

## Case Study

application	<b>Soil Nailed Versa-Lok Retaining Wall</b>
location	<b>Toronto, Ontario, Canada</b>
Coordinates	<b>N 430 40.537' W 0790 25.35'</b>
product	<b>Miragrid® 3XT &amp; 5XT</b>

job owner	<b>City of Toronto</b>
engineer	<b>McCormick Rankin</b>
contractor	<b>Dynex Construction</b>

TenCate™ develops and produces materials that function to increase performance, reduce costs and deliver measurable results by working with our customers to provide advanced solutions.

### THE CHALLENGE

A 5m (16ft) steep slope and masonry stone wall located in a 75 year old neighborhood in downtown Toronto began to fail, thus threatening the house footings of the adjacent property. Due to the close proximity of the slope/wall to the adjacent property, a conventional wall could not be constructed. The City of Toronto originally decided to construct a soldier pile wall with a Cast-In-Place concrete fascia. The project was originally designed and tendered in 2006, however project tenders came in significantly over-budget and were put on hold for a year. The owner of the property adjacent to the retaining wall did a search for retaining walls on the internet and found Armtec's website. After further discussion with the property owner and subsequent site visits, Armtec was able to assess the problem and propose a solution, which they took to the City of Toronto's Consulting Engineer.

### THE DESIGN

The proposal put forth by Armtec was a Versa-Lok segmental retaining wall fascia with DuckBill Earth Anchors as a tie-back. Armtec had used this system on a number of previous projects with great success. The use of earth anchors eliminates the need for any significant excavation into the slope, while the natural look of the Versa-Lok fascia blended in well with the mature neighborhood.

The design consisted of a series of 3 types of earth anchors spaced at 1m (3ft) centres driven to a depth of 3.25m (10.6 ft). Anchor working loads ranged from 15kN – 40kN (3000lbf -

9000lbf). The fascia selected was a grey Versa-Lok segmental block. The design required 2 types of geogrid reinforcement with an LTDS of 26.7kN/m (1831lb/ft) and 36kN/m (2458lb/ft). Miragrid® 3XT and 5XT high tenacity polyester geogrids met this minimum LTDS. The connection to the earth anchors and Versa-Lok, utilized a 75mm (3in) dia. x 5.4mm (1/4in) wall thickness galvanized pipe connected to the earth anchors with galvanized cables. A 100% wrap of the Miragrid® geogrids around the pipe connected the fascia to the pipe and created a positive mechanical connection. Backfill material was to be an OPSS Granular B Type 1 compacted to 95% Standard Proctor density (SPD).

### THE CONSTRUCTION

Construction of the wall took approximately 3 weeks. Layout of the retaining wall was critical as the base of the wall elevation changed 5m (16ft) over its length of 40m (130ft). A total of 11 steps were required to meet this change in wall elevation. Typical construction sequence required the excavation of 1m of slope face, placing Mirafi® 160N nonwoven geotextile on the slope, driving the earth anchors at the designated elevations using a pneumatic air hammer and excavating the stepped footing. Next individual Versa-Lok blocks were stacked to the design elevations where the Miragrid® geogrid was to be installed. At the required elevation, a layer of Miragrid® geogrid was sandwiched between 2 blocks, laid flat on the compacted granular behind the wall, extended under and around the anchor pipe attached to the earth anchors and returned to the front face, where it was again sandwiched between two blocks, 300mm (12in) higher. This provided the 100% wrap of the system. The Ontario Provincial Standard Granular B backfill was then placed and compacted and the entire sequence started again.



View looking along face of wall, showing minimal excavation.



Geogrid wrap and return and sauna tubes for posts.



Connection detail to earth anchor.

**THE PERFORMANCE**

The homeowner of the adjacent property is absolutely thrilled with the contractor's performance and the end result.

The City of Toronto is also pleased with the result especially since the project was now closer to the original budget. An additional benefit to the homeowner was they actually gained some additional property on top of the wall.

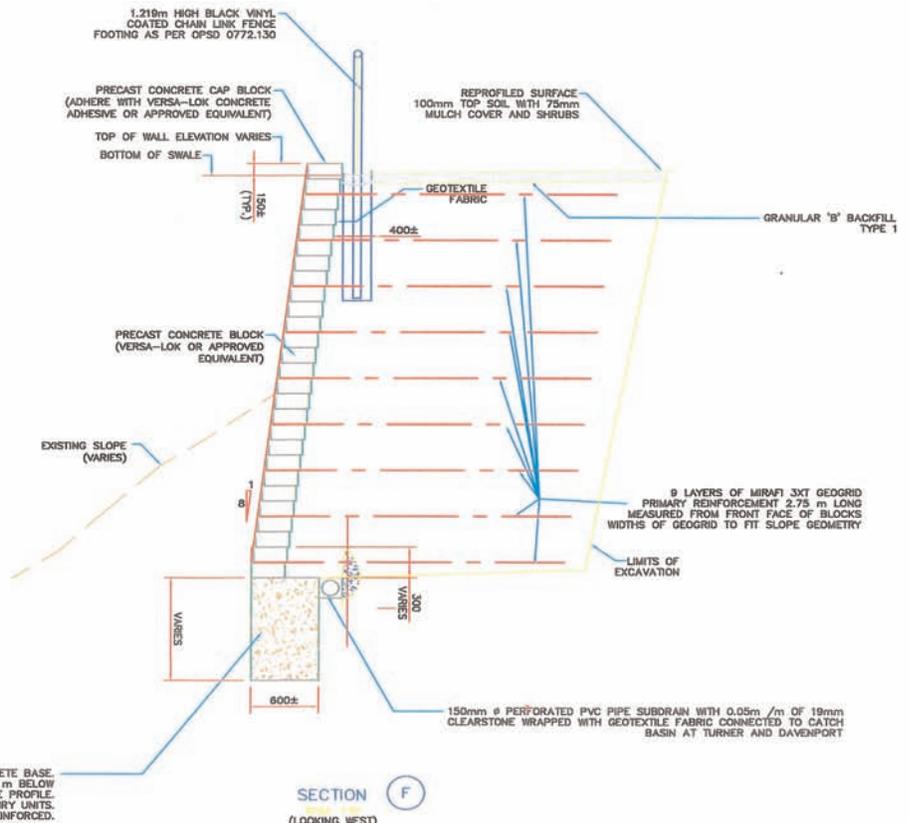
The project was essentially a design build contract, with the contractor sub-contracting the supply of the wall components and the certified design to Armtec.



Finished wall.



Wall under construction, showing earth anchors.



**RIGHT:** Front elevation of wall showing change in wall footing.

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