

**REPORT**  
**RESULTS OF**  
**ROSETTA BLOCK UNIT**  
**USING THE BACK OF BLOCK CONFIGURATION**  
**AND PARAWEB 30**  
**CONNECTION CAPACITY TESTING**

submitted to

**ROSETTA HARDSCAPES LLC**

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## Introduction

This report gives the results of a connection testing program carried out to evaluate the mechanical performance of the connection between Rosetta<sup>®</sup> modular concrete block units manufactured by Rosetta Hardscapes, LLC and ParaWeb 30<sup>®</sup> polyester strap using the back of block configuration.

The test program was initiated in response to an email authorization to proceed from Mr. Jamie Johnson of Rosetta Hardscapes, LLC. received 23 February 2007.

The tests were carried out at the laboratories of Bathurst, Clarabut Geotechnical Testing, Inc. in Kingston, Ontario, under the supervision of Mr. Peter Clarabut.

## Objectives of test program

The facing-polyester strap connection between Rosetta concrete block units and ParaWeb 30 polyester strap using the back of block configuration was investigated using a large-scale connection test apparatus.

The principal objective of the testing was to evaluate the mechanical performance of these connections. A second objective was to make preliminary recommendations for the selection of long-term tensile connection capacities to be used in the design and analysis of polyester strap-reinforced soil wall systems that employ Rosetta blocks in combination with ParaWeb 30 polyester strap using the back of block configuration.

## Materials

Rosetta Blocks are solid concrete units weighing approximately 580 pounds per unit. The nominal dimensions of the block are 17 inches wide (toe to heel) by 12 inches high by 35 inches long. Construction alignment and wall batter is achieved by means of two concrete keys cast into the bottom surface of the units. The installation arrangement is illustrated in **Figure 1**. A photograph of the Rosetta Block units is shown in **Figures 2 and 3**. The blocks used in this series of tests were supplied by Rosetta Hardscapes, LLC and were received at our laboratory on 29 June 2007 and designated as BIC 07-033.

ParaWeb 30 is a coated geosynthetic strap composed of 100% polyester multifilament yarn with a tensile strength of 6750 lb/strap in the machine direction (based on ASTM D 6637 method of test and reported in the manufacturers' literature). The specimens used in this series of testing were cut from roll/lot # 2215/11 received at our laboratory on 9 May 2005.

## Apparatus and general test procedure

The method of test used in this investigation follows generally that reported by Bathurst and Simac (1993) and recommended by the NCMA (Simac et al. 1993) and ASTM D 6638. A brief description of the apparatus and test methodology is presented here. The test apparatus used to perform the tests is illustrated in **Figure 1**. The test apparatus allows tensile loads of up

to 35,000 pounds to be applied to the polyester strap while it is attached to the back of the block. The facing blocks were laterally restrained and surcharged vertically. A polyester strap reinforcement was extended over the steel bolt/steel flange arrangement and both ends of the reinforcement were attached to the roller clamp. Wall heights were simulated by applying an additional surcharge load using the vertically-oriented hydraulic jack shown in **Figure 1**. Gum rubber mats were placed over the top block to ensure a uniform distribution of vertical surcharge pressure. The connection force was applied at a constant rate of displacement (i.e. 0.75 inch/minute) using a computer-controlled hydraulic actuator. The load and displacements measured by the actuator were recorded continuously during the test by a microcomputer/data acquisition system. The block used in the tests was visually inspected to confirm that it was free of defects. Each test was continued until there was a sustained loss in connection load due to strap rupture. Following each test, the strap was examined to confirm failure modes. A virgin specimen of strap was used for each test.

The only variable in this series of connection tests was the magnitude of surcharge load.

### **Test program**

The surcharge loads used in the test program are given in **Table 1**. Also tabulated are the failure loads observed for each test.

### **Test results**

The peak connection capacity between Rosetta units and ParaWeb 30 for walls between 590 and 6368 lb/ft normal load, ranged between 85 and 98% of the index tensile strength (times two) of ParaWeb 30. The average tensile load at rupture for this connection was 4226 lb/ft. ParaWeb 30 has a reported tensile strength of 6750 lb/strap in the machine direction (based on ASTM D 6637 method of test and reported in the manufacturers' literature). Hence, for the connection configuration used in the field the maximum reference tensile capacity of two straps is 13,500 lbs.

