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.

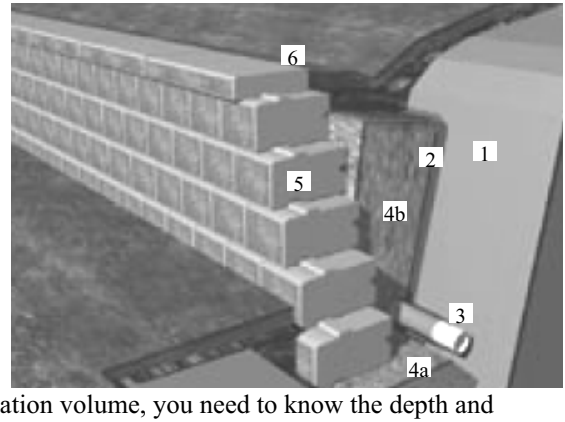
STEP 2– ESTIMATE QUANTITIES

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

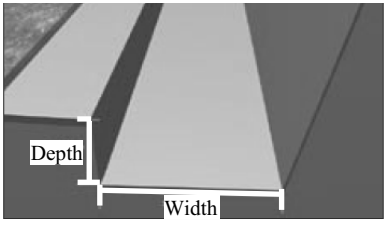
Remember to provide enough wall units for the exposed and buried portions of the wall. The rule of thumb is to at a minimum fully bury one course (row) or 10% of the total wall height, whichever is greater. The Easy Wall Estimator on Pages 44-45 has been developed to assist with this calculation.

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.

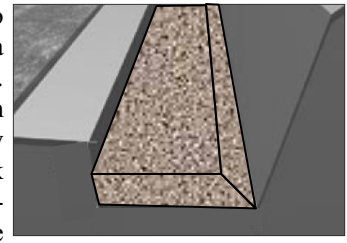
The offset between the front of the excavation and the front of the wall is typically 100-150 mm (4-6"), which is the minimum width that can be properly compacted using standard tools of the trade. The offset between the back of the wall and the back of the excavation is at a minimum 150 mm (6") for 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.

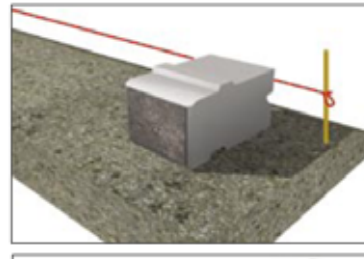


Backfill base of trench in 75mm (3") lifts to desired grade, compacting the material to at a minimum 98% Standard Proctor density. Leave a v-notch at the back of the excavation for the drain pipe. Set a string level to verify final grade. Ensure base is level front to back and side to side as this will 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.

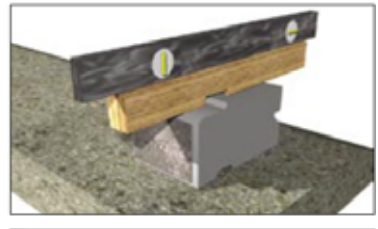
Lay the geotextile starting just under the back of the wall and up the back slope of the trench. Remember to leave adequate material at the top of the slope for the fold back, and to overlap the separate pieces a minimum of 150 mm (6"). Use sand bags or similar to keep the geotextile in place as required.

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).

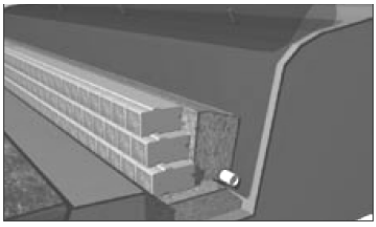


Set a string level to mark the back of the first course. Use a level to ensure blocks are level front to back and side to side.

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.

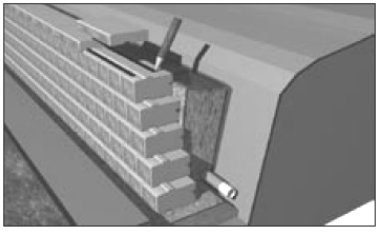
STEP 6- REMAINING COURSES



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.

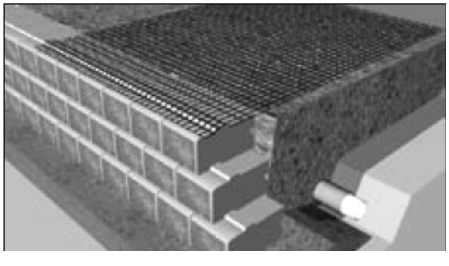
STEP 7– COPING AND GRADING



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.

