GEORESOURCES
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December 20, 2023

Taco Time Northwest
3401 Lind Avenue Southwest
Renton, Washington 98057

Attn: Robby Tonkin
(206) 499-1360
rtonkin@tacotimenw.com

City of Puyallup
Development & Permitting Services
ISSUED PERMIT
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City of Puyallup
Building
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PRRWF20250009

Calculations required to be provided by the Permittee on site for all Inspections

Retaining Wall Design Letter
Proposed Block Retaining Wall
1115 & 1129 East Main
Puyallup, Washington
PN: 7845100032 & 0420271171
Doc ID: TacoTimeNW.EMainSt.RW

INTRODUCTION

We are pleased to provide this *Retaining Wall Design Letter* for the proposed mechanically stabilized earth (MSE) retaining walls to be constructed using Kelley Blocks or another similar block, as part of the parking lot improvements for the existing Taco Time NW at the above referenced parcel. Our understanding of the project is based on our past work at the site including our most recent *Updated Soils Report* that included subsurface explorations dated February 3, 2023, our review of the *Site Plan* prepared by Azure Green dated December 20, 2023, and our past experience in the area.

We understand that a retaining wall with a maximum total height of 6 feet is being planned to retain a portion of the proposed parking lot and drive through. Based on our understanding of the project the walls will have relatively level backslopes and foreslopes less than 3H:1V. A traffic surcharge of 250 psf is anticipated.

PURPOSE & SCOPE

The purpose of our services was to prepare a retaining wall design for the proposed project. Specifically, our scope of services for this project included the following:

1. Reviewing available geologic data for the site vicinity;
2. Performing retaining wall design calculations using the GEO 5 design software; and,
3. Providing this written *Retaining Wall Design Letter* summarizing our retaining wall calculations.

CONCLUSIONS AND RECOMMENDATIONS

Based on our understanding of the project, it is our opinion that the use of a large block retaining wall (Kelley Block, Ecology blocks, or another approved equivalent) constructed in an MSE configuration is feasible from a geotechnical standpoint. Pertinent conclusions and recommendations are provided below.

Wall Design Inputs

We designed the wall sections using the GEO 5 software for the MSE walls using 2002 AASHTO Allowable Strength Design (ASD) methods. Global stability analyses were not performed as part of our scope of work**.** The proposed MSE walls should be constructed per the block manufacturer's specifications and GeoResources' recommendations contained herein.

Block Information

For the purpose of our design, we assumed a 2-foot tall by 2-foot deep by 4-foot-wide retaining wall block, that weighs approximately 2,000 pounds. Generally, the large block retaining wall units have an interlocking shape cast into the top of the block, that provides sliding resistance from the block below. Kelley blocks in particular are cast with a hollow tube that create a column to allow for grout for a fence or railing post. If a block with different dimensions is chosen, we should be notified and adjust our design letter as needed.

Wall Design Assumptions

Our wall design calculations are for a 6-foot tall and 4-foot tall retaining wall. Both of our designs assume drained conditions, with level back and foreslopes. A 250 psf traffic surcharge was applied to both of our designs because the wall will be supporting a parking lot. A seismic surcharge was not applied to our retaining wall designs because the walls are not taller than 6 feet in height. No other surcharges are anticipated. If the proposed conditions are modified or are not correct, we should be notified and allowed to review our calculations prior to construction of the proposed retaining walls.

We used the soil properties in Table 1, below, based on the soils we have observed in our past work at the site and our experience in the area. We also included typical values for Crushed Surfacing Top Course (CSTC) in accordance with recommended values contained in the 2021 WSDOT *Geotechnical Design Manual* (GDM). Cohesion was not considered in our retaining wall designs.

TABLE 1:
SOIL PROPERTIES FOR WALL DESIGN

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)
Retained Soil (Native Soils)	130	0	30
Leveling Pad (*Crushed Surfacing WSDOT 9-03.9(3)*)	130	0	40

Wall Bearing Surfaces

We assume that the walls will be founded on suitable native soils consisting of undisturbed stiff sandy silt or medium dense sand. If suitable native soils are not encountered, it may be necessary to remove and replace the unsuitable soils with properly compacted structural fill. Passive pressures were not accounted for in our design, but we recommend a minimum toe embedment of at least 8 inches for erosion protection. The walls should be founded on a compacted bearing pad of crushed rock, such as WSDOT Standard Specification 9-03.9(3) "*Crushed Surfacing*", with a minimum thickness of 6 inches, that extends 6 inches in all directions of the bottom block.

