APPENDIX III
RESULTS OF SLOPE STABILITY ANALYSES

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RESULTS OF SLOPE STABILITY ANALYSES

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

State of California, Department of Transportation
Statewide A&E Contract No. 59A0284

FUGRO

Calculation Summary Sheet

Structure Number: see below	Task No.: 00002: Prepare Plan Sheets (185)		
Description:	**Sheet No.:** 1 though 16 (attached)		
Overall stability assessment for retaining walls: 353R,		**Signed**	**Date**
357R1, 361L, 361R and 361L1	Project Manager	CMS	Dec 6, 02
	Review	CMS	Dec 6, 02
	Chk. Engineer	CMS	Dec 6, 02
	Design Engineer	A.J.M.	Dec 6, 02

Relevant Documentation:

1	Report Number:	Fugro GDR, issue 1, dated December 6, 2002
2	Figure/Drawing Number:	Cross section drawings (for design purposes only) prepared Caltrans
3	Other References:	Guidelines for Foundation Investigation and Reports, Caltrans, 2002, (V1.2)

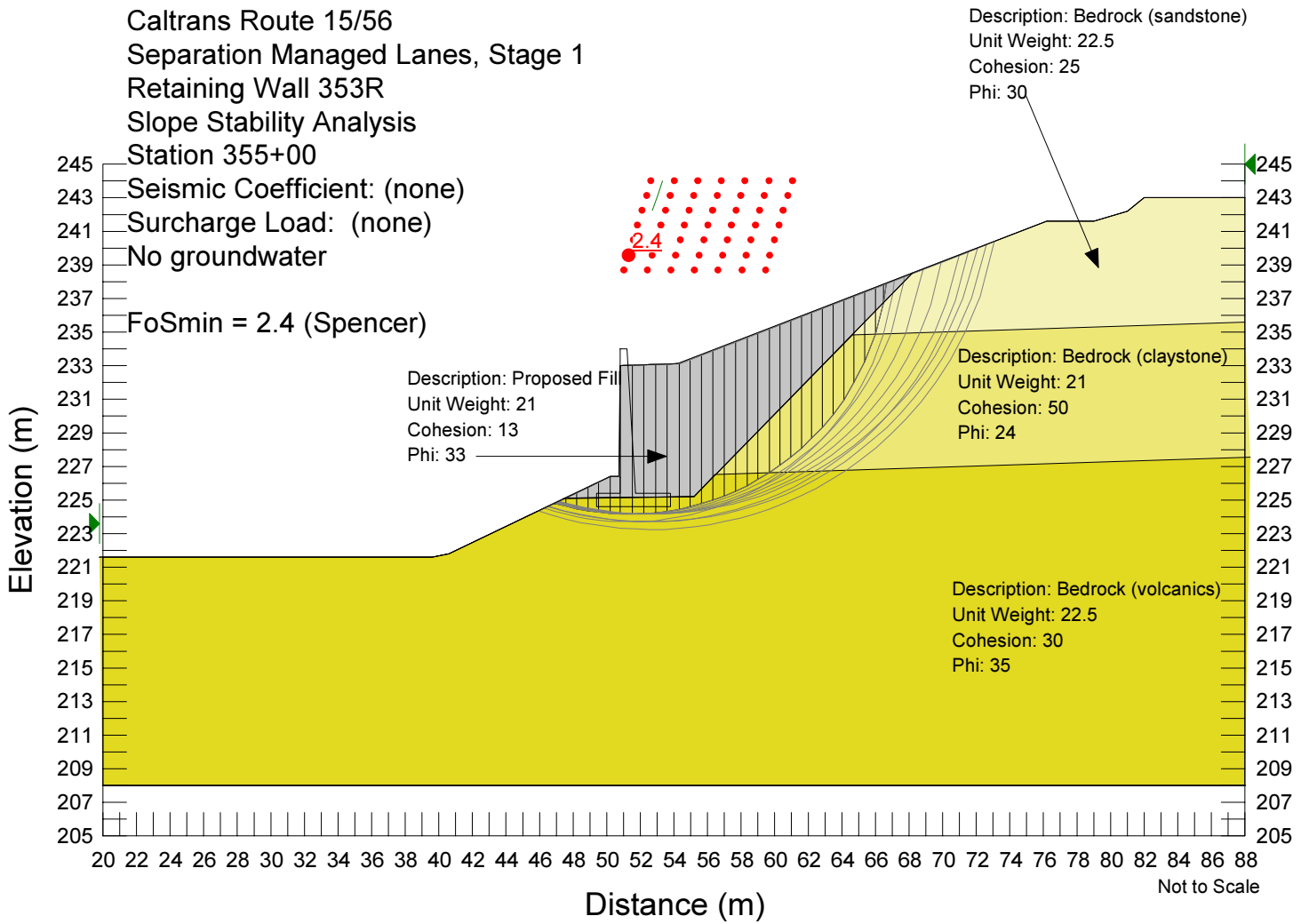
Output Required

Report		Figures		Quantities	
Drawing		Size		Cost Estimate	
Calculations	Slope stability calculations – overall stability of retaining walls.				

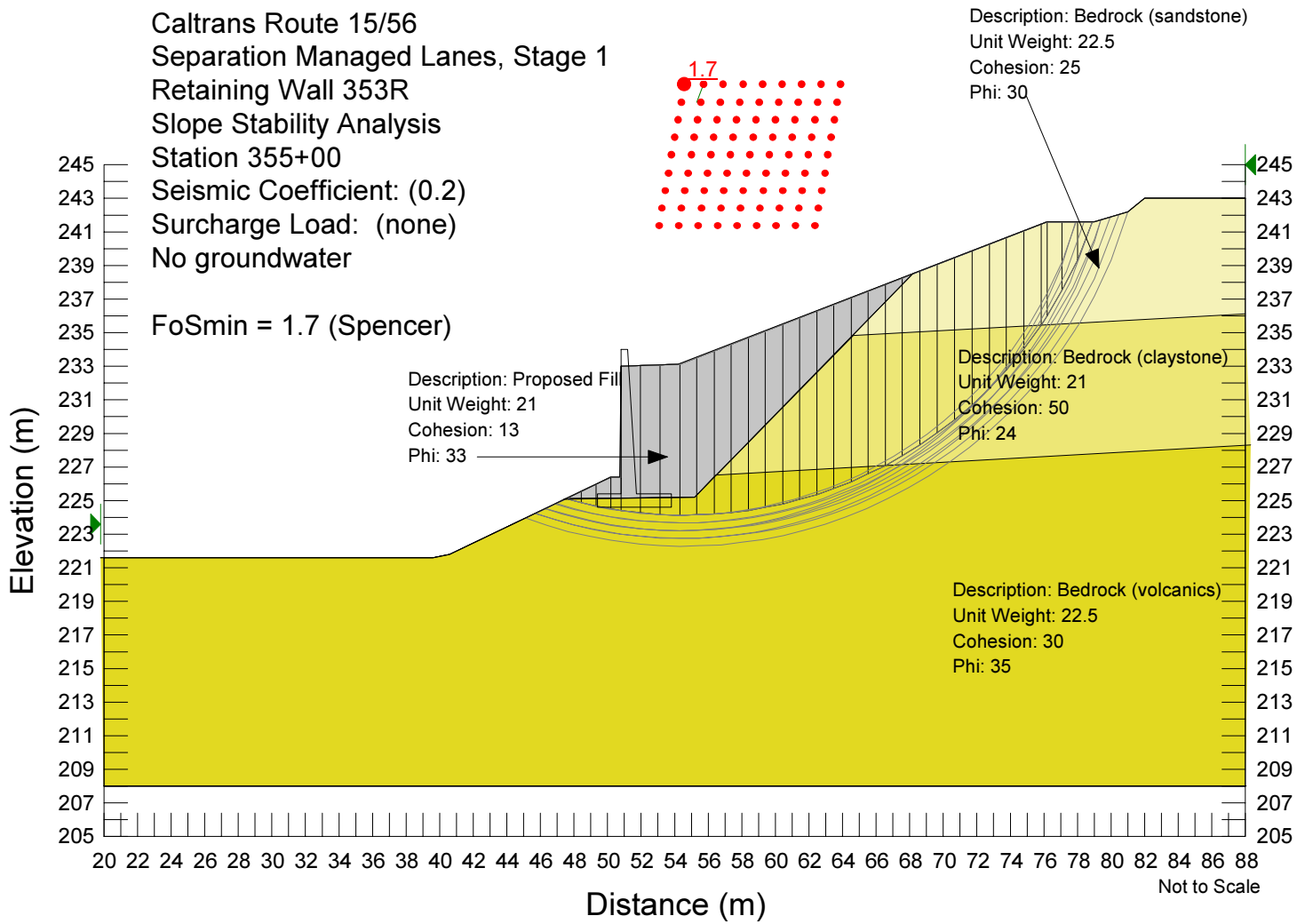
Project Constraints/Interfaces	**Checked**
Stability sections developed from cross section drawings (for design purposes only)	CMS
prepared Caltrans.	

