



# MEMORANDUM

**TO:** District Engineers

**DATE:** January 14, 2013

**FROM:** Gregg A. Freeby, P.E.

**SUBJECT:** New and Revised Retaining Wall Standard Drawings

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New and revised retaining wall standard drawings, with an issue/revision date of January 2013, are posted on the TxDOT web site and are available for immediate use.

Key revisions to the standard drawing **RW(MSE)** include:

- The standard was previously one sheet and is now two sheets.
- Typical sections now have text identifying foundation and retained soil
- It is now required for the select fill zone to extend a minimum of 2' beyond the end of the earth reinforcement.
- The minimum embedment requirement has been modified. Additional guidance for determining the minimum required embedment is contained on a new standard sheet RW(MSE)DD.
- The values for friction angles of the foundation and retained soils have been removed from this standard and now are to be populated by the design engineer of record on the new RW(MSE)DD standard sheet.
- Added level up detail requiring minimum reinforcement for this concrete.
- Provided clarification on the controlling factors of safety for both the dry and the draw down analysis condition.
- Added that the service life of the structure is to be calculated using AASHTO corrosion rates.
- Added note of clarification for panel joints.
- Added note addressing the presence of obstructions and the requirement for the wall supplier to address these obstructions and provide calculations and details in the shop drawings.
- Expanded the concrete requirements for unreinforced, reinforced and precast concrete.
- Added note requiring the use of the new RW(MSE)DD standard sheet in conjunction with the RW(MSE) standard.

Key revision to the standard drawing **RW(TRF)** include:

- Addition of a table defining rail type, associated detail and allowable method of construction.
- Modification of the rail anchorage requirement for "Wide Based" Railing adjacent to concrete. New requirement is 12" minimum embedment into coping or otherwise fully developed.

Key revisions to the standard drawing **RW(TEW)** include:

- Top mat requirement to stabilize top of wall, however, alternate methods may be submitted.
- Intermediate strut optional requirement for wall face stability.
- Requirement for the select fill zone to extend a minimum of 1' beyond the end of the earth reinforcement.

The **RW(MSE)DD** (Design Data) is a new standard sheet in the Proprietary Retaining Wall section. This standard sheet must be used in conjunction with the RW(MSE) standard. It is required that the retaining wall designer of record at the time of plan preparation populate this sheet with assumptions fundamental to the wall design, and sign and seal this sheet. Refer to the attached document, RW(MSE)DD Guidance, for further information on the use of this standard.

These revised standard drawings apply to construction projects beginning with the July 2013 letting. Prior use is at the option of each District.

These and other bridge standard drawings are available on the Bridge Standards web pages in MicroStation® “dgn” and Adobe® Acrobat® “pdf” formats. See <http://www.dot.state.tx.us/business/standardplanfiles.htm> .

For questions or comments concerning these standard drawings, please contact Marcus Galvan, P.E., at (512) 416-2224.

Note: Original Signed By Gregg A. Freeby

Attachment

cc: Federal Highway Administration  
Bridge Design Consultants  
Administration  
Division and Office Directors  
Directors of Transportation Planning and Development  
District Bridge Engineers  
Bridge Division Employees

## **Mechanically Stabilized Earth Retaining Wall Design Data**

### **RW(MSE)DD Standard**

The RW(MSE)DD standard has been developed to be utilized in conjunction with the RW(MSE) standard. The purpose of the RW(MSE)DD standard is to provide specific design assumptions that were used in the design and development of the MSE retaining walls. These design assumptions will then be used by the wall supplier in the development of the project specific MSE retaining wall shop drawings.

The following is a brief summary of what is contained on this sheet:

**Wall Summary Table** – the Wall Summary Table provides input fields for the designer to identify 1) the retaining wall designation and station limits, 2) retained soil friction angle, 3) foundation soil friction angle, 4) if ground improvement is necessary, 5) the minimum earth reinforcement length, 6) the minimum wall embedment required, 7) underdrain requirement, 8) if a draw down analysis is necessary and 9) minimum bench width at the base of the wall.

- 1) Retaining Wall Designation and Station Limits – these fields identify the wall and wall limit to which all other information provided on the specific row in the table are applicable.
- 2) Retained Soil Friction Angle – this field is to identify the applicable long term drained friction angle of the retained soil. The default value that has historically been used for this strength property is 30 degrees. Field evidence has shown that the actual strength of the retained soil may vary from this value and is highly dependent on the physical properties of the soil that is to be retained. Existing and proposed ground surface elevations will also have an impact on the material that is to be retained. Conditions in which MSE walls are constructed include pure cut situations, cut/fill situations and pure fill situations. In pure cut situations, depending on the height of cut, shoring may be required and since the wall will be retaining previously place fill or naturally occurring soil, the strength properties of that soil must be used in design. In cut/fill situations, depending on the amount of cut necessary, shoring may be required. The retained properties in this condition will be dependent on both the cut portion and the fill portion of the retained zone. In a pure fill situation, the retained properties will be solely dependent on the properties of the newly placed retained fill.

