TERRA ASSOCIATES, Inc.
Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

February 9, 2024
Project No. T-8661

Mr. Michael Cohn
Cref3 Puyallup Owner, LLC
11611 San Vincente Boulevard, 10th Floor
Los Angeles, California 90049

Subject: Retaining Wall Design
240 – 15th Street SE Industrial
240 – 15th Street Southeast
Puyallup, Washington

Reference: Geotechnical Report, 240 – 15th Street SE Industrial, 240 – 15th Street Southeast, Puyallup, Washington, Project No. T-8661, prepared by Terra Associates, Inc., dated January 12, 2022, Revised June 23, 2023

Dear Mr. Cohn:

As requested, we have prepared designs for construction of the project's retaining walls. This letter presents the results of our analyses and provides recommendations for construction.

Based on our review of Sheet C7, *Grading and Drainage Plan,* prepared by Barghausen Consulting Engineers, Inc., dated December 6, 2023, a single fill wall is planned in the northwestern portion of the site. The wall will support the vertical grade transitions between the site and adjacent properties. Exposed wall heights generally vary from approximately one to five feet tall with 2:1 (Horizontal: Vertical) or flatter front slopes and level back slopes. The fill wall has been designed as a Lock + Load wall.

The soil conditions used in the design of the Lock + Load wall were based on information contained in the referenced report. Our Lock + Load wall designs address internal and external wall stability considerations and were completed using the computer program MSEW v.3.0 published by ADAMA Engineering, Inc. All analyses yielded acceptable factors of safety for both static and seismic cases. Details showing Lock + Load with varying wall heights are shown on Figure 1. Design calculations are attached for official review.

We recommend all subgrade preparation activities, placement, and compaction of structural fill associated with construction of the walls, be completed in accordance with recommendations as outlined in the referenced report and our onsite recommendations. All wall foundations should be observed by a representative of Terra Associates, Inc. to ensure the soil conditions are as expected and suitable for wall construction.

12220 113th Avenue NE, Ste. 130, Kirkland, Washington 98034
Phone (425) 821-7777 • Fax (425) 821-4334

We trust the information presented in this report is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

