MECHANICAL STABILIZED EARTH (MSE) RETAINING WALL STANDARDS

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Changes to MSE Standards

- RW(MSE) Standard has grown from 1 to 2 sheets.
- Added the RW(MSE)DD standard as an additional required sheet.
• Section now identifies foundation and retained soil
• The select fill zone extends a minimum of 2’ beyond the earth reinforcement.
Select Fill/Retained Fill
Minimum embedment requirement has been modified. Additional guidance for determining minimum required embedment can be found on the RW(MSE)DD standard.

1) Minimum embedment conforming to the values given on the RW(MSE)DD standard.
Wall Embedment
Wall Embedment
Values for friction angles of the foundation and retained soil have been removed from the standard and are now to be populated on the RW(MSE)DD standard.

### MSE Design Parameters

**Design Parameters:**

Design of retaining walls shall be based on the following design parameters unless stated elsewhere in the plans:

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit Weight</th>
<th>Unit Weight (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained Soil</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>Foundation Soil</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Select Backfill</td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>Cement Stabilized Select Backfill</td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>

**Soil Design Parameter:**

Soil design parameter must be based on long term soil strength. Design parameters must be listed on the RW(MSE)DD standard.

**Select Backfill Unit Weight:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit Weight</th>
<th>Internal Stability</th>
<th>External Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>105 PCF</td>
<td>Pullout</td>
<td>Sliding, Overturning, Eccentricity</td>
</tr>
<tr>
<td>C, D</td>
<td>125 PCF</td>
<td>Rupture</td>
<td>Bearing</td>
</tr>
</tbody>
</table>
Level up detail for top panels.
Coping Stability
Panel Level-Up
Provided clarification on the controlling factors of safety for both dry and drawdown analysis.

Design service life is to be calculated using AASHTO corrosion rates.

Added note of clarification for panel joints.

Added note requiring wall supplier to address obstructions and provide calculations and details in the shop drawings.

Expanded concrete requirements for unreinforced, reinforced and precast concrete.
WALL SUMMARY

<table>
<thead>
<tr>
<th>Use Retaining Wall</th>
<th>Begin Station</th>
<th>End Station</th>
<th>Retained soil incline angle</th>
<th>Foundation friction angle</th>
<th>Ground improvement</th>
<th>Max Earth Pressure (psf)</th>
<th>Win Wall Backslope</th>
<th>Underdrain Required</th>
<th>Drawdown Analysis</th>
<th>Bench mark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**TYPICAL SECTION**

- Vertical and horizontal control points
- 2" Min. Retained soil
- 1" Min. Foundation soil
- 1" Min. Earth reinforcement

**Indications:**
- Indicate lines for which the stated soil design requirements/assumptions apply.
- Retained and foundation friction angle listed should be based on local experience or on reasonable short-term strength values.
- Indicate if ground improvement is required or not required. If shown on plans, refer to Ground Improvement Details for additional information.
- Indicate on plans minimum length and strength ratio required. The minimum length and strength should be greater than the wall length, whichever is greater. Wall height and design wall height may differ, depending on project geometry and bedding conditions.
- Indicate if underdrain is required or not required.
- Indicate if rapid drawdown analysis is required.
- Indicate if soil conditions of any kind or any other information included on plans, the minimum embedded depth of the test pit is needed.
- Indicate if any other information is needed.
- Indicate if any other information is needed.
- Indicate if any other information is needed.

**SPECIAL NOTES:**
- This sheet is to be filled out by the structural engineer or design engineer of record or design team prior to starting the design of the specified walls.
- The completed sheet shall be reviewed, signed, sealed and dated by a licensed professional engineer.