MSE Wall Design

We designed the wall sections using the GEO 5 design software using the 2002 AASHTO ASD method. The wall should be constructed using uniform grid lengths of **0.8H** measured from the back of the block, where H is the **TOTAL** height of the wall. A geogrid with a minimum long term design strength of 1,660 plf such as Mirafi Miragrid 3XT should be used. The grid should be placed between each course of blocks and be installed in accordance with the block and grid manufacturer specifications. A typical MSE Wall detail is shown as Figure 1. Our design calculations are provided in Appendix A.

Wall Drainage

Adequate drainage behind retaining structures is imperative. Positive drainage which controls the development of hydrostatic pressure can be accomplished by placing a zone of drainage behind the wall. Typically, we recommend granular drainage material should contain less than 2 percent fines and at least 30 percent retained on the US No. 4 sieve, such as WSDOT Standard Specification 9-03.12(4) "*Gravel Backfill for Drains*", pea gravel, clean crushed rock, or quarry spall backfill.

We also recommend a minimum 4-inch diameter perforated or slotted PVC pipe should be placed in the drainage zone along the base and behind the wall to provide an outlet for accumulated water and direct accumulated water to an appropriate discharge location. The soil drainage zone should extend horizontally at least 12 inches from the back of the wall. The drainage zone should also extend from the base of the wall to within 1 foot of the top of the wall. The soil drainage zone should be compacted to approximately 90 percent of the MDD, as determined in accordance with ASTM D1557. For MSE walls, nonwoven geotextile fabric should be placed between the geogrids and on top of the drainage zone, as shown on Figure 1. Over-compaction of the drainage zone should be avoided as this can lead to excessive lateral pressures on the wall.

Structural Fill

All material placed as fill for the proposed wall should be placed as structural fill. Material placed as structural fill should be free of debris, organic matter, trash, and cobbles greater than 4-inches in diameter. The moisture content of the fill material should be adjusted as necessary for proper compaction.

Materials

The suitability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines (material passing US No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve. During wet weather, we recommend use of well-graded sand and gravel with less than 5 percent (by weight) passing the US No. 200 sieve based on that fraction passing the ¾-inch sieve, such as *Gravel Backfill for Walls* (WSDOT 9-03.12(2)). If prolonged dry weather prevails during the wall construction, higher fines content (up to 10 to 12 percent) may be acceptable.

Placement and Compaction

The appropriate lift thickness will depend on the structural fill characteristics and compaction equipment used, but it is typically limited to 4 to 6 inches for hand operated equipment; thicker lifts may be appropriate for larger equipment. For larger equipment such as a hoe-pac or drum roller, we recommend a maximum loose-lift thickness of 12 inches. Structural fill should be compacted to at least 95 percent of the MDD as determined by the Modified Proctor (ASTM D1557), except for within 12 inches of the back of the wall, as described in the "**Wall Drainage**" section of this report. Additionally, the moisture content should be maintained within 3 percent of the optimum moisture content in accordance with ASTM D1557.

Suitability of On-Site Materials as Fill

During dry weather construction, non-organic on-site soil may be considered for use as structural fill; provided it meets the criteria described above in the "**Structural Fill"** section of this report and can be compacted as recommended. If the soil material is over-optimum in moisture content when excavated, it will be necessary to aerate or dry the soil prior to placement as structural fill. We generally did not observe the site soils to be excessively moist at the time of our subsurface exploration program. However, the soils at the site generally have a high fines content that would produce an unstable mixture during wet weather that may be nearly impossible to compact.

The previously placed fill encountered at shallow depths across the site consist of a mixture of sand, silt, and gravel with significant amounts of man-made debris and organics. These soils are not suitable for reuse as structural fill unless they are screened of the manmade debris and organic materials. The moisture content for the onsite soils for use of structural fill should be maintained within 2 percent of the optimum moisture determined by ASTM D1557.

