

ReCon
Mechanically Stabilized Earth Retaining Wall System
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Reporting on Work Plan 2010-2
Category II Experimental Project

State of Vermont
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Construction and Materials Bureau
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Abstract

Mechanically stabilized earth wall (MSE) technology using the ReCon MSE Earth Retaining Wall System had not been put into practice by the Agency prior to this project. This particular system utilized concrete block facing and geogrid for soil reinforcement to construct a retaining wall that provided grade separation and earth retention along the Morristown, VT alternate truck route as part of the Morristown STP F 029-1(2) project. Because a single proprietary product was specified for this project, complete details of the wall system were solicited in advance and the Agency was allowed to review and comment on the design prior to bid letting. Staff from the Geotechnical Engineering Section was on-site during construction activities to document and monitor the installation of the wall. One year after the completion of the wall, the system was inspected and was performing well. As a result, the ReCon MSE Earth Retaining Wall System was added to the Agency's Approved Products List for earth retaining systems.

Introduction

During the fall of 2013, the Vermont Agency of Transportation (VTrans) constructed a ReCon mechanically stabilized earth (MSE) retaining wall as part of the Morrystown STP F029-1(2) project. The Recon MSE retaining wall was designed to provide grade separation and earth retention along the Morrystown alternate truck route.

Civil Design Professionals (CDP) provided the shop drawings for the project, based upon design criteria provided by VTrans. Since this was the State of Vermont's first time using this particular type of retaining wall on a federal aid project, it was designated a Category II Experimental Feature.

The ReCon MSE retaining wall system was thought to be beneficial for several reasons.

- Complete details of the wall system would be solicited in advance and incorporated into the contract documents. This would allow contractors in this area not familiar with this type of construction to become better acquainted with the construction requirements.
- The design could be reviewed in advance by the Agency of Transportation. This would allow the Agency to resolve any problems it had with computations, allowable stresses, design loads, construction details, and specifications, before bid letting.
- The ReCon MSE retaining wall system does not require a concrete footing. According to the manufacturer, it can be placed directly on a compacted granular material which meets the following requirements.

Sieve Size	% Passing
25mm	100
19mm	75-100
4.75mm	0-10
300µm	0-5

- In accordance with the Agency's "Policy on Earth Retaining Structures" dated November 1995, successful completion and satisfactory performance of this wall in the field would allow the addition of another retaining wall system to the Agency's Earth Retaining System Selection Chart for Mechanically Stabilized Earth walls and more competitive bidding of future projects.
- A ReCon retaining wall would be more tolerant of differential settlement than a conventional reinforced concrete wall.

This report documents our observations during and post construction and provides a summary of our recommendations.

Site Conditions

The ReCon wall at this site is adjacent to the new alternate truck route and supports the parking area of a storage facility above. The wall is approximately 4.2 meters tall by 42.0 meters long. Two borings, B-201 and B-202 were drilled by the Agency in March of 2010 and indicated the in-situ soils to be comprised of loose to very dense sand and sandy gravel/gravelly sand to depth. Lab tests performed on the samples indicated the material to meet the gradation requirements specified for the reinforced fill material. As a result, the in-situ material was allowed to be used as backfill material for the wall. It should be noted that the in-situ material did not meet the gradation requirements for the granular material specified for the leveling pad, so the leveling pad was constructed using additional material that was brought on site.

Wall Details

The retaining wall system supplied by ReCon Retaining Walls was produced locally through S.D. Ireland, in Williston, VT. The wall system achieves its structural integrity through the use of its weight, the key cast into the block, and the geogrid reinforcement as seen in Figure 1.



Figure 1: Segment of the ReCon wall illustrating the interlocking keys cast into the blocks and geogrid reinforcement to be embedded into the soil

Leveling Pad

This project required a 600 millimeter by 1.0 meter leveling pad made of granular material meeting the gradation requirements specified above. Figure 2 below illustrates the construction of the granular leveling pad.



Figure 2: Geotextile fabric installed as a grade separator & leveling pad construction

Geogrid

A Mirafi 5XT geogrid was specified for this project. The geogrid was placed on top of the blocks and extended back into the soil mass a distance of approximately 3.2 meters. After placement of the next course of blocks, the geogrid was pulled taut and then staked in the field to ensure it remained in place, prior to placement and compaction of the soil. Figure 3 below depicts the typical geogrid layout pattern.

