

Memorandum

*Flex your power!
Be energy efficient!*

To: DES DEPUTY DIVISION CHIEFS
DES MANAGERS AND SUPERVISORS

Date: July 22, 2011

From: BARTON NEWTON
Deputy Division Chief
Structure Policy & Innovation
Division of Engineering Services



Subject: **Design of Earth Retaining Systems**

For projects using the 2006 Standard Specifications and Standard Plans, design of Earth Retaining Systems (ERS) may continue using Working Stress Design (WSD) per the *Caltrans Bridge Design Specifications (BDS), April 2000*. For projects using the 2010 Standards, structural design and geotechnical recommendations must be based on the *American Association of State Highway Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) BDS, Fourth Edition* as amended by the Department in September of 2010. DES staff should communicate with the District on this matter before commencing work.

Guidance for structural and geotechnical LRFD as well as ERS software will be completed in accordance with the FY11-12 DES Contract for Performance and Innovation. During this transition period, the "General Notes" need to clearly indicate what design methodology was used for ERS. This memo is superseded if a consultant contract requires that ERS use LRFD.

Attachment

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Attachment
Design of Earth Retaining Systems

July 20, 2011

Updated Standards and guidance for Earth Retaining Systems (ERS) contain state-of-the-practice enhancements as well as LRFD-related changes, and will be released for use as they become available. The designer is allowed to switch to an updated Standard or guidance that becomes available during the project design process if there is no negative impact to the project. Designers should check with SOE on the flexibility of the Specifications for a given wall technology, and approach Geotechnical Services for any additional foundation information needed.

Other changes for the common ERS technologies are as follows.

A. Conventional Walls

Rigid gravity and semi-gravity walls are called “conventional walls” in the AASHTO LRFD BDS, and include Caltrans Standard Plans for Types 1 through 6 walls and Standard Details (Bridge XS Sheets) for sound-wall, barrier, and pile-modified Standard Plan walls (the SWBP series). Please note, Types 2, 3, & 4 were discontinued. Both Standard Plan Types 1A and 5, as well as the SWBP series of modified Type 1, 5 & 7 walls have different footing dimensions than the previous designs.

B. Non-gravity Cantilever Walls

Soldier pile walls, both with and without lagging, as well as the special design secant and tangent walls, are referred to as non-gravity cantilever walls in the AASHTO LRFD BDS. New XS Sheets (publication pending) have been developed for soldier pile typical details with timber lagging. Additional details for concrete lagging are under development.

C. Anchored Walls

Type 7 walls with tiedowns and tieback walls, both with and without soldier piles—are referred to as anchored walls in the AASHTO LRFD BDS. This terminology is used in the recently released 2010 Standards and on the updated XS sheets for ground anchors. Designers will now need to place the Factored Test Load (FTL) and Lock-off Load (LL) directly on the wall plans for the revised testing procedure in the 2010 Standard Specifications. Updated guidance has also been developed for release as MTD 5-12 (publication pending). New XS sheets (publication pending) have been developed for soldier pile walls with ground anchors, with and without concrete walers.

D. MSE

The various types of MSE include our Mechanically Stabilized Embankment on the XS sheets, as well as all special design MSE with wire mesh or modular block facing, Geosynthetic Reinforced Embankment (GRE), Plantable Geosynthetic Reinforced walls (PGR) and MSE abutments. Revised MSE XS sheets and BDA 3-8 (pending) have been updated with 5 by 5 ft square panels standardized for typical architectural treatment, completely reconfigured steel soil reinforcement, and only two backfill cases. Additional details are under development. For MSE abutments, utilize the methodology in AASHTO LRFD BDS, in conjunction with the methods provided in FHWA-NHI-10-024*.

E. Prefabricated Modular Walls

Standard plan crib walls and special design gabion walls are categorized as prefabricated modular walls in the AASHTO LRFD BDS. Standard Plan Concrete and Steel Crib Walls were completely overhauled with changes to the range of heights available and range of backfill slope heights allowed. Timber crib walls have been discontinued.

F. Soil Nail Walls

Design guidance for soil nail walls is not included in either the AASHTO LRFD BDS (2007) or the Caltrans BDS (2000). Until guidance specific to this technology has been published, the methods provided in the FHWA publication FHWA-IF-03-017* should be utilized in conjunction with the Caltrans software SNAILZwin.

G. Wall Drains

2010 specification updates will now allow for geocomposite drains behind standard walls. An XS sheet has been published to extend them for use in special design walls (such as soil nail and concrete faced soldier pile walls). These wall relief drains are designed only for subsurface flows under 50 ft of soil pressure.

H. Barrier on Moment Slab for ERS

Standard details have been developed for a concrete barrier on its own moment slab for use over all ERS technologies including existing walls not originally designed for collision loading. The detail, previously available for MSE, has been updated for TL-4 loading and will accommodate a standard soundwall. The pile support is still necessary for the soundwall loading above the standardized MSE facing until further modeling can be completed. The support is needed to keep the safety shape (barrier) in proper alignment. [The MSE facing readily deforms under the uneven loading on the slab caused by heavy masonry soundwalls.] Additional details are under development.

* FHWA publications are available on-line at the Geotechnical Engineering Publication Library http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm