GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

November 20, 2024

JN 23150

Tammy Cui
8636 North Mercer Way
Mercer Island, Washington 98040
via email: tmsliu3@gmail.com

Subject: **Geotechnical and Critical Areas Report**
Proposed Landscape Improvements
8636 North Mercer Way
Mercer Island, Washington

Greetings:

This report presents our geotechnical engineering report related to the landscape improvements that have been constructed on the southern portion of your property. The scope of our services consisted of assessing the site surface and subsurface conditions, and then developing this summary report.

Based on our discussions with your project team, a permit is being applied for to address the gazebo, pavers, and terraced modular block walls that have been constructed to the south of the existing detached garage/dwelling unit. We previously prepared a report entitled *Assessment of Recently-Constructed Modular Block Walls* dated June 5, 2023. A copy of that report is attached as a part of this geotechnical report.

The City of Mercer Island GIS maps your entire lot as lying within a Potential Landslide Hazard and a Seismic Hazard, and all but the south portion of the property is mapped as an Erosion Hazard. There are no steep slopes mapped on, or around, your property. We reviewed the *Mercer Island Landslide Hazard Assessment* (Troos(t) and Wisher, 2009). Our firm has also been conducting geotechnical studies on Mercer Island since 1986 and is very familiar with the site and surrounding area. There have been documented historic landslides on properties two to four lots to the east of the site. We have reviewed the geotechnical reports for the previous development of those properties. Two of those studies were actually completed by our firm in 1989 and 1994. While the explorations on those lots encountered near-surface loose or disturbed soils, there were no indications of deep-seated instability. Larger slope failures have been documented on the south side of Interstate 90 during the deep excavations needed for its construction. The cuts for construction of the freeway were initially attempted without adequate shoring, resulting in the failures of the temporary oversteepened cuts. No large-scale or deep-seated slides have been documented on the north side of Interstate 90, including the site and surrounding lots.

According to King County Assessor's records, the existing residence and detached garage/accessory dwelling unit were constructed in 2012. We have reviewed the geotechnical report completed in 2010 by GeoSpectrum Consultants for the redevelopment of the property with this current home and detached structure. They noted that they saw no signs of recent slope instability on the property. Settlement of uncompacted fill that had been placed for a parking area on the south portion of the site was noted. This filled parking area has since been removed to construct the detached garage/dwelling unit. A boring was completed by GeoSpectrum in the footprint of the detached building, immediately to the north of the recently-constructed landscape

improvements. This boring found approximately 5 feet of loose soil, which is at least partially old fill, overlying stiff to very stiff silt. The stiff to very stiff silt is commonly encountered on nearby properties, upslope of the lake shore.

During our recent site visits, we assessed the soil conditions in the area of the recent landscape improvements by conducting shallow, hand-excavated test holes. We discussed the results of these explorations in our June 5, 2023 report. The test holes conducted behind the stepped modular block walls found loose, variable backfill soils. Stiff, native silt was encountered at the base of both the lower and middle of the modular walls. The uppermost wall, which is only approximately 2 feet in height, was constructed on the variable backfill of the middle wall. No seepage was encountered in the test holes. It is not uncommon to find at least isolated zones of subsurface water perched on top of the native silt following extended wet weather.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

Based on our observations, and available information about the subsurface conditions in the area, it is our opinion that the recently-constructed landscape improvements on the south end of the property have not adversely impacted the stability or the erosion potential of the site or the neighboring lots. However, the following geotechnical improvements will be necessary:

1. The stepped modular block landscape walls will need to be rebuilt using imported structural fill that is reinforced with geogrids. This work is addressed in our June 5, 2023 report. The reconstruction of the walls should be observed by the geotechnical engineer of record.
2. The gazebo foundations, which are to be reconstructed, should be excavated to suitable native bearing soils verified by the project geotechnical engineer.

Potential Landslide Hazard Areas: The slopes on and around the site are gentle to moderate. They are not susceptible to instability under static or seismic conditions. The stiff to very stiff, glacially-compressed silt soils that underlie the area of the landscape improvements are not prone to strength loss during an earthquake.

The excavations for the removal/replacement of the modular block walls and the reconstruction of the gazebo's foundations will occur within the site boundaries and will not increase the landslide potential.