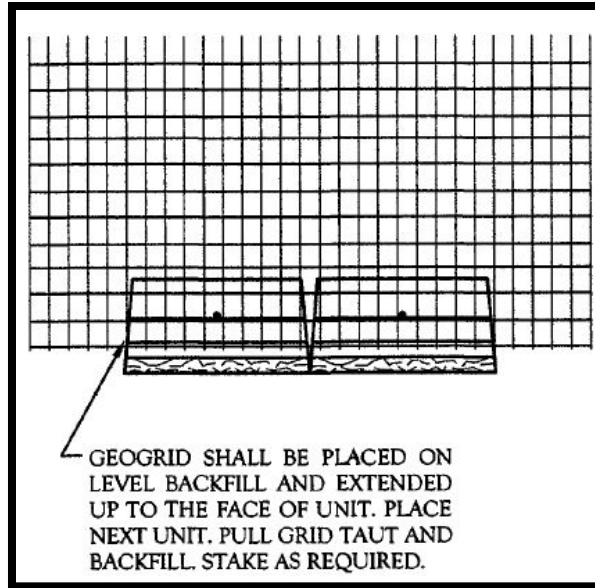


Figure 3: Typical geogrid layout pattern

Wall Units

For this project, there were seven different block types used based on location including capstones, corner blocks, middle blocks, half middle blocks, bottom blocks, half bottom blocks, and half end capstones (field cut). All the blocks, with the exception of the capstones, are 610 mm tall and all the blocks have a textured face. Figure 4 shows the shop drawings illustrating the dimensions of the different types of blocks.

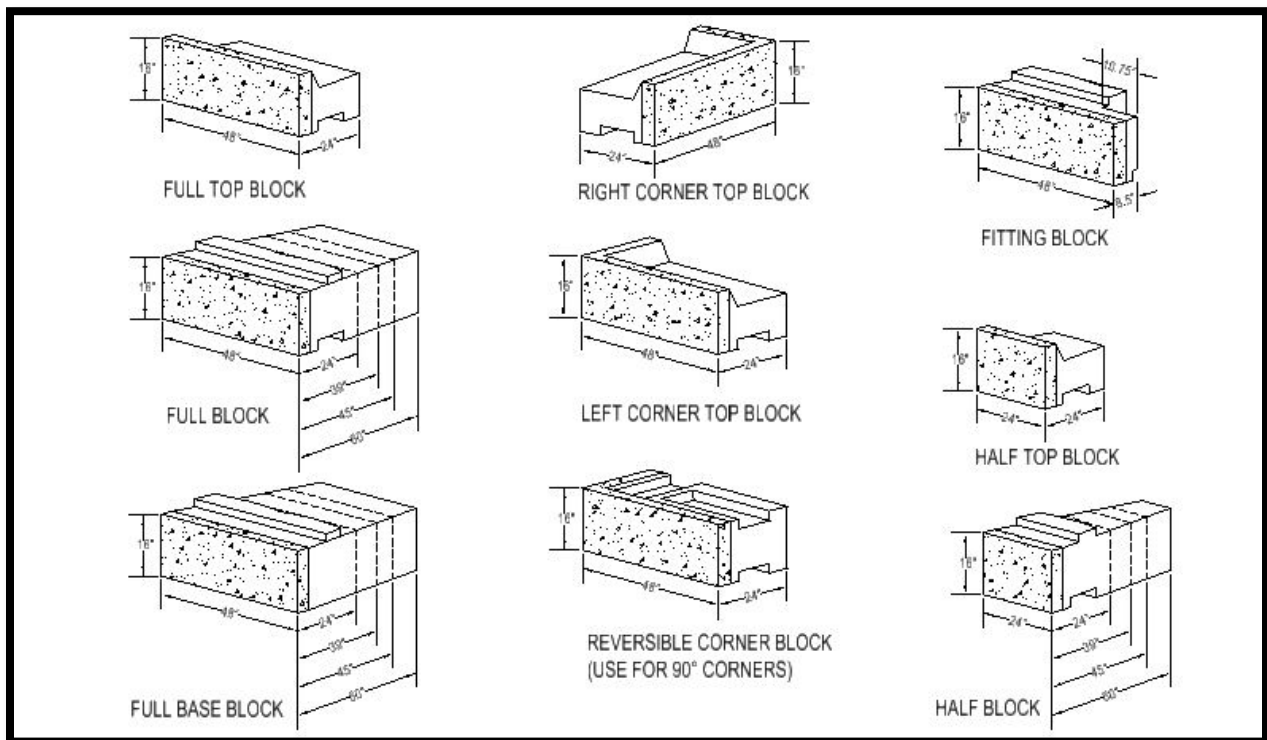


Figure 4: Typical block dimensions

Construction

The ReCon retaining wall was assembled by Winterset, Inc. Figure 5 illustrates a Typical Cross Section for this project.

