

Technical Memorandum

To: Electronic Distribution Recipients

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Assistant Commissioner, Engineering Services



Subject: Use of Mechanically Stabilized Earth (MSE) Walls with a Precast Concrete Panel Facing

Expiration

This Technical Memorandum supersedes Technical Memorandum 14-02-B-01. This Technical Memorandum will expire on July 16, 2024 unless superseded.

Implementation

Precast concrete panel facing MSE walls may be used in lieu of conventional gravity, cantilever, or counterfort retaining walls.

This Technical Memorandum is intended to cover precast concrete panel facing MSE walls and does not include MSE walls with other facing systems. For guidelines regarding the use of wet cast prefabricated modular block walls or without soil reinforcement refer to MnDOT Design Scene chapter 11 at the following web site:

<http://www.dot.state.mn.us/pre-letting/scene/index.html>

Introduction

Precast concrete panel MSE walls are reinforced soil retaining wall systems that consist of vertical or near vertical precast concrete facing panels, metallic or polymeric tensile soil reinforcement, and granular backfill. The precast concrete panels have a minimum thickness of 5 ½" and include cruciform, square, rectangular, diamond, or hexagonal shapes. The strength and stability of the MSE wall is derived from the composite response due to frictional interaction between the reinforcement and the granular fill. MSE systems can be classified according to the reinforcement geometry, stress transfer mechanism, reinforcement material, extensibility of the reinforcement material, and the type of facing connections (see Federal Highway Administration publication Nos. FHWA-NHI-10-024 and FHWA-NHI-10-025, entitled "Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes - Volumes I and II" for more details about the different types of MSE walls).

Purpose

MSE walls may offer an economical alternative to walls higher than about 10 ft or where special foundations would be required for a conventional cast-in-place concrete wall.

Guidelines

MSE walls may provide the following advantages:

- A. MSE wall system construction is relatively rapid and does not require specialized labor or equipment;
- B. MSE wall systems are flexible and can accommodate moderate settlements without distress;
- C. Soil reinforcement is light and easy to handle; and
- D. Concrete facing panels can provide options for architectural finishes and textures. (Note: Joint spacing and alignment, which are tied to panel types, must meet the aesthetic requirements of a particular project.)

In general, MSE walls **shall not** be used where:

- A. Two walls meet and form an angle less than 70°;
- B. There is scour or erosion potential that may undermine the reinforced fill zone or any supporting footing;
- C. There is groundwater flow or a high groundwater level within the reinforced fill zone or footing area;
- D. Walls with high curvature (radius less than 50 ft);
- E. Soil is contaminated by corrosive material such as acid mine drainage, other industrial pollutants or any other condition which may increase the corrosion rate, such as the presence of stray electrical currents. (See publication No. FHWA-NHI-09-087 for details);
- F. Wall height is greater than 50 ft. For total wall height greater than 50 ft, separate walls may be used in a terraced configuration (access, drainage and adequate distance between the walls shall be provided for maintenance operations);
- G. Sites where extensive excavation is required or sites that lack granular soils where the cost of importing suitable fill material may render the system uneconomical;
- H. Walls are along shorelines;
- I. Walls adjacent to or on railroad right of way;
- J. There is potential for placing buried utilities within the reinforced zone, refer to the MnDOT LRFD Bridge Design Manual for utility information;
- K. Back-to-back walls when the distance between the walls is less than 1.2 H, where H is the larger height of the two walls;
- L. There is potential of placing trees or plants within the reinforced zone, except for erosion or settlement control;
- M. The limit of permanent MnDOT Right of Way (ROW) is not sufficient to contain the entire length of the wall earth reinforcement and any needed clearance for utilities or/and future excavations; or
- N. Grade at toe of wall exceeds a 1 Vertical (V): 4 Horizontal (H) slope or 1V: 6H in poor soil as determined by the Foundations Unit (Or the geotechnical consultant for State Aid Projects).

Pre-Qualification

For a wall system to be considered on a MnDOT project, the wall system must be pre-qualified. The pre-qualification requirements and list can be found at the following web site:

<http://www.dot.state.mn.us/products/walls/msewalls.html>

Design and Construction Requirements

Extensive information and requirements regarding wall design, project submittals, acceptable materials, construction, including interference with utilities, can be found in the latest special provision, found at the following website:

<http://www.dot.state.mn.us/pre-letting/prov/index.html>

Shop Drawing and Submittal Review

The Contractor shall send all submittals to the Project Engineer for review. MnDOT's review of computations and shop drawings shall not relieve the Contractor of full responsibility for the wall design and the submission of complete shop drawings for the accurate construction of the wall. If technical assistance in review is required, the Project Engineer may contact the MnDOT office as indicated in parenthesis below:

- A. Project line and grade. (MnDOT Projects - Roadway Design, State Aid Projects – District State Aid Office)
- B. Design calculations and methods, factored tensile resistance, strength and service bearing resistance, connection design, pullout parameters, external and internal stability, surcharge load, and capacity/demand ratios. (MnDOT or State Aid Projects - MnDOT Structural Wall Engineer)
- C. Design details at obstructions such as drainage structures or other appurtenances, traffic barriers, cast in place junctions, etc. (MnDOT or State Aid Projects - MnDOT Structural Wall Engineer)
- D. Facing details and architectural treatment. (Project Engineer)
- E. Overall and compound stability. (MnDOT Projects - Foundations Unit, State Aid Projects - Geotechnical Consultant & Foundations Unit)

Questions

Any questions regarding the technical provisions of this Technical Memorandum can be addressed to the following:

Joe Black, Structural Wall Engineer, at (651) 366-4485

Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, DesignStandards.DOT@state.mn.us. A link to all active and historical Technical Memoranda can be found at <http://techmemos.dot.state.mn.us/techmemo.aspx>.

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