Midwest Testing
GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

8606 Page Avenue
St. Louis, Missouri 63114
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AASHTO 2002 ASD DESIGN METHOD
Jamestown Mall

MSEW+: Update # 2021.14

PROJECT IDENTIFICATION

Title: Jamestown Mall
Project Number: 15277
Client:
Designer: KLL
Station Number: 0+50

Description:

Company's information:

Name: Midwest Testing
Street: 8606 Page Avenue

St. Louis, MO 63114
Telephone #: (314) 739-2727
Fax #:
E-Mail:

File path and name: S:\Jobs\Active Jobs\15277\RW\Engineering\MSEW\15277.Sta.....
.....15277.Sta. 0+50.BENp

Original date and time of creating this file: Wed Sep 08 08:39:25 2021

PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.

SOIL DATA

REINFORCED SOIL

Unit weight,	γ	130.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	38.0 °

RETAINED SOIL

Unit weight,	γ	120.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	26.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight,	$\gamma_{equiv.}$	120.0 lb/ft ^{3}
Equivalent internal angle of friction,	$\phi_{equiv.}$	26.0 °
Equivalent cohesion, c	$_{equiv.}$	50.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2379 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 64.00° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.4787 (eq. 17 is utilized to calculate Ka for all batters)
(For external stability user specified δ = 0.00°)

BEARING CAPACITY

Bearing capacity is controlled by general shear.
Bearing capacity factors (calculated by MSEW): Nc = 22.25 N γ = 12.54

SEISMICITY

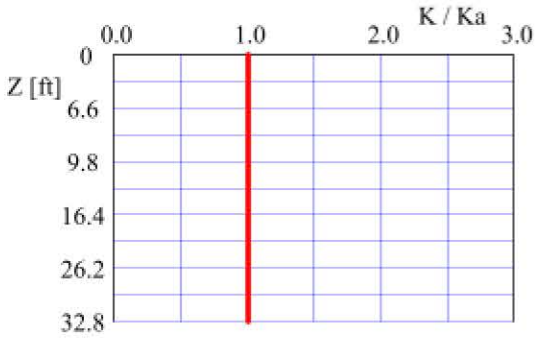
Not Applicable

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]	3437.0	4815.0	8025.0		
Durability reduction factor, RFd	1.10	1.10	1.10		
Installation-damage reduction factor, RFid	1.05	1.05	1.05		
Creep reduction factor, RFc	1.55	1.55	1.55	N/A	N/A
Fs-overall for strength	N/A	N/A	N/A		
Coverage ratio, Rc	1.000	1.000	1.000		
Friction angle along geogrid-soil interface, ρ	27.52	27.52	27.52		
Pullout resistance factor, F*	$0.67 \cdot \tan\phi$	$0.67 \cdot \tan\phi$	$0.67 \cdot \tan\phi$	N/A	N/A
Scale-effect correction factor, α	0.8	0.8	0.8		

Variation of Lateral Earth Pressure Coefficient With Depth

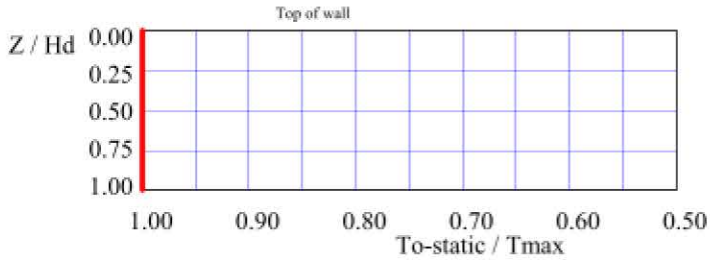
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



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 1.00/0.67 ft. Horizontal distance to Center of Gravity of block is: 0.50 ft.
Average unit weight of block is: γ_f = 120.00 lb/ft ^{3}

Z / Hd	To-static / Tmax
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
0.0	0.40	0.0	0.33	0.0	0.29				
2000.0	0.43	2000.0	0.49	2000.0	0.39	N/A		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
0.0	0.31	0.0	0.25	0.0	0.17				
2000.0	0.35	2000.0	0.39	2000.0	0.27	N/A		N/A	

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

D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	HP200	HP300	HP500	N/A	N/A
Connection strength reduction factor, RFd	1.00	1.00	1.00	N/A	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 7.67 [ft] { Embedded depth is E = 0.67 ft, and height above top of finished bottom grade is H = 7.00 ft }

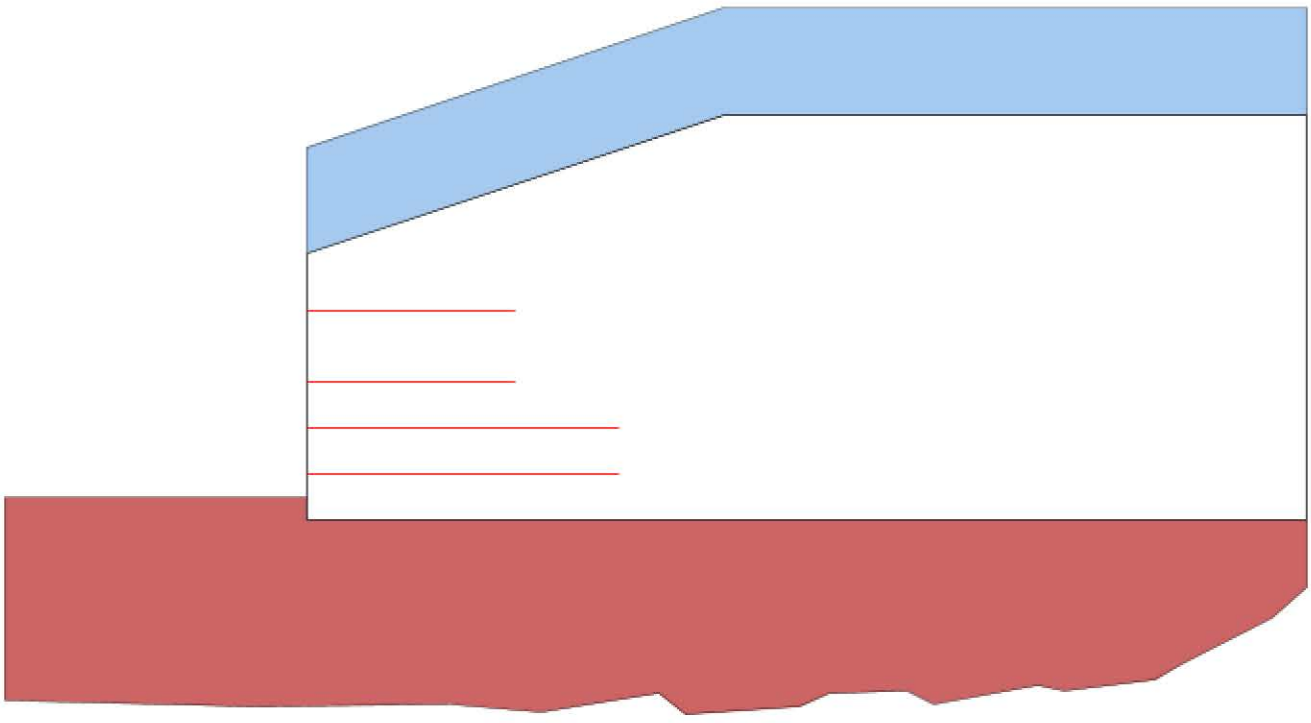
Soil in front of wall is Horizontal.