It is our opinion that no buffers or setbacks are required for the reconstruction of the modular block walls or the gazebo's foundations, provided the recommendations presented in this report are followed. The recommendations presented in the report are intended to prevent adverse impacts to the stability of the site and the neighboring properties, and to avoid the landscape improvements from being damaged by slope movement. The excavations for the wall reconstruction and new gazebo footings will be shallow, and will not increase the potential for instability on neighboring properties.

Seismic Hazard: In accordance with the International Building Code (IBC) the site class within 100 feet of the ground surface is best represented by Site Class D (stiff soil).

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The glacially-compressed soils beneath the site that will support the modular walls and gazebo foundations are not susceptible to seismic liquefaction under the ground motions of the MCE because of their compact nature and high internal strength.

<u>The development area is not a Seismic Hazard.</u>

Erosion Hazard Areas: The site meets the City of Mercer Island's criteria for an Erosion Hazard Area. However, the erosion potential related to this project is low, due to the limited ground disturbance anticipated. The temporary erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered during the site work. One of the most important considerations, particularly during wet weather, is to immediately cover any bare soil areas to prevent accumulated water or runoff from the work area from becoming silty in the first place. A straw wattle or wire-backed silt fence should be erected as close as possible to the planned work areas, and the existing vegetation around the work area should be left in place. Soil stockpiles should be minimized. Tracking of soil and mud onto the driveway and surrounding streets must be prevented. Following rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface.

We provide the following "statement of risk" to satisfy City of Mercer Island conditions:

> "It is our professional opinion that the practices proposed in this report for the new development would render the alteration as safe as if it were not located in a geologic hazard area."

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

CONVENTIONAL FOUNDATIONS

New footings for the gazebo must be excavated to the stiff to very stiff, native silt.

We recommend that continuous and individual spread footings have minimum widths of 12 and 16 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

An allowable bearing pressure of 2,000 pounds per square foot (psf) is appropriate for footings supported on stiff to very stiff native soil. A one-third increase in this design bearing pressure can be used when considering short-term wind or seismic loads. For the above design criteria, it is

anticipated that the total post-construction settlement of footings founded on competent native soil will be less than one inch, with differential settlements on the order of one-quarter-inch in a distance of 25 feet along a continuous footing with a uniform load.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing soil, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level, well-compacted fill. We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.40
Passive Earth Pressure	300 pcf

Where: pcf is Pounds per Cubic Foot, and Passive Earth Pressure is computed using the Equivalent Fluid Density.

LIMITATIONS

This report has been prepared for the exclusive use of Tammy Cui and her representatives, for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

11/20/2024

Marc R. McGinnis, P.E.
Principal

Attachment: June 5, 2023 *Assessment of Recently-Constructed Modular Block Walls*

cc: **Gregerson Custom Homes** – Chris Gregerson
via email: chrisg@gregersoncustomhomes.com

MRM:kg

GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

June 5, 2023

JN 23150

Gregerson Custom Homes
21627 N.E. 133rd Street
Woodinville, Washington 98077

Attention: Chris Gregerson
via email: chrisg@gregersoncustomhomes.com

Subject: **Assessment of Recently-Constructed Modular Block Walls**
Cui Residence
8636 North Mercer Way
Mercer Island, Washington

Greetings:

This geotechnical report presents our observations and conclusions related to the terraced modular blocks walls recently constructed to the south of the existing Cui residence. The undersigned principal engineer visited the site on two different occasions to observe the as-constructed configuration of the walls, and to conduct explorations to assess the soil conditions behind and beneath the walls.

The terraced configuration generally consists of a lower and middle wall that each have a maximum exposed height of 4 feet. These modular block walls are separated by a distance of 3 to 4 feet. In front of the lower wall is a paver patio. Set back behind the middle wall is a short (2-foot) modular block wall, with a paver patio behind this short upper wall.

None of the modular walls was reinforced with geogrids. We assessed the soil conditions and found that the modular walls had been backfilled with a 6-inch width of pea gravel, behind which the backfill consisted of imported topsoil or the on-site silt soils. The soil placed behind the walls was loose. Explorations verified that the base of both the lower and middle walls had been placed on stiff native silt, which is the typical soil condition for the site vicinity. No groundwater seepage was observed in the test holes. However, the backfill soils had an elevated moisture content.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Based on the test holes, the lower and middle modular block walls were constructed on competent native soils. The ground surface around the walls does not slope steeply, and the walls themselves are laterally restrained by the foundations of the existing Cui residence.