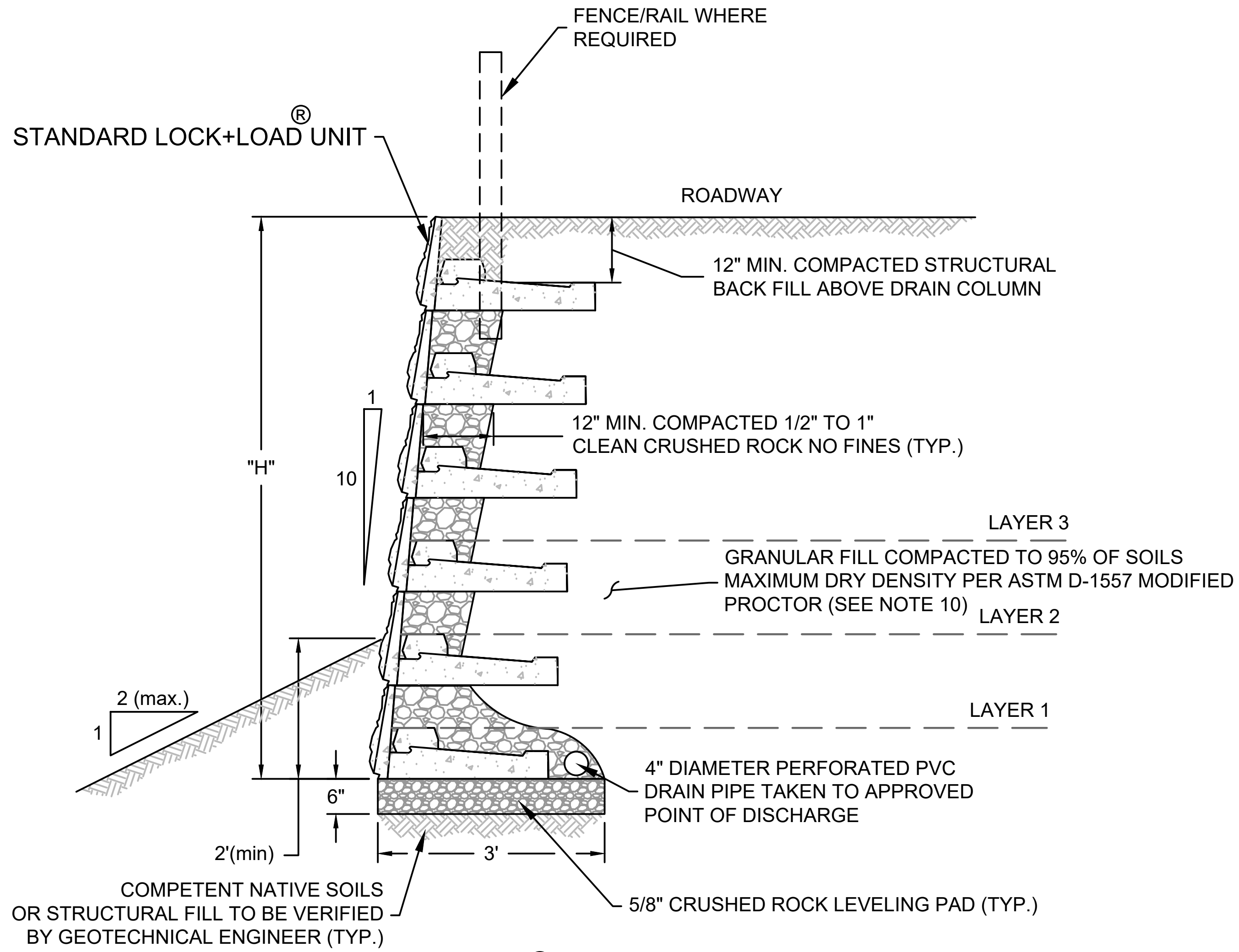
Michael J. Xenos, E.I.T.
Staff Engineer

CAROLYN S. DECKER
STATE OF WASHINGTON
47016
REGISTERED
PROFESSIONAL ENGINEER

2-9-24

Carolyn S. Decker, P.E.
President

Attached: Figure 1 – Lock + Load Wall Details
Design Calculations – Lock + Load Walls



LOCK+LOAD® WALL

NOT TO SCALE

REINFORCING SCHEDULE

TOTAL NUMBER OF PANELS IN WALL	TOTAL WALL HEIGHT "H"	LAYER NO.	REINFORCEMENT TYPE	REINFORCEMENT LENGTH "L"	HEIGHT (FT)
3 OR LESS	NO REINFORCEMENT REQUIRED				
4	5.33 FT	1	MIRAFI 5 XT	4.50 FT	0.66
5	6.67 FT	1 2	MIRAFI 5 XT	5.50 FT 5.50 FT	0.66 2.00
6	8.00 FT	1 2 3	MIRAFI 5 XT	6.50 FT 6.50 FT 6.50 FT	0.66 2.00 3.33
NOTE: GEOGRID ELEVATION TOLERANCE ± .5' (ALL DIMENSIONS ARE IN FEET)					

GENERAL NOTES

1) REFER TO CIVIL GRADING PLANS FOR WALL ALIGNMENTS AND ELEVATIONS.

2) REFER TO REINFORCING SCHEDULE FOR GEOGRID LENGTHS AND ELEVATIONS.

3) GEOGRID ELEVATION MEASURED FROM TOP OF CRUSHED ROCK LEVELING PAD.

4) GEOGRID LENGTH "L" MEASURED FROM BACK OF FACE UNIT.

5) GEOGRID SHALL BE INSTALLED BEHIND WALL WITH MACHINE DIRECTION (STRONGEST AXIS) PERPENDICULAR TO WALL.

6) GEOGRID SHALL BE INSTALLED ON HORIZONTAL SURFACE OF COMPACTED STRUCTURAL FILL.

7) GEOGRID SHALL BE PULLED TIGHT BEHIND WALL. STAKE END OF GEOGRID AS REQUIRED TO MAINTAIN TENSION BEFORE COVERING WITH STRUCTURAL FILL.

8) PROTECT GEOGRID FROM CONSTRUCTION DAMAGE PER MANUFACTURERS SPECIFICATIONS. CONSTRUCTION EQUIPMENT SHALL NOT TRAVEL DIRECTLY ON GEOGRID. ANY GEOGRID THAT IS DAMAGED SHALL BE REPLACED WITH NEW GEOGRID AT CONTRACTORS EXPENSE.

9) LOCK+LOAD ® WALL ASSEMBLY TO BE COMPLETED PER MANUFACTURERS SPECIFICATIONS.

10) STRUCTURAL FILL SHALL BE PLACED AND COMPACTED ACCORDING TO RECOMMENDATIONS PROVIDED IN THE GEOTECHNICAL REPORT, 240 - 15TH STREET SE INDUSTRIAL, 240 - 15TH STREET SOUTHEAST, PUYALLUP, WASHINGTON, PROJECT NO. T-8661, PREPARED BY TERRA ASSOCIATES, INC., DATED JANUARY 12, 2022, REVISED JUNE 23, 2023. STRUCTURAL FILL IN REINFORCED ZONE SHALL BE GRANULAR MATERIAL WITH A MAXIMUM AGGREGATE SIZE OF 3-INCHES AND A MAXIMUM SOIL FINES (LESS THAN # 200 SIEVE) CONTENT OF 30 PERCENT.