Batter, ω 0.0 [deg]
Backslope, β 18.4 [deg]
Backslope rise 4.0 [ft] Broken back equivalent angle, I = 14.61° (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 0.0 [lb/ft ²], and live load is 100.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 3.82, Meyerhof stress = 1665 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.503, Eccentricity, e/L = 0.1214, Fs-overturning = 3.55

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	1.33	9.00	1	2.17	3.72	3.725	13.956	1.619	0.0879	HP200
2	2.67	9.00	1	4.02	6.98	6.976	20.358	1.784	0.0555	HP200
3	4.00	6.00	1	4.12	7.22	7.217	8.239	1.589	0.0794	HP200
4	6.00	6.00	1	4.36	7.75	7.754	4.247	1.930	0.0012	HP200

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Jamestown Mall
MSEW+: Update # 2021.14

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Project Number: 15277
Client:
Designer: KLL
Station Number: 0+75

Description:

Company's information:

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St. Louis, MO 63114
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SOIL DATA

REINFORCED SOIL

Unit weight,	γ	130.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	38.0 °

RETAINED SOIL

Unit weight,	γ	120.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	26.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight,	$\gamma_{equiv.}$	120.0 lb/ft ^{3}
Equivalent internal angle of friction,	$\phi_{equiv.}$	26.0 °
Equivalent cohesion, c	$_{equiv.}$	50.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2379 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 64.00° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.5744 (eq. 17 is utilized to calculate Ka for all batters)
(For external stability user specified δ = 0.00°)

BEARING CAPACITY

Bearing capacity is controlled by general shear.
Bearing capacity factors (calculated by MSEW): Nc = 22.25 N γ = 12.54

SEISMICITY

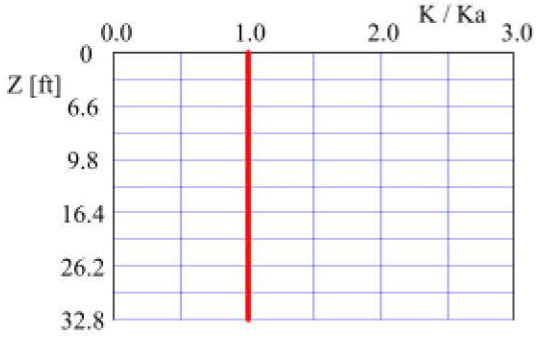
Not Applicable

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]	3437.0	4815.0	8025.0		
Durability reduction factor, RFd	1.10	1.10	1.10		
Installation-damage reduction factor, RFid	1.05	1.05	1.05		
Creep reduction factor, RFc	1.55	1.55	1.55	N/A	N/A
Fs-overall for strength	N/A	N/A	N/A		
Coverage ratio, Rc	1.000	1.000	1.000		
Friction angle along geogrid-soil interface, ρ	27.52	27.52	27.52		
Pullout resistance factor, F*	$0.67 \cdot \tan\phi$	$0.67 \cdot \tan\phi$	$0.67 \cdot \tan\phi$	N/A	N/A
Scale-effect correction factor, α	0.8	0.8	0.8		

Variation of Lateral Earth Pressure Coefficient With Depth

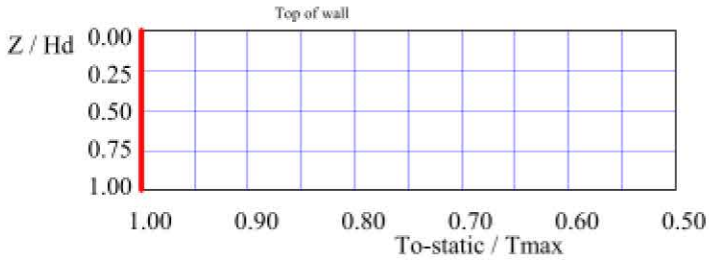
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



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 1.00/0.67 ft. Horizontal distance to Center of Gravity of block is: 0.50 ft.
Average unit weight of block is: γ_f = 120.00 lb/ft ^{3}

Z / Hd	To-static / Tmax
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
0.0	0.40	0.0	0.33	0.0	0.29				
2000.0	0.43	2000.0	0.49	2000.0	0.39	N/A		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
0.0	0.31	0.0	0.25	0.0	0.17				
2000.0	0.35	2000.0	0.39	2000.0	0.27	N/A		N/A	

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

D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	HP200	HP300	HP500	N/A	N/A
Connection strength reduction factor, RFd	1.00	1.00	1.00	N/A	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 7.34 [ft] { Embedded depth is E = 0.67 ft, and height above top of finished bottom grade is H = 6.67 ft }