**MECHANICALLY STABILIZED EARTH RETAINING WALL DESIGN DATA**

- Basin Width or Depth of wall varies, use the following principles to establish wall width:
  - 4 - 2.0 x 0.8 for x ≤ 4
  - 4 - 4.0 x 0.8 for x > 4
- Applicable to both drywall and dry condition.
# WALL SUMMARY

<table>
<thead>
<tr>
<th>MSE Remaining Wall</th>
<th>Begin Station</th>
<th>End Station</th>
<th>Retained Soil Friction Angle</th>
<th>Foundation Soil Friction Angle</th>
<th>Ground Improvement</th>
<th>Min. Earth Reinforcement</th>
<th>Min. Wall Embankment</th>
<th>Underlain Required</th>
<th>Drawdown Analysis</th>
<th>Bench Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETAINING WALL 1</td>
<td>630+00.00</td>
<td>830+00.00</td>
<td>30 deg.</td>
<td>30 deg.</td>
<td>SEE NOTE</td>
<td>6&quot; OR TIL</td>
<td>2.0&quot; to 1.0&quot;</td>
<td>YES</td>
<td>N/A</td>
<td>3.0&quot;</td>
</tr>
<tr>
<td>RETAINING WALL 2</td>
<td>630+00.00</td>
<td>845+00.00</td>
<td>30 deg.</td>
<td>30 deg.</td>
<td>SEE NOTE</td>
<td>10&quot; OR BOL OF 8&quot;</td>
<td>1.0&quot;</td>
<td>YES</td>
<td>N/A</td>
<td>3.0&quot;</td>
</tr>
<tr>
<td>RETAINING WALL 3</td>
<td>645+00.00</td>
<td>850+00.00</td>
<td>30 deg.</td>
<td>30 deg.</td>
<td>SEE NOTE</td>
<td>10&quot; OR BOL OF 8&quot;</td>
<td>1.0&quot;</td>
<td>YES</td>
<td>N/A</td>
<td>3.0&quot;</td>
</tr>
<tr>
<td>RETAINING WALL 4</td>
<td>655+00.00</td>
<td>855+00.00</td>
<td>30 deg.</td>
<td>30 deg.</td>
<td>SEE NOTE</td>
<td>10&quot; OR BOL OF 8&quot;</td>
<td>1.0&quot;</td>
<td>YES</td>
<td>N/A</td>
<td>3.0&quot;</td>
</tr>
<tr>
<td>RETAINING WALL 5</td>
<td>665+00.00</td>
<td>860+00.00</td>
<td>30 deg.</td>
<td>30 deg.</td>
<td>SEE NOTE</td>
<td>10&quot; OR BOL OF 8&quot;</td>
<td>1.0&quot;</td>
<td>YES</td>
<td>N/A</td>
<td>3.0&quot;</td>
</tr>
<tr>
<td>RETAINING WALL 6</td>
<td>675+00.00</td>
<td>865+00.00</td>
<td>30 deg.</td>
<td>30 deg.</td>
<td>SEE NOTE</td>
<td>10&quot; OR BOL OF 8&quot;</td>
<td>1.0&quot;</td>
<td>YES</td>
<td>N/A</td>
<td>3.0&quot;</td>
</tr>
<tr>
<td>RETAINING WALL 7</td>
<td>685+00.00</td>
<td>870+00.00</td>
<td>30 deg.</td>
<td>30 deg.</td>
<td>SEE NOTE</td>
<td>10&quot; OR BOL OF 8&quot;</td>
<td>1.0&quot;</td>
<td>YES</td>
<td>N/A</td>
<td>3.0&quot;</td>
</tr>
<tr>
<td>RETAINING WALL 8</td>
<td>695+00.00</td>
<td>875+00.00</td>
<td>30 deg.</td>
<td>30 deg.</td>
<td>SEE NOTE</td>
<td>10&quot; OR BOL OF 8&quot;</td>
<td>1.0&quot;</td>
<td>YES</td>
<td>N/A</td>
<td>3.0&quot;</td>
</tr>
</tbody>
</table>

**NOTE:** Perform proof rolling on retaining wall foundation area to identify any loose, soft or unstable materials in accordance with Item 216. Material not meeting a minimum n-value of 1 in per pass of pneumatic tire roller should continue to be rolled or removed and replaced with suitable material.

