BASALITE®
CONCRETE PRODUCTS, LLC

STANDARDIZED ENGINEERING DOUBLE STACK DESIGN GEOWALL MAX

March 15, 2015

Basalite® Concrete Products, LLC

Tel: 800.747.8971 (National)
Tel: 800.350.5866 (California)
www.basalite.com

Table of Contents

1.0
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Disclaimer

THE INFORMATION PRESENTED IN THIS TECHNICAL NOTE (TECH NOTE) IS BASED ON THE FOLLOWING ASSUMPTIONS:

- SOIL CONDITIONS AT THE SITE ARE SIMILAR TO OR STRONGER THAN THE SOIL CONDITIONS REFERENCED IN THIS STANDARDIZED ENGINEERING DESIGN; AND
- **GEOWALL**™ RETAINING WALL CONSTRUCTION IN ACCORDANCE WITH INDUSTRY STANDARDS AND RECOMMENDATIONS FROM THE SUPPLIERS. PLEASE REFER TO THE NATIONAL CONCRETE MASONRY ASSOCIATION (NCMA) DESIGN MANUAL (3RD EDITION) FOR DESIGN RECOMMENDATIONS, INSTALLATION INSTRUCTIONS AND QUALITY ASSURANCE GUIDELINES FOR SRW CONSTRUCTION NOT CONTAINED IN THIS TECH NOTE.

THE INFORMATION PRESENTED IN THIS TECHNICAL NOTE, INCLUDING TECHNICAL AND ENGINEERING DATA, FIGURES, TABLES, DRAWINGS AND PROCEDURES IS PRESENTED FOR GENERAL INFORMATION ONLY. WHILE EVERY EFFORT HAS BEEN MADE TO ENSURE ITS ACCURACY, THIS INFORMATION SHOULD NOT BE USED OR RELIED UPON FOR ANY SPECIFIC APPLICATION WITHOUT THE INDEPENDENT PROFESSIONAL REVIEW AND VERIFICATION OF ITS ACCURACY, SUITABILITY, AND APPLICABILITY FOR YOUR SPECIFIC PROJECT. ANYONE USING THIS MATERIAL ASSUMES ANY AND ALL LIABILITY, OBLIGATIONS AND/OR CONSEQUENCES RESULTING FROM SUCH USE. **BASALITE®** CONCRETE PRODUCTS, LLC, DOES NOT INTEND, AND HEREBY DISCLAIMS, ANY AND ALL EXPRESS, IMPLIED OR STATUTORY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY, ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ANY IMPLIED WARRANTIES OTHERWISE ARISING FROM COURSE OF DEALING OR USAGE OF TRADE, OR FREEDOM FROM INFRINGEMENT OF ANY PATENT, TRADEMARK, OR COPYRIGHT IN REGARD TO THE INFORMATION OR PRODUCTS CONTAINED OR REFERRED TO HEREIN. NOTHING HEREIN CONTAINED SHALL BE AS GRANTING A LICENSE, EXPRESS OR IMPLIED, UNDER ANY PATENTS, TRADEMARKS, COPYRIGHTS OR OTHER INTELLECTUAL PROPERTY.

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ALL THE INFORMATION CONTAINED IN THE FOLLOWING PAGES OF THE TECHNICAL NOTE IS GOVERNED AND LIMITED BY THE FOREGOING.

2.0
Photographs

Subgrade Prepared for Leveling Pad

Initial Course of GeoWall Max on Leveling Pad

Two Courses Installed. Note Rear Pin Position for Installation.

Drain Rock Installed as Blocks are Installed

Cut Application Made Double Stack Economical

Finished Wall

3.0
Specifications

MODULAR CONCRETE RETAINING WALL
GEOWALL MAX SPECIFICATIONS

PART 1: GENERAL

1.01 Description

A. Work shall consist of furnishing and construction of a Geowall Retaining Wall System in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the plans.

B. Work includes preparing foundation soil, furnishing and installing leveling pad, unit drainage fill and backfill to the lines and grades shown on the construction drawings.

C. Work includes furnishing and installing geogrid soil reinforcement of the type, size, location, and lengths designated on the construction drawings.

1.02 Related Sections

A. Section 02100 - Site Preparation
B. Section 02200 - Earthwork

1.03 Reference Documents

A. American Society for Testing and Materials (ASTM)

1. ASTM C-1372 Specification for Segmental Retaining Wall Units
2. ASTM D-422 Particle Size Analysis
3. ASTM D-698 Laboratory Compaction Characteristics of Soil -Standard Effort
4. ASTM D-4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils
5. ASTM D-4595 Tensile Properties of Geotextiles - Wide Width Strip
6. ASTM D-5262 Unconfined Tension Creep Behavior of Geosynthetics
7. ASTM D-3034 Polyvinyl Chloride Pipe (PVC)
8. ASTM D-1248 Corrugated Plastic Pipe

B. Geosynthetic Research Institute (GRI)

1. GRI-GG4 Determination of Long Tern Design Strength of Geogrids
2. GRI-GG5 Determination of Geogrid (soil) Pullout

C. National Concrete Masonry Association (NCMA)

1. NCMA SRWU-1 Test Method for Determining Connection Strength of SRW
2. NCMA SRWU-2 Test Method for Determining Shear Strength of SRW

1.04 Submittals/Certification

A. Contractor shall submit a Manufacturer's certification, prior to start of work, that the retaining wall system components meet the requirements of this specification and the structure design.

1.05 Delivery, Storage and Handling

A. Contractor shall check all materials upon delivery to assure that the proper type, grade, color, and certification have been received.

B. Contractor shall protect all materials from damage due to jobsite conditions and in accordance with manufacturer's recommendations. Damaged materials shall not be incorporated into the work.

PART 2: PRODUCTS

2.01 Definitions

A. Modular Unit - a concrete retaining wall element machine made from Portland cement, water, and aggregates.

B. Structural Geogrid - a structural element formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.

C. Unit Drainage Fill - drainage aggregate which is placed within and immediately behind the modular concrete blocks.

D. Reinforced Backfill - compacted soil placed within the reinforced soil area outlined on the plans.

2.02 Modular Concrete Retaining Wall Units

A. Modular concrete units shall conform to the following architectural requirements:

The Owner may specify face color -concrete gray or tan - standard manufacturers' color.

Face finish - sculptured rock face in angular tri-planer or straight face configuration. Other face finishes will not be allowed without written approval of Owner.

Bond configuration - running with bonds nominally located at midpoint vertically adjacent units, in both straight and curved alignments.

Exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused lighting.

B. Modular concrete materials shall conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units.

C. Modular concrete units shall conform to the following structural and geometric requirements measured in accordance with appropriate references:

Compressive strength = 3000 psi minimum;

Absorption = 8 % maximum (6% in northern states) for standard weight aggregates;

Dimensional tolerances = ± 1/8" from nominal unit dimensions not including rough split face, ±1/16" unit height - top and bottom planes;

Unit size - 8" (H) x 18" (W) x 21½ "(D);

Unit weight - 100-lbs/unit minimum for standard weight aggregates;

Inter-unit shear strength - 1500 plf minimum at 2 psi normal pressure;

Geogrid/unit peak connection strength -1000 plf minimum at 2-psi normal force.

D. Modular concrete units shall conform to the following constructability requirements:

Vertical setback = 1/8"± per course (near vertical) or 1"+ per course per the design;
Alignment and grid positioning mechanism - fiberglass pins, two per unit minimum;
Maximum horizontal gap between erected units shall be - 1/2 inch.

2.03 Shear Connectors

A. Shear connectors shall be 1/2-inch diameter thermoset isopthalic polyester resin-pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units. Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10 degrees F to + 100 degrees F.

B. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

2.04 Base Leveling Pad Material

A. Material shall consist of a compacted crushed stone base, Class 2 AB or non-reinforced concrete as shown on the construction drawings.

2.05 Unit Drainage Fill

A. Unit drainage fill shall consist of clean 1" minus crushed stone, Class 2 Perm or crushed gravel meeting the following gradation tested in accordance with ASTM D-422:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	75-100
No. 4	0 - 10
No. 50	0 - 5

B. One cubic foot, minimum, of drainage fill shall be used for each square foot of wall face. Drainage fill shall be placed within cores of, between, and behind units to meet this requirement.

2.06 Reinforced Backfill

A. Reinforced backfill shall be free of debris and meet the following gradation:

Sieve Size	Percent Passing
2 inch	100-75
3/4 inch	100-75
No. 40	0-60
No. 200	0-35

Plasticity Index (PI) <15 and Liquid Limit <40 per ASTM D-4318.

B. The maximum aggregate size shall be limited to 3/4 inch unless field tests have been performed to evaluate potential strength reductions to the geogrid due to damage during construction.

C. Material can be site-excavated soils where the above requirements can be met. High plastic clays or organic soils shall not be used in the backfill or in the reinforced soil mass.

2.07 Geogrid Soil Reinforcement

A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high-density polyethylene. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 Meg/m and a carboxyl end group values less than 30. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking, and stripping.

B. Ta, Long Term Allowable Tensile Design Load, of the geogrid material shall be determined as follows:

Ta = Tult / (RFcr x RFd x RFid x FS)
Ta shall be evaluated based on a 75-year design life.

1. Tult, Short Term Ultimate Tensile Strength
Tult is based on the minimum average roll values (MARV)

2. RFcr, Reduction Factor for Long Term Tension Creep
RFcr shall be determined from 10,000-hour creep testing performed in accordance with ASTM D5262. Reduction value = 1.60 minimum.

3. RFd, Reduction Factor for Durability
RFd shall be determined from polymer specific durability testing covering the range of expected soil environments. RFd = 1.10 minimum.

4. RFid, Reduction Factor for Installation Damage
RFid shall be determined from product specific construction damage testing performed in accordance with GRI-GG4. Test results shall be provided for each product to be used with project specific or more severe soil type. RFid = 1.10 minimum.

5. FS, Overall Design Factor of Safety
FS shall be 1.5 unless otherwise noted for the maximum allowable working stress calculation.

C. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the "Hinge Height" divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with NCMA SRWU-1 Test Method for Determining Connection Strength of SRW.

D. **Soil Interaction Coefficient, Ci.**
Ci values shall be determined per GRI: GG5 at a maximum 0.75 inch displacement.

E. Manufacturing Quality Control
The geogrid manufacturer shall have a manufacturing quality control program that includes QC testing by an independent laboratory.
The QC testing shall include:
Tensile Strength Testing
Melt Flow Index (HDPE)
Molecular Weight (Polyester)

2.08 Drainage Pipe

A. The drainage pipe shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D-3034 or corrugated HDPE pipe manufactured in accordance with ASTM D-1248.

PART 3 EXECUTION

3.01 Excavation

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Owner's representative shall inspect the excavation and approve prior to placement of leveling material or fill soils. Proof roll foundation area as directed to determine if remedial work is required.

B. Over-excavation and replacement of unsuitable foundation soils and replacement with approved compacted fill will be compensated as agreed upon with the Owner.

3.02 Base Leveling Pad

A. Leveling pad material shall be placed to the lines and grades shown on the construction drawings, to a minimum thickness of 6 inches and extend laterally a minimum of 6" in front and behind the modular wall unit.

B. Soil leveling pad materials shall be compacted to a minimum of 95 % Standard Proctor density per ASTM D-698

C. Leveling pad shall be prepared to insure full contact to the base surface of the concrete units.

3.03 Modular Unit Installation

A. First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated.

B. Place the front of the blocks side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations.

C. Install shear/connecting devices per manufacturer's recommendations.

E. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.

F. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction shall not exceed two courses.

3.04 Structural Geogrid Installation

A. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.

B. Geogrid reinforcement shall be placed at the strengths, lengths, and elevations shown on the construction design drawings or as directed by the Engineer.

C. The geogrid shall be laid horizontally on compacted backfill and attached to the modular wall units. Place the next course of modular concrete units over the geogrid. The geogrid shall be pulled taut and anchored prior to backfill placement on the geogrid.

D. Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level.

3.05 Reinforced Backfill Placement

A. Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid and installation damage.

B. Reinforced backfill shall be placed and compacted in lifts not to exceed 6 inches where hand compaction is used, or 8 - 10 inches where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.

C. Reinforced backfill shall be compacted to at least 90% relative compaction based on ASTM D1557. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be dry of optimum, + 0%, - 3%.

D. Only lightweight hand-operated equipment shall be allowed within 3 feet from the tail the modular concrete units.

E. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

F. Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided.

G. At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

3.06 Cap Installation

A. Cap units shall be glued to underlying units with an all-weather adhesive recommended by the manufacturer.

3.07 As-built Construction Tolerances

A. Vertical alignment: ± 1.5" over any 10' distance.

B. Wall Batter: within 2 degrees of design batter.

C. Horizontal alignment: ± 1.5" over any 10' distance.
Corners, bends, curves ± 1 ft to theoretical location.

D. Maximum horizontal gap between erected units shall be 1/2 inch.

3.08 Field Quality Control

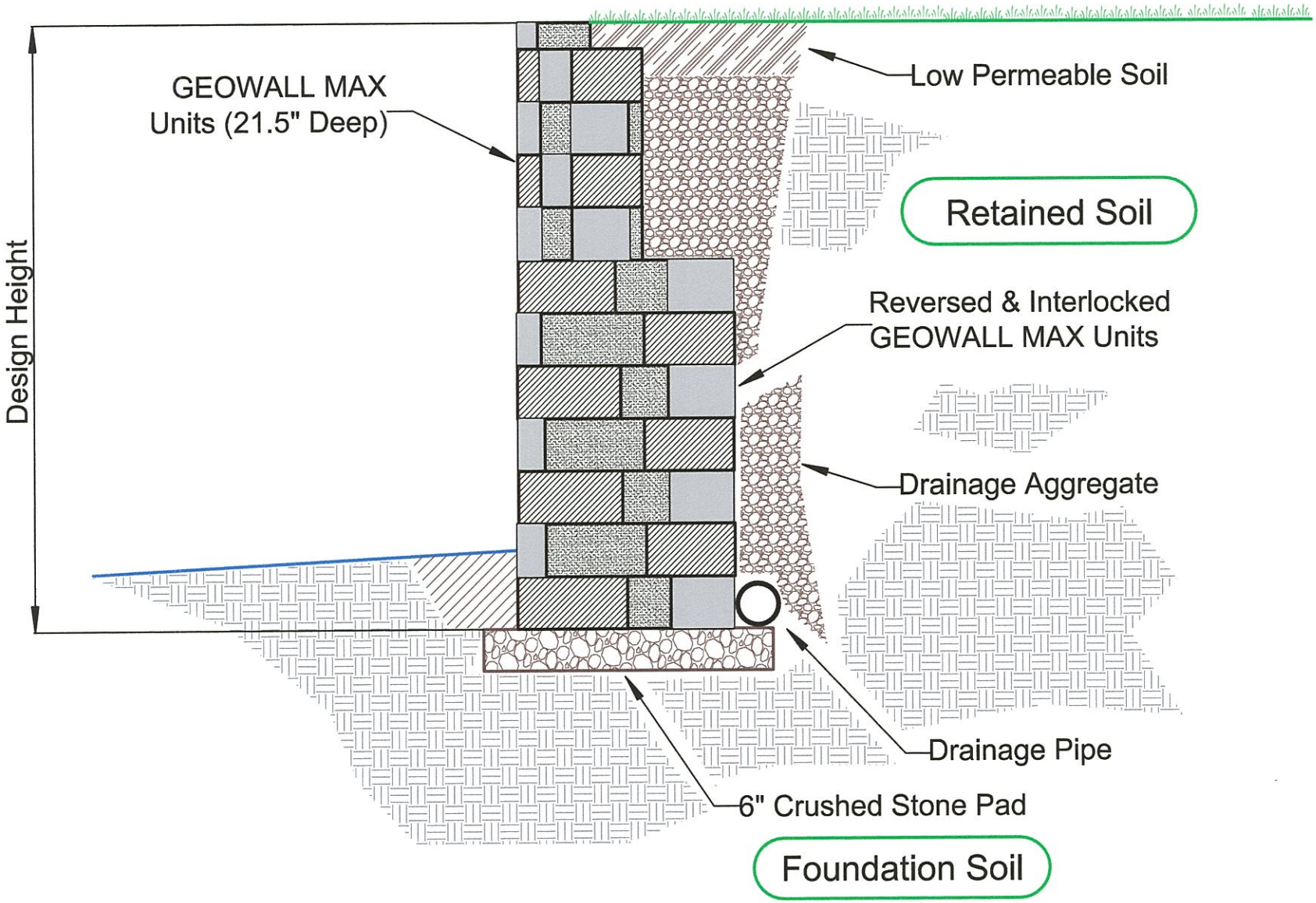
A. Quality Assurance - The Owner shall/may engage inspection and testing services, including independent laboratories, to provide quality assurance and testing services during construction. This does not relieve the Contractor from securing the necessary construction control testing.

B. Quality assurance should include foundation soil inspection. Verification of geotechnical design parameters and verification that the contractor's quality control testing is adequate as a minimum. Quality assurance shall also include observation of construction for general compliance with design drawings and project specifications. The site geotechnical engineer best performs quality assurance.

C. Quality Control – The Contractor shall engage inspection and testing services to perform the minimum quality control testing described in the retaining wall design plans and specifications. Only qualified and experienced technicians and engineers shall perform testing and inspection services.

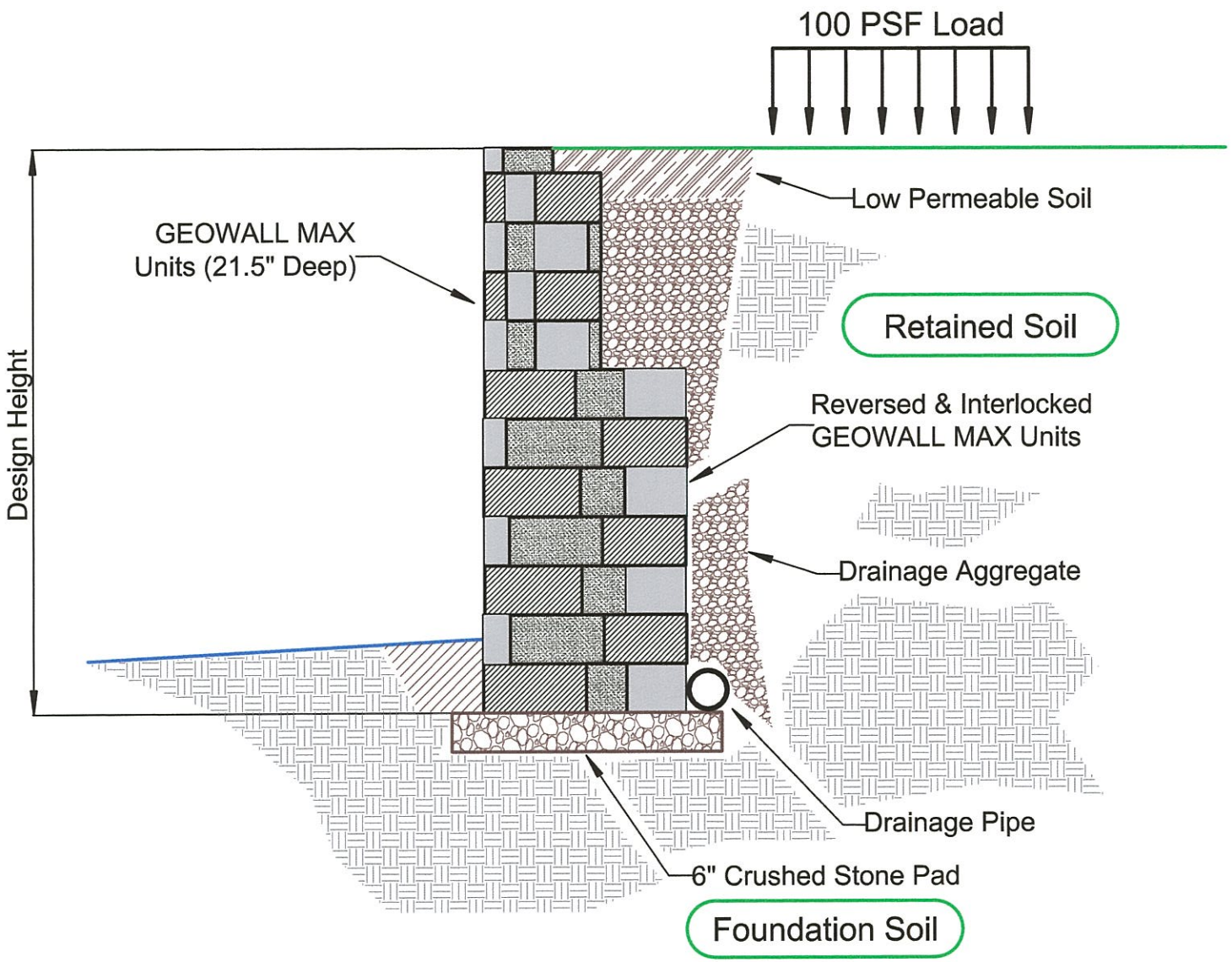
D. Quality control testing shall include soil and backfill testing to verify soil compaction and verification that the retaining wall is being constructed in accordance with the design plans and project specifications.