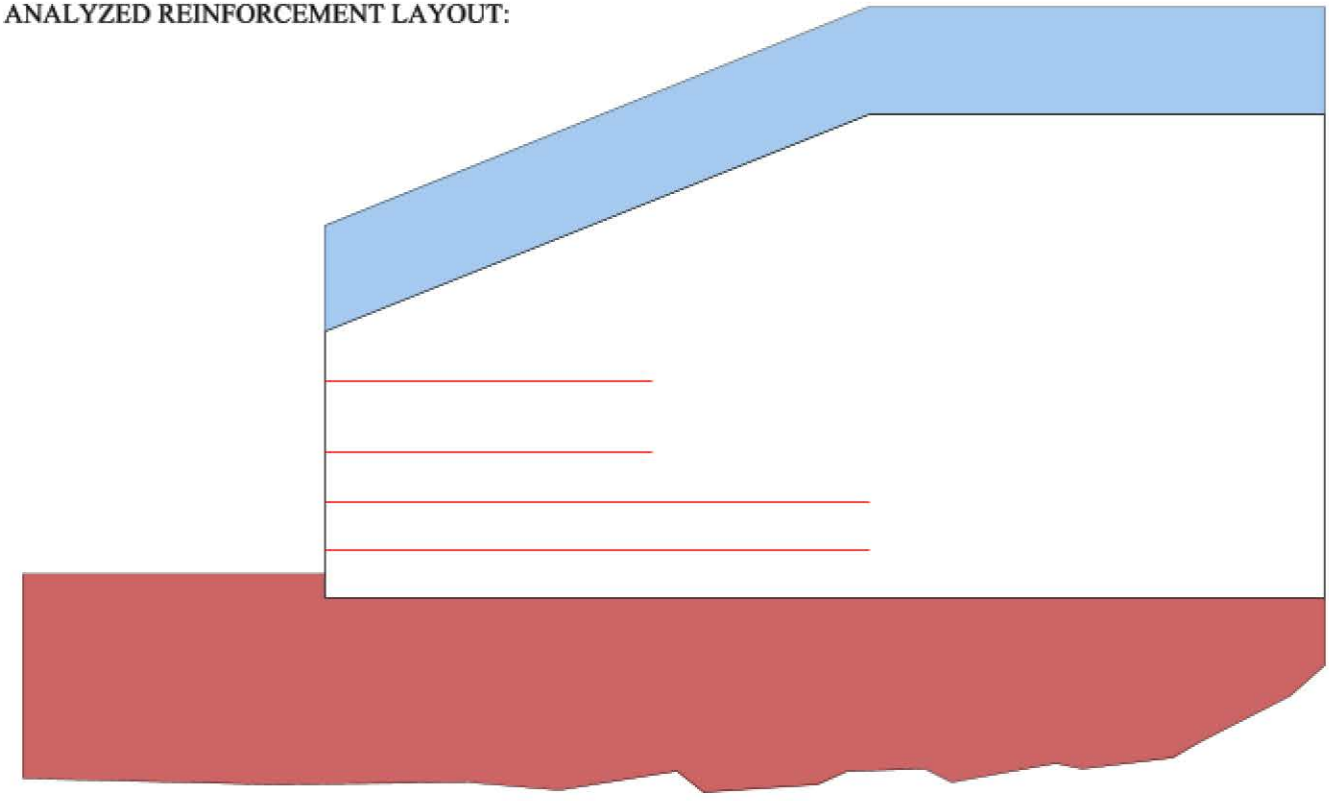
Soil in front of wall is Horizontal.

Batter, ω 0.0 [deg]
Backslope, β 21.8 [deg]
Backslope rise 6.0 [ft] Broken back equivalent angle, I = 21.80° (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 0.0 [lb/ft ²], and live load is 100.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 6.89, Meyerhof stress = 1621 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.534, Eccentricity, e/L = 0.0587, Fs-overturning = 5.12

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	1.33	15.00	1	2.22	3.81	3.815	28.246	1.618	0.0357	HP200
2	2.67	15.00	1	4.13	7.19	7.188	44.077	1.718	0.0116	HP200
3	4.00	9.00	1	4.27	7.50	7.503	16.513	1.523	0.0381	HP200
4	6.00	9.00	1	5.01	8.94	8.943	11.418	1.702	-0.0325	HP200

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AASHTO 2002 ASD DESIGN METHOD
Jamestown Mall
MSEW+: Update # 2021.14

PROJECT IDENTIFICATION

Title: Jamestown Mall
Project Number: 15277
Client:
Designer: KLL
Station Number: 1+25

Description:

Company's information:

Name: Midwest Testing
Street: 8606 Page Avenue

St. Louis, MO 63114
Telephone #: (314) 739-2727
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File path and name: S:\Jobs\Active Jobs\15277\RW\Engineering\MSEW\15277.Sta..... .....15277.Sta. 1+25.BENp

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PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.

SOIL DATA

REINFORCED SOIL

Unit weight,	γ	130.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	38.0 °

RETAINED SOIL

Unit weight,	γ	120.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	26.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight,	$\gamma_{equiv.}$	120.0 lb/ft ^{3}
Equivalent internal angle of friction,	$\phi_{equiv.}$	26.0 °
Equivalent cohesion, c	$_{equiv.}$	50.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2379 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 64.00° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.5744 (eq. 17 is utilized to calculate Ka for all batters)
(For external stability user specified δ = 0.00°)

BEARING CAPACITY

Bearing capacity is controlled by general shear.
Bearing capacity factors (calculated by MSEW): Nc = 22.25 N γ = 12.54

SEISMICITY

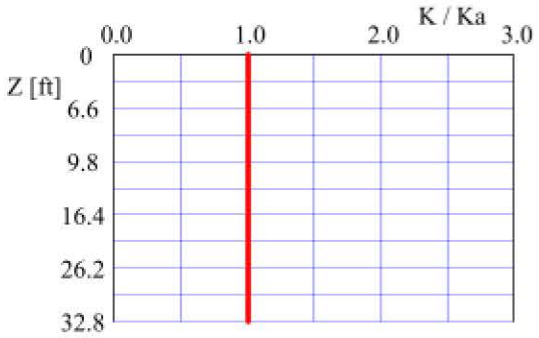
Not Applicable

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]	3437.0	4815.0	8025.0		
Durability reduction factor, RFd	1.10	1.10	1.10		
Installation-damage reduction factor, RFid	1.05	1.05	1.05		
Creep reduction factor, RFc	1.55	1.55	1.55	N/A	N/A
Fs-overall for strength	N/A	N/A	N/A		
Coverage ratio, Rc	1.000	1.000	1.000		
Friction angle along geogrid-soil interface, ρ	27.52	27.52	27.52		
Pullout resistance factor, F*	$0.67 \cdot \tan\phi$	$0.67 \cdot \tan\phi$	$0.67 \cdot \tan\phi$	N/A	N/A
Scale-effect correction factor, α	0.8	0.8	0.8		

Variation of Lateral Earth Pressure Coefficient With Depth

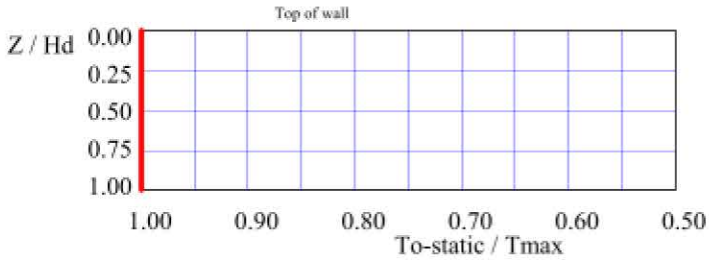
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



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 1.00/0.67 ft. Horizontal distance to Center of Gravity of block is: 0.50 ft.
Average unit weight of block is: γ_f = 120.00 lb/ft ^{3}

Z / Hd	To-static / Tmax
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
0.0	0.40	0.0	0.33	0.0	0.29				
2000.0	0.43	2000.0	0.49	2000.0	0.39	N/A		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
0.0	0.31	0.0	0.25	0.0	0.17				
2000.0	0.35	2000.0	0.39	2000.0	0.27	N/A		N/A	