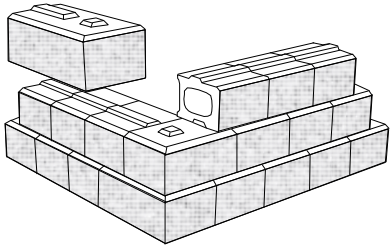
For geogrid walls, the following changes are made to the installation instructions:

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 taught to its full length and stake in place at back to maintain tension. Backfill and compact next lift.

BUILDING 90^0 CORNERS WITH PISA LIGHT®

(Note: Same methods apply to Parkwall and Parkwall Classic)

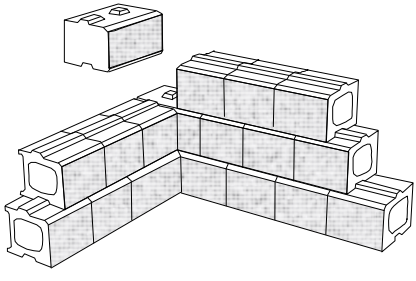


OUTSIDE CORNERS

1st Course– Position corner unit so both rough faces will be exposed in the final construction.

2nd Course– Place a corner unit that faces the other direction on the next course to interlock the corner.

3rd Course– repeat 1st course. Continue pattern until desired height is achieved.



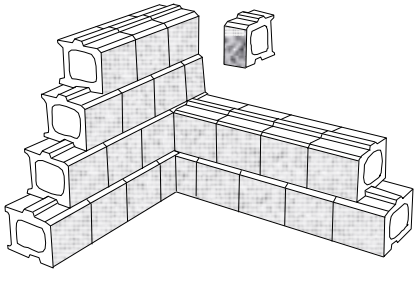
INSIDE CORNERS

Corner Unit Method

Place first corner unit so small face will be hidden behind the final construction.

Place a corner unit from the other direction on the next course to interlock the corners.

Repeat the first course. Continue pattern until desired height is achieved.



Half Unit Method

Complete three or four courses on one side of the corner.

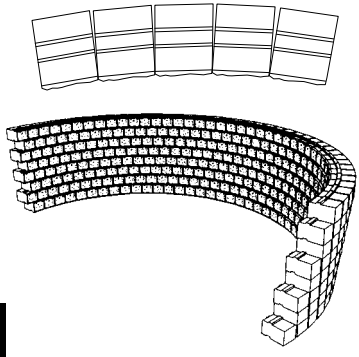
End the wall using half units on every other course. For Pisa Light, each course should extend 19mm (3/4") beyond the first course to match the batter of the adjacent wall. For Parkwall and Parkwall Classic, each course should extend 25mm (1") beyond the first course.

Place units along the second wall using half units on alternate courses.

BUILDING CURVES-PISA LIGHT®

(Note: Same methods apply to Parkwall and Parkwall Classic)

INSIDE Concave) CURVES



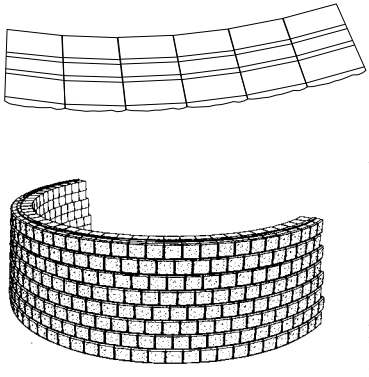
Standard units are typically used to construct inside curves. The front faces of the units are placed tightly together while small spaces are left between the back of the units.

The minimum inside radius is 2.4 m (8 ft). Smaller inside radii would require cutting.

The minimum radii would occur at the bottom row. For Pisa Light, the radius will increase 19mm (3/4") for each course added due to the wall's natural batter. For Parkwall, the increase is 25mm (1") per course.

With curves, the joints begin to line up because of the natural batter: a cut (half) unit can be used to re-establish the running bond.

OUTSIDE (Convex) CURVES



Taper units are used to construct outside curves. For smooth flowing curves, place all units tapered on the left side on one course, and all units tapered on the right side on the next course.

The minimum outside radius is 2.4 m (8 ft). Smaller outside radii would require cutting.

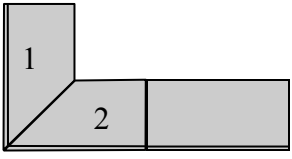
Because the radius decreases with each course, the minimum radius would occur at the top row. The radius of the bottom row needs to be adjusted 19mm (3/4") for each additional row with Pisa Light, or 25mm (1") for each additional row with Parkwall.

