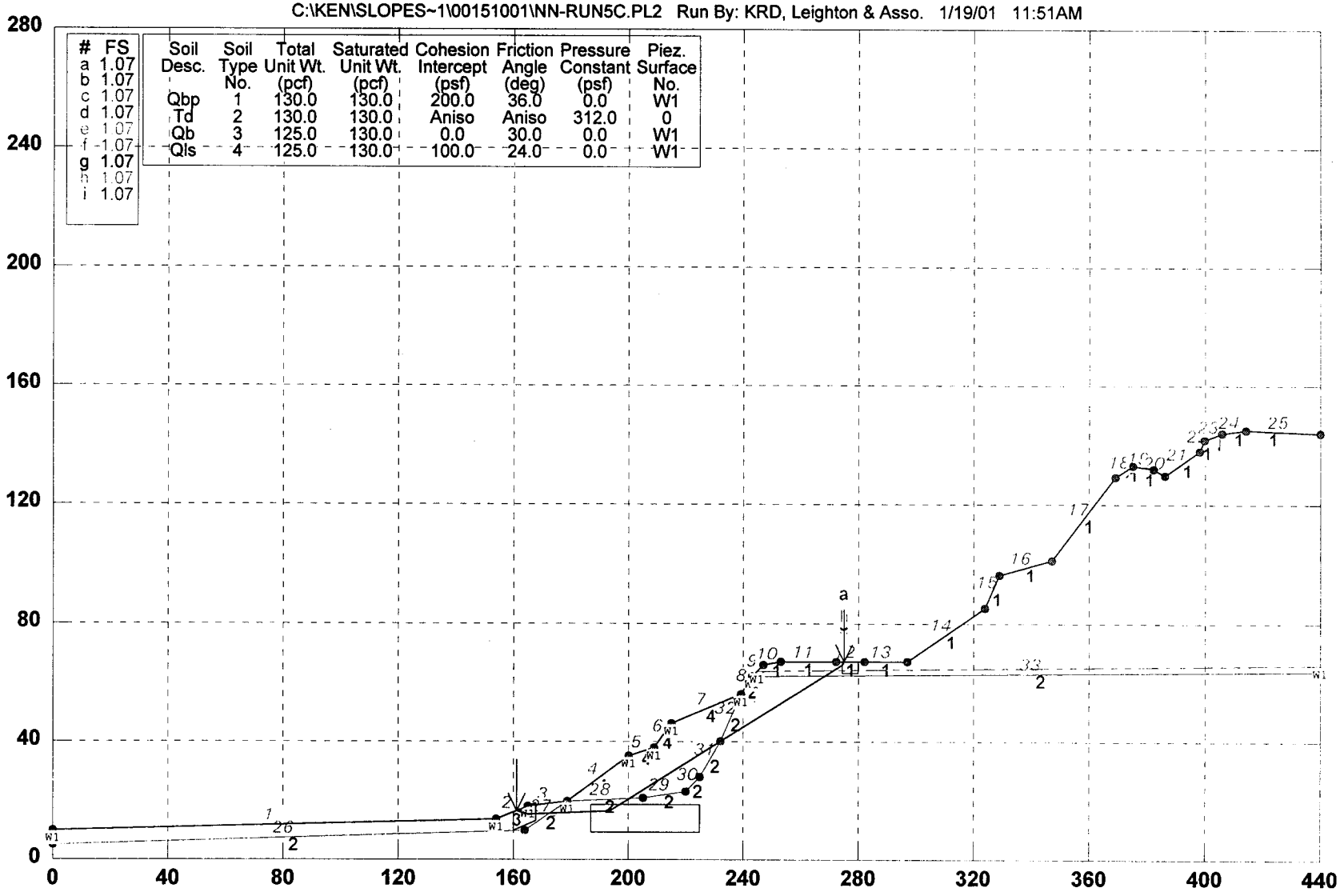
STED

Cross-Section (N-N'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\NN-RUN5C.PL2 Run By: KRD, Leighton & Asso. 1/19/01 11:51AM

#	FS
a	1.07
b	1.07
c	1.07
d	1.07
e	1.07
f	1.07
g	1.07
h	1.07
i	1.07

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1



GSTABL7 FSmin=1.07

Safety Factors Are Calculated By The Simplified Janbu Method

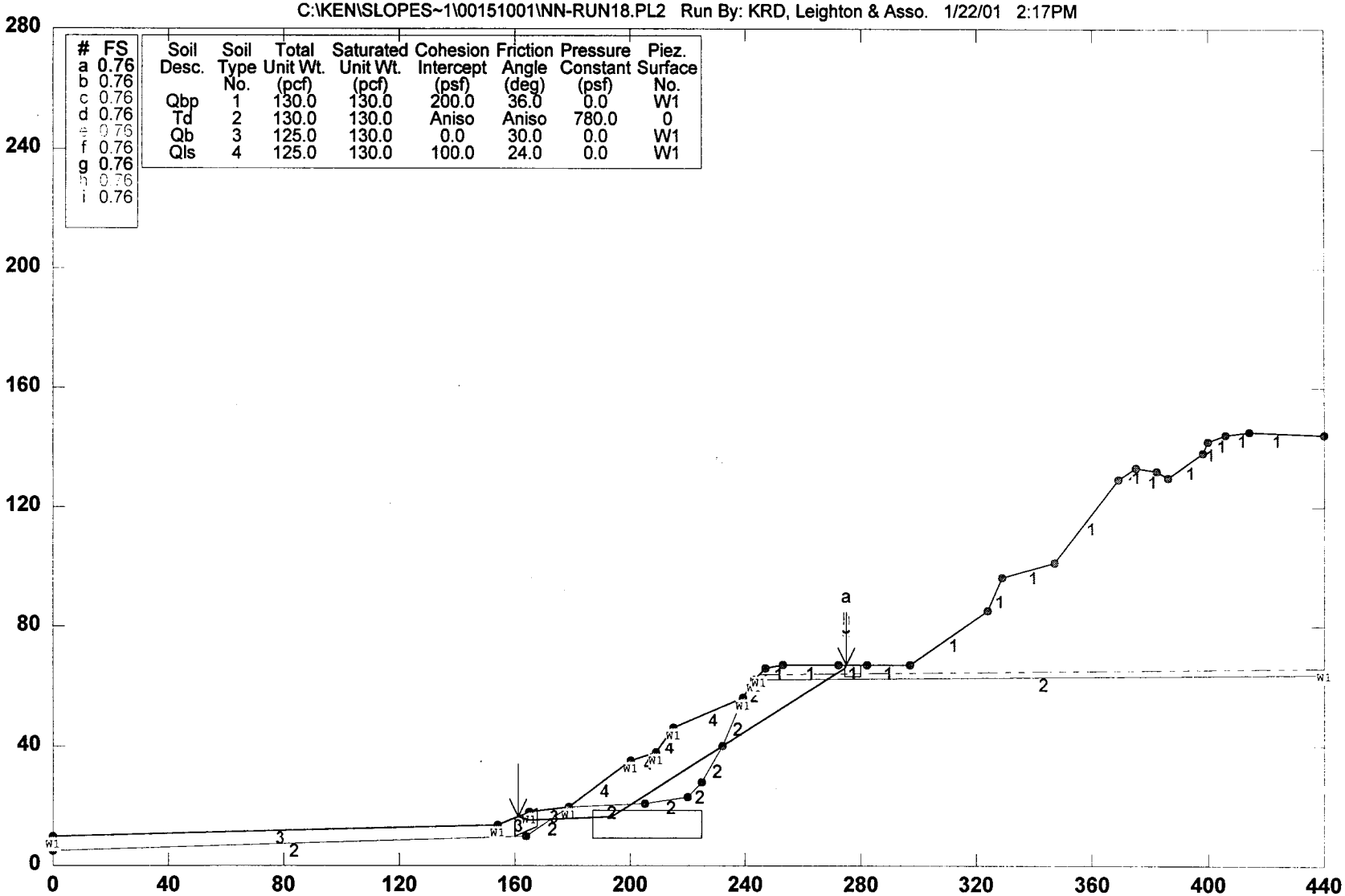
STED

Cross-Section (N-N'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\NN-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 2:17PM

#	FS
a	0.76
b	0.76
c	0.76
d	0.76
e	0.76
f	0.76
g	0.76
h	0.76
i	0.76

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1



GSTABL7 FSmin=0.76

Safety Factors Are Calculated By The Simplified Janbu Method

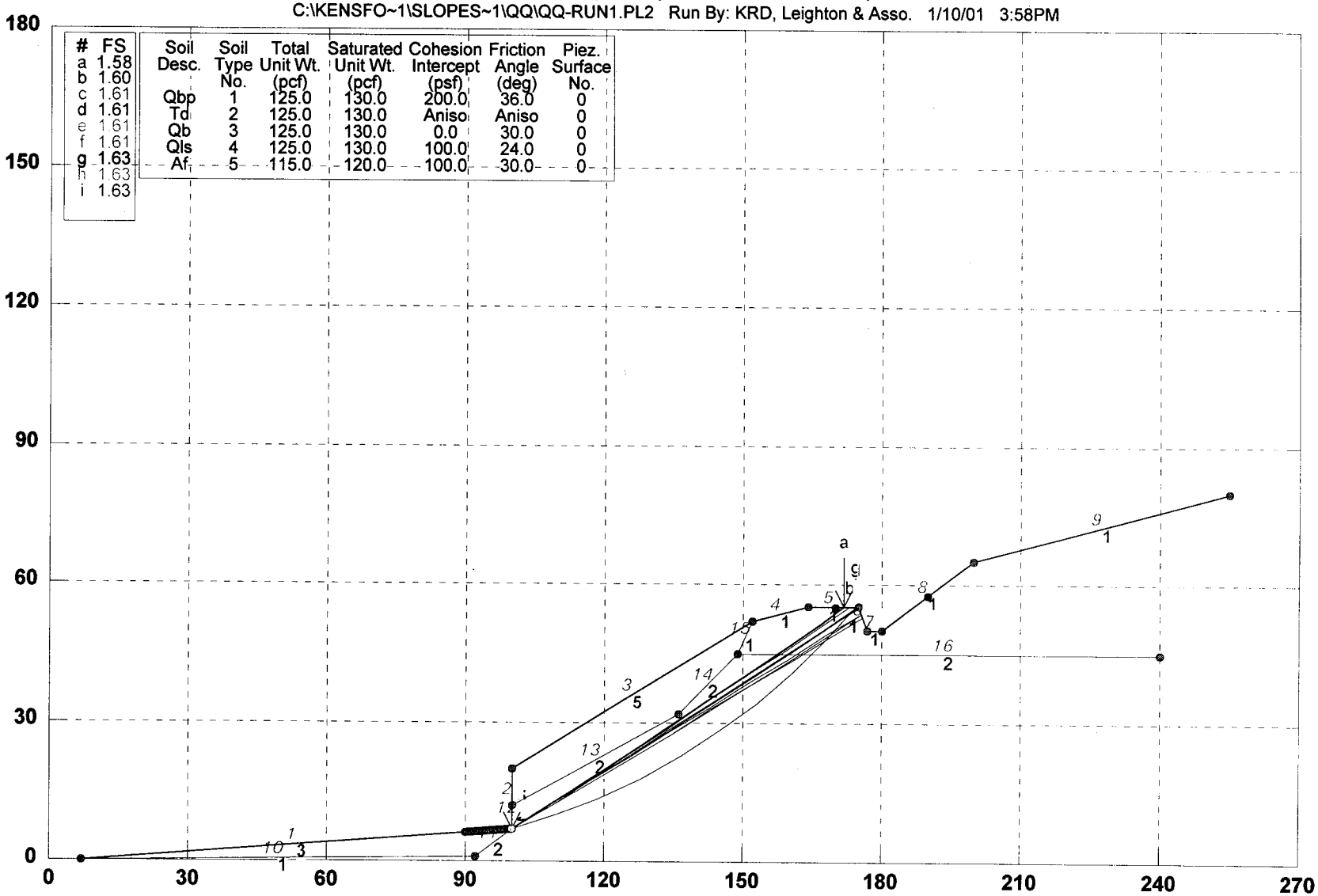
STED

Cross-Section (Q-Q'), Del Mar Bluffs, Static

C:\KENSFO~1\SLOPES~1\QQ\QQ-RUN1.PL2 Run By: KRD, Leighton & Asso. 1/10/01 3:58PM

#	FS
a	1.58
b	1.60
c	1.61
d	1.61
e	1.61
f	1.61
g	1.63
h	1.63
i	1.63

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0



GSTABL7 FSmin=1.58

Safety Factors Are Calculated By The Modified Bishop Method

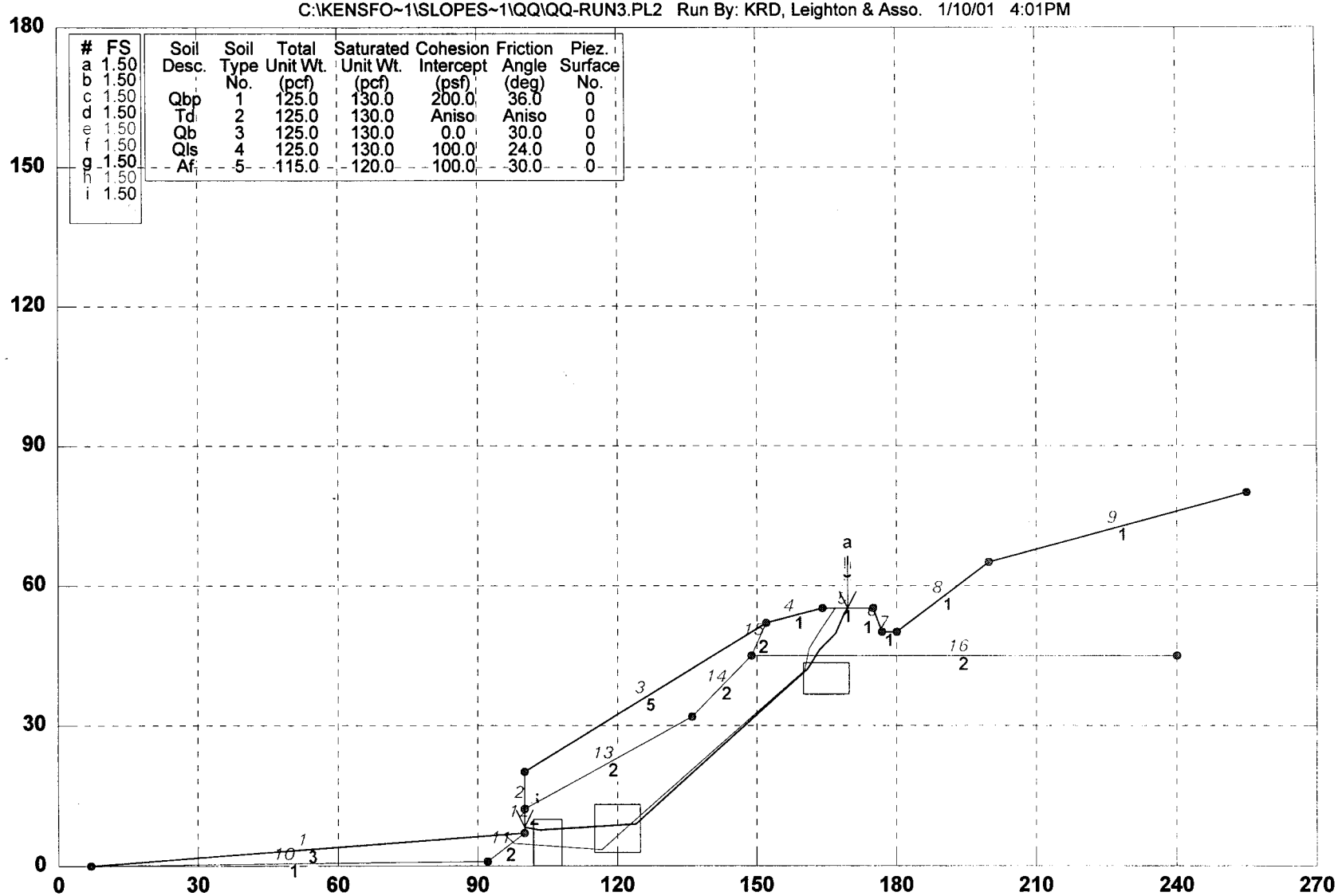
STED

Cross-Section (Q-Q'), Del Mar Bluffs, Static

C:\KENSFO~1\SLOPES~1\QQ\QQ-RUN3.PL2 Run By: KRD, Leighton & Asso. 1/10/01 4:01PM

#	FS
a	1.50
b	1.50
c	1.50
d	1.50
e	1.50
f	1.50
g	1.50
h	1.50
i	1.50

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0



GSTABL7 FSmin=1.50

Safety Factors Are Calculated By The Simplified Janbu Method

STED

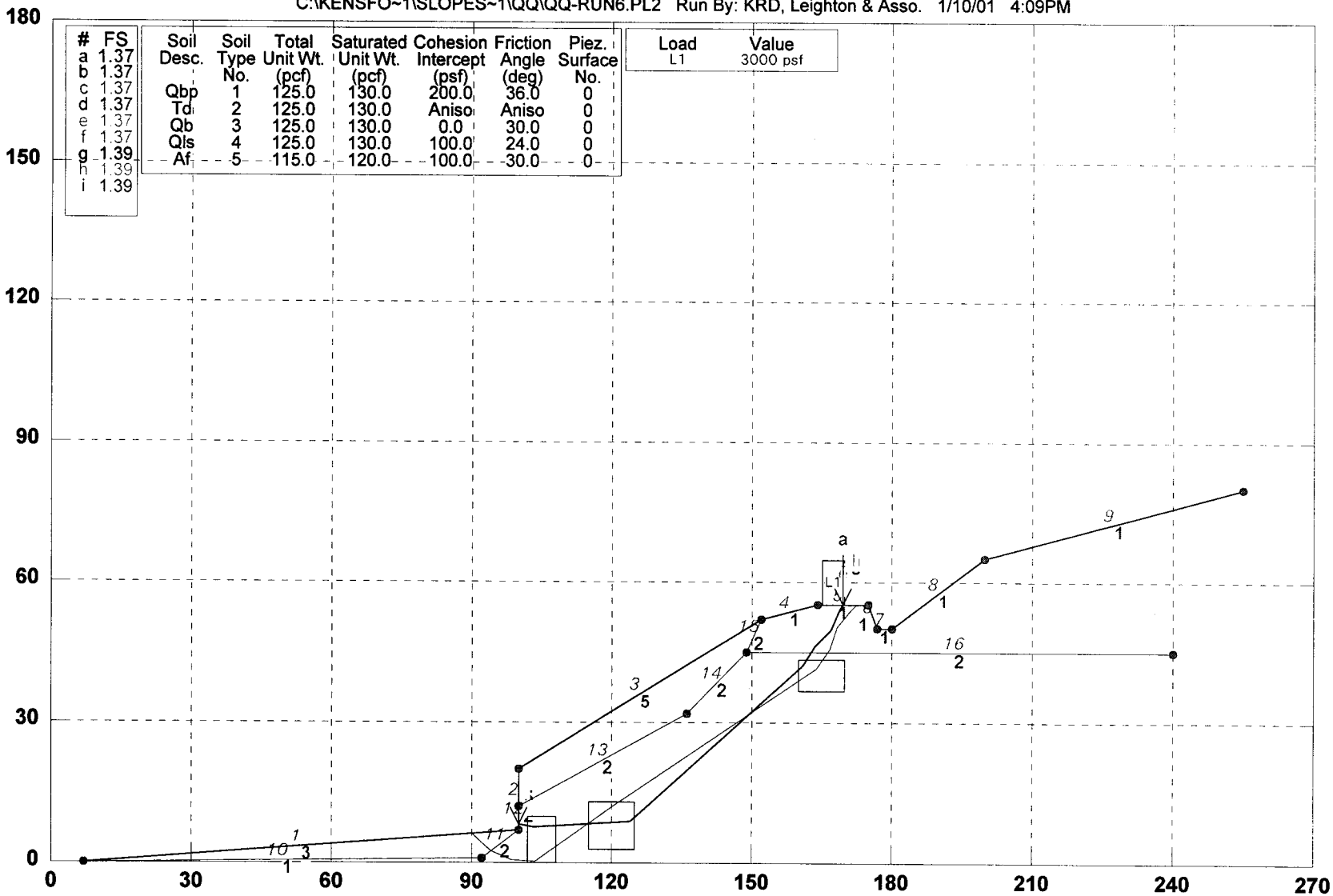
Cross-Section (Q-Q'), Del Mar Bluffs, Static w/Surcharge

C:\KENSFO~1\SLOPES~1\QQ\QQ-RUN6.PL2 Run By: KRD, Leighton & Asso. 1/10/01 4:09PM

#	FS
a	1.37
b	1.37
c	1.37
d	1.37
e	1.37
f	1.37
g	1.39
h	1.39
i	1.39

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
L1	3000 psf



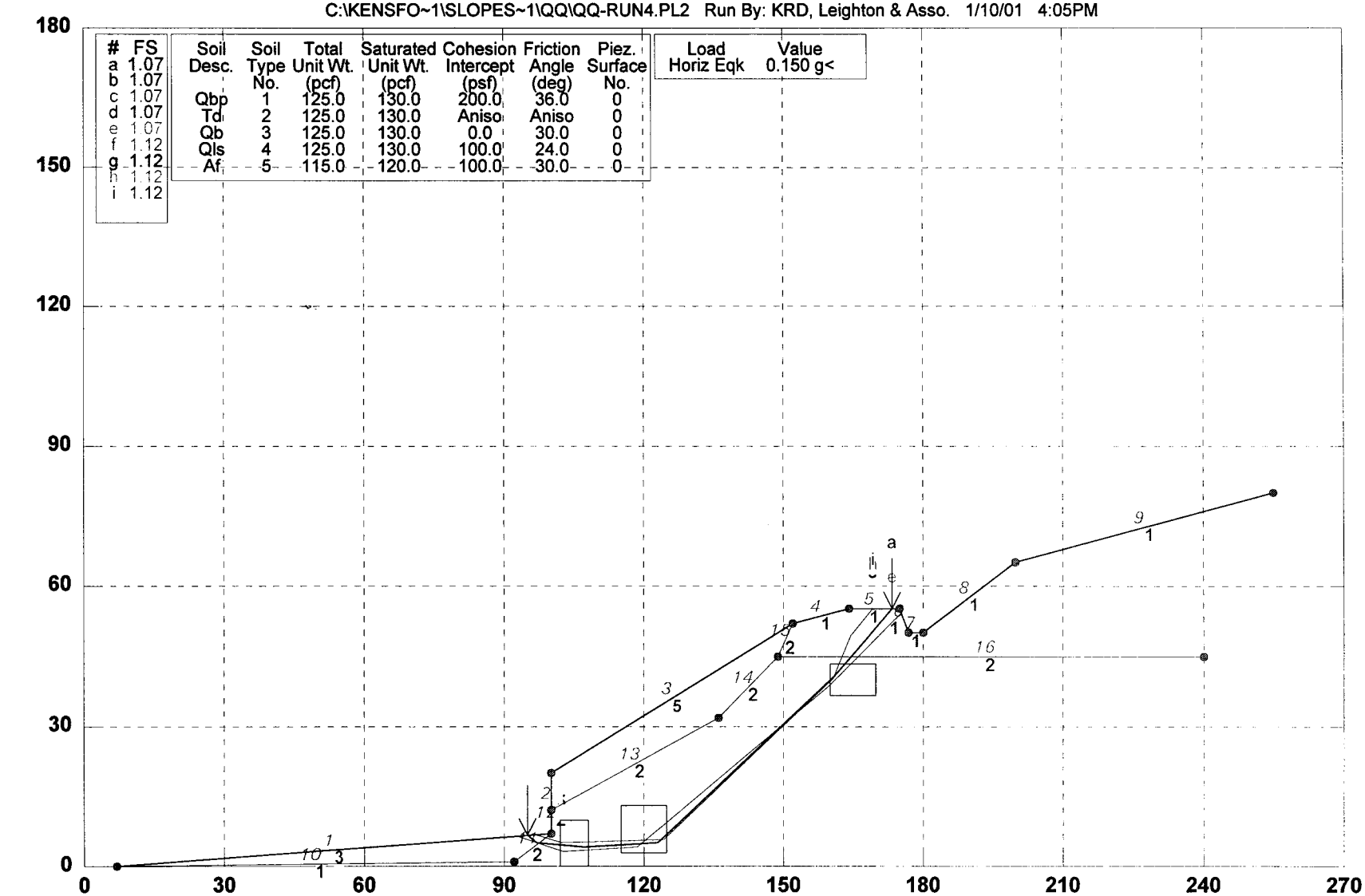
GSTABL7 FSmin=1.37

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross-Section (Q-Q'), Del Mar Bluffs, Pseudo-Static @ 0.15