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

D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	HP200	HP300	HP500	N/A	N/A
Connection strength reduction factor, RFd	1.00	1.00	1.00	N/A	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 6.34 [ft] { Embedded depth is E = 0.67 ft, and height above top of finished bottom grade is H = 5.67 ft }

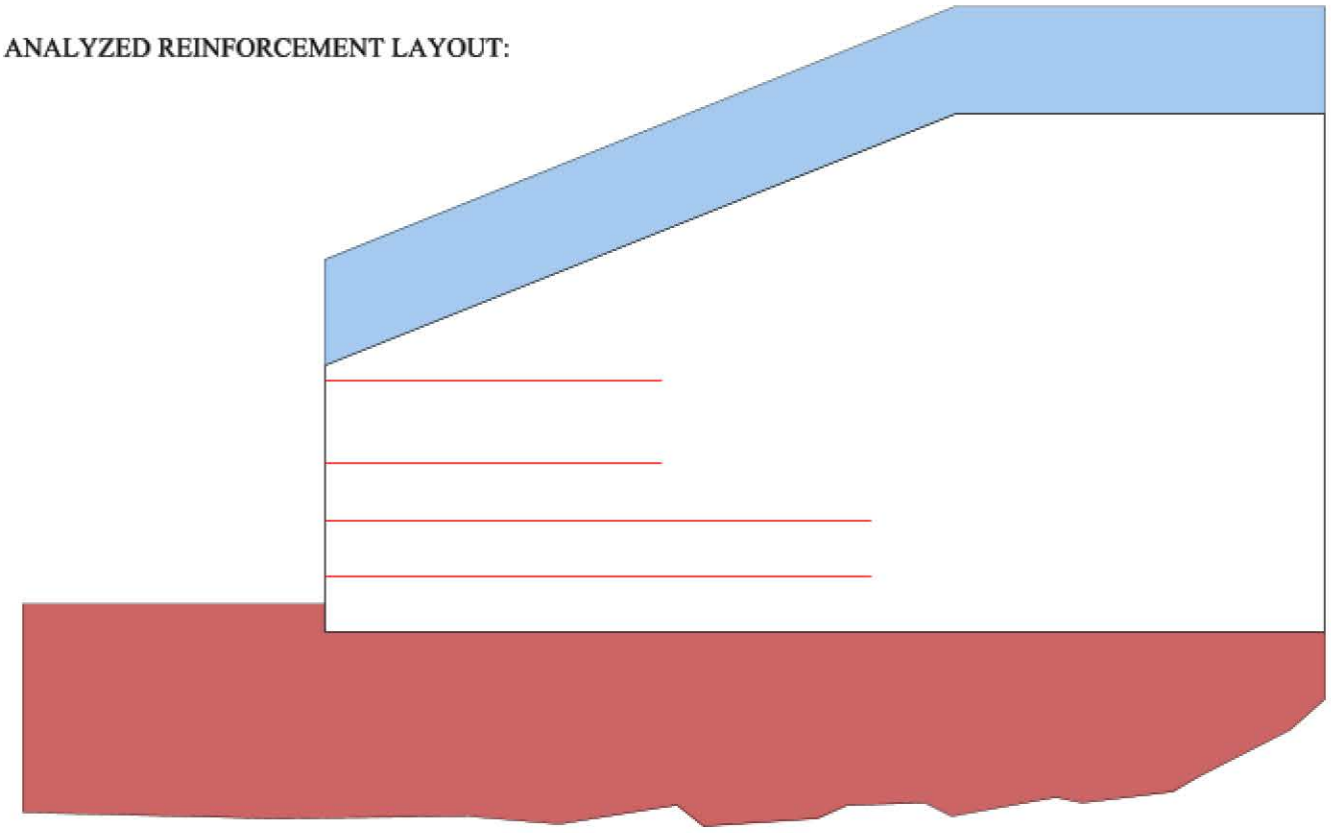
Soil in front of wall is Horizontal.

Batter, ω 0.0 [deg]
Backslope, β 21.8 [deg]
Backslope rise 6.0 [ft] Broken back equivalent angle, I = 21.80° (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 0.0 [lb/ft ²], and live load is 100.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 6.89, Meyerhof stress = 1422 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.527, Eccentricity, e/L = 0.0609, Fs-overturning = 5.02

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	1.33	13.00	1	2.56	4.44	4.436	23.943	1.604	0.0341	HP200
2	2.67	13.00	1	4.98	8.73	8.726	37.632	1.715	0.0055	HP200
3	4.00	8.00	1	5.50	9.74	9.737	14.398	1.552	0.0188	HP200
4	6.00	8.00	1	11.08	19.91	19.911	14.396	1.655	-0.0836	HP200

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REINFORCED SOIL

Unit weight,	γ	130.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	38.0 °

RETAINED SOIL

Unit weight,	γ	120.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	26.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight,	$\gamma_{equiv.}$	120.0 lb/ft ^{3}
Equivalent internal angle of friction,	$\phi_{equiv.}$	26.0 °
Equivalent cohesion,	$c_{equiv.}$	50.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2379 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 64.00° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.5744 (eq. 17 is utilized to calculate Ka for all batters)
(For external stability user specified δ = 0.00°)

BEARING CAPACITY

Bearing capacity is controlled by general shear.
Bearing capacity factors (calculated by MSEW): Nc = 22.25 N γ = 12.54

SEISMICITY

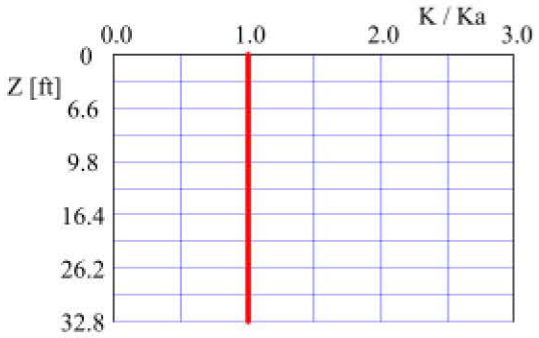
Not Applicable

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]	3437.0	4815.0	8025.0		
Durability reduction factor, RFd	1.10	1.10	1.10		
Installation-damage reduction factor, RFid	1.05	1.05	1.05		
Creep reduction factor, RFc	1.55	1.55	1.55	N/A	N/A
Fs-overall for strength	N/A	N/A	N/A		
Coverage ratio, Rc	1.000	1.000	1.000		
Friction angle along geogrid-soil interface, ρ	27.52	27.52	27.52		
Pullout resistance factor, F*	$0.67 \cdot \tan\phi$	$0.67 \cdot \tan\phi$	$0.67 \cdot \tan\phi$	N/A	N/A
Scale-effect correction factor, α	0.8	0.8	0.8		

