

Project: 19.9096 - Streets of West Pryor

Site: Lee's Summit, MO

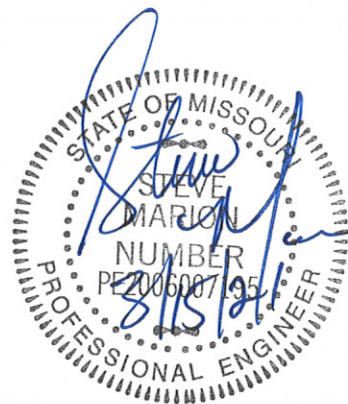
Date: 3/10/2021

Wall Calculations



Aspen

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Project Information

Client	MSE		
Name	Streets of West Pryor	Number	19.9096
Site	Lee's Summit, MO	Designer	AMA
Revision	1	Created	3/10/2021
Standard	National Concrete Masonry Association 3rd Edition		
Seismic As	0.07	Default Deflection of 2.00 inch	
Comments	1. Revision 2: Wall geometry provided by Kaw Valley Engineering dated 1-16-2019 2. Geotechnical report provided by Cook, Fatt, and Strobel Engineers dated 6-15-2018. Fat clays were found to be present throughout the site. 3. Clean rock backfill 4. Lot 7 wall is unlabeled 5. Revision per Joseph Hanranahan's page C-13 Wall A 6. Revision per new civil plans dated 5-16-2019 7. Revision per CFS global on walls N and P dated 7-16-2019 (walls N and P will have grid lengths equal to wall height); Wall G was deleted per email from Kirk Middleton dated 7-31-2019 8. Revision per civil plans dated 7-3-19. Wall J changed 9. Revision per civil plans dated 9-26-19. Wall N changed and Wall B removed 10. Revision to grid lengths on Wall N and P per email from Adam McEachron with Cook, Flatt & STrobel Engineers dated 12-13-19 11. Wall E revised per civils dated 1-11-21 Changes of the wall from STA 2+62.5 to end of wall.		

Selected Facing Unit

Licenser/Product Line: User defined
Name: Venture V-12



Project Design Inputs

Design Standard National Concrete Masonry Association 3rd Edition

Minimum Factors of Safety

Conventional

External		Value	Internal		Value	Facing	Value
FSsl	Base Sliding	1.50	FSsl	Internal Sliding	1.50		
FSbc	Bearing Capacity	2.00	FSsc	Shear Capacity	1.50		
FSot	Overturning	1.50					

MultiDepth

External		Value	Internal		Value	Facing	Value
FSsl	Base Sliding	1.50					
FSbc	Bearing Capacity	2.00					
FSot	Overturning	1.50					

No Fines

External		Value	Internal		Value	Facing	Value
FSsl	Base Sliding	1.50					
FSbc	Bearing Capacity	2.00					
FSot	Overturning	1.50					

Reinforced

External		Value	Internal		Value	Facing	Value
FSsl	Base Sliding	1.50	FSsl	Internal Sliding	1.50	FScs	Connection Strength 1.50
FSbc	Bearing Capacity	2.00	FSpo	Pullout	1.50	FSsc	Facing Shear 1.50
FSct	Crest Toppling	1.50	FSto	Tensile Overstress	1.50		
FSot	Overturning	2.00					

Seismic

Conventional

External		Value	Internal		Value	Facing	Value
FSsl	Base Sliding	1.10	FSsl	Internal Sliding	1.10		
FSbc	Bearing Capacity	1.10	FSsc	Shear Capacity	1.10		
FSot	Overturning	1.10					

MultiDepth

External		Value	Internal		Value	Facing	Value
FSsl	Base Sliding	1.10					
FSbc	Bearing Capacity	1.10					
FSot	Overturning	1.10					

No Fines

External		Value	Internal		Value	Facing	Value
FSsl	Base Sliding	1.10					
FSbc	Bearing Capacity	1.50					
FSot	Overturning	1.10					