When laying all but the top row (if at the minimum radii), the front faces are placed tightly together while small spaces are left between the back of the units. The top row would then be placed flush from front to back of the unit.

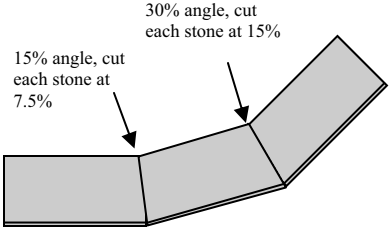
C0PING INSTALLATION -PISA LIGHT® 9" CAP STONE

(Note: Same methods apply to Parkwall 12" Cap)

Place units tight against one another for straight walls.



For 90^0 corners, it is recommended that both units 1 and 45^0 so that the split front face is continuous, and the tongue and groove is hidden.



For gradual curves, units can be cut as required. Again, it is recommended that both units be mitred at 1/2 the total angle so that the units sit flush together.

PILLARS USING PISA LIGHT® CORNERS

(Note: Same methods apply to Parkwall Corner Units)

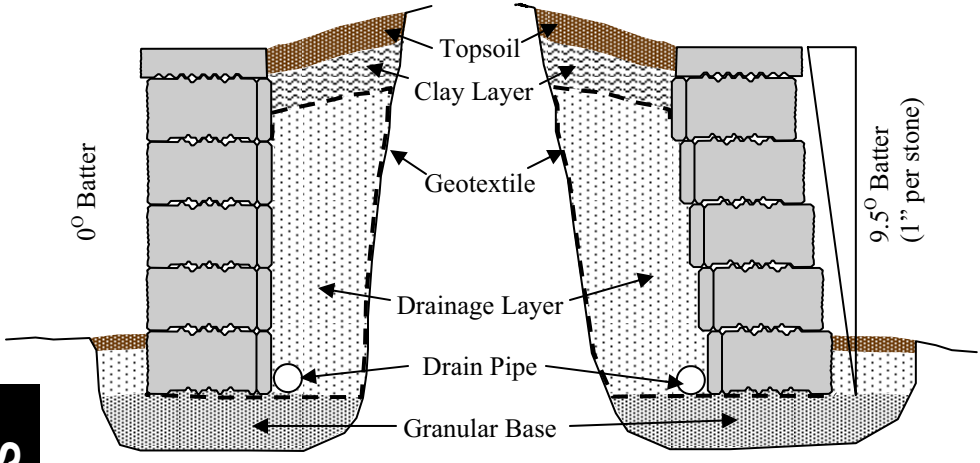
For smaller pillars, start by placing 4 corner units together (all same type) to create a square. For larger pillars, place Pisa Light Straight (Parkwall Straight) units between the corners.

For the second row, alternate the corner units (i.e. if the base course was composed of right corner units, left corner units are used for the second row).

Continue this method of alternating corner units per course until the desired pillar height is achieved. For added stability, sheets of biaxial Geogrid (Page 70) can be placed between layers.

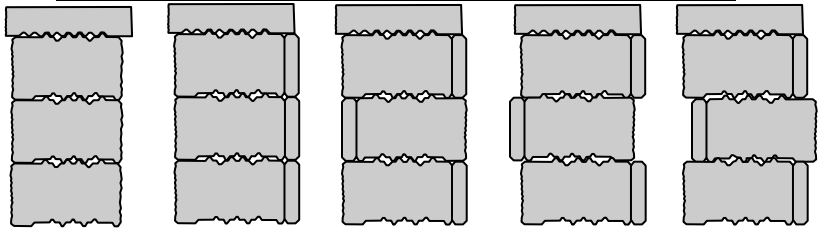
The pillar cap can either be made using 9"Cap Stones (Parkwall 12" Caps) cut to fit, or a pre-manufactured capstone as shown on Page 72.

RETAINING WALL FACING OPTIONS



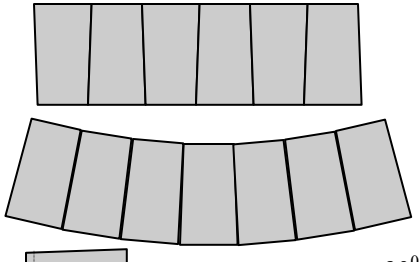
Note: with the Parkwall system, both the split face and/or the smooth face can be used on the exposed side.

STRAIGHT STACK WALL FACING OPTIONS