Assumptions	**Checked**
1. Soil/rock profile based on site investigation data.	CMS
2. Shear strength parameters developed from laboratory test data.	CMS
3. No groundwater.	CMS
4. Seismic coefficient (k) should no exceed 0.2	CMS

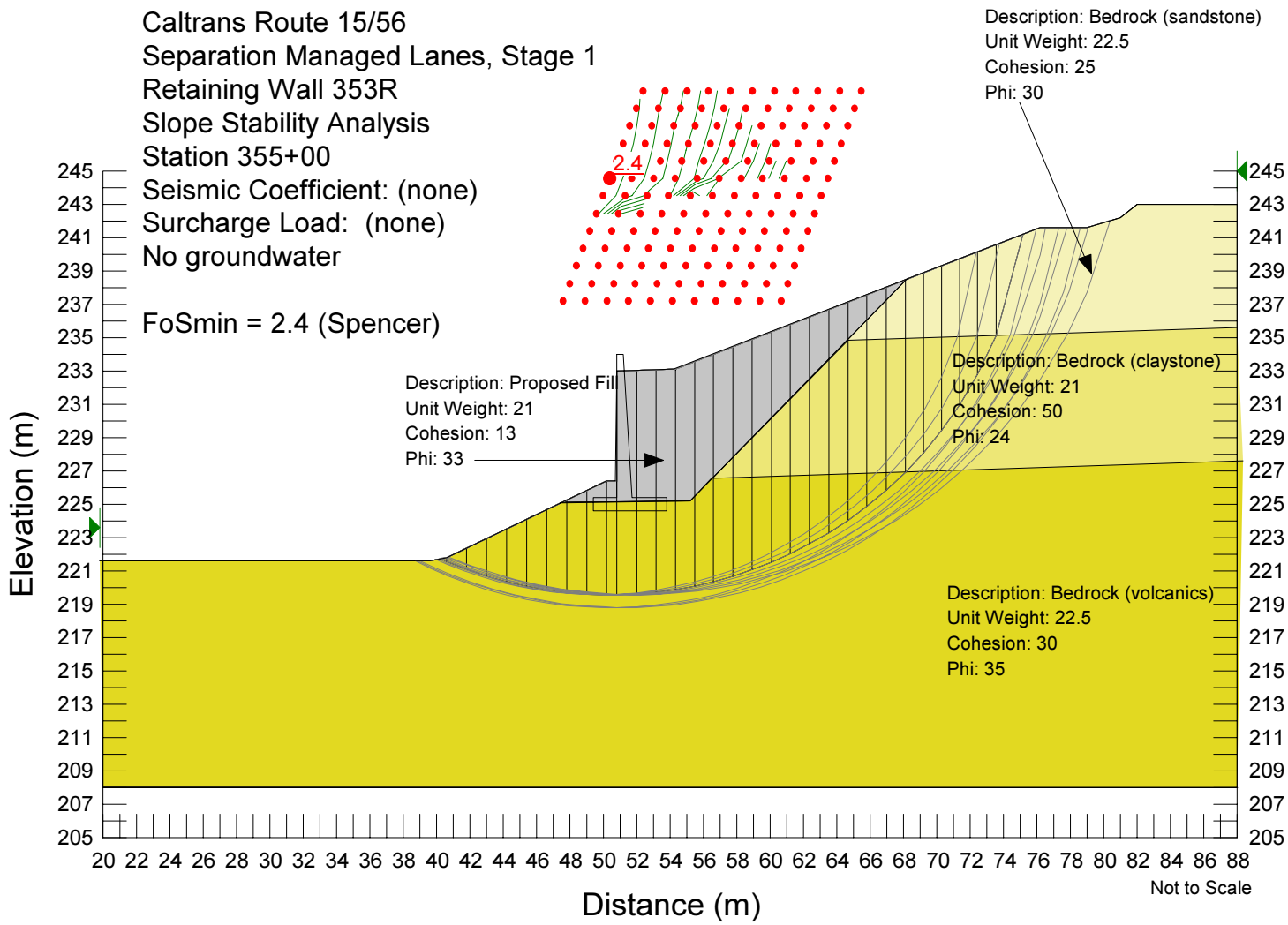
Procedure	**Checked**
Calculate the static and pseudostatic factors of safety against deep-seated failure using	CMS
Conventional limit-equilibrium methods of analyses (e.g., Janbu, Spencer, and Morgenstern and	
Price)	
Filed in: 1394.013 **Date:**	Dec 6, 02



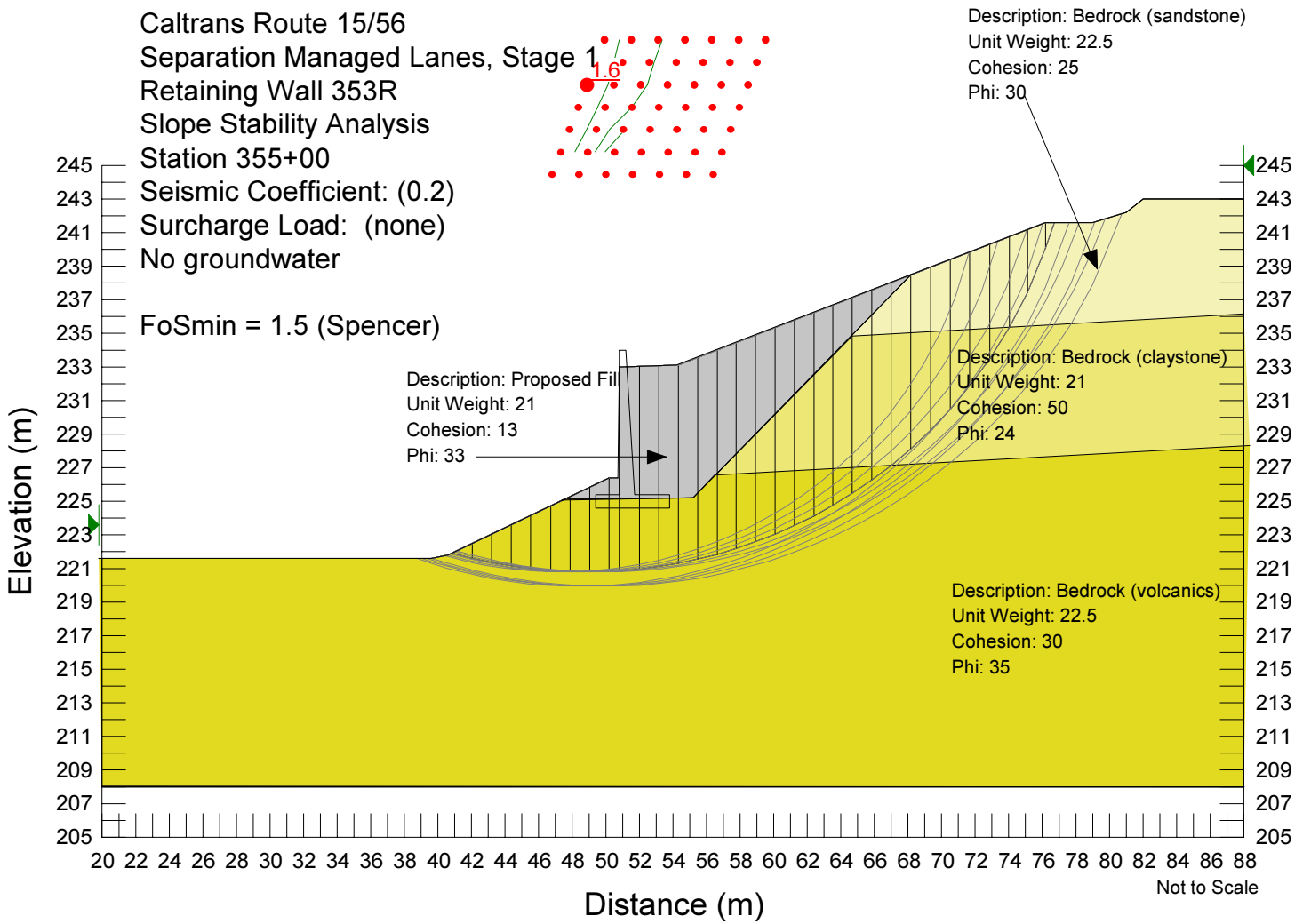
RESULTS OF SLOPE STABILITY (STATIC, BELOW FOOTING)
Retaining Wall 353R, Station 355+00
Route 15/56 Separation Managed Lanes
San Diego County, California