C:\KENSFO~1\SLOPES~1\QQ\QQ-RUN4.PL2 Run By: KRD, Leighton & Asso. 1/10/01 4:05PM



#	FS
a	1.07
b	1.07
c	1.07
d	1.07
e	1.07
f	1.12
g	1.12
h	1.12
i	1.12

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
Horiz Eqk	0.150 g<

GSTABL7 FSmin=1.07

Safety Factors Are Calculated By The Simplified Janbu Method

STED

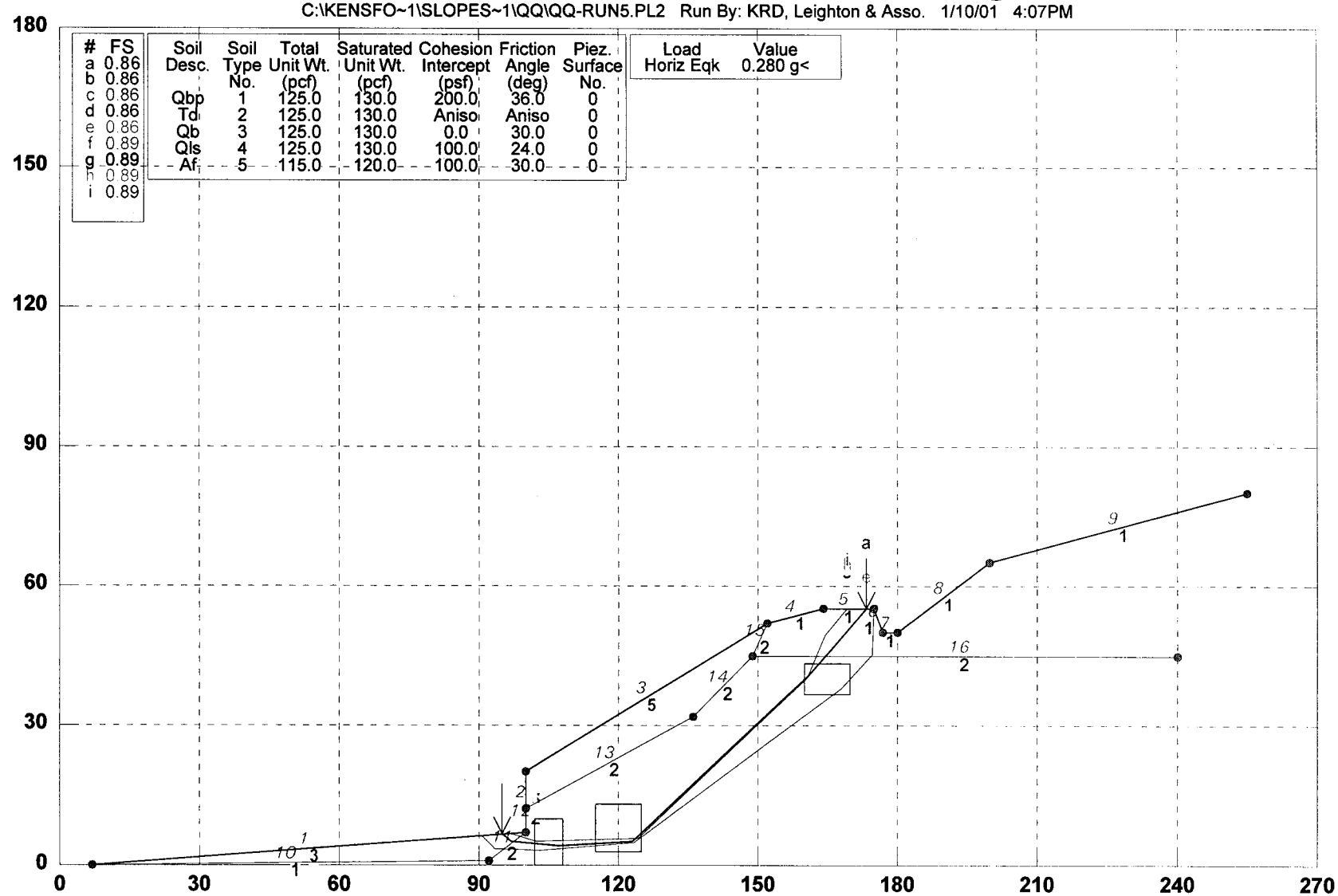
Cross-Section (Q-Q'), Del Mar Bluffs, Pseudo-Static @ 0.28

C:\KENSFO~1\SLOPES~1\QQ\QQ-RUN5.PL2 Run By: KRD, Leighton & Asso. 1/10/01 4:07PM

#	FS
a	0.86
b	0.86
c	0.86
d	0.86
e	0.86
f	0.89
g	0.89
h	0.89
i	0.89

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
Horiz Eqk	0.280 g<



GSTABL7 FSmin=0.86

Safety Factors Are Calculated By The Simplified Janbu Method

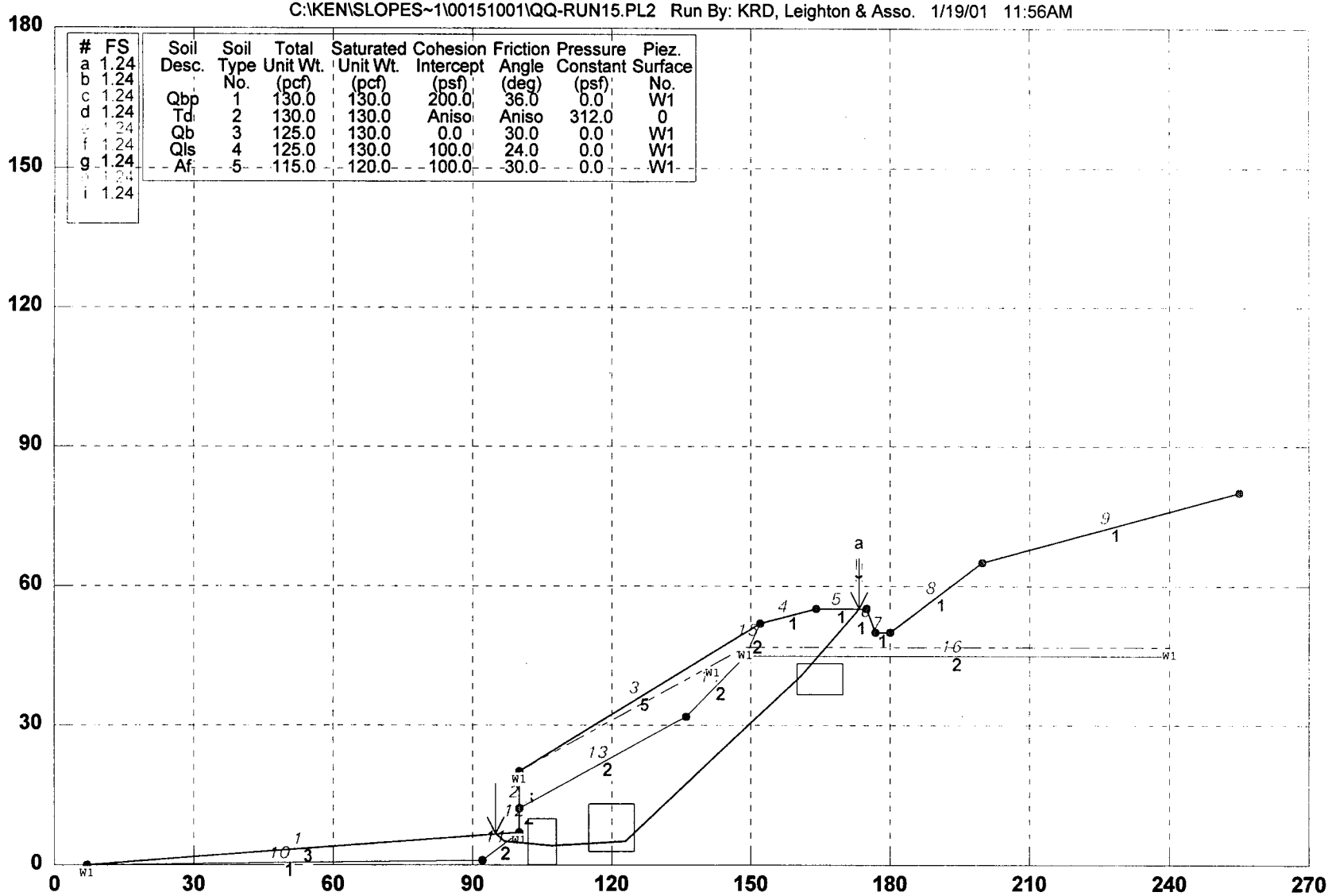
STED

Cross-Section (Q-Q'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\QQ-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 11:56AM

#	FS
a	1.24
b	1.24
c	1.24
d	1.24
e	1.24
f	1.24
g	1.24
h	1.24
i	1.24

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1
Af	5	115.0	120.0	100.0	30.0	0.0	W1



GSTABL7 FSmin=1.24

Safety Factors Are Calculated By The Simplified Janbu Method

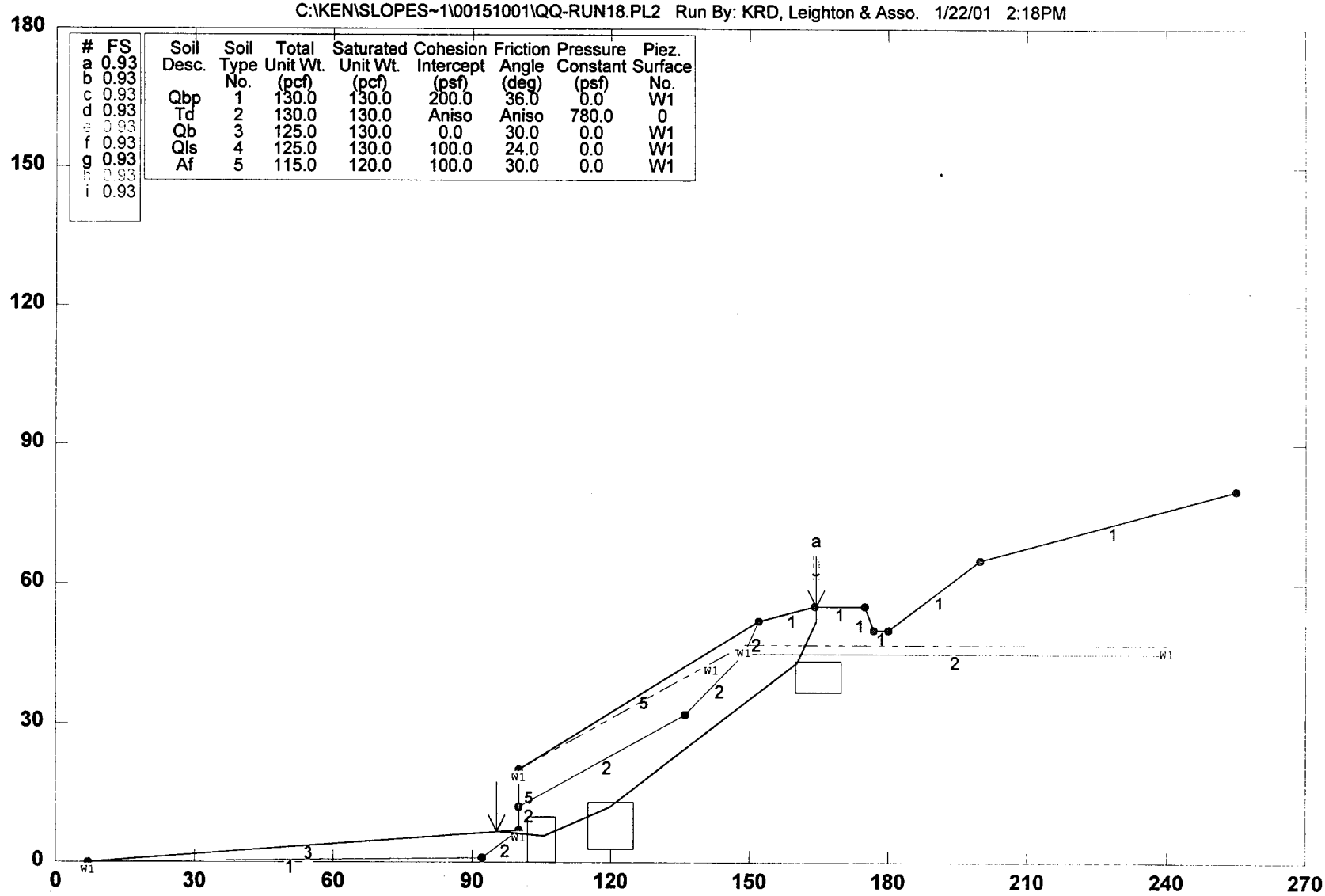
STED

Cross-Section (Q-Q'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\QQ-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 2:18PM

#	FS
a	0.93
b	0.93
c	0.93
d	0.93
e	0.93
f	0.93
g	0.93
h	0.93
i	0.93

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1
Af	5	115.0	120.0	100.0	30.0	0.0	W1



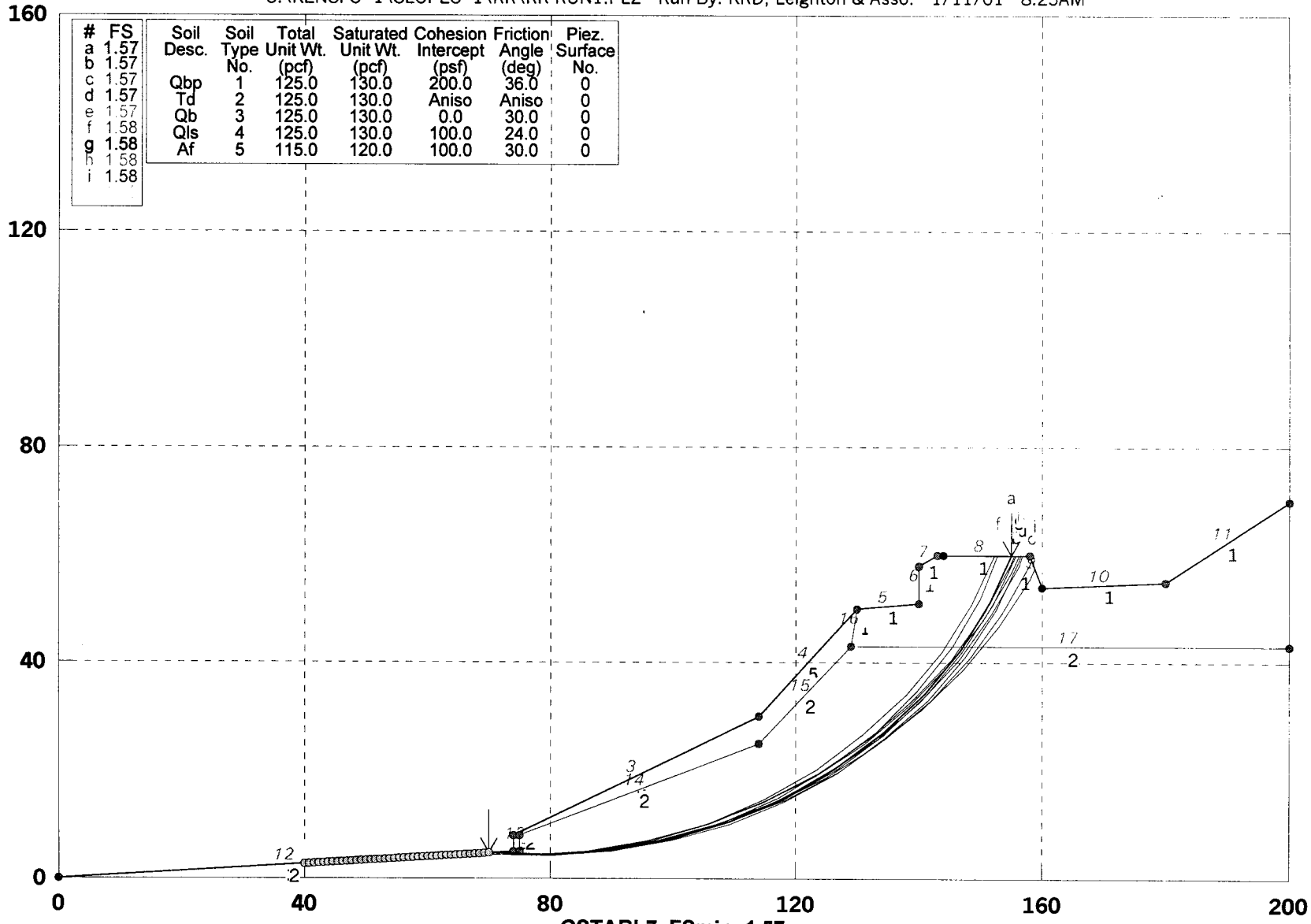
GSTABL7 FSmin=0.93

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross-Section (R-R'), Del Mar Bluffs, Static

C:\KENSFO~1\SLOPES~1\RR\RR-RUN1.PL2 Run By: KRD, Leighton & Asso. 1/11/01 8:25AM



#	FS
a	1.57
b	1.57
c	1.57
d	1.57
e	1.57
f	1.58
g	1.58
h	1.58
i	1.58

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

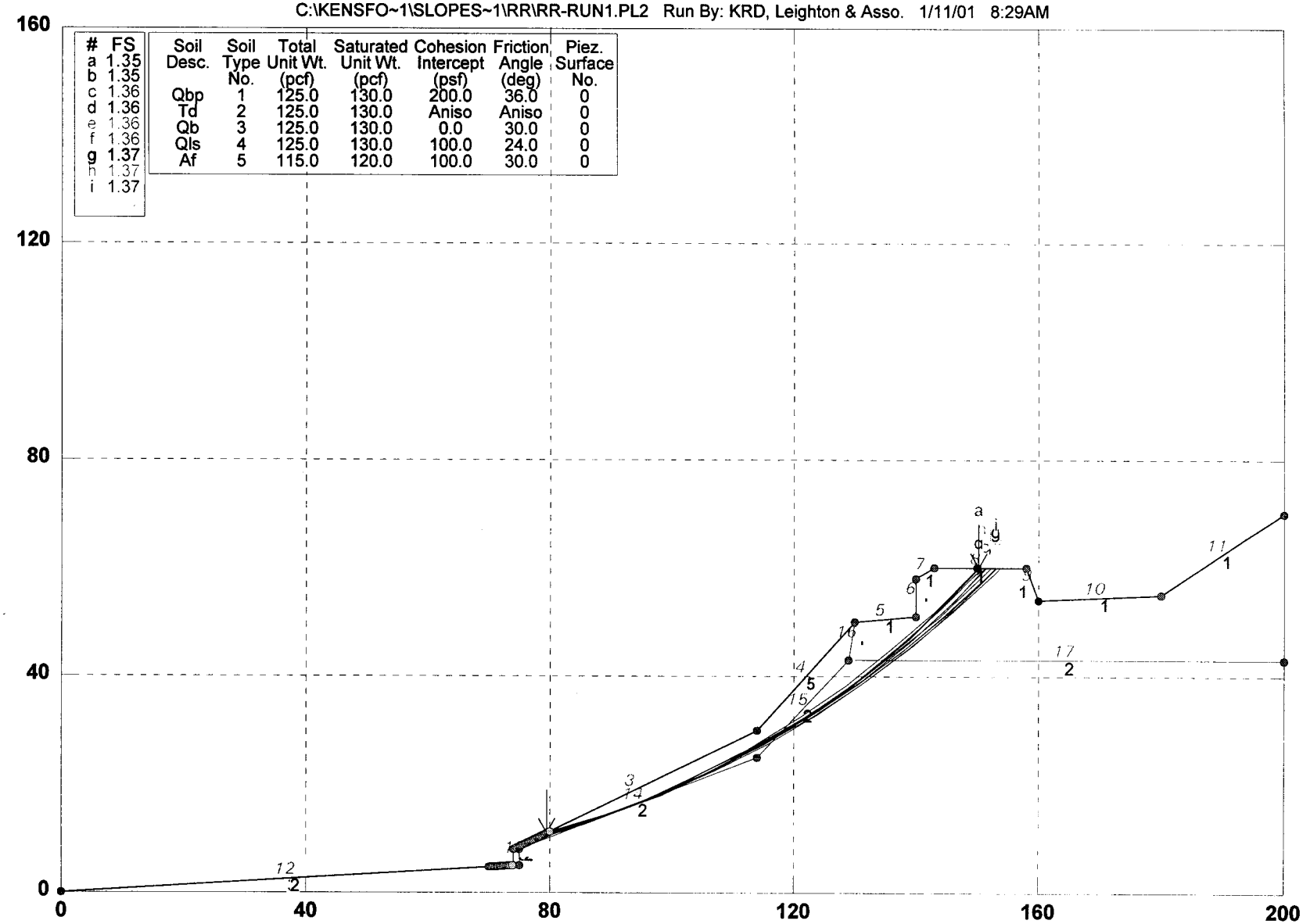
GSTABL7 FSmin=1.57

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (R-R'), Del Mar Bluffs, Static

C:\KENSFO~1\SLOPES~1\RR\RR-RUN1.PL2 Run By: KRD, Leighton & Asso. 1/11/01 8:29AM



#	FS
a	1.35
b	1.35
c	1.36
d	1.36
e	1.36
f	1.36
g	1.37
h	1.37
i	1.37

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

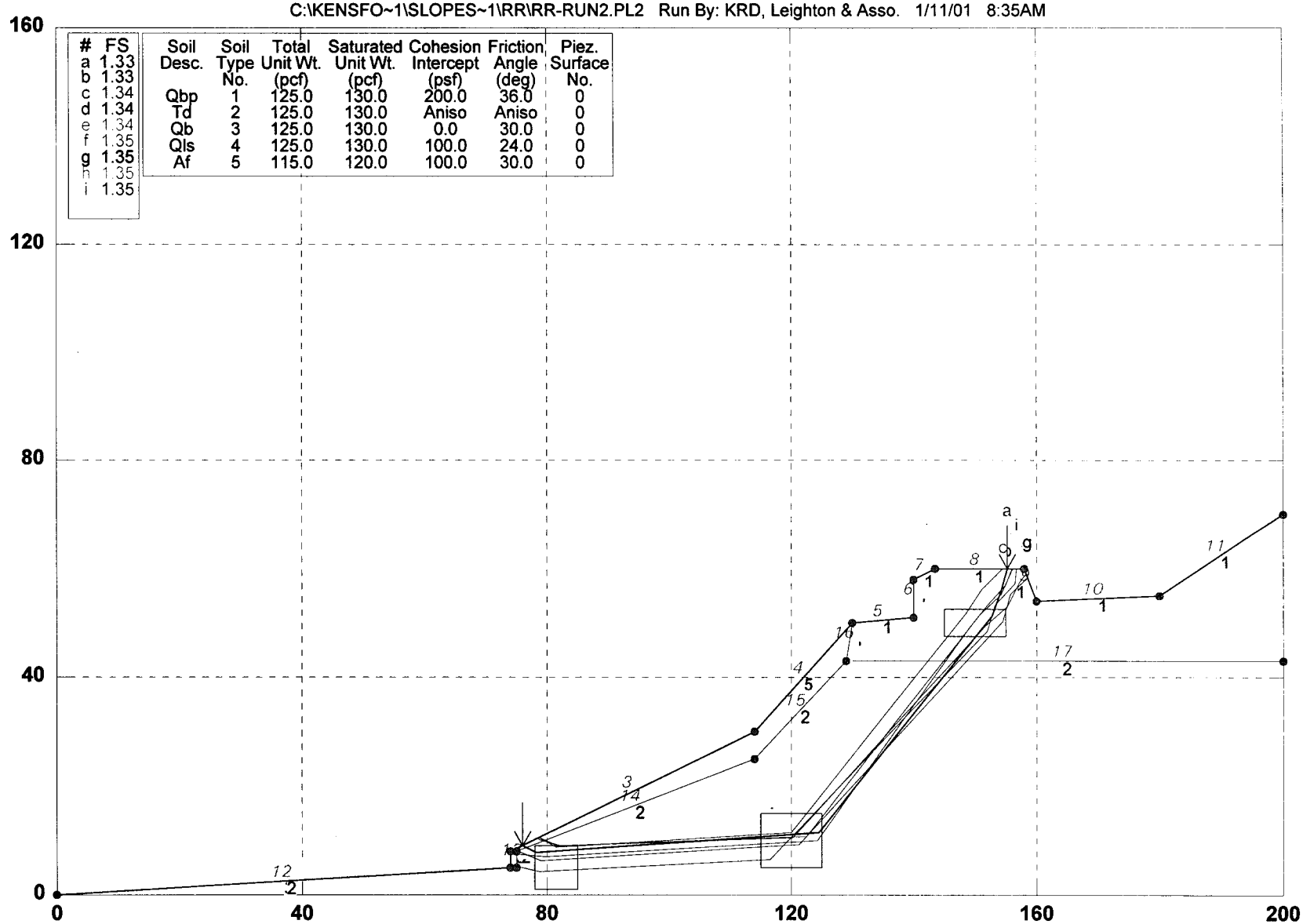
GSTABL7 FSmin=1.35

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (R-R'), Del Mar Bluffs, Static

C:\KENSFO~1\SLOPES~1\RR\RR-RUN2.PL2 Run By: KRD, Leighton & Asso. 1/11/01 8:35AM



#	FS
a	1.33
b	1.33
c	1.34
d	1.34
e	1.34
f	1.35
g	1.35
h	1.35
i	1.35

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

GSTABL7 FSmin=1.33

Safety Factors Are Calculated By The Simplified Janbu Method

STED

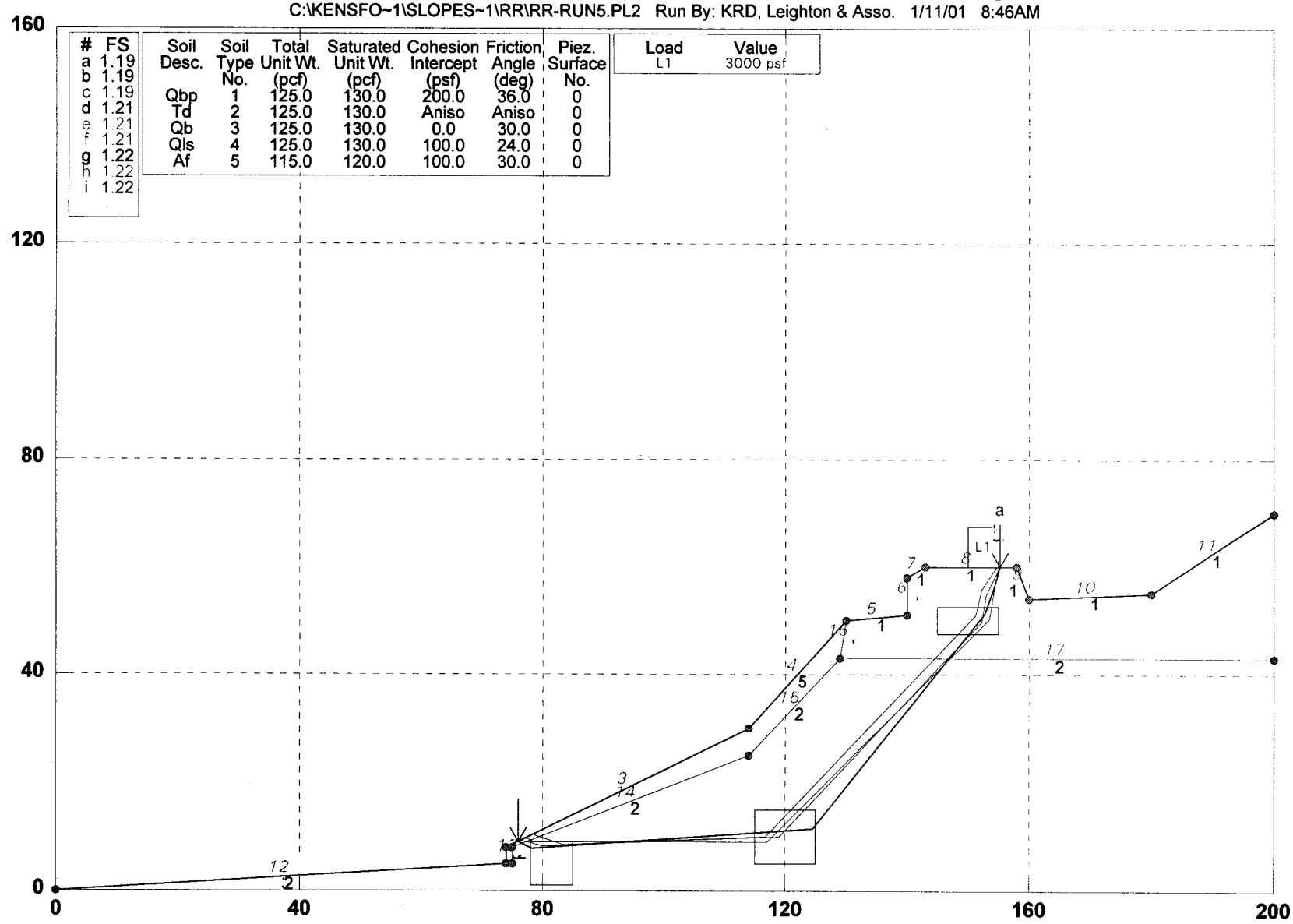
Cross-Section (R-R'), Del Mar Bluffs, Static w/Surcharge