We recommend that completed graded-areas be restricted from traffic or protected prior to wet weather conditions. The graded areas may be protected by paving, placing asphalt-treated base, a layer of free-draining material such as pit run sand and gravel or clean crushed rock material containing less than 5 percent fines, or some combination of the above.

Additional Services and Construction Observation

We recommend GeoResources be retained to observe the geotechnical aspects of construction, particularly the wall subgrade, fill placement and compaction, and drainage activities, including the wall drainage zone. This observation would allow us to verify the subsurface conditions as they are exposed during construction, determine the suitability of existing soil for re-use as structural fill, and to determine that work is accomplished in accordance with recommendations.

LIMITATIONS

We have prepared this report for use by Taco Time Northwest and other members of the design team for use the design of a portion of this project. The construction recommendations included herein are specific to retaining structures. We relied on subsurface conditions observed in the field during our previous site visit. We have assumed that this information is representative of the subsurface conditions in the wall areas. If the actual conditions observed during construction differ from those assumed for the site, we should be advised at once so that we can review these conditions and reconsider our recommendations, where necessary. If there is a substantial lapse of

time between submission of our report and the start of work at the site, or if conditions have changed because of natural forces or construction operations at or near the site, it is recommended that this report be reviewed to determine the applicability of the conclusions and recommendations.

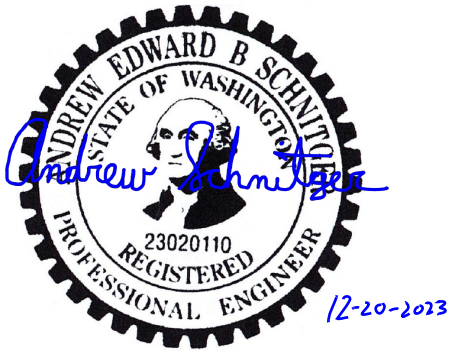
This report may be made available to regulatory agencies or others, but this report and conclusions should not be construed as a warranty of subsurface conditions. Subsurface conditions can vary over short distances and can change with time. The scope of our services did not include environmental assessment or evaluation regarding the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air at the subject site other than those activities described in this report.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No warranty, express or implied, should be understood.

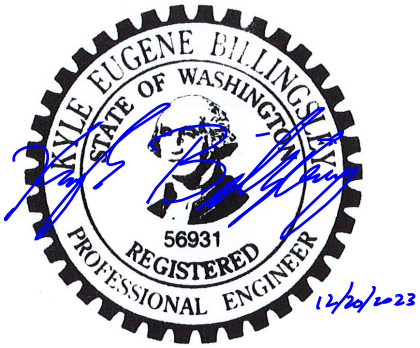
◆ ◆ ◆

We have appreciated working for you on this project. Please do not hesitate to call at your earliest convenience if you have any questions or comments.

Respectfully submitted,
GeoResources, LLC



Andrew Schnitger, PE
Project Engineer



Kyle Billingsley, PE
Senior Geotechnical Engineer

AES:KEB/aes
Doc ID: TacoTimeNW.EMainSt.RW
Attachments: Figure 1: Typical MSE Wall Detail
Appendix A: Retaining Wall Calculations