Unfortunately, the soils that were used to backfill the modular walls have low compacted strengths and poor drainage characteristics. This, combined with the lack of geogrid reinforcement, makes the long-term stability of the walls questionable. The modular blocks are not sufficiently strong to resist the lateral soil loads that will result from silty, poorly-drained backfill soils.

We have discussed different alternatives for providing long-term stability for the modular block walls. Removal and replacement of the walls with properly engineered and constructed modular walls appears feasible and most appropriate. We have completed a design for such a system, which would involve the removal of the existing walls and poor backfill, followed by reconstruction using the existing modular blocks combined with imported granular backfill and geogrid reinforcement. These reinforced walls will support lateral loads from potential earthquakes, as well as the surcharge caused by both the middle and upper walls.

Attached to this letter is a typical detail for the lower and middle reinforced walls. The short, upper wall does not require geogrid reinforcement.

The existing soil that is removed to construct the new walls should be hauled away from the site.

Reconstruction of the walls, including the placement of the granular backfill and geogrids, should be observed by the geotechnical engineer of record.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site soil profile within 100 feet of the ground surface is best represented by Soil Profile D (Stiff Soil Profile). The site soils that will support the new construction are not susceptible to seismic liquefaction because of their granular nature, dense condition, and absence of near-surface groundwater. This liquefaction assessment is based on the Maximum Considered Earthquake (MCE), which has a return period of once in 2,475 years. According to the USGS, the factored MCE peak ground acceleration is 0.655g.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our site visit. If the subsurface conditions encountered during construction are significantly different from those anticipated, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated soil conditions are commonly encountered on construction sites. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project.

This report has been prepared for the exclusive use of Gregerson Custom Homes, and their representatives, for specific application to this project and site. Our recommendations and conclusions are based on the site materials observed and on previous experience with sites that have similar observed conditions. The conclusions and recommendations are professional opinions derived in accordance with current standards of practice within the limited scope of our services. No warranty is expressed or implied.

Please contact us if you have any questions regarding this report, or if we can be of further service.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

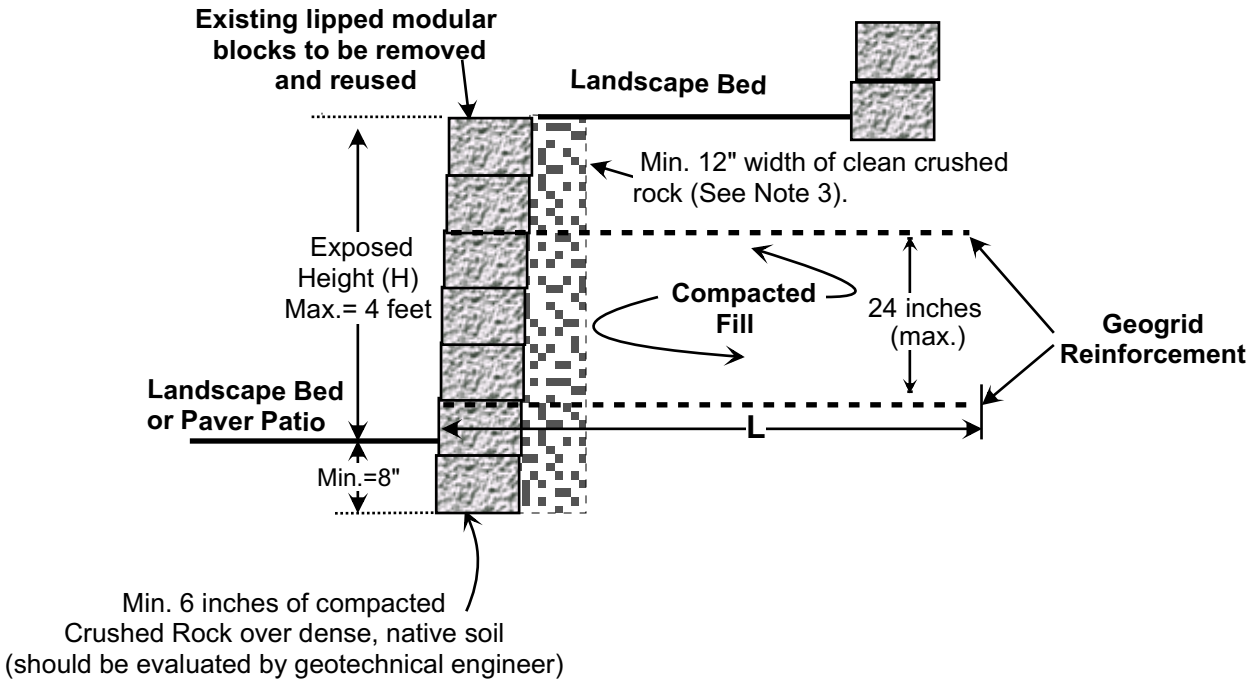
6/5/2023

Marc R. McGinnis, P.E.
Principal

Attachments:

- Modular Block Wall Detail
- Wall Calculations

MRM:kg



Notes:

1. This design for a typical retaining wall condition, and is not intended to support surcharges, such as those from vehicles or structures.

2. Geogrid reinforcement shall be Stratagrid 150, Miragrid 3XT, or equivalent, with a maximum separation of 24 inches between geogrid layers. Based on a 3- to 4-foot exposed height, geogrid reinforcement shall extend behind the block facing a minimum distance of **L** = 6 feet. This geogrid length accounts for the need to excavate approximately 3 feet below existing grade to reach dense, stable soil suitable for bearing.

3. A minimum of 12 inches of washed crushed rock shall be placed between the facing blocks and the Compacted Fill. If a 4-inch diameter perforated drain pipe is buried at the wall base, the perforated drain should connect to a suitable discharge point.

4. Compacted fill shall be free-draining, imported, coarse-grained granular soil, such as Seattle Type 17. A sample of which shall be submitted to the Geotechnical Engineer for approval prior to its use. The on-site soil is unacceptable for use ias Compacted Fill n the geogrid-reinforced zone. The fill shall be compacted in a maximum of 10-inch lifts using a jumping jack..

5. Exposed slopes should be vegetated or hydroseeded following completion to reduce the potential for erosion.

6/5/2023

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GEOGRID-REINFORCED WALL

8636 North Mercer Way
Mercer Island, Washington

Job No:	Date:		Plate:
23150	June 2023		1

Client	Gregerson Custom Homes		
Name	Cui Landscape Walls	Number	23150
Site	8636 North Mercer Way	Designer	M McGinnis
Revision	1	Created	6/4/2023
Modified	6/5/2023		
Standard	Rankine Theory Analysis		

Comments

Lower and Middle Walls Support Surcharge from Wall Above

Note †: Total Facing quantity is based on using full-sized units only on bottom course and an even mix of defined facing sizes, as identified elsewhere in this report, on remaining courses of each Section. The use of corners, tapered or cut units is not reflected in this quantity.

Note ‡: Infill values are calculated based on the average geogrid length in each Section. They do not account for anything beyond the reinforced zone (end of the geogrids). Actual infill values may be significantly higher.

Note Δ: Face drain values do not include the drainage stone within block. Drainage stone within block is calculated based on the percentage hollow core of the wall unit selected. If the percentage hollow core is not defined then the drainage stone within block will not be calculated.

Note ll: Cap area assumes double caps at steps as illustrated in wall elevation when half height caps are utilized. Other capping systems may may result in different quantities

Note: The Toe Slope input is only used to establish the basic embedment depth based on the Design Criteria settings and provide a graphical representation of the toe conditions for export. The Toe Slope input does not account for reduced bearing capacity due to the sloping toe condition or the geometrical considerations of bench construction on embedment and wall height. User must perform separate analysis for bearing and stability on slopes and properly interpret grading for bench construction effects on wall height.

Quantities

Wall	Facing	Wall/Cap Length [ft]	Facing Area [ft²]	Cap Area [ft²]	Total Wall Area [ft²]
Reinforced 54-In	BroadStone 8 in	2	14	1	15
		2	14	1	15

Wall Unit	Reinforced 54-Inch Wall	Wall 1
BroadStone 8 in	11	0

Wall	Leveling Pad [yd³]	Reinforced Fill [yd³]	Drainage Fill [yd³]	Core Fill [yd³]
Reinforced 54-Inch Wall	0	2	0	0
Totals:	**0**	**2**	**0**	**0**

Reinforcements

Wall	SG150 [yd²]
Reinforced 54-Inch Wall	2
Totals:	**2**

MARC R. McGINNIS
STATE OF WASHINGTON
27845
REGISTERED
PROFESSIONAL ENGINEER

6/5/2023

NOTE: THESE CALCULATIONS, QUANTITIES, AND LAYOUTS ARE FOR PRELIMINARY DESIGN ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION WITHOUT REVIEW BY A QUALIFIED ENGINEER