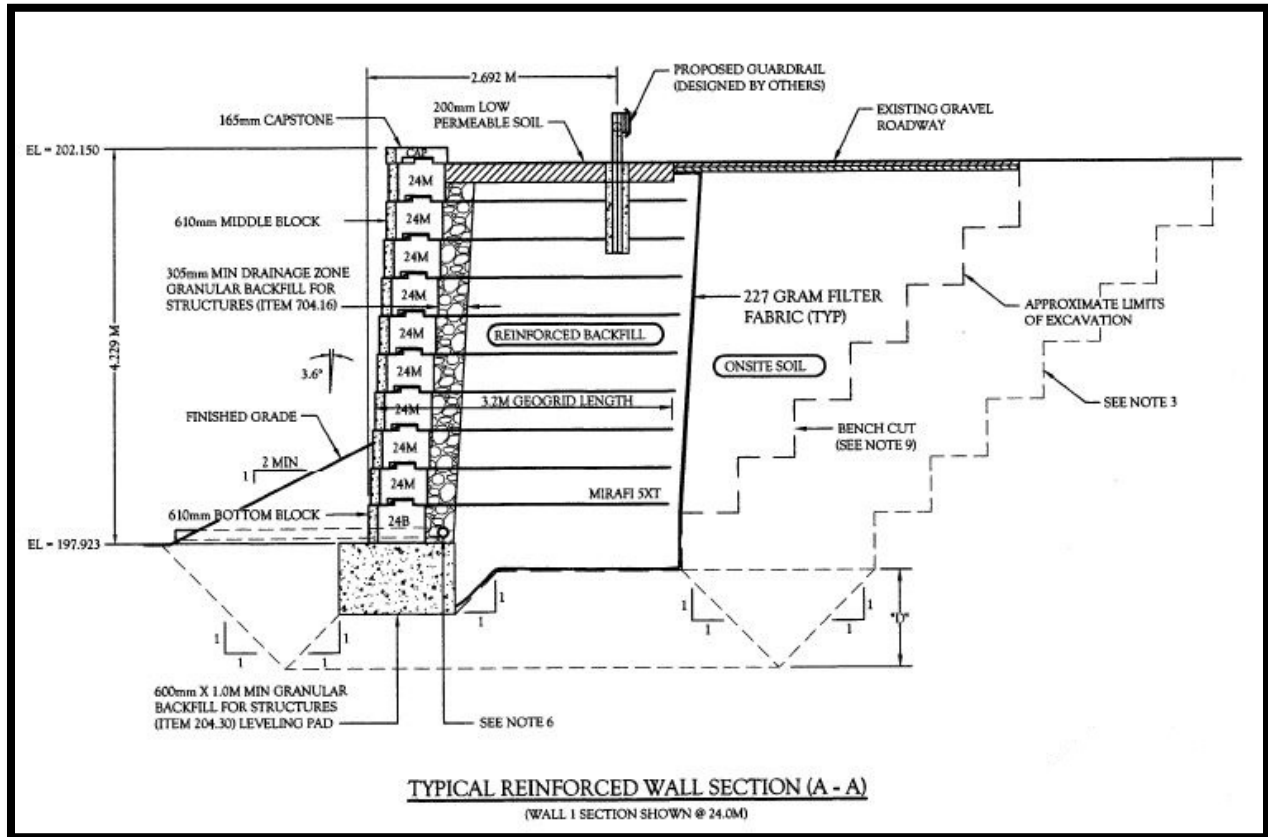


Figure 5: Typical cross section of ReCon retaining wall

The first stage of construction required the excavation of the in-situ soil and the construction of the leveling pad. Blocks were then installed in rows. As the rows of blocks were installed, the drainage stone and in-situ reinforced backfill were placed behind the blocks and compacted using a vibratory roller and a small vibratory plate compactor when in close proximity to the wall face. The geogrid was installed per the manufacturer's recommendations. Figure 6 shows the installation of a row of blocks.



Figure 6: Installation of a row of blocks

The design of the project required that a drainage pipe be installed on the back side of the wall. This was easily done with a perforated pipe that would allow water to infiltrate and then flow away from the base of the wall.

The final step in constructing the wall was the installation of a fence on the top of the wall. The fence was installed on the uphill side of the wall and can be seen in Figure 7.

Observations

Overall, construction of the ReCon wall went smoothly. Once the blocks were delivered on-site, they were color coded, indicating where the block would be placed (note the yellow and blue tags visible in Figure 6). This system allowed the contractor to keep track of the various block types used on site. There was a delay, however, with the number of block forms S.D. Ireland had available. As a result, the contractor was often waiting for the next delivery of blocks. Other than the delay of materials, the contractor and Resident Engineer both thought the ReCon wall was fairly easy to install.

The wall was inspected in the fall of 2014, approximately one year after construction, and there were no visible distresses evident in the final product. Overall, the wall appeared to be performing as designed. Figure 7 illustrates the completed wall.

Recommendations

The wall discussed in this report incorporated the use of geogrid as soil reinforcement. This wall system proved to be an acceptable Mechanically Stabilized Earth Wall on this project. In the future, the ReCon retaining wall system will need to be designed on a project specific basis to take into account variations in wall heights, soil conditions, and external loads acting on the retaining wall.

It is also recommended that this project be monitored into the future for any adverse changes and the changes be reported in future updates.

As a result of the performance documented in this report, the ReCon retaining wall system has been added to the Vermont Agency of Transportation Earth Retaining System Selection Chart for Mechanically Stabilized Earth walls for non-bridge supporting applications.



Figure 7: Completed ReCon retaining wall