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**TYPICAL SECTION**

- **Vertical and Horizontal Control Point:**
- **Retained Soil:**
- **High Water Elevations:**
- **Drawdown:**
- **Foundation Soil:**
- **Earth Reinforcements:**
- **Underlain (if required):**

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** мероприятие:**

1. Indicate soils for which the stated soil design requirements/applications are applicable.
2. Retained and Foundation soil friction angles listed should be based on local experience or measured/consented across the strength values.
3. Indicate if ground improvement is required or not required. If shown as required, refer to ground improvement details for additional information.
4. Indicate on table minimum length and length ratio required. The minimum length of earth reinforcements shall be within a 3" or 10" of height which may vary depending on project geometry and loading conditions. Height of bridge elements is equal to the distance between the top of leveling pad and finished grade at the bridge abutment backwall.
5. Indicate if underlain is required or not required.
6. Indicate if rapid drawdown analysis is required.
7. Guidance to wall designer for determination of minimum wall drainage. For use with 4"d or 4"D or smaller drainage. The minimum depth provided from the top of leveling pad to finish grade shall be 1" for level ground and 2" for 1% or steeper or higher or where there is potential for erosion or 2" for sloping ground (4%,1% or steeper) or where there is potential for removal of soil in front of the wall.
8. Horizontal bench width at base of wall varies. Use the following chart for horizontal bench width, A = 2.0" Min for 3" = 4", or A = 1.0" Min for 4", applicable to both drawdown and dry condition.
Retaining wall designation and station limits. These fields identify the wall and wall limit to which all other information provide on the specific row in the table are applicable.
• These fields identify the applicable long term drained friction angle of the retained and foundation soil.
• Historic default used = 30 degrees.
• The friction angles listed should be based on local experience or measured/correlated strength values.
• Values used should also be used by the designer to evaluate the overall wall stability.
• Remember all soils are not created equal!
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.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Friction Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock</td>
<td>30 degrees*</td>
</tr>
<tr>
<td>Sand/Gravel</td>
<td>30 degrees*</td>
</tr>
<tr>
<td>Lean Clay; PI&lt;20</td>
<td>30 degrees</td>
</tr>
<tr>
<td>Lean Clay; 20&lt;PI&lt;30</td>
<td>27&lt;phi&lt;30</td>
</tr>
<tr>
<td>Fat Clay; 30&lt;PI&lt;45</td>
<td>25&lt;phi&lt;27</td>
</tr>
</tbody>
</table>

*Designer may elect to use higher values based laboratory test data or local experience.
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.
Pile Supported Embankment
Stone Columns/Geopiers

MSE Wall Select
Backfill

Geosynthetic Reinforcement

Stone Columns
Remove and Replace/Wick Drains
Remove and Replace – Reinforced Pad

**General Notes**
- Geogrid Pad to be constructed under Wall 4 between Sta. 1+65.32 to Sta. 1+38.91. Pad to be composed of geogrid reinforcement to provide support for the retained soil and reinforced with two levels of geogrid reinforcement. Geogrid to be placed 13 feet below existing grade and have a minimum 15% of 1500 lb/ft².
- Geogrid to be placed 12½ feet below the top and bottom of stabilized pad.
- Underdrain pipe to be placed in prime section of WSE wall between STA 1+65.32 to STA 1+38.91. An underdrain pipe made of 1½ inch diameter pipe to be placed 3½ inches from the face of the retaining wall from STA 1+65.32 to STA 1+38.91. The underdrain is then to run downhill for 10½ feet.
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.
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.

Underdrain Required – this field allows the wall designer of record to indicate if an underdrain is required for the wall.
Rapid Drawdown – this field allows the wall designer of record to indicate if a rapid draw down analysis is required for the wall.

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.
Draw Down Typical

TYPICAL SECTION
(RAPID DRAWDOWN CONDITION)