C:\KENSFO~1\SLOPES~1\RR\RR-RUN5.PL2 Run By: KRD, Leighton & Asso. 1/11/01 8:46AM

#	FS
a	1.19
b	1.19
c	1.19
d	1.21
e	1.21
f	1.21
g	1.22
h	1.22
i	1.22

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
L1	3000 psf



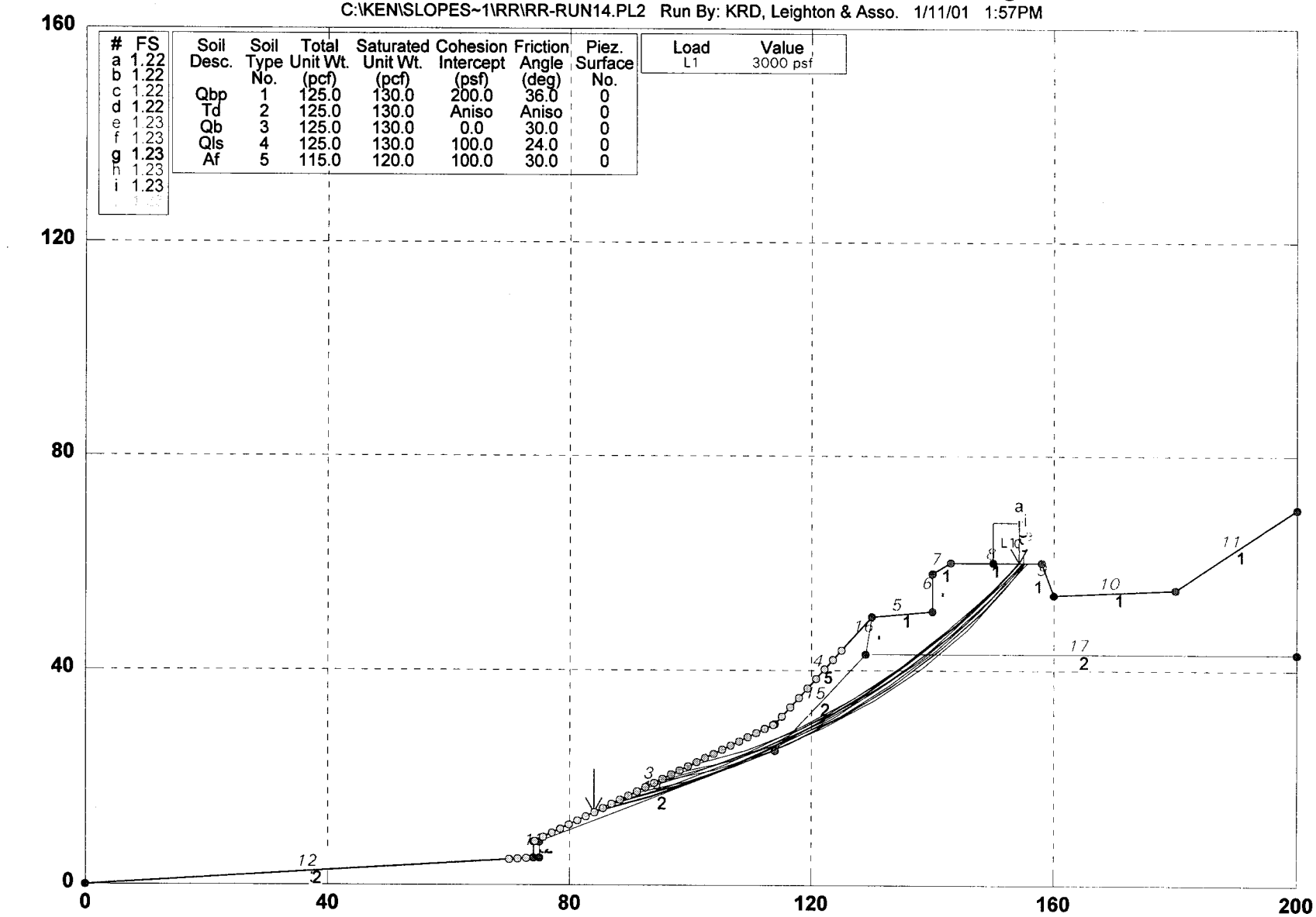
GSTABL7 FSmin=1.19

Safety Factors Are Calculated By The Simplified Janbu Method

STED

Cross-Section (R-R'), Del Mar Bluffs, Static/Surcharge

C:\KEN\SLOPES~1\RR\RR-RUN14.PL2 Run By: KRD, Leighton & Asso. 1/11/01 1:57PM



GSTABL7 FSmin=1.22

Safety Factors Are Calculated By The Modified Bishop Method

STED

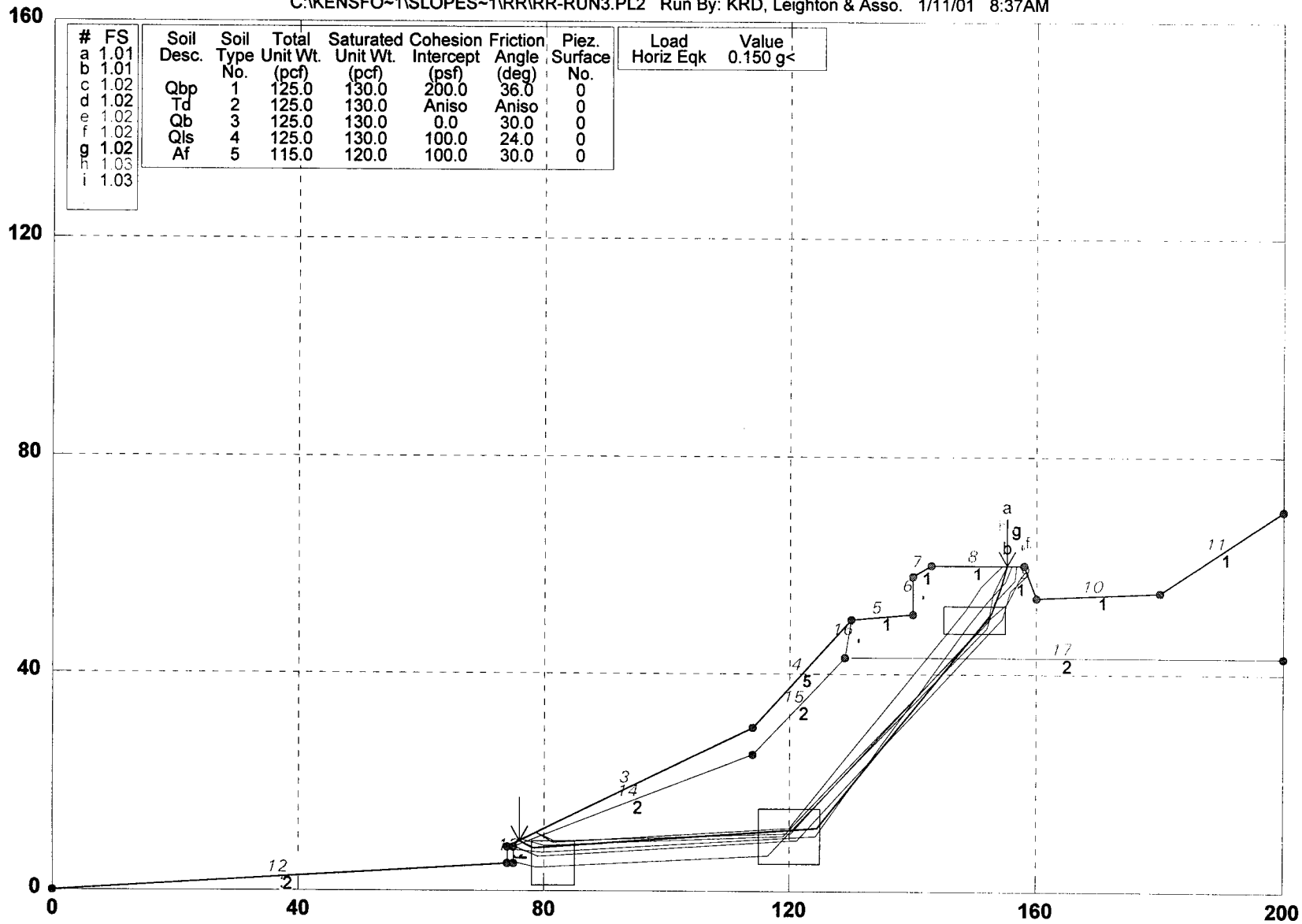
Cross-Section (R-R'), Del Mar Bluffs, Pseudo-Static @ 0.15

C:\KENSFO~1\SLOPES~1\RR\RR-RUN3.PL2 Run By: KRD, Leighton & Asso. 1/11/01 8:37AM

#	FS
a	1.01
b	1.01
c	1.02
d	1.02
e	1.02
f	1.02
g	1.02
h	1.03
i	1.03

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
Horiz Eqk	0.150 g<



GSTABL7 FSmin=1.01

Safety Factors Are Calculated By The Simplified Janbu Method

STED

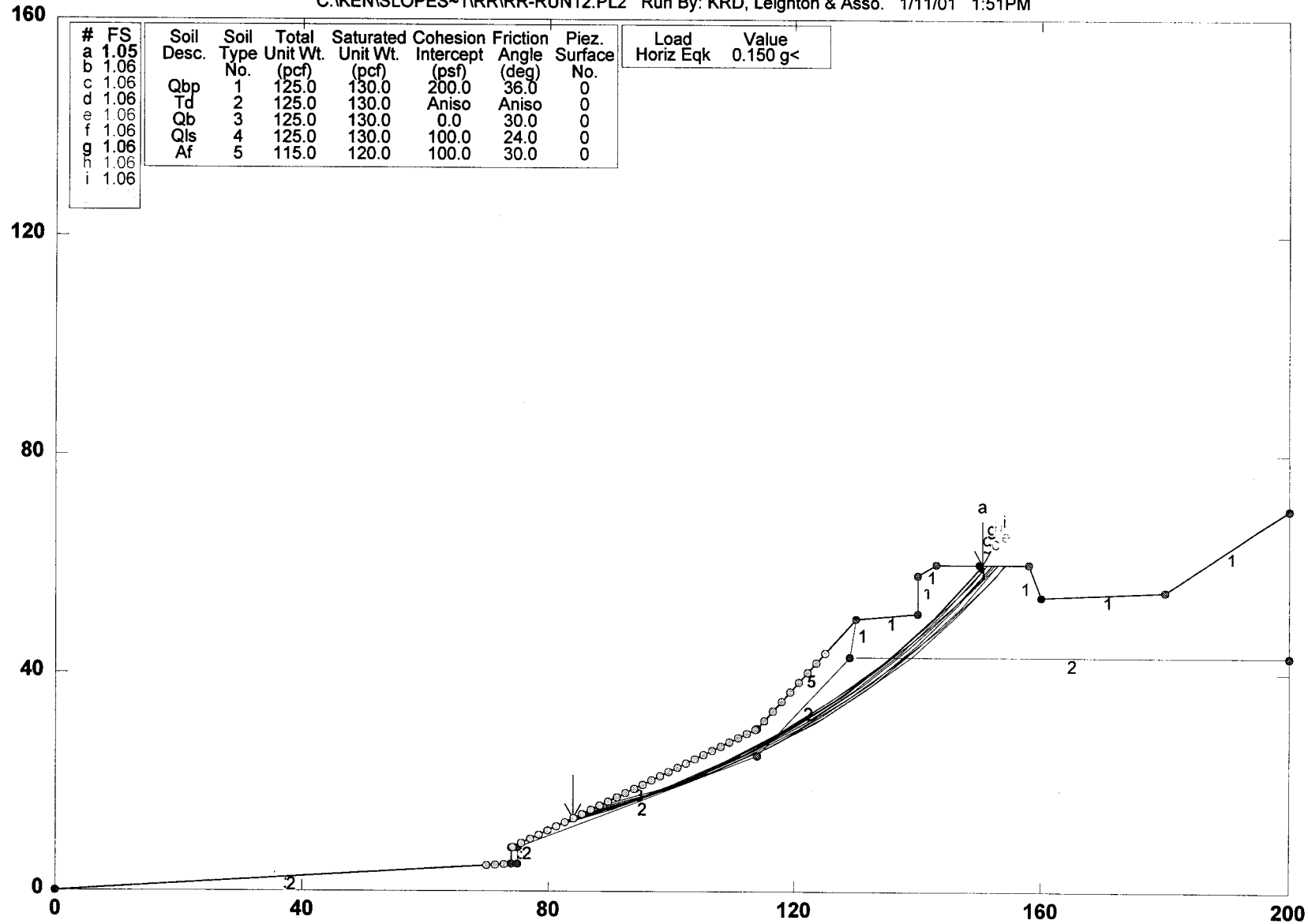
Cross-Section (R-R'), Del Mar Bluffs, Pseudo-Static @ 0.15

C:\KEN\SLOPES~1\RR\RR-RUN12.PL2 Run By: KRD, Leighton & Asso. 1/11/01 1:51PM

#	FS
a	1.05
b	1.06
c	1.06
d	1.06
e	1.06
f	1.06
g	1.06
h	1.06
i	1.06

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
Horiz Eqk	0.150 g<



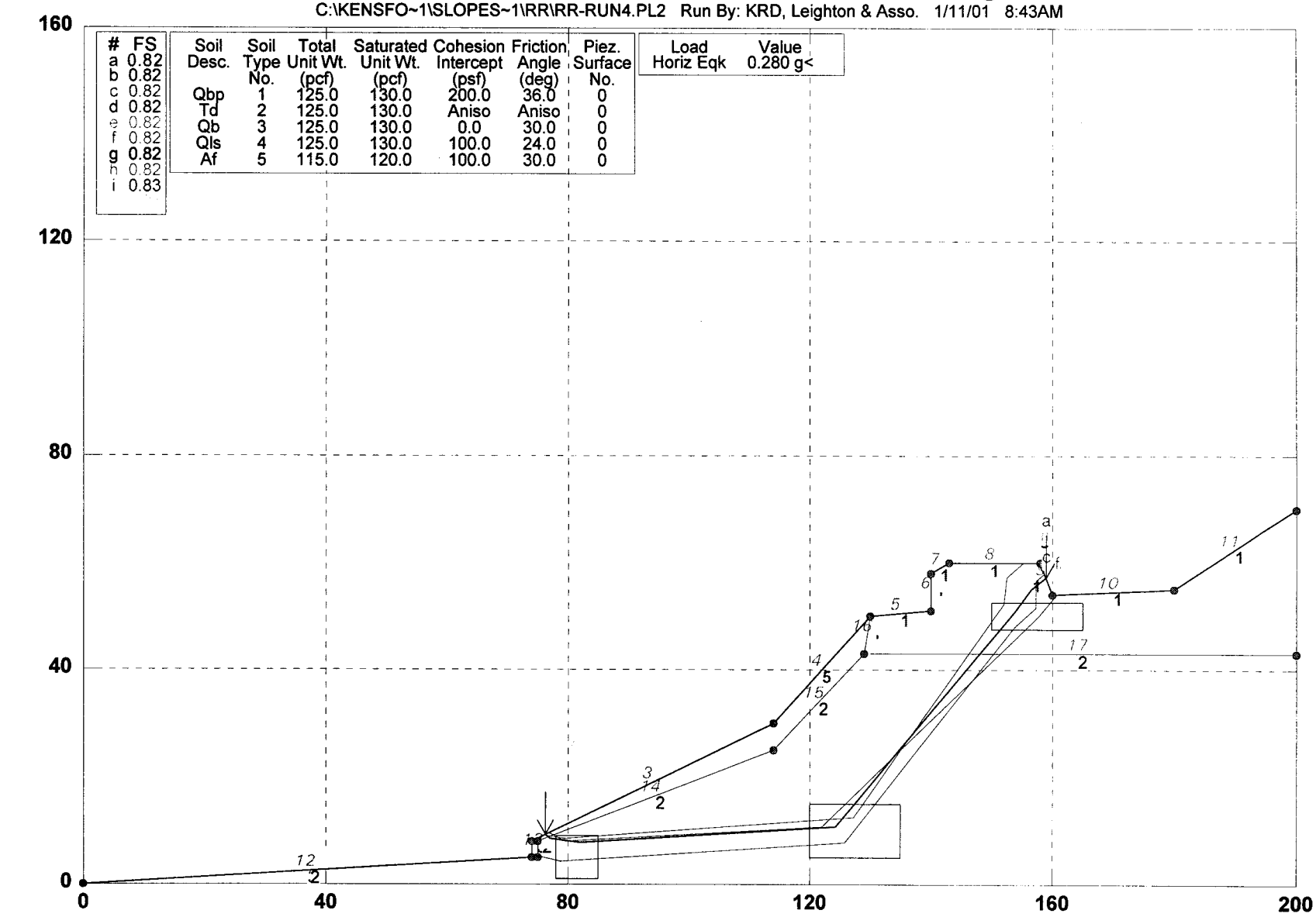
GSTABL7 FSmin=1.05

Safety Factors Are Calculated By The Modified Bishop Method

STED

Cross-Section (R-R'), Del Mar Bluffs, Pseudo-Static @ 0.28

C:\KENSFO~1\SLOPES~1\RR\RR-RUN4.PL2 Run By: KRD, Leighton & Asso. 1/11/01 8:43AM



#	FS
a	0.82
b	0.82
c	0.82
d	0.82
e	0.82
f	0.82
g	0.82
h	0.82
i	0.83

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
Horiz Eqk	0.280 g<

GSTABL7 FSmin=0.82

Safety Factors Are Calculated By The Simplified Janbu Method

STED

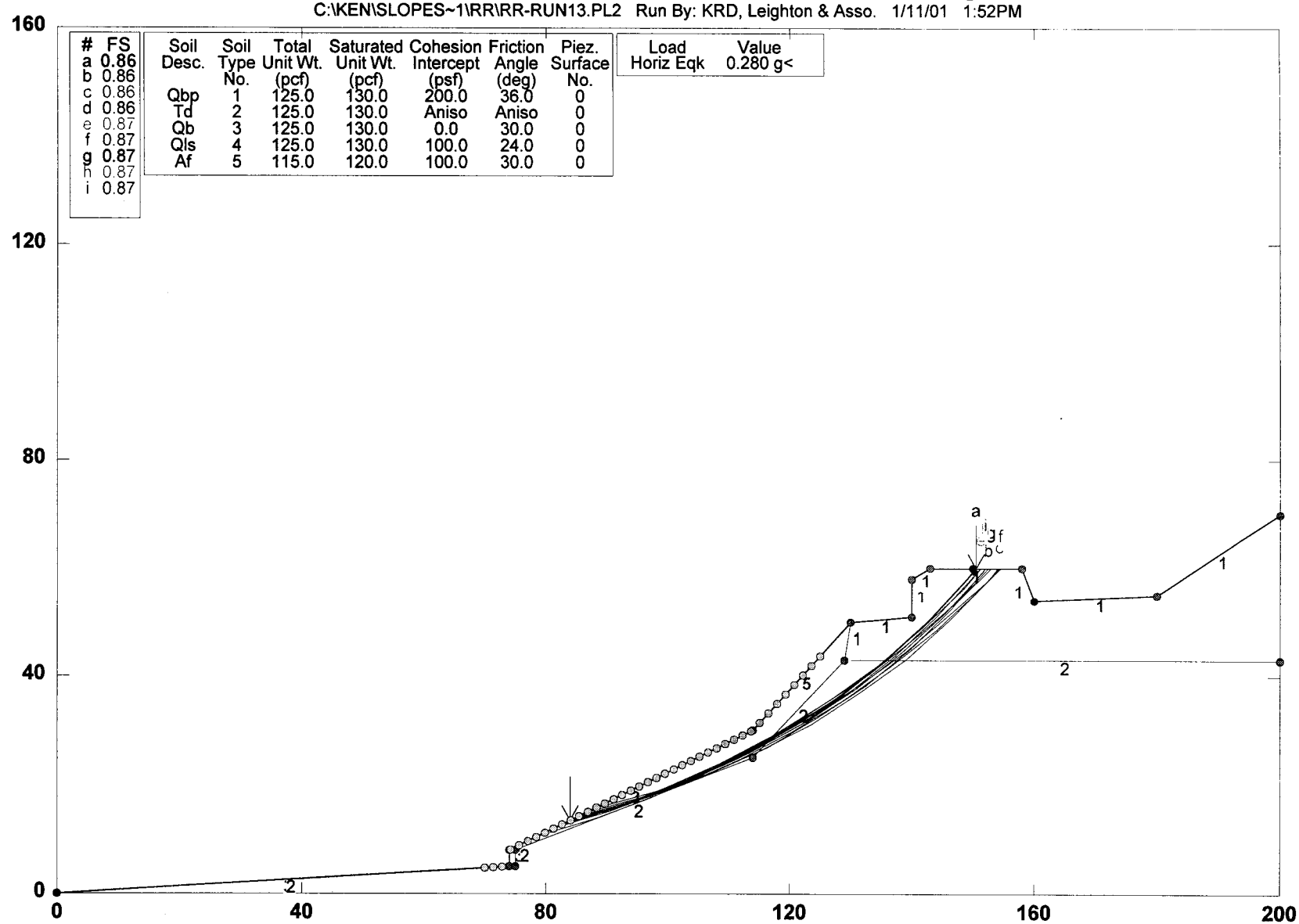
Cross-Section (R-R'), Del Mar Bluffs, Pseudo-Static @ 0.28

C:\KEN\SLOPES~1\RR\RR-RUN13.PL2 Run By: KRD, Leighton & Asso. 1/11/01 1:52PM

#	FS
a	0.86
b	0.86
c	0.86
d	0.86
e	0.87
f	0.87
g	0.87
h	0.87
i	0.87

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
Horiz Eqk	0.280 g<



GSTABL7 FSmin=0.86

Safety Factors Are Calculated By The Modified Bishop Method

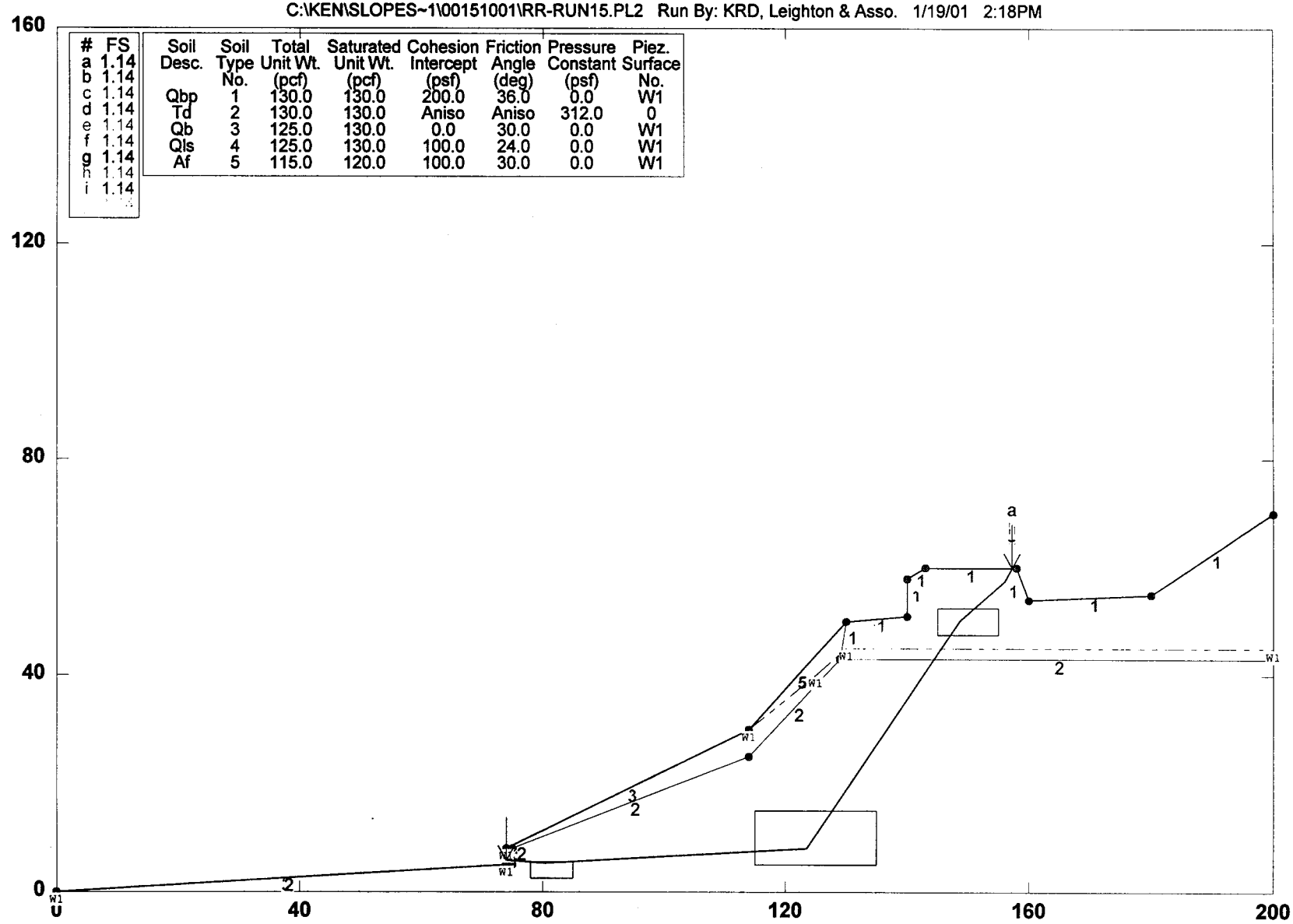
STED

Cross-Section (R-R'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\RR-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 2:18PM

