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PROJECT:	SHEET:
Engineering Calculation Highlights	*1 of 2*
PREPARED BY:	DATE:
Rosetta Hardscapes, LLC	*03-03-08*

This sheet highlights some of the design values used to prepare the Preliminary Rosetta Wall Height Guide charts. It is intended to serve as reference information for Design Professionals only. Wall design requires a detailed understanding of engineering concepts, and must be prepared by a Licensed Professional Engineer.

DESIGN BLOCK

Gravity walls were analyzed based on a 12" high x 5.5' long block. For the gravity walls in the preliminary height guides, wall sliding was the controlling criteria. The 12" x 5.5' block has the smallest average block width and yields the lowest available wall heights to resist sliding. Since Rosetta blocks come in 6" height increments, the block height, weight, and setback values for the 12" x 5.5' block were halved to represent an equivalent 6" block for analysis.

h_{block} = 6" W_{block} = 17.3" (average width)
L_{block} = 65.8" G_u = 8.1" (from theoretical toe)
Weight = 573 lbs Block Setback = 1.5" horizontal/6" vertical, ω = 14.0°

INTERFACE SHEAR

(See the testing report for the 12" x 3' Rosetta block prepared by Bathurst Clarabut Geotechnical Testing, Inc.) The 12" x 6' Rosetta block has the smallest shear heel area per wall face (5.7 in^2 shear area / ft^2 wall face - see table below) of all Rosetta blocks. It has half the shear area per wall face as the 12"x3' block, and is assumed to have half the interface shear capacity of the 12" x 3' block. Since Rosetta blocks come in 6" height increments, the capacity of the 12"x6' block was halved (again) to represent an equivalent 6" block for analysis.

$V_u = 360 + N \tan 26° \leq 1000$ lb/ft

BLOCK *(Block Size)*	SHEAR HEEL *(Number / Size)*	WALL FACE *(ft^2)*	SHEAR AREA / WALL FACE *(in^2 / ft^2)*
6" x 2'	(1) 15.5	1.0	15.5
6" x 3'	(1) 23.0	1.5	15.3
6" x 4'	(1) 35.0	2.0	17.5
12" x 3'	(2) 17.1	3.0	11.4
12" x 3.5'	(2) 17.1	3.5	9.7
12" x 4'	(2) 17.1	4.0	8.5
12" x 4.5'	(2) 17.1	4.5	7.6
12" x 5'	(2) 17.1	5.0	6.8
12" x 5.5'	(2) 17.1	5.5	6.2
12" x 6'	(2) 17.1	6.0	5.7
18" x 5'	(2) 27.6	7.5	7.3
24" x 4'	(2) 23.5	8.0	5.8

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PARAWEB STRAP DESIGN

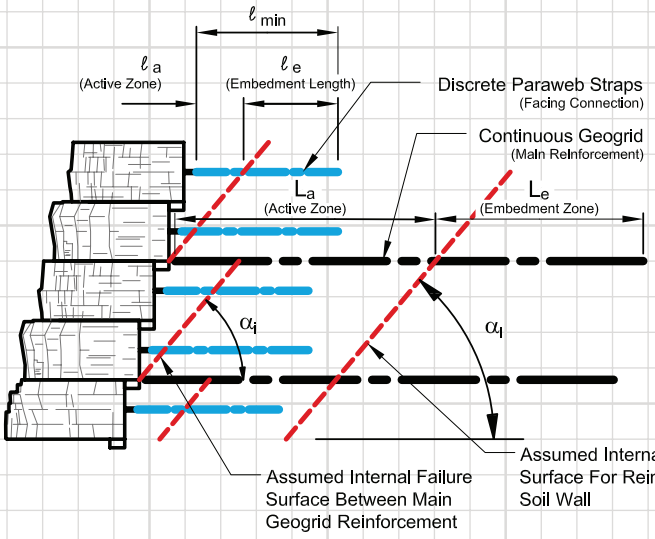
Paraweb strap is designed to hold the individual facing blocks into a reinforced soil mass. The capacity of the strap to resist pullout is set equal to the force acting on the block times a factor of safety, ($R_{po} = F_{po} \times F.S.$). The resulting equation is solved for the minimum required length of strap embedment:

$$\ell_e = [\, K_{ah} \times \sigma_{n\ (DL\ and\ LL)} \times A_{block} \times F.S.] \,/\, [\, C_i \times W_s \times 2\ legs/hook \times 2\ sides/leg \times \sigma_{n\ (DL\ only)} \times \tan \phi_i\,]$$

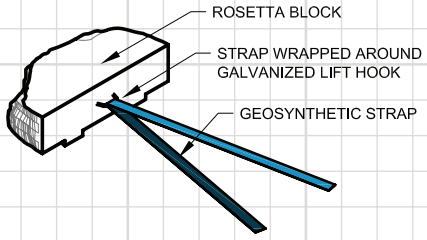
Additional strap is required to insure ℓ_e is located beyond a local failure surface between geogrid layers. The length of strap in the active zone, ℓ_a is calculated by:

ℓ_a = geogrid layer vertical spacing / tan α_i (α_i is the angle of the Coulomb failure surface)

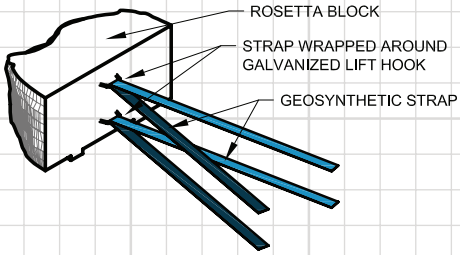
The strap required for each block is the sum of the embedment and active lengths, $\ell_{min} = \ell_e + \ell_a$
For typical construction, the longest required strap length is used on all blocks in the wall.