The retained friction angle listed should be based on local experience or measured/correlated long term strength values. The typical means of measuring drained soil strengths is with Consolidated-Undrained triaxial testing with pore pressure measurements. This test is very complicated and very sensitive to soil disturbance and its use on laboratory compacted soils is not recommended.

Correlations exist that utilize the index properties of soils to estimate the drained friction angle and can be found in many geotechnical engineering references. As a general rule of thumb the following recommendations can be used to establish appropriate soils strengths.

Design Friction Angle	
Material Type	Friction Angle
Rock	30 degrees*
Sand/Gravel	30 degrees*
Lean Clay; $PI < 20$	30 degrees
Lean Clay; $20 < PI < 30$	$27 < \phi < 30$
Fat Clay; $30 < PI < 45$	$25 < \phi < 27$

\*Designer may elect to use higher values based laboratory test data or local experience.

Keep in mind that the selected strength values for retained soil should also be used by the designer to evaluate the overall site stability. Any known areas of instability will have a profound impact on the overall stability of the walls being proposed.

- 3) Foundation Soil Friction Angle – this field is to identify the applicable long term drained friction angle of the wall foundation soils. The default value that has historically been used for this strength property is 30 degrees. Field evidence has shown that the actual strength of the foundation soil may vary from this value and is highly dependent on the physical properties of the foundation soil. Existing and proposed ground surface elevations will also have an impact on the soils found below the proposed wall. For walls built at or below existing grade, the walls will be founded on natural/existing soils and the strength properties of these soils will dictate the value used for foundation sliding. For walls built above existing grade or on ground improvement material, the strength properties of this fill material will dictate the strength value used for foundation sliding. Similar to the retained fill, the foundation friction angle listed should be based on local experience or measure/correlated long term strength values. The typical means of measuring drained soil strength is with Consolidated-Undrained triaxial testing with pore pressure measurements. This test is very complicated and very sensitive to soil disturbance and its used on laboratory compacted soils is not recommended. The values in the Design Friction Angle table above can be used as an estimate of soil strengths.

Foundation base sliding is a critical mode of failure. It is highly recommended that walls not be placed directly on material with PI greater than 45 and that ground improvement considerations be given to those sites.

Keep in mind that the selected strength values for retained soil should also be used by the designer to evaluate the overall site stability. Any known areas of instability will have a profound impact on the overall stability of the walls being proposed.

- 4) Ground Improvement – this field is to identify if ground improvement is required for a given wall or given section of wall. For sites with weak foundation soils it is sometimes more economical to provide a ground (foundation) improvement plan to allow the safe use of MSE walls rather than change out the wall type. Ground improvement plans can vary from the simple remove and recompact or replace material to the complex, i.e, the use of geopiers, stone columns or geogrid reinforced pads. The friction angle of the foundation soil should reflect the frictional properties of the material used for the ground improvement.
- 5) Minimum Earth Reinforcement Length – this field is to list the minimum length and wall design height to length ratio required for the wall design. The wall supplier will utilize this information to properly size the reinforced volume to satisfy project requirements. The default minimum reinforcement length is set at 8' or 70% of the design wall height, whichever is greater. If the default values satisfy stability requirements then 8' or 70% would be entered in the table. If the designer of record determines the need for a longer minimum such as 10' or 80% of the wall height this value would be entered on the table.
- 6) Minimum Wall Embedment Required – this field allows the wall designer of record to indicate the required minimum wall embedment below finished grade. The previous requirement was 1.0' regardless of the ground condition in front of the proposed wall. This requirement has been changed to address the ground slope condition in front of the proposed wall. Guidelines for the minimum embedment of the wall from top of leveling pad to finished grade are 1' for level ground where there is no potential for erosion or future excavation; 2' for sloping ground (4H:1V or steeper) or where there is potential for removal of soil in front of the wall.
- 7) Underdrain Required – this field allows the wall designer of record to indicate if an underdrain is required for the wall.
- 8) Rapid Drawdown – this field allows the wall designer of record to indicate if a rapid draw down analysis is required for the wall.
- 9) Bench Width – this field allows the wall designer of record to identify the minimum bench width requirement for the proposed wall. For walls on slopes, the bench width will vary depending on the steepness of the slope. Guidelines for minimum bench widths are: 2' for slopes flatter than a 4H:1V and 4' for slopes that are 4H:1V or steeper.