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Unique Design Considerations for Mechanically Stabilized Earth Walls in Transportation Widening Applications

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Abstract

As many transportation corridors have exceeded design capacity, additional lanes are being constructed adjacent to existing traffic. The construction of new lanes often requires support of excavation or relies on existing retaining structures for temporary and permanent load relief on new MSE walls. Although various types of hybrid MSE structures using combinations of existing walls or multiple wall types have been successfully constructed for decades, minimal formal design guidance existed until 2006 when the US Federal Highway Administration issued a manual for Shored MSE walls (SMSE).

This paper will present case studies and best practice suggestions for the use of MSE walls in highway widening applications, including where new MSE walls are placed in close proximity to existing MSE walls or other retaining structures.

Keywords: MSE, Shored Mechanically Stabilized Earth, soil nail, reinforced soil

1 Introduction

Mechanically Stabilized Earth (MSE) walls have been in use in North American highway and rail applications for over 45 years. Due to the economy, flexibility and load bearing resistance of properly designed and constructed MSE walls, these structures have become the preferred method for earth retention in fill situations. With transportation facilities expanding due to need for increased capacity, right of way is often at a premium and innovative solutions are needed to provide safe, economical MSE walls in areas where conventional MSE solutions require too much space to fit the typical length of soil reinforcements.

MSE Walls consist of three major elements (Soil Reinforcement, Backfill and Facing Elements). The length of soil reinforcement required is based on providing a coherent gravity structure, capable of resisting externally applied forces (from retained fill, earth quakes, etc) with its own mass. Fundamental to the concept of a coherent gravity mass, the structure must be internally stable to behave as a semi-rigid block. The internal stability of a MSE structure relies on the interaction of reinforcement (spaced at regular intervals) and frictional backfill.

The length of the soil reinforcement is typically on the order of 70% of the height of the wall [1] (See Figure 1). This "aspect ratio" is frequently referred to as L/H. While the typical length of reinforcement suits construction of MSE retaining structures in fill situations, it often precludes the use of MSE walls in cuts or in areas with limited fill space (i.e. where there is less than 70% of the wall height available for placement of soil reinforcements).

While the 70% ratio has become gospel to many MSE wall designers, there is in fact no theoretical reason to limit the length to this ratio. It should be noted that the 70% ratio is based on typical conditions, and if field conditions permit and analysis shows that the MSE wall is internally, externally and globally stable, reinforcement lengths shorter than 70% of the wall height may be used, provided that deformations of the wall face are controlled.

In the field of reinforced soil structures, the pioneering work of Terre Armee, starting in the 1970's, led to additional research throughout the

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