#	FS
a	1.14
b	1.14
c	1.14
d	1.14
e	1.14
f	1.14
g	1.14
h	1.14
i	1.14

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1
Af	5	115.0	120.0	100.0	30.0	0.0	W1



GSTABL7 FSmin=1.14

Safety Factors Are Calculated By The Simplified Janbu Method

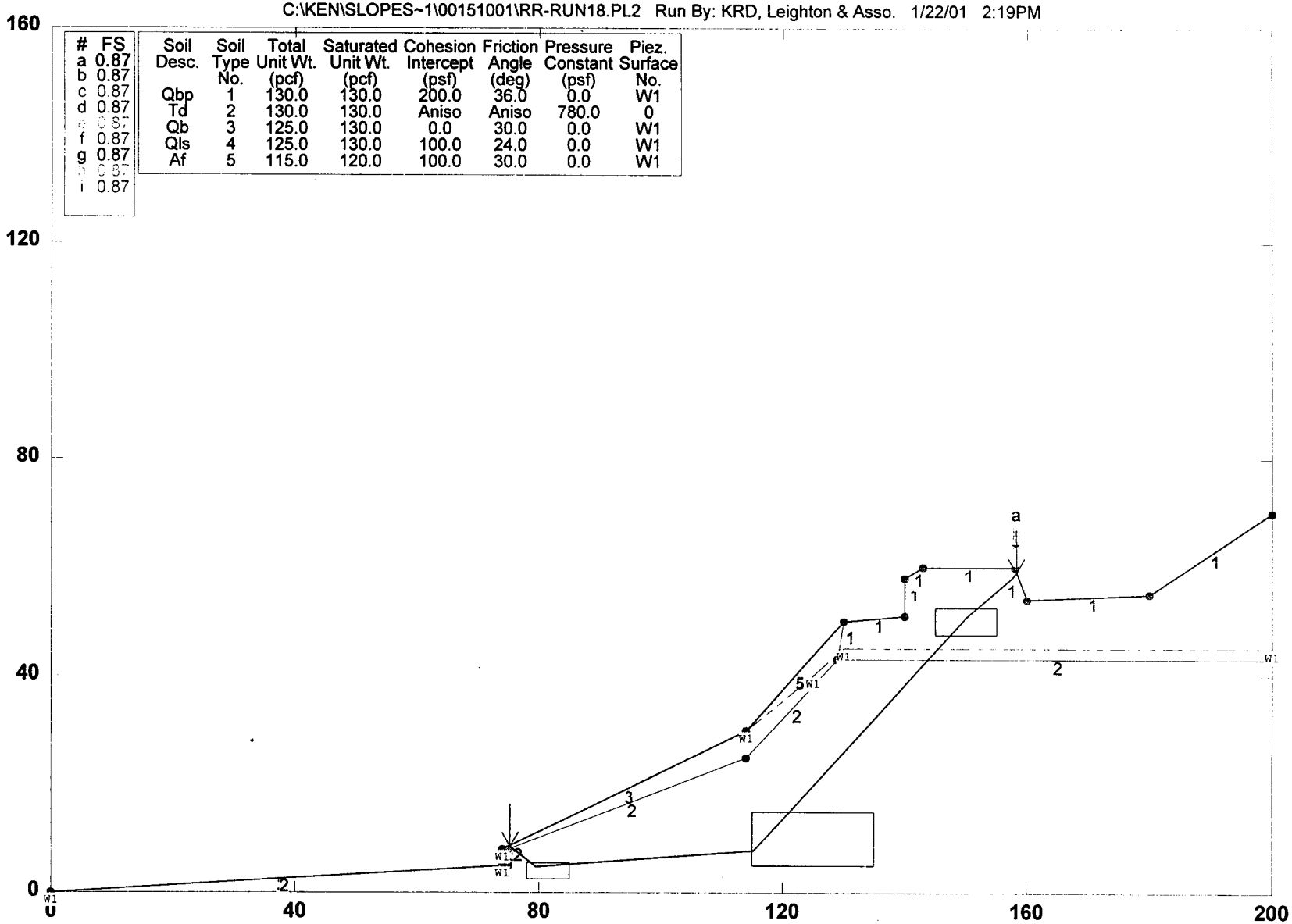
STED

Cross-Section (R-R'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\RR-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 2:19PM

#	FS
a	0.87
b	0.87
c	0.87
d	0.87
e	0.87
f	0.87
g	0.87
h	0.87
i	0.87

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1
Af	5	115.0	120.0	100.0	30.0	0.0	W1



GSTABL7 FSmin=0.87

Safety Factors Are Calculated By The Simplified Janbu Method

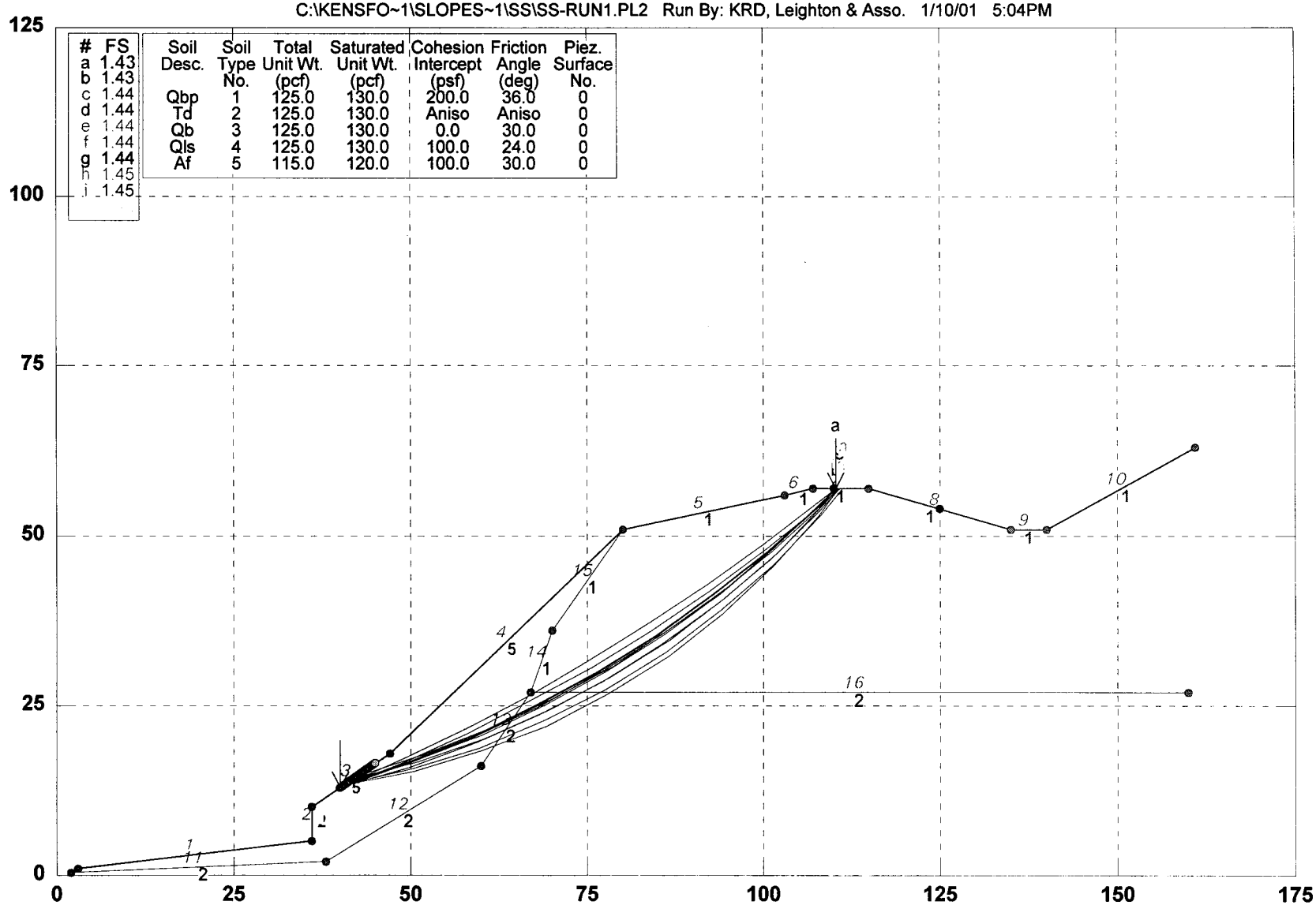
STED

Cross-Section (S-S'), Del Mar Bluffs, Static

C:\KENSFO~1\SLOPES~1\SS\SS-RUN1.PL2 Run By: KRD, Leighton & Asso. 1/10/01 5:04PM

#	FS
a	1.43
b	1.43
c	1.44
d	1.44
e	1.44
f	1.44
g	1.44
h	1.45
i	1.45

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0



GSTABL7 FSmin=1.43

Safety Factors Are Calculated By The Simplified Janbu Method

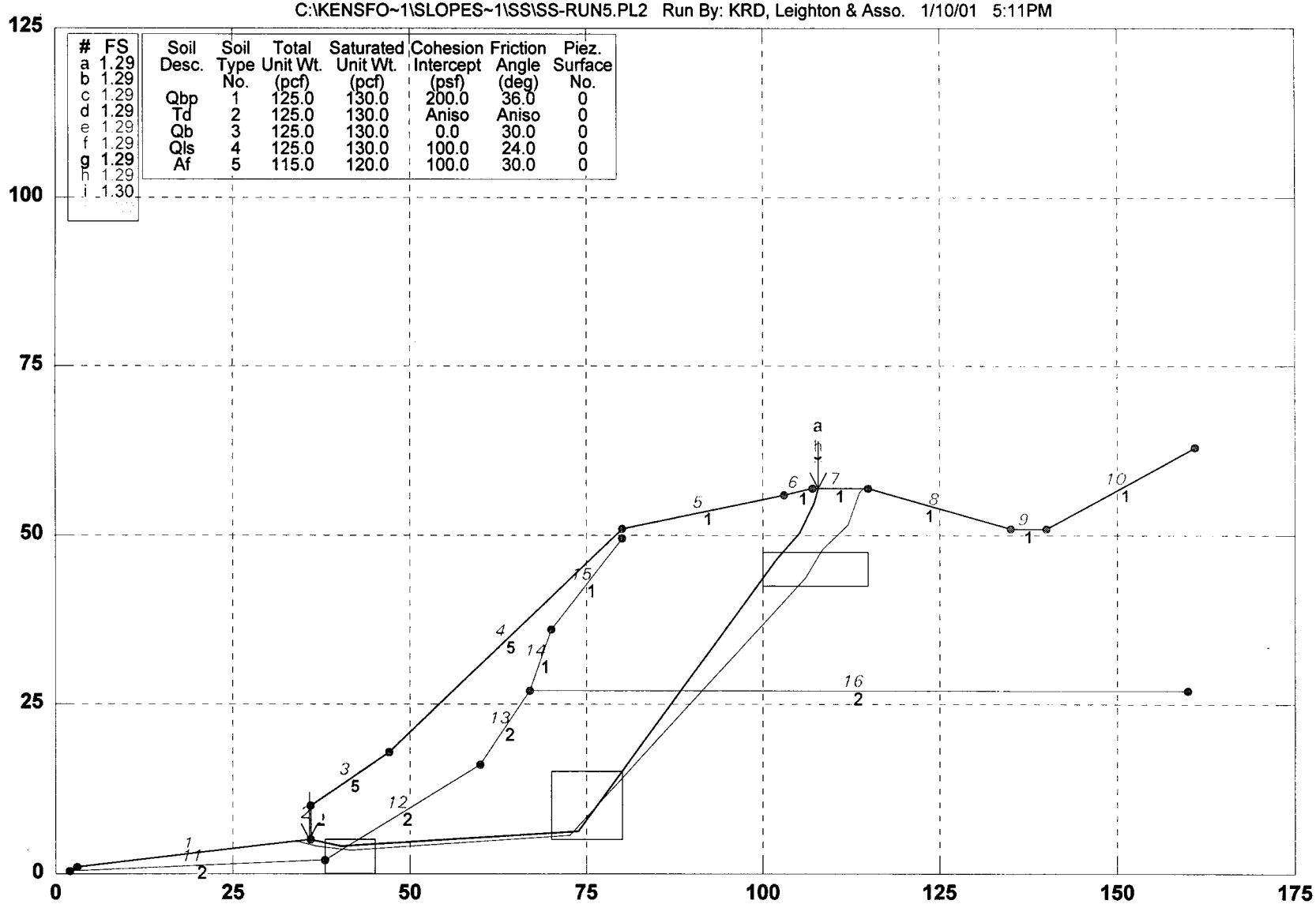
STED

Cross-Section (S-S'), Del Mar Bluffs, Static

C:\KENSFO~1\SLOPES~1\SS\SS-RUN5.PL2 Run By: KRD, Leighton & Asso. 1/10/01 5:11PM

#	FS
a	1.29
b	1.29
c	1.29
d	1.29
e	1.29
f	1.29
g	1.29
h	1.29
i	1.30

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0



GSTABL7 FSmin=1.29

Safety Factors Are Calculated By The Simplified Janbu Method

STED

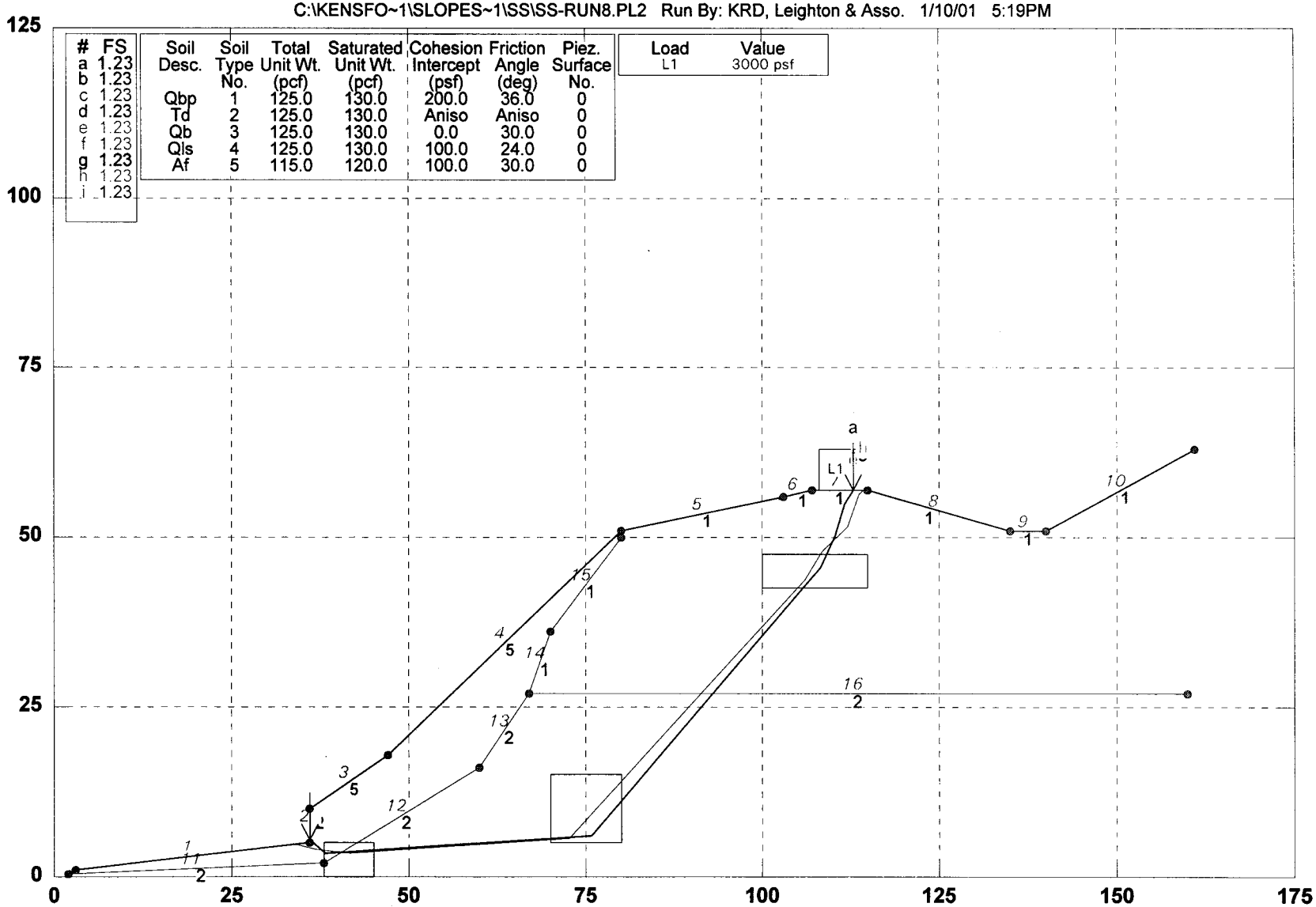
Cross-Section (S-S'), Del Mar Bluffs, Static w/Surcharge

C:\KENSFO~1\SLOPES~1\SS\SS-RUN8.PL2 Run By: KRD, Leighton & Asso. 1/10/01 5:19PM

#	FS
a	1.23
b	1.23
c	1.23
d	1.23
e	1.23
f	1.23
g	1.23
h	1.23
i	1.23

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
L1	3000 psf



GSTABL7 FSmin=1.23

Safety Factors Are Calculated By The Simplified Janbu Method

STED

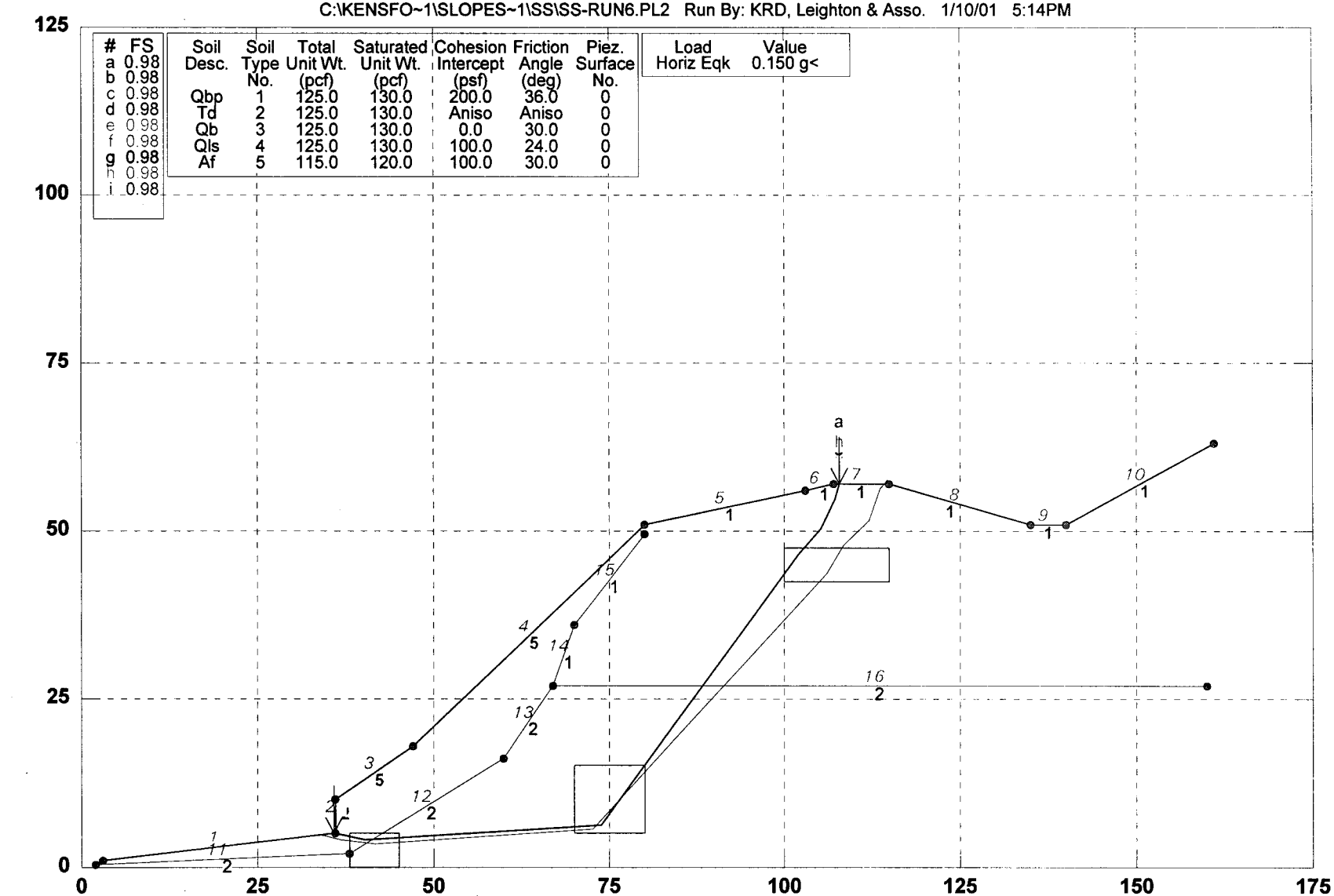
Cross-Section (S-S'), Del Mar Bluffs, Pseudo-Static @ 0.15

C:\KENSFO~1\SLOPES~1\SS\SS-RUN6.PL2 Run By: KRD, Leighton & Asso. 1/10/01 5:14PM

#	FS
a	0.98
b	0.98
c	0.98
d	0.98
e	0.98
f	0.98
g	0.98
h	0.98
i	0.98

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
Horiz Eqk	0.150 g<



GSTABL7 FSmin=0.98

Safety Factors Are Calculated By The Simplified Janbu Method

STED

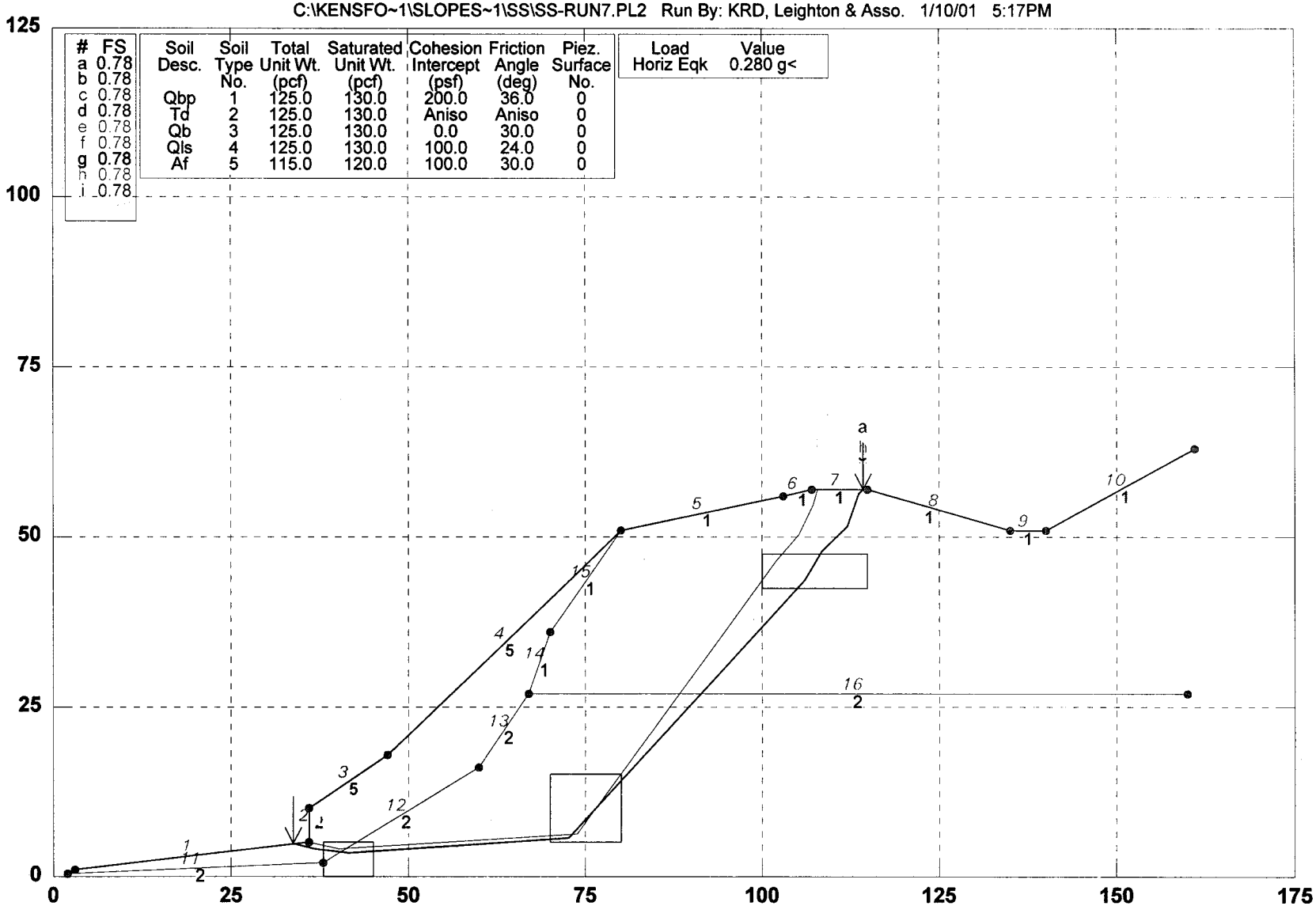
Cross-Section (S-S'), Del Mar Bluffs, Pseudo-Static @ 0.28