Variation of Lateral Earth Pressure Coefficient With Depth

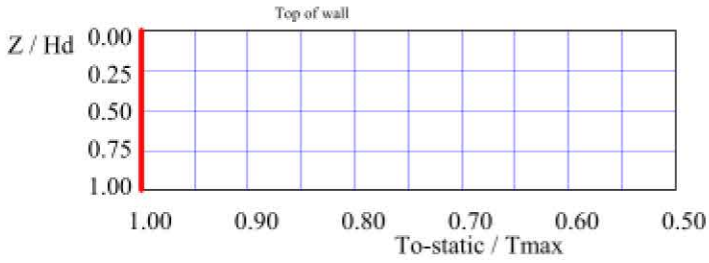
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



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 1.00/0.67 ft. Horizontal distance to Center of Gravity of block is: 0.50 ft.
Average unit weight of block is: γ_f = 120.00 lb/ft ^{3}

Z / Hd	To-static / Tmax
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
0.0	0.40	0.0	0.33	0.0	0.29				
2000.0	0.43	2000.0	0.49	2000.0	0.39	N/A		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
0.0	0.31	0.0	0.25	0.0	0.17				
2000.0	0.35	2000.0	0.39	2000.0	0.27	N/A		N/A	

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

D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	HP200	HP300	HP500	N/A	N/A
Connection strength reduction factor, RFd	1.00	1.00	1.00	N/A	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 4.34 [ft] { Embedded depth is E = 0.67 ft, and height above top of finished bottom grade is H = 3.67 ft }

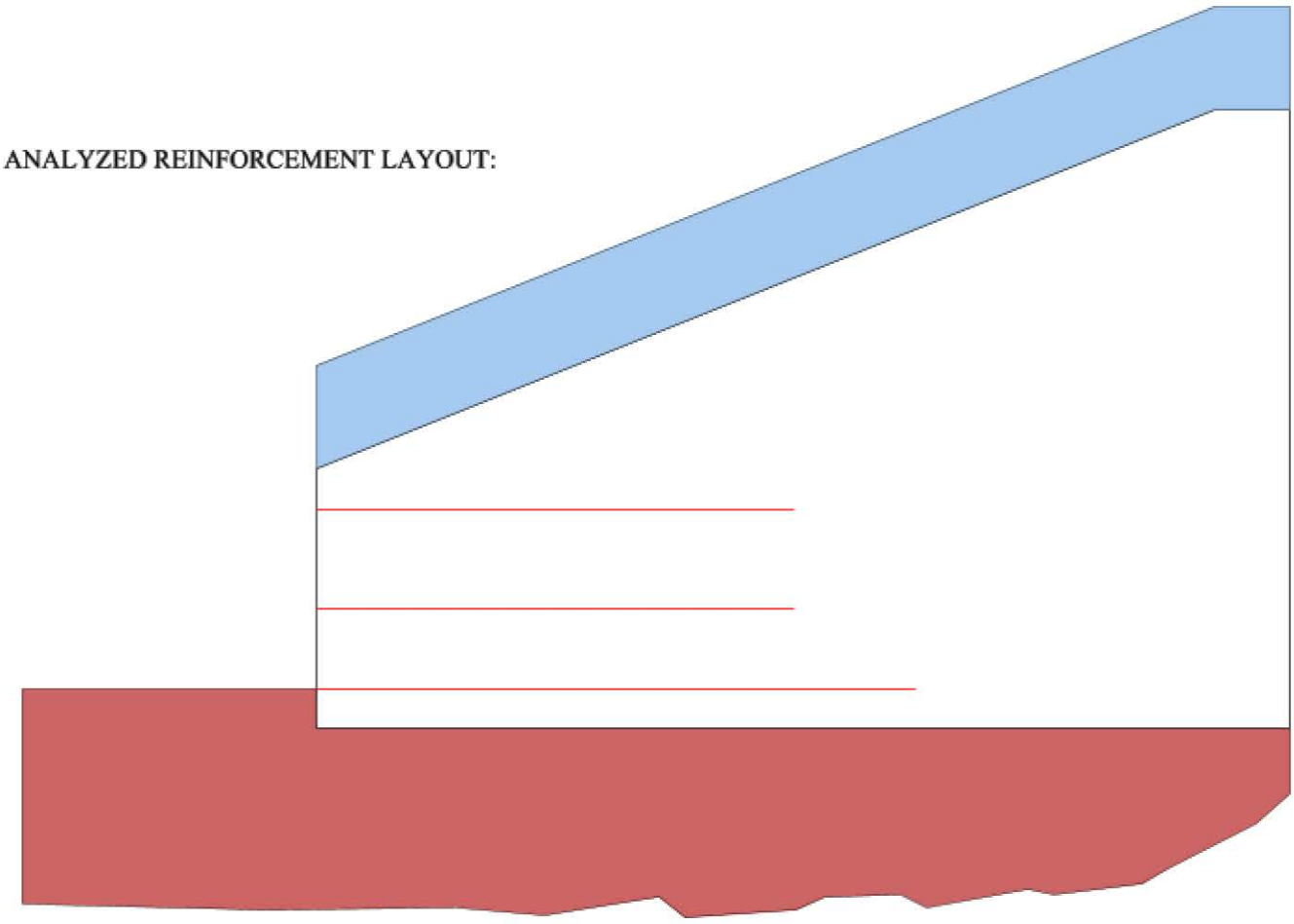
Soil in front of wall is Horizontal.

Batter, ω 0.0 [deg]
Backslope, β 21.8 [deg]
Backslope rise 6.0 [ft] Broken back equivalent angle, I = 21.80° (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 0.0 [lb/ft ²], and live load is 100.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 7.78, Meyerhof stress = 1020 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.572, Eccentricity, e/L = 0.0525, Fs-overturning = 5.26

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	0.67	10.00	1	5.26	9.21	9.210	28.845	1.557	0.0344	HP200
2	2.00	8.00	1	6.44	11.40	11.396	18.686	1.552	0.0188	HP200
3	3.67	8.00	1	10.81	19.37	19.373	17.844	1.666	-0.0595	HP200

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Midwest Testing
GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

AASHTO 2002 ASD DESIGN METHOD
Jamestown Mall
MSEW+: Update # 2021.14

PROJECT IDENTIFICATION

Title: Jamestown Mall
Project Number: 15277
Client:
Designer: KLL
Station Number: 2+00

Description:

Company's information:

Name: Midwest Testing
Street: 8606 Page Avenue

St. Louis, MO 63114
Telephone #: (314) 739-2727
Fax #:
E-Mail:

File path and name: S:\Jobs\Active Jobs\15277\RW\Engineering\MSEW\15277.Sta.....
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Original date and time of creating this file: Wed Sep 08 08:39:25 2021

PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.

