24-031

Engineering a Large Eco-Friendly Reinforced Sloped MSE Wall System to Increase the Size of a Flat, Work Area of a Mine

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An engineering endeavor involves the creation of an expansive, environmentally conscious reinforced sloped MSE wall system. The objective is to enlarge a flat mining work area. Situated in southern Arizona, this mine is dedicated to extracting essential resources such as Manganese, zinc, silver, and lead, crucial for advancing clean and renewable energy initiatives. The project necessitates the implementation of a Mechanically Stabilized Earth retention system. This system aims to both expand the mine's working area and facilitate access to underground tunnels.

The expansion pad must be robust enough to endure the substantial loads exerted by heavy mining machinery. The wall's reinforcement components are strategically designed to counteract the challenges posed by aggressive soil conditions with low resistivity. Furthermore, they must be resilient against potential damage during installation. The system's ease of transportation is crucial due to challenging access conditions, and its design must allow for efficient drainage.

A significant consideration is the integration of a face system that fosters vegetation growth and seamlessly merges with the existing flora of the area. In addition, plans include the construction of an access road downslope from the wall. The chosen solution involves a reinforced sloped system with a 70-degree incline. The wall's surface is adorned with an erosion control mat, intended to promote the proliferation of vegetation. For added durability, the wire basket units are equipped with galvanized wire featuring a polymer coating. High tensile strip bonded geogrids, featuring a robust polyester core, provide essential reinforcement.

The completed wall is an impressive feat, spanning 1500 feet in length and soaring to a height of 45 feet. It stands as a testament to innovative engineering in harmony with environmental and functional considerations.

SELECTION OF GEOSYNTHETIC REINFORCEMENT MATERIALS

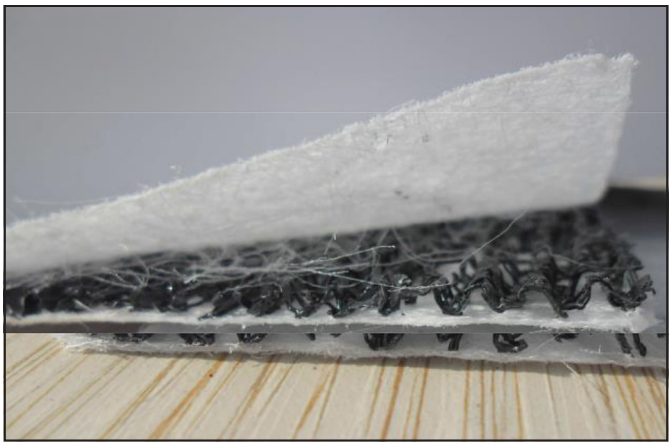
The design parameters to be considered in the design of the MSE wall structure included a horizonal and vertical peak ground acceleration coefficients, CONEX Box Containers Loading capacity, and in situ backfill selection of highly corrosive soils.

A selection of Geogrid geosynthetics manufactured from high tenacity, multifilament polyester yarns aligned and co-extruded with polyethylene (LLDPE) to form Polymeric strips. The heavy LLDPE coating enable the Geogrid product to be used as reinforcement of contaminated and high aggressive materials for use in environmental applications. Different strengths of geogrid were used to accommodate height levels and loading, below is a chart of the products used:

Product Name	Tensile Strength (Ultimate)
Paragrid 65/5	65 kN/m – 4454 lb/ft
Paragrid 80/8	80 – 5482 lb/ft
Paragrid 100/5	100 kN/m – 6852 lb/ft
Paragrid 120/5	120 kN/m – 8222 lb/ft