TYPICAL COMPONENTS - SECTION VIEW



6" OR 12" HIGH ROSETTA BLOCKS



18" OR 24" HIGH ROSETTA BLOCKS

PARAWEB STRAP CONNECTION

(See the testing report prepared by Bathurst Clarabut Geotechnical Testing, Inc.) In testing, the connection between Paraweb 30 Strap and the Rosetta blocks failed in strap rupture between 85% and 98% of the index tensile strength times two (2 legs/hook) of the strap.
Connection capacity, $T_c = 0.85 \times T_{ult} \times 2 / F.S. = 0.85 \times 6750 \times 2 / 1.5 = 7{,}650$ lb
The 12"x6' block has the greatest face area per connection, resulting in the smallest available connection strength. As such, the connection strength of the 12"x6' block is used for analysis.

$T_c = 6{,}750$ lb / 6 ft = 1,275 lb/ft

Engineering Assumptions

The gravity wall and reinforced wall charts shown on the following pages are based on our understanding of the concepts and principles for the design of segmental retaining walls as described in the National Concrete Masonry Association (NCMA) *Design Manual for Segmental Retaining Walls, Second Edition*. The design calculations used to derive these charts are available upon request. These charts are not intended to be used for actual construction and all final designs for construction purposes must be performed by a registered professional engineer qualified to design segmental retaining wall structures, using the actual conditions of the proposed site. Many other design applications that are not specifically shown in these charts may also be possible. Contact your local engineer to determine the suitability of Rosetta Hardscapes blocks on unique sites.

Assumed Criteria for Chart Calculations

- Soil friction angles (Φ) of 28°, 30°, and 34° as noted.
- **Global stability has not been considered.** It is recommended that a local engineer compute and apply all local conditions and factors, including global stability, to the site-specific wall design.
- Testing of the Rosetta Hardscapes block interface shear and connection between the Rosetta Hardscapes blocks and Paraweb 30 geosynthetic strap was completed by Bathurst, Clarabut Geotechnical Testing, Inc. Test reports are available upon request.
- Gravity wall sections were analyzed based on a 12" high x 5.5' long (0.305 m x 1.676 m) block.
- Interface shear values were based on the 12" high x 6' long (0.305 m x 1.829 m) block.
- Reinforced wall sections are designed with geogrid to provide the main soil reinforcement and individual Paraweb straps to hold the facing blocks into the reinforced soil mass.
- Paraweb strap lengths are calculated to hold a 12" high x 6' long (0.305 m x 1.829 m) block in place. The longest required strap is used on all blocks in a reinforced wall.

Factors of Safety

Wall Sliding Resistance =	1.5
Wall Overturning =	1.5 – Non Reinforced, 2.0 - Reinforced
Wall Bearing Capacity =	2.0

Material Assumptions

Unit Weight of Concrete =	145 pcf (22.8 kN/m^3)
Minimum Concrete Compressive Strength =	4,000 psi (27.6 MPa)
Moist Soil Unit Weight =	120 pcf (18.9 kN/m^3)

These assumptions were made to provide Rosetta Hardscapes LLC with an approximate retaining wall height. These wall heights were calculated using the assumed material properties and may vary from location to location depending on the soil properties. **For this reason, all final designs for construction purposes must be performed by a registered professional engineer qualified to design segmental retaining wall structures, using the actual conditions of the proposed site.**

February 26, 2008

Commercially Available Engineering Resources

NCMA Design Manual for Segmental Retaining Walls (SRW), 2nd Edition, National Concrete Masonry Association, 13750 Sunrise Valley Drive, Herndon, Virginia 20171-4662 (703) 713-1900
Available at www.ncma.org

NCMA Design Software for Segmental Retaining Walls – SRWall
SRW design for both conventional gravity and soil reinforced walls with simple geometry. Excludes overall stability analysis.
Available at www.ncma.org

MSEW (Mechanically Stabilized Earth Walls) by ADAMA Engineering, Inc.
MSEW will handle more complex loading and wall geometry, including tiered walls. MSEW follows AASHTO and FHWA guidelines.
Available at www.msew.com

ReSSA (Reinforced Soil Slope Analysis) by ADAMA Engineering, Inc.
Global stability analysis to assess the rotation and translational stability of slopes.
Available at www.msew.com

January 4, 2008