SOIL DATA

REINFORCED SOIL

Unit weight,	γ	130.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	38.0 °

RETAINED SOIL

Unit weight,	γ	120.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	26.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight,	$\gamma_{equiv.}$	120.0 lb/ft ^{3}
Equivalent internal angle of friction,	$\phi_{equiv.}$	26.0 °
Equivalent cohesion, c	$_{equiv.}$	50.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2379 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 64.00° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.4264 (eq. 17 is utilized to calculate Ka for all batters)
(For external stability user specified δ = 0.00°)

BEARING CAPACITY

Bearing capacity is controlled by general shear.
Bearing capacity factors (calculated by MSEW): Nc = 22.25 N γ = 12.54

SEISMICITY

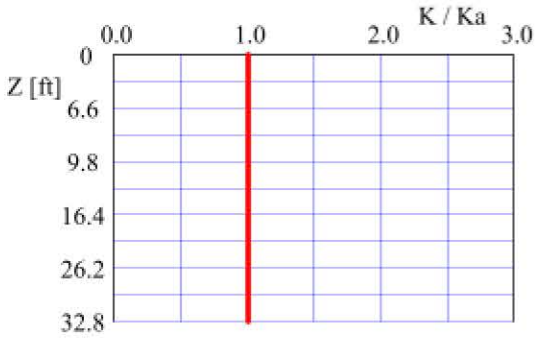
Not Applicable

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]	3437.0	4815.0	8025.0		
Durability reduction factor, RFd	1.10	1.10	1.10		
Installation-damage reduction factor, RFid	1.05	1.05	1.05		
Creep reduction factor, RFc	1.55	1.55	1.55	N/A	N/A
Fs-overall for strength	N/A	N/A	N/A		
Coverage ratio, Rc	1.000	1.000	1.000		
Friction angle along geogrid-soil interface, ρ	27.52	27.52	27.52		
Pullout resistance factor, F*	0.67·tan ϕ	0.67·tan ϕ	0.67·tan ϕ	N/A	N/A
Scale-effect correction factor, α	0.8	0.8	0.8		

Variation of Lateral Earth Pressure Coefficient With Depth

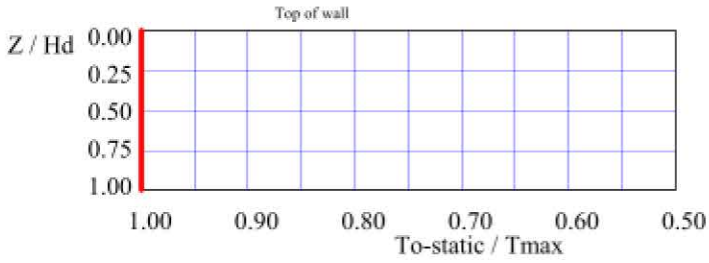
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



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 1.00/0.67 ft. Horizontal distance to Center of Gravity of block is: 0.50 ft.
Average unit weight of block is: γ_f = 120.00 lb/ft ^{3}

Z / Hd	To-static / Tmax
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
0.0	0.40	0.0	0.33	0.0	0.29				
2000.0	0.43	2000.0	0.49	2000.0	0.39	N/A		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
0.0	0.31	0.0	0.25	0.0	0.17				
2000.0	0.35	2000.0	0.39	2000.0	0.27	N/A		N/A	

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

D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	HP200	HP300	HP500	N/A	N/A
Connection strength reduction factor, RFd	1.00	1.00	1.00	N/A	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 4.34 [ft] { Embedded depth is E = 0.67 ft, and height above top of finished bottom grade is H = 3.67 ft }

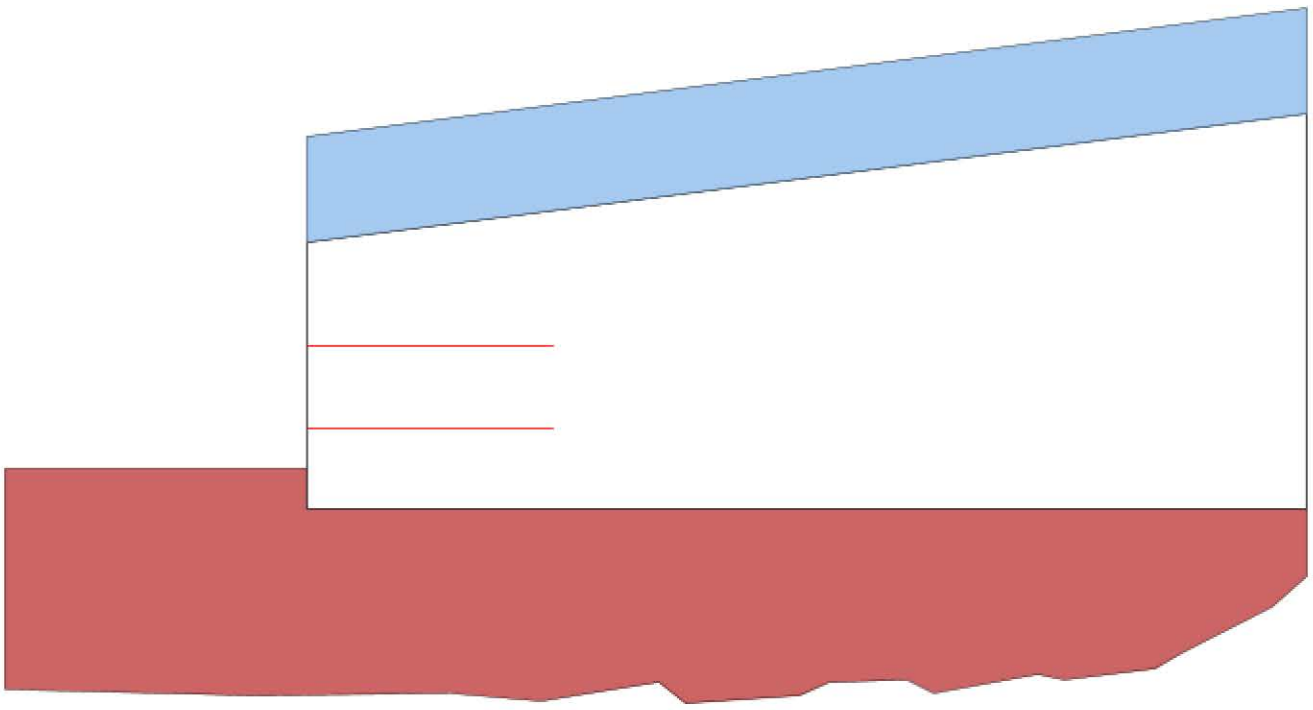
Soil in front of wall is Horizontal.