Reinforced

External		Value	Internal		Value	Facing	Value
FSsl	Base Sliding	1.10	FSsl	Internal Sliding	1.10	FScs	Connection Strength 1.10
FSbc	Bearing Capacity	1.50	FSpo	Pullout	1.10	FSsc	Facing Shear 1.10
FSct	Crest Toppling	1.10	FSto	Tensile Overstress	1.10		
FSot	Overturning	1.50					

Design Factors

Term	Description	Minimum (as appl.)	Maximum (as appl.)
RC	Reinforced coverage ratio	1.00	0.00

Selected Facing Unit

Licenser/Product Line: User defined
Name: Venture V-12



Facing Height	Hu	0.67 ft
Facing Width	Lu	1.50 ft
Facing Depth	Wu	1.00 ft
Facing Weight	Xu	129 lb/ft ³
Center of Gravity	Gu	0.50 ft
Setback	Δu	0.08 ft
Batter	ω	7.10 °
Cap Height	Hcu	0.33 ft
Initial Shear Capacity	au	0.00 lb/ft
Apparent Shear Angle	λu	60.00 °
Maximum Shear Capacity	Vu(max)	55.00 lb/ft

Selected Reinforcement Types

Reinforcements

3XT - Mirafi Miragrid 3XT		Supplier: TenCate Geosynthetics - Mirafi, Fill Type: 3/4"- gravels or aggregate				
Tult	3,500.78 lb/ft	RFcr	1.58	RFd	1.10	LTDS
RFid	1.10	Cds	0.90	Ci	0.90	1,831.14 lb/ft

Connection/Shear Properties

αcs1	1,560.00 lb/ft	IP-1	600.00 lb/ft	αcs2	1,778.00 lb/ft	IP-2	3,000.00 lb/ft
αcs max	2,652.00 lb/ft	au	565.00 lb/ft	λu	38.00 lb/ft	Vu(max)	2,855.00 lb/ft

5XT - Mirafi Miragrid 5XT

Supplier: TenCate Geosynthetics - Mirafi, Fill Type: 3/4"- gravels or aggregate

Tult	4,701.28 lb/ft	RFcr	1.58	RFd	1.10	LTDS	2,459.09 lb/ft
RFid	1.10	Cds	0.90	Ci	0.90		

Connection/Shear Properties

αcs1	943.00 lb/ft	IP-1	600.00 lb/ft	αcs2	2,095.00 lb/ft	IP-2	3,000.00 lb/ft
αcs max	3,214.00 lb/ft	au	565.00 lb/ft	λu	38.00 lb/ft	Vu(max)	2,855.00 lb/ft

Selected Soil Types

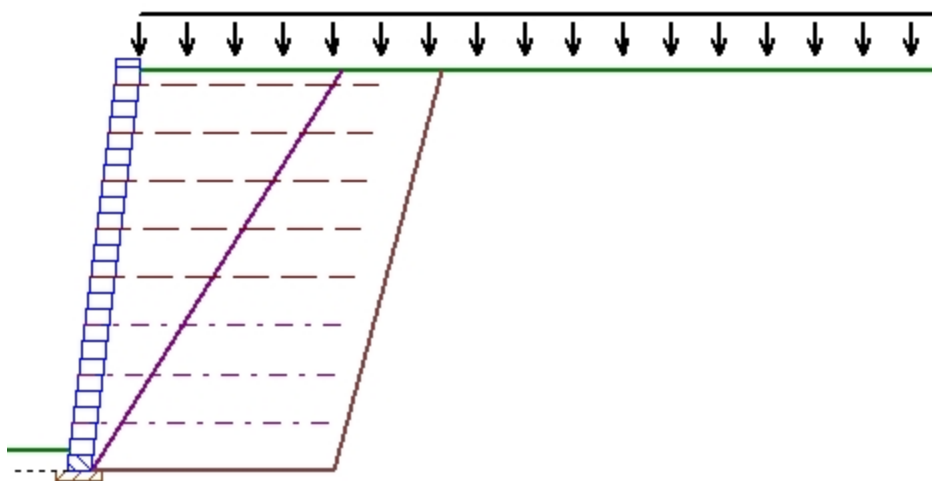
Soil Zone	Soil Type	Friction Angle φ	In Situ	
			Density γ [lb/ft ³]	Cohesion Cf [lb/ft ²]
Infill (i)	GP	38°	110.00	n/a
Retained (r)	CH	24°	125.00	n/a
Foundation (f)	CH	24°	125.00	0.00
Base (b)	GW	38°	140.02	n/a

