



STRUCTURAL

7700 SHAWNEE MISSION PARKWAY SUITE 104

OVERLAND PARK, KANSAS 66202

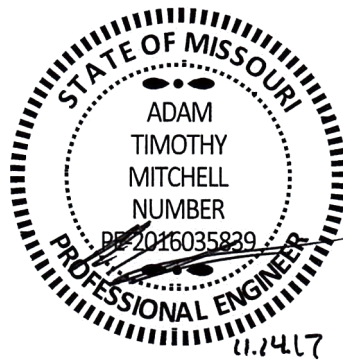
913.735.7006

BIG BLOCK SEGMENTAL GRAVITY RETAINING WALL STRUCTURAL CALCULATIONS

COLEMAN, EQUIPMENT

LEE'S SUMMIT, MISSOURI

PROJECT # 117-083





S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Gabion analysis

Input data

Project

Date : 9/13/2017

Settings

ASD TYP

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	$SF_o =$	1.50	[-]
Safety factor for sliding resistance :	$SF_s =$	1.50	[-]
Safety factor for bearing capacity :	$SF_b =$	1.00	[-]
Safety factor for mesh strength :	$SF_n =$	1.50	[-]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of friction between blocks :	$\gamma_f =$	1.50	[-]
Reduction coeff. of contact base - soil :	$\mu =$	1.00	[-]

Material of blocks - filling

No.	Name	γ [pcf]	ϕ [°]	c [psf]
1	BIG BLOCK	130.00	34.00	0.0
2	Leveling Pad	115.00	34.00	0.0

Material of blocks - mesh

No.	Name	Strength overh. R_t [lbf/ft]	Spacing of vert. meshes v [ft]	Bear.cap. of front joint R_s [lbf/ft]
1	BIG BLOCK	2700.00	3.00	2700.00
2	Leveling Pad	2700.00	1.00	2700.00

Geometry of structure

No.	Width b [ft]	Height h [ft]	Offset a [ft]	Material
8	2.00	1.50	0.10	BIG BLOCK
7	2.00	1.50	0.10	BIG BLOCK
6	2.00	1.50	0.10	BIG BLOCK
5	3.50	1.50	0.10	BIG BLOCK
4	3.50	1.50	0.10	BIG BLOCK



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

No.	Width b [ft]	Height h [ft]	Offset a [ft]	Material
3	5.00	1.50	0.10	BIG BLOCK
2	5.00	1.50	0.50	BIG BLOCK
1	6.00	0.50	-	Leveling Pad

Gabion slope = 0.00 °
Overall height = 11.00 ft
Overall wall volume = 37.50 ft³/ft

Soil parameters

Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 25.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 16.75 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 130.0 pcf

Fat Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 20.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 13.33 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 130.0 pcf

Clean Gravel

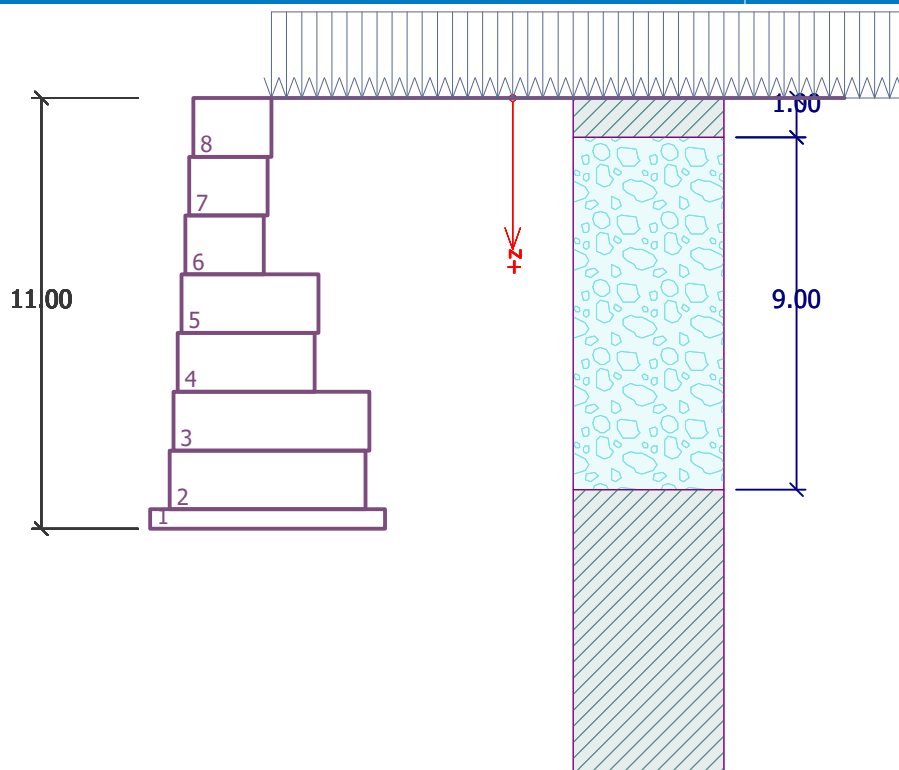
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 22.67 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 130.0 pcf

Geological profile and assigned soils

No.	Layer [ft]	Assigned soil	Pattern
1	1.00	Lean Clay	
2	9.00	Clean Gravel	
3	-	Lean Clay	

Name : Profile and assignment

Stage - analysis : 1 - 0



Foundation

Type of foundation : soil from geological profile

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1 [lb/ft ²]	Mag.2 [lb/ft ²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
	new	change						
1	Yes		variable	50.0				on terrain
No.	Name							
1	Incidental							

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Global settings

Minimum dimensioning pressure is considered as $\sigma_{a,min} = 0.20\sigma_z$

Settings of the stage of construction

Design situation : permanent



Verification No. 1

Forces acting on construction

Name	F _{hor} [lbf/ft]	App.Pt. z [ft]	F _{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-4.36	4830.0	2.64	1.000
Weight - earth wedge	0.0	-0.79	26.3	5.67	1.000
Weight - earth wedge	0.0	-4.31	200.0	4.69	1.000
Weight - earth wedge	0.0	-7.31	200.0	3.39	1.000
Active pressure	1972.7	-3.53	2349.0	4.96	1.000
Incidental	154.3	-5.48	181.1	4.53	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 26978.1$ lbfft/ft