11) HEAVY CONSTRUCTION EQUIPMENT SUCH AS VIBRATORY DRUM ROLLERS, LOADED DUMP TRUCKS, FRONT-END LOADERS, ETC., SHALL NOT OPERATE WITHIN FIVE FEET OF BACK OF WALLS. STRUCTURAL FILL PLACED IN THIS ZONE SHALL HAVE MAXIMUM LOOSE LIFT THICKNESS OF 12 INCHES AND SHALL BE COMPACTED USING HAND OPERATED COMPACTION EQUIPMENT.

Terra Associates, Inc.
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LOCK+LOAD WALL DETAIL
240 - 15TH ST SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj.No. T-8661	Date: FEB 2024	Figure 1

DESIGN CALCULATIONS

LOCK + LOAD WALLS

Project No. T-8661

TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

AASHTO 2002 ASD DESIGN METHOD
240 - 15th Street SE Industrial

MSEW(3.0): Update # 14.972

PROJECT IDENTIFICATION

Title:	240 - 15th Street SE Industrial
Project Number:	T-8661
Client:	Cref3 Puyallup Owner, LLC
Designer:	M. Xenos
Station Number:	

Description:

4 Panel Lock + Load Wall

Company's information:

Name: Terra Associates, Inc.
Street: 12220 - 113th Avenue NE
Suite 130
Kirkland, WA 98034
Telephone #: 425-821-7777
Fax #:
E-Mail: mxenos@terra-associates.com

Original file path and name: G:\USERS\MXenos\Projects\8661 240 - 15th Street SE Indu.....
.....anel Lock + Load.BEN

Original date and time of creating this file: Tuesday January 30, 2024

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.

SOIL DATA

REINFORCED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{\text{equiv.}}$	125.0 lb/ft ³
Equivalent internal angle of friction, $\phi_{\text{equiv.}}$	36.0 °
Equivalent cohesion, $c_{\text{equiv.}}$	0.0 lb/ft ²

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 62.00° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 0.00 N γ= 14.94

SEISMICITY

Maximum ground acceleration coefficient, A = 0.270
Design acceleration coefficient in Internal Stability: Kh = Am = 0.319
Design acceleration coefficient in External Stability: Kh_d = 0.102 => Kh = Am = 0.138
(Kh in External Stability is based on allowable displacement, d = 100 mm. using AASHTO 2002 equation)

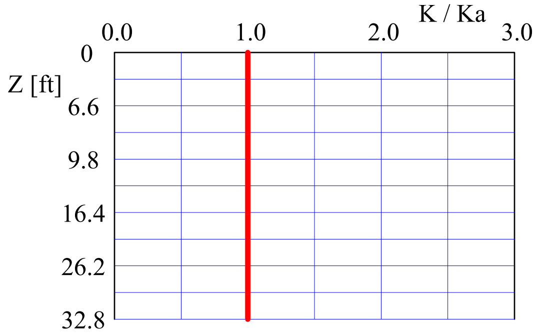
Kae (Kh > 0) = 0.3279 Kae (Kh = 0) = 0.2462 Δ Kae = 0.0817
Seismic soil-geogrid friction coefficient, F* is 80.0% of its specified static value.

INPUT DATA: Geogrids
(Analysis)

D A T A	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	4700.0	7400.0	9400.0	13705.0	
Durability reduction factor, RFd	1.30	1.30	1.30	1.30	
Installation-damage reduction factor, RFid	1.12	1.12	1.12	1.12	
Creep reduction factor, RFc	1.45	1.45	1.45	1.45	N/A
Fs-overall for strength	N/A	N/A	N/A	N/A	
Coverage ratio, Rc	1.000	1.000	1.000	1.000	
Friction angle along geogrid-soil interface, ρ	28.00	28.00	28.00	28.00	
Pullout resistance factor, F*	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	N/A
Scale-effect correction factor, α	0.8	0.8	0.8	0.8	

Variation of Lateral Earth Pressure Coefficient With Depth

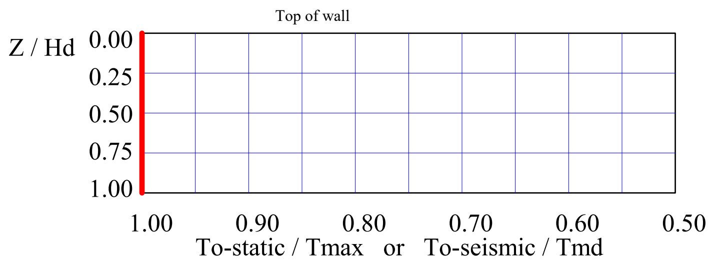
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