Soil Glossary

CH:	Inorganic clays, high plasticity
CL:	Inorganic clays, low to medium plasticity, gravelly, sandy, silty, lean clays
GC:	Clayey gravels, poorly graded gravel-sand-clay mixtures
GM:	Silty gravels, poorly graded gravel-sand-silt mixtures
GP:	1/2"-3/4" clean crushed stone or crushed gravel
GW:	Well-graded gravels, gravel-sand. Little or no fines.
MH:	Inorganic clayey silts, elastic silts
ML:	Inorganic silts, very fine sands, silty or clayey, slight plasticity
SC:	Clayey sands, poorly graded sand-clay mixtures
SM:	Silty sands, poorly graded sand-silt mixtures
SP:	Poorly-graded sands, gravelly sands. Little or no fines.
SW:	Well-graded sands, gravelly sands. Little or no fines.

Section 22 Details

Section 22 Cross-section



Section 22 Cross-section Details

Upper Slope Angle	β	0.00 °
Crest Offset		0.00 ft
Live Load	ql	150 lb/ft ²
Live Offset	qlofs	0.00 ft
Dead Load	qd	0 lb/ft ²
Dead Offset	qdofs	0.00 ft
Peak Acceleration	As	0.07
Top of Section		977.67 ft
Bottom Grade		961.50 ft
Base of Section		960.67 ft
Design Height	H	16.51 ft
Embedment Depth	Hemb	0.83 ft

* Analysis includes Vertical Forces

* Embedment is included in Bearing Capacity

Empirical Checks

Check	Description	Min. Requirement	Result	Status
Hemb	Minimum Embedment %	5.0000	5.3100	Pass
L	Min. Reinforcement Length	4.0000	11.0000	Pass
L/H Ratio	Min. L/H Ratio	0.6000	0.6662	Pass
La	Min. Anchorage Length	1.0000	1.9934	Pass
MinHemb	Minimum Embedment	6.0000	10.0000	Pass
Rs	Max. Reinforcement Separation	0.0000	2.0000	Pass
RsBottom	Max. multiple of Hu at bottom	0.0000	3.0000	Pass
RsTop	Max. multiple of Hu at top	0.0000	1.5000	Pass

External Checks

Static

Check	Description	Min. Requirement	Result	Status
FSbc	Bearing Capacity	2.00	3.25	Pass
FSct	Crest Toppling	1.50	10.21	Pass
FSot	Overturning	2.00	4.26	Pass
FSsl	Base Sliding	1.50	1.62	Pass

Seismic

Check	Description	Min. Requirement	Result	Status
FSbc	Bearing Capacity	1.50	3.58	Pass
FSct	Crest Toppling	1.10	17.30	Pass
FSot	Overturning	1.50	4.57	Pass
FSsl	Base Sliding	1.10	1.70	Pass



Internal and Local Checks**Static**

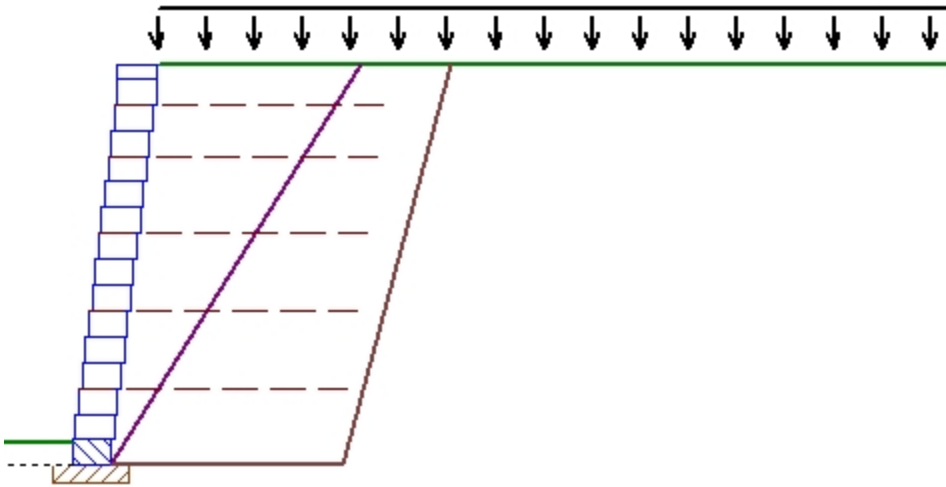
Layer	Elevation (ft)	FScs	FSpO	FSsl	FSto
1	962.67	3.06	22.99	3.02	2.80
2	964.67	5.17	31.19	3.42	4.95
3	966.67	5.76	26.79	3.95	5.79
4	968.67	5.54	22.35	4.70	5.18
5	970.67	6.62	17.86	5.82	6.50
6	972.67	8.42	13.27	7.74	8.71
7	974.67	12.10	8.39	11.87	13.21
8	976.67	27.61	2.76	35.70	31.92

Seismic

Layer	Elevation (ft)	FScs	FSpO	FSsl	FSto
1	962.67	2.76	20.74	3.39	3.99
2	964.67	4.58	27.64	3.96	6.94
3	966.67	5.00	23.29	4.61	7.95
4	968.67	4.69	18.94	5.52	6.94
5	970.67	5.40	14.57	6.92	8.37
6	972.67	6.46	10.18	9.33	10.56
7	974.67	8.29	5.75	14.43	14.30
8	976.67	15.00	1.50	32.45	27.41

Section 43 Details

Section 43 Cross-section



Section 43 Cross-section Details

Upper Slope Angle	β	0.00 °
Crest Offset		0.00 ft
Live Load	ql	150 lb/ft ²
Live Offset	qlofs	0.00 ft
Dead Load	qd	0 lb/ft ²
Dead Offset	qdofs	0.00 ft
Peak Acceleration	As	0.07
Top of Section		981.00 ft
Bottom Grade		971.27 ft
Base of Section		970.67 ft
Design Height	H	10.33 ft
Embedment Depth	Hemb	0.60 ft

* Analysis includes Vertical Forces

* Embedment is included in Bearing Capacity

Empirical Checks

Check	Description	Min. Requirement	Result	Status
Hemb	Minimum Embedment %	5.0000	6.1900	Pass
L	Min. Reinforcement Length	4.0000	7.0000	Pass
L/H Ratio	Min. L/H Ratio	0.6000	0.6774	Pass
La	Min. Anchorage Length	1.0000	1.3294	Pass
MinHemb	Minimum Embedment	6.0000	7.2323	Pass
Rs	Max. Reinforcement Separation	0.0000	2.0000	Pass
RsBottom	Max. multiple of Hu at bottom	0.0000	3.0000	Pass
RsTop	Max. multiple of Hu at top	0.0000	1.5000	Pass

External Checks

Static

Check	Description	Min. Requirement	Result	Status
FSbc	Bearing Capacity	2.00	3.07	Pass
FSct	Crest Toppling	1.50	2.58	Pass
FSot	Overturning	2.00	3.95	Pass
FSsl	Base Sliding	1.50	1.53	Pass

Seismic

Check	Description	Min. Requirement	Result	Status
FSbc	Bearing Capacity	1.50	3.62	Pass
FSct	Crest Toppling	1.10	6.09	Pass
FSot	Overturning	1.50	4.69	Pass
FSsl	Base Sliding	1.10	1.72	Pass

Internal and Local Checks**Static**

Layer	Elevation (ft)	FScs	FSpO	FSsl	FSto
1	972.67	3.56	11.78	3.26	3.35
2	974.67	2.76	20.74	3.39	3.99
3	976.67	6.74	27.64	3.96	6.94
4	978.67	4.58	14.23	4.09	6.65
5	980.00	8.65	23.29	5.56	7.95