4.0
Construction Drawings



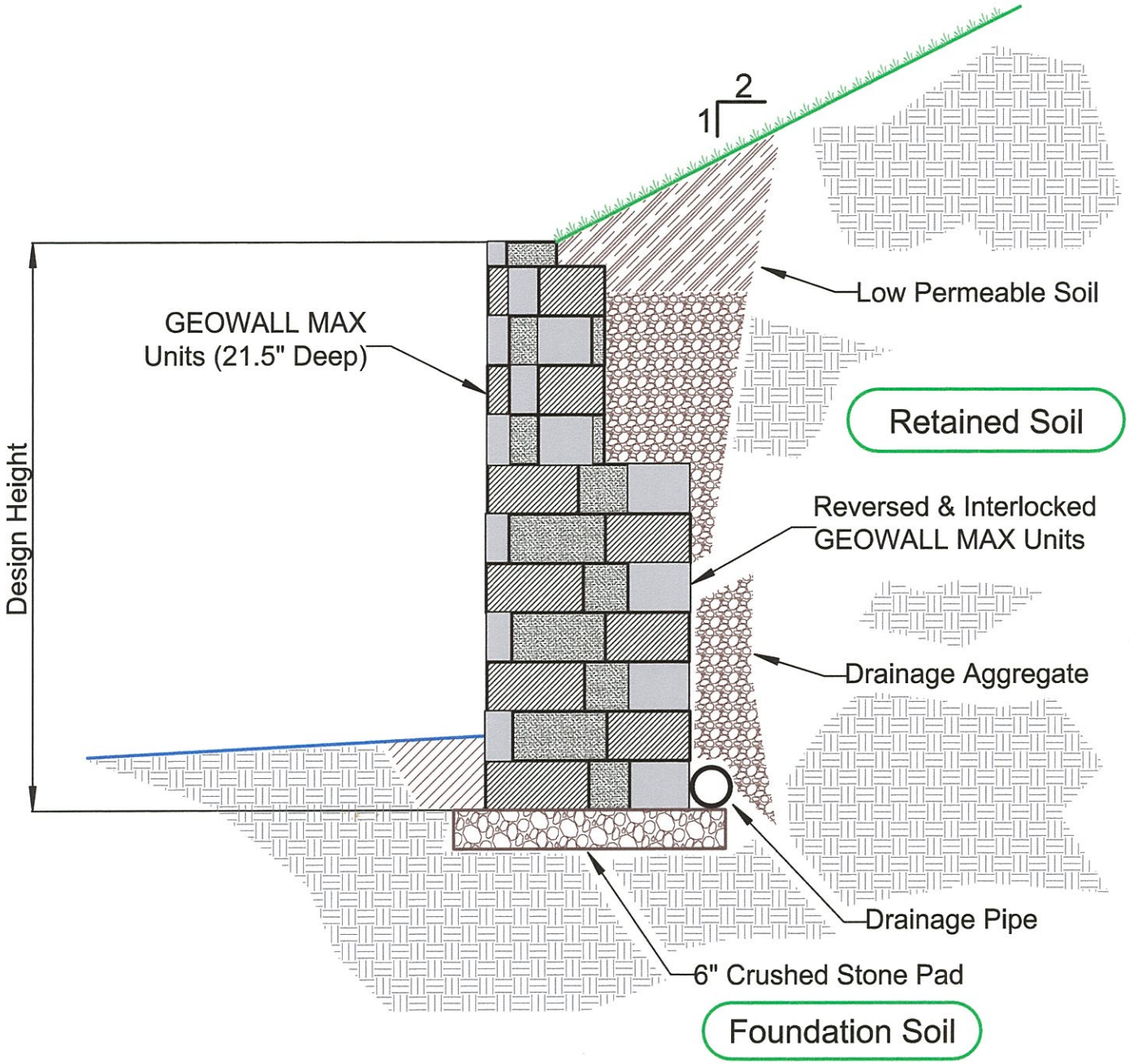
Typical Double Stack Wall Section

GeoWall Max - Near Vertical, Level Top Slope



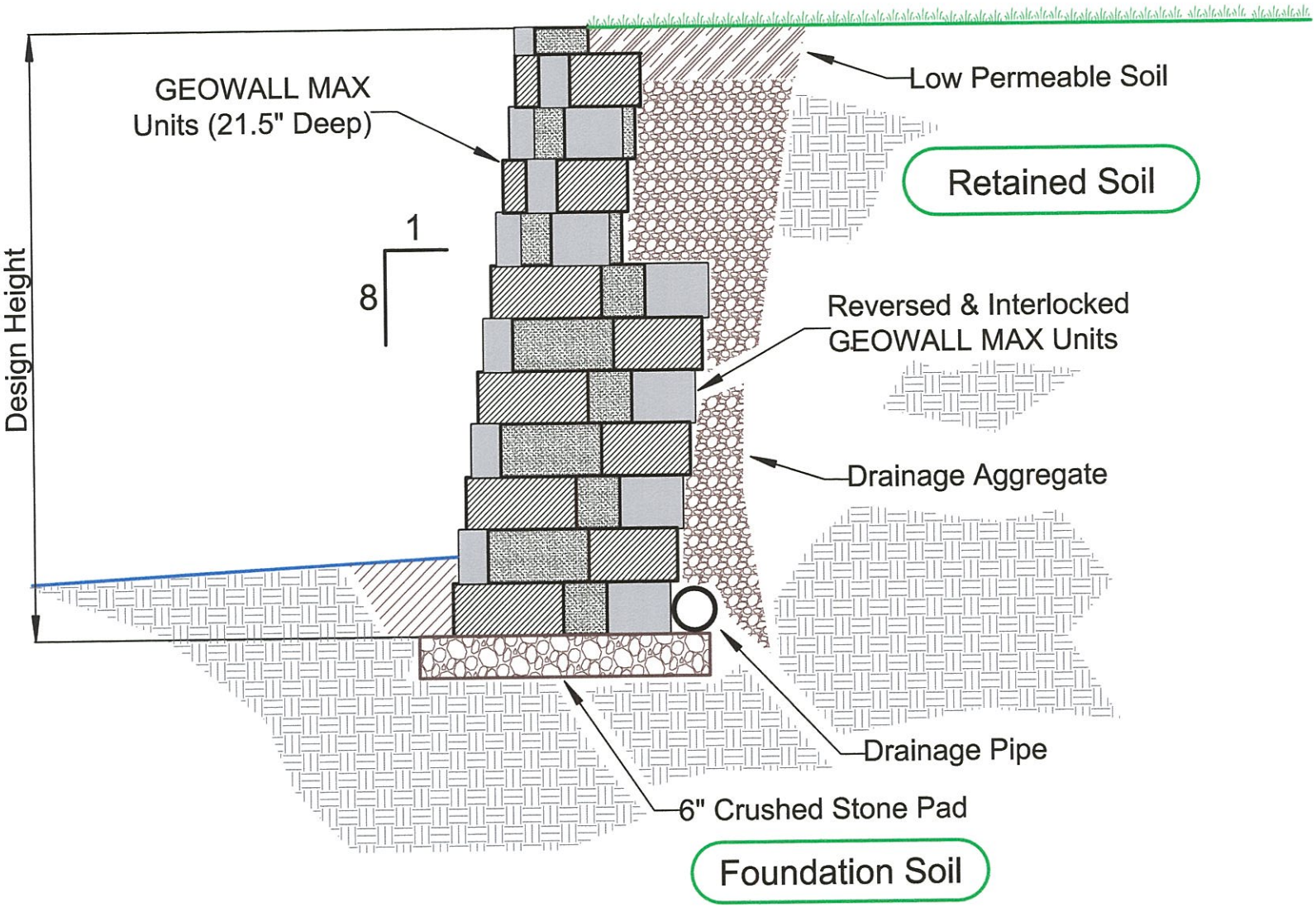
Typical Double Stack Wall Section

GeoWall Max - Near Vertical, Level Backfill with Surcharge



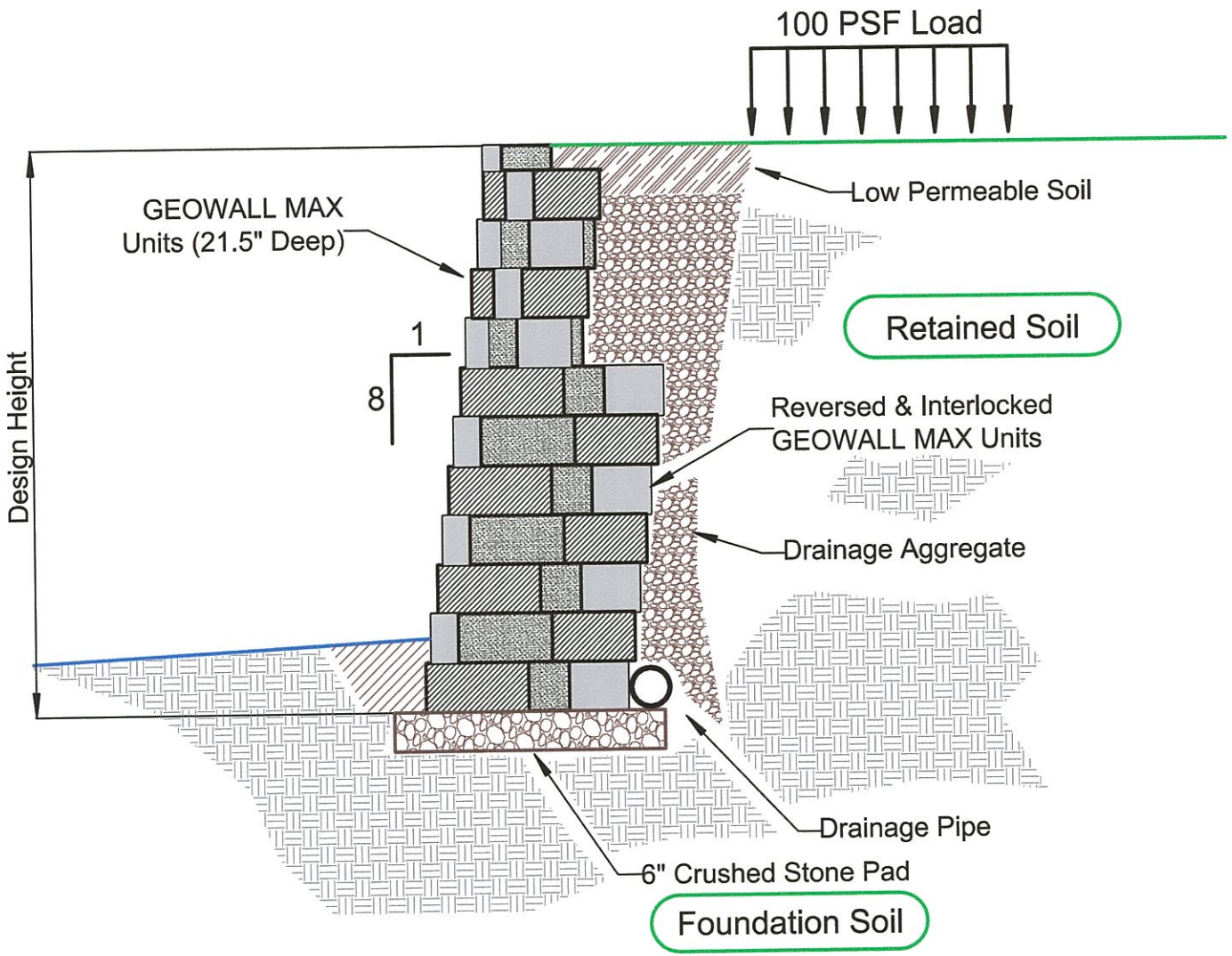
Typical Double Stack Wall Section

GeoWall Max - Near Vertical, 2:1 Top Slope



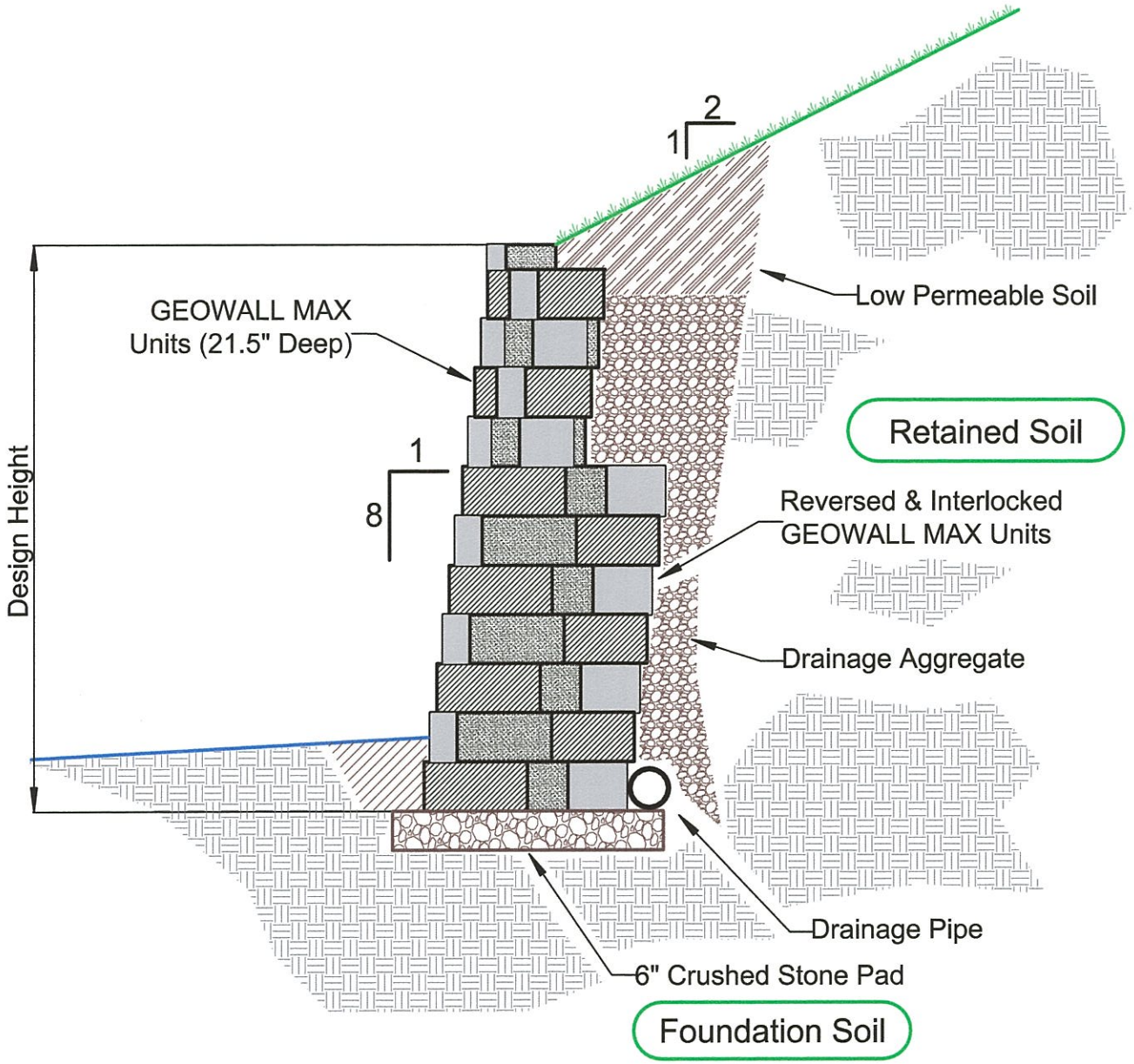
Typical Double Stack Wall Section

GeoWall Max - 1:8 Batter, Level Top Slope



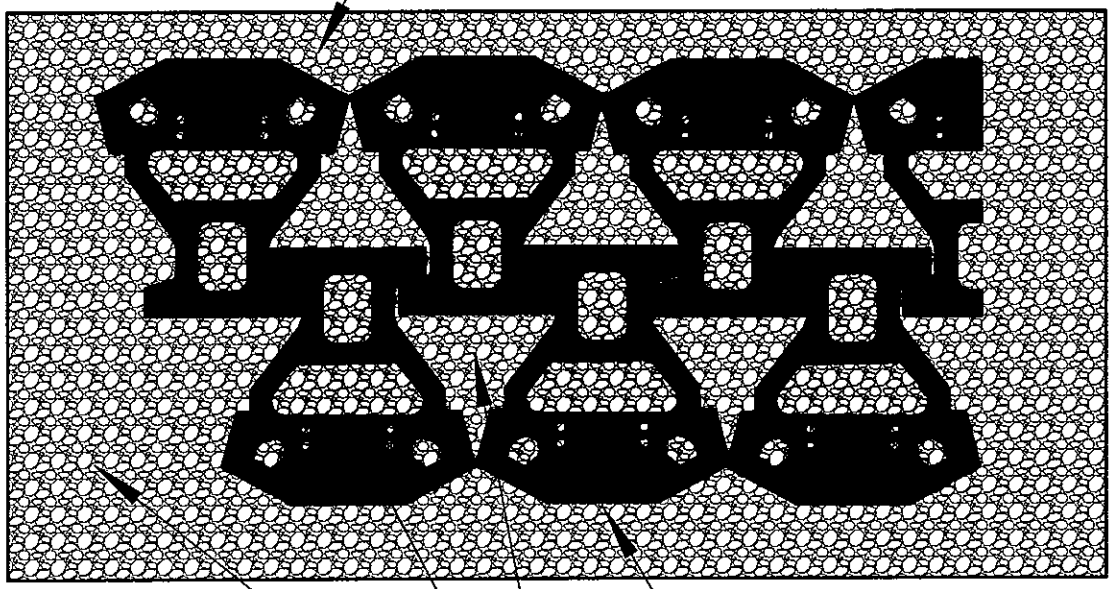
Typical Double Stack Wall Section

GeoWall Max - 1:8 Batter, Level Backfill with Surcharge



Typical Double Stack Wall Section

GeoWall Max - 1:8 Batter, 2:1 Top Slope

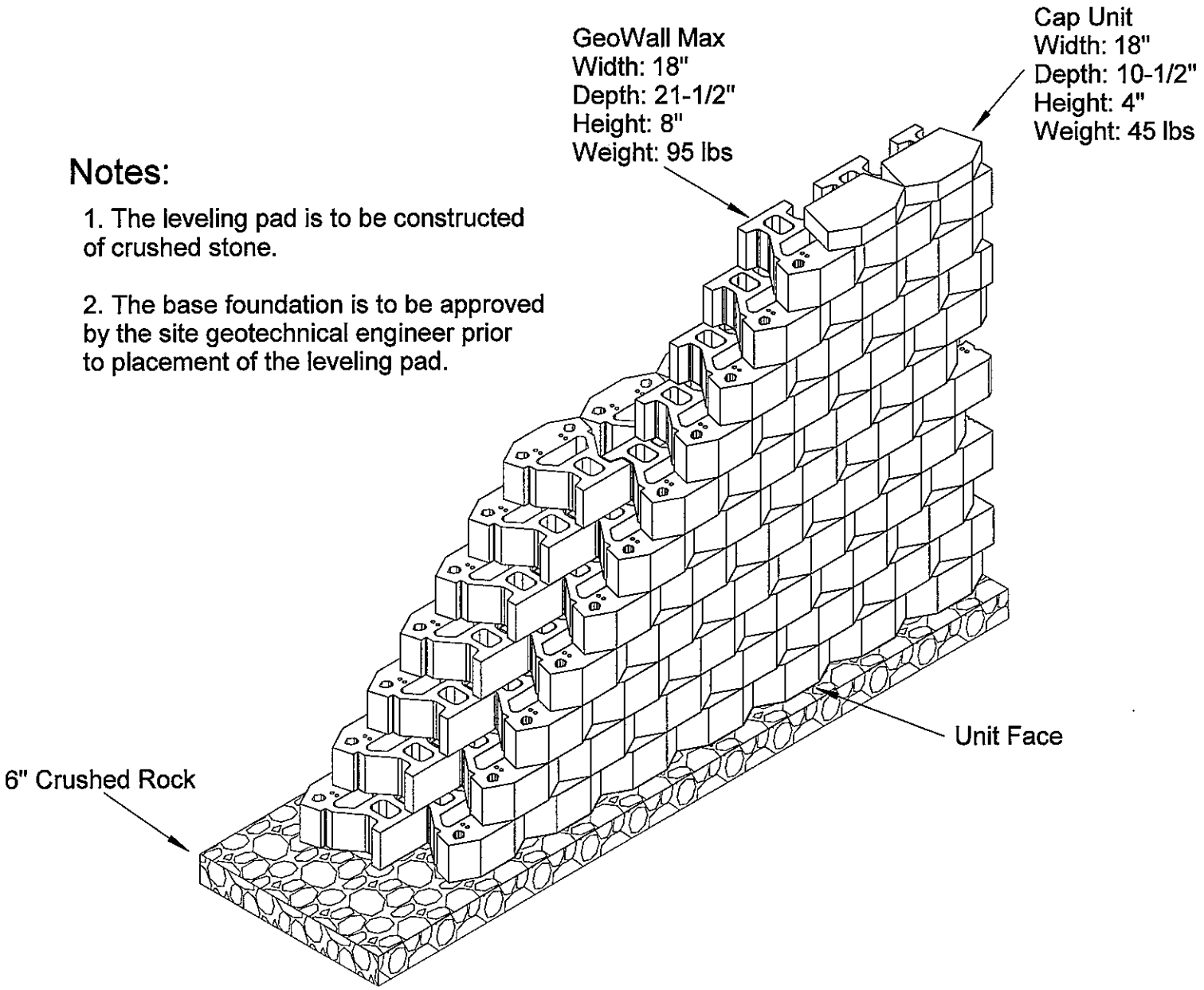


Typical Plan View
Double Stack Wall

Notes:

1. The leveling pad is to be constructed of crushed stone.

2. The base foundation is to be approved by the site geotechnical engineer prior to placement of the leveling pad.



Leveling Pad Isometric Section View

5.0
Retaining Wall Design Calculations

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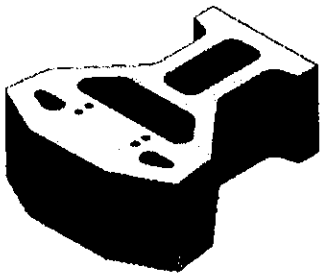
The Standardized Engineering for the Double Stack Configuration is a set of tables and recommendations for the design and construction of larger gravity walls using the GEOWALL Max blocks. The approach described is cost effective when faced with a nearby property line or obstruction prohibiting the use of geogrid reinforcing.

GEOWALL™ Max Unit

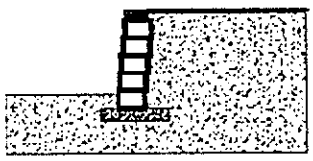
Size:	8" (h) x 18" (w) x 21.5" (d)
Weight:	94 lbs
Face Area:	1.0 sq. ft.
Delivery:	30 units per pallet



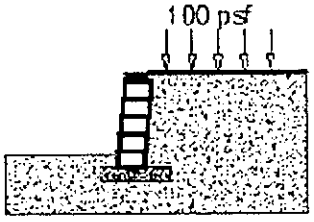
There are numerous combinations of soil conditions, slopes, surcharges that will affect the allowable heights using the double stack configuration. In this document, the following common cases have been analyzed with a near-vertical batter and a 1:8 batter:

- Level – No Surcharge
- Level – 100 psf Surcharge
- 2:1 Top Slope – No Surcharge.

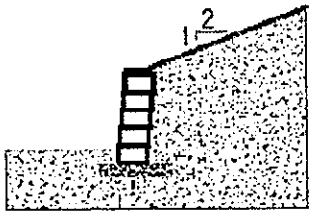
The analysis also evaluates two common soil conditions of a 30° and 32° phi angle. If the conditions encountered in the field vary from the exact conditions outlined, then the analysis is not applicable.



Case A
Level, No Surcharge



Case B
Level, 100 psf Surcharge



Case C
Sloping, No Surcharge

Double Stack Geowall Max Wall

The following presents a summary of the geometry requirements for the design of the interlocking Geowall Max block walls. The configuration requires no geogrid and is considered a gravity wall. The blocks are to be placed "tail to tail" as illustrated in the Typical Double Stack Detail. It should be noted that the wall shall be buried 12-inches (1.5 blocks) below grade. All measurements are in feet. The following 4 cases have been evaluated:

1. Case 1: Near-Vertical Batter and 30°Phi Angle
2. Case 2: Near-Vertical Batter and 32°Phi Angle
3. Case 3: 1:8 Batter and 30°Phi Angle
4. Case 4: 1:8 Batter and 32°Phi Angle

Case 1: Near-Vertical Batter and 30° Phi Angle

LEVEL – No Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
4.33 or less	5.33	0.67
5.0 or less	6.0	2.0
7.0 or less	8.0	7.33

LEVEL – 100 psf Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
3.0 or less	4.0	0.67
5.0 or less	6.0	4.0
5.67 or less	6.67	6.67

2:1 TOP SLOPE – No Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
3.0 or less	4.0	1.33
5.0 or less	6.0	6.0

Notes:

1- The exposed height is the wall height measured from finished grade.
2- The front wall height is the wall height measured from the top of the leveling pad.
3- The back wall height is measured from the top of the leveling pad.

Case 2: Near-Vertical Batter and 32° Phi Angle

LEVEL – No Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
4.33 or less	5.33	0.67
5.0 or less	6.0	2.0
7.0 or less	8.0	6.67

LEVEL – 100 psf Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
3.0 or less	4.0	0.67
5.0 or less	6.0	3.33
6.33 or less	7.33	7.33

2:1 TOP SLOPE – No Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
3.0 or less	4.0	0.67
5.0 or less	6.0	4.67
5.67 or less	6.67	6.67

Notes:

1- The exposed height is the wall height measured from finished grade.
2- The front wall height is the wall height measured from the top of the leveling pad.
3- The back wall height is measured from the top of the leveling pad.