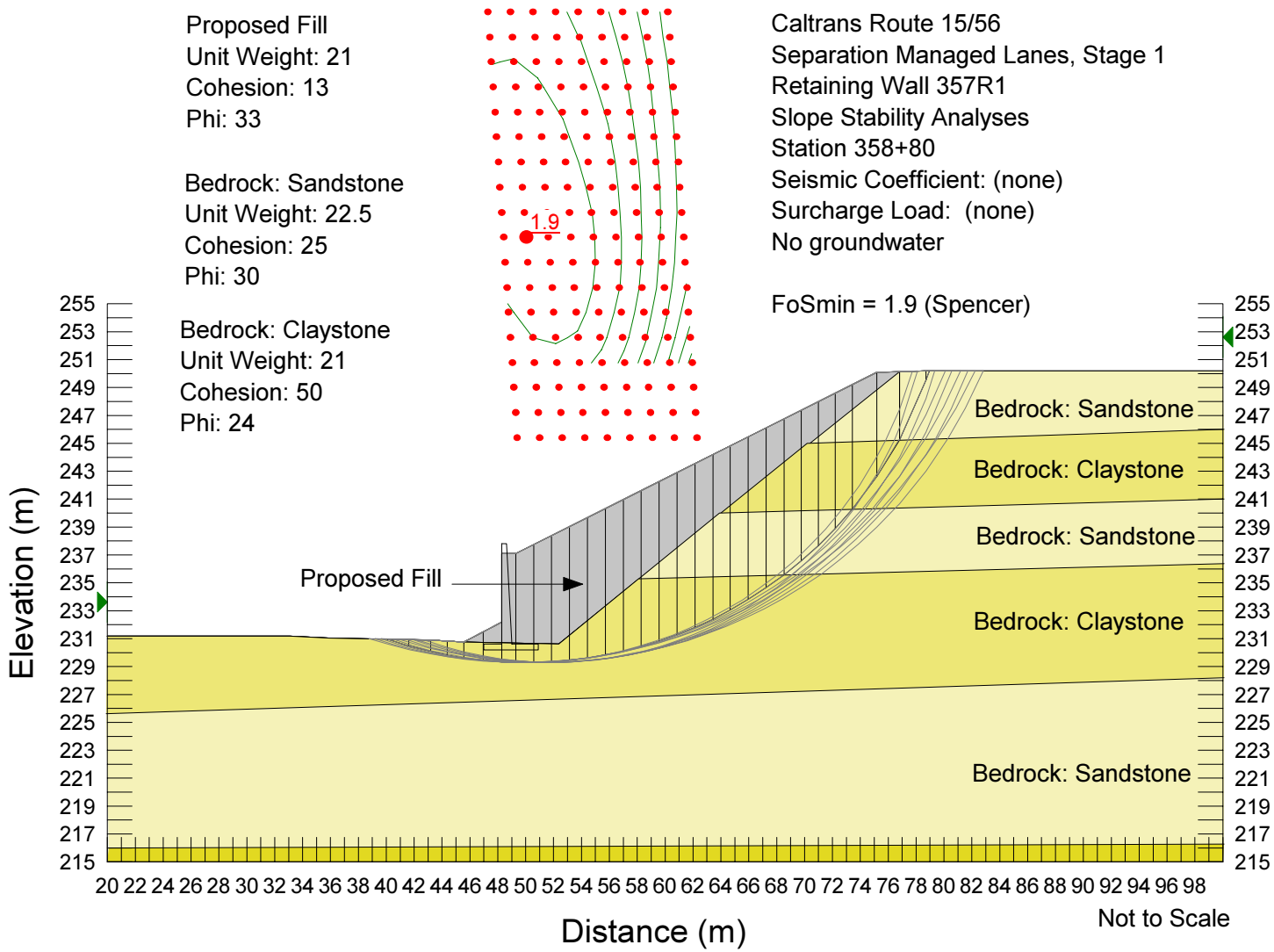
RESULTS OF SLOPE STABILITY (SEISMIC, BELOW FOOTING)
Retaining Wall 353R, Station 355+00
Route 15/56 Separation Managed Lanes
San Diego County, California



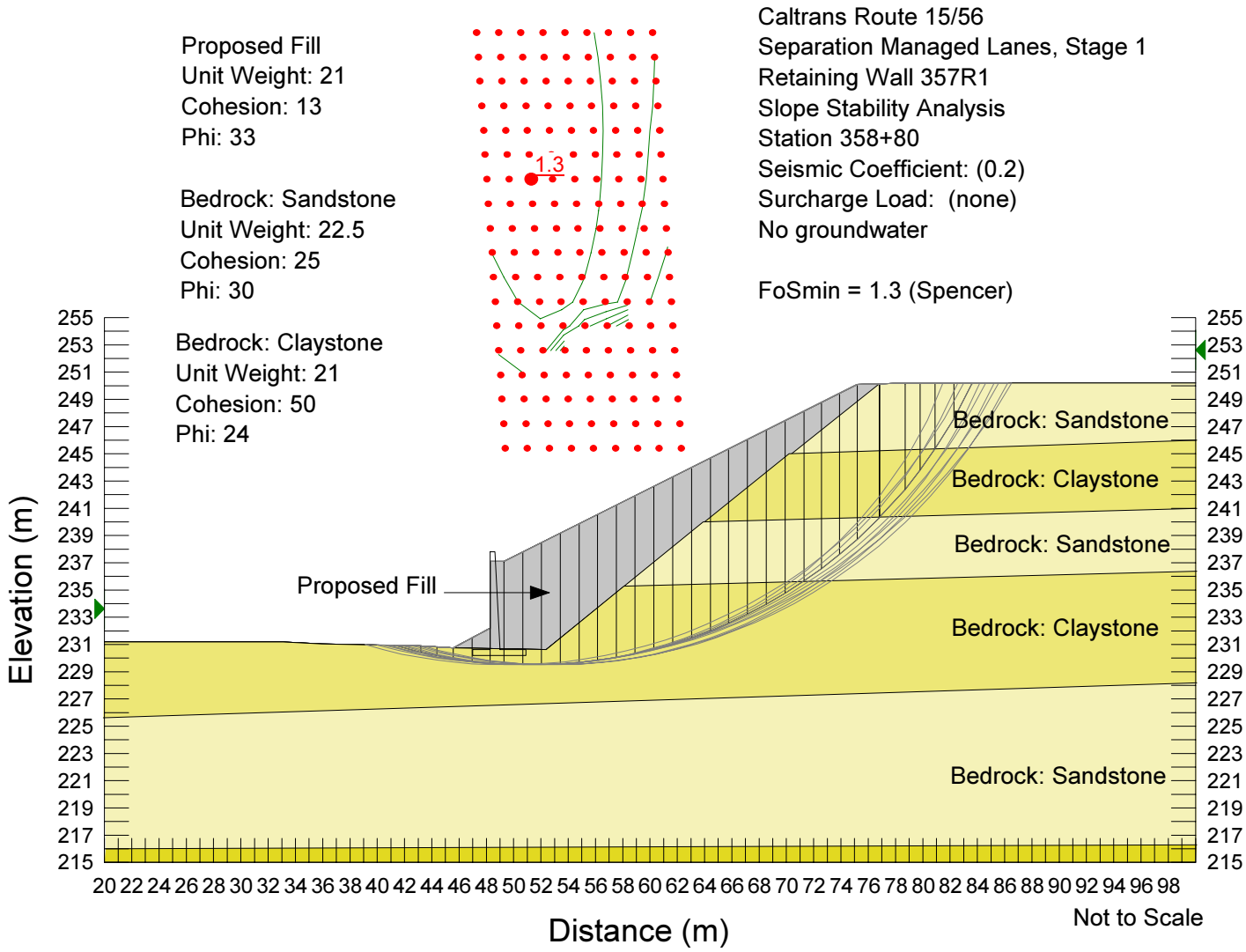
RESULTS OF SLOPE STABILITY (STATIC, AT TOE)
Retaining Wall 353R, Station 355+00
Route 15/56 Separation Managed Lanes
San Diego County, California



RESULTS OF SLOPE STABILITY (SEISMIC, AT TOE)
Retaining Wall 353R, Station 355+00
Route 15/56 Separation Managed Lanes
San Diego County, California



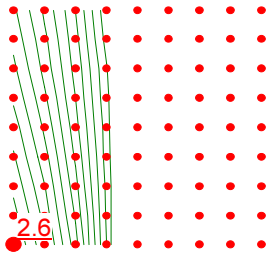
RESULTS OF SLOPE STABILITY (STATIC, BELOW FOOTING)
Retaining Wall 357R1, Station 358+80
Route 15/56 Separation Managed Lanes
San Diego County, California