Batter, ω	0.0	[deg]	
Backslope, β	7.3	[deg]	
Backslope rise	5.0	[ft]	Broken back equivalent angle, I = 7.30° (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 0.0 [lb/ft ²], and live load is 100.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

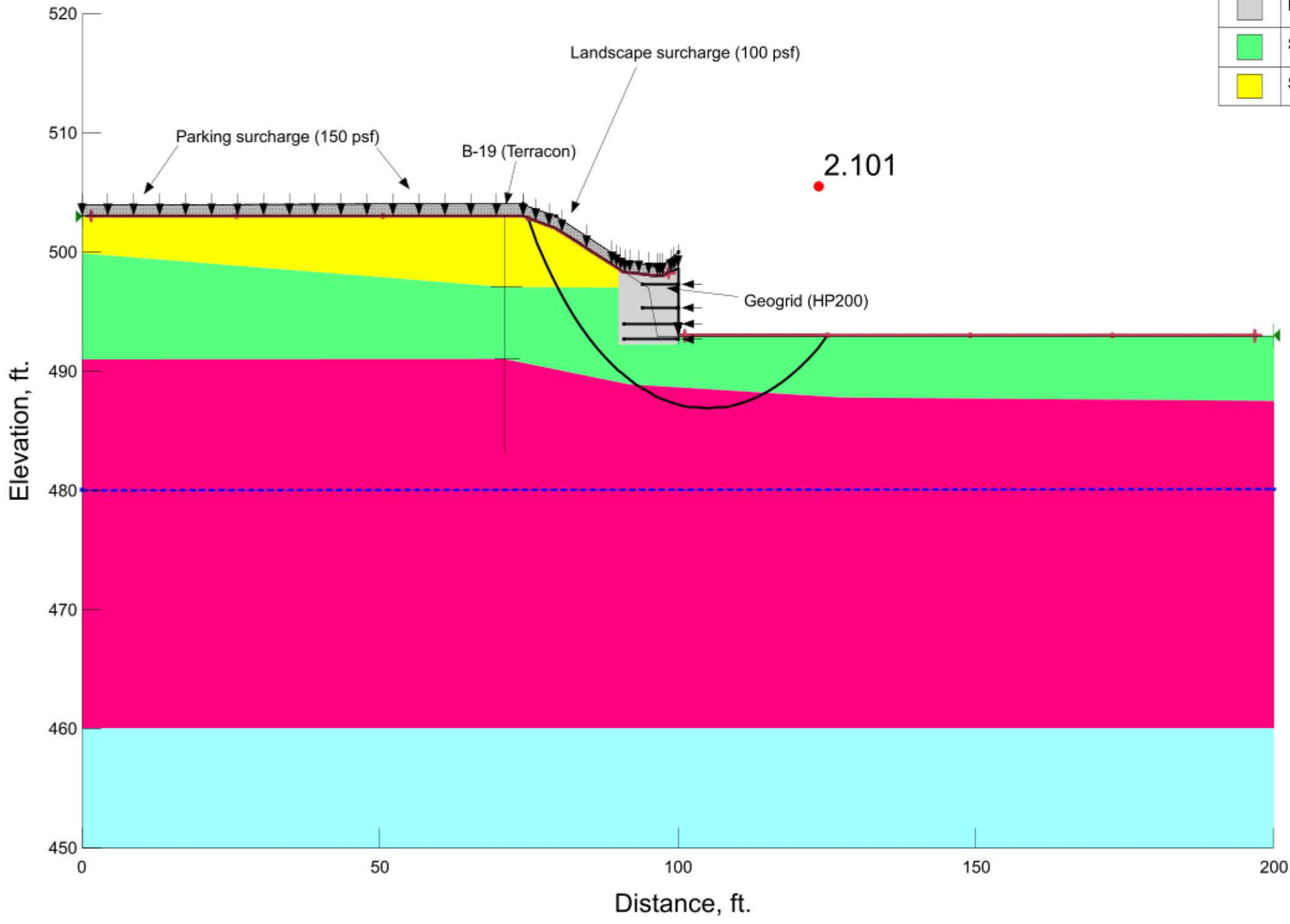
0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 3.63, Meyerhof stress = 928 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.687, Eccentricity, e/L = 0.1451, Fs-overturning = 3.30

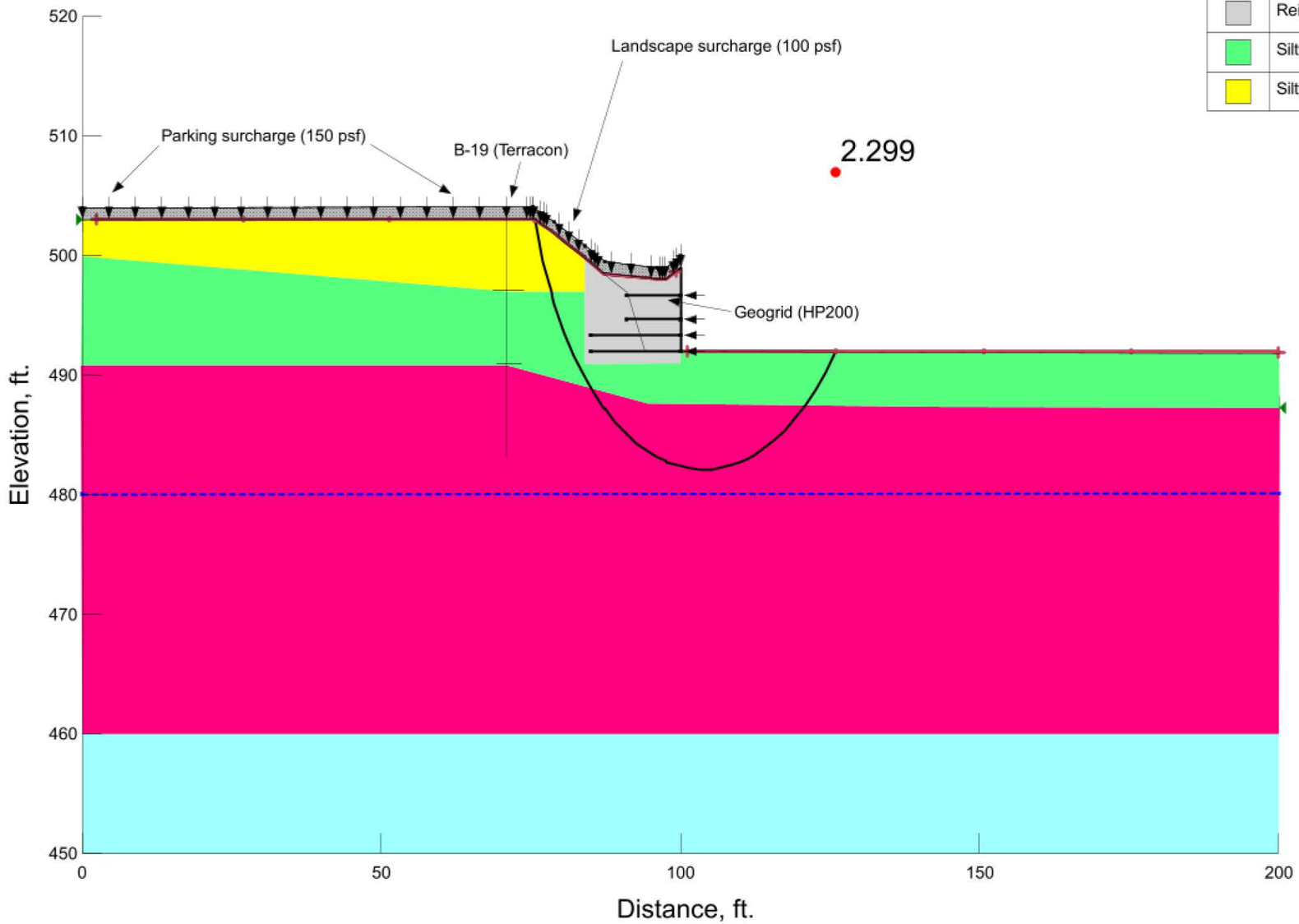
GEOGRID				CONNECTION						
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.33	4.00	1	4.10	7.21	7.212	4.514	1.893	0.0807	HP200
2	2.67	4.00	1	6.99	12.43	12.433	3.805	2.429	0.0253	HP200