Case 3: 1:8 Batter and 30° Phi Angle

LEVEL – No Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
5.67 or less	6.67	0.67
7.0 or less	8.0	3.33
8.33 or less	9.33	6.67

LEVEL – 100 psf Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
4.33 or less	5.33	0.67
5.0 or less	6.0	1.33
7.0 or less	8.0	5.33
7.67 or less	8.67	8.0

2:1 TOP SLOPE – No Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
3.67 or less	4.67	1.33
5.0 or less	6.0	4.0
5.67 or less	6.67	6.0

Notes:

1- The exposed height is the wall height measured from finished grade.
2- The front wall height is the wall height measured from the top of the leveling pad.
3- The back wall height is measured from the top of the leveling pad.

Case 4: 1:8 Batter and 32° Phi Angle

LEVEL – No Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
6.33 or less	7.33	1.33
7.0 or less	8.0	2.67
9.0 or less	10.0	7.33
9.67 or less	10.67	10.67

LEVEL – 100 psf Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
4.33 or less	5.33	0.67
5.0 or less	6.0	1.33
7.0 or less	8.0	4.67
8.33 or less	9.33	9.33

2:1 TOP SLOPE – No Surcharge

Exposed Wall Ht [1]	Front Wall Ht [2]	Back Wall Ht [3]
3.67 or less	4.67	0.67
5.0 or less	6.0	2.0
6.33 or less	7.33	7.33

Notes:

1- The exposed height is the wall height measured from finished grade.
2- The front wall height is the wall height measured from the top of the leveling pad.
3- The back wall height is measured from the top of the leveling pad.

Interlocking Standard Unit Wall

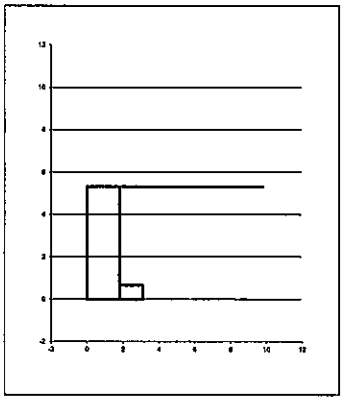
(Coulomb Analysis)

Project No: Case 1 **Wall:** 5.33 Levl **Date:** 3/15/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) **UNIT TYPE** Standard Units Unit Depth = 1.79 ft

2) **BATTER :** 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) **GEOMETRY**

Front Height (feet) : 5.33
Back Height (feet) : 0.67
Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) **RETAINED SOIL PROPERTIES**

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.297	

Driving Earth Pressure, Horiz
Es = 476.2 plf
Eq = 0.0 plf

5) **STATIC EXTERNAL STABILITY ANALYSIS**

Weights & Masses

SF Overturning = **1.51** OK > 1.5 W1= 1144.9 plf
SF Sliding = **1.90** OK > 1.5 W2= 103.7 plf
Bearing Press (psf) = **724** Refer to site soils report
Eccentricity (ft.)= **0.68** Greater than L/6 Sliding Resist - Gravel, 36 deg = 907.2 plf
Sliding Resist - Block/Gravel = 1382.1 plf

6) **SEISMIC EXTERNAL STABILITY ANALYSIS** A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.51** OK > 1.1 Kae = 0.297
SF Sliding = **1.90** OK > 1.1 (75% of 1.5) psi = 2.684
Bearing Press (psf) = **724** Refer to site soils report theta = 0.000
Eccentricity (ft.)= **0.68** OK, less than L/2 Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

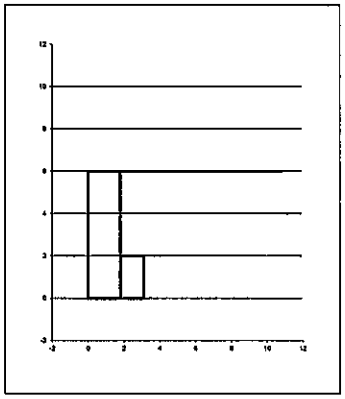
(Coulomb Analysis)

Project No:	**Case 1**	**Wall:**	6' Level	**Date:**	3/4/2015
Project Name:	**Basalite - Double Stack**			**By:**	RSI
Location:	**California**			**FSot:**	1.5
				Units:	English

1) UNIT TYPE Standard Units — Unit Depth = 1.79 ft

2) BATTER : 0 degree — Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6

Back Height (feet) : 2

Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.297	

Driving Earth Pressure, Horiz

Es = 603.5 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning =	**1.58**	OK > 1.5
SF Sliding =	**1.92**	OK > 1.5
Bearing Press (psf) =	**1,018**	Refer to site soils report
Eccentricity (ft.)=	**0.76**	Greater than L/6

Weights & Masses

W1= 1288.8 plf

W2= 309.6 plf

Sliding Resist - Gravel, 36 deg = 1161.3 plf

Sliding Resist - Block/Gravel = 1490.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g — kh = A/2 = 0.000

SF Overturning =	**1.58**	OK > 1.1
SF Sliding =	**1.92**	OK > 1.1 (75% of 1.5)
Bearing Press (psf) =	**1,018**	Refer to site soils report
Eccentricity (ft.)=	**0.76**	OK, less than L/2

Kae = 0.297

psi = 2.684

theta = 0.000

Pae = 0.0 plf

P inertial = 0.0 plf

Interlocking Standard Unit Wall

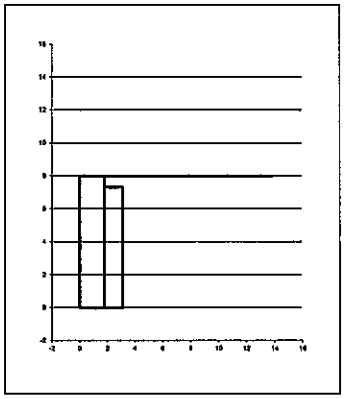
(Coulomb Analysis)

Project No: Case 1 **Wall:** 8' Level **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 8
Back Height (feet) : 7.33
Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.297	

Driving Earth Pressure, Horiz
Es = 1072.8 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.50** OK > 1.5
SF Sliding = **1.75** OK > 1.5
Bearing Press (psf) = **2,655** Refer to site soils report
Eccentricity (ft.)= **1.00** Greater than L/6