Project: 23150 - Cui Landscape Walls

Site: 8636 North Mercer Way

Date: 6/5/2023

Section Summary Report

Section	#1 at Station 1.00
Report Date	June 05, 2023
Designer	M McGinnis
Design Standard	Rankine Theory Analysis
Design	Static and Seismic
Unit of Measure	U.S./Imperial
Selected Facing Unit	
Product Line:	Keystone Lip/Lug Systems
Name:	BroadStone 8 in
Seismic As 0.44	Default Deflection of 2.00 inch

Soil Parameters

Soil Zone	Phi Angle [degrees]	Cohesion [lb/ft²]	Unit Weight [lb/ft³]	Description
Reinforced	32	n/a	135.00	Imported Compacted Type 17
Retained	28	0.00	120.00	On-site Silt
Foundation	32	100.00	125.00	Native Stiff Silt
Leveling Pad	40	n/a	n/a	
Drainage	n/a	n/a	0.70	

Section Details

Section Height	5.00	Back Slope	0.00°	LL Surcharge	0	DL Surcharge	0
Design Height	4.67 ft	Crest Offset	0.00 ft	LL Offset	0.00 ft	DL Offset	0.00 ft
Embedment	0.17 ft	Wall Batter	1.80°	Toe Slope	0.00°	Toe Offset	0.00 ft

Minimum Factors of Safety

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

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						

Reinforcements

SG150 - StrataGrid 150 **Supplier: Strata Systems - Stratagrid, Fill Type:**

Tult	1,875.00 lb/ft	RFcr	1.65	RFd	1.10	LTDS	939.14 lb/ft
RFid	1.10	Cds	0.70	Ci	0.70		

Connection/Shear Properties

αcs1	1,140.00 lb/ft	IP-1	1,800.00 lb/ft	αcs2	1,457.39 lb/ft	IP-2	6,000.00 lb/ft
αcs max	1,457.39 lb/ft	au	520.00 lb/ft	λu	37.00 lb/ft	Vu(max)	2,781.00 lb/ft

Analysis Results

*** Embedment is included in Bearing Capacity**

External Static	FS			
Bearing Capacity	15.53	Bearing Pressure	690.84	lb/ft²
Overturning	7.12	Max Eccentricity	0.23	ft
Base Sliding	3.36			
Crest Toppling	6.55			
Internal Sliding	6.08			

External Seismic	FS			
Bearing Capacity	11.75	Bearing Pressure	912.73	lb/ft²
Overturning	2.86	Max Eccentricity	0.66	ft
Base Sliding	1.74			
Crest Toppling	3.37			
Internal Sliding	2.88			

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Internal Static Layer	Elevation	Rein	Length	Load	Tensile Resist.	Tensile FS	Pullout Resist.	Pullout FS	Conn. Resist.	Conn. FS
2	3.17	SG150	6.00	109	939	8.65	513	4.73	1,168	10.76
1	1.17	SG150	4.00	326	939	2.88	907	2.78	1,211	3.72

Internal Seismic Layer	Elevation	Rein	Length	Load	Tensile Resist.	Tensile FS	Pullout Resist.	Pullout FS	Conn. Resist.	Conn. FS
2	3.17	SG150	6.00	458	1,550	3.38	513	1.12	1,168	2.55
1	1.17	SG150	4.00	573	1,550	2.71	907	1.58	1,211	2.11

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Project: 23150 - Cui Landscape Walls