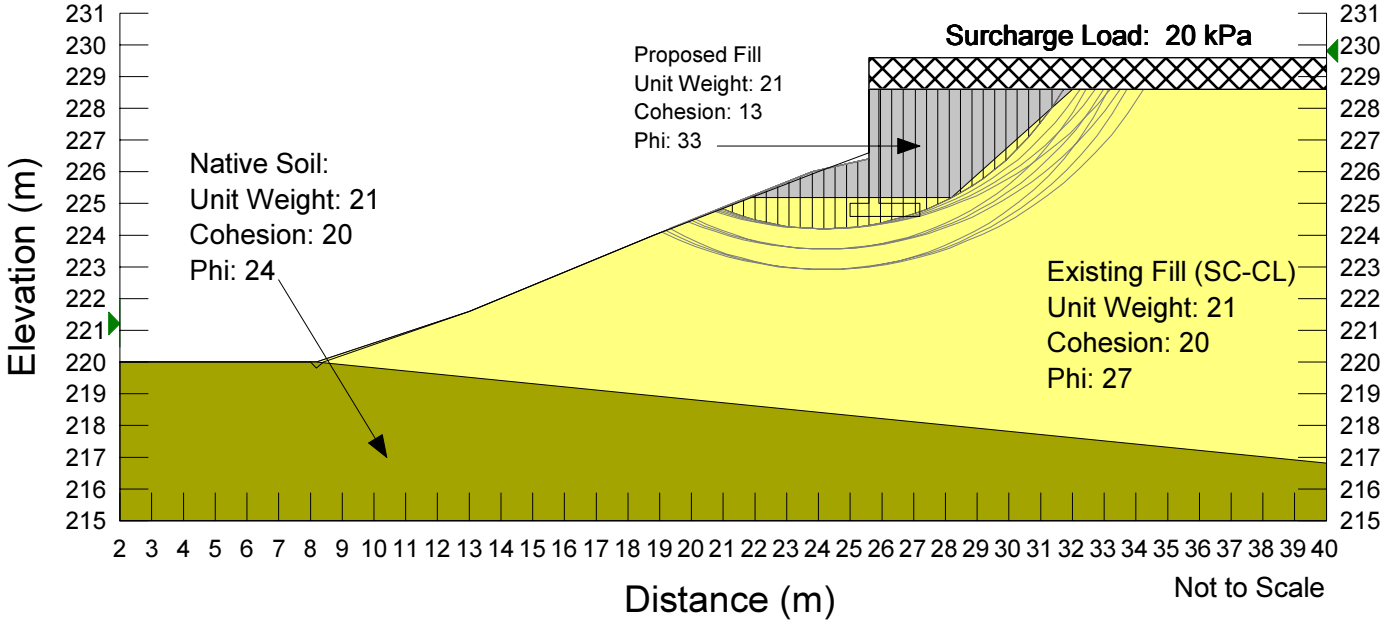


RESULTS OF SLOPE STABILITY (SEISMIC, BELOW FOOTING)
Retaining Wall 357R1, Station 358+80
Route 15/56 Separation Managed Lanes
San Diego County, California

Caltrans Route 15/56
Separation Managed Lanes, Stage 1
Retaining Wall 361L
Slope Stability Analysis
Station 363+13
Seismic Coefficient: (none)
Surcharge Load: 20 kPa
No groundwater

FoSmin = 2.6 (Spencer)

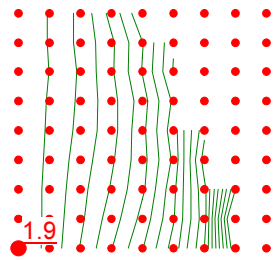


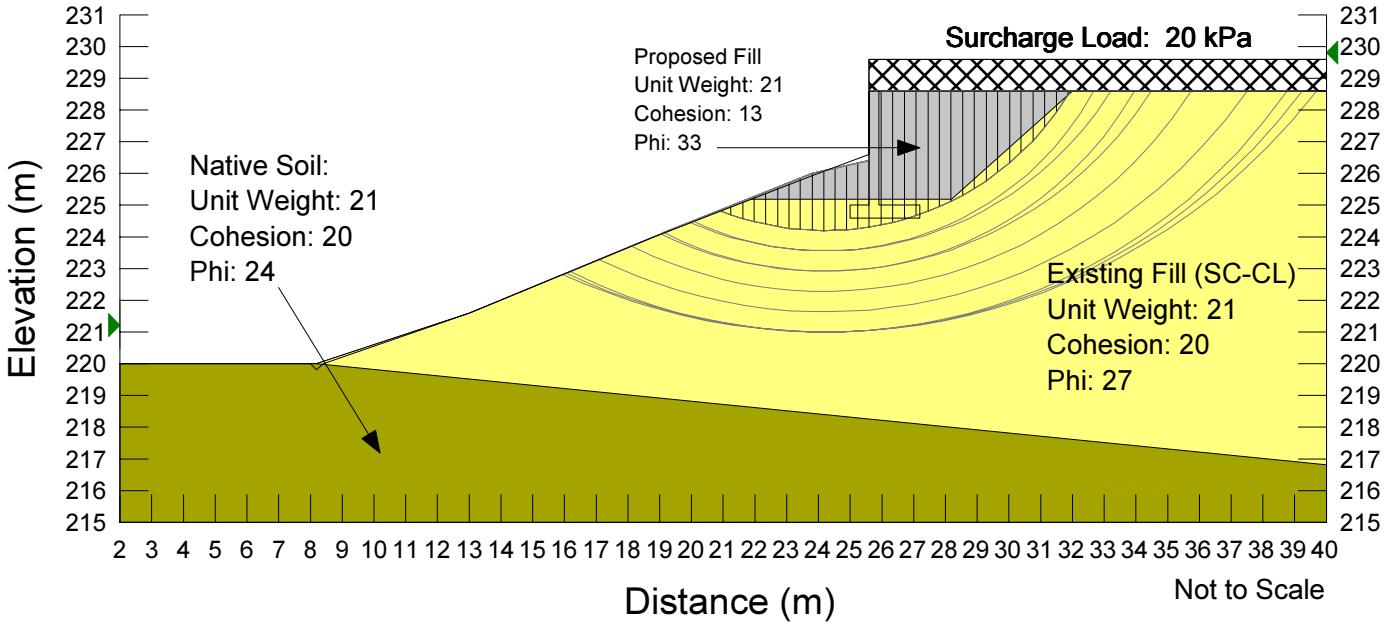


RESULTS OF SLOPE STABILITY (STATIC, AT TOE)
Retaining Wall 361L, Station 363+13
Route 15/56 Separation Managed Lanes
San Diego County, California

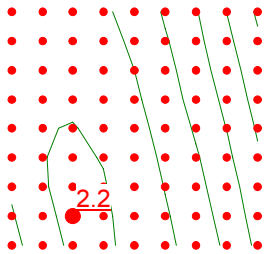
Caltrans Route 15/56
Separation Managed Lanes, Stage 1
Retaining Wall 361L
Slope Stability Analysis
Station 363+13
Seismic Coefficient: (0.2)
Surcharge Load: 20 kPa
No groundwater

FoSmin = 1.9 (Spencer)



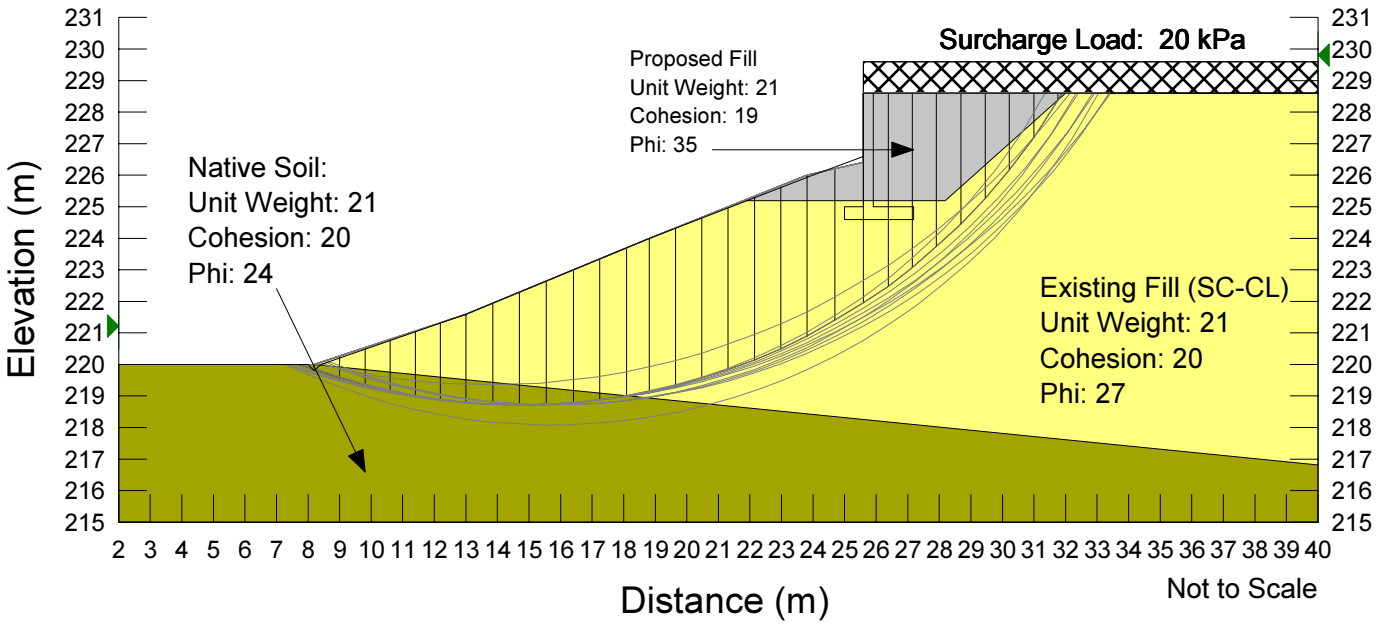


RESULTS OF SLOPE STABILITY (SEISMIC, AT TOE)
Retaining Wall 361L, Station 363+13
Route 15/56 Separation Managed Lanes
San Diego County, California

