

DATE: January 29, 1993

TO: All Bridge Designers

FROM: A. J. Siccardi

SUBJECT: Technical Memorandum #11
Preparation of Plans and Specifications for
Mechanically Stabilized Earth (MSE) walls

The concept of a default wall, in Section 5 of the Bridge Design Manual, is to provide the contractor with a definitive basis upon which he can submit a proposal. It was originally anticipated that the default wall would usually be a reinforced concrete retaining wall. As we have gained experience with MSE walls, it has become clear that in many instances where an MSE wall was deemed by the designer to be an acceptable design type for a given situation, the more traditional reinforced concrete wall was not a competitive alternate. In these instances, the default wall should have been an MSE wall.

The purpose of this memorandum is to establish the design and contract document requirements for MSE walls, and to direct designers to use an MSE wall as the default wall when it receives the highest rating from the wall selection process. Although much of the information contained herein is discussed in the Bridge Design Manual, the contents of our plans and design calculations have not been consistent for MSE walls. The objective is to make the requirements clear in order to obtain consistent, complete, and reliable plans and specifications.

SELECTION

The wall selection criteria in Subsections 5.1, 5.3, and 5.4 in the Bridge Design Manual shall be followed. As stated above, when an MSE wall receives the highest rating, it should be used as the default wall. All acceptable and reasonable alternate wall types and MSE wall systems should be named and allowed by the contract documents as alternate walls. The wall selection

criteria should be used for all walls; however, a formal retaining wall selection report is not required when the total length of walls at the site is less than 50' (e.g., minor extension of the wingwalls on a bridge).

The contract documents need to provide for alternate walls unless the total length of walls at the site is less than 50', or if due to special conditions (e.g. as identified by Subsection 5.8 of the Bridge Design Manual) approval for not allowing alternates is obtained from the Staff Bridge Engineer early in the project. If the default wall is an MSE wall, alternate MSE wall systems must be allowed unless otherwise approved by the Staff Bridge Engineer, regardless of total wall length.

The default wall design, as described below, must be provided unless the conditions for Case A in Subsection 5.8 in the Bridge Design Manual are satisfied, or unless otherwise approved by the Staff Bridge Engineer early in the project. For Case A, all of the following conditions must be met. It is the responsibility of the designer to ensure they are.

- Height less than or equal to 16 feet.
- Class 1 backfill used.
- Toe pressure less than or equal to 3 ksf.
- The wall is secondary (i.e., the retained fill does not directly or indirectly support roadway or structure embankment, or provide for a critical drainage path) or temporary.
- There are no anticipated bearing and/or settlement problems.
- The allowed alternates are CDOT approved MSE and/or modular proprietary wall systems.

When selecting the default wall every effort should be made to avoid facing requirements that reduce the number of acceptable alternate walls; or, reduce the number of probable bids that will be received on the alternate walls, or alternate MSE wall systems, that are allowed. The primary asset of an MSE wall, economy, can be impaired by restrictive facing appearance requirements. The preferred facing requirements for retaining walls is color and texture, without any reference to panel, or block, size or type.

DESIGN

The design calculations shall provide a full internal and external stability analysis of the default wall in accordance with Section 5 of the AASHTO Standard Specifications. To do this the designer will need to design the internal reinforcement, selecting type, length, and spacing of reinforcement.

To start this process designers will need to choose the type of reinforcement to use. Polymeric geogrids will normally be assumed. The reinforcement properties necessary for design should then be obtained from the manufacturer. The designer may utilize design calculations provided by reinforcing manufacturers; however, the designer must independently verify, and document, that these calculations satisfy all applicable AASHTO and CDOT design requirements.

The intent of the default wall is to provide within the contract documents all of the design details the Contractor needs to build the wall. For MSE walls this means complete non-proprietary details of the facing and facing/reinforcement connection. The Contractor will then have the option of building the default wall from the plans, or building one of the manufacturer designed, CDOT approved, MSE systems listed as acceptable alternates. Although this is preferred, until greater experience is gained in this area, designers will be allowed to assume a proprietary facing for the default wall. In this case it is not practical to fully check the reinforcement to facing connection, or the facing itself. The purpose of having approved wall systems (as identified in our MSE wall special provision, and discussed in Subsection 5.2 of the Bridge Design Manual) is to help insure the facing and its connections are reliable when proprietary facings are used.

In addition to the AASHTO Standard Specifications, the design needs to satisfy the requirements in Section 5 of the Bridge Design Manual. This includes any design necessary for drainage, corrosion protection, and attachments (bridge rails, fences) to the wall. The design shall receive an independent design check. Upon completion the design and design check calculations shall be submitted for inclusion in the project file.

PROJECT PLANS

The following shall be identified in the project plans. These are minimum requirements, additional items may be necessary.

- The wall's complete vertical and horizontal geometry, as well as typical section, provided by a General Layout.
- The type of reinforcement assumed and all of its properties (AASHTO 5.8.5, 5.8.6, and 5.8.7) that were assumed in design.
- The reinforcement length and spacing.
- The factors of safety that apply to the wall, see AASHTO 5.8.1 and 5.5.5.
- All of the soil parameters assumed in design, including maximum allowable bearing pressure, friction angle, and soil unit weight.
- A listing, or reference to the specifications for the listing, of acceptable alternate wall types.
- A generic description of the wall facing appearance requirements.
- Full facing and facing/reinforcement connection details, if a proprietary facing was not assumed for the default wall.
- Attachment details for bridge rails, fences or other items mounted on the wall.
- Drainage requirements.

SPECIFICATIONS

- Corrosion protection requirements; e.g., an impervious membrane, if applicable.
- General Notes, Summary of Quantities, and Engineering Geology sheet.

The product name of the reinforcement assumed for the default wall should be given. The facing should be described generically without a manufacturer's product name, even if a proprietary facing was assumed for the default wall. The project's specifications need to provide for the applicable items in Subsection 5.1, 5.6, and 5.7 of the Bridge Design Manual. Backfill gradation requirements also need to be included. These and other specification requirements are addressed by using the

Technical Memorandum #11
January 29, 1993
Page 5

Revision of Section 504 Project Special Provision Staff Bridge keeps on file.

Staff Bridge is currently in the process of refining this specification. It is imperative that the designer be familiar with its contents before including it in the contract documents. Project specific revisions may be necessary.

SHOPS

CDOT approved MSE wall systems must satisfy the requirements discussed in Subsection 5.7 of the Bridge Design Manual, and specified by the 504 Project Special Provision. Although these shop drawings are signed and sealed by the manufacturer's professional engineer, they will follow the normal shop drawing routing and review process. The designer shall check these plans for conformance to the design requirements established in the plans. Facing and facing/reinforcement connection strength requirements do not need to be checked. The shops may be approved noting thus.

If the designer elects to provide full facing and facing/reinforcement connection details for the default wall, and the contractor selects the default wall, then a shop drawing submittal is not required.

IMPLEMENTATION

The requirements given by this memorandum shall be satisfied by all projects currently under design. The CDOT Bridge Design Manual will be revised as necessary to conform with this memorandum. Until that time, this memorandum shall govern over the contents of the manual, as is stated in article 1.1.4.A of the CDOT Bridge Design Manual.