INPUT DATA: Facia and Connection (according to revised Demo 82) (Analysis)

FACIA type: Facing enabling frictional connection of reinforcement (e.g., modular concrete blocks, gabions)
Depth/height of block is 2.17/1.34 ft. Horizontal distance to Center of Gravity of block is 1.08 ft.
Average unit weight of block is $\gamma_f = 125.00$ lb/ft ³

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



Geogrid Type #1 σ [(1)]	CRult [(2)]	Geogrid Type #2 σ	CRult	Geogrid Type #3 σ	CRult	Geogrid Type #4 σ	CRult	Geogrid Type #5 σ	CRult
1044.2	1.00	1044.2	1.00	1044.2	1.00	1044.2	1.00		
2088.5	1.00	2088.5	1.00	2088.5	1.00	2088.5	1.00	N/A	

Geogrid Type #1[3)] σ	CRcr	Geogrid Type #2 σ	CRcr	Geogrid Type #3 σ	CRcr	Geogrid Type #4 σ	CRcr	Geogrid Type #5 σ	CRcr
1044.2	0.60	1044.2	0.60	1044.2	0.60	1044.2	0.60		
2088.5	0.90	2088.5	0.90	2088.5	0.90	2088.5	0.90	N/A	

(1) σ = Confining stress in between stacked blocks [lb/ft ²]
(2) CRult = Tc-ult / Tult
(3) CRcr = Tcre / Tult

In seismic analysis, long term strength is reduced to 80% of its static value.

D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Mirafi 5XT	Mirafi 8XT	Mirafi 10..	Mirafi 20..	N/A
Connection strength reduction factor, RFd	1.30	1.30	1.30	1.30	N/A
Creep reduction factor, RFc	N/A	N/A	N/A	N/A	N/A

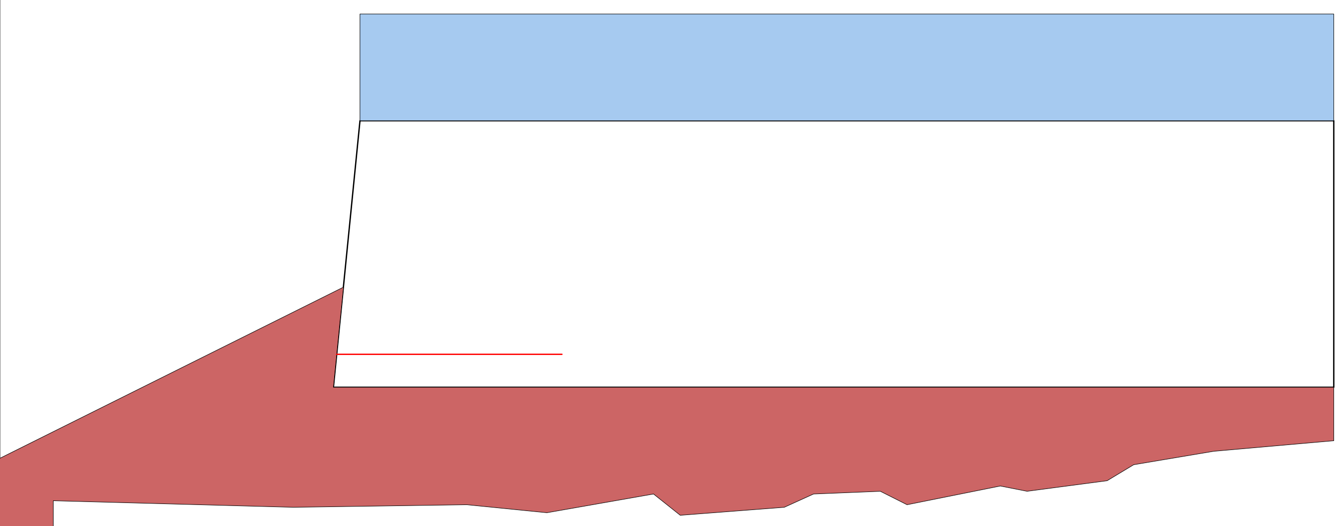
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	5.33	[ft]	{ Embedded depth is E = 2.00 ft, and height above top of finished bottom grade is H = 3.33 ft }
Batter, ω	5.7	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M   S U R C H A R G E

Uniformly distributed dead load is 250.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 3.61, Meyerhof stress = 994 lb/ft².

Foundation Interface: Direct sliding, Fs = 2.926, Eccentricity, e/L = 0.0737, Fs-overturning = 4.86

GEOGRID #	Elevation [ft]	Length [ft]	Type #	CONNECTION Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	0.66	4.50	1	2.47	2.53	2.534	3.393	2.600	0.0540	Mirafi 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, Fs = 2.86, Meyerhof stress = 1115 lb/ft².