The results in **Table 1** illustrate that there is variability in connection capacity between nominal identical tests. The variability is 7.5% and hence within the  $\pm 10\%$  of the mean peak load criterion required by the NCMA. This variability is likely the result of small differences in the setting up of the polyester strap reinforcement. The observed failure mechanism in all tests was rupture of the polyester strap member.

### **Implications to Rosetta design and construction with ParaWeb 30 polyester strap using the back of block configuration**

The long-term design connection capacity in the field must be less than the peak capacity envelope determined in this test series for the same method and quality of construction. The NCMA Segmental Retaining Wall Design Manual (First Edition, 1993) recommends that the design connection capacity at a given surcharge load for a critical wall structure be the lesser of the peak capacity divided by a minimum factor of safety (not less than 1.5) or the capacity based

on a 3/4 inch displacement criterion (the latter was not achieved due to the stiffness of the polyester strap). The design capacity is therefore calculated to be 2817 lb/ft.

This design capacity value should be used with caution. The actual design capacity should be lower if the quality of construction in the field is less than that adopted in this controlled laboratory investigation and/or lower quality concrete is used in the manufacture of the blocks.

It is very important that production blocks have uniform dimensions so that there is no stepping at the block joints that can lead to non-uniform frictional resistance at the block-block interfaces and possibly fracture of the concrete units.

### **Summary of conclusions**

A laboratory testing program was carried out to evaluate the mechanical connection performance of Rosetta modular block facing units in combination with ParaWeb 30 polyester strap using the back of block configuration. The following conclusions can be drawn:

1. The peak connection capacity between Rosetta units and ParaWeb 30 polyester strap for walls between 590 and 6368 lb/ft normal load, ranged between 85 and 98% of the index tensile strength of 6750 lb/strap (times two) in the machine direction (based on ASTM D 6637 method of test and reported in the manufacturers' literature).
2. The average connection capacity was 4226 lb/ft. In addition, variability in strength values was observed between nominal identical tests due to small differences in setting up the polyester strap reinforcement connection.
3. Care must be taken during the installation of Rosetta units in order to prevent accumulation of soil and rock debris at the concrete block-block interface surfaces. This debris may significantly reduce the capacity of the Rosetta facing unit-strap system.
4. The design capacity value of 2817 lb/ft is based on an interpretation of test data as recommended in the NCMA Segmental Retaining Wall Design Manual (First Edition, 1993). The choice of design connection strengths may vary from site to site and quality of construction in the field may require a lower design value.



R. J. Bathurst, Ph.D., P. Eng.



P. Clarabut

## REFERENCES

ASTM D 6638-01. Standard Test Method for Determining Connection Strength between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks), American Society for Testing and Materials, West Conshohocken, PA 19428-2958 USA.

Bathurst, R.J. and Simac, M.R., 1993. Laboratory Testing of Modular Unit/Geogrid Facing Connections, *ASTM Symposium on Geosynthetic Soil Reinforcement Testing Procedures*, San Antonio, 19 January 1993.

Simac, M.R., Bathurst, R.J., Berg, R.R. and Lothspeich, S.E., 1993. *NCMA Segmental Retaining Wall Design Manual (First Edition)*, National Concrete Masonry Association, 2302 Horse Pen Road, Herndon, VA 22071-3406.

**Table 1:****Test Program:**

Rosetta modular block unit (back connection detail) -  
ParaWeb 30 polyester strap connection

Test number	normal load (lb/ft)	peak tensile capacity (lb/ft) *	peak tensile capacity (lb) **	observed failure mode
1	2904	4544	13,253	strap rupture
2	590	4482	13,073	strap rupture
3	1740	3942	11,498	strap rupture
4	2912	4150	12,105	strap rupture
5	4062	4197	12,240	strap rupture
6	5234	4004	11,678	strap rupture
7	2912	4366	12,735	strap rupture
8	6368	4119	12,015	strap rupture
Avg		4226		

- Notes:
- 1) \* lb/foot length of block in the wall direction based on the 35 inch unit.
  - 2) No displacement at the connection was assumed due to high stiffness of the polyester strap material.
  - 3) \*\* two straps per connection (block)

LEGEND

- |   |                            |    |                    |    |  |
|---|----------------------------|----|--------------------|----|--|
| 1 | Rosetta block              | 6  | guide rail         | 11 | platform                               |
| 2 | ParaWeb 30                 | 7  | back connection    | 12 | computer controlled hydraulic actuator |
| 3 | loading platen             | 8  | surcharge actuator | 13 | stiff gum rubber mat                   |
| 4 | roller clamp               | 9  | loading frame      |    |  |
| 5 | lateral restraining system | 10 | spacers            |    |  |

