

Design of the cantilevered portions of the soil nail wall facing which typically occurs at the top, bottom, or ends of the wall shall be in accordance with the requirements of LRFD-BDS Section 11.6 for conventional retaining walls.

8.1.9 **Design of Shaft Walls**

Shaft retaining walls are often referred to as cylinder pile walls, secant pile walls, or tangent pile walls. This wall type may be comprised of closely spaced structural concrete shafts or closely spaced structural concrete shafts with interlocking or tangent non-structural shafts.

8.1.10 **Scour of Retaining Walls**

The foundation for all walls constructed along rivers and streams shall be evaluated during design by the Hydraulics Engineer for **total** scour in accordance with LRFD-BDS and Hydraulic Engineering Circular No. 23 (HEC-23). The bottom of the wall foundation and bottom of wall elements such as, the fascia panel, lagging, leveling pad, footing, pile cap or shaft cap shall be located a minimum of 2 feet below the **total scour at the check flood** elevation in accordance with the *Geotechnical Design Manual* Section 15-4.5 unless a greater depth is otherwise specified.

In situations where scour (e.g., due to wave or stream erosion) can occur in front of the wall, the bottom of the wall foundation (e.g., structural earth or Geosynthetic wall leveling pad, concrete wall spread footing, the cap for pile or shaft supported walls), and the bottom of fascia panel or lagging, shall meet the minimum embedment requirements relative to the **total** scour elevation in front of the wall.

At any location where a retaining wall or reinforced slope can be in contact with water (such as a culvert outfall, ditch, wetland, lake, river, or floodplain), there is a risk of scour at the toe. The wall designers shall address this risk, based on the Hydraulics Engineer's assessment of the **total** scour potential at the wall site.

Total Scour includes the amount of streambed vertical elevation drop at a given location due to the removal of streambed material caused by flowing water **and the effects of lateral migration**. In accordance with LRFD-BDS Section 3.7.5 and Section 2.6.4 consequences of changes in foundation conditions (due to **total** scour) shall be considered at **Extreme Event**, Strength, and Service Limit States.

Retaining walls or portions of retaining walls that are located within the **total scour at scour check flood** line of a stream shall be designed to resist scour as shown in **Figures 8.1.10-1 and 8.1.10-2**.

Alternatives for designing retaining walls adjacent to bridge ends for scour and **lateral** migration could include:

1. Increasing bridge span lengths or number of spans to move any associated retaining walls beyond the **total scour at scour check flood line**.
2. Including revetment or scour countermeasure designs at the bridge ends, and obtaining the permits required for these features. See **Figure 8.1.10-3**.
 - A. **All revetment or scour countermeasures shall be designed and constructed in accordance with the most current version of the HEC-23.**

- B. The estimated scour groundline above the scour countermeasure shall extend from the top of the scour countermeasure at an angle equal to the angle of repose. The bottom of wall foundation or element shall be located a minimum of 2 feet below the estimated scour groundline as shown in Figure 8.1.10-3.

Retaining walls associated with Bent-Type Abutments as shown in Figure 7.5.1-4, Isolated Abutments as shown in Figure 7.5.1-5, and Abutments Supported by MSE walls as shown and described in Section 7.5.2, shall be designed for total scour at the design flood. For these situations, the bottom of the retaining wall element or foundation shall be located a minimum of 2 feet below the total scour at scour check flood line as shown in Figures 8.1.10-1 and 8.1.10-2. The permissible modifications to the location of the bottom of wall foundation or element due to the addition of revetments or scour countermeasures does not apply to these design scenarios.