Weights & Masses
W1= 1718.4 plf
W2= 1134.7 plf
Sliding Resist - Gravel, 36 deg = 2072.9 plf
Sliding Resist - Block/Gravel = 1879.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.50** OK > 1.1
SF Sliding = **1.75** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **2,655** Refer to site soils report
Eccentricity (ft.)= **1.00** OK, less than L/2

Kae = 0.297
psi = 2.684
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

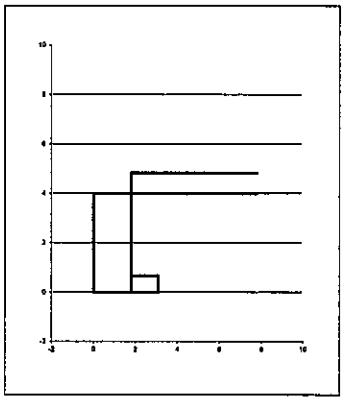
(Coulomb Analysis)

Project No: Case 1 **Wall:** 4' w/ Load **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) **UNIT TYPE** Standard Units Unit Depth = 1.79 ft

2) **BATTER :** 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) **GEOMETRY**

Front Height (feet) : 4
Back Height (feet) : 0.67
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) **RETAINED SOIL PROPERTIES**

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.297	

Driving Earth Pressure, Horiz
Es = 268.2 plf
Eq = 111.8 plf

5) **STATIC EXTERNAL STABILITY ANALYSIS**

SF Overturning = **1.76** OK > 1.5
SF Sliding = **1.84** OK > 1.5
Bearing Press (psf) = **514** Refer to site soils report
Eccentricity (ft.)= **0.60** Greater than L/6

Weights & Masses
W1= 859.2 plf
W2= 103.7 plf
Sliding Resist - Gravel, 36 deg = 699.6 plf
Sliding Resist - Block/Gravel = 1293.5 plf

6) **SEISMIC EXTERNAL STABILITY ANALYSIS** A = 0.00 g

SF Overturning = **2.86** OK > 1.1
SF Sliding = **2.61** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **412** Refer to site soils report
Eccentricity (ft.)= **0.37** OK, less than L/2

kh = A/2 = 0.000
Kae = 0.297
psi = 2.684
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

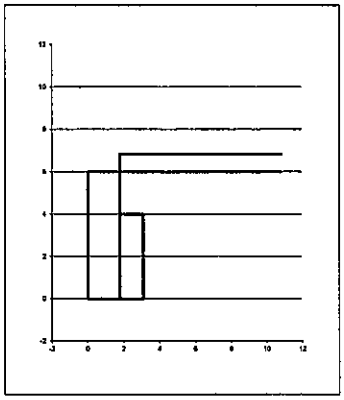
(Coulomb Analysis)

Project No: Case 1 **Wall:** 6' w/ Load **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6
Back Height (feet) : 4
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.297	

Driving Earth Pressure, Horiz
Es = 603.5 plf
Eq = 167.6 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.56** OK > 1.5
SF Sliding = **1.80** OK > 1.5
Bearing Press (psf) = **1,482** Refer to site soils report
Eccentricity (ft.)= **0.90** Greater than L/6

Weights & Masses
W1= 1288.8 plf
W2= 619.2 plf
Sliding Resist - Gravel, 36 deg = 1386.2 plf
Sliding Resist - Block/Gravel = 1586.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.20** OK > 1.1
SF Sliding = **2.30** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,051** Refer to site soils report
Eccentricity (ft.)= **0.63** OK, less than L/2

Kae = 0.297
psi = 2.684
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

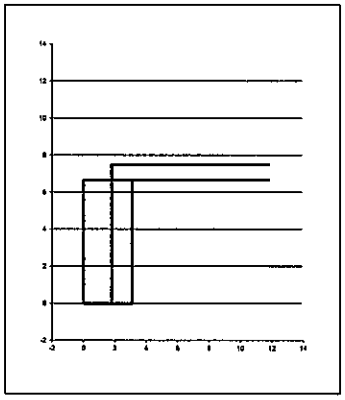
(Coulomb Analysis)

Project No: Case 1 **Wall:** 6.7' Load **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6.67
Back Height (feet) : 6.67
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.297	

Driving Earth Pressure, Horiz
Es = 745.8 plf
Eq = 186.3 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.67** OK > 1.5
SF Sliding = **1.89** OK > 1.5
Bearing Press (psf) = **2,003** Refer to site soils report
Eccentricity (ft.)= **0.92** Greater than L/6

Weights & Masses
W1= 1432.7 plf
W2= 1032.5 plf
Sliding Resist - Gravel, 36 deg = 1791.1 plf
Sliding Resist - Block/Gravel = 1759.2 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.29** OK > 1.1
SF Sliding = **2.36** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,421** Refer to site soils report
Eccentricity (ft.)= **0.67** OK, less than L/2

Kae = 0.297
psi = 2.684
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

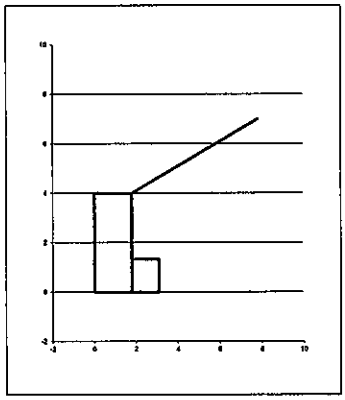
(Coulomb Analysis)

Project No: Case 1 **Wall:** 4' - 2:1 **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 4
Back Height (feet) : 1.33
Slope Angle (degrees): 26.6 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.525	

Driving Earth Pressure, Horiz
Es = 474.0 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **2.01** OK > 1.5
SF Sliding = **1.63** OK > 1.5
Bearing Press (psf) = **563** Refer to site soils report
Eccentricity (ft.)= **0.59** Greater than L/6

Weights & Masses
W1= 859.2 plf
W2= 205.9 plf

Sliding Resist - Gravel, 36 deg = 773.8 plf
Sliding Resist - Block/Gravel = 1325.2 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.01** OK > 1.1
SF Sliding = **1.63** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **563** Refer to site soils report
Eccentricity (ft.)= **0.59** OK, less than L/2

Kae = 0.525
psi = 1.519
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

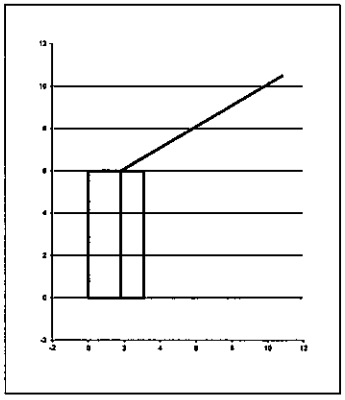
(Coulomb Analysis)

Project No: Case 1 **Wall:** 6' - 2:1 **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6
Back Height (feet) : 6
Slope Angle (degrees): 26.6 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.525	

Driving Earth Pressure, Horiz
Es = 1066.4 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.60** OK > 1.5
SF Sliding = **1.51** OK > 1.5
Bearing Press (psf) = **1,918** Refer to site soils report
Eccentricity (ft.)= **0.96** Greater than L/6

Weights & Masses
W1= 1288.8 plf
W2= 928.8 plf
Sliding Resist - Gravel, 36 deg = 1611.2 plf
Sliding Resist - Block/Gravel = 1682.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g

SF Overturning = **1.60** OK > 1.1
SF Sliding = **1.51** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,918** Refer to site soils report
Eccentricity (ft.)= **0.96** OK, less than L/2

kh = A/2 = 0.000
Kae = 0.525
psi = 1.519
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

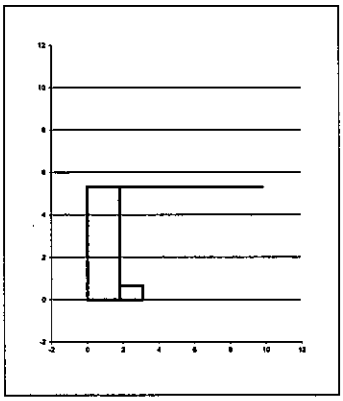
(Coulomb Analysis)

Project No:	**Case 2**	**Wall:** 5.3' - Level	**Date:** 3/4/2015
Project Name:	**Basalite - Double Stack**		**By:** RSI
Location:	**California**		**FSot:** 1.5
			Units: English

1) UNIT TYPE **Standard Units** Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 5.33

Back Height (feet) : 0.67

Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.275	

Driving Earth Pressure, Horiz

Es = 436.7 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning = **1.65** OK > 1.5 W1= 1144.9 plf

SF Sliding = **2.08** OK > 1.5 W2= 103.7 plf

Bearing Press (psf) = **680** Refer to site soils report

Eccentricity (ft.)= **0.62** Greater than L/6 Sliding Resist - Gravel, 36 deg = 907.2 plf

Sliding Resist - Block/Gravel = 1382.1 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.65** OK > 1.1 Kae = 0.275

SF Sliding = **2.08** OK > 1.1 (75% of 1.5) psi = 2.807

Bearing Press (psf) = **680** Refer to site soils report theta = 0.000

Eccentricity (ft.)= **0.62** OK, less than L/2 Pae = 0.0 plf

P inertial = 0.0 plf

Interlocking Standard Unit Wall

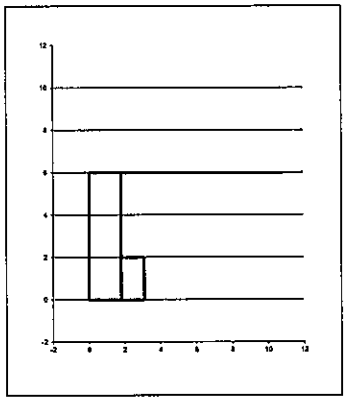
(Coulomb Analysis)

Project No:	**Case 2**	**Wall:**	6' - Level	**Date:**	3/4/2015
Project Name:	**Basalite - Double Stack**			**By:**	RSI
Location:	**California**			**FSot:**	1.5
				Units:	English

1) UNIT TYPE Standard Units — Unit Depth = 1.79 ft

2) BATTER : 0 degree — Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6

Back Height (feet) : 2

Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.275	

Driving Earth Pressure, Horiz

Es = 553.3 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning =	**1.72**	OK > 1.5
SF Sliding =	**2.10**	OK > 1.5
Bearing Press (psf) =	**943**	Refer to site soils report
Eccentricity (ft.)=	**0.69**	Greater than L/6

Weights & Masses

W1= 1288.8 plf

W2= 309.6 plf

Sliding Resist - Gravel, 36 deg = 1161.3 plf

Sliding Resist - Block/Gravel = 1490.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g — kh = A/2 = 0.000

SF Overturning =	**1.72**	OK > 1.1
SF Sliding =	**2.10**	OK > 1.1 (75% of 1.5)
Bearing Press (psf) =	**943**	Refer to site soils report
Eccentricity (ft.)=	**0.69**	OK, less than L/2

Kae = 0.275

psi = 2.807

theta = 0.000

Pae = 0.0 plf

P inertial = 0.0 plf

Interlocking Standard Unit Wall

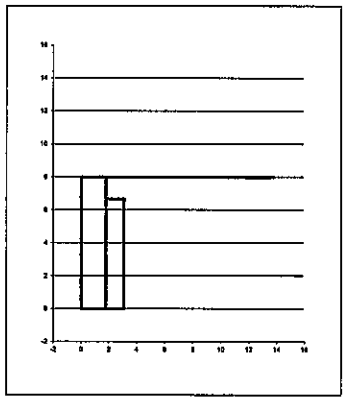
(Coulomb Analysis)

Project No: Case 2 **Wall:** 8' - Level **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 8
Back Height (feet) : 6.67
Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.275	

Driving Earth Pressure, Horiz
Es = 983.7 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.54** OK > 1.5
SF Sliding = **1.88** OK > 1.5
Bearing Press (psf) = **2,346** Refer to site soils report
Eccentricity (ft.)= **0.95** Greater than L/6

Weights & Masses
W1= 1718.4 plf
W2= 1032.5 plf
Sliding Resist - Gravel, 36 deg = 1998.7 plf
Sliding Resist - Block/Gravel = 1847.8 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.54** OK > 1.1
SF Sliding = **1.88** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **2,346** Refer to site soils report
Eccentricity (ft.)= **0.95** OK, less than L/2

Kae = 0.275
psi = 2.807
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

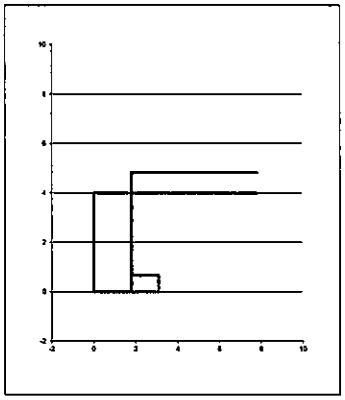
(Coulomb Analysis)

Project No: Case 2 **Wall:** 4.0' - Load **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 4
Back Height (feet) : 0.67
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.275	

Driving Earth Pressure, Horiz
Es = 245.9 plf
Eq = 102.5 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning =	**1.92**	OK > 1.5	W1=	859.2 plf
SF Sliding =	**2.01**	OK > 1.5	W2=	103.7 plf
Bearing Press (psf) =	**488**	Refer to site soils report		
Eccentricity (ft.)=	**0.55**	Greater than L/6	Sliding Resist - Gravel, 36 deg =	699.6 plf
			Sliding Resist - Block/Gravel =	1293.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning =	**3.12**	OK > 1.1	Kae =	0.275
SF Sliding =	**2.84**	OK > 1.1 (75% of 1.5)	psi =	2.807
Bearing Press (psf) =	**401**	Refer to site soils report	theta =	0.000
Eccentricity (ft.)=	**0.34**	OK, less than L/2	Pae =	0.0 plf
			P inertial =	0.0 plf