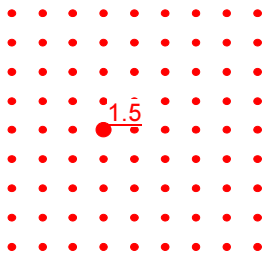


Caltrans Route 15/56
Separation Managed Lanes, Stage 1
Retaining Wall 361L
Slope Stability Analysis
Station 363+13
Seismic Coefficient: (none)
Surcharge Load: 20 kPa
No groundwater

FoSmin = 2.2 (Spencer)

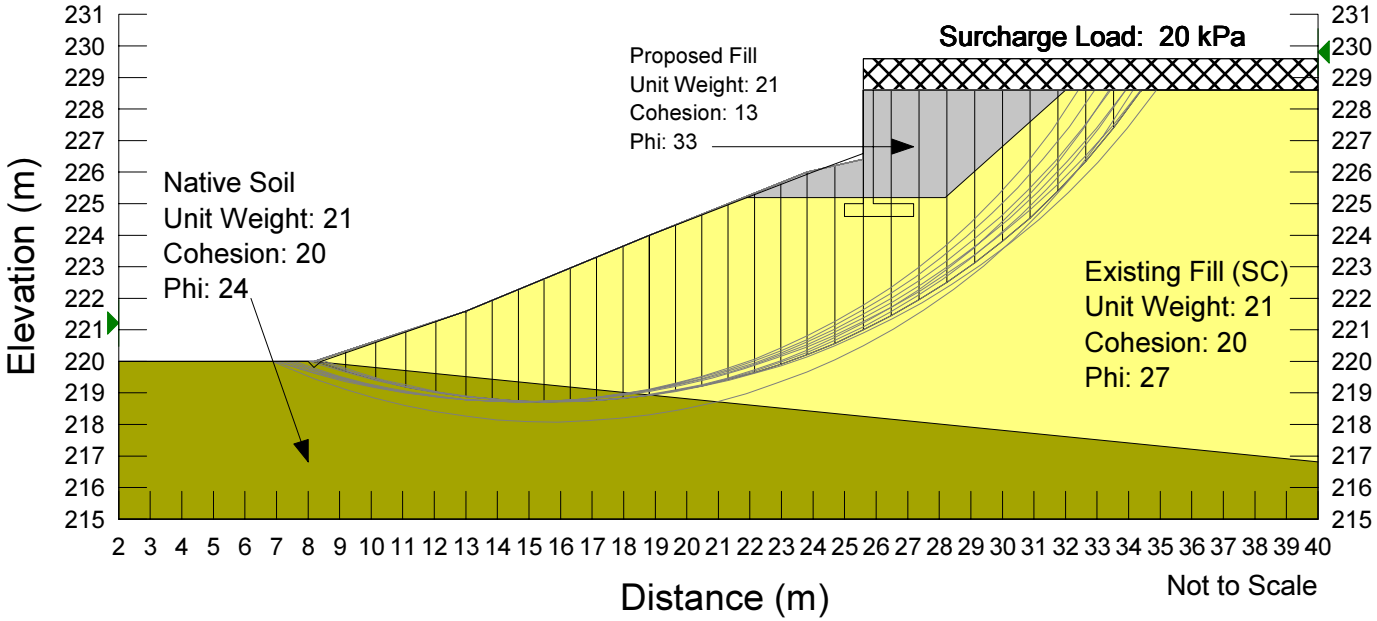


RESULTS OF SLOPE STABILITY (STATIC, AT TOE)
Retaining Wall 361L, Station 363+13
Route 15/56 Separation Managed Lanes
San Diego County, California

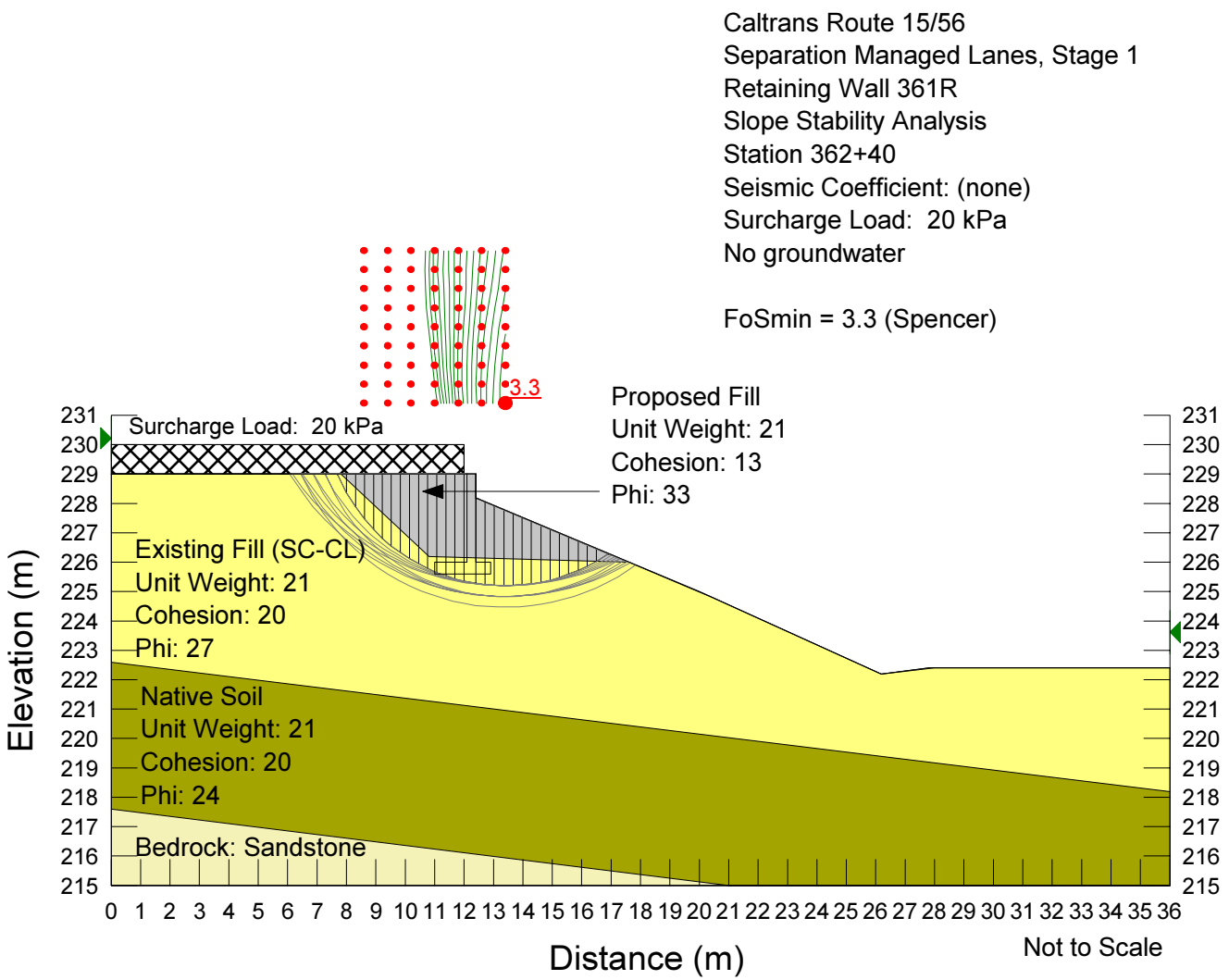


Caltrans Route 15/56
Separation Managed Lanes, Stage 1
Retaining Wall 361L
Slope Stability Analysis
Station 363+13
Seismic Coefficient: (0.2)
Surcharge Load: 20 kPa
No groundwater

FoSmin = 1.5 (Spencer)



