

RETAINING WALL INSTALLATION

STEP 1– DESIGN AND LAYOUT

The starting point of any project is the preliminary design drawing. The drawing should include an overview of the project (site plan) and one or more cross sections through the wall (profiles), and should be done on graph paper to a convenient scale so that it is easy to read and estimate quantities from.

POINTER: Remember to incorporate the layout of the drainage system, specifically the outlet(s), in the design.

NOTE: The Ontario Building Code requires that a building permit be obtained for walls in excess of 1 metre that are adjacent to: (A) public property; (B) access to a building; or (C) private property to which the public is admitted. To assist with building permit applications, typical cross sections are available for most walls (and at various heights) for reference, or arrangements can be made for a complete engineered designs to be conducted.

It is further recommended that an engineered design be prepared for walls that: include geogrid; are being installed on questionable soil; have steep slopes at the top or bottom; are waterfront applications; or, include railings / barriers.

STEP 2– ESTIMATE QUANTITIES

Items to be estimated:

- 1- Volume of excavation.
- 2- Area of geotextile.
- 3- Length of drain pipe.
- 4- Volume of granular.
- 5- Number of wall units.
- 6- Number of coping units.

Optional items:

- Area of geogrid.
- Amount of adhesive.

Volume of Excavation

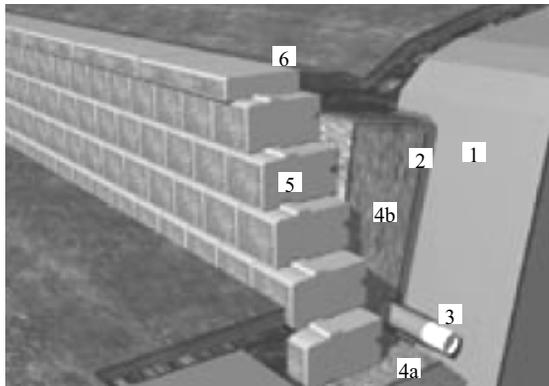
To calculate the total excavation volume, you need to know the depth and width of the base trench, and the angle of repose of the native soils. These items are discussed in greater below.

Area of Geotextile

Geotextile should line the entire drainage layer behind the wall from top to bottom. Ensure there is adequate extra material at the top of the slope to be able to fold the geotextile back towards the wall once all the drainage material is in place. Also remember to provide extra material for overlap of lengths.

Length of Drain Pipe

A drain pipe is required behind all retaining walls to provide a route for water to escape. The drain pipe should run the full length of the wall.



Volume of Granular

Granular fill is required for the granular base (4a) and the drainage layer behind the retaining wall (4b). The granular base material should be well-graded, free draining material suitable for the given application (e.g. Granular A). The drainage material should be clear stone (no sharps) or pea gravel. To calculate the respective volumes, measure the cross sectional area of each of the materials from each of the cross sectional drawings and multiply these by the length of the applicable wall sections.

POINTER: If the native soil is a compactable material, it may be possible to use it for part of the backfill behind the retaining wall (clear stone or gravel would still be required for at a minimum a 300 mm (12”) thick drainage layer directly behind the wall). The geotextile would be placed between the replaced native material and the drainage layer.

Number of Wall Units

Remember to provide enough wall units for the exposed and buried portions of the wall. The rule of thumb is to at a minimum fully bury one course (row) or 10% of the total wall height, whichever is greater. The Easy Wall Estimator on Pages 44-45 has been developed to assist with this calculation.

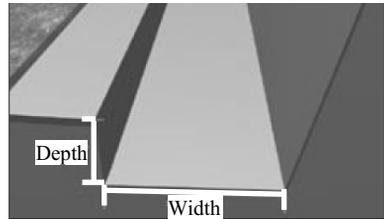
Number of Coping (Wall Cap) Units

The Easy Wall Estimator on Pages 44-45 also includes a table to assist with this calculation. Remember to provide some extras if there are corners or curves in the wall where coping units may need to be cut.

STEP 3– EXCAVATION

POINTER: Remember to complete your locates prior to starting the work.

The excavation depth is the sum of the depth of the buried course(s) plus a minimum of 150 mm (6”) for the granular base.



The offset between the front of the excavation and the front of the wall is typically 100-150 mm (4-6”), which is the minimum width that can be properly compacted using standard tools of the trade. The offset between the back of the wall and the back of the excavation is at a minimum 150 mm (6”) for low walls (<27”) and 300 mm (12”) for higher walls. The total width of the excavation is the sum of the front offset, the depth of the unit, and the back offset.

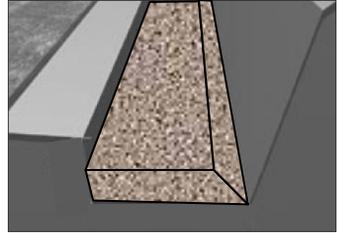
The angle of repose for the native soils is the angle at which the soil can be left without collapsing. This can range from near vertical (90^0 from the horizontal for dense clay to 27^0 from the horizontal for loose sand). The higher the angle, the smaller the excavation.

When completed, the bottom of the excavation should be slightly sloped towards the Drain Pipe discharge point(s), and should be free of debris such as large stones, roots, etc. Run a compactor over the bottom to level it out and to evaluate the stability of the native material.