Overturning moment $M_{ovr} = 7818.6$ lbfft/ft

Safety factor = 3.45 > 1.50

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 3630.84$ lbf/ft

Active horizontal force $H_{act} = 2126.95$ lbf/ft

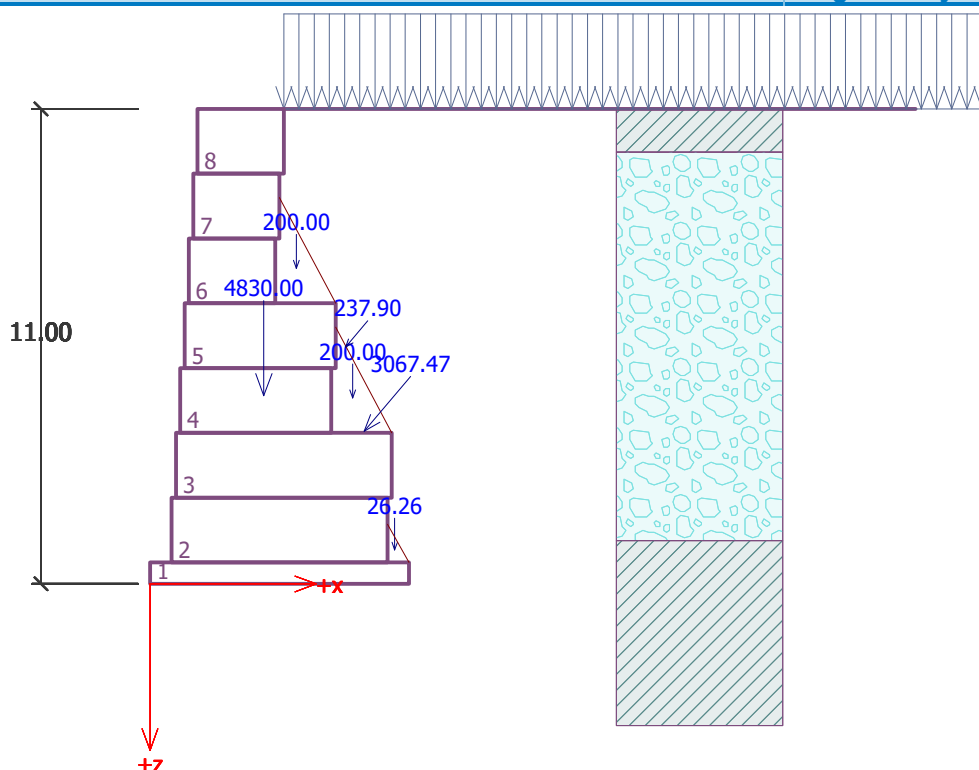
Safety factor = 1.71 > 1.50

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Name : Verification

Stage - analysis : 1 - 1



Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lb/ft]	Shear Force [lb/ft]	Eccentricity [-]	Stress [psf]
1	4199.6	7786.37	2126.95	0.090	1582.2

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lb/ft]	Shear Force [lb/ft]
1	4199.6	7786.37	2126.95

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force $e = 0.090$

Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom $\sigma = 1582.2$ psf

Bearing capacity of foundation soil $R_d = 2000.0$ psf

Safety factor = 1.26 > 1.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY



Dimensioning No. 1

Forces acting on construction

Name	F _{hor} [lb/ft]	App.Pt. z [ft]	F _{vert} [lb/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-4.17	4485.0	2.11	1.000
Weight - earth wedge	0.0	-3.81	200.0	4.19	1.000
Weight - earth wedge	0.0	-6.81	200.0	2.89	1.000
Active pressure	1701.8	-3.54	1805.8	4.20	1.000
Incidental	143.2	-5.38	157.9	3.84	1.000

Verification of construction joint above the block No.: 1

Check for overturning stability

Resisting moment $M_{res} = 19067.2$ lbfft/ft

Overturning moment $M_{ovr} = 6787.5$ lbfft/ft

Safety factor = 2.81 > 1.50

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 4619.54$ lbf/ft

Active horizontal force $H_{act} = 1845.05$ lbf/ft

Safety factor = 2.50 > 1.50

Joint for slip is SATISFACTORY

Maximum pressure on the bottom block = 1909.9 psf

Red.Coeff. by offset of top block = 0.00

Average value of pressure on face = 10.4 psf

Shear force transmitted by friction = 3079.69 lbf/ft

Bearing capacity against transverse pressure:

Joint bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = 778.80 > 1.50

Transverse pressure check is SATISFACTORY

Joint btw. blocks check:

Mesh material bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = 778.80 > 1.50

Joint between blocks is SATISFACTORY



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Gabion analysis

Input data

Project

Date : 9/13/2017

Settings

ASD TYP

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	$SF_o =$	1.50	[-]
Safety factor for sliding resistance :	$SF_s =$	1.50	[-]
Safety factor for bearing capacity :	$SF_b =$	1.00	[-]
Safety factor for mesh strength :	$SF_n =$	1.50	[-]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of friction between blocks :	$\gamma_f =$	1.50	[-]
Reduction coeff. of contact base - soil :	$\mu =$	1.00	[-]

Material of blocks - filling

No.	Name	γ [pcf]	ϕ [°]	c [psf]
1	BIG BLOCK	130.00	34.00	0.0
2	Leveling Pad	115.00	34.00	0.0

Material of blocks - mesh

No.	Name	Strength overh. R_t [lbf/ft]	Spacing of vert. meshes v [ft]	Bear.cap. of front joint R_s [lbf/ft]
1	BIG BLOCK	2700.00	3.00	2700.00
2	Leveling Pad	2700.00	1.00	2700.00

Geometry of structure

No.	Width b [ft]	Height h [ft]	Offset a [ft]	Material
7	2.00	1.50	0.10	BIG BLOCK
6	2.00	1.50	0.10	BIG BLOCK
5	2.00	1.50	0.10	BIG BLOCK
4	3.50	1.50	0.10	BIG BLOCK
3	3.50	1.50	0.10	BIG BLOCK