Foundation Interface: Direct sliding, Fs = 2.195, Eccentricity, e/L = 0.1201, Fs-overturning = 3.42

GEOGRID #	Elevation [ft]	Length [ft]	Type #	CONNECTION Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	0.66	4.50	1	1.69	2.13	2.126	2.124	1.979	0.0880	Mirafi 5XT

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AASHTO 2002 ASD DESIGN METHOD
240 - 15th Street SE Industrial

MSEW(3.0): Update # 14.972

PROJECT IDENTIFICATION

Title:	240 - 15th Street SE Industrial
Project Number:	T-8661
Client:	Cref3 Puyallup Owner, LLC
Designer:	M. Xenos
Station Number:	

Description:

5 Panel Lock + Load Wall

Company's information:

Name: Terra Associates, Inc.
Street: 12220 - 113th Avenue NE
Suite 130
Kirkland, WA 98034
Telephone #: 425-821-7777
Fax #:
E-Mail: mxenos@terra-associates.com

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Original date and time of creating this file: Tuesday January 30, 2024

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.

SOIL DATA

REINFORCED SOIL

Unit weight, γ	125.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	125.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	125.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	36.0 °
Equivalent cohesion, $c_{equiv.}$	0.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 62.00° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 0.00 N γ= 14.94

SEISMICITY

Maximum ground acceleration coefficient, A = 0.270
Design acceleration coefficient in Internal Stability: Kh = Am = 0.319
Design acceleration coefficient in External Stability: Kh_d = 0.102 => Kh = Am = 0.138
(Kh in External Stability is based on allowable displacement, d = 100 mm. using AASHTO 2002 equation)

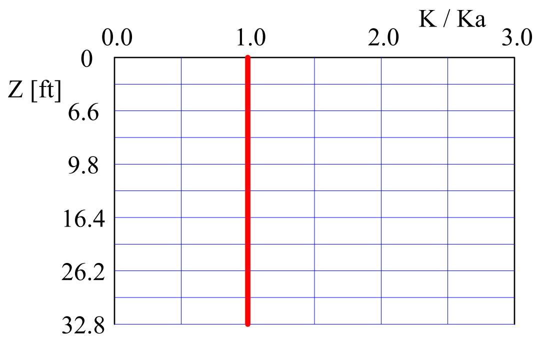
Kae (Kh > 0) = 0.3279 Kae (Kh = 0) = 0.2462 Δ Kae = 0.0817
Seismic soil-geogrid friction coefficient, F* is 80.0% of its specified static value.

INPUT DATA: Geogrids
(Analysis)

D A T A	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	4700.0	7400.0	9400.0	13705.0	
Durability reduction factor, RFd	1.30	1.30	1.30	1.30	
Installation-damage reduction factor, RFid	1.12	1.12	1.12	1.12	
Creep reduction factor, RFc	1.45	1.45	1.45	1.45	N/A
Fs-overall for strength	N/A	N/A	N/A	N/A	
Coverage ratio, Rc	1.000	1.000	1.000	1.000	
Friction angle along geogrid-soil interface, ρ	28.00	28.00	28.00	28.00	
Pullout resistance factor, F*	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	N/A
Scale-effect correction factor, α	0.8	0.8	0.8	0.8	

Variation of Lateral Earth Pressure Coefficient With Depth

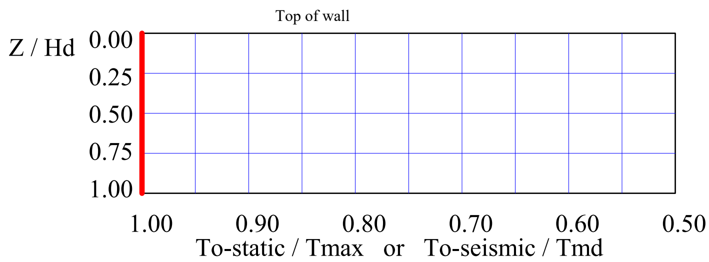
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



INPUT DATA: Facia and Connection (according to revised Demo 82) (Analysis)

FACIA type: Facing enabling frictional connection of reinforcement (e.g., modular concrete blocks, gabions)
Depth/height of block is 2.17/1.34 ft. Horizontal distance to Center of Gravity of block is 1.08 ft.
Average unit weight of block is γ_f = 125.00 lb/ft ³

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



Geogrid Type #1		Geogrid Type #2		Geogrid Type #3		Geogrid Type #4		Geogrid Type #5	
σ (1)	CRult (2)	σ	CRult	σ	CRult	σ	CRult	σ	CRult
1044.2	1.00	1044.2	1.00	1044.2	1.00	1044.2	1.00		
2088.5	1.00	2088.5	1.00	2088.5	1.00	2088.5	1.00	N/A	