Site: 8636 North Mercer Way

Date: 6/5/2023

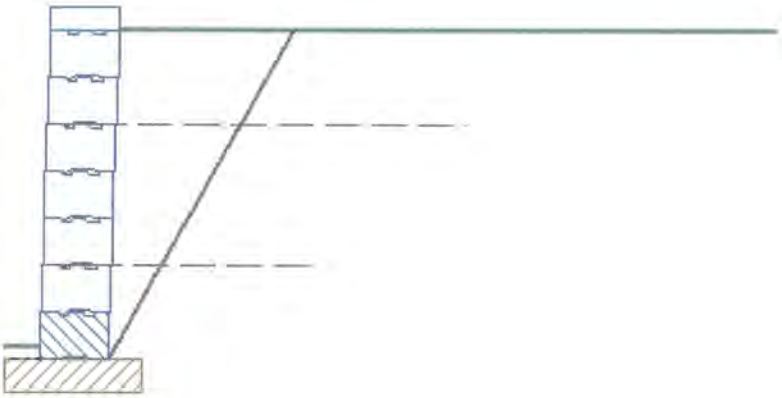
Wall: Reinforced 54-Inch Wall

Project Summary

Note: **The Toe Slope input is only used to establish the basic embedment depth based on the Design Criteria settings and provide a graphical representation of the toe conditions for export. The Toe Slope input does not account for reduced bearing capacity due to the sloping toe condition or the geometrical considerations of bench construction on embedment and wall height. User must perform separate analysis for bearing and stability on slopes and properly interpret grading for bench construction effects on wall height.**

Tallest Section

Section Height 5.00 ft



Project Design Inputs

Selected Reinforcement Types

Reinforcements

SG150 - StrataGrid 150 **Supplier: Strata Systems - Stratagrid, Fill Type:**

Tult	1,875.00 lb/ft	RFcr	1.65	RFd	1.10	LTDS	939.14 lb/ft
RFid	1.10	Cds	0.70	Ci	0.70		

Connection/Shear Properties

αcs1	1,140.00 lb/ft	IP-1	1,800.00 lb/ft	αcs2	1,457.39 lb/ft	IP-2	6,000.00 lb/ft
αcs max	1,457.39 lb/ft	au	520.00 lb/ft	λu	37.00 lb/ft	Vu(max)	2,781.00 lb/ft

Selected Soil Types

Soil Zone	Phi Angle [degrees]	Cohesion [lb/ft²]	Unit Weight [lb/ft³]	Description
Reinforced	32	n/a	135.00	Imported Compacted Type 17
Retained	28	0.00	120.00	On-site Silt
Foundation	32	100.00	125.00	Native Stiff Silt
Leveling Pad	40	n/a	n/a	
Drainage	n/a	n/a	0.70	

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 plasticty
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.

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AND SHOULD NOT BE USED FOR CONSTRUCTION WITHOUT REVIEW BY A QUALIFIED ENGINEER

Analysis Summary

Lowest Values - Reinforced

Static Analysis

Test	Description	Section	Layer/ Course	Minimum Requirement	Result	Status
FSsl	Base Sliding	1		1.50	3.36	Pass
FSbc	Bearing Capacity	1		2.00	15.53	Pass
FSct	Crest Toppling	1	5	1.50	6.55	Pass
FSot	Overturning	1		2.00	7.12	Pass
FSsl	Internal Sliding	1	1	1.50	6.08	Pass
FSpo	Pullout	1	1	1.50	2.78	Pass
FSto	Tensile Overstress	1	1	1.50	2.88	Pass
FScs	Connection Strength	1	1	1.50	3.72	Pass
Rs	Max. Reinforcement Separation	1		0.0000	2.0000	Pass
RsBottom	Max. multiple of Hu at bottom	1		0.0000	2.0000	Pass
RsTop	Max. multiple of Hu at top	1		0.0000	2.0000	Pass
La	Min. Anchorage Length	1		1.0000	2.3028	Pass
L/H Ratio	Min. L/H Ratio	1		0.7000	0.8571	Pass
L	Min. Reinforcement Length	1		4.0000	4.0000	Pass

Seismic Analysis

Test	Description	Section	Layer/ Course	Minimum Requirement	Result	Status
FSsl	Base Sliding	1		1.10	1.74	Pass
FSbc	Bearing Capacity	1		1.50	11.75	Pass
FSct	Crest Toppling	1	5	1.10	3.37	Pass
FSot	Overturning	1		1.50	2.86	Pass
FSsl	Internal Sliding	1	1	1.10	2.88	Pass
FSpo	Pullout	1	2	1.10	1.12	Pass
FSto	Tensile Overstress	1	1	1.10	2.71	Pass
FScs	Connection Strength	1	1	1.10	2.11	Pass

Below Standard Values

Test	Description	Section	Layer/ Course	Minimum Requirement	Result
Hemb	Minimum Embedment %	1		10.0000	3.2000
MinHemb	Minimum Embedment	1		12.0000	1.8031

NOTE: THESE CALCULATIONS, QUANTITIES, AND LAYOUTS ARE FOR PRELIMINARY DESIGN ONLY
AND SHOULD NOT BE USED FOR CONSTRUCTION WITHOUT REVIEW BY A QUALIFIED ENGINEER