Interlocking Standard Unit Wall

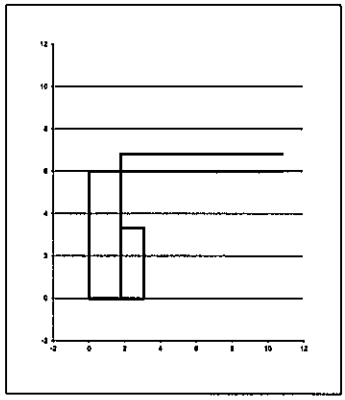
(Coulomb Analysis)

Project No: Case 2 **Wall:** 6.0' - Load **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6
Back Height (feet) : 3.33
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.275	

Driving Earth Pressure, Horiz
Es = 553.3 plf
Eq = 153.7 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.54** OK > 1.5
SF Sliding = **1.85** OK > 1.5
Bearing Press (psf) = **1,344** Refer to site soils report
Eccentricity (ft.)= **0.87** Greater than L/6

Weights & Masses
W1= 1288.8 plf
W2= 515.5 plf

Sliding Resist - Gravel, 36 deg = 1310.9 plf
Sliding Resist - Block/Gravel = 1554.3 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

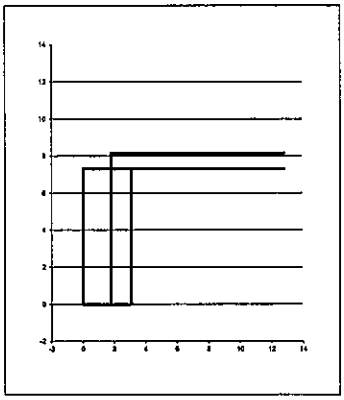
SF Overturning = **2.18** OK > 1.1
SF Sliding = **2.37** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **974** Refer to site soils report
Eccentricity (ft.)= **0.61** OK, less than L/2

Kae = 0.275
psi = 2.807
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

(Coulomb Analysis)

Project No: Case 2 **Wall:** 7.3' - Load **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English



1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf

3) GEOMETRY

Front Height (feet) : 7.33
Back Height (feet) : 7.33
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.275	

Driving Earth Pressure, Horiz
Es = 825.8 plf
Eq = 187.8 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.54** OK > 1.5
SF Sliding = **1.81** OK > 1.5
Bearing Press (psf) = **2,503** Refer to site soils report
Eccentricity (ft.)= **1.00** Greater than L/6

Weights & Masses
W1= 1574.5 plf
W2= 1134.7 plf
Sliding Resist - Gravel, 36 deg = 1968.3 plf
Sliding Resist - Block/Gravel = 1834.8 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.07** OK > 1.1
SF Sliding = **2.22** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,703** Refer to site soils report
Eccentricity (ft.)= **0.74** OK, less than L/2

Kae = 0.275
psi = 2.807
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

(Coulomb Analysis)

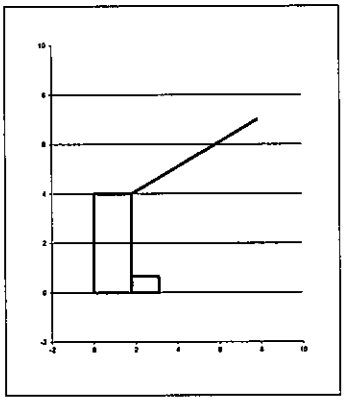
Project No: Case 2 Wall: 4.0' - 2:1
Project Name: Basalite - Double Stack
Location: California

Date: 3/4/2015
By: RSI
FSot: 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 4
Back Height (feet) : 0.67
Slope Angle (degrees): 26.6 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.456	

Driving Earth Pressure, Horiz
Es = 407.9 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.88** OK > 1.5
SF Sliding = **1.72** OK > 1.5
Bearing Press (psf) = **494** Refer to site soils report
Eccentricity (ft.)= **0.56** Greater than L/6

Weights & Masses
W1= 859.2 plf
W2= 103.7 plf

Sliding Resist - Gravel, 36 deg = 699.6 plf
Sliding Resist - Block/Gravel = 1293.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.88** OK > 1.1
SF Sliding = **1.72** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **494** Refer to site soils report
Eccentricity (ft.)= **0.56** OK, less than L/2

Kae = 0.456
psi = 1.693
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

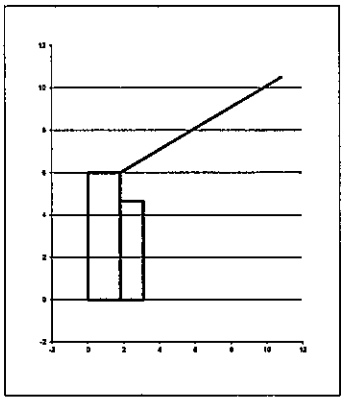
(Coulomb Analysis)

Project No: Case 2 **Wall:** 6.0' - 2:1 **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6
Back Height (feet) : 4.67
Slope Angle (degrees): 26.6 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.456	

Driving Earth Pressure, Horiz
Es = 917.7 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.59** OK > 1.5
SF Sliding = **1.59** OK > 1.5
Bearing Press (psf) = **1,603** Refer to site soils report
Eccentricity (ft.)= **0.91** Greater than L/6

Weights & Masses
W1= 1288.8 plf
W2= 722.9 plf

Sliding Resist - Gravel, 36 deg = 1461.6 plf
Sliding Resist - Block/Gravel = 1618.6 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.59** OK > 1.1
SF Sliding = **1.59** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,603** Refer to site soils report
Eccentricity (ft.)= **0.91** OK, less than L/2

Kae = 0.456
psi = 1.693
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

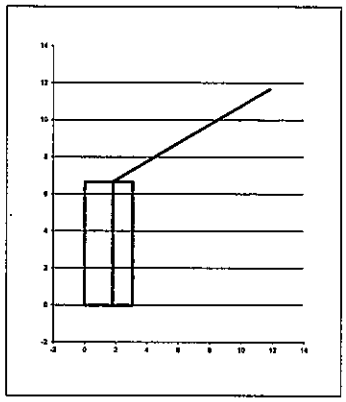
(Coulomb Analysis)

Project No: Case 2 **Wall:** 6.7' - 2:1 **Date:** 3/4/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 0 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6.67
Back Height (feet) : 6.67
Slope Angle (degrees): 26.6 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.456	

Driving Earth Pressure, Horiz
Es = 1134.1 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning = **1.51** OK > 1.5 W1= 1432.7 plf
SF Sliding = **1.55** OK > 1.5 W2= 1032.5 plf
Bearing Press (psf) = **2,383** Refer to site soils report
Eccentricity (ft.)= **1.02** Greater than L/6 Sliding Resist - Gravel, 36 deg = 1791.1 plf
Sliding Resist - Block/Gravel = 1759.2 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.51** OK > 1.1 Kae = 0.456
SF Sliding = **1.55** OK > 1.1 (75% of 1.5) psi = 1.693
Bearing Press (psf) = **2,383** Refer to site soils report theta = 0.000
Eccentricity (ft.)= **1.02** OK, less than L/2 Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

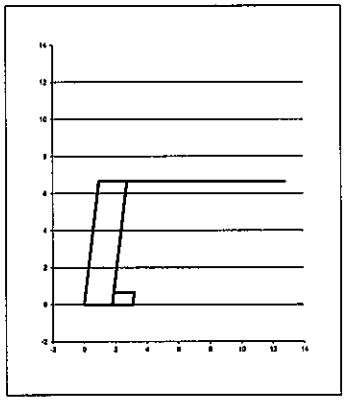
(Coulomb Analysis)

Project No: Case 3 **Wall:** 6.7' Level **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6.67
Back Height (feet) : 0.67
Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.244	

Driving Earth Pressure, Horiz
Es = 637.1 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.56** OK > 1.5
SF Sliding = **1.75** OK > 1.5
Bearing Press (psf) = **707** Refer to site soils report
Eccentricity (ft.)= **0.45** OK, less than L/6

Weights & Masses
W1= 1432.7 plf
W2= 103.7 plf

Sliding Resist - Gravel, 36 deg = 1116.3 plf
Sliding Resist - Block/Gravel = 1471.3 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.56** OK > 1.1
SF Sliding = **1.75** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **707** Refer to site soils report
Eccentricity (ft.)= **0.45** OK, less than L/2

Kae = 0.244
psi = 2.653
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

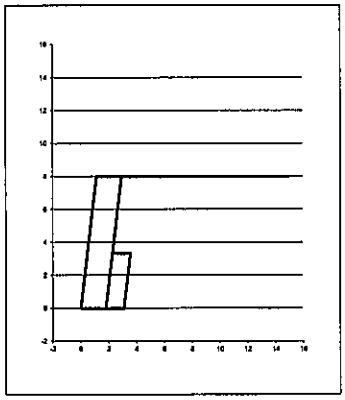
(Coulomb Analysis)

Project No: Case 3 **Wall:** 8' - Level **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 8
Back Height (feet) : 3.33
Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.244	

Driving Earth Pressure, Horiz
Es = 916.5 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.59** OK > 1.5
SF Sliding = **1.77** OK > 1.5
Bearing Press (psf) = **1,108** Refer to site soils report
Eccentricity (ft.)= **0.53** Greater than L/6

Weights & Masses
W1= 1718.4 plf
W2= 515.5 plf
Sliding Resist - Gravel, 36 deg = 1623.0 plf
Sliding Resist - Block/Gravel = 1687.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.59** OK > 1.1
SF Sliding = **1.77** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,108** Refer to site soils report
Eccentricity (ft.)= **0.53** OK, less than L/2

Kae = 0.244
psi = 2.653
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

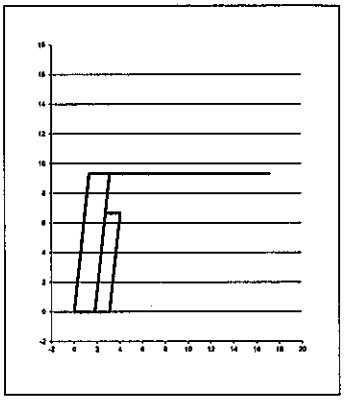
(Coulomb Analysis)

Project No: Case 3 **Wall:** 10' - Level **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 9.33
Back Height (feet) : 6.67
Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.244	

Driving Earth Pressure, Horiz
Es = 1246.6 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning = **1.57** OK > 1.5 W1= 2004.1 plf
SF Sliding = **1.55** OK > 1.5 W2= 1032.5 plf
Bearing Press (psf) = **1,652** Refer to site soils report
Eccentricity (ft.)= **0.62** Greater than L/6 Sliding Resist - Gravel, 36 deg = 2206.2 plf
Sliding Resist - Block/Gravel = 1936.3 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.57** OK > 1.1 Kae = 0.244
SF Sliding = **1.55** OK > 1.1 (75% of 1.5) psi = 2.653
Bearing Press (psf) = **1,652** Refer to site soils report theta = 0.000
Eccentricity (ft.)= **0.62** OK, less than L/2 Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

(Coulomb Analysis)

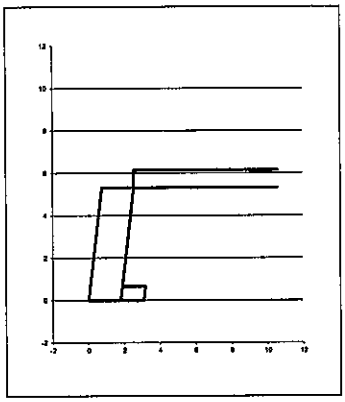
Project No: Case 3 **Wall:** 5.3' - Load
Project Name: Basalite - Double Stack
Location: California

Date: 3/7/2015
By: RSI
FSot: 1.5
Units: English

1) UNIT TYPE Standard Units — Unit Depth = 1.79 ft

2) BATTER : 8 degree — Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 5.33
Back Height (feet) : 0.67
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.244	

Driving Earth Pressure, Horiz
Es = 406.8 plf
Eq = 127.2 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.61** OK > 1.5
SF Sliding = **1.70** OK > 1.5
Bearing Press (psf) = **587** Refer to site soils report
Eccentricity (ft.)= **0.48** OK, less than L/6

Weights & Masses
W1= 1144.9 plf
W2= 103.7 plf

Sliding Resist - Gravel, 36 deg = 907.2 plf
Sliding Resist - Block/Gravel = 1382.1 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g — kh = A/2 = 0.000

SF Overturning = **2.37** OK > 1.1
SF Sliding = **2.23** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **467** Refer to site soils report
Eccentricity (ft.)= **0.20** OK, less than L/2

Kae = 0.244
psi = 2.653
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

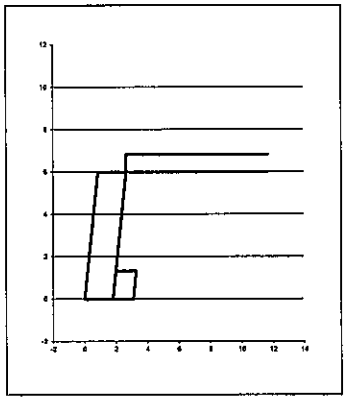
(Coulomb Analysis)

Project No: Case 3 **Wall:** 6' - Load **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6
Back Height (feet) : 1.33
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.244	