City of Puyallup
Building
REVIEWED
FOR
COMPLIANCE
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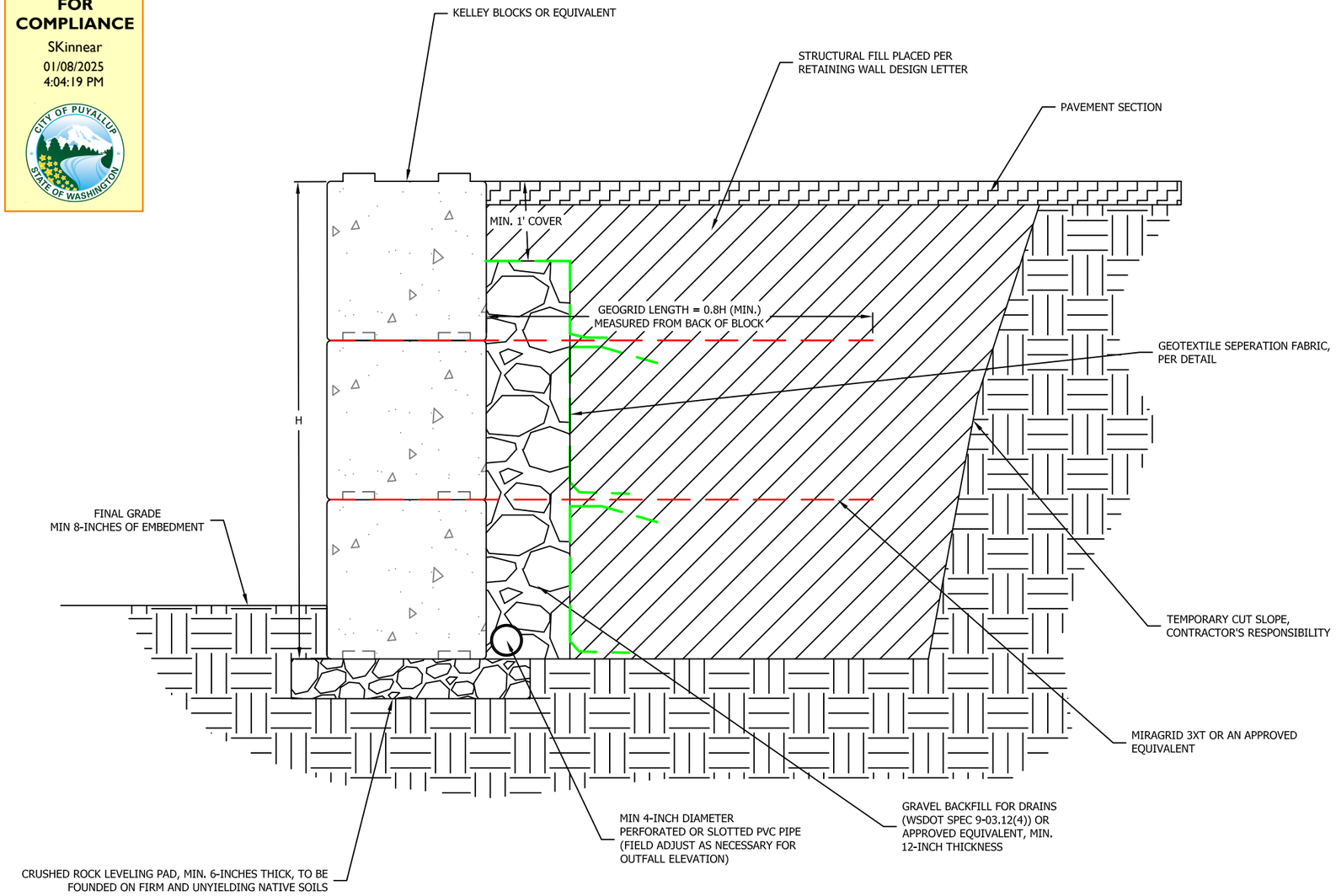
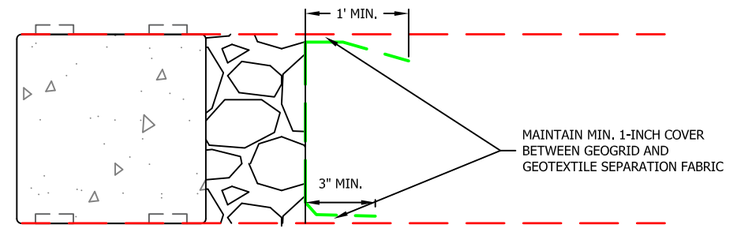
Approval of submitted plans is not an approval of omissions or oversights by this office or non compliance with any applicable regulations of local government. The contractor is responsible for making sure that the building complies with all applicable codes and regulations of the local government.



MAX HEIGHT MSE WALL
(No Scale)



DRAINAGE FABRIC DETAIL
(No Scale)

The approved construction plans, documents, and all engineering must be posted on the job at all inspections in a visible and readily accessible location.

Full sized legible color plans are required to be provided by the permitee on site for inspection.