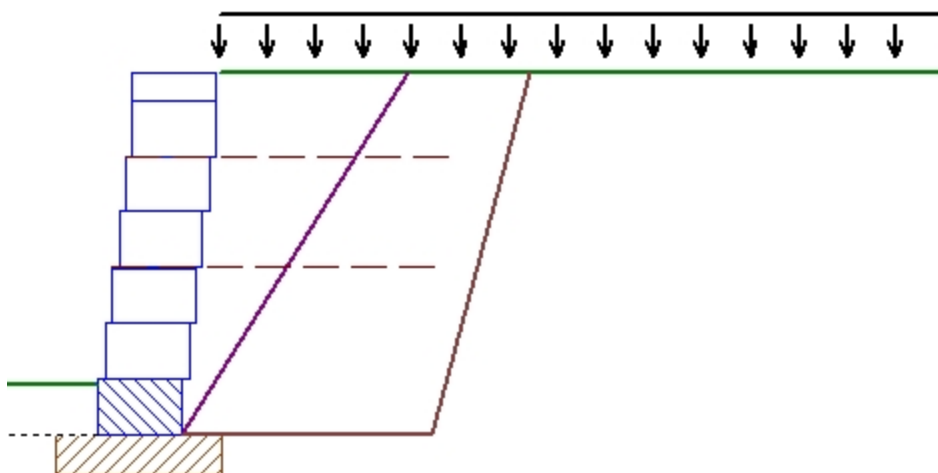
Seismic

Layer	Elevation (ft)	FScs	FSpO	FSsl	FSto
1	972.67	3.28	10.86	4.11	4.87
2	974.67	6.06	12.79	5.22	9.45
3	976.67	7.51	8.56	7.22	12.33
4	978.67	11.84	5.11	11.87	20.53
5	980.00	17.61	2.25	21.16	31.71



Section 52 Details

Section 52 Cross-section



Section 52 Cross-section Details

Upper Slope Angle	β	0.00 °
Crest Offset		0.00 ft
Live Load	ql	150 lb/ft ²
Live Offset	qlofs	0.00 ft
Dead Load	qd	0 lb/ft ²
Dead Offset	qdofs	0.00 ft
Peak Acceleration	As	0.07
Top of Section		981.00 ft
Bottom Grade		977.25 ft
Base of Section		976.67 ft
Design Height	H	4.33 ft
Embedment Depth	Hemb	0.59 ft

* Analysis includes Vertical Forces

* Embedment is included in Bearing Capacity

Empirical Checks

Check	Description	Min. Requirement	Result	Status
Hemb	Minimum Embedment %	5.0000	15.6300	Pass
L	Min. Reinforcement Length	4.0000	4.0000	Pass
L/H Ratio	Min. L/H Ratio	0.6000	0.9231	Pass
La	Min. Anchorage Length	1.0000	1.3320	Pass
MinHemb	Minimum Embedment	6.0000	7.0276	Pass
Rs	Max. Reinforcement Separation	0.0000	1.3333	Pass
RsBottom	Max. multiple of Hu at bottom	0.0000	3.0000	Pass
RsTop	Max. multiple of Hu at top	0.0000	1.5000	Pass

External Checks

Static

Check	Description	Min. Requirement	Result	Status
FSbc	Bearing Capacity	2.00	4.29	Pass
FSct	Crest Toppling	1.50	2.58	Pass
FSot	Overturning	2.00	4.98	Pass
FSsl	Base Sliding	1.50	1.62	Pass

Seismic

Check	Description	Min. Requirement	Result	Status
FSbc	Bearing Capacity	1.50	5.76	Pass
FSct	Crest Toppling	1.10	6.09	Pass
FSot	Overturning	1.50	8.00	Pass
FSsl	Base Sliding	1.10	2.30	Pass



Internal and Local Checks**Static**

Layer	Elevation (ft)	FScs	FSpa	FSsl	FSto
1	978.67	8.02	3.47	4.11	8.80
2	980.00	3.28	10.86	6.49	4.87

Seismic

Layer	Elevation (ft)	FScs	FSpa	FSsl	FSto
1	978.67	8.07	3.49	9.06	13.99
2	980.00	24.83	3.18	18.16	44.71