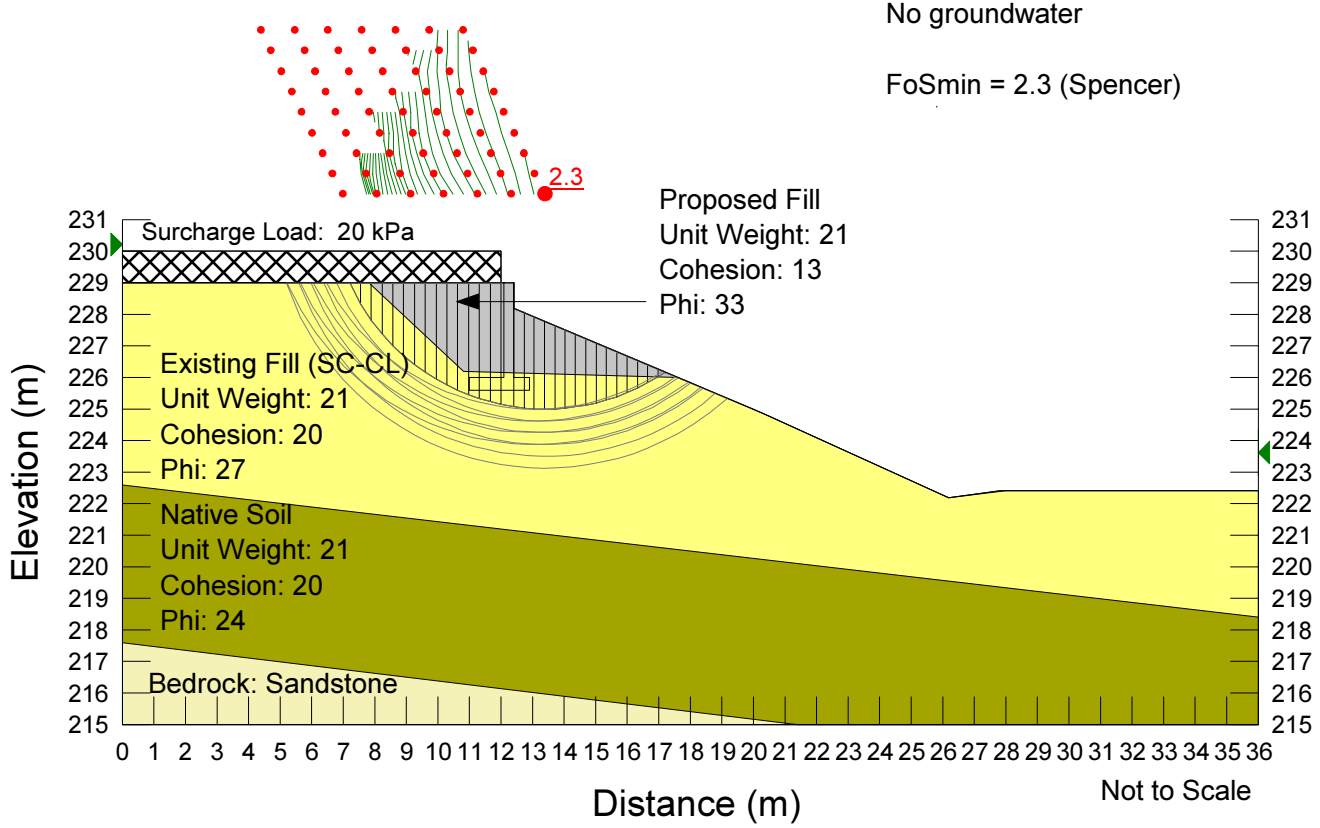
RESULTS OF SLOPE STABILITY (SEISMIC, AT TOE)
Retaining Wall 361L, Station 363+13
Route 15/56 Separation Managed Lanes
San Diego County, California



RESULTS OF SLOPE STABILITY (STATIC, BELOW FOOTING)
Retaining Wall 361R, Station 362+40
Route 15/56 Separation Managed Lanes
San Diego County, California

Caltrans Route 15/56
Separation Managed Lanes, Stage 1
Retaining Wall 361R
Slope Stability Analysis
Station 362+40
Seismic Coefficient: (0.2)
Surcharge Load: 20 kPa
No groundwater

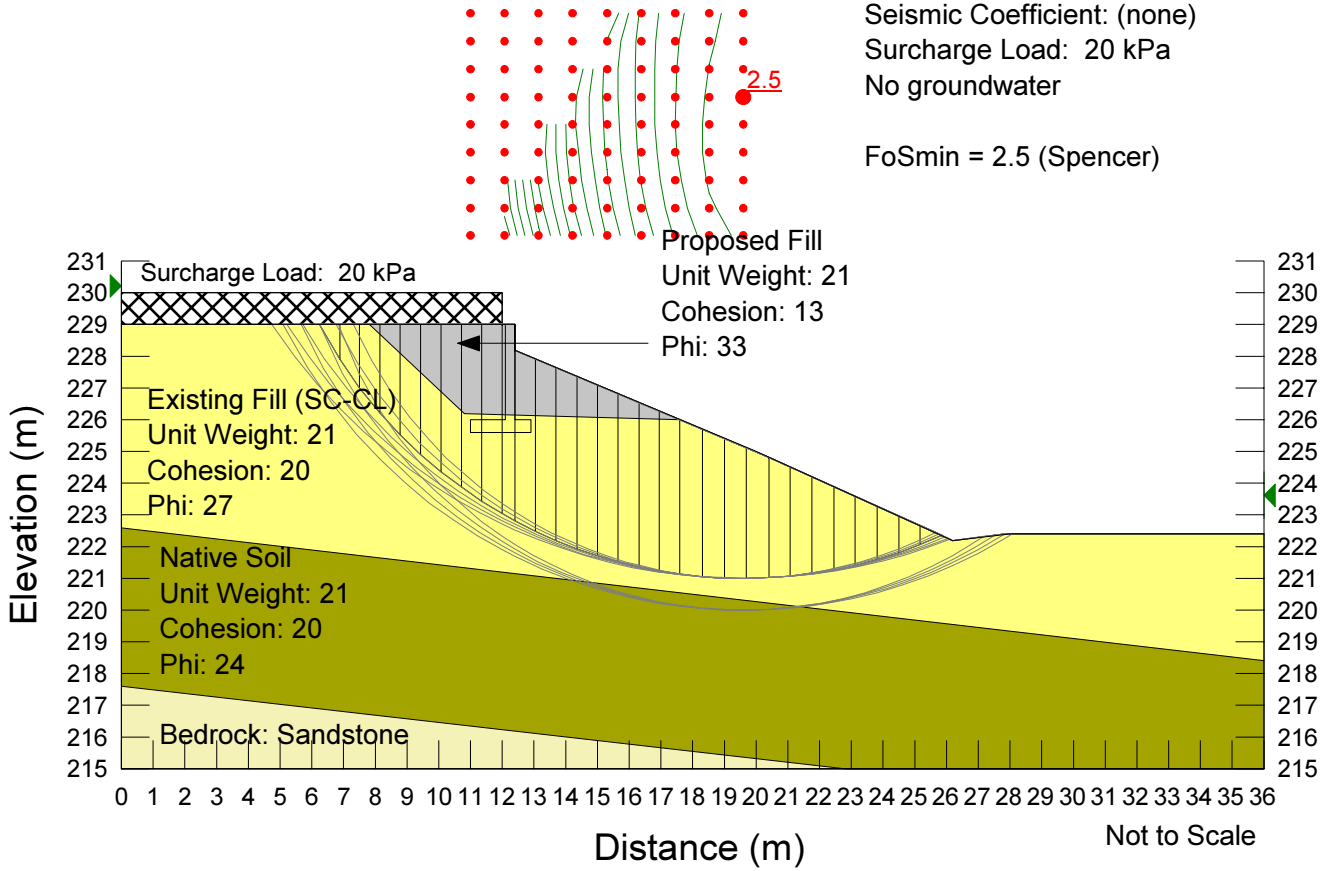
FoSmin = 2.3 (Spencer)



RESULTS OF SLOPE STABILITY (SEISMIC, BELOW FOOTING)
Retaining Wall 361R, Station 362+40
Route 15/56 Separation Managed Lanes
San Diego County, California

Caltrans Route 15/56
Separation Managed Lanes, Stage 1
Retaining Wall 361R
Slope Stability Analysis
Station 362+40
Seismic Coefficient: (none)
Surcharge Load: 20 kPa
No groundwater

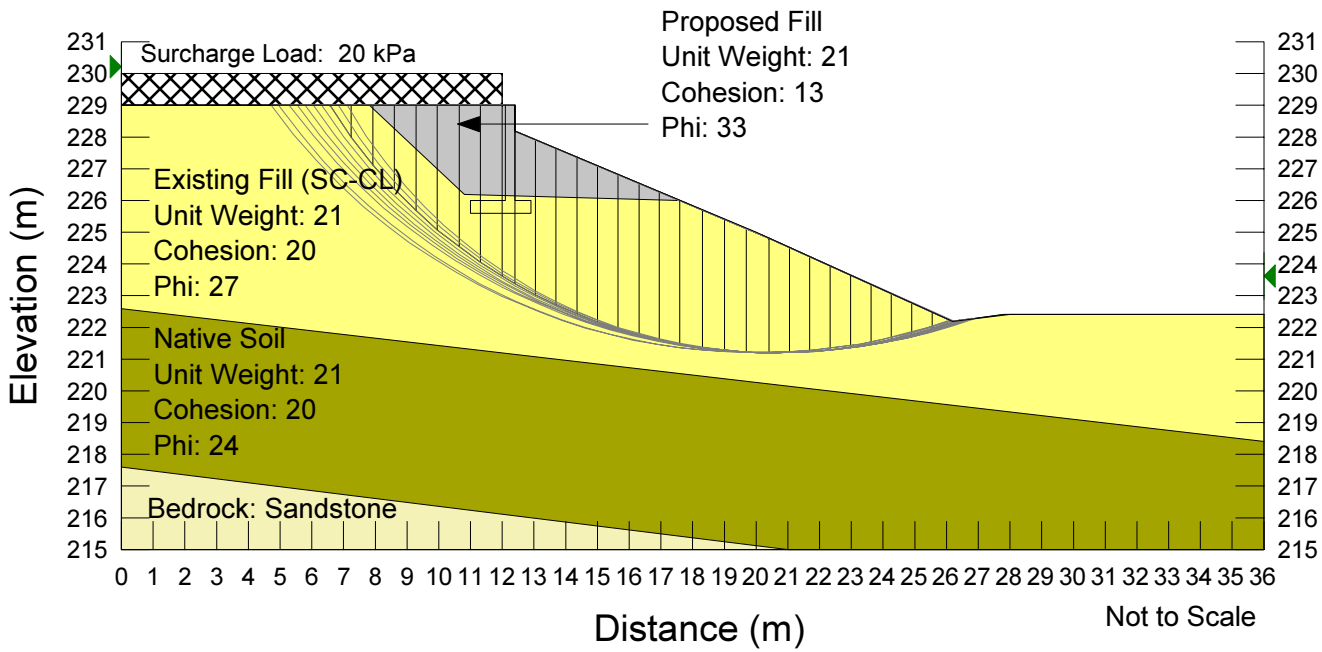
FoSmin = 2.5 (Spencer)