SELECTION OF DRAINAGE COMPOSITE MATERIALS

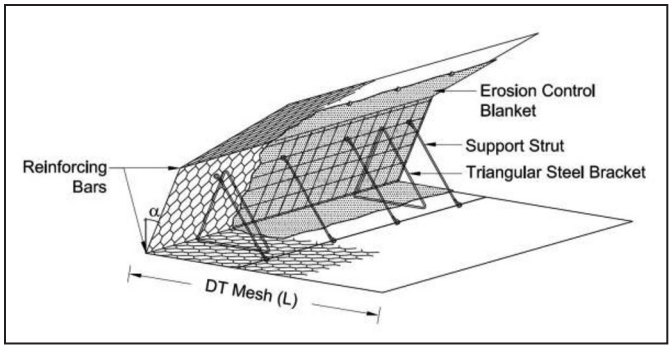
The large expansion pad area would be subject to collect substantial amounts of rainfall, a proper drainage system for the wall was a key factor for the proper functioning of the MSE wall. A Geocomposite for planar drainage system (GCD), was selected. It is realized by thermobonding a draining core in extruded monofilaments (GMA) with two

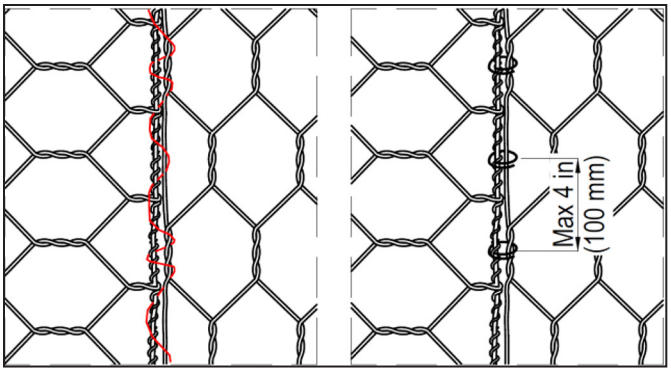


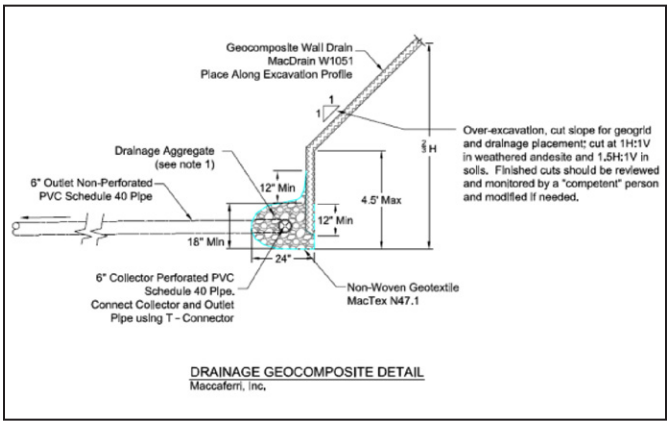
filtering non-woven geotextiles that may also be working as separation of protecting layers. The drainage three-dimensional core will have a "W" configuration as longitudinal parallel channels. Macdrain W 1051 has a flux perpendicular to the plane value of 100 gpm/sf or 100 l/sm. The drainage core (GMA) is a three-dimensional geomat made by extruded monofilaments set in the longitudinal parallel channel configuration.

