

Design and evaluation of efforts on a Mechanically Stabilized Earth Wall.

Gabriel L. Brancaglion*, Paulo J. R. Albuquerque.

Abstract

The Mechanically Stabilized Earth Wall is one among the variety of retaining walls used to overcome soil unevenness, standing out as a cost-effective way to attend design criteria, which involves external and internal stability analysis. This research main objective is to design and evaluate the efforts suffered by this retaining structure, as well increase the understanding of this powerful tool.

Key words:

Mechanically Stabilized Earth Wall, design, evaluation of effort.

Introduction

The Mechanically Stabilized Earth Wall is a cost-effective retaining wall technic compound of precast concrete square panels reinforced by metallic strips and other auxiliaries pre-manufactured components, which contributes for its rapid construction and capability to tolerate deformation due to poor subsoil foundation conditions¹.

This research has the objective of develop the knowledge of the Mechanically Stabilized Earth Wall technic by an extensive bibliography research in order to provide understanding to design a retaining wall in an area near the Faculdade de Engenharia Civil, Arquitetura e Urbanismo of UNICAMP, precisely along the Avenue Albert Einstein.

Results and Discussion

According with the results of a percussion drilling survey was possible correlate essential soil properties of each layer (Chart 1) in order to gather enough information to evaluate the system soil-retaining wall equilibrium.

Chart 1. Soil layers' properties.

Thickness (m)	SPT average	Friction Angle	Coesion (kPa)	Unit Weight (kN/m ³)
0.65	0	-	-	-
10.3	4.6	25	9	19
7.55	6.4	26	12	19
4.95	37.2	37	28	20

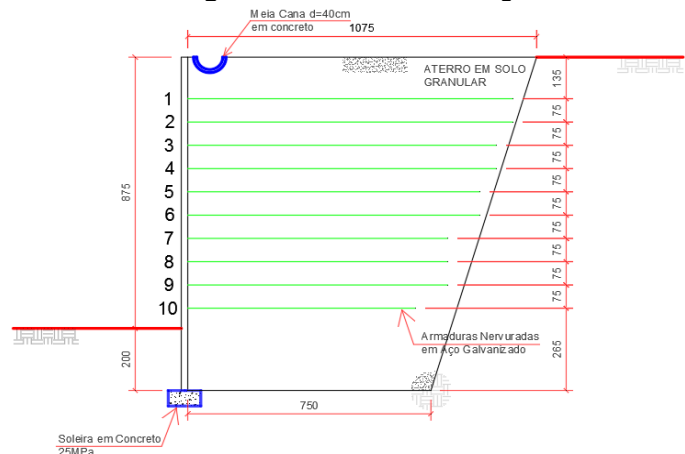
The retaining wall was designed to overcome an 8.26m slope at the critical section, following the orientations at the FHWA-NHI-10-024² and the NBR 8286/86³. This way the structure considered a back landfill of 7.35m of extension, reaching 10.5m final height, including the buried part.

Chart 2. Safety Factors for the project configuration.

Stability		Design Safety Factor	NBR 9286/86 Safety Factor
Internal	Pullout Failure	4.17	1.50
	Tensile Forces	5.08	1.50
External	Sliding	1.87	1.50
	Eccentricity	6.22	External efforts resulting acting within the base third central
	Bearing Capacity	3.97	2.00
	Global	1.8	1.50

Then the internal and external equilibrium analyses were developed due to achieve the major safety factor possible using the full extension of the back landfill (Chart 2). For the global analysis were compared the safety factors obtained by Morgenstern-Price, Bishop and Fellenius (Ordinary), using the computer software Slope/2012, developed by GeoStudio.

Image 2. Critical section design.



Conclusions

According with the analysis of the critical slope situation, the Mechanically Stabilized Earth Wall is technically feasible in order to improve the slope stability and provide a significant increase of useful area. The security factor of the suggested area can be improved from 1.38 to 1.80 by the designed wall.

This technic of soil reinforcement is suitable for the studied area because of its rapid construction and do not require as large of construction equipment, consequently, demands less space in front of the structure for construction operations, which can be considered excellent, as this area is nowadays occupied by a road and surrounded by existing infrastructures.

¹THE REINFORCED EARTH COMPANY. Design Manual for Reinforced Earth Walls. Vienna. 2005. 76 p.

²U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION. Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume I. 2009.737p.

³ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS. NBR9286 – Terra Armada. Rio de Janeiro. 1986.