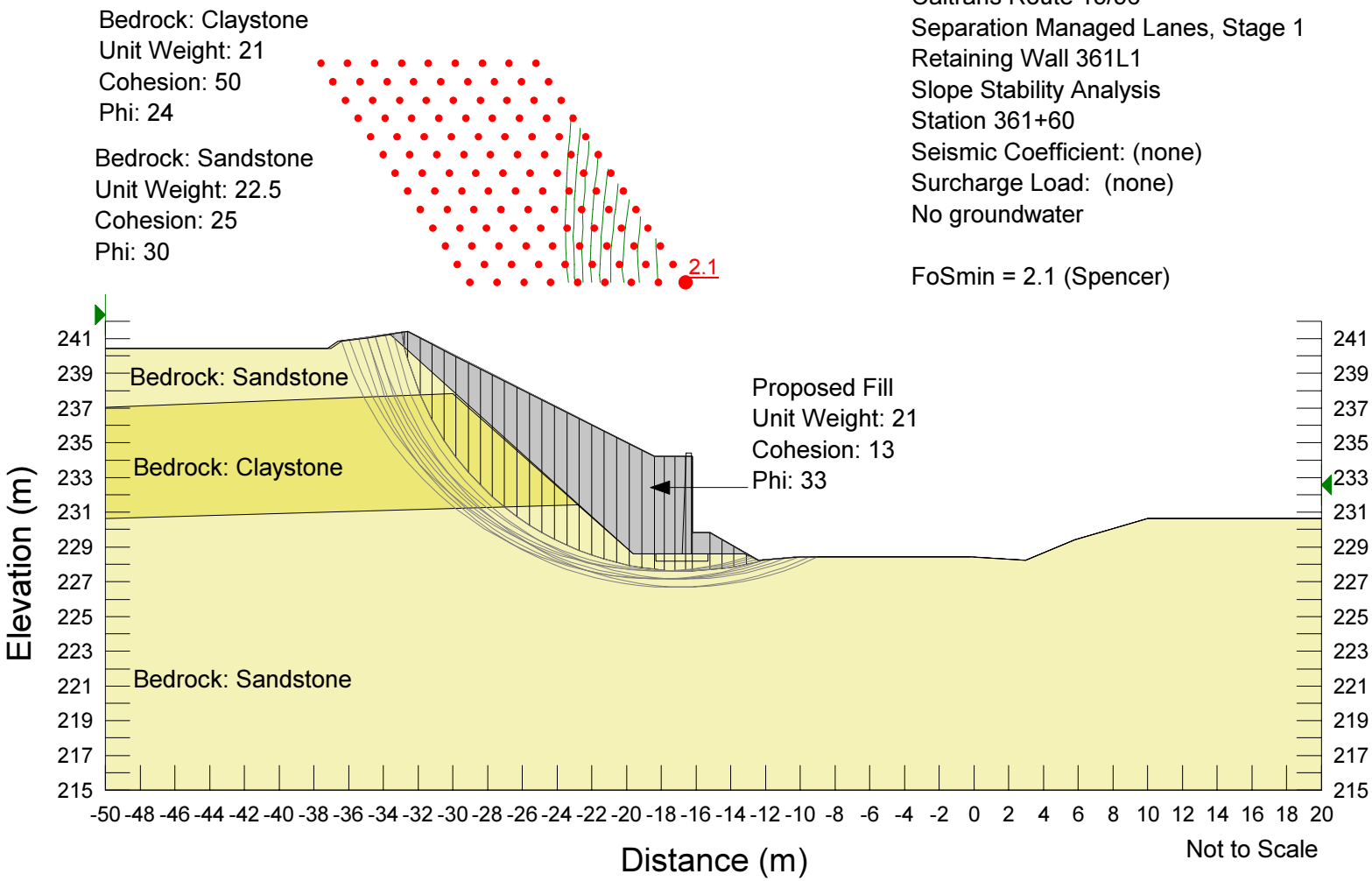
RESULTS OF SLOPE STABILITY (STATIC, AT TOE)
Retaining Wall 361R, Station 362+40
Route 15/56 Separation Managed Lanes
San Diego County, California

Caltrans Route 15/56
Separation Managed Lanes, Stage 1
Retaining Wall 361R
Slope Stability Analysis
Station 362+40
Seismic Coefficient: (0.2)
Surcharge Load: 20 kPa
No groundwater

FoSmin = 1.6 (Spencer)



RESULTS OF SLOPE STABILITY (SEISMIC, AT TOE)
Retaining Wall 361R, Station 362+40
Route 15/56 Separation Managed Lanes
San Diego County, California



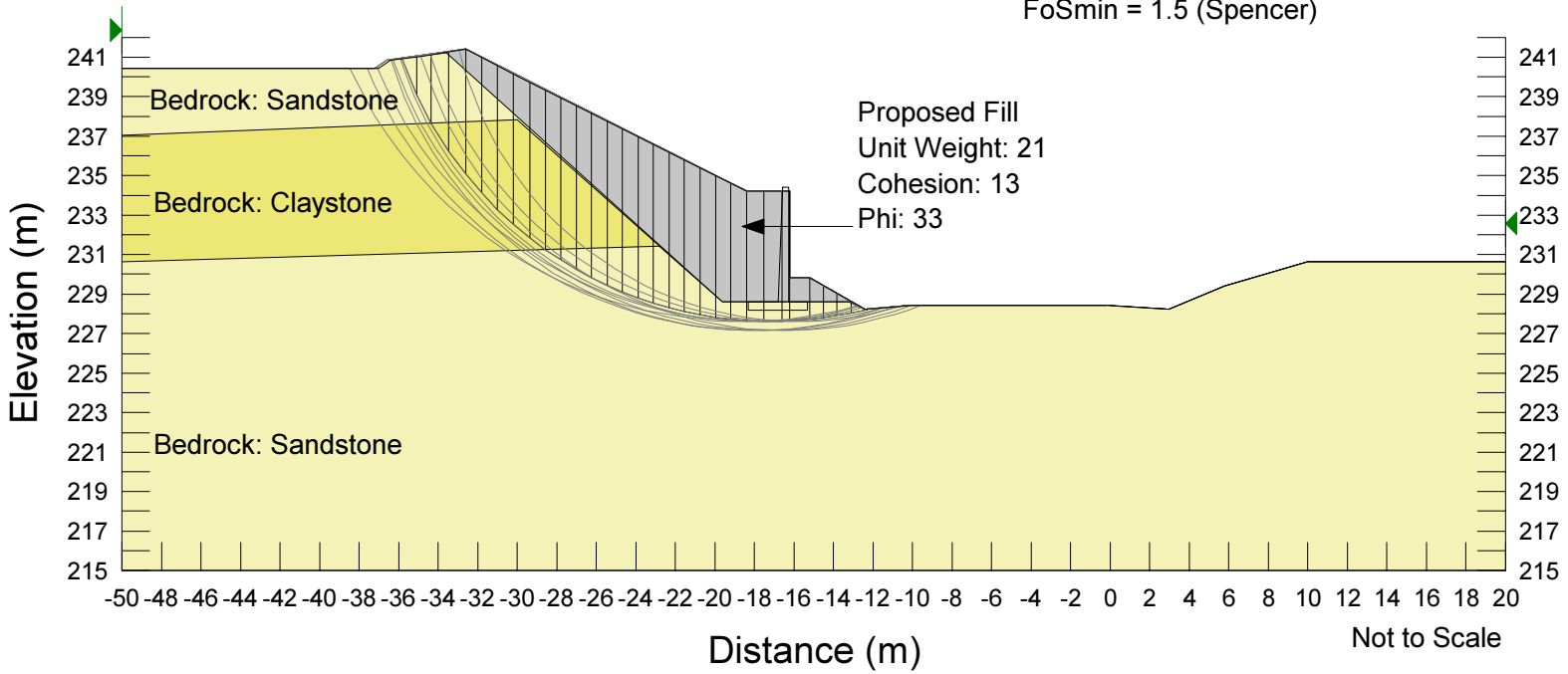
RESULTS OF SLOPE STABILITY (STATIC)
Retaining Wall 361L1, Station 361+60
Route 15/56 Separation Managed Lanes
San Diego County, California