PRRWF20250009

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Typical MSE Wall Detail
Proposed Block Retaining Wall
1115 & 1129 East Main
Puyallup, Washington
PN: 7845100032 & 0420271171

DocID: TacoTimeNW.EMain.F	December 2023	Figure 1

Appendix A

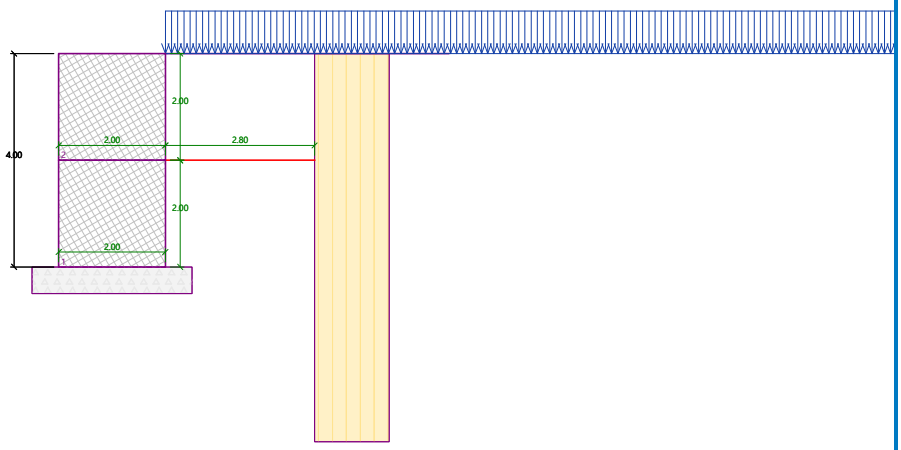
Retaining Wall Calculations

Prefab wall analysis

Input data

Task : 4 ft Retaining Wall
Part : Taco Time NW
Customer : Taco Time Northwest
Author : AES
Date : 12/15/2023
Project ID : TacoTimeNW.EMainSt

Name : TacoTimeNW.EMainSt	Stage - analysis : 1 - 0
Description : 4 ft Tall MSE Wall	



Settings

USA - Safety factor

Materials and standards

Concrete structures : ACI 318-19

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333

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 =	2.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]

Geometry of structure

Slope of wall = 0.00 °

No.	Width b [ft]	Height h [ft]	Offset k [ft]	Offs.(L) o_1 [ft]	Offs.(R) o_2 [ft]	Merge	Self w. [pcf]	Friction [–]	Cohesion [psf]	Shear bear.cap. [lbf/ft] R_s	F_{max}
2	2.00	2.00	0.00	0.00	0.00	No	125.00	0.533	0.0	100.00	-
1	2.00	2.00	-	0.00	0.00	-	125.00	-	-	-	-

No.	Reinforcement	Length l [ft]	Strength R_t [lbf/ft]	Coefficient C [–]	Anchor. l. l_k [ft]	Bear.cap. T_p [lbf/ft^2]	Slip coeff. C_{ds} [–]
2	No	-	-	-	-	-	-
1	Yes	2.80	1660.00	0.80	-	-	0.80

Note: Blocks are ordered from bottom to the top

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Retained Soil		30.00	0.0	130.00	77.50	20.10
2	Leveling Pad		40.00	0.0	130.00	77.50	26.80

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Retained Soil

Unit weight : γ = 130.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.10 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 140.0 pcf

Leveling Pad

Unit weight : γ = 130.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.80 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 140.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Foundation

Type of foundation : strip foundation
Soil of foundation - Leveling Pad

Geometry

Foundation thickness h = 0.50 ft

Offset left b_l = 0.50 ft
Offset right b_p = 0.50 ft

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		permanent	250.00		0.00	20.00	on terrain

No.	Name
1	Traffic Surcharge

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Global settings

Settings of the stage of construction

Design situation : permanent
The wall is free to move. Active earth pressure is therefore assumed.
Reduction of soil/soil friction angle : do not reduce

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	-2.00	1000.0	1.00	1.000
Active pressure	290.3	-1.33	106.2	2.00	1.000
Traffic Surcharge	277.3	-1.99	101.5	2.00	1.000
Reinforcement	-348.1	-2.00	0.0	3.35	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 2111.6 lbfft/ft
Overturning moment M_{ovr} = 937.8 lbfft/ft

Safety factor = 2.25 > 1.50
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1361.49 lbf/ft
Active horizontal force H_{act} = 567.64 lbf/ft

Safety factor = 2.40 > 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	33.9	1207.73	219.55	0.014	621.3

