

Retaining Wall (RW)



Practice Description

A retaining wall is a constructed wall used to eliminate steep slopes between areas that have abrupt changes in grade. This practice is used to replace cut or fill slopes in confined areas or where a wall is necessary to achieve stable slopes. A retaining wall can be constructed of reinforced concrete, treated timbers, gabions, reinforced earth (a system of face panels and buried reinforcement strips), and other manufactured products such as interlocking concrete blocks.

Planning Considerations

Retaining walls should be used in conjunction with steep cut or fill slopes, that may be unstable due to steepness, space limitations, or poor soil conditions to stabilize the site. Retaining walls may be used to relieve the need to construct cuts into steep hillsides or on small lots where fill toe-outs or slope cut-outs would go off of the property being developed. Retaining walls may be required to achieve the best or intended use of the property.

Retaining walls can be constructed from the following materials:

- Reinforced concrete
- Concrete cribbing
- Geotextile-wrapped face wall
- Geotextile-reinforced steep slopes
- Modular blocks
- Treated timbers

Each case is different and the type of retaining wall to be used should be selected by a qualified design professional based on the particular site conditions and what best meets the needs of the site. In most cases, treated timber is the least desirable material because of its potential to decay.



Figure 1: Retaining wall made of gabions

Design Criteria and Construction

The design of a retaining wall is or can be a complicated engineering procedure. There are many factors to consider. Each case is different and requires a different set of considerations and a different design.

The qualified design professional should consider the stresses and forces outside and within the wall as well as allowable height and minimum thickness. Other considerations are foundation design with respect to loadings, bearing values of soils and footing dimensions. Additional design factors include safety hazards, drainage aspects and appearance.

Each retaining wall requires a specific engineering design which requires the capabilities of a competent qualified design professional. Retaining walls are engineering structures that affect public property, life and welfare of citizens. Mississippi law which regulates the practice of professional engineering in the State of Mississippi must be followed on structures such as retaining walls. The State Board of Registration for Professional Engineers and Land Surveyors in Jackson is responsible for administering the provisions of the law.

Site Preparation

At least 3 days prior to construction, contact the Mississippi One-Call System, Inc (1-800-227-6477) to identify, locate and mark all underground utilities within the project area. See **Appendix C** for more information about Mississippi One-Call and utility markings.

Clear installation area of debris and obstacles, such as tree and stumps, that might hinder grading and installation of the wall.

Grading

Grade existing embankments according to the design plan to provide a stable slope until construction of the retaining wall is complete.

Grade the top of the embankments according to the design plan to direct stormwater runoff around the area where retaining walls are being constructed.

Installation of Wall

Concrete Wall Installation

The placement of reinforcing steel, the construction of forms, concrete batching, mixing, placement, curing, and finishing should be in accordance with the project specifications and the American Concrete Institute (ACI) standards. The concrete mix quantities, air entrainment, slump, temperature, and compressive strength should be in accordance with the plans for the job.



Compressive strength of the concrete should be verified by laboratory tests on representative cylinders made during concrete placement.

Drains and weep holes should be installed as shown on the design plans.

Modular Block Wall Installation

Prepare a leveling pad of compacted, crushed rock (typically 6" thick and 18" wide). Place the first row of modular blocks on the leveling pad (not a footing, as the geosynthetic reinforcement will bear the weight of the block and the backfill). Install additional modular blocks and geosynthetic reinforcement (geogrid or geotextile) according to design plans.

Timber Wall Installation

Timbers should be new pressure-treated (usually 0.6 pcf for ground contact) members having a design life consistent with that of the project and free of splits and deep cracks.

Proper tiebacks are essential to the stability of timber retaining



walls. Install tiebacks according to design plans.

Manufactured Products Installation

Specifications for manufactured products should be provided by the manufacturer or in the design plan. Inspect all such materials for damage prior to installation.

Drain Installation

Install drains as specified in the design plans.

Backfill Installation

Backfill for all wall types should be placed carefully in layers not exceeding 8" (loose) and compacted with hand-operated tampers. The degree of compaction should be provided as specified in the design plans. Before compacting, the soil should be moistened or dried as necessary to obtain the optimum moisture content specified. Backfill should not be placed on surfaces that are muddy, frozen or contain frost or ice.

Backfill for retaining walls built of manufactured products such as reinforced earth or interlocking concrete blocks should be placed according to manufacturer's recommendations. Tiebacks or geosynthetic reinforcements should be placed as specified in the design plans.

Nonwoven geotextile fabric should be used behind timber or modular block walls to help keep soil in place.

Erosion Control

Stabilize all bare areas according to the vegetation plan.

Safety

Steep slopes are subject to collapse and can be a safety hazard to persons in the area. No person should work adjacent to steep slopes without shoring protection or properly sloping the embankment.

Construction Verification

Check finished retaining wall for conformance with design plans and specifications.

Check for cracks or movement of the retaining wall.

Common Problems

Consult with a qualified design professional if any of the following occur:

Variations in topography on site indicate retaining wall will not function as intended.

Seepage is encountered during construction. It may be necessary to install drains.

Poor foundation soils are encountered under the proposed wall location.

Design specifications for concrete, timbers, backfill or other materials cannot be met; substitutions may be required. Unapproved substitutions could lead to failure.

High soil and water pressures result in structural failure of the wall—consult qualified design professional and rebuild according to revised plan and specifications.

Maintenance

Inspect retaining walls periodically and after heavy rains for cracks, undercutting of the foundation, piping erosion, wetness or movement.

Repair problems determined during inspections. Repair cracks according to manufacturer's recommendations.

References

The following references may be useful in the application/installation of this practice.

BMPs from Volume 1

Chapter 4

Permanent Seeding (PS)

4-53

Appendices Volume

Appendix C

Mississippi One-Call & 811 Color Coding

C-1