C:\KENSFO~1\SLOPES~1\SS\SS-RUN7.PL2 Run By: KRD, Leighton & Asso. 1/10/01 5:17PM

#	FS
a	0.78
b	0.78
c	0.78
d	0.78
e	0.78
f	0.78
g	0.78
h	0.78
i	0.78

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qbp	1	125.0	130.0	200.0	36.0	0
Td	2	125.0	130.0	Aniso	Aniso	0
Qb	3	125.0	130.0	0.0	30.0	0
Qls	4	125.0	130.0	100.0	24.0	0
Af	5	115.0	120.0	100.0	30.0	0

Load	Value
Horiz Eqk	0.280 g<



GSTABL7 FSmin=0.78

Safety Factors Are Calculated By The Simplified Janbu Method

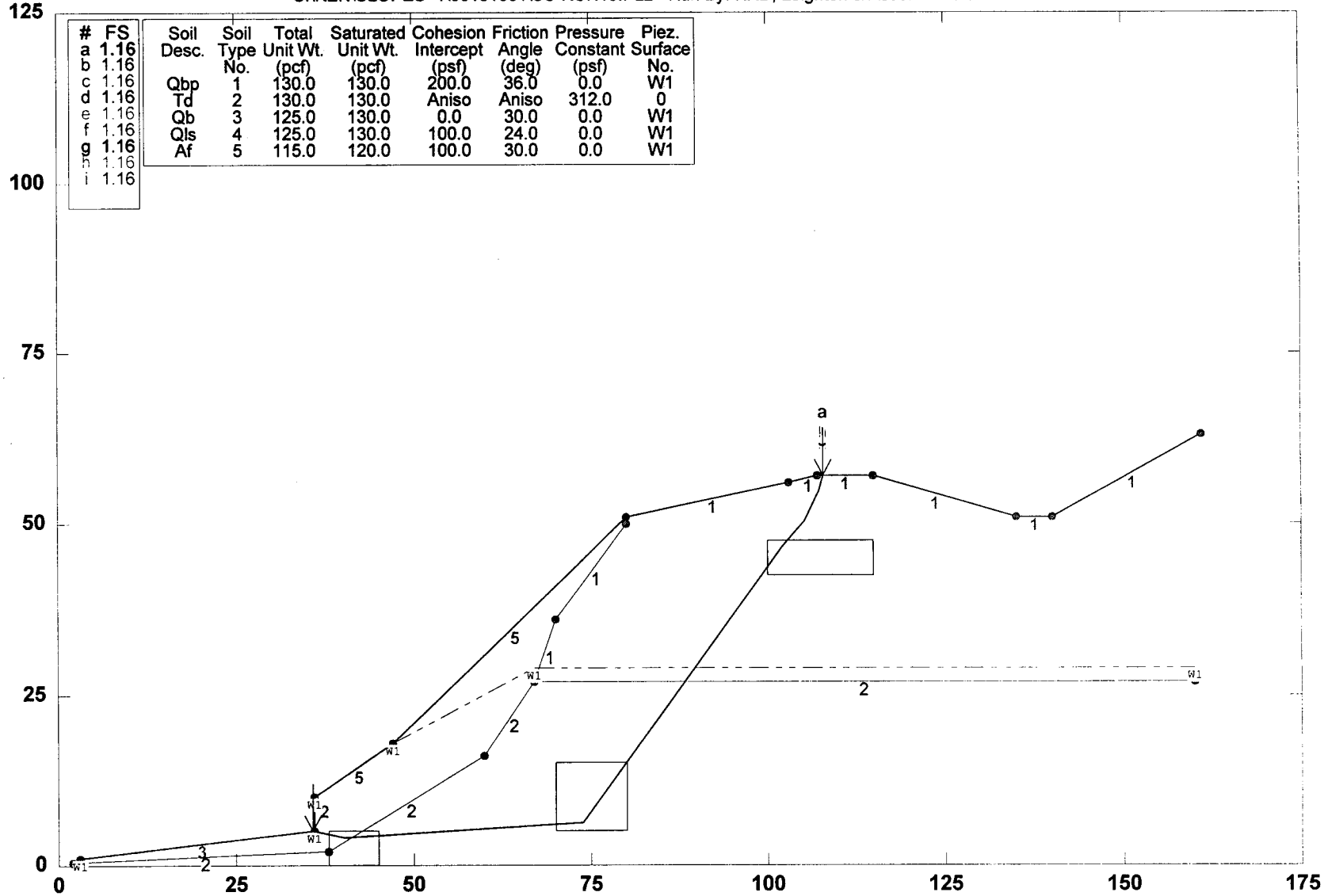
STED

Cross-Section (S-S'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\SS-RUN15.PL2 Run By: KRD, Leighton & Asso. 1/19/01 2:23PM

#	FS
a	1.16
b	1.16
c	1.16
d	1.16
e	1.16
f	1.16
g	1.16
h	1.16
i	1.16

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	312.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1
Af	5	115.0	120.0	100.0	30.0	0.0	W1



GSTABL7 FSmin=1.16

Safety Factors Are Calculated By The Simplified Janbu Method

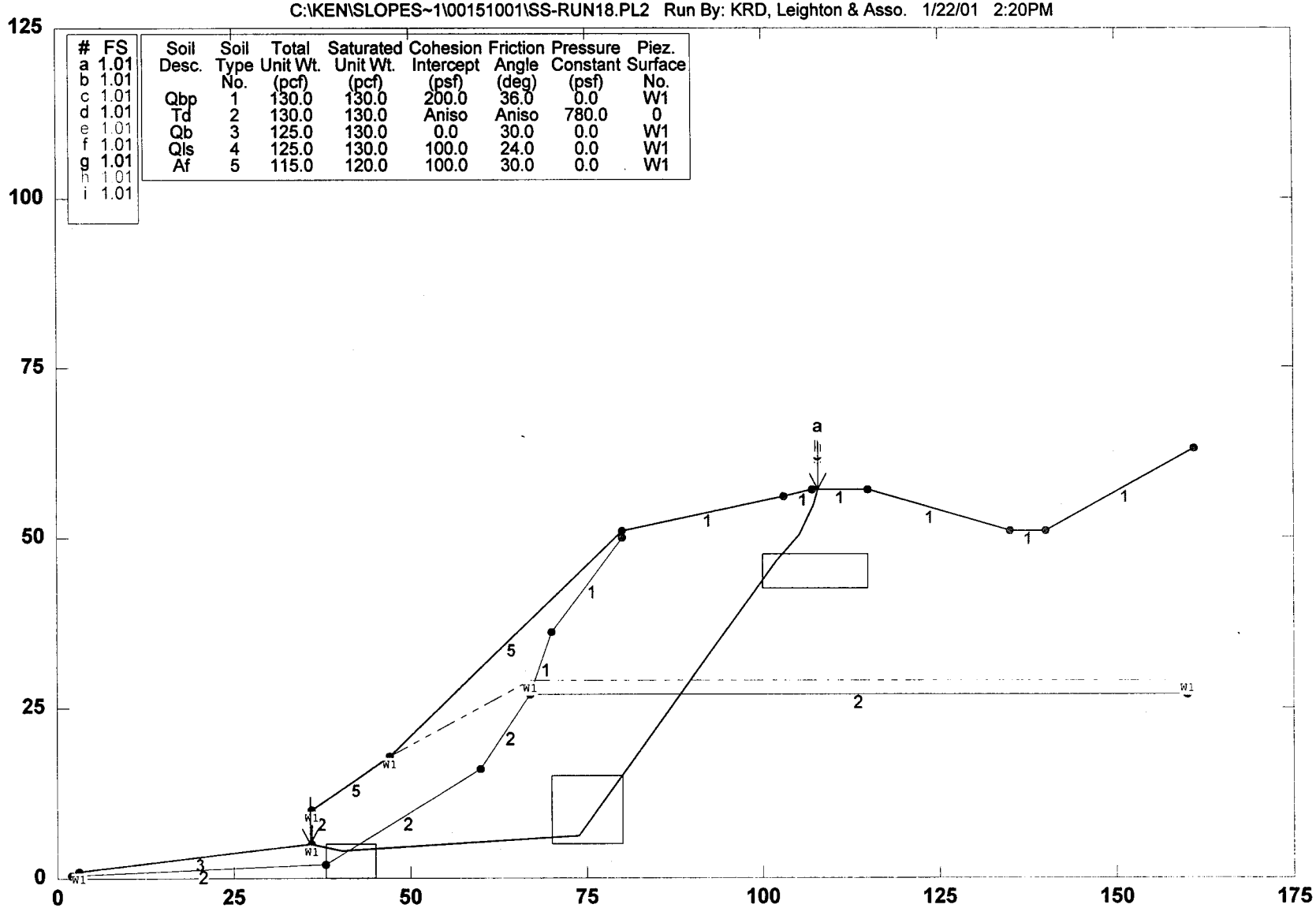
STED

Cross-Section (S-S'), Del Mar Bluffs, Static/Saturated

C:\KEN\SLOPES~1\00151001\SS-RUN18.PL2 Run By: KRD, Leighton & Asso. 1/22/01 2:20PM

#	FS
a	1.01
b	1.01
c	1.01
d	1.01
e	1.01
f	1.01
g	1.01
h	1.01
i	1.01

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pressure Constant (psf)	Piez. Surface No.
Qbp	1	130.0	130.0	200.0	36.0	0.0	W1
Td	2	130.0	130.0	Aniso	Aniso	780.0	0
Qb	3	125.0	130.0	0.0	30.0	0.0	W1
Qls	4	125.0	130.0	100.0	24.0	0.0	W1
Af	5	115.0	120.0	100.0	30.0	0.0	W1



GSTABL7 FSmin=1.01

Safety Factors Are Calculated By The Simplified Janbu Method

STED

APPENDIX H

HISTORICAL DATA

APPENDIX H

SURVEY DATA

Date of Survey	Mile Post	Location	Event
1889	244.1 to 245.6	Coast Blvd to Anderson Canyon	Survey Map
January 4th, 1941	244.79	7th Street	Landslide of December 31, 1940
April 21st, 1941	244.33	13th Street	Landslide of February 21, 1941
January 20th, 1958	244.76	Little Orphan Alley	Landslide survey
January 20th, 1961	244.44	11.5 Street	Landslide survey
February 15th, 1962	244.5	11th Street	Test holes in slide
February 7th, 1962	244.5	11th Street	New drains
March 14th, 1962	244.47	11.25 Street	Landslide
March 26th, 1962	244.47	11.25 Street	Landslide
November 12th, 1964	244.47	11.25 Street	Ret. Wall Survey
July 10th, 1962	244.47	11th Street	Ditch lining & subdrain
April 17th, 1975	244.78	7th Street	Slide Protection

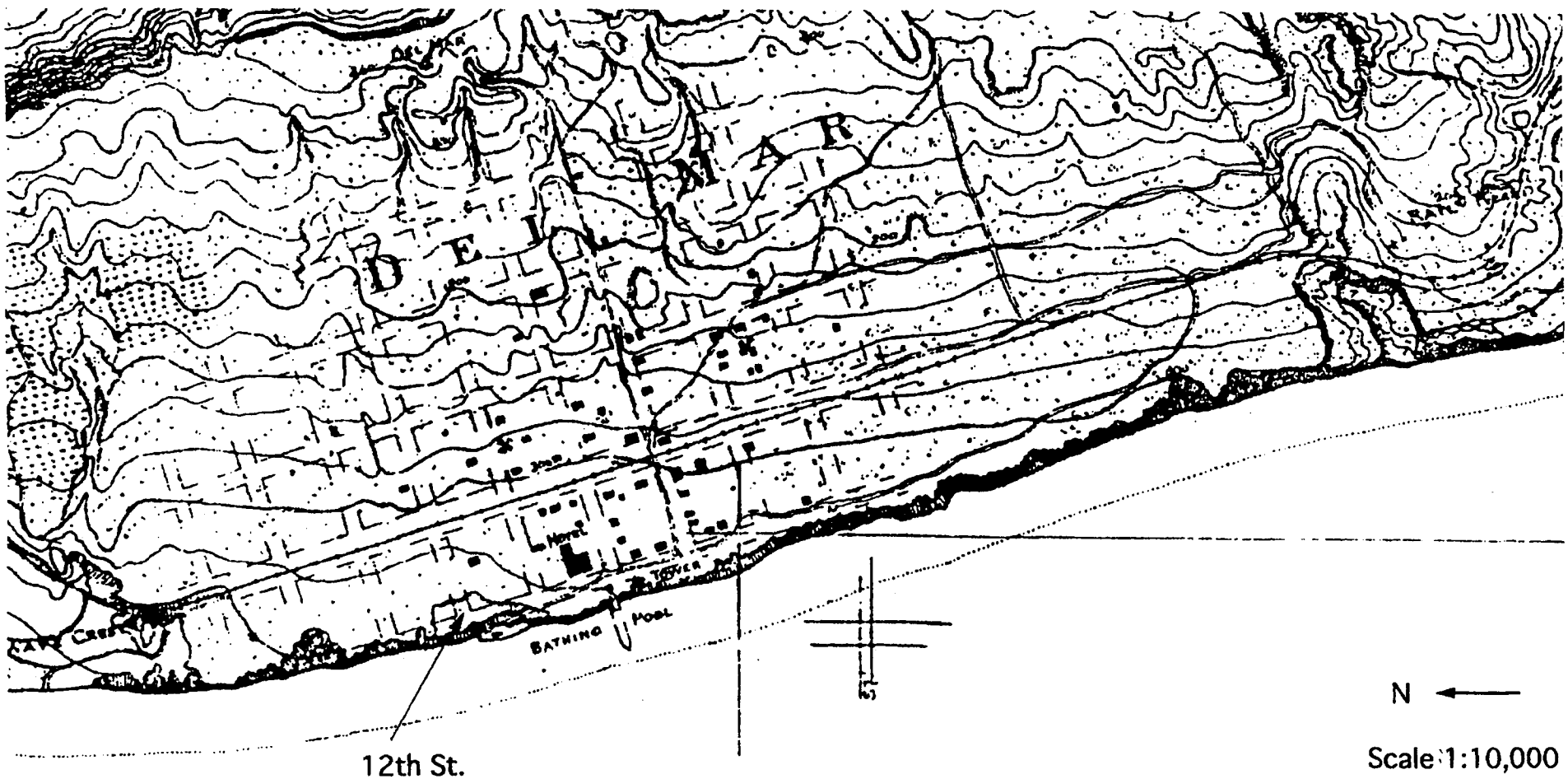


Figure 1 - U. S. Coast and Geodetic Survey Map, 1889

Form 1928 Standard

DATE 1-4-41 THE A. T. & S. F. RY. CO. SYSTEM 244+4170

DRAWING NO. L-26-13937 CORR. PAGE 1 15

TRANSITMAN G K Haffly FOR COMPLETION REPORT CARBON TO CHIEF ENGR. STATION ½ Mile E Del Mar

RODMAN W H Robinette AUTH. VAL. SEC. STATE Calif

CHAINMAN R A Hall COMM. IN SERVICE 244/4170

NOTES TAKEN BY GKH COMP L.A. 4th.

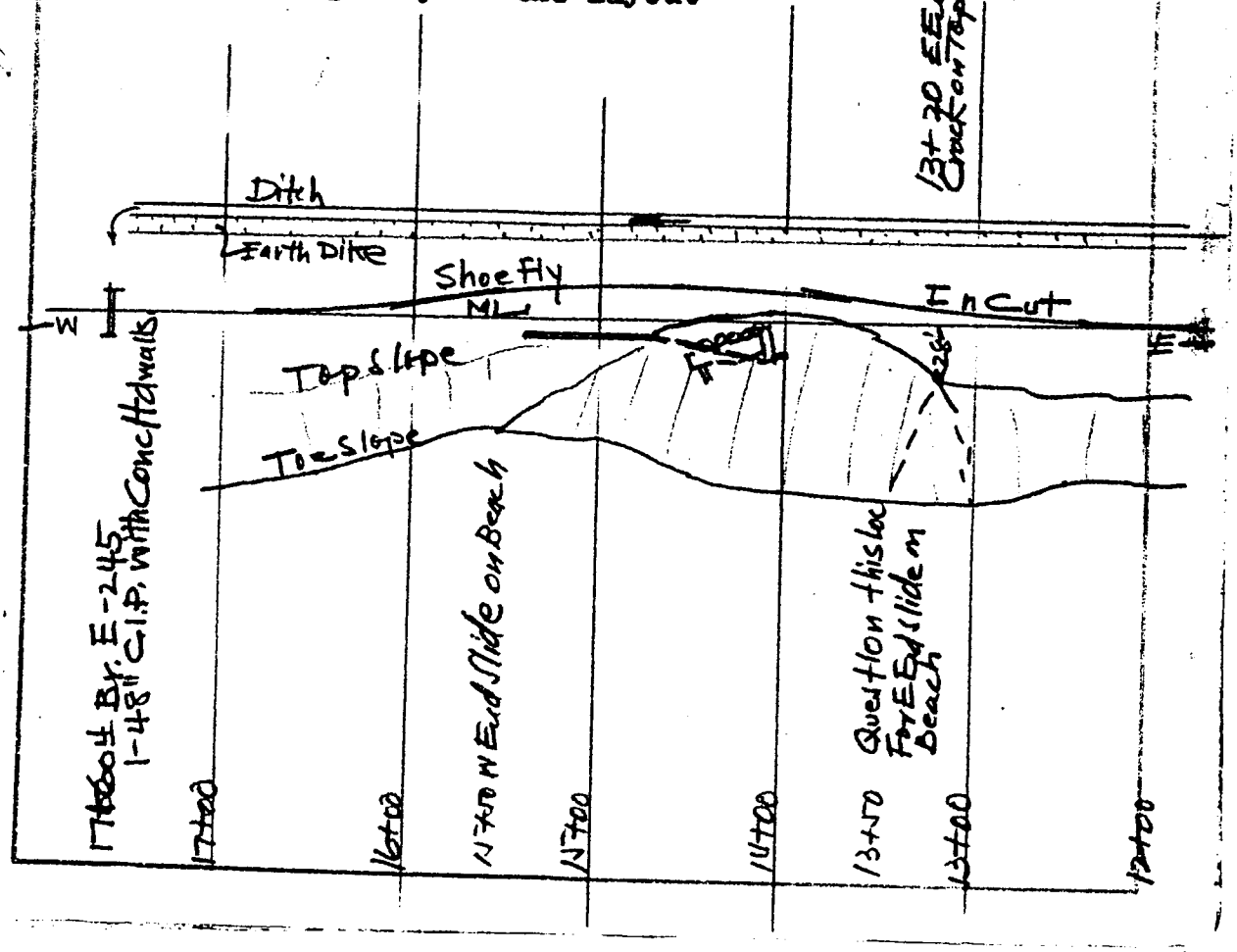
TITLE Topographic Survey Site of Wreck Ex 1676 W. 12-31-40.

The following series of notes consists principally of toppgraphic cross-sections taken at even Engineer's Stas and plus 50's, extending about three hundred feet out on north side and down onto beach south side.

Some data on remaining portion of concrete retaining wall is given, also location of thefragments of same which lie on slope below engine.

The performance of this work was obstructed by work trains and crowd of sight-seers, and the various portions of the sections were taken as openings presented, continuity of sections was not possible, but that in no way affects the final results.

No sketch plan could be made in the available time, but any kind of plan can be made from thesections. The principal topographic features are noted in the sections. Below is a rough key to the layout



Form 1928 Standard

DATE 1-4-41 THE A. T. & S. F. RY. CO. SYSTEM PAGE 11 OF N

DRAWING NO. CORP. CARBON TO CHIEF ENGR.

TRANSITMAN FOR COMPLETION REPORT STATION SAN. E. & DelMar

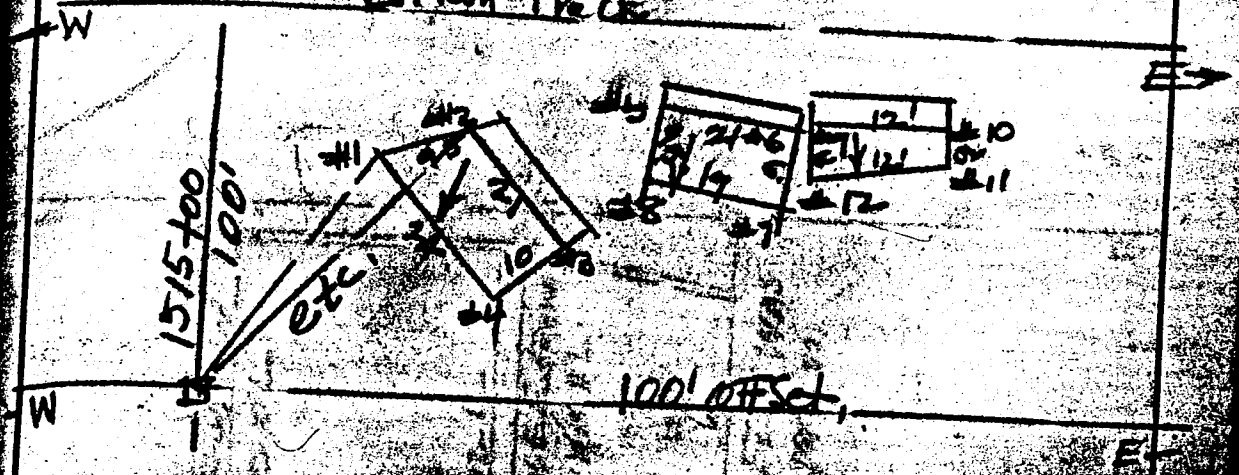
RODMAN AUTH. VAL. SEC. STATE Calif

CHAINMAN COMM. IN SERVICE M. P. 244+170 = 244+79

NOTES TAKEN BY G.K.H. COMP. DIVISION L.A. DISTRICT

TITLE Topographic Survey Site of Wreck 12-31-40

Location Fragments of Retaining Wall Lying on Slope



Note 1 - There are 3 Slabs of Retwall Lying on Slope below engine. Back face up - 5 x 25' Footing up - The Points Located are all Neat wall, toe as well as top.

H.I. 8.35 Inst. Set up	Fore-sight	Horiz. L	Vert. L	Dist. Measured Slope	Horiz. Dist. from Inst.	Vert. Dist. above Inst.	Elev.	
15+00	Target	68-15	14-20	65.7	63.8	16.3	246	Pt #1
100 South	East	62-30	16-11	71.6	68.4	20.6	28.9	2
		45-50	11-10	60.5	58.9	14.2	22.4	3
		47-20	8-10	57.4	56.8	8.5	16.8	4
		52-45	17-30	86.0	81.0	26.1	34.4	5
		41-35	16-01	91.0	86.1	27.3	35.6	6
		39-00	15-11	93.9	89.7	24.4	32.7	7
		46-30	14-30	78.1	76.4	20.0	28.3	8
		37-30	18-07	106.3	101.0	33.1	41.4	9
		34-15	15-40	104.5	100.1	30.0	38.3	10
		29-00	14-54	96.0	92.7	24.7	33.0	11
								12

Form 1926 Standard

DATE 1-4-51 — THE A. T. & S. F. RY. CO. SYSTEM — PAGE 1 OF 1

DRAWING NO. — CORP. — CARBON TO CHIEF ENGR.

TRANSITMAN — FOR COMPLETION REPORT — STATION Near Del Mar

RODMAN — AUTH. — VAL. SEC. — STATE Calif.

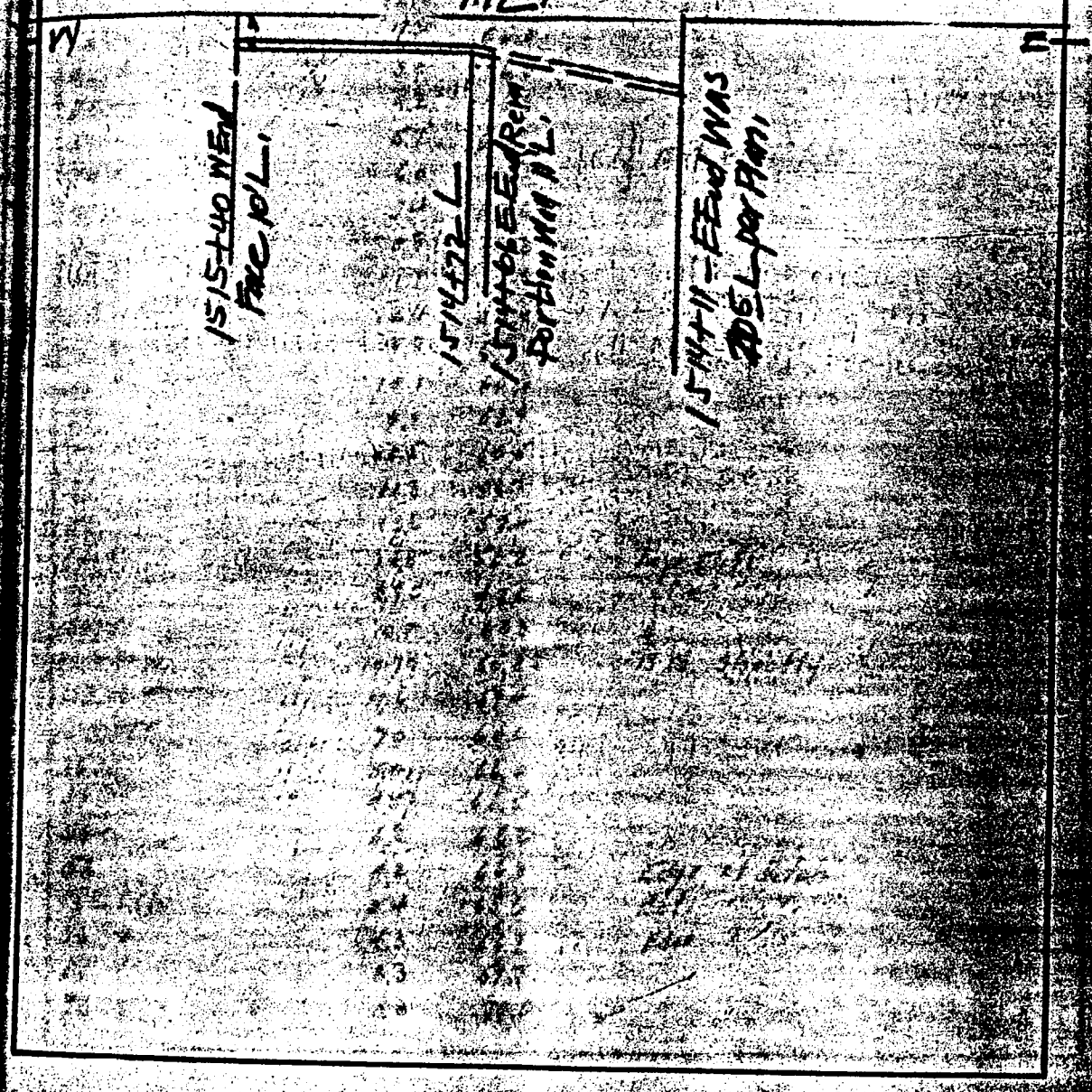
CHAINMAN — COMM. — IN SERVICE — M. P. 244+9170

NOTES TAKEN BY GKH — COMP. — DIVISION — DISTRICT

TITLE Topographic Survey Sht. of Nrec. 12-51-40

Loc. Remaining Portion of Parallel Retaining Wall

Plan - Drwg F-3-8488



244+1764

Form 1928 Standard

DATE 4-21-41. **THE A. T. & S. F. RY. CO. SYSTEM** PAGE 1 OF 3

DRAWING NO. ______ CORP. ______ CARBON TO CHIEF ENGR. 4/22/41

TRANSITMAN N. A. Richards

RODMAN K. C. Keeney

CHAINMAN T. V. Dulity

NOTES TAKEN BY R.