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	33.9	1207.73	219.55

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force $e = 0.014$
Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom $\sigma = 621.3$ psf
Bearing capacity of foundation soil $R_d = 2500.0$ psf

Safety factor = 4.02 > 2.00
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} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.00	500.0	1.00	1.000
Active pressure	72.6	-0.67	26.6	2.00	1.000
Traffic Surcharge	137.7	-0.99	50.4	2.00	1.000

Verification of the most stressed construction joint - above the block No. 1

Check for overturning stability
Resisting moment $M_{res} = 653.9$ lbfft/ft
Overturning moment $M_{ovr} = 184.1$ lbfft/ft

Safety factor = 3.55 > 1.50
Joint for overturning stability is SATISFACTORY

Eccentricity verification
Max. eccentricity of normal force $e = 0.093$
Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Check for slip
Resisting horizontal force $H_{res} = 407.51$ lbf/ft
Active horizontal force $H_{act} = 210.25$ lbf/ft

Safety factor = 1.94 > 1.50

Joint for slip is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.00	500.0	-1.00	1.000
Active pressure	66.8	-0.67	38.6	2.80	1.000
Traffic Surcharge	126.9	-0.99	73.3	2.80	1.000
Weight - reinforced soil	0.0	-1.00	727.6	1.40	1.000
Traffic Surcharge	0.0	-2.00	700.0	1.40	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface	=	90.00	°
Overall normal force acting on reinforcement	=	1539.48	lbf/ft
Coefficient of reduction of slip along geo-textile	=	0.80	
Resistance along geo-reinforcement	=	711.06	lbf/ft
Wall resistance	=	266.50	lbf/ft
Overall bearing capacity of reinforcements	=	0.00	lbf/ft

Check for slip:

Resisting horizontal force H_{res} = 977.56 lbf/ft
Active horiz. force H_{act} = 193.73 lbf/ft

Factor of safety = 5.05 > 1.50

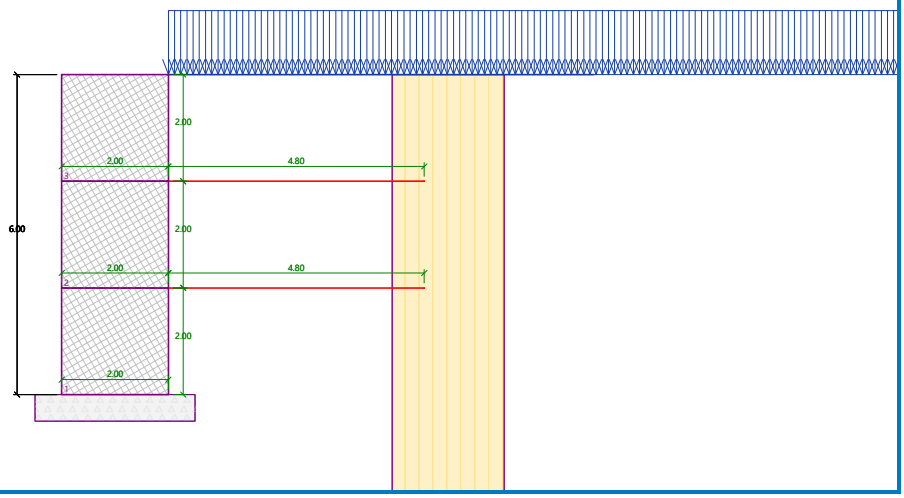
Slip along geotextile is SATISFACTORY

Prefab wall analysis

Input data

Task : 6 ft Retaining Wall
Part : Taco Time NW
Customer : Taco Time Northwest
Author : AES
Date : 12/15/2023
Project ID : TacoTimeNW.EMainSt

Name : TacoTimeNW.EMainSt	Stage - analysis : 1 - 0
Description : 6 ft Tall MSE Wall	



Settings

USA - Safety factor

Materials and standards

Concrete structures : ACI 318-19

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333

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 =	2.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]

Geometry of structure

Slope of wall = 0.00 °

No.	Width b [ft]	Height h [ft]	Offset k [ft]	Offs.(L) o_1 [ft]	Offs.(R) o_2 [ft]	Merge	Self w. [pcf]	Friction [–]	Cohesion [psf]	Shear bear.cap. [lbf/ft] R_s	F_{max}
3	2.00	2.00	0.00	0.00	0.00	No	125.00	0.533	0.0	100.00	-
2	2.00	2.00	0.00	0.00	0.00	No	125.00	0.533	0.0	100.00	-
1	2.00	2.00	-	0.00	0.00	-	125.00	-	-	-	-