STEP 4—PREPARE FOUNDATION

POINTER: A solid and flat granular base will simplify the remainder of the installation process. Take the time to make sure this step is done correctly.

Backfill base of trench in 75mm (3") lifts to desired grade, compacting the material to at a minimum 98% Standard Proctor density. Leave a v-notch at the back of the excavation for the drain pipe. Set a string level to verify final grade. Ensure base is level front to back and side to side as this will minimize the leveling of individual blocks and will ensure straight lines and smooth arcs. As an option, a skim coat (2" thick layer) of unreinforced concrete can be used to create a durable leveling surface.

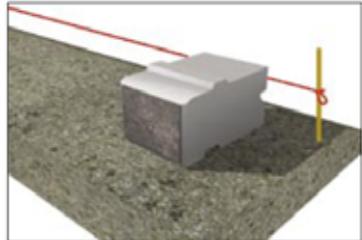


Lay the geotextile starting just under the back of the wall and up the back slope of the trench. Remember to leave adequate material at the top of the slope for the fold back, and to overlap the separate pieces a minimum of 150 mm (6"). Use sand bags or similar to keep the geotextile in place as required.

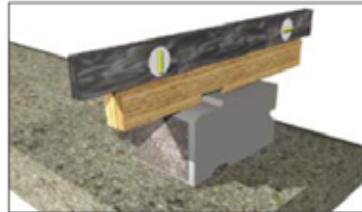
Place the drain pipe in the v-notch at the back of the foundation, and surround with drain rock.

STEP 5—LAYING FIRST COURSE

Select the starting point for the wall. If the base of the wall is stepped up, start at the lowest point and work up; remember to adjust for the natural batter in the wall between steps. If there is an outside corner, start with the corner unit (to potentially avoid having to cut stones later on to fit).



Set a string level to mark the back of the first course. Use a level to ensure blocks are level front to back and side to side.



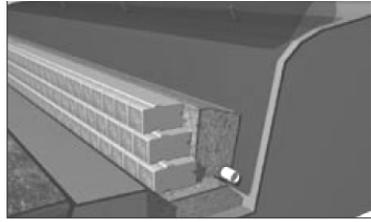
POINTER: For a non-battered wall, level the blocks from side to side, but tilt the back slightly down (approximately 2%) so that the entire wall, when constructed leans slightly toward the soil being retained.

Backfill on both sides of the wall simultaneously to prevent the blocks from moving. Place material in 3" lifts and compact to 95% Std Proctor Density. Compacted backfill to be level with back of the course.



STEP 6- REMAINING COURSES

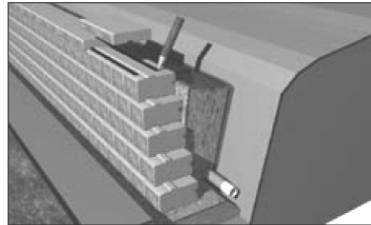
Sweep the top of each course prior to proceeding. Place next course of units in a running bond pattern so that the middle of the unit is approximately above the joint between the underlying blocks. NEVER ALIGN BLOCKS VERTICALLY. After laying a course, backfill behind wall to the same elevation as the top of the just placed units.



POINTER: Ensure compaction equipment is adequately sized to provide proper compaction but not so large as to push the wall out. Check levelness of wall after each layer of backfill; re-align wall if required.

STEP 7- COPING AND GRADING

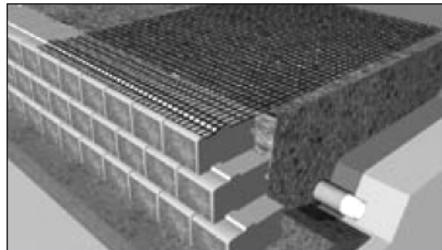
Where coping is required, sweep the top of the underlying course prior to proceeding. Place a line of butyl tape or Bond Loc adhesive near the front and back of the underlying course. Place the coping unit on top and apply some pressure to secure.



Prior to backfilling behind the coping and last wall unit, pull the filter cloth towards the back of wall and tuck in place. Fill to final grade using a layer of clay and then topsoil to suit desired conditions, and ensure final slopes allow for proper drainage away from, or over the top of, the wall.

ADDITIONAL TIPS- GEOGRID REINFORCED WALLS

In simplest terms, a retaining wall uses its total weight to hold back the soil located behind it. With a gravity wall, the total weight is the sum of the blocks being used. With a reinforced wall, the total weight is the sum of the blocks and the backfill within which the geogrid is located.



For geogrid walls, the following changes are made to the installation instructions:

Step 2- The offset between the front of the wall and the back of the excavation equals the specified length of the geogrid.

Step 6- Precut the geogrid from the roll to the specified length and perpendicular to the direction of primary strength. Continue wall and backfill placement as outlined above up to elevation of first layer of geogrid. The compacted backfill material should be level with the back of the wall unit to allow the geogrid to be laid out flat. Lay the geogrid starting within 25mm (1") of the face. Lay the next row of wall units to secure the geogrid in place. Pull the geogrid taut to its full length and stake in place at back to maintain tension. Backfill and compact next lift.