FOR COMPLETION REPORT

AUTH. ______ VAL. SEC. ______

COMM. ______ IN SERVICE ______

COMP. ______ L.A. DIVISION

STATION Del Mar

STATE Calif.

M. P. 244 + 1763.8

4th DISTRICT

TITLE Slide at Del Mar on South Side of Track

1534+52.0 Beg Ditch 39.0 R
on Top of cut
This Ditch carrys
Seepage Water to Br C-245

37+45 Beg slide
Top of Cliff 21.0 L
Toe Cut 17.5 R

37+80.0 Top cliff 21.0 L
Shows seepage 5.2 below
Top of cliff

38+05 Top cliff 39.0 L

38+83.0 Top cliff 30.0 L

39+00 End of slide
Top Cliff 35.0 L

HALL

40M Sets 2-56 — Form 1928 Standard

DATE 1-20-58 — **THE A. T. & S. F. RY. CO. SYSTEM** — **PAGE** 1 **OF** 1

DRAWING NO. — CORP. — CARBON TO CHIEF ENGR.

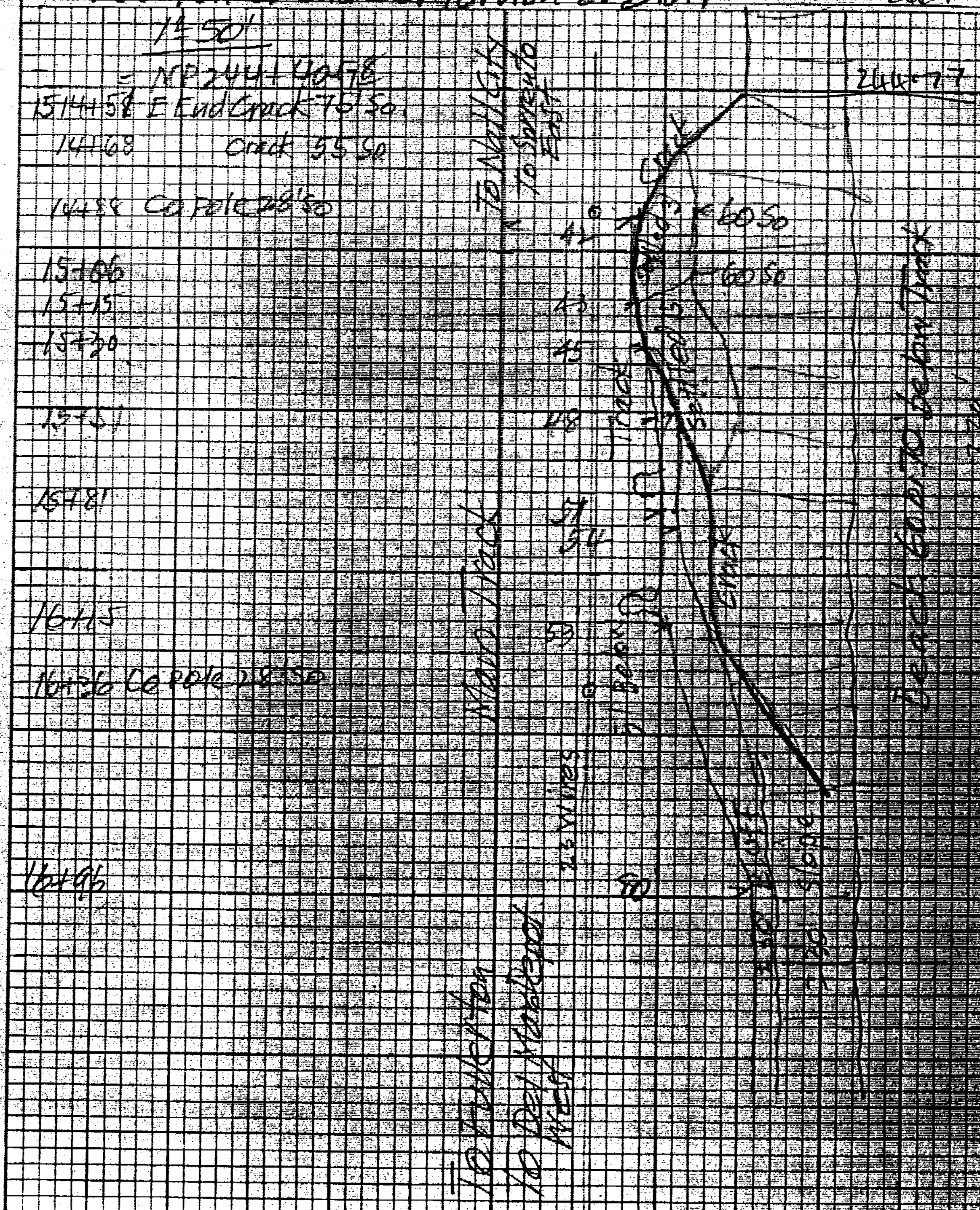
TRANSITMAN G.K. Hatfly — FOR COMPLETION REPORT — STATION Del Mar

RODMAN J.E. Boyd — AUTH. — VAL. SEC. — STATE Calif.

CHAINMAN R.D. San Miguel — COMM. — IN SERVICE — M.P. 244+4000' = 244.79

NOTES TAKEN BY G.K.H. — COMP. — DIVISION L.A. 4th — DISTRICT 244.76

TITLE Location of Slide of Portion of Bluff



Hall 30M Sets 7-59

Form 1928 Standard

244+2322

DATE 1-20-61 — THE A. T. & S. F. RY. CO. SYSTEM — PAGE 1 OF 10

DRAWING NO. — CORP. S.F.C.L. — CARBON TO CHIEF ENGR.

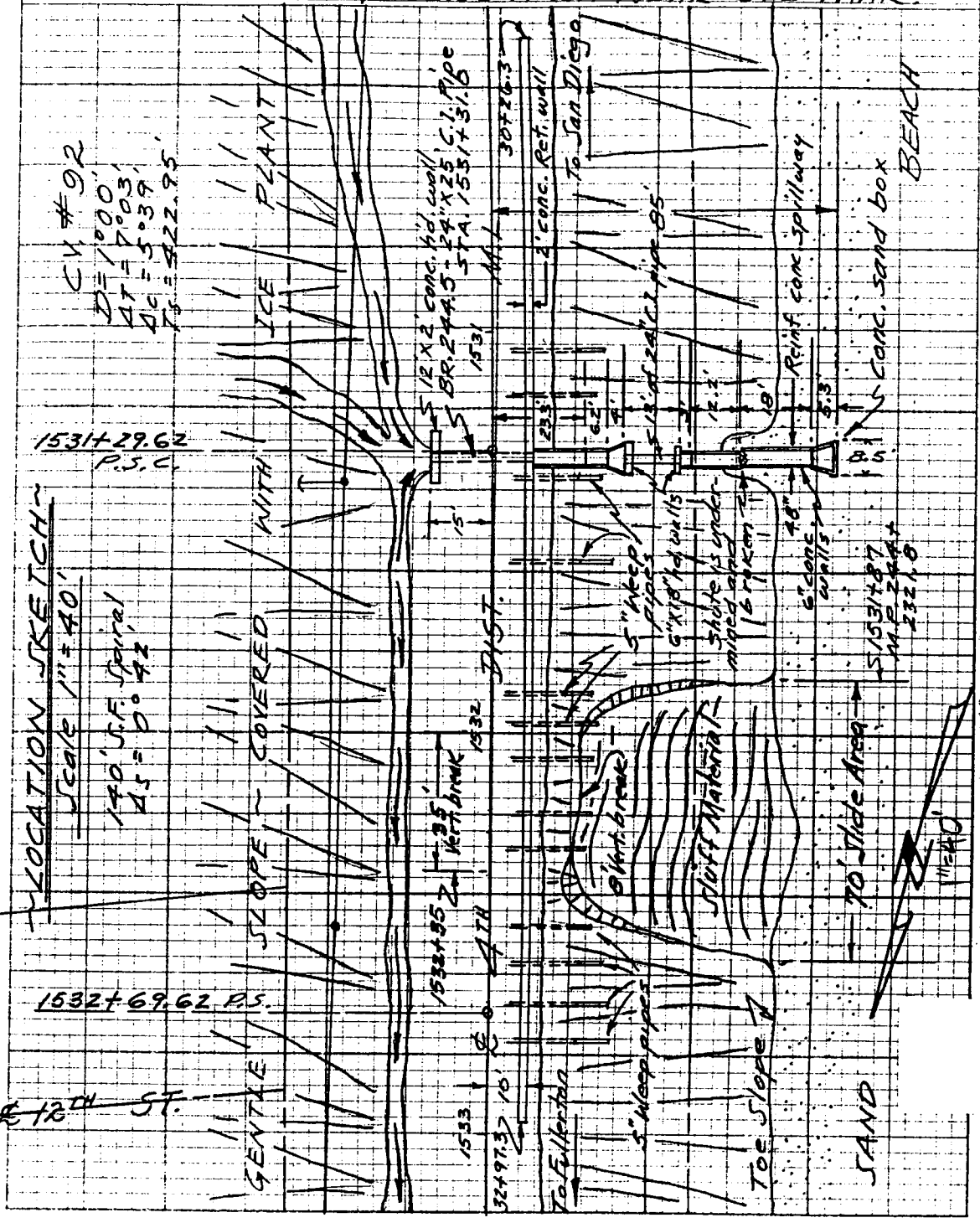
TRANSITMAN W. Westerson — FOR COMPLETION REPORT — STATION Nr. Del Mar

RODMAN J. Krupp — AUTH. — VAL. SEC Ar. Cal. 7-8 — STATE Calif.

CHAINMAN — — COMM. — IN SERVICE — M. P. 244+2321.8

NOTES TAKEN BY W. — COMP. — L.A. DIVISION 4th DISTRICT

TITLE LOCATION SURVEY - SLIDE AREA NEAR DEL MAR.



Hall 30M Sets 7-59

Form 1928 Standard

DATE 1-20-61 — **THE A. T. & S. F. RY. CO. SYSTEM** — PAGE 2 OF 10

DRAWING NO.

CORP. S.F.C.L. — CARBON TO CHIEF ENGR.

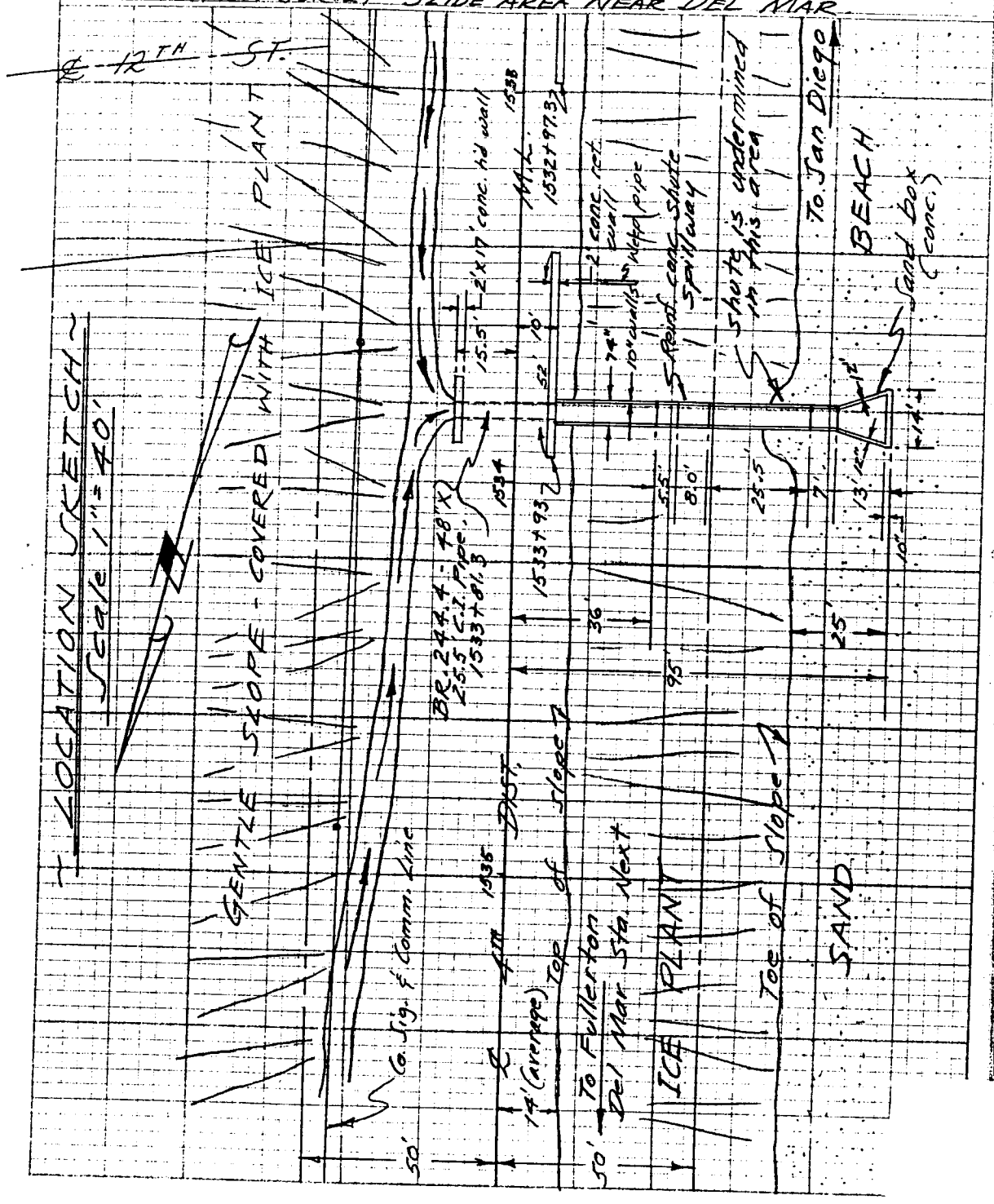
TRANSITMAN W. Westerson — FOR COMPLETION REPORT — STATION Near Del Mar

RODMAN J. Krupp — AUTH. — VAL. SEC Ar. Cal. 7-8 — STATE Calif.

CHAINMAN — — COMM. — IN SERVICE — M. P. 244+2321.8

NOTES TAKEN BY W. — COMP. — L.A. DIVISION 4th DISTRICT

TITLE LOCATION SURVEY - SLIDE AREA NEAR DEL MAR



Hall 30M Sets 7-59

Form 1928 Standard

DATE 1-20-61 THE A. T. & S. F. RY. CO. SYSTEM PAGE 8 OF 10

DRAWING NO. CORP S.F.C.L. CARBON TO CHIEF ENGR.

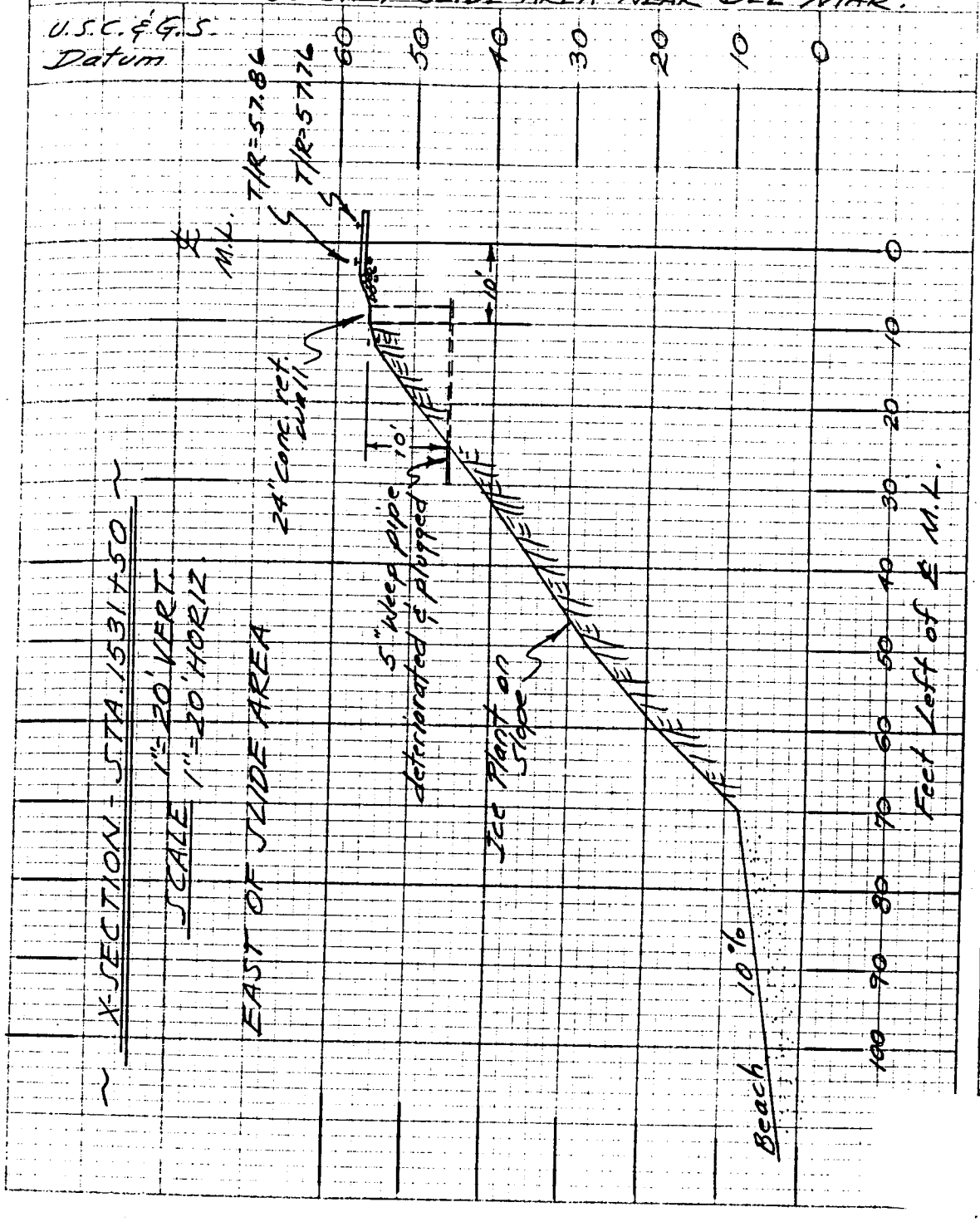
TRANSITMAN W. Westerson FOR COMPLETION REPORT STATION Nr. Del Mar

RODMAN J. Krupp AUTH. VAL. SEC At. Cal. 7-8 STATE Calif.

CHAINMAN — COMM. IN SERVICE M. P. 244+2321.8

NOTES TAKEN BY W. COMP. L.A. DIVISION 4TH DISTRICT

TITLE LOCATION SURVEY - SLIDE AREA NEAR DEL MAR.



Hall 30M Sets 7-59

Form 1928 Standard

DATE 1-20-61 — THE A. T. & S. F. RY. CO. SYSTEM — PAGE 9 OF 10

DRAWING NO. — CORP. S.F.C.L. — CARBON TO CHIEF ENGR.

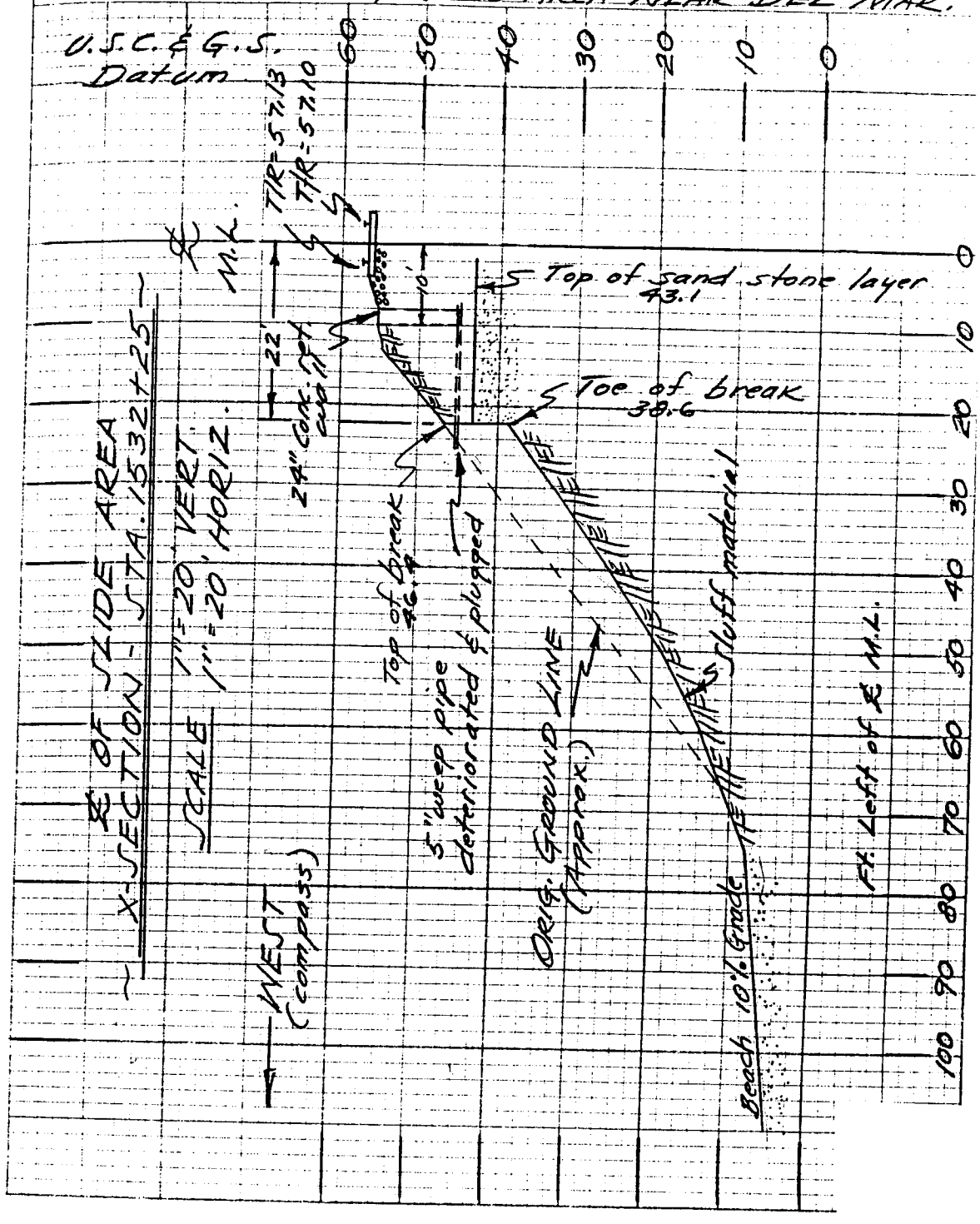
TRANSITMAN W. Westerson — FOR COMPLETION REPORT — STATION Nr. Del Mar

RODMAN J. Krupp — AUTH. — VAL. SEC. At. Cal. 7-8 — STATE Calif.

CHAINMAN — — COMM. — IN SERVICE — M. P. 244+2321.8

NOTES TAKEN BY W. — COMP. — L.A. DIVISION 4th DISTRICT

TITLE LOCATION SURVEY - SLIDE AREA NEAR DEL MAR.



Hall 30M Sets 7-59

Form 1928 Standard

THE A. T. & S. F. RY. CO. SYSTEM

DATE 1-23-61 PAGE 10 OF 10

DRAWING NO.

TRANSITMAN W. Westerson CORP. SFCL CARBON TO CHIEF ENGR.