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Clay (CH)	Mohr-Coulomb	115	0	22
	Limestone	Bedrock (Impenetrable)			
	Reinforced	Mohr-Coulomb	130	0	38
	Silty Clay (CL)	Mohr-Coulomb	120	0	26
	Silty Clay Fill	Mohr-Coulomb	120	0	26

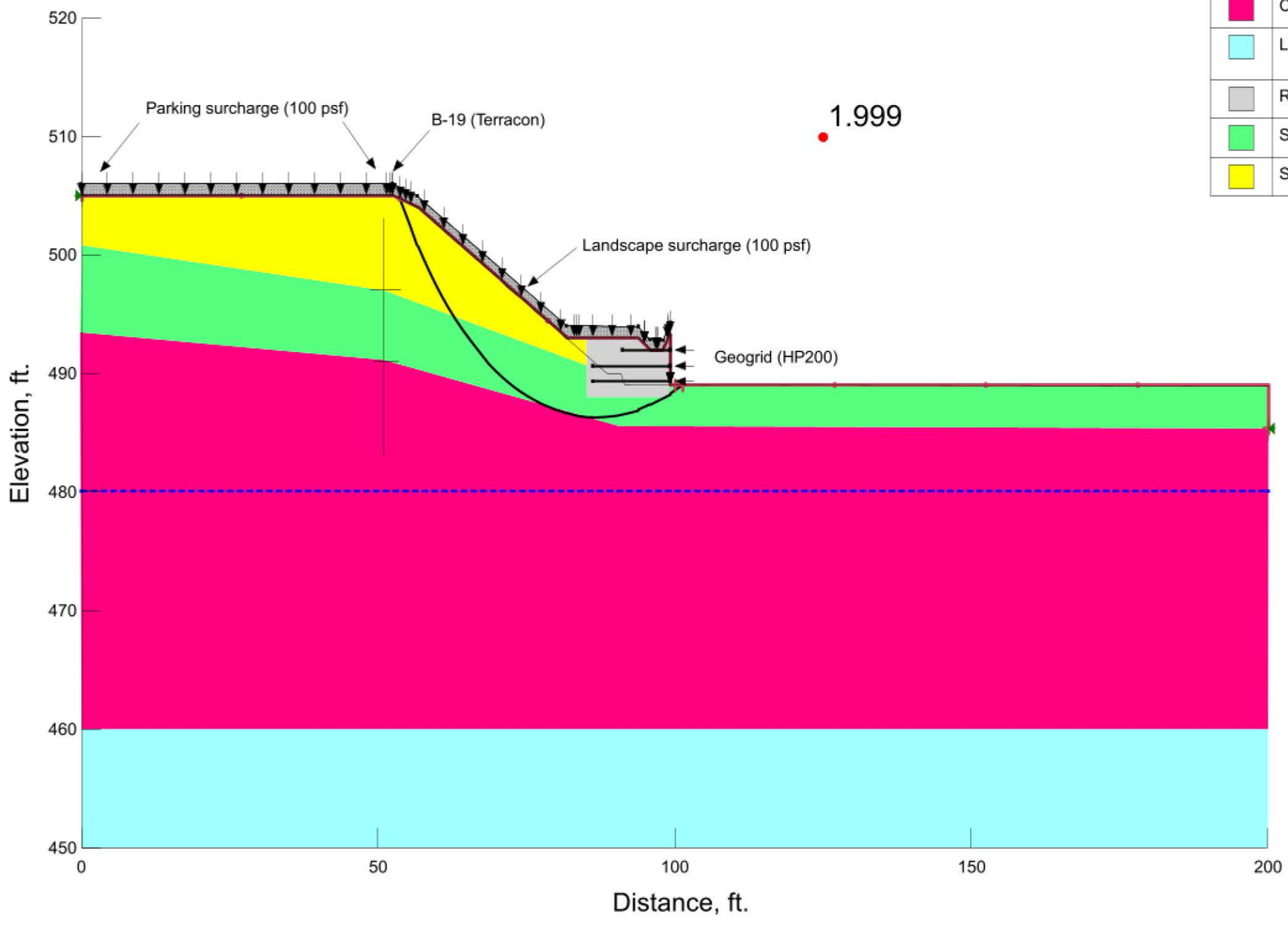


Global Stability
Jamestown Mall
Retaining Wall
Sta. 0+50 (3:1 Slope)

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Clay (CH)	Mohr-Coulomb	115	0	22
	Limestone	Bedrock (Impenetrable)			
	Reinforced	Mohr-Coulomb	130	0	38
	Silty Clay (CL)	Mohr-Coulomb	120	0	26
	Silty Clay Fill	Mohr-Coulomb	120	0	26



Global Stability
Jamestown Mall
Retaining Wall
Sta. 0+75 (2.5:1 Slope)



Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Clay (CH)	Mohr-Coulomb	115	0	22
	Limestone	Bedrock (Impenetrable)			
	Reinforced	Mohr-Coulomb	130	0	38
	Silty Clay (CL)	Mohr-Coulomb	120	0	26
	Silty Clay Fill	Mohr-Coulomb	120	0	26

Global Stability
Jamestown Mall
Retaining Wall
Sta. 1+60 (2:1 Slope)