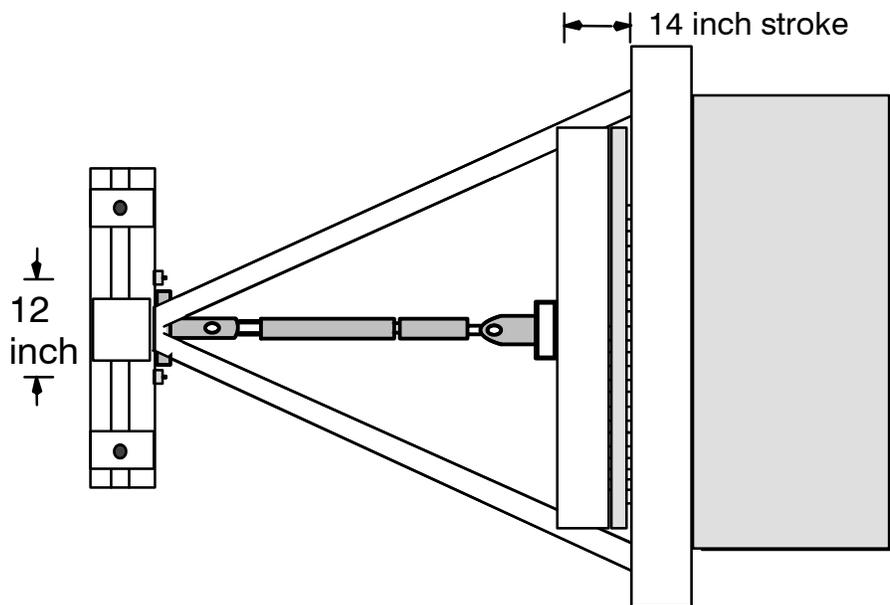
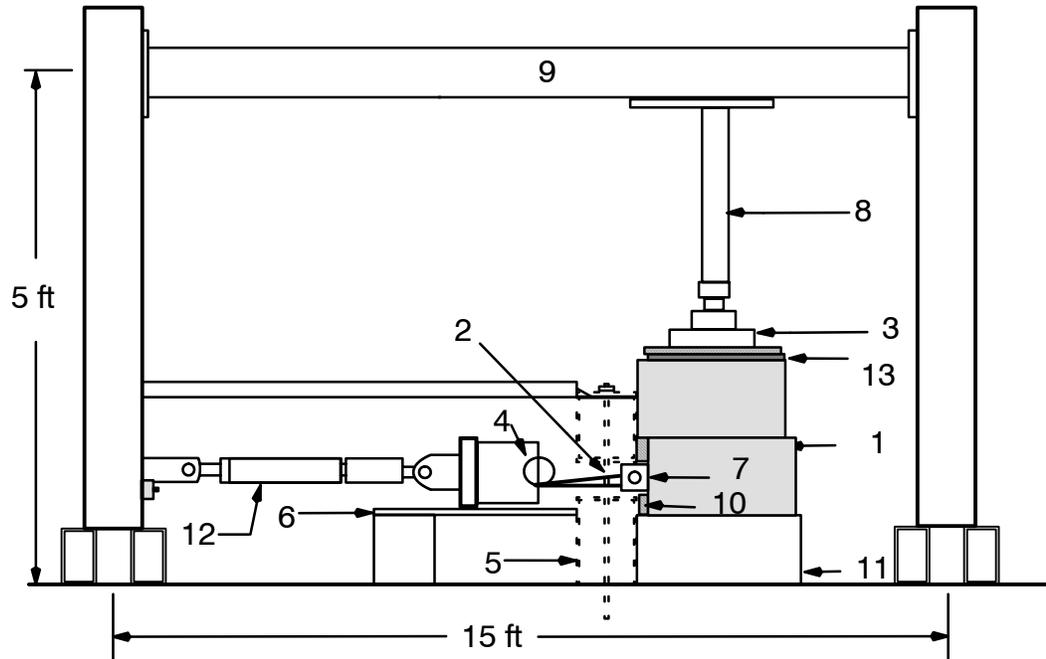


Figure 1: Schematic of connection apparatus showing Rosetta units and ParaWeb 30 using the back of block connection configuration



Figure 2: Photograph of connection detail and ParaWeb polyester strap in the connection test apparatus.



Figure 3: Photograph of Rosetta block unit with the back of block configuration in the connection test apparatus.