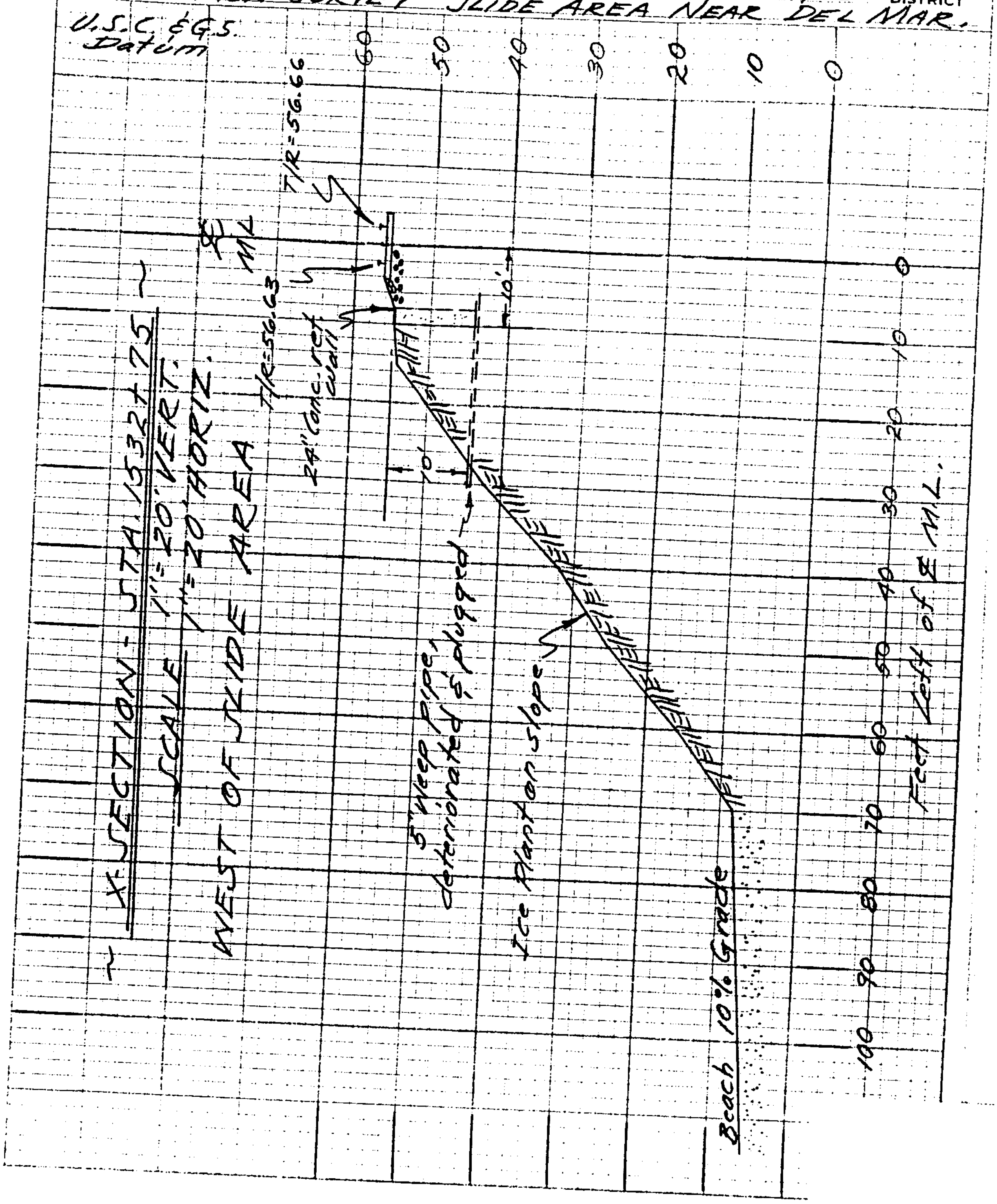
RODMAN J. Krupp FOR COMPLETION REPORT STATION Nr. Del Mar

CHAINMAN — AUTH. VAL. SEC. AT. Cal. 7-8 STATE Calif.

NOTES TAKEN BY W. COMM. IN SERVICE M. P. 244+2321.8

COMP. L.A. DIVISION 4th DISTRICT

TITLE LOCATION SURVEY - SLIDE AREA NEAR DEL MAR.



Hall 40M Sets 1 55 File D-16001 Form 1928 Standard

DATE 2-15-61 **THE A. T. & S. F. RY. CO. SYSTEM** PAGE 1 OF 1

DRAWING NO. Drafting

TRANSITMAN N.C. Bell

RODMAN

CHAINMAN

NOTES TAKEN BY W.L. Paul

TITLE Location of Test Holes in Slide Area

CORP.

FOR COMPLETION REPORT

AUTH. VAL. SEC.

COMM. IN SERVICE

COMP.

CARBON TO CHIEF ENGR.

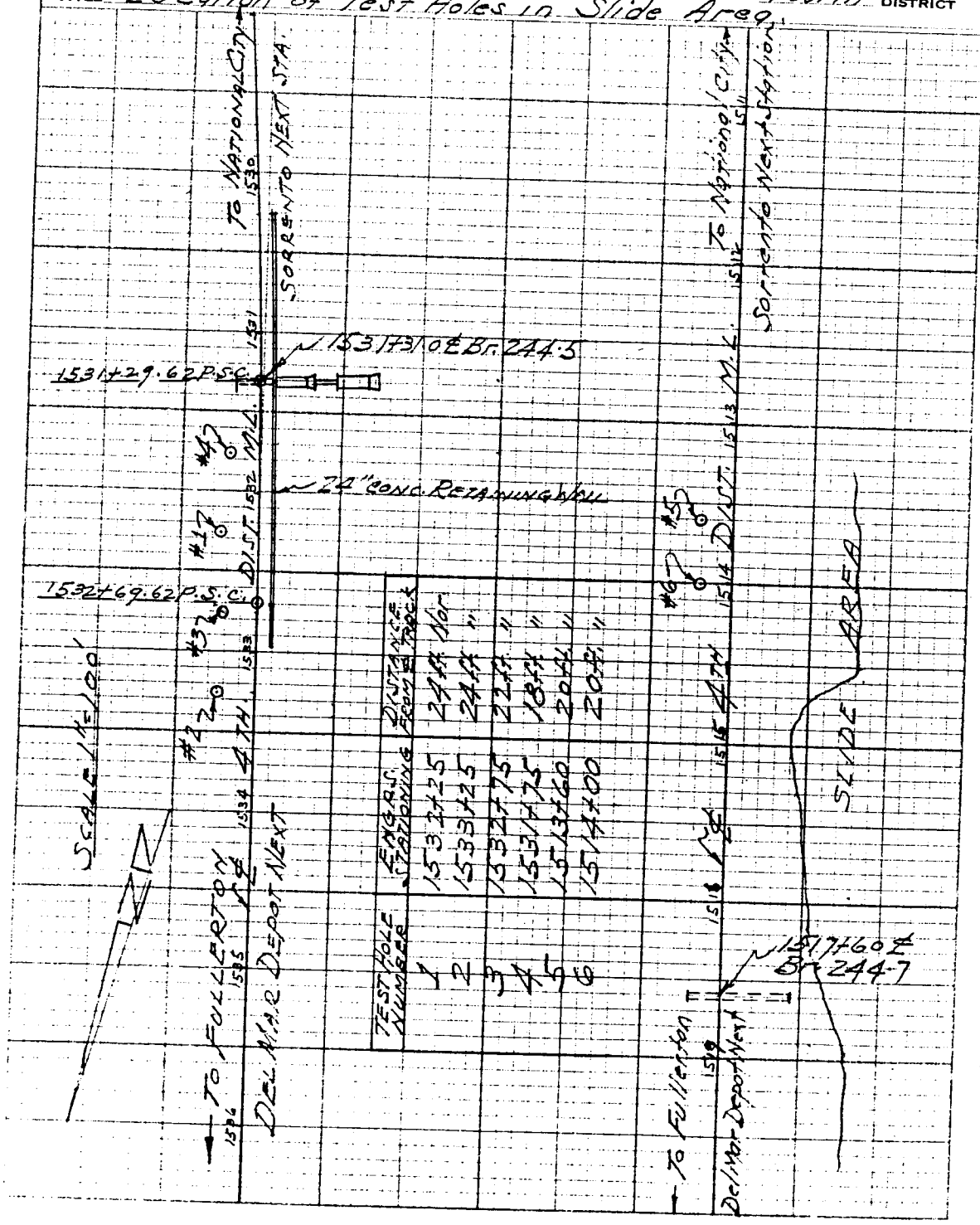
STATION Near Del Mar

STATE Calif.

M. P. 244+148.8 &
244+233.8

DIVISION Fourth DISTRICT

L.A.



Form 1928 Standard G.MO.-9037-61

DATE 2-7-62 THE A. T. & S. F. RY. CO. SYSTEM PAGE 2 OF 5

DRAWING NO. L-4-24594 CORP. S.F.C.L. CARBON TO CHIEF ENGR.

TRANSITMAN W.E. WESTERSON FOR COMPLETION REPORT STATION Nr. DEL MAR

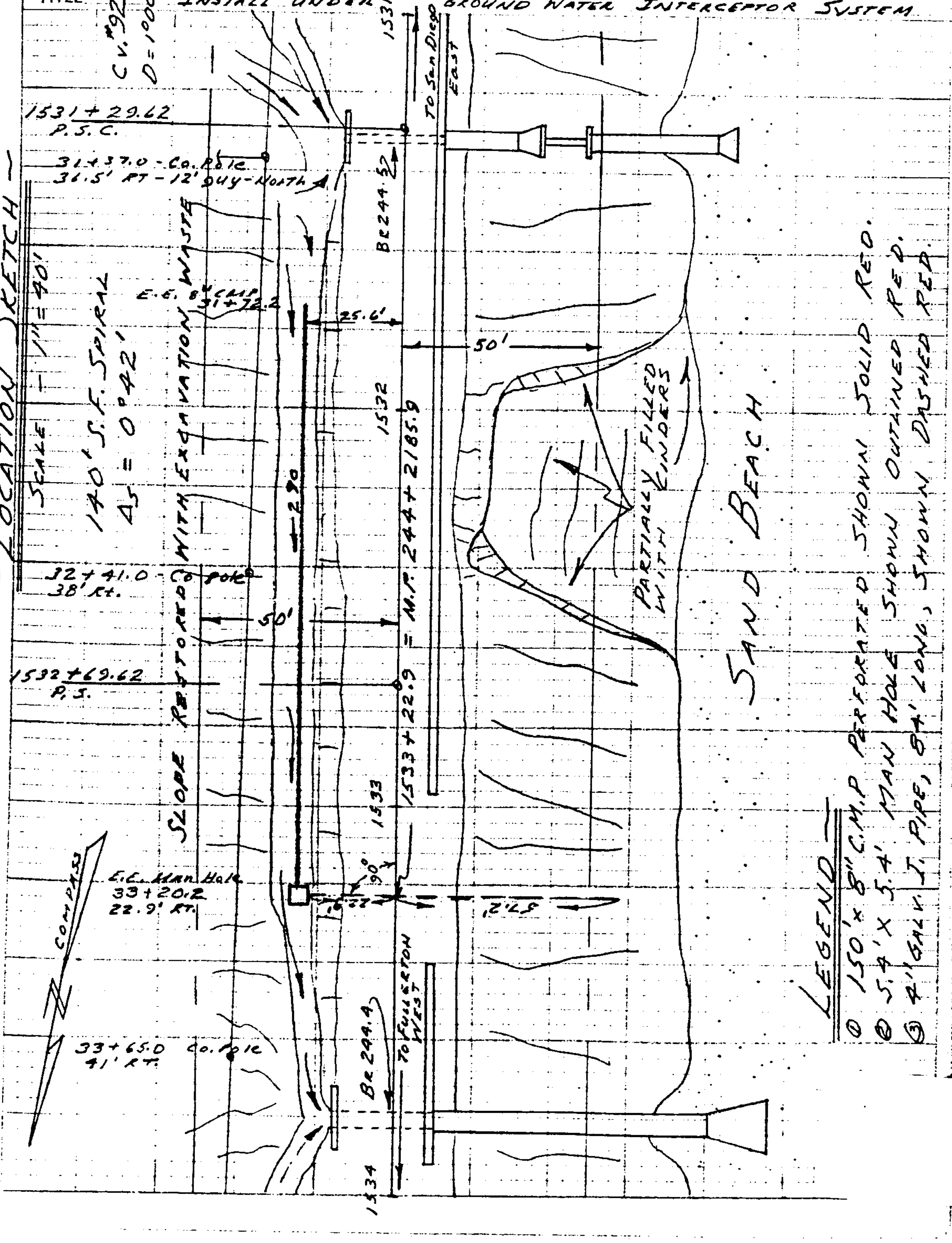
RODMAN J.L. KRUPP AUTH GMO-9037-61 AL. SEC. At.Cal. 758 STATE CALIFORNIA

CHAINMAN R.A. SCHOULTZ COMM. 11-18-61 IN SERVICE 12-15-61 M. P. 244+2185.9

NOTES TAKEN BY R.A. SCHOULTZ COMP. 12-15-61 L.A. DIVISION FOURTH DISTRICT

TITLE INSTALL UNDERGROUND WATER INTERCEPTOR SYSTEM

1"=40'



LOCATION SKETCH
SCALE 1"=40'
140' S.F. SPIRAL
Δs = 0°42'
Cv. #92 40°
D=1000'
1531+29.62
P.S.C.
31+37.0 - Co. Pole
31.5' Rt - 12' Guy - North
E.E. 8" CMP 31+72.2
25.6'
50'
32+41.0 - Co. Pole
38' Rt.
1532+69.62
P.S.
SLOPE RESTORED WITH EXCAVATION WASTE
290
1531
To San Diego East
Br 244.3
1532
M.P. 244+2185.9 = 1533+22.9
1533
E.E. Man Hole
33+20.2
22.9' Rt.
90°
57.2'
To Fullerton West
Br 244.4
1534
33+65.0 Co. Pole
41' Rt.
COMPASS
PARTIALLY FILLED WITH CINDERS
SAND BEACH
LEGEND
① 150' x 8" C.M.P. PERFORATED SHOWN SOLID RED.
② 5.4' x 5.4' MAN HOLE SHOWN OUTLINED RED.
③ 4' GALV. I. PIPE, 84' LONG, SHOWN DASHED RED.

Form 1928 Standard G.M.O. - 9037-61

DATE 2-7-62 **THE A. T. & S. F. RY. CO. SYSTEM** PAGE 3 OF 5

DRAWING NO. L-4-24594 CORP. S.F.C.L. CARBON TO CHIEF ENGR.

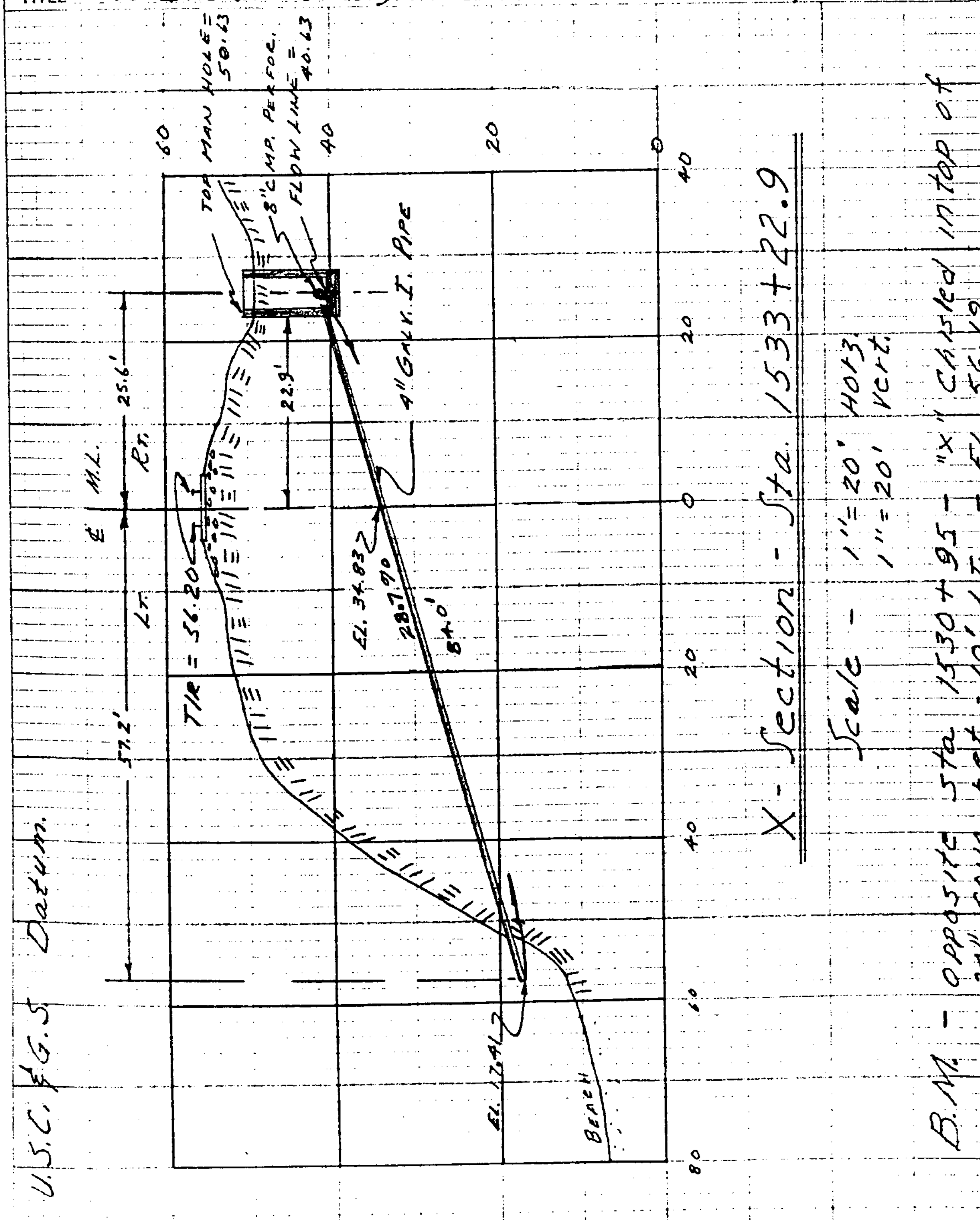
TRANSITMAN W.E. Westerson FOR COMPLETION REPORT STATION Nr. Del Mar

RODMAN J.L. Krupp AUTH. G.M.O 9037+A1 SEC. At Cal 7/8 STATE California

CHAINMAN R.A. Schoultz COMM. 11-18-61 IN SERVICE 12-15-61 M.P. 244+2185.9 = 244.414 M.

NOTES TAKEN BY R.A.S. COMP. 12-15-61 L.A. DIVISION Fourth DISTRICT

TITLE c/o Install Underground Water Interceptor System



Hall 10M Sets 306

~~244+2486'~~ Form 1928 Standard D-16001

DATE March 14, 1962 THE A. T. & S. F. RY. CO. SYSTEM PAGE 1 OF 5

DRAWING NO.

CORP AT & SF CL CARBON TO CHIEF ENGR.

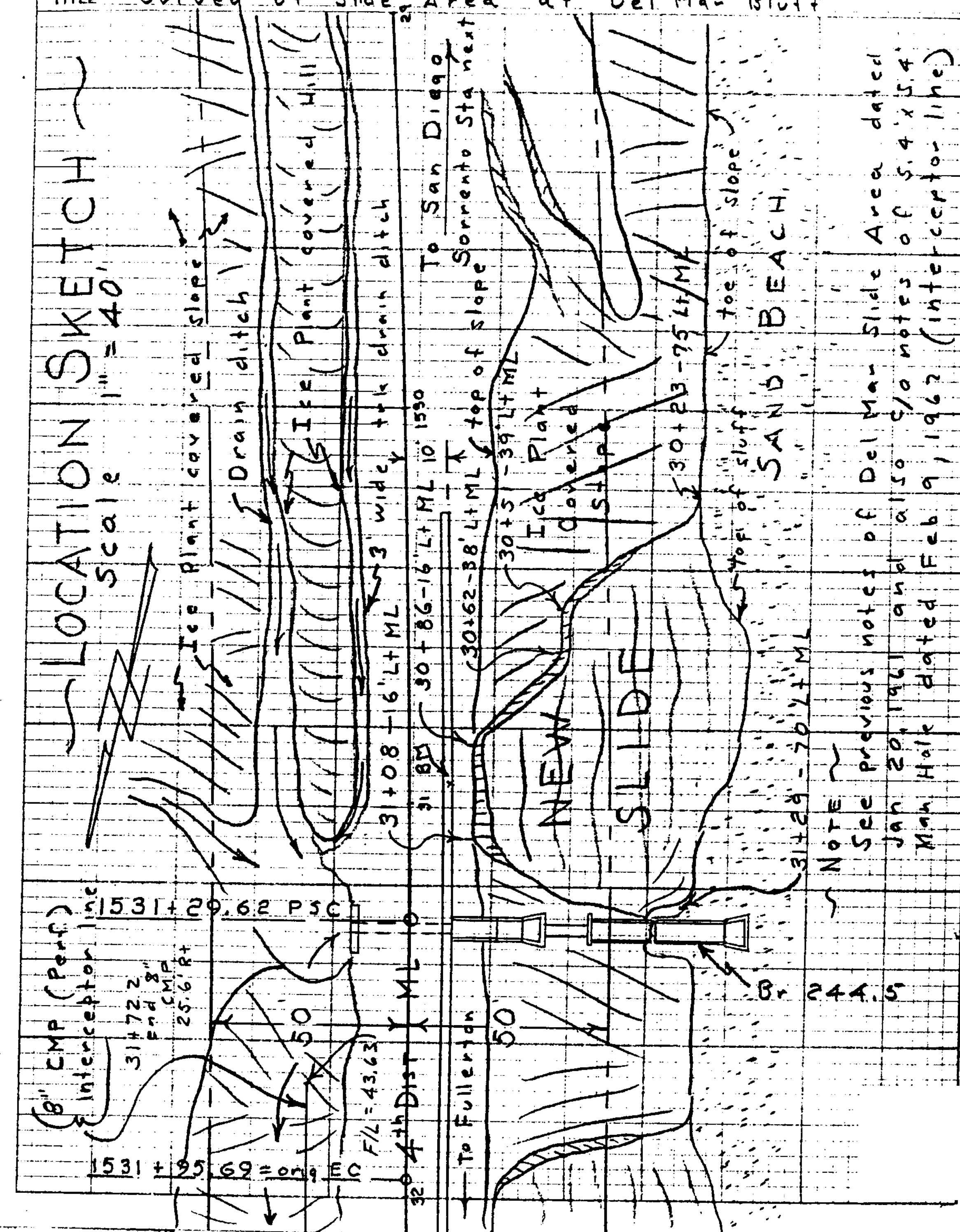
TRANSITMAN W E Westerson FOR COMPLETION REPORT STATION Del Mar

RODMAN J L Krupp AUTH. VAL. SEC. ATCal 7 & 8 STATE California

CHAINMAN R A Schoultz COMM. IN SERVICE M. P. 244 + 2485.8

NOTES TAKEN BY JLK COMP. LA DIVISION 4th DISTRICT

TITLE Survey of Slide Area at Del Mar Bluff



Hall 10M Sets 3-60

Form 1928 Standard

DATE March 14, 1962 THE A. T. & S. F. RY. CO. SYSTEM PAGE 2 OF 5

DRAWING NO. CORP A T & S F C L CARBON TO CHIEF ENGR.

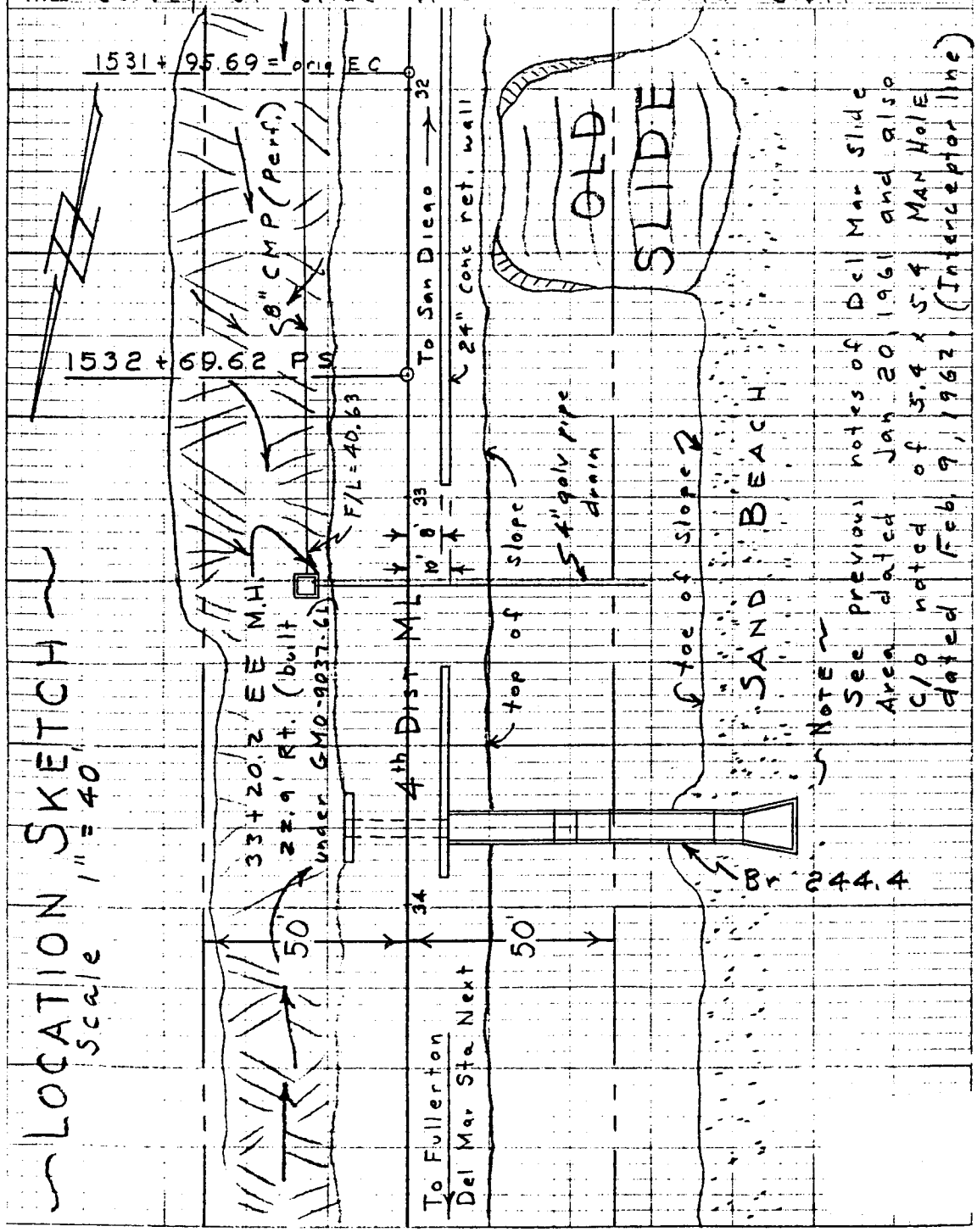
TRANSITMAN W E Westerson FOR COMPLETION REPORT STATION Del Mar

RODMAN J L Krupp AUTH. VAL. SEC. AT Cal 7/8 STATE California

CHAINMAN R A Schoultz COMM. IN SERVICE M. P. 244+2485.8

NOTES TAKEN BY J L K COMP. LA DIVISION 4th DISTRICT

TITLE Survey of Slide Area at Del Mar Bluff



Hall 10M Sets 3-60

Form 1928 Standard

DATE March 14, 1962 THE A. T. & S. F. RY. CO. SYSTEM PAGE 3 OF 5

DRAWING NO. CORP. AT & SF CL CARBON TO CHIEF ENGR.

