MSE Wall with Geosynthetic Reinforcement Case Study in Prince George's County, MD

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INTRODUCTION

MSE retaining wall with concrete facing panels is a pretty popular system used globally to support or enable the construction of infrastructure, forming retaining walls, abutments and wing walls.
Polymeric reinforcement strips have been introduced in the MSE wall market as an alternative from the traditional reinforcements, they represent a significant advantage for both cost-effectiveness and performances. MSE walls with polymeric strips are recommended for non-conventional situations such as poor subsoil conditions, chemically aggressive environment or in warm climates.
Generally, performance of an MSE structure depends on the interaction between the reinforcement component and the surrounding soil, which are linked to the properties of the materials used and the construction methods adopted. High adherence polymeric reinforcing strips have been introduced to increase the design life of the wall even in highly aggressive environments, reduce the overall project costs and provide design flexibility.
MSE walls with polymeric strip were first introduced to the European market in the mid-1970s and their market has been growing ever since all over the world but only recently has been developed in North America.

PROJECT DESCRIPTION

The MSE wall presented in this paper is located in Prince George's County, Maryland and it is part of a bigger project called Andrews Federal Center Bus Operations and Maintenance Facility. The project included the design and construction facilities, garages and buildings in support of the Washington Metropolitan Area Transit Authority's (WMATA) mixed fleet of transit vehicles. Four different types of retaining wall systems were considered for this complex, and among them two were an MSE wall with concrete facing panels.
Significant challenges were associated to this project: the quality of the structural soil to be used, the presence of obstacles like drainage pipes and ornamental fences, and the layout of the wall itself with several bends and curves. An MSE wall with concrete facing panels and polymeric strip reinforcement was selected to face these challenges due to the flexibility of the geosynthetic reinforcement to accommodate obstructions and bends, and the suitability of the polymeric strip for non-conventional backfill material.
In situ soil used as structural soil, as per requirement of the project, was classified as orange brown poorly graded sand with silt and gravel with the following characteristics:

	Value
pH	9.3
Resistivity	2900 ohm-cm
Sulfate	89.3 ppm
Chloride	44 ppm

The MSE retaining walls were designed in accordance to AASHTO LRFD Bridge Design Specifications, 7th Edition, considering a standard traffic live load (12 kPa), a guardrail impact of 0.41 kN/m and a seismic acceleration coefficient As = 0.05. These walls were designed considering a service life of 120 years.

Concrete panels for this project have all the same shape and dimensions (1.52 x 3.04 m and 14 cm thick), except as necessary to maintain grade and length. The polymeric reinforcement elements consist of planar strips manufactured from high tenacity, multifilament polyester yarns aligned and co-extruded with LLDPE (Linear Low-Density Polyethylene) to form polymeric strips. The ParaWeb™ mechanical and physical properties have been qualified by NTPEP (National Transportation Product Evaluation Program). Further, the polyethylene coating allows the use of these polymeric strips in highly alkaline environments (pH>11) as recycled concrete or lime-stabilized backfill materials.

The connection is a bar encased in a HDPE plastic box and precasted with the concrete panel to guarantee the mechanical link and the geostrips are placed and pre-tensioned on the jobsite.

The HDPE cavity insert box is connected to the panel by a steel embedded rebar encased in a polymeric sleeve for corrosion protection. The sleeve avoids water and cement from entering during the casting phase and prevents damage to the polymeric soil reinforcing strips in contact with the deformed rebar.

During installation the panels were positioned with a slight back inward inclination to compensate for outward movement that can occur during placement and compaction of the “non-conventional” backfill. The inclination was obtained by pulling the top of the panel towards the rear face of the structure and was maintained inserting timber wedges and using clamps to fix two adjacent panels. The timber wedges were then removed when the next row was placed to avoid panel damage.

Overall there were no issues with the vertical and horizontal alignment of the panels and the inclination was checked with a level regularly.

Figure 1 Connection detail

Figure 2. Full Wall one year after the end of installation