Driving Earth Pressure, Horiz
Es = 515.5 plf
Eq = 143.2 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.52** OK > 1.5
SF Sliding = **1.65** OK > 1.5
Bearing Press (psf) = **759** Refer to site soils report
Eccentricity (ft.)= **0.56** Greater than L/6

Weights & Masses
W1= 1288.8 plf
W2= 205.9 plf
Sliding Resist - Gravel, 36 deg = 1086.0 plf
Sliding Resist - Block/Gravel = 1458.4 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.15** OK > 1.1
SF Sliding = **2.11** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **588** Refer to site soils report
Eccentricity (ft.)= **0.27** OK, less than L/2

Kae = 0.244
psi = 2.653
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

(Coulomb Analysis)

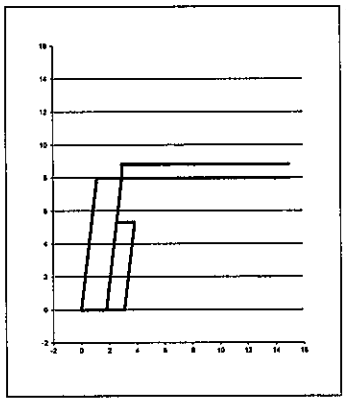
Project No: Case 3 **Wall:** 8' - Load
Project Name: Basalite - Double Stack
Location: California

Date: 3/7/2015
By: RSI
FSot: 1.5
Units: English

1) UNIT TYPE Standard Units — Unit Depth = 1.79 ft

2) BATTER : 8 degree — Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 8
Back Height (feet) : 5.33
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.244	

Driving Earth Pressure, Horiz
Es = 916.5 plf
Eq = 190.9 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.50** OK > 1.5
SF Sliding = **1.61** OK > 1.5
Bearing Press (psf) = **1,512** Refer to site soils report
Eccentricity (ft.)= **0.70** Greater than L/6

Weights & Masses
W1= 1718.4 plf
W2= 825.1 plf

Sliding Resist - Gravel, 36 deg = 1847.9 plf
Sliding Resist - Block/Gravel = 1783.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g — kh = A/2 = 0.000

SF Overturning = **1.97** OK > 1.1
SF Sliding = **1.95** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,114** Refer to site soils report
Eccentricity (ft.)= **0.40** OK, less than L/2

Kae = 0.244
psi = 2.653
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

(Coulomb Analysis)

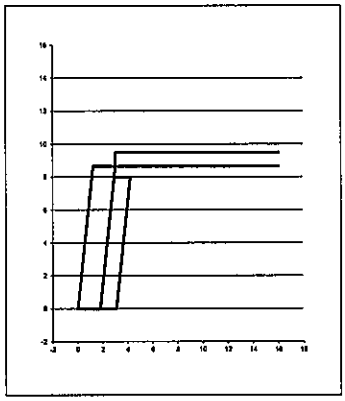
Project No: Case 3 **Wall:** 8.67'-Load
Project Name: Basalite - Double Stack
Location: California

Date: 3/7/2015
By: RSI
FSot: 1.5
Units: English

1) UNIT TYPE Standard Units — Unit Depth = 1.79 ft

2) BATTER : 8 degree — Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 8.67
Back Height (feet) : 8
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.244	

Driving Earth Pressure, Horiz
Es = 1076.5 plf
Eq = 206.9 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.63** OK > 1.5
SF Sliding = **1.52** OK > 1.5
Bearing Press (psf) = **1,810** Refer to site soils report
Eccentricity (ft.)= **0.68** Greater than L/6

Weights & Masses
W1= 1862.3 plf
W2= 1238.4 plf

Sliding Resist - Gravel, 36 deg = 2252.8 plf
Sliding Resist - Block/Gravel = 1956.2 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g — kh = A/2 = 0.000

SF Overturning = **2.09** OK > 1.1
SF Sliding = **1.82** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,353** Refer to site soils report
Eccentricity (ft.)= **0.39** OK, less than L/2

Kae = 0.244
psi = 2.653
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

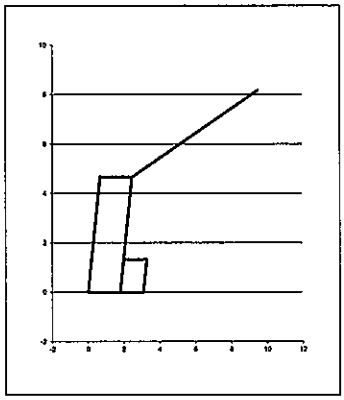
(Coulomb Analysis)

Project No:	**Case 3**	**Wall:** 4.67' - 2:1		**Date:**	3/7/2015
Project Name:	**Basalite - Double Stack**			**By:**	RSI
Location:	**California**			**FSot:**	1.5
				Units:	English

1) UNIT TYPE **Standard Units** Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 4.67

Back Height (feet) : 1.33

Slope Angle (degrees): 26.6 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.423	

Driving Earth Pressure, Horiz

Es = 541.0 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning = **2.07** OK > 1.5 W1= 1003.1 plf

SF Sliding = **1.62** OK > 1.5 W2= 205.9 plf

Bearing Press (psf) = **516** Refer to site soils report

Eccentricity (ft.)= **0.37** OK, less than L/6 Sliding Resist - Gravel, 36 deg = 878.4 plf

Sliding Resist - Block/Gravel = 1369.8 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.07** OK > 1.1 Kae = 0.423

SF Sliding = **1.62** OK > 1.1 (75% of 1.5) psi = 1.532

Bearing Press (psf) = **516** Refer to site soils report theta = 0.000

Eccentricity (ft.)= **0.37** OK, less than L/2 Pae = 0.0 plf

P inertial = 0.0 plf

Interlocking Standard Unit Wall

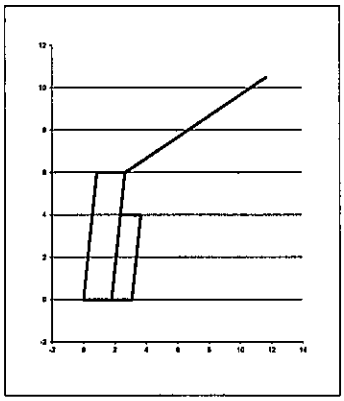
(Coulomb Analysis)

Project No: Case 3 **Wall:** 6' - 2:1 **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6
Back Height (feet) : 4
Slope Angle (degrees): 26.6 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.423	

Driving Earth Pressure, Horiz
Es = 893.1 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.89** OK > 1.5
SF Sliding = **1.55** OK > 1.5
Bearing Press (psf) = **930** Refer to site soils report
Eccentricity (ft.)= **0.51** Greater than L/6

Weights & Masses
W1= 1288.8 plf
W2= 619.2 plf
Sliding Resist - Gravel, 36 deg = 1386.2 plf
Sliding Resist - Block/Gravel = 1586.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.89** OK > 1.1
SF Sliding = **1.55** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **930** Refer to site soils report
Eccentricity (ft.)= **0.51** OK, less than L/2

Kae = 0.423
psi = 1.532
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

(Coulomb Analysis)

Project No: Case 3 **Wall:** 6.67'- 2:1 **Date:** 3/7/2015

Project Name: Basalite - Double Stack **By:** RSI

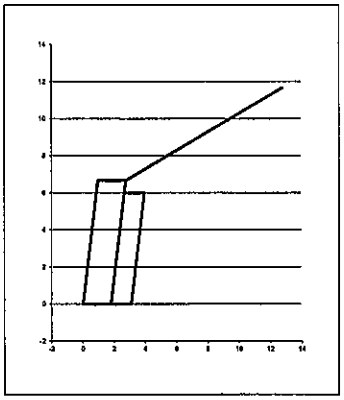
Location: California **FSot:** 1.5

Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6.67

Back Height (feet) : 6

Slope Angle (degrees): 26.6 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	30	20.00
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.423	

Driving Earth Pressure, Horiz

Es = 1103.7 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning = **1.88** OK > 1.5 W1= 1432.7 plf

SF Sliding = **1.55** OK > 1.5 W2= 928.8 plf

Bearing Press (psf) = **1,218** Refer to site soils report

Eccentricity (ft.)= **0.57** Greater than L/6 Sliding Resist - Gravel, 36 deg = 1715.7 plf

Sliding Resist - Block/Gravel = 1727.1 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.88** OK > 1.1 Kae = 0.423

SF Sliding = **1.55** OK > 1.1 (75% of 1.5) psi = 1.532

Bearing Press (psf) = **1,218** Refer to site soils report theta = 0.000

Eccentricity (ft.)= **0.57** OK, less than L/2 Pae = 0.0 plf

P inertial = 0.0 plf

Interlocking Standard Unit Wall

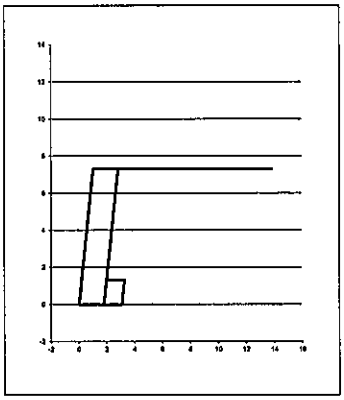
(Coulomb Analysis)

Project No: Case 4 **Wall:** 7.3'-Level **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 7.33
Back Height (feet) : 1.33
Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.222	

Driving Earth Pressure, Horiz
Es = 696.6 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.61** OK > 1.5
SF Sliding = **1.86** OK > 1.5
Bearing Press (psf) = **810** Refer to site soils report
Eccentricity (ft.)= **0.44** OK, less than L/6

Weights & Masses
W1= 1574.5 plf
W2= 205.9 plf
Sliding Resist - Gravel, 36 deg = 1293.5 plf
Sliding Resist - Block/Gravel = 1546.9 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.61** OK > 1.1
SF Sliding = **1.86** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **810** Refer to site soils report
Eccentricity (ft.)= **0.44** OK, less than L/2

Kae = 0.222
psi = 2.769
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

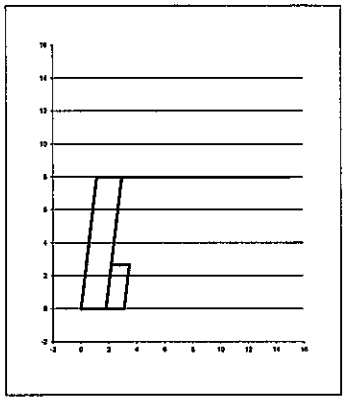
(Coulomb Analysis)

Project No:	**Case 4**	**Wall:** 8' - Level		**Date:**	3/7/2015
Project Name:	**Basalite - Double Stack**			**By:**	RSI
Location:	**California**			**FSot:**	1.5
				Units:	English

1) UNIT TYPE Standard Units — Unit Depth = 1.79 ft

2) BATTER : 8 degree — Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 8

Back Height (feet) : 2.67

Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.222	

Driving Earth Pressure, Horiz

Es = 829.7 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning =	**1.62** OK > 1.5	W1=	1718.4	plf
SF Sliding =	**1.87** OK > 1.5	W2=	413.3	plf
Bearing Press (psf) =	**1,002** Refer to site soils report			
Eccentricity (ft.)=	**0.48** OK, less than L/6	Sliding Resist - Gravel, 36 deg =	1548.8	plf
		Sliding Resist - Block/Gravel =	1655.8	plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g — kh = A/2 = 0.000

SF Overturning =	**1.62** OK > 1.1	Kae =	0.222	
SF Sliding =	**1.87** OK > 1.1 (75% of 1.5)	psi =	2.769	
Bearing Press (psf) =	**1,002** Refer to site soils report	theta =	0.000	
Eccentricity (ft.)=	**0.48** OK, less than L/2	Pae =	0.0	plf
		P inertial =	0.0	plf

Interlocking Standard Unit Wall

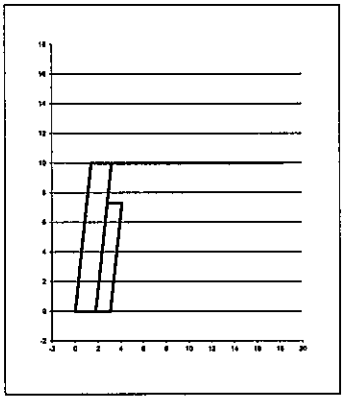
(Coulomb Analysis)

Project No:	**Case 4**	**Wall:**	10'-Level	**Date:**	3/7/2015
Project Name:	**Basalite - Double Stack**			**By:**	RSI
Location:	**California**			**FSot:**	1.5
				Units:	English

1) UNIT TYPE **Standard Units** Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 10

Back Height (feet) : 7.33

Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.222	

Driving Earth Pressure, Horiz

Es = 1296.4 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning = **1.57** OK > 1.5 W1= 2148.0 plf

SF Sliding = **1.55** OK > 1.5 W2= 1134.7 plf

Bearing Press (psf) = **1,772** Refer to site soils report

Eccentricity (ft.)= **0.61** Greater than L/6 Sliding Resist - Gravel, 36 deg = 2385.0 plf

Sliding Resist - Block/Gravel = 2012.6 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.57** OK > 1.1 Kae = 0.222