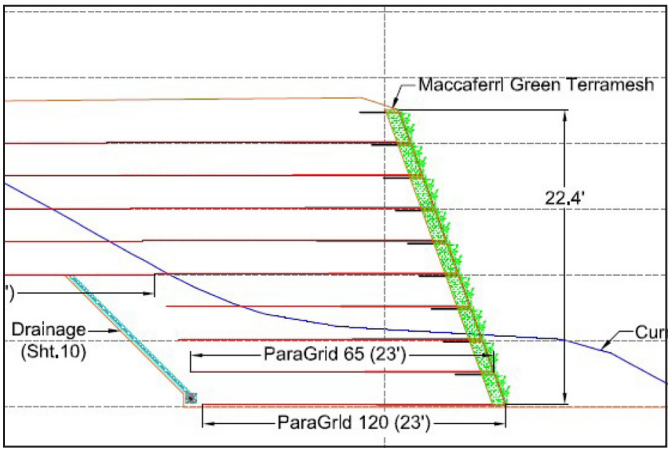
SELECTION OF FRONT FACE FASCIA

To satisfy the low-carbon policy and green solution capable of providing a front face surface suitable for vegetation, a Maccaferri Green Terramesh slope reinforcement system was selected. A Green Terramesh is a HITEC evaluated reinforced soil slope system comprised of continuous double twisted wire mesh that form the top wrap, facing and continues in the reinforced soil zone as a reinforcement. The units are lined with a geosynthetic or biodegradable erosion control blanke and stiffened with welded mesh panel. Two triangular brackets and foru steel support struts are used to achieve the inclination. The soft or medium temper steel wire is coated with a high abrasion resistant polymer coating (PoliMac) that provides additional protection for use in polluted, contaminated or aggressive environments.









A Separation non-woven polypropylene geotextile was needed to separate the fines of the backfill to the Green Terramesh units. MacTex N47.1 was selected.

A mix of Southeastern Arizona Native Grass and Forb Revegetation seed were utilized to perform a hydroseeding of the fascia of the walls.

24-032

Enhancement of Ultrafine Phosphate Flotation Using Eriez' Cavtube Column Flotation Technology

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ABSTRACT

The rapid increase of P_2O_5 use for food, biofuels, and $LiFePO_4$ batteries etc. accelerates the depletion rate of phosphate reserves. In the phosphate industry, a significant amount of ultrafine phosphate has been discarded as slime tailing due to processing difficulties. The major problems associated with ultrafine particle flotation are low probability of bubble-particle collision and adhesion, and high probability of unwanted gangue particles entrainment. This paper investigates the enhanced ultrafine phosphate particle flotation probability by Eriez' CavTube generated fine/ultrafine bubbles and the improved flotation selectivity by wash water etc. Ultrafine phosphates with various gangue minerals of quartz/muscovite, calcite/dolomite, and iron/silica were studied. Microscopic observations show that the entrained ultrafine gangue minerals can be minimized by using wash water in column flotation. A three-factor three-level central composite experimental design was conducted for ultrafine phosphate flotation. For comparison, both benchtop mechanical cell and laboratory column flotation tests were performed at their optimal respective flotation conditions. Using Eriez CavTube column flotation technology for Industries Chimiques du Senegal (ICS) ultrafine slime tailings, a concentrate grade of 36.0% P_2O_5, was achieved at 89.4% P_2O_5 recovery. Improved flotation performance was achieved using column flotation as compared to benchtop mechanical cell flotation. The benefits of Eriez' column flotation technology realized from this study include the high P_2O_5 grade and recovery.

INTRODUCTION

Phosphate is crucial for plants and animals, including humans. Isaac Asimov, an important science writer, defined phosphorus as "life's bottleneck." The rapid increase in P_2O_5 use is mainly caused by the growth in demand for food because, coupled with increased food crops for biofuels and the great demand for $LiFePO_4$ batteries, etc. In many phosphate mines, a significant amount of phosphate is routinely discarded as an ultrafine slime tailing stream due to technical and economic barriers using conventional flotation technology. Ultrafine particle flotation has been a long-standing problem, especially for non-sulfide ores flotation. The major issues associated with ultrafine particle flotation are the low probability of bubble-particle collision, the low probability of bubble-particle adhesion, and the high probability of unwanted gangue particles entrainment.

In the past twenty years, scholars have conducted extensive scientific work to improve fine/ultrafine particle flotation using fine and ultrafine bubbles generated by hydrodynamic cavitation [1–20]. Ultrafine bubbles can bridge hydrophobic particles to form aggregates [21–23] and increase the ultrafine particles flotation selectivity and flotation kinetics. Cavitation tube generated nanobubbles can not only promote the formation of flocs, but also increase the stability of flocs [24–28]. Improved flotation performance by cavitation tube generated fine bubbles has been verified in the flotation of various minerals such as quartz [29–33], sulfide [34–41], phosphate [42–46], coal