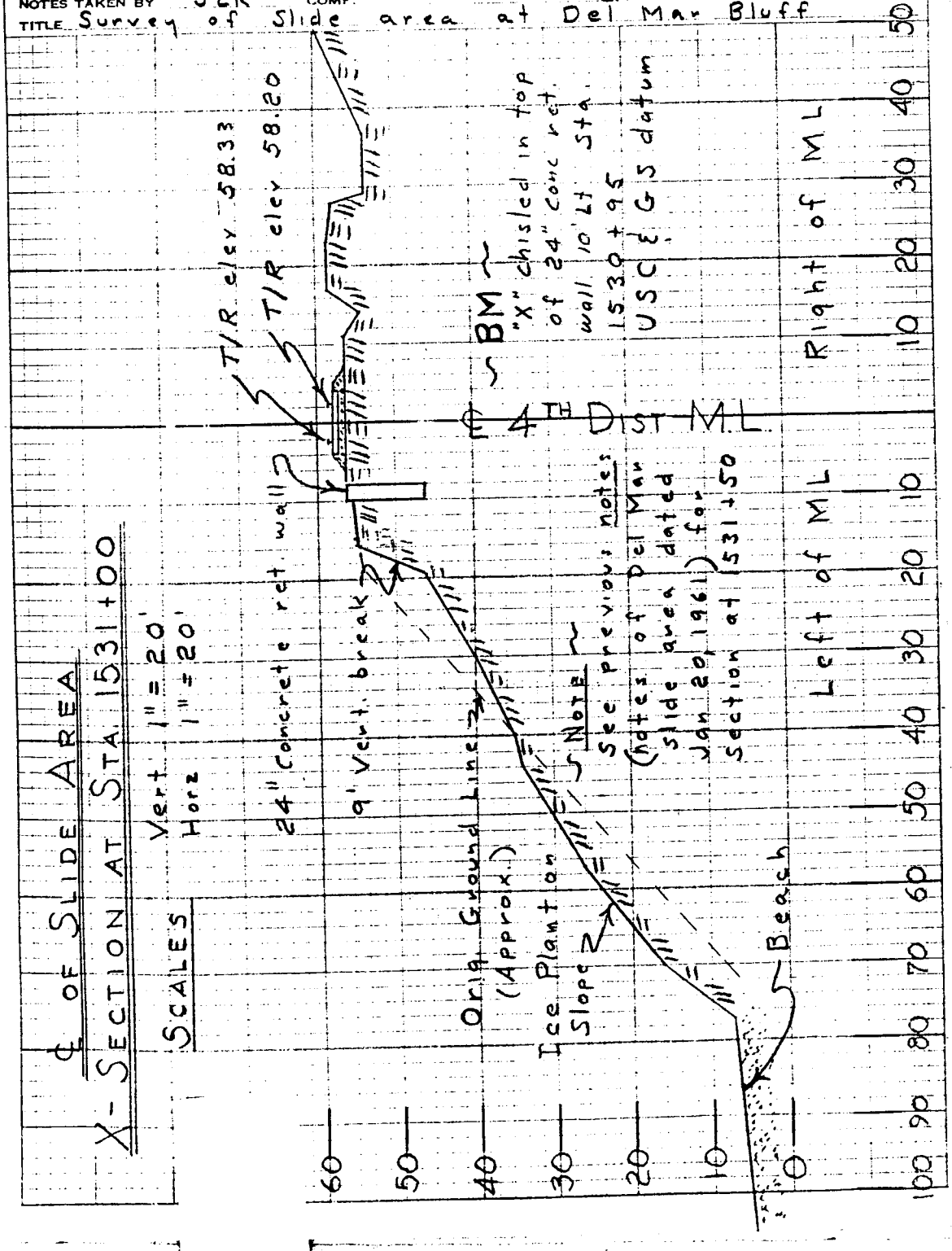
TRANSITMAN W E Wilcoxson FOR COMPLETION REPORT STATION Del Mar

RODMAN J L Krupp AUTH. VAL. SEC. ATral 7&8 STATE California

CHAINMAN R A Schoultz COMM. IN SERVICE M. P. 244+2485.8

NOTES TAKEN BY J L K COMP. LA DIVISION 4th DISTRICT

TITLE Survey of Slide area at Del Mar Bluff



Form 1928 Standard

DATE March 26, 1962 **THE A. T. & S. F. RY. CO. SYSTEM** PAGE 2 OF 2

DRAWING NO. CORP. AT&SF CL CARBON TO CHIEF ENGR.

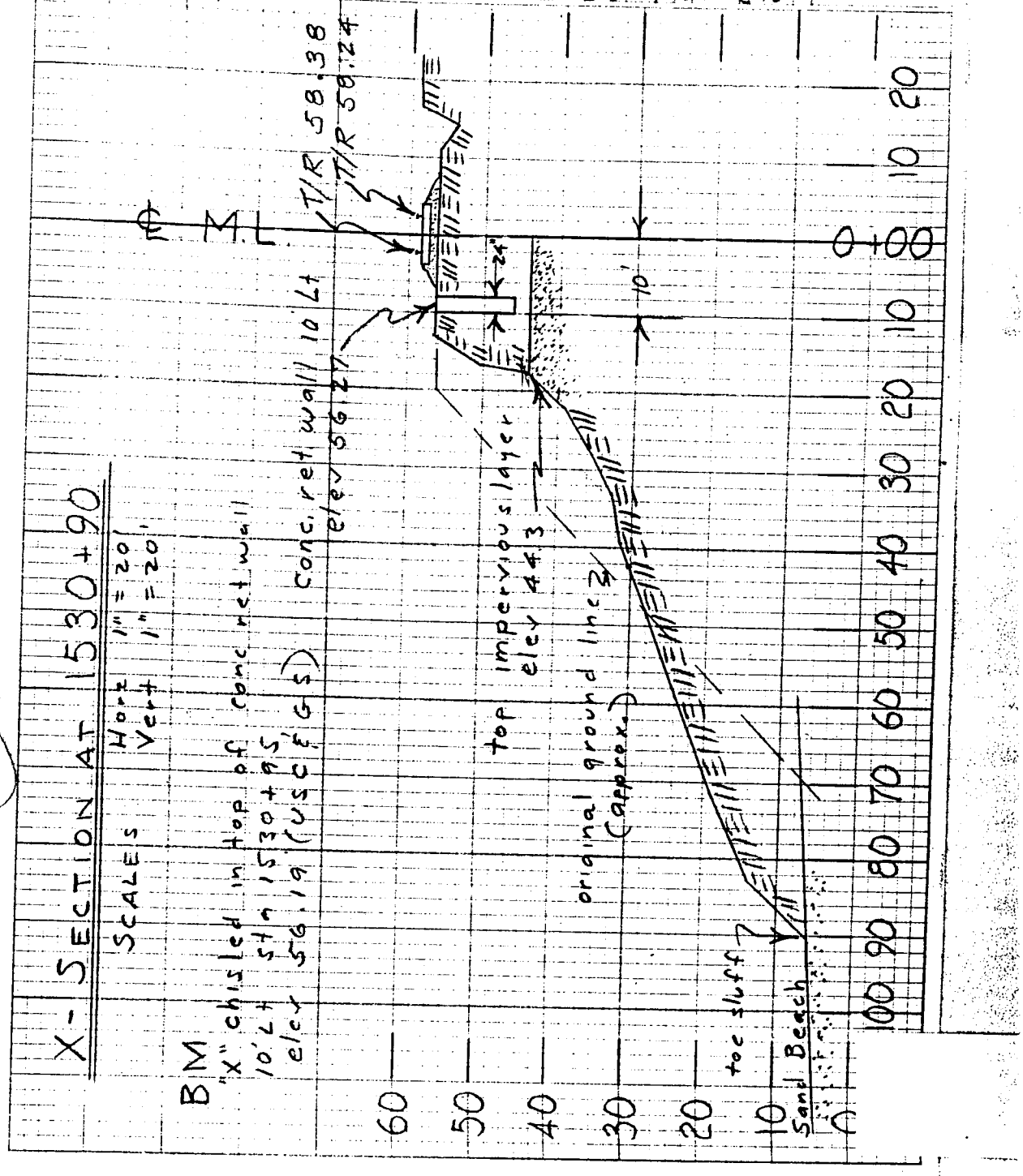
TRANSITMAN W E Westerson FOR COMPLETION REPORT STATION Del Mar

RODMAN J L Krupp AUTH. VAL. SEC. ATG17C8 STATE California

CHAINMAN R A Schoultz COMM. IN SERVICE M. P. 244 + 2485 Y

NOTES TAKEN BY J L K COMP. LA DIVISION 4th DISTRICT

TITLE Survey of Slide Area at Del Mar Bluff



USED FOR X-SEC. W-W'

Hall 38M 11-63 **244+2493** Form 1928 Standard D-16001

DATE Nov. 12, 1964 **THE A. T. & S. F. RY. CO. SYSTEM** PAGE OF

DRAWING NO. CORP. C/L CARBON TO CHIEF ENGR.

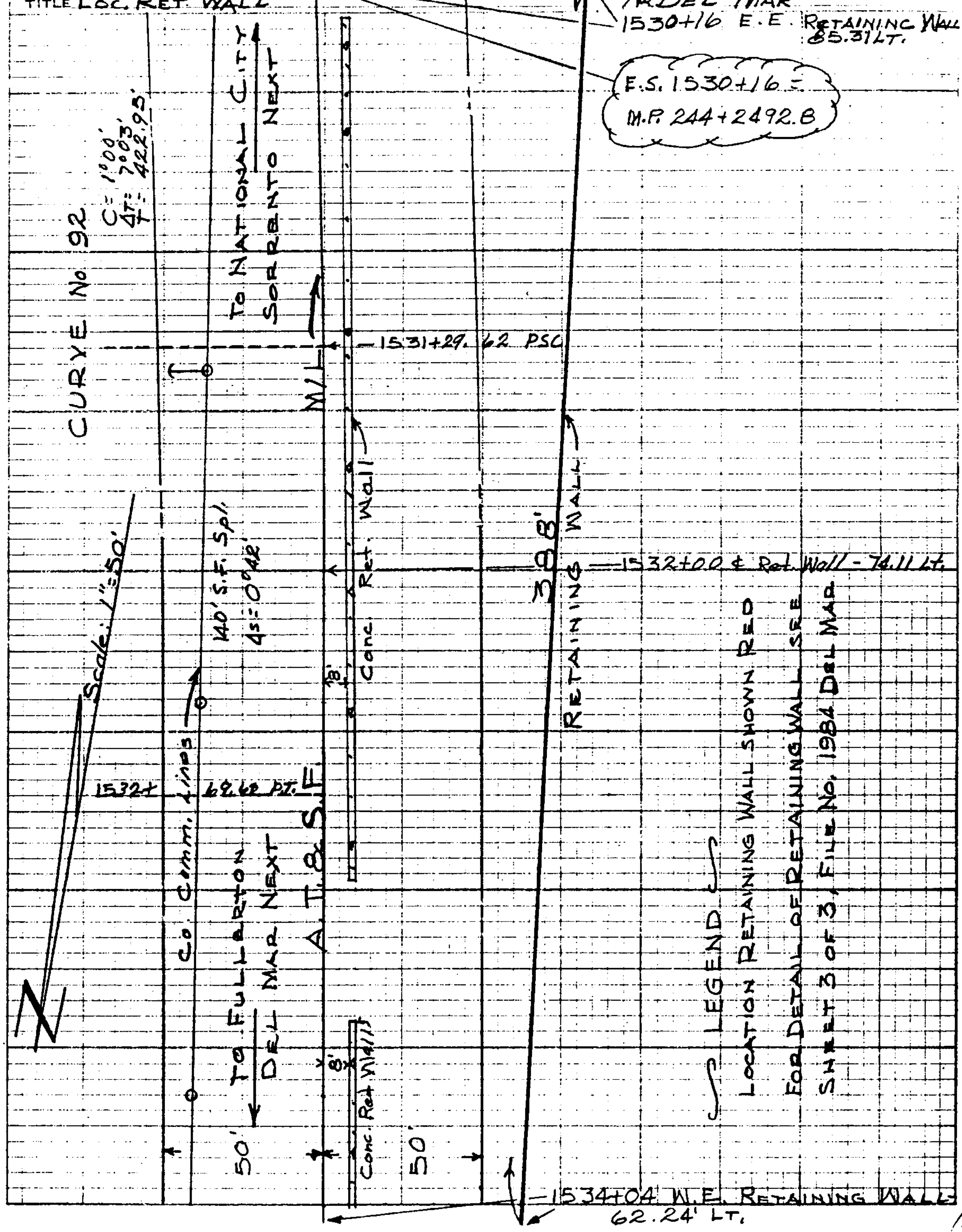
TRANSITMAN D.C. McREYNOLDS FOR COMPLETION REPORT STATION Nr. DEL MAR

RODMAN R.D. SAN MIGUEL AUTH. VAL. SEC. STATE CALIF.

CHAINMAN E.M. WALSH COMM. IN SERVICE M. P. 244+2492.8

NOTES TAKEN BY E.M.W. COMP. L.A. DIVISION FOURTH DISTRICT

TITLE LOC. RET. WALL Nr DEL MAR



1530+16 E.E. RETAINING WALL 85.31 LT.
E.S. 1530+16 = M.P. 244+2492.8
CURVE No 92
C= 1°00'
ΔT= 7°03'
T= 422.95'
TO NATIONAL CITY
SORRENTO NEXT
1531+29.62 PSC
M/L
Conc. Ret. Wall
RETAINING WALL
3.8'
1532+00 ¢ Ret. Wall - 74.11 Lt.
140' S.F. Spl
Δs= 0°42'
Scale: 1"=50'
8'
1532+ 62.62 PT.
Co. Comm. Lines
A.T.&S.F.
TO FULLERTON
DEL MAR NEXT
N
Conc. Ret. Wall
50'
50'
LEGEND
LOCATION RETAINING WALL SHOWN RED
FOR DETAIL OF RETAINING WALL SEE
SHEET 3 OF 3, FILE No. 1984 DEL MAR
1534+04 W.E. RETAINING WALL
62.24' LT.

Hall 40M Sets 7-60

Form 1928 Standard D-16001

DATE JULY 10, 1962 THE A. T. & S. F. RY. CO. SYSTEM PAGE 2 OF 3

DRAWING NO. L-6-25111 CORP. S.F.C.L. CARBON TO CHIEF ENGR.

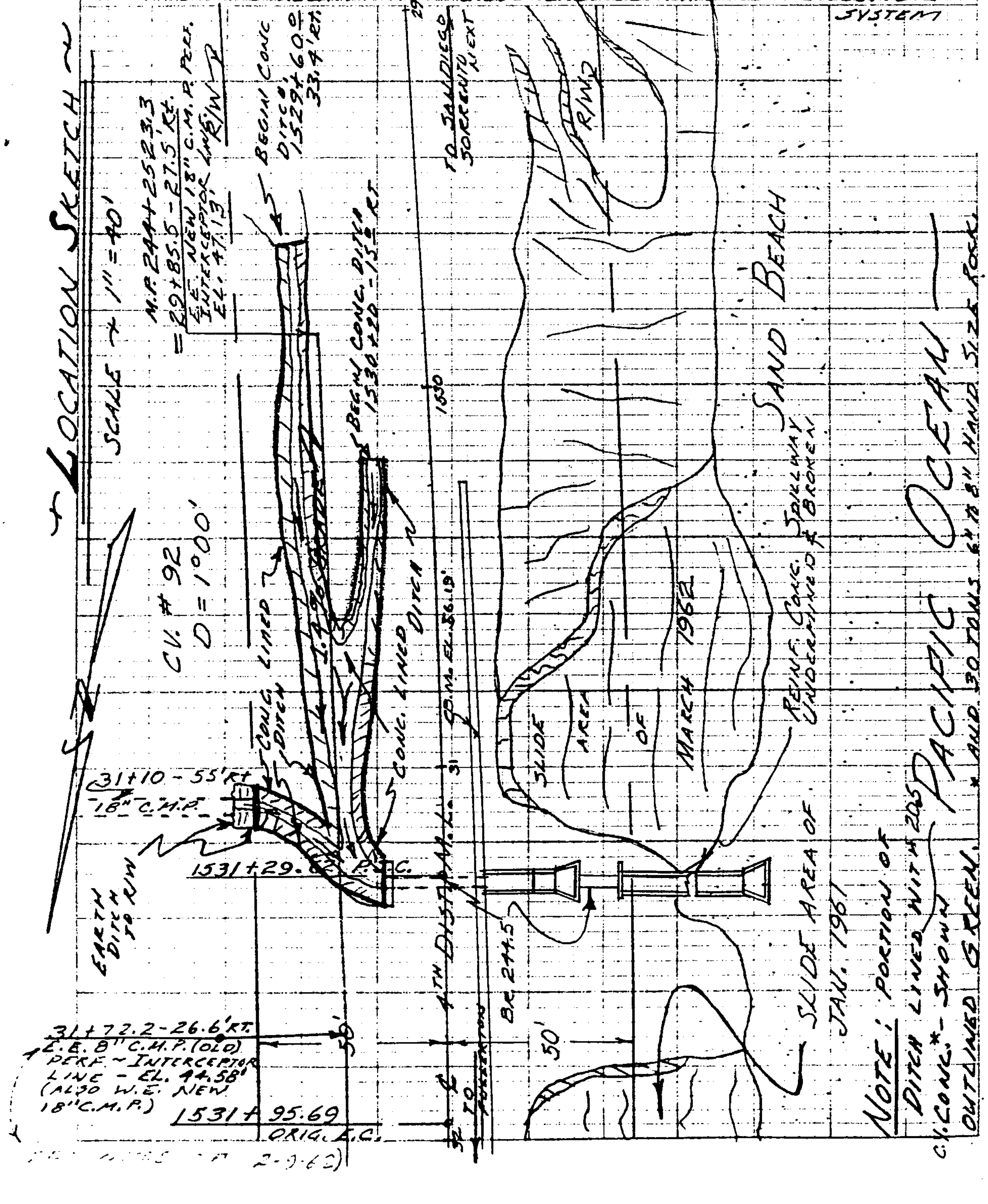
TRANSITMAN G.E. CAGLE FOR COMPLETION REPORT STATION DEL MAR

RODMAN R.D. SAN MIGUEL GMO AUTH. 9061-62 VAL. SEC. 7 & 8 STATE CALIFORNIA

CHAINMAN R.A. SCHOULTZ COMM. 6-62 IN SERVICE M. P. 244+2523.3

NOTES TAKEN BY R.A. SCHOULTZ COMP. 6-26-62 LOS ANGELES DIVISION FOURTH DISTRICT

TITLE C/O INSTALLATION OF UNDERGROUND WATER INTERCEPTOR SYSTEM



LOCATION SKETCH
SCALE 1" = 40'
M.P. 244+2523.3 = 29+85.5 - 27.5' Rt.
E.E. NEW 18" C.M.P. PERF. INTERCEPTOR LINE EL. 47.13'
R/W
BEGIN CONC. DITCH 1529+60.0 33.4' RT.
TO SAN DIEGO SORRENTO NEXT
BEGIN CONC. DITCH 1530+20 - 15' RT.
CV. # 92 D = 1°00'
CONC. LINED DITCH
SLIDE AREA OF MARCH 1962
SAND BEACH
SPILLWAY REINF. CONC. UNDERMINED & BROKEN
PACIFIC OCEAN
31+10 - 55' Rt.
18" C.M.P.
EARTH DITCH TO R/W
1531+29.6 P.C.
4TH DIST. M.L.
Br 244.5
SLIDE AREA OF JAN. 1961
NOTE: PORTION OF DITCH LINED WITH 205 C.Y. CONC.* SHOWN OUTLINED GREEN. * AND 30 TONS 6" TO 8" HAND SIZE ROCK
31+72.2 - 26.6' RT.
E.E. 8" C.M.P. (OLD) PERF. ~ INTERCEPTOR LINE - EL. 44.58' (ALSO W.E. NEW 18" C.M.P.)
1531+95.69 ORIG. P.C.
50'

1975

MP
FILE 4/12
RS

FILE D-16001

4/17/75

C.L

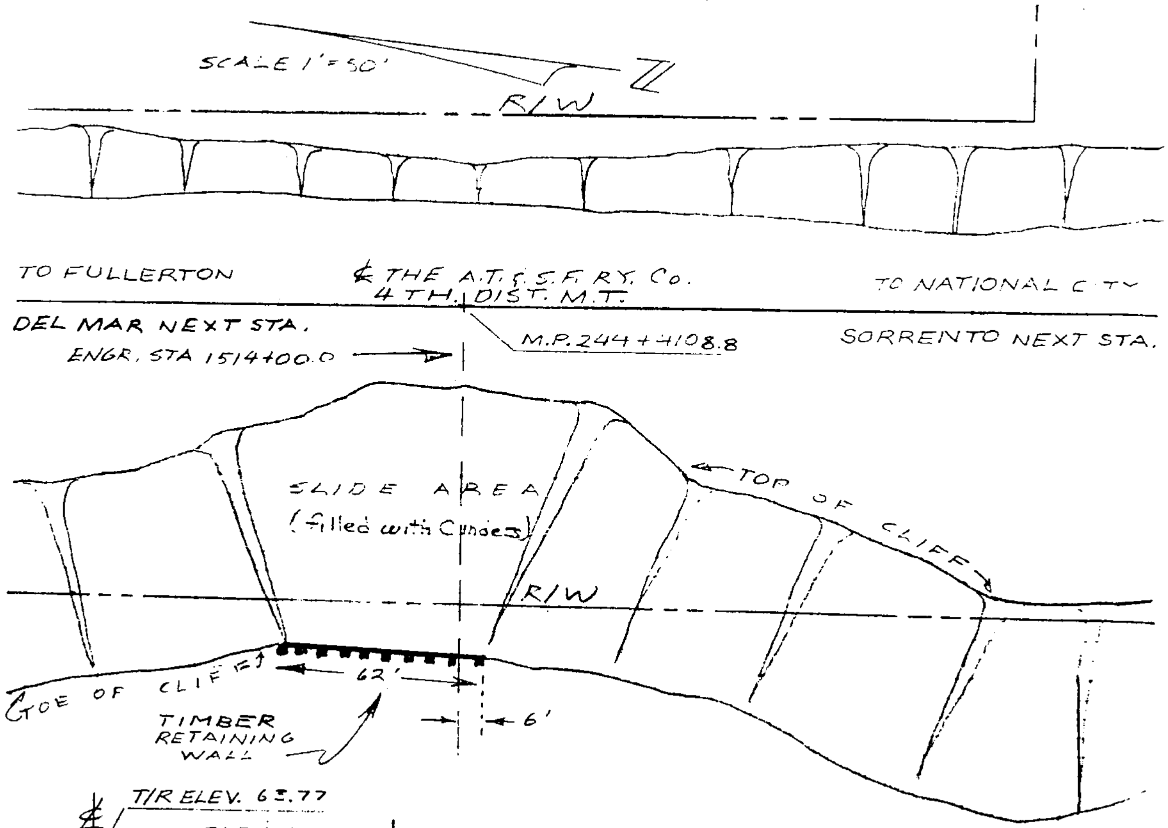
T.C. McDOUGALL
D.L. SMALLEN
R.R. SCHULTZ
D.L.S.

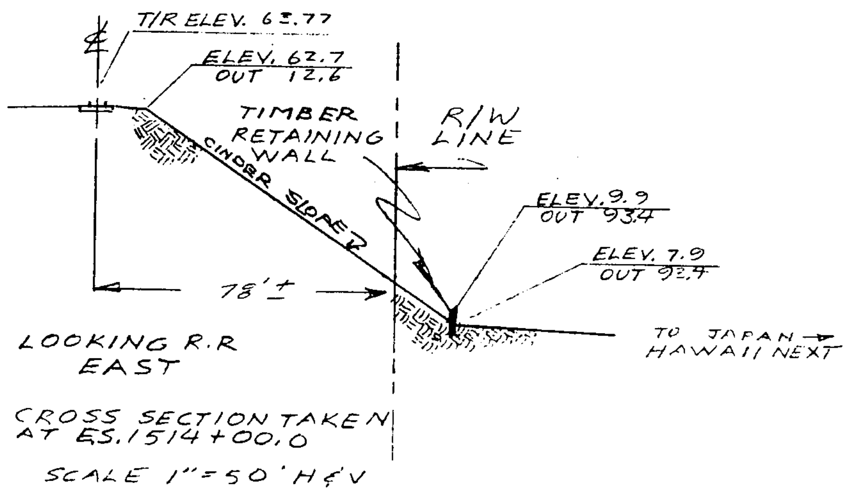
768

L.A.

NR. DEL MAR
CALIF.
244+4108.8
4TH

LOCATION OF RETAINING WALL, AT SLIDE AREA





Note Retaining wall to [illegible] ft. High