SF Sliding = **1.55** OK > 1.1 (75% of 1.5) psi = 2.769

Bearing Press (psf) = **1,772** Refer to site soils report theta = 0.000

Eccentricity (ft.)= **0.61** OK, less than L/2 Pae = 0.0 plf

P inertial = 0.0 plf

Interlocking Standard Unit Wall

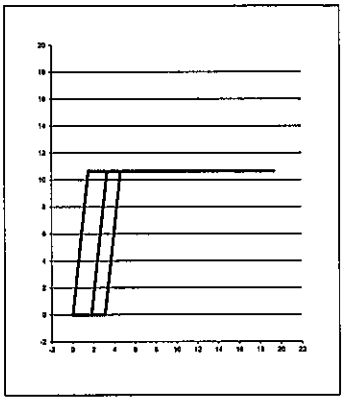
(Coulomb Analysis)

Project No: Case 4 **Wall:** 10.7' -Level **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 10.67
Back Height (feet) : 10.67
Slope Angle (degrees): 0.0 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.222	

Driving Earth Pressure, Horiz
Es = 1476.0 plf
Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning = **1.72** OK > 1.5 W1= 2291.9 plf
SF Sliding = **1.50** OK > 1.5 W2= 1651.7 plf
Bearing Press (psf) = **2,057** Refer to site soils report
Eccentricity (ft.)= **0.58** Greater than L/6 Sliding Resist - Gravel, 36 deg = 2865.2 plf
Sliding Resist - Block/Gravel = 2217.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.72** OK > 1.1 Kae = 0.222
SF Sliding = **1.50** OK > 1.1 (75% of 1.5) psi = 2.769
Bearing Press (psf) = **2,057** Refer to site soils report theta = 0.000
Eccentricity (ft.)= **0.58** OK, less than L/2 Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

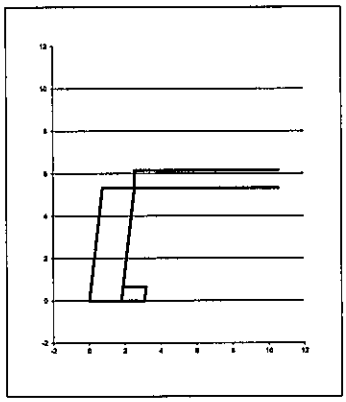
(Coulomb Analysis)

Project No: Case 4 **Wall:** 5.3'-Load **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 5.33
Back Height (feet) : 0.67
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.222	

Driving Earth Pressure, Horiz
Es = 368.3 plf
Eq = 115.2 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.78** OK > 1.5
SF Sliding = **1.88** OK > 1.5
Bearing Press (psf) = **545** Refer to site soils report
Eccentricity (ft.)= **0.40** OK, less than L/6

Weights & Masses
W1= 1144.9 plf
W2= 103.7 plf

Sliding Resist - Gravel, 36 deg = 907.2 plf
Sliding Resist - Block/Gravel = 1382.1 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.61** OK > 1.1
SF Sliding = **2.46** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **449** Refer to site soils report
Eccentricity (ft.)= **0.15** OK, less than L/2

Kae = 0.222
psi = 2.769
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

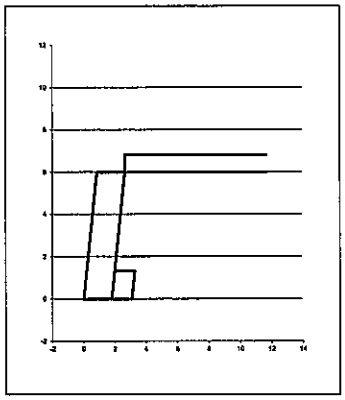
(Coulomb Analysis)

Project No: Case 4 **Wall:** 6' - Load **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) **UNIT TYPE** Standard Units Unit Depth = 1.79 ft

2) **BATTER :** 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) **GEOMETRY**

Front Height (feet) : 6
Back Height (feet) : 1.33
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) **RETAINED SOIL PROPERTIES**

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.222	

Driving Earth Pressure, Horiz
Es = 466.7 plf
Eq = 129.6 plf

5) **STATIC EXTERNAL STABILITY ANALYSIS**

SF Overturning = **1.68** OK > 1.5
SF Sliding = **1.82** OK > 1.5
Bearing Press (psf) = **694** Refer to site soils report
Eccentricity (ft.)= **0.46** OK, less than L/6

Weights & Masses
W1= 1288.8 plf
W2= 205.9 plf
Sliding Resist - Gravel, 36 deg = 1086.0 plf
Sliding Resist - Block/Gravel = 1458.4 plf

6) **SEISMIC EXTERNAL STABILITY ANALYSIS** A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.38** OK > 1.1
SF Sliding = **2.33** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **559** Refer to site soils report
Eccentricity (ft.)= **0.20** OK, less than L/2

Kae = 0.222
psi = 2.769
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

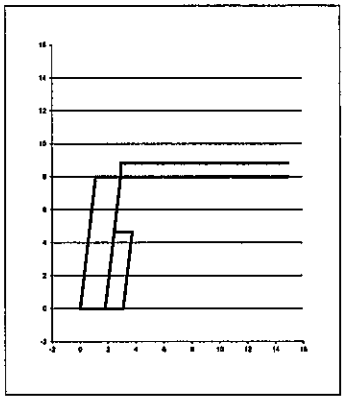
(Coulomb Analysis)

Project No: Case 4 **Wall:** 8' - Load **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 8
Back Height (feet) : 4.67
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.222	

Driving Earth Pressure, Horiz
Es = 829.7 plf
Eq = 172.9 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.55** OK > 1.5
SF Sliding = **1.75** OK > 1.5
Bearing Press (psf) = **1,338** Refer to site soils report
Eccentricity (ft.)= **0.63** Greater than L/6

Weights & Masses
W1= 1718.4 plf
W2= 722.9 plf

Sliding Resist - Gravel, 36 deg = 1773.7 plf
Sliding Resist - Block/Gravel = 1751.8 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.03** OK > 1.1
SF Sliding = **2.11** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,021** Refer to site soils report
Eccentricity (ft.)= **0.34** OK, less than L/2

Kae = 0.222
psi = 2.769
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

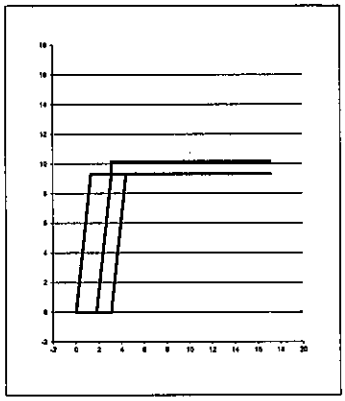
(Coulomb Analysis)

Project No: Case 4 **Wall:** 9.3' -Load **Date:** 3/7/2015
Project Name: Basalite - Double Stack **By:** RSI
Location: California **FSot:** 1.5
Units: English

1) UNIT TYPE Standard Units Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 9.33
Back Height (feet) : 9.33
Slope Angle (degrees): 0.0 Surcharge: 100 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.222	

Driving Earth Pressure, Horiz
Es = 1128.5 plf
Eq = 201.6 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning = **1.70** OK > 1.5
SF Sliding = **1.55** OK > 1.5
Bearing Press (psf) = **1,905** Refer to site soils report
Eccentricity (ft.)= **0.63** Greater than L/6

Weights & Masses
W1= 2004.1 plf
W2= 1444.3 plf
Sliding Resist - Gravel, 36 deg = 2505.4 plf
Sliding Resist - Block/Gravel = 2064.0 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **2.16** OK > 1.1
SF Sliding = **1.83** OK > 1.1 (75% of 1.5)
Bearing Press (psf) = **1,464** Refer to site soils report
Eccentricity (ft.)= **0.36** OK, less than L/2

Kae = 0.222
psi = 2.769
theta = 0.000
Pae = 0.0 plf
P inertial = 0.0 plf

Interlocking Standard Unit Wall

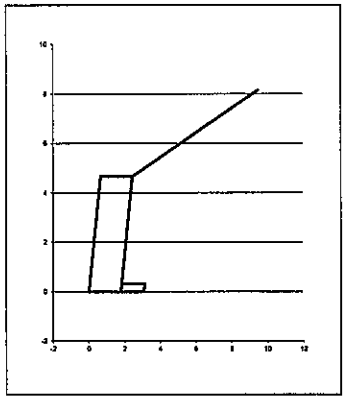
(Coulomb Analysis)

Project No:	**Case 4**	**Wall:**	4.7' -2:1	**Date:**	3/7/2015
Project Name:	**Basalite - Double Stack**			**By:**	RSI
Location:	**California**			**FSot:**	1.5
				Units:	English

1) UNIT TYPE **Standard Units** Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 4.67

Back Height (feet) : 0.33

Slope Angle (degrees): 26.5 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.359	

Driving Earth Pressure, Horiz

Es = 456.6 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning =	**1.90** OK > 1.5	W1=	1003.1	plf
SF Sliding =	**1.68** OK > 1.5	W2=	51.1	plf
Bearing Press (psf) =	**441** Refer to site soils report			
Eccentricity (ft.)=	**0.35** OK, less than L/6	Sliding Resist - Gravel, 36 deg =	765.9	plf
		Sliding Resist - Block/Gravel =	1321.8	plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning =	**1.90** OK > 1.1	Kae =	0.359	
SF Sliding =	**1.68** OK > 1.1 (75% of 1.5)	psi =	1.715	
Bearing Press (psf) =	**441** Refer to site soils report	theta =	0.000	
Eccentricity (ft.)=	**0.35** OK, less than L/2	Pae =	0.0	plf
		P inertial =	0.0	plf

Interlocking Standard Unit Wall

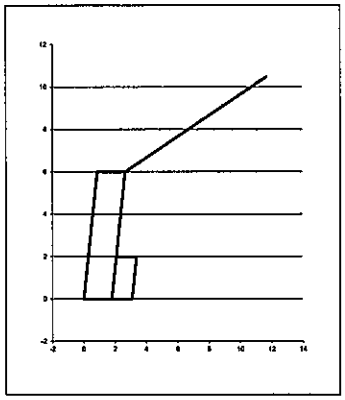
(Coulomb Analysis)

Project No:	**Case 4**	**Wall:**	6' - 2:1	**Date:**	3/7/2015
Project Name:	**Basalite - Double Stack**			**By:**	RSI
Location:	**California**			**FSot:**	1.5
				Units:	English

1) UNIT TYPE **Standard Units** Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 6

Back Height (feet) : 2

Slope Angle (degrees): 26.5 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.359	

Driving Earth Pressure, Horiz

Es = 753.6 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

Weights & Masses

SF Overturning = **1.65** OK > 1.5 W1= 1288.8 plf

SF Sliding = **1.54** OK > 1.5 W2= 309.6 plf

Bearing Press (psf) = **785** Refer to site soils report

Eccentricity (ft.)= **0.52** Greater than L/6 Sliding Resist - Gravel, 36 deg = 1161.3 plf

Sliding Resist - Block/Gravel = 1490.5 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning = **1.65** OK > 1.1 Kae = 0.359

SF Sliding = **1.54** OK > 1.1 (75% of 1.5) psi = 1.715

Bearing Press (psf) = **785** Refer to site soils report theta = 0.000

Eccentricity (ft.)= **0.52** OK, less than L/2 Pae = 0.0 plf

P inertial = 0.0 plf

Interlocking Standard Unit Wall

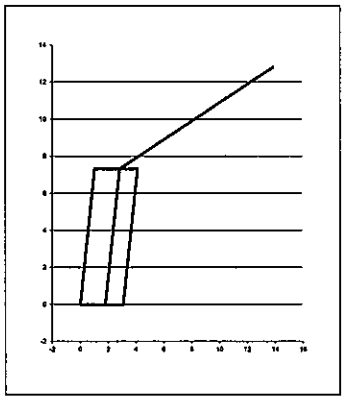
(Coulomb Analysis)

Project No:	**Case 4**	**Wall:** 7.3' - 2:1		**Date:**	3/7/2015
Project Name:	**Basalite - Double Stack**			**By:**	RSI
Location:	**California**			**FSot:**	1.5
				Units:	English

1) UNIT TYPE **Standard Units** Unit Depth = 1.79 ft

2) BATTER : 8 degree Total Depth = 3.08 ft

Unit Weight = 120 pcf



3) GEOMETRY

Front Height (feet) : 7.33

Back Height (feet) : 7.33

Slope Angle (degrees): 26.5 Surcharge: 0 psf

4) RETAINED SOIL PROPERTIES

	Soil	Delta@2/3
Phi Angle in degrees	32	21.33
Unit Weight (lbs/cf)	120	
Ka Coefficient	0.359	

Driving Earth Pressure, Horiz

Es = 1124.8 plf

Eq = 0.0 plf

5) STATIC EXTERNAL STABILITY ANALYSIS

SF Overturning =	**2.03**	OK > 1.5			
SF Sliding =	**1.63**	OK > 1.5			
Bearing Press (psf) =	**1,302**	Refer to site soils report			
Eccentricity (ft.)=	**0.50**	OK, less than L/6	Sliding Resist - Gravel, 36 deg =	1968.3	plf
			Sliding Resist - Block/Gravel =	1834.8	plf

Weights & Masses

W1= 1574.5 plf

W2= 1134.7 plf

6) SEISMIC EXTERNAL STABILITY ANALYSIS A = 0.00 g kh = A/2 = 0.000

SF Overturning =	**2.03**	OK > 1.1	Kae =	0.359	
SF Sliding =	**1.63**	OK > 1.1 (75% of 1.5)	psi =	1.715	
Bearing Press (psf) =	**1,302**	Refer to site soils report	theta =	0.000	
Eccentricity (ft.)=	**0.50**	OK, less than L/2	Pae =	0.0	plf
			P inertial =	0.0	plf