No.	Reinforcement	Length l [ft]	Strength R_t [lbf/ft]	Coefficient C [–]	Anchor. l. l_k [ft]	Bear.cap. T_p [lbf/ft^2]	Slip coeff. C_{ds} [–]
3	No	-	-	-	-	-	-
2	Yes	4.80	1660.00	0.80	-	-	0.80
1	Yes	4.80	1660.00	0.80	-	-	0.80

Note: Blocks are ordered from bottom to the top

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Retained Soil		30.00	0.0	130.00	77.50	20.10
2	Leveling Pad		40.00	0.0	130.00	77.50	26.80

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Retained Soil

Unit weight : γ = 130.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.10 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 140.0 pcf

Leveling Pad

Unit weight : γ = 130.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.80 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 140.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Foundation

Type of foundation : strip foundation
Soil of foundation - Leveling Pad

Geometry

Foundation thickness $h = 0.50$ ft
Offset left $b_l = 0.50$ ft
Offset right $b_p = 0.50$ ft

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft^2]	Mag.2 [lbf/ft^2]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		permanent	250.00		0.00	20.00	on terrain

No.	Name
1	Traffic Surcharge

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Global settings

Settings of the stage of construction

Design situation : permanent
The wall is free to move. Active earth pressure is therefore assumed.
Reduction of soil/soil friction angle : do not reduce

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	-3.00	1500.0	1.00	1.000
Active pressure	653.2	-2.00	239.0	2.00	1.000
Traffic Surcharge	416.9	-2.99	152.6	2.00	1.000
Reinforcement	-1656.9	-2.00	0.0	3.35	1.000
Reinforcement	-504.0	-4.00	0.0	4.70	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 7613.2$ lbfft/ft
Overturning moment $M_{ovr} = 2551.4$ lbfft/ft

Safety factor = 2.98 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 3748.18$ lbf/ft
Active horizontal force $H_{act} = 1070.14$ lbf/ft

Safety factor = 3.50 > 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	-3170.2	1891.61	-1090.80	0.000	945.8

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-3170.2	1891.61	-1090.80

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force $e = 0.000$
Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom $\sigma = 945.8$ psf
Bearing capacity of foundation soil $R_d = 2500.0$ psf

Safety factor = 2.64 > 2.00
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} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.00	500.0	1.00	1.000
Active pressure	72.6	-0.67	26.6	2.00	1.000
Traffic Surcharge	137.7	-0.99	50.4	2.00	1.000

Verification of the most stressed construction joint - above the block No. 2

Check for overturning stability
Resisting moment $M_{res} = 653.9$ lbfft/ft
Overturning moment $M_{ovr} = 184.1$ lbfft/ft

Safety factor = 3.55 > 1.50
Joint for overturning stability is SATISFACTORY

Eccentricity verification
Max. eccentricity of normal force $e = 0.093$
Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Check for slip
Resisting horizontal force $H_{res} = 407.51$ lbf/ft
Active horizontal force $H_{act} = 210.25$ lbf/ft

Safety factor = 1.94 > 1.50
Joint for slip is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.00	1000.0	-1.00	1.000
Active pressure	267.5	-1.33	154.5	4.80	1.000
Traffic Surcharge	255.6	-1.99	147.6	4.80	1.000
Weight - reinforced soil	0.0	-2.00	2495.4	2.40	1.000
Traffic Surcharge	0.0	-4.00	1200.0	2.40	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface	=	90.00	°
Overall normal force acting on reinforcement	=	3997.41	lbf/ft
Coefficient of reduction of slip along geo-textile	=	0.80	
Resistance along geo-reinforcement	=	1846.33	lbf/ft
Wall resistance	=	533.00	lbf/ft
Overall bearing capacity of reinforcements	=	0.00	lbf/ft

Check for slip:
Resisting horizontal force H_{res} = 2379.33 lbf/ft
Active horiz. force H_{act} = 523.14 lbf/ft

Factor of safety = 4.55 > 1.50
Slip along geotextile is SATISFACTORY