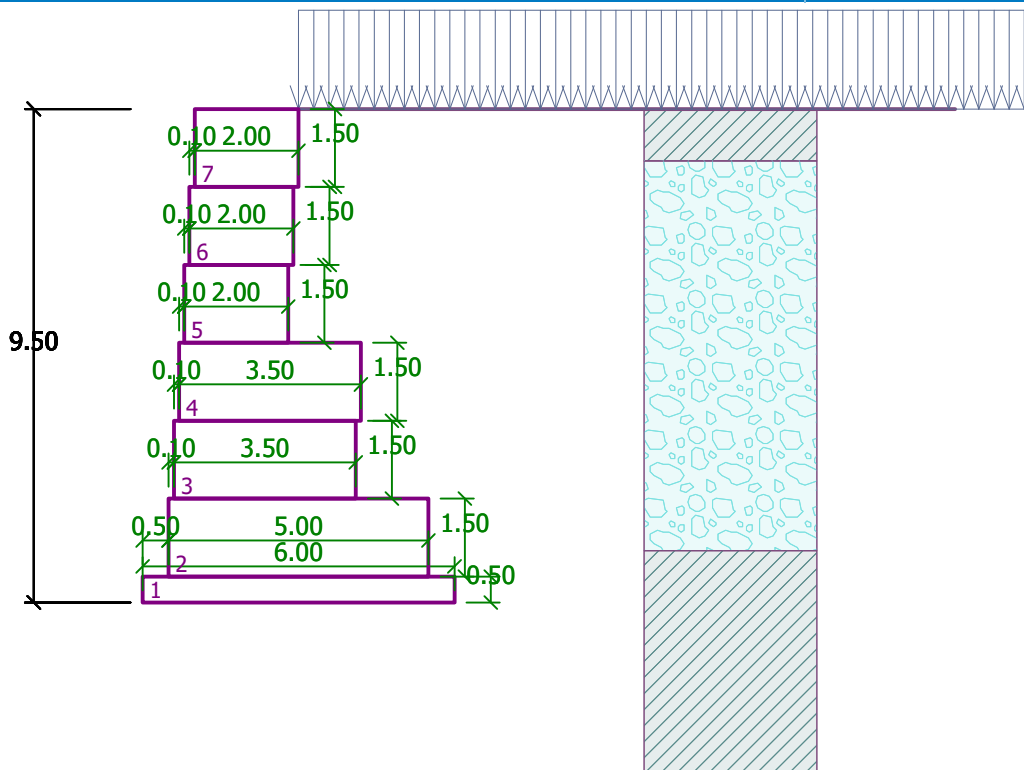
S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

No.	Width b [ft]	Height h [ft]	Offset a [ft]	Material
2	5.00	1.50	0.50	BIG BLOCK
1	6.00	0.50	-	Leveling Pad

Gabion slope = 0.00 °
Overall height = 9.50 ft
Overall wall volume = 30.00 ft³/ft

Name : Geometry

Stage - analysis : 1 - 0



Soil parameters

Lean Clay

Unit weight : $\gamma = 120.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{ef} = 25.00^\circ$
Cohesion of soil : $c_{ef} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 16.75^\circ$
Soil : cohesionless
Saturated unit weight : $\gamma_{sat} = 130.0$ pcf

Fat Clay

Unit weight : $\gamma = 120.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{ef} = 20.00^\circ$
Cohesion of soil : $c_{ef} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 13.33^\circ$



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Soil : cohesionless
Saturated unit weight : $\gamma_{\text{sat}} = 130.0$ pcf

Clean Gravel

Unit weight : $\gamma = 115.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{\text{ef}} = 34.00^\circ$
Cohesion of soil : $c_{\text{ef}} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 22.67^\circ$
Soil : cohesionless
Saturated unit weight : $\gamma_{\text{sat}} = 130.0$ pcf

Geological profile and assigned soils

No.	Layer [ft]	Assigned soil	Pattern
1	1.00	Lean Clay	
2	7.50	Clean Gravel	
3	-	Lean Clay	

Foundation

Type of foundation : soil from geological profile

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	change	Action	Mag.1 [lbf/ft ²]	Mag.2 [lbf/ft ²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	50.0				on terrain

No.	Name
1	Incidental

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Global settings

Minimum dimensioning pressure is considered as $\sigma_{a,\text{min}} = 0.20\sigma_z$

Settings of the stage of construction

Design situation : permanent



Verification No. 1

Active pressure behind the structure - partial results

Layer No.	Thickness [ft]	α [°]	Φ_d [°]	C_d [psf]	γ [pcf]	δ_d [°]	K_a	Comment
1	1.00	0.00	25.00	0.0	120.00	16.75	0.361	
2	0.50	0.00	34.00	0.0	115.00	22.67	0.254	
3	0.56	0.00	34.00	0.0	115.00	22.67	0.254	
4	0.94	28.00	34.00	0.0	115.00	34.00	0.602	
5	1.50	28.00	34.00	0.0	115.00	34.00	0.602	
6	0.56	0.00	34.00	0.0	115.00	22.67	0.254	
7	0.94	28.00	34.00	0.0	115.00	34.00	0.602	
8	1.50	28.00	34.00	0.0	115.00	34.00	0.602	
9	0.62	0.00	34.00	0.0	115.00	22.67	0.254	
10	0.38	29.55	34.00	0.0	115.00	34.00	0.634	
11	0.50	29.55	25.00	0.0	120.00	25.00	0.698	
12	0.50	0.00	25.00	0.0	120.00	16.75	0.361	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [ft] End [ft]	σ_z [psf]	σ_w [psf]	Pressure [psf]	Hor. comp. [psf]	Vert. comp. [psf]
1	0.00	0.0	0.0	0.0	0.0	0.0
	1.00	120.0	0.0	43.3	41.4	12.5
2	1.00	120.0	0.0	30.5	28.2	11.8
	1.50	177.5	0.0	45.1	41.6	17.4
3	1.50	177.5	0.0	45.1	41.6	17.4
	2.06	241.3	0.0	61.4	56.6	23.7
4	2.06	241.3	0.0	145.3	68.2	128.3
	3.00	350.0	0.0	210.8	98.9	186.1
5	3.00	350.0	0.0	210.8	98.9	186.1
	4.50	522.5	0.0	314.6	147.7	277.8
6	4.50	522.5	0.0	132.9	122.6	51.2
	5.06	586.3	0.0	149.1	137.6	57.5
7	5.06	586.3	0.0	353.1	165.8	311.8
	6.00	695.0	0.0	418.5	196.5	369.5
8	6.00	695.0	0.0	418.5	196.5	369.5
	7.50	867.5	0.0	522.4	245.2	461.3
9	7.50	867.5	0.0	220.6	203.5	85.0
	8.12	938.6	0.0	238.6	220.2	92.0
10	8.12	938.6	0.0	594.9	265.0	532.6
	8.50	982.5	0.0	622.7	277.4	557.5
11	8.50	982.5	0.0	685.7	397.7	558.5
	9.00	1042.5	0.0	727.5	422.0	592.6
12	9.00	1042.5	0.0	376.0	360.1	108.4
	9.50	1102.5	0.0	397.7	380.8	114.6