Figure 8.1.10-1 Scour without Lateral Migration

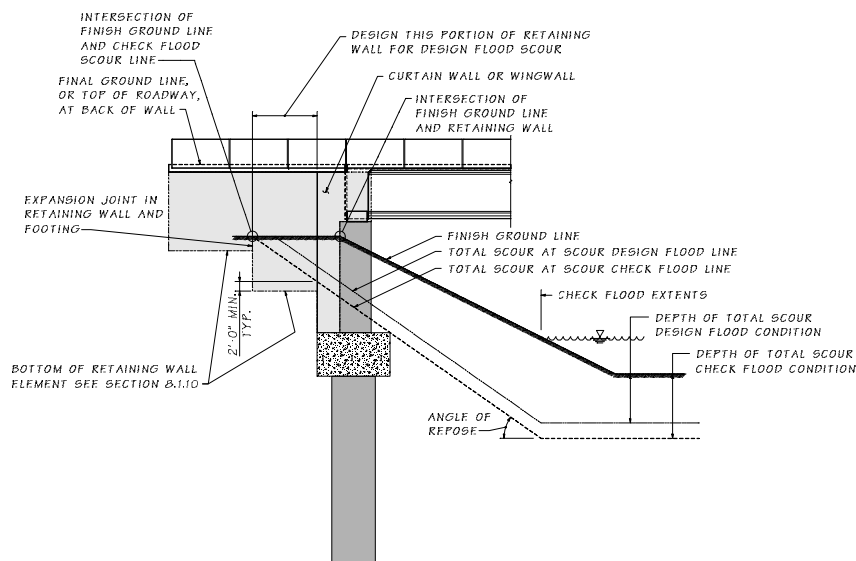


Figure 8.1.10-2 Scour WITH Lateral Migration

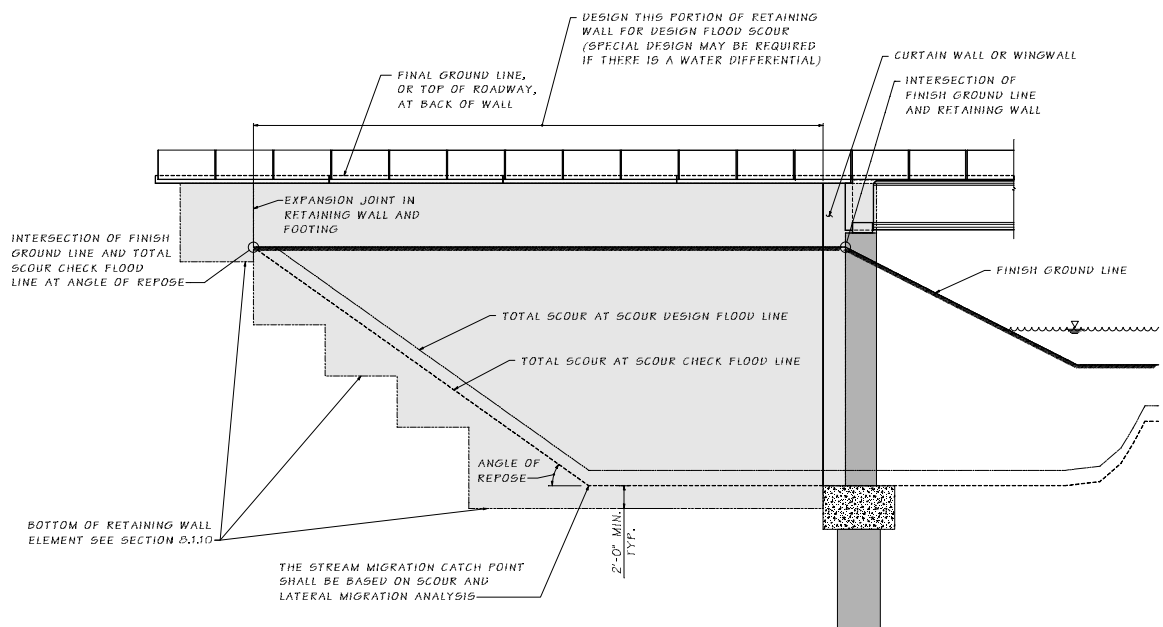
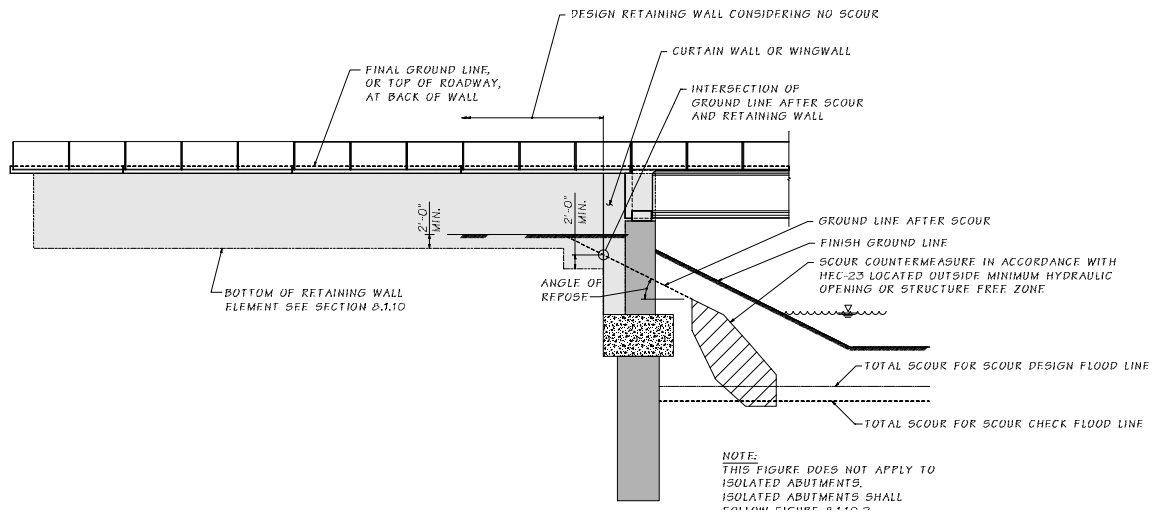


Figure 8.1.10-3 Scour with Lateral Migration and Scour Countermeasures



8.1.11 Miscellaneous Items

8.1.11.A Architectural Finishes and Top of Wall Profile

Approval by the State Bridge and Structures Architect is required on all retaining wall aesthetics, including finishes, materials, and configuration.

8.1.11.B Fall Protection

For retaining walls with exposed wall heights of 4 feet or more, fall protection shall be provided in accordance with [WAC 296-880](#) and as described in the [Design Manual Chapter 730](#).

For retaining walls with a fascia, the fall protection shall be located directly on top of the fascia or attached to the back face of the fascia. For retaining walls without a fascia, the fall protection shall be located within 6 inches of the face of the wall.

Fall protection shall be required regardless of the location of a traffic barrier placed behind the wall, unless the traffic barrier has a minimum height of 3'-6" and is either a moment slab traffic barrier located on top of the wall or a traffic barrier constructed integral with the top of the wall. The Standard Plan Chain Link Fence Types 3 and 4, and Glare Screen Types 1 and 2 are not considered acceptable fall protection systems.

8.1.11.C Drainage

Drainage features shall be detailed in the Plans.

Permanent drainage systems shall be provided to prevent hydrostatic pressures developing behind the wall. A cut that slopes toward the proposed wall will invariably encounter natural subsurface drainage. Vertical chimney drains or prefabricated drainage mats can be used for normal situations to collect and transport drainage to a weep hole or pipe located at the base of the wall. Installing horizontal drains to intercept the flow at a distance well behind the wall may control concentrated areas of subsurface drainage (see [Geotechnical Design Manual Chapter 15](#)).