Geogrid Type #1 3)		Geogrid Type #2		Geogrid Type #3		Geogrid Type #4		Geogrid Type #5	
σ	CRcr	σ	CRcr	σ	CRcr	σ	CRcr	σ	CRcr
1044.2	0.60	1044.2	0.60	1044.2	0.60	1044.2	0.60		
2088.5	0.90	2088.5	0.90	2088.5	0.90	2088.5	0.90	N/A	

(1) σ = Confining stress in between stacked blocks [lb/ft ²]
(2) CRult = Tc-ult / Tult
(3) CRcr = Tcre / Tult

In seismic analysis, long term strength is reduced to 80% of its static value.

D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Mirafi 5XT	Mirafi 8XT	Mirafi 10..	Mirafi 20..	N/A
Connection strength reduction factor, RFd	1.30	1.30	1.30	1.30	N/A
Creep reduction factor, RFc	N/A	N/A	N/A	N/A	N/A

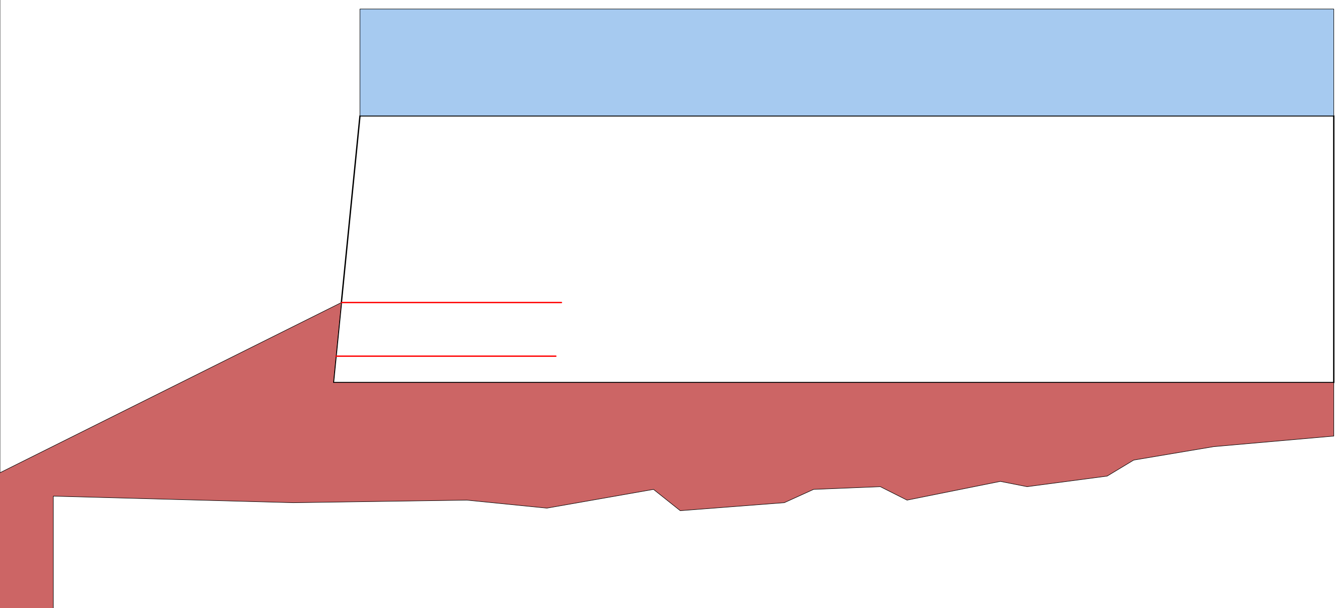
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	6.67	[ft]	{ Embedded depth is E = 2.00 ft, and height above top of finished bottom grade is H = 4.67 ft }
Batter, ω	5.7	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

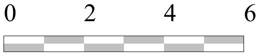
U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 250.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:



ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 3.73, Meyerhof stress = 1174 lb/ft².

Foundation Interface: Direct sliding, Fs = 2.959, Eccentricity, e/L = 0.0730, Fs-overturning = 4.90

GEOGRID #	Elevation [ft]	Length [ft]	Type #	CONNECTION Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	0.66	5.50	1	5.77	5.92	5.917	11.643	2.566	0.0571	Mirafi 5XT
2	2.00	5.50	1	2.46	2.53	2.526	3.786	3.220	0.0304	Mirafi 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, Fs = 2.89, Meyerhof stress = 1335 lb/ft².

Foundation Interface: Direct sliding, Fs = 2.168, Eccentricity, e/L = 0.1245, Fs-overturning = 3.33

GEOGRID #	Elevation [ft]	Length [ft]	Type #	CONNECTION Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	0.66	5.50	1	3.49	4.32	4.316	6.056	1.901	0.0976	Mirafi 5XT
2	2.00	5.50	1	1.75	2.21	2.214	2.515	2.451	0.0528	Mirafi 5XT

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AASHTO 2002 ASD DESIGN METHOD
240 - 15th Street SE Industrial

MSEW(3.0): Update # 14.972

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Designer:	M. Xenos
Station Number:	

Description:

6 Panel Lock + Load Wall

Company's information:

Name: Terra Associates, Inc.
Street: 12220 - 113th Avenue NE
Suite 130
Kirkland, WA 98034
Telephone #: 425-821-7777
Fax #:
E-Mail: mxenos@terra-associates.com

Original file path and name: G:\USERS\MXenos\Projects\8661 240 - 15th Street SE Indu.....
.....anel Lock + Load.BEN

Original date and time of creating this file: Tuesday January 30, 2024

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Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	125.0 lb/ft ³
Equivalent internal angle of friction, $\phi_{equiv.}$	36.0 °
Equivalent cohesion, $c_{equiv.}$	0.0 lb/ft ²

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 62.00° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 0.00 N γ= 14.94

SEISMICITY

Maximum ground acceleration coefficient, A = 0.270
Design acceleration coefficient in Internal Stability: Kh = Am = 0.319
Design acceleration coefficient in External Stability: Kh_d = 0.102 => Kh = Am = 0.138
(Kh in External Stability is based on allowable displacement, d = 100 mm. using AASHTO 2002 equation)

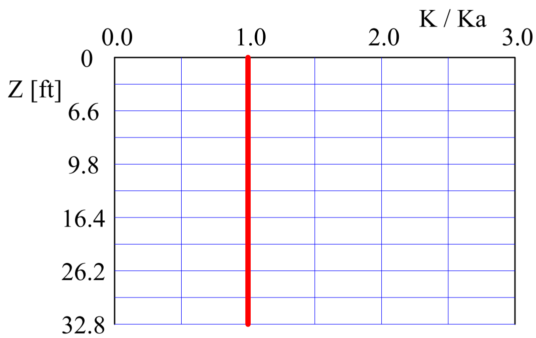
Kae (Kh > 0) = 0.3279 Kae (Kh = 0) = 0.2462 Δ Kae = 0.0817
Seismic soil-geogrid friction coefficient, F* is 80.0% of its specified static value.

INPUT DATA: Geogrids
(Analysis)

D A T A	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	4700.0	7400.0	9400.0	13705.0	
Durability reduction factor, RFd	1.30	1.30	1.30	1.30	
Installation-damage reduction factor, RFid	1.12	1.12	1.12	1.12	
Creep reduction factor, RFc	1.45	1.45	1.45	1.45	N/A
Fs-overall for strength	N/A	N/A	N/A	N/A	
Coverage ratio, Rc	1.000	1.000	1.000	1.000	
Friction angle along geogrid-soil interface, ρ	28.00	28.00	28.00	28.00	
Pullout resistance factor, F*	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	N/A
Scale-effect correction factor, α	0.8	0.8	0.8	0.8	

Variation of Lateral Earth Pressure Coefficient With Depth

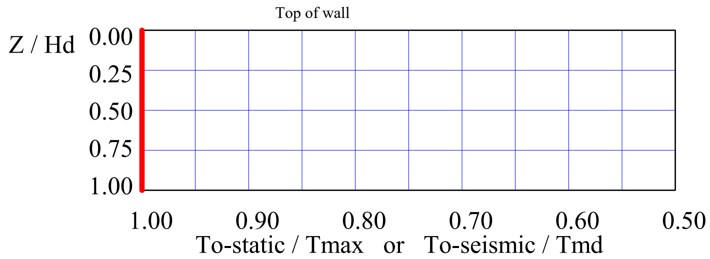
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



INPUT DATA: Facia and Connection (according to revised Demo 82) (Analysis)

FACIA type: Facing enabling frictional connection of reinforcement (e.g., modular concrete blocks, gabions)
Depth/height of block is 2.17/1.34 ft. Horizontal distance to Center of Gravity of block is 1.08 ft.
Average unit weight of block is γ_f = 125.00 lb/ft ³

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



Geogrid Type #1		Geogrid Type #2		Geogrid Type #3		Geogrid Type #4		Geogrid Type #5	
σ [(1)]	CRult [(2)]	σ	CRult	σ	CRult	σ	CRult	σ	CRult
1044.2	1.00	1044.2	1.00	1044.2	1.00	1044.2	1.00		
2088.5	1.00	2088.5	1.00	2088.5	1.00	2088.5	1.00	N/A	

Geogrid Type #1 [3)]		Geogrid Type #2		Geogrid Type #3		Geogrid Type #4		Geogrid Type #5	
σ	CRcr	σ	CRcr	σ	CRcr	σ	CRcr	σ	CRcr
1044.2	0.60	1044.2	0.60	1044.2	0.60	1044.2	0.60		
2088.5	0.90	2088.5	0.90	2088.5	0.90	2088.5	0.90	N/A	

(1) σ = Confining stress in between stacked blocks [lb/ft ²]
(2) CRult = Tc-ult / Tult
(3) CRcr = Tcre / Tult

In seismic analysis, long term strength is reduced to 80% of its static value.