Bedrock: Claystone
Unit Weight: 21
Cohesion: 50
Phi: 24

Bedrock: Sandstone
Unit Weight: 22.5
Cohesion: 25
Phi: 30

Caltrans Route 15/56
Separation Managed Lanes, Stage 1
Retaining Wall 361L1
Slope Stability Analyses
Station 361+60
Seismic Coefficient: (0.2)
Surcharge Load: (none)
No groundwater

FoSmin = 1.5 (Spencer)



RESULTS OF SLOPE STABILITY (SEISMIC)
Retaining Wall 361L1, Station 361+60
Route 15/56 Separation Managed Lanes
San Diego County, California

State of California, Department of Transportation
Statewide A&E Contract No. 59A0284

FUGRO

Calculation Summary Sheet

Structure Number: see below	Task No.: 00002: Prepare Plan Sheets (185)		
Description:	**Sheet No.:** 1 though 9 (attached)		
Bearing capacity assessment for retaining walls: 346L,		**Signed**	**Date**
349L, 353R, 357R, 357R1, 361L, 361R and 361L1	Project Manager	CMS	Dec 6, 02
	Review	CMS	Dec 6, 02
	Chk. Engineer	CMS	Dec 6, 02
	Design Engineer	[illegible]	Dec 6, 02

Relevant Documentation:

1	Report Number:	Fugro GDR, issue 1, dated December 6, 2002
2	Figure/Drawing Number:	Retaining wall plans prepared Caltrans
3	Other References:	Guidelines for Foundation Investigation and Reports, Caltrans, 2002, (V1.2)

Output Required

Report		Figures		Quantities	
Drawing		Size		Cost Estimate	
Calculations	Bearing capacity				

Project Constraints/Interfaces	**Checked**
Footing depth and width from Caltrans Standard Plans	CMS

Assumptions	**Checked**
1. Soil/rock profile based on site investigation data.	CMS
2. Shear strength parameters developed from laboratory test data.	CMS
3. No groundwater.	CMS

Procedure	**Checked**
Use effective stress methods (e.g., Terzaghi, Hansen) to calculate the bearing capacity.	CMS
Filed in: 1394.013 **Date:**	Dec 6, 02

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 346L**

CALCULATION SHEET # **1**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Native Soil	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	Figure II-4s	FOOTING LENGTH:	100 feet
COHESION:	418 psf	FOOTING WIDTH:	6.2 feet
PHI ANGLE:	24 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	9.60	Dq =	1.07	Sy =	0.98
Nc =	19.32	Gc =	1.00	Dy =	1.00
Ny =	5.75	Bc =	1.00	Iy =	1.00
Sc =	1.03	Iq =	1.00	Gy =	1.00
Sq =	1.03	Ic =	1.00	Gq =	1.00
Dc =	1.10	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	13,552.2 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	4,517.4 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	15.7%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE NATIVE SOIL WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 110 kPa.

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 349L**

CALCULATION SHEET # **2**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Volcanics	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	0	FOOTING LENGTH:	100 feet
COHESION:	627 psf	FOOTING WIDTH:	7.2 feet
PHI ANGLE:	35 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	33.30	Dq =	1.05	Sy =	0.97
Nc =	46.12	Gc =	1.00	Dy =	1.00
Ny =	33.92	Bc =	1.00	Iy =	1.00
Sc =	1.05	Iq =	1.00	Gy =	1.00
Sq =	1.05	Ic =	1.00	Gq =	1.00
Dc =	1.08	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	56,115.5 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	18,705.2 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	12.5%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE VOLCANICS WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 160 kPa.

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 353R**

CALCULATION SHEET # **3**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Sandstone	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	Figure II-4u	FOOTING LENGTH:	100 feet
COHESION:	522 psf	FOOTING WIDTH:	14.3 feet
PHI ANGLE:	30 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	18.40	Dq =	1.03	Sy =	0.94
Nc =	30.14	Gc =	1.00	Dy =	1.00
Ny =	15.07	Bc =	1.00	Iy =	1.00
Sc =	1.09	Iq =	1.00	Gy =	1.00
Sq =	1.08	Ic =	1.00	Gq =	1.00
Dc =	1.04	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	35,495.8 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	11,831.9 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	9.5%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE SANDSTONE WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 310 kPa.

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 357R**

CALCULATION SHEET # **4**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Sandstone	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	Figure II-4u	FOOTING LENGTH:	100 feet
COHESION:	522 psf	FOOTING WIDTH:	5.1 feet
PHI ANGLE:	30 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	18.40	Dq =	1.08	Sy =	0.98
Nc =	30.14	Gc =	1.00	Dy =	1.00
Ny =	15.07	Bc =	1.00	Iy =	1.00
Sc =	1.03	Iq =	1.00	Gy =	1.00
Sq =	1.03	Ic =	1.00	Gq =	1.00
Dc =	1.12	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	27,221.7 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	9,073.9 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	16.1%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE SANDSTONE WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 105 kPa.

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 357R1**

CALCULATION SHEET # **5**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Claystone	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	Figure II-4w	FOOTING LENGTH:	100 feet
COHESION:	1044 psf	FOOTING WIDTH:	14.3 feet
PHI ANGLE:	24 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	9.60	Dq =	1.03	Sy =	0.94
Nc =	19.32	Gc =	1.00	Dy =	1.00
Ny =	5.75	Bc =	1.00	Iy =	1.00
Sc =	1.07	Iq =	1.00	Gy =	1.00
Sq =	1.06	Ic =	1.00	Gq =	1.00
Dc =	1.04	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	29,783.6 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	9,927.9 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	7.0%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE CLAYSTONE WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 310 kPa.

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 358L**

CALCULATION SHEET # **6**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Native Soil	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	Figure II-4s	FOOTING LENGTH:	100 feet
COHESION:	418 psf	FOOTING WIDTH:	6.2 feet
PHI ANGLE:	24 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	9.60	Dq =	1.07	Sy =	0.98
Nc =	19.32	Gc =	1.00	Dy =	1.00
Ny =	5.75	Bc =	1.00	Iy =	1.00
Sc =	1.03	Iq =	1.00	Gy =	1.00
Sq =	1.03	Ic =	1.00	Gq =	1.00
Dc =	1.10	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	13,552.2 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	4,517.4 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	15.7%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE NATIVE SOIL WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 110 kPa.

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 361L**

CALCULATION SHEET # **7**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Fill	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	Figure II-4q	FOOTING LENGTH:	100 feet
COHESION:	418 psf	FOOTING WIDTH:	7.2 feet
PHI ANGLE:	27 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	13.20	Dq =	1.06	Sy =	0.97
Nc =	23.94	Gc =	1.00	Dy =	1.00
Ny =	9.32	Bc =	1.00	Iy =	1.00
Sc =	1.04	Iq =	1.00	Gy =	1.00
Sq =	1.04	Ic =	1.00	Gq =	1.00
Dc =	1.08	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	18,512.0 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	6,170.7 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	14.7%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE FILL WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 135 kPa.

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 361L1**

CALCULATION SHEET # **9**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Claystone	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	Figure II-4w	FOOTING LENGTH:	100 feet
COHESION:	1044 psf	FOOTING WIDTH:	10 feet
PHI ANGLE:	24 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	9.60	Dq =	1.05	Sy =	0.96
Nc =	19.32	Gc =	1.00	Dy =	1.00
Ny =	5.75	Bc =	1.00	Iy =	1.00
Sc =	1.05	Iq =	1.00	Gy =	1.00
Sq =	1.04	Ic =	1.00	Gq =	1.00
Dc =	1.06	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	28,207.3 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	9,402.4 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	8.4%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE CLAYSTONE WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 200 kPa.

BEARING CAPACITY ANALYSIS

JN: **1394.013** CONSULT: **CEW**
CLIENT: **Caltrans, 361R**

CALCULATION SHEET # **8**

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	Native Soil	EMBEDMENT DEPTH:	1.48 feet
SHEAR DIAGRAM:	Figure II-4s	FOOTING LENGTH:	100 feet
COHESION:	418 psf	FOOTING WIDTH:	4.3 feet
PHI ANGLE:	24 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	134 pcf	FOOTING INCLINATION:	0 degrees
SAFETY FACTOR:	3		
FOOTING TYPE:	S Strip		

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	9.60	Dq =	1.11	Sy =	0.98
Nc =	19.32	Gc =	1.00	Dy =	1.00
Ny =	5.75	Bc =	1.00	Iy =	1.00
Sc =	1.02	Iq =	1.00	Gy =	1.00
Sq =	1.02	Ic =	1.00	Gq =	1.00
Dc =	1.14	Bq =	1.00	By =	1.00

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	13,162.9 psf
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	4,387.6 psf
PERCENT INCREASE FOR EMBEDMENT DEPTH	18.7%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE NATIVE SOIL WERE CALCULATED USING HANSEN'S METHOD. THE DESIGN TOE PRESSURE IS 90 kPa.