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Pressure profile due to surcharge - Incidental

Point No.	Depth [ft]	Hor. comp. [psf]	Vert. comp. [psf]
1	0.00	17.3	5.2
2	1.00	17.3	5.2
3	1.00	11.7	4.9
4	1.50	11.7	4.9
5	1.50	0.0	0.0
6	1.50	0.0	0.0
7	1.50	11.7	4.9
8	2.06	11.7	4.9
9	2.06	14.1	26.6
10	3.00	14.1	26.6
11	3.00	0.0	0.0
12	3.00	0.0	0.0
13	3.00	14.1	26.6
14	4.50	14.1	26.6
15	4.50	11.7	4.9
16	5.06	11.7	4.9
17	5.06	14.1	26.6
18	6.00	14.1	26.6
19	6.00	0.0	0.0
20	6.00	0.0	0.0
21	6.00	14.1	26.6
22	7.50	14.1	26.6
23	7.50	11.7	4.9
24	8.12	11.7	4.9
25	8.12	14.1	28.4
26	8.50	14.1	28.4
27	8.50	20.2	28.4
28	9.00	20.2	28.4
29	9.00	17.3	5.2
30	9.50	17.3	5.2

Forces acting on construction

Name	F _{hor} [lbf/ft]	App.Pt. z [ft]	F _{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.78	3855.0	2.45	1.000
Weight - earth wedge	0.0	-0.79	26.3	5.67	1.000
Weight - earth wedge	0.0	-2.81	200.0	4.59	1.000
Weight - earth wedge	0.0	-5.81	200.0	3.29	1.000
Active pressure	1528.7	-3.01	2103.0	4.81	1.000
Incidental	136.7	-4.68	173.8	4.40	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 22063.7 \text{ lbfft/ft}$



Overturning moment $M_{ovr} = 5242.8 \text{ lbfft/ft}$

Safety factor = $4.21 > 1.50$

Wall for overturning is SATISFACTORY

Check for slip

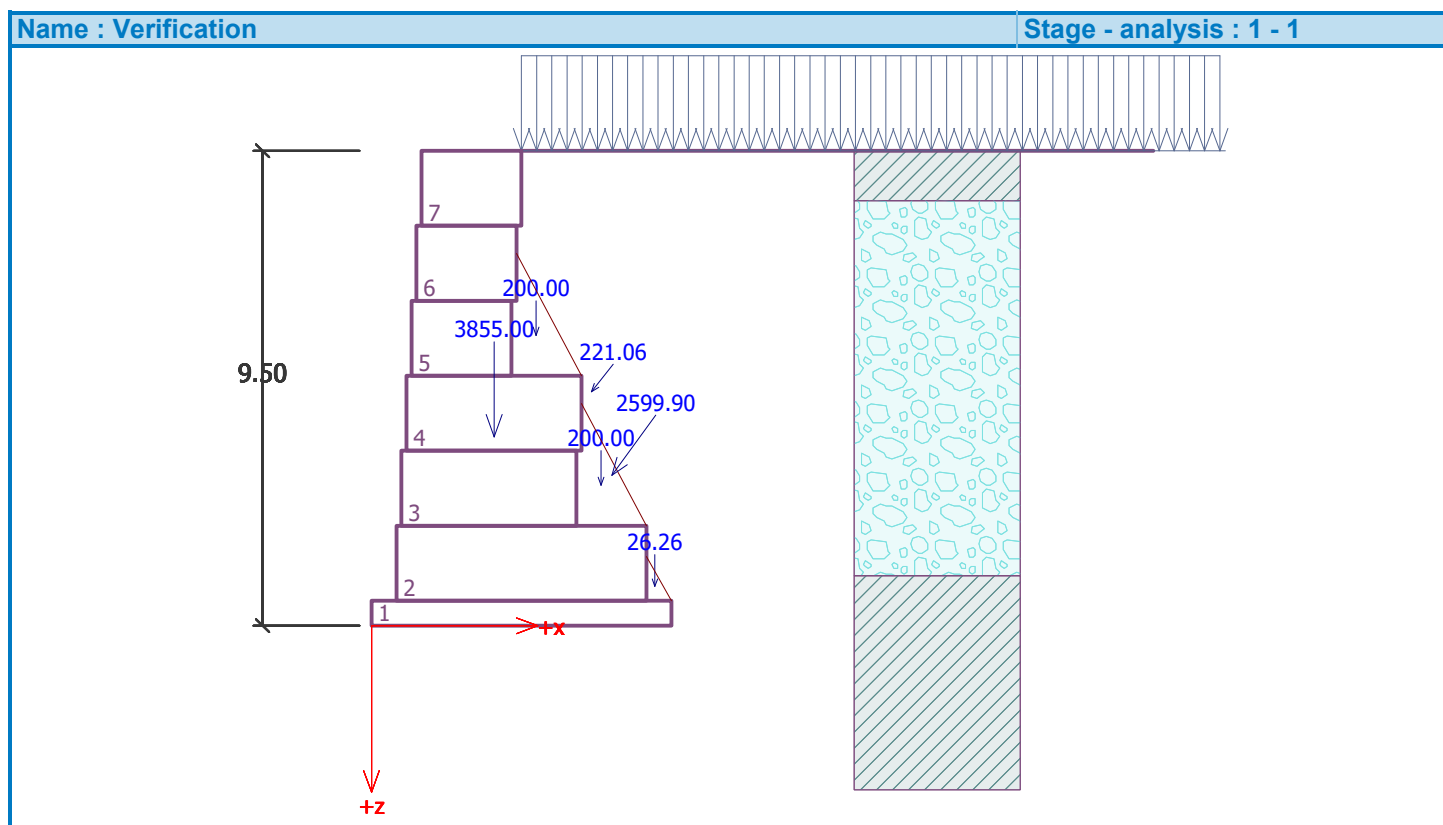
Resisting horizontal force $H_{res} = 3058.03 \text{ lbf/ft}$

Active horizontal force $H_{act} = 1665.39 \text{ lbf/ft}$

Safety factor = $1.84 > 1.50$

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY



Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [-]	Stress [psf]
1	2853.0	6557.98	1665.39	0.073	1278.4

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	2853.0	6557.98	1665.39



Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force $e = 0.073$

Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom $\sigma = 1278.4$ psf

Bearing capacity of foundation soil $R_d = 2000.0$ psf

Safety factor = $1.56 > 1.00$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lb/ft]	App.Pt. z [ft]	F_{vert} [lb/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.62	3510.0	1.90	1.000
Weight - earth wedge	0.0	-2.31	200.0	4.09	1.000
Weight - earth wedge	0.0	-5.31	200.0	2.79	1.000
Active pressure	1295.9	-2.98	1639.8	4.02	1.000
Incidental	125.6	-4.56	150.6	3.68	1.000

Verification of construction joint above the block No.: 1

Check for overturning stability

Resisting moment $M_{res} = 15192.9$ lbfft/ft

Overturning moment $M_{ovr} = 4438.4$ lbfft/ft

Safety factor = $3.42 > 1.50$

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 3844.92$ lb/ft

Active horizontal force $H_{act} = 1421.55$ lb/ft

Safety factor = $2.70 > 1.50$

Joint for slip is SATISFACTORY

Maximum pressure on the bottom block = 1510.7 psf

Red.Coeff. by offset of top block = 0.00

Average value of pressure on face = 10.4 psf

Shear force transmitted by friction = 2563.28 lb/ft

Bearing capacity against transverse pressure:

Joint bear.capacity = 2700.00 lb/ft

Computed stress-state = 3.47 lb/ft



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Safety factor = 778.80 > 1.50

Transverse pressure check is SATISFACTORY

Joint btw. blocks check:

Mesh material bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = 778.80 > 1.50

Joint between blocks is SATISFACTORY



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Gabion analysis

Input data

Project

Date : 9/13/2017

Settings

ASD TYP

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	$SF_o =$	1.50	[-]
Safety factor for sliding resistance :	$SF_s =$	1.50	[-]
Safety factor for bearing capacity :	$SF_b =$	1.00	[-]
Safety factor for mesh strength :	$SF_n =$	1.50	[-]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of friction between blocks :	$\gamma_f =$	1.50	[-]
Reduction coeff. of contact base - soil :	$\mu =$	1.00	[-]

Material of blocks - filling

No.	Name	γ [pcf]	ϕ [°]	c [psf]
1	BIG BLOCK	130.00	34.00	0.0
2	Leveling Pad	115.00	34.00	0.0

Material of blocks - mesh

No.	Name	Strength overh. R_t [lbf/ft]	Spacing of vert. meshes v [ft]	Bear.cap. of front joint R_s [lbf/ft]
1	BIG BLOCK	2700.00	3.00	2700.00
2	Leveling Pad	2700.00	1.00	2700.00

Geometry of structure

No.	Width b [ft]	Height h [ft]	Offset a [ft]	Material
5	2.00	1.50	0.10	BIG BLOCK
4	2.00	1.50	0.10	BIG BLOCK
3	2.00	1.50	0.10	BIG BLOCK
2	3.50	1.50	0.50	BIG BLOCK
1	4.50	0.50	-	Leveling Pad



Gabion slope = 0.00 °
Overall height = 6.50 ft
Overall wall volume = 16.50 ft³/ft

Soil parameters

Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 25.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 16.75 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 130.0 pcf

Fat Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 20.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 13.33 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 130.0 pcf

Clean Gravel

Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 22.67 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 130.0 pcf

Geological profile and assigned soils

No.	Layer [ft]	Assigned soil	Pattern
1	1.00	Lean Clay	
2	4.50	Clean Gravel	
3	-	Lean Clay	

Foundation

Type of foundation : soil from geological profile

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Input surface surcharges

No.	Surcharge new	change	Action	Mag.1 [lb/ft ²]	Mag.2 [lb/ft ²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	50.0				on terrain

No.	Name
1	Incidental

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Global settings

Minimum dimensioning pressure is considered as $\sigma_{a,min} = 0.20\sigma_z$

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Active pressure behind the structure - partial results

Layer No.	Thickness [ft]	α [°]	φ_d [°]	c_d [psf]	γ [pcf]	δ_d [°]	K_a	Comment
1	1.00	0.00	25.00	0.0	120.00	16.75	0.361	
2	0.50	0.00	34.00	0.0	115.00	22.67	0.254	
3	0.56	0.00	34.00	0.0	115.00	22.67	0.254	
4	0.94	28.00	34.00	0.0	115.00	34.00	0.602	
5	1.50	28.00	34.00	0.0	115.00	34.00	0.602	
6	0.62	0.00	34.00	0.0	115.00	22.67	0.254	
7	0.38	29.55	34.00	0.0	115.00	34.00	0.634	
8	0.50	29.55	25.00	0.0	120.00	25.00	0.698	
9	0.50	0.00	25.00	0.0	120.00	16.75	0.361	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [ft] End [ft]	σ_z [psf]	σ_w [psf]	Pressure [psf]	Hor. comp. [psf]	Vert. comp. [psf]
1	0.00	0.0	0.0	0.0	0.0	0.0
	1.00	120.0	0.0	43.3	41.4	12.5
2	1.00	120.0	0.0	30.5	28.2	11.8
	1.50	177.5	0.0	45.1	41.6	17.4
3	1.50	177.5	0.0	45.1	41.6	17.4
	2.06	241.3	0.0	61.4	56.6	23.7
4	2.06	241.3	0.0	145.3	68.2	128.3
	3.00	350.0	0.0	210.8	98.9	186.1
5	3.00	350.0	0.0	210.8	98.9	186.1
	4.50	522.5	0.0	314.6	147.7	277.8
6	4.50	522.5	0.0	132.9	122.6	51.2
	5.12	593.6	0.0	150.9	139.3	58.2



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Layer No.	Start [ft] End [ft]	σ_z [psf]	σ_w [psf]	Pressure [psf]	Hor. comp. [psf]	Vert. comp. [psf]
7	5.12	593.6	0.0	376.2	167.6	336.8
	5.50	637.5	0.0	404.1	180.0	361.8
8	5.50	637.5	0.0	444.9	258.1	362.4
	6.00	697.5	0.0	486.8	282.3	396.5
9	6.00	697.5	0.0	251.6	240.9	72.5
	6.50	757.5	0.0	273.2	261.6	78.7

Forces acting on construction

Name	F_{hor} [lb/ft]	App.Pt. z [ft]	F_{vert} [lb/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.79	2111.2	1.95	1.000
Weight - earth wedge	0.0	-0.79	26.3	4.17	1.000
Weight - earth wedge	0.0	-2.81	200.0	3.09	1.000
Active pressure	737.5	-2.03	916.2	3.77	1.000
Incidental	95.6	-3.19	106.0	3.55	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 8663.8$ lbfft/ft

Overturning moment $M_{ovr} = 1803.6$ lbfft/ft

Safety factor = 4.80 > 1.50

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 1566.66$ lb/ft

Active horizontal force $H_{act} = 833.05$ lb/ft

Safety factor = 1.88 > 1.50

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lb/ft]	Shear Force [lb/ft]	Eccentricity [-]	Stress [psf]
1	699.2	3359.72	833.05	0.046	822.7

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lb/ft]	Shear Force [lb/ft]
1	699.2	3359.72	833.05

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification



Max. eccentricity of normal force $e = 0.046$

Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom $\sigma = 822.7$ psf

Bearing capacity of foundation soil $R_d = 2000.0$ psf

Safety factor = $2.43 > 1.00$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lb/ft]	App.Pt. z [ft]	F_{vert} [lb/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.64	1852.5	1.40	1.000
Weight - earth wedge	0.0	-2.31	200.0	2.59	1.000
Active pressure	580.8	-1.98	612.9	2.99	1.000
Incidental	84.6	-3.05	82.9	2.84	1.000

Verification of construction joint above the block No.: 1

Check for overturning stability

Resisting moment $M_{res} = 5182.8$ lbfft/ft

Overturning moment $M_{ovr} = 1407.5$ lbfft/ft

Safety factor = $3.68 > 1.50$

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 1853.74$ lbf/ft

Active horizontal force $H_{act} = 665.34$ lbf/ft

Safety factor = $2.79 > 1.50$

Joint for slip is SATISFACTORY

Maximum pressure on the bottom block = 1000.3 psf

Red.Coeff. by offset of top block = 0.00

Average value of pressure on face = 10.4 psf

Shear force transmitted by friction = 1235.82 lbf/ft

Bearing capacity against transverse pressure:

Joint bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = $778.80 > 1.50$

Transverse pressure check is SATISFACTORY

Joint btw. blocks check:



S1 STRUCTURAL

7700 Shawnee Mission Parkway Ste 104

Overland Park, KS 913.735.7006

Mesh material bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = 778.80 > 1.50

Joint between blocks is SATISFACTORY



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Gabion analysis

Input data

Project

Date : 9/13/2017

Settings

ASD TYP

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	$SF_o =$	1.50	[-]
Safety factor for sliding resistance :	$SF_s =$	1.50	[-]
Safety factor for bearing capacity :	$SF_b =$	1.00	[-]
Safety factor for mesh strength :	$SF_n =$	1.50	[-]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of friction between blocks :	$\gamma_f =$	1.50	[-]
Reduction coeff. of contact base - soil :	$\mu =$	1.00	[-]

Material of blocks - filling

No.	Name	γ [pcf]	ϕ [°]	c [psf]
1	BIG BLOCK	130.00	34.00	0.0
2	Leveling Pad	115.00	34.00	0.0

Material of blocks - mesh

No.	Name	Strength overh. R_t [lbf/ft]	Spacing of vert. meshes v [ft]	Bear.cap. of front joint R_s [lbf/ft]
1	BIG BLOCK	2700.00	3.00	2700.00
2	Leveling Pad	2700.00	1.00	2700.00

Geometry of structure

No.	Width b [ft]	Height h [ft]	Offset a [ft]	Material
6	2.00	1.50	0.10	BIG BLOCK
5	2.00	1.50	0.10	BIG BLOCK
4	2.00	1.50	0.10	BIG BLOCK
3	3.50	1.50	0.10	BIG BLOCK
2	3.50	1.50	0.50	BIG BLOCK



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

No.	Width b [ft]	Height h [ft]	Offset a [ft]	Material
1	6.00	0.50	-	Leveling Pad

Gabion slope = 0.00 °
Overall height = 8.00 ft
Overall wall volume = 22.50 ft³/ft

Soil parameters

Lean Clay

Unit weight : $\gamma = 120.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{ef} = 25.00$ °
Cohesion of soil : $c_{ef} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 16.75$ °
Soil : cohesionless
Saturated unit weight : $\gamma_{sat} = 130.0$ pcf

Fat Clay

Unit weight : $\gamma = 120.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{ef} = 20.00$ °
Cohesion of soil : $c_{ef} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 13.33$ °
Soil : cohesionless
Saturated unit weight : $\gamma_{sat} = 130.0$ pcf

Clean Gravel

Unit weight : $\gamma = 115.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{ef} = 34.00$ °
Cohesion of soil : $c_{ef} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 22.67$ °
Soil : cohesionless
Saturated unit weight : $\gamma_{sat} = 130.0$ pcf

Geological profile and assigned soils

No.	Layer [ft]	Assigned soil	Pattern
1	1.00	Lean Clay	
2	6.00	Clean Gravel	
3	-	Lean Clay	

Foundation

Type of foundation : soil from geological profile

Terrain profile

Terrain behind the structure is flat.



Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1 [lb/ft ²]	Mag.2 [lb/ft ²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
	new	change						
1	Yes		variable	50.0				on terrain
No.	Name							
1	Incidental							

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Global settings

Minimum dimensioning pressure is considered as $\sigma_{a,min} = 0.20\sigma_z$

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Active pressure behind the structure - partial results

Layer No.	Thickness [ft]	α [°]	φ_d [°]	c_d [psf]	γ [pcf]	δ_d [°]	K_a	Comment
1	1.00	0.00	25.00	0.0	120.00	16.75	0.361	
2	0.50	0.00	34.00	0.0	115.00	22.67	0.254	
3	0.56	0.00	34.00	0.0	115.00	22.67	0.254	
4	0.94	28.00	34.00	0.0	115.00	34.00	0.602	
5	1.50	28.00	34.00	0.0	115.00	34.00	0.602	
6	1.50	0.00	34.00	0.0	115.00	22.67	0.254	
7	0.62	0.00	34.00	0.0	115.00	22.67	0.254	
8	0.38	29.55	34.00	0.0	115.00	34.00	0.634	
9	0.50	29.55	25.00	0.0	120.00	25.00	0.698	
10	0.50	0.00	25.00	0.0	120.00	16.75	0.361	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [ft] End [ft]	σ_z [psf]	σ_w [psf]	Pressure [psf]	Hor. comp. [psf]	Vert. comp. [psf]
1	0.00	0.0	0.0	0.0	0.0	0.0
	1.00	120.0	0.0	43.3	41.4	12.5
2	1.00	120.0	0.0	30.5	28.2	11.8
	1.50	177.5	0.0	45.1	41.6	17.4
3	1.50	177.5	0.0	45.1	41.6	17.4
	2.06	241.3	0.0	61.4	56.6	23.7
4	2.06	241.3	0.0	145.3	68.2	128.3
	3.00	350.0	0.0	210.8	98.9	186.1



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Layer No.	Start [ft] End [ft]	σ_z [psf]	σ_w [psf]	Pressure [psf]	Hor. comp. [psf]	Vert. comp. [psf]
5	3.00	350.0	0.0	210.8	98.9	186.1
	4.50	522.5	0.0	314.6	147.7	277.8
6	4.50	522.5	0.0	132.9	122.6	51.2
	6.00	695.0	0.0	176.7	163.1	68.1
7	6.00	695.0	0.0	176.7	163.1	68.1
	6.62	766.1	0.0	194.8	179.7	75.1
8	6.62	766.1	0.0	485.6	216.3	434.7
	7.00	810.0	0.0	513.4	228.7	459.6
9	7.00	810.0	0.0	565.3	327.9	460.5
	7.50	870.0	0.0	607.2	352.2	494.6
10	7.50	870.0	0.0	313.8	300.5	90.4
	8.00	930.0	0.0	335.5	321.2	96.7

Forces acting on construction

Name	F_{hor} [lb/ft]	App.Pt. z [ft]	F_{vert} [lb/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.38	2822.5	2.11	1.000
Weight - earth wedge	0.0	-0.79	26.3	4.17	1.000
Weight - earth wedge	0.0	-4.31	200.0	3.19	1.000
Active pressure	1060.0	-2.52	1111.5	3.89	1.000
Incidental	113.2	-3.97	113.4	3.65	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 11447.4$ lbfft/ft

Overturning moment $M_{ovr} = 3122.1$ lbfft/ft

Safety factor = 3.67 > 1.50

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 1992.84$ lb/ft

Active horizontal force $H_{act} = 1173.20$ lb/ft

Safety factor = 1.70 > 1.50

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lb/ft]	Shear Force [lb/ft]	Eccentricity [-]	Stress [psf]
1	1290.4	4273.65	1173.20	0.067	1096.9

Service load acting at the center of footing bottom



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

No.	Moment [lbfft/ft]	Norm. force [lb/ft]	Shear Force [lb/ft]
1	1290.4	4273.65	1173.20

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force $e = 0.067$

Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom $\sigma = 1096.9$ psf

Bearing capacity of foundation soil $R_d = 2000.0$ psf

Safety factor = $1.82 > 1.00$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lb/ft]	App.Pt. z [ft]	F_{vert} [lb/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.23	2535.0	1.57	1.000
Weight - earth wedge	0.0	-3.81	200.0	2.69	1.000
Active pressure	865.3	-2.50	728.3	3.15	1.000
Incidental	102.2	-3.86	90.2	2.98	1.000

Verification of construction joint above the block No.: 1

Check for overturning stability

Resisting moment $M_{res} = 7081.3$ lbfft/ft

Overturning moment $M_{ovr} = 2559.8$ lbfft/ft

Safety factor = $2.77 > 1.50$

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 2396.85$ lb/ft

Active horizontal force $H_{act} = 967.43$ lb/ft

Safety factor = $2.48 > 1.50$

Joint for slip is SATISFACTORY

Maximum pressure on the bottom block = 1396.4 psf

Red.Coeff. by offset of top block = 0.00

Average value of pressure on face = 10.4 psf

Shear force transmitted by friction = 1597.90 lb/ft



S1 STRUCTURAL

7700 Shawnee Mission Parkway Ste 104

Overland Park, KS 913.735.7006

Bearing capacity against transverse pressure:

Joint bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = 778.80 > 1.50

Transverse pressure check is SATISFACTORY

Joint btw. blocks check:

Mesh material bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = 778.80 > 1.50

Joint between blocks is SATISFACTORY



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Gabion analysis

Input data

Project

Date : 9/13/2017

Settings

ASD TYP

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	$SF_o =$	1.50	[-]
Safety factor for sliding resistance :	$SF_s =$	1.50	[-]
Safety factor for bearing capacity :	$SF_b =$	1.00	[-]
Safety factor for mesh strength :	$SF_n =$	1.50	[-]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of friction between blocks :	$\gamma_f =$	1.50	[-]
Reduction coeff. of contact base - soil :	$\mu =$	1.00	[-]

Material of blocks - filling

No.	Name	γ [pcf]	ϕ [°]	c [psf]
1	BIG BLOCK	130.00	34.00	0.0
2	Leveling Pad	115.00	34.00	0.0

Material of blocks - mesh

No.	Name	Strength overh. R_t [lbf/ft]	Spacing of vert. meshes v [ft]	Bear.cap. of front joint R_s [lbf/ft]
1	BIG BLOCK	2700.00	3.00	2700.00
2	Leveling Pad	2700.00	1.00	2700.00

Geometry of structure

No.	Width b [ft]	Height h [ft]	Offset a [ft]	Material
4	2.00	1.50	0.10	BIG BLOCK
3	2.00	1.50	0.10	BIG BLOCK
2	2.00	1.50	0.50	BIG BLOCK
1	3.00	0.50	-	Leveling Pad

Gabion slope = 0.00 °



Overall height = 5.00 ft
Overall wall volume = 10.50 ft³/ft

Soil parameters

Lean Clay

Unit weight : $\gamma = 120.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{ef} = 25.00^\circ$
Cohesion of soil : $c_{ef} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 16.75^\circ$
Soil : cohesionless
Saturated unit weight : $\gamma_{sat} = 130.0$ pcf

Fat Clay

Unit weight : $\gamma = 120.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{ef} = 20.00^\circ$
Cohesion of soil : $c_{ef} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 13.33^\circ$
Soil : cohesionless
Saturated unit weight : $\gamma_{sat} = 130.0$ pcf

Clean Gravel

Unit weight : $\gamma = 115.0$ pcf
Stress-state : effective
Angle of internal friction : $\phi_{ef} = 34.00^\circ$
Cohesion of soil : $c_{ef} = 0.0$ psf
Angle of friction struc.-soil : $\delta = 22.67^\circ$
Soil : cohesionless
Saturated unit weight : $\gamma_{sat} = 130.0$ pcf

Geological profile and assigned soils

No.	Layer [ft]	Assigned soil	Pattern
1	1.00	Lean Clay	
2	3.00	Clean Gravel	
3	-	Lean Clay	

Foundation

Type of foundation : soil from geological profile

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.



S1 STRUCTURAL
7700 Shawnee Mission Parkway Ste 104
Overland Park, KS 913.735.7006

Input surface surcharges

No.	Surcharge new	change	Action	Mag.1 [lb/ft ²]	Mag.2 [lb/ft ²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	50.0				on terrain
No.	Name							
1	Incidental							

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Global settings

Minimum dimensioning pressure is considered as $\sigma_{a,min} = 0.20\sigma_z$

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Active pressure behind the structure - partial results

Layer No.	Thickness [ft]	α [°]	φ_d [°]	c_d [psf]	γ [pcf]	δ_d [°]	K_a	Comment
1	1.00	0.00	25.00	0.0	120.00	16.75	0.361	
2	0.50	0.00	34.00	0.0	115.00	22.67	0.254	
3	1.50	0.00	34.00	0.0	115.00	22.67	0.254	
4	0.62	0.00	34.00	0.0	115.00	22.67	0.254	
5	0.38	29.55	34.00	0.0	115.00	34.00	0.634	
6	0.50	29.55	25.00	0.0	120.00	25.00	0.698	
7	0.50	0.00	25.00	0.0	120.00	16.75	0.361	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [ft] End [ft]	σ_z [psf]	σ_w [psf]	Pressure [psf]	Hor. comp. [psf]	Vert. comp. [psf]
1	0.00	0.0	0.0	0.0	0.0	0.0
	1.00	120.0	0.0	43.3	41.4	12.5
2	1.00	120.0	0.0	30.5	28.2	11.8
	1.50	177.5	0.0	45.1	41.6	17.4
3	1.50	177.5	0.0	45.1	41.6	17.4
	3.00	350.0	0.0	89.0	82.1	34.3
4	3.00	350.0	0.0	89.0	82.1	34.3
	3.62	421.1	0.0	107.1	98.8	41.3
5	3.62	421.1	0.0	266.9	118.9	238.9
	4.00	465.0	0.0	294.7	131.3	263.9
6	4.00	465.0	0.0	324.5	188.2	264.3
	4.50	525.0	0.0	366.4	212.5	298.5
7	4.50	525.0	0.0	189.4	181.3	54.6
	5.00	585.0	0.0	211.0	202.1	60.8



Pressure profile due to surcharge - Incidental

Point No.	Depth [ft]	Hor. comp. [psf]	Vert. comp. [psf]
1	0.00	17.3	5.2
2	1.00	17.3	5.2
3	1.00	11.7	4.9
4	1.50	11.7	4.9
5	1.50	0.0	0.0
6	1.50	0.0	0.0
7	1.50	11.7	4.9
8	3.00	11.7	4.9
9	3.00	0.0	0.0
10	3.00	0.0	0.0
11	3.00	11.7	4.9
12	3.62	11.7	4.9
13	3.62	14.1	28.4
14	4.00	14.1	28.4
15	4.00	20.2	28.4
16	4.50	20.2	28.4
17	4.50	17.3	5.2
18	5.00	17.3	5.2

Forces acting on construction

Name	F _{hor} [lbf/ft]	App.Pt. z [ft]	F _{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.43	1342.5	1.59	1.000
Weight - earth wedge	0.0	-0.79	26.3	2.67	1.000
Active pressure	430.7	-1.51	341.2	2.74	1.000
Incidental	72.1	-2.45	45.7	2.72	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 3260.3$ lbfft/ft

Overturning moment $M_{ovr} = 828.1$ lbfft/ft

Safety factor = 3.94 > 1.50

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 818.69$ lbf/ft

Active horizontal force $H_{act} = 502.84$ lbf/ft

Safety factor = 1.63 > 1.50

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY



Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lb/ft]	Shear Force [lb/ft]	Eccentricity [-]	Stress [psf]
1	201.3	1755.68	502.84	0.038	633.7

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lb/ft]	Shear Force [lb/ft]
1	201.3	1755.68	502.84

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force $e = 0.038$

Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom $\sigma = 633.7$ psf

Bearing capacity of foundation soil $R_d = 2000.0$ psf

Safety factor = 3.16 > 1.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lb/ft]	App.Pt. z [ft]	F_{vert} [lb/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.25	1170.0	1.10	1.000
Active pressure	312.1	-1.45	118.0	2.06	1.000
Incidental	61.1	-2.32	22.5	2.10	1.000

Verification of construction joint above the block No.: 1

Check for overturning stability

Resisting moment $M_{res} = 1576.8$ lbfft/ft

Overturning moment $M_{ovr} = 593.0$ lbfft/ft

Safety factor = 2.66 > 1.50

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 883.91$ lb/ft

Active horizontal force $H_{act} = 373.18$ lb/ft

Safety factor = 2.37 > 1.50

Joint for slip is SATISFACTORY

**S1 STRUCTURAL**

7700 Shawnee Mission Parkway Ste 104

Overland Park, KS 913.735.7006

Maximum pressure on the bottom block = 872.9 psf
Red.Coeff. by offset of top block = 0.00
Average value of pressure on face = 10.4 psf
Shear force transmitted by friction = 589.27 lbf/ft

Bearing capacity against transverse pressure:

Joint bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = 778.80 > 1.50

Transverse pressure check is SATISFACTORY**Joint btw. blocks check:**

Mesh material bear.capacity = 2700.00 lbf/ft

Computed stress-state = 3.47 lbf/ft

Safety factor = 778.80 > 1.50

Joint between blocks is SATISFACTORY