D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Mirafi 5XT	Mirafi 8XT	Mirafi 10..	Mirafi 20..	N/A
Connection strength reduction factor, RFd	1.30	1.30	1.30	1.30	N/A
Creep reduction factor, RFc	N/A	N/A	N/A	N/A	N/A

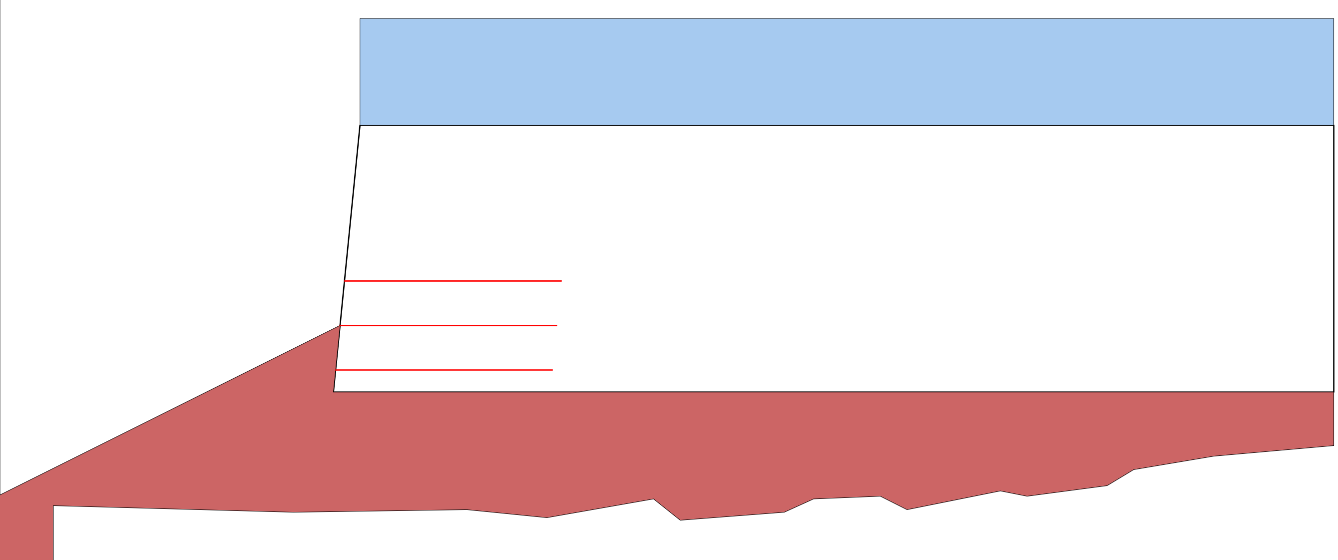
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	8.00	[ft]	{ Embedded depth is E = 2.00 ft, and height above top of finished bottom grade is H = 6.00 ft }
Batter, ω	5.7	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 250.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 3.84, Meyerhof stress = 1352 lb/ft².

Foundation Interface: Direct sliding, Fs = 2.992, Eccentricity, e/L = 0.0718, Fs-overturning = 4.97

GEOGRID				CONNECTION						
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	0.66	6.50	1	4.94	5.07	5.074	13.795	2.555	0.0586	Mirafi 5XT
2	2.00	6.50	1	5.75	5.90	5.897	12.886	3.072	0.0356	Mirafi 5XT
3	3.33	6.50	1	2.47	2.53	2.530	4.139	3.840	0.0178	Mirafi 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, Fs = 2.92, Meyerhof stress = 1552 lb/ft².

Foundation Interface: Direct sliding, Fs = 2.155, Eccentricity, e/L = 0.1269, Fs-overturning = 3.29

GEOGRID				CONNECTION						
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	0.66	6.50	1	3.10	3.85	3.850	7.555	1.855	0.1039	Mirafi 5XT
2	2.00	6.50	1	3.56	4.42	4.417	6.939	2.276	0.0641	Mirafi 5XT
3	3.33	6.50	1	1.77	2.24	2.241	2.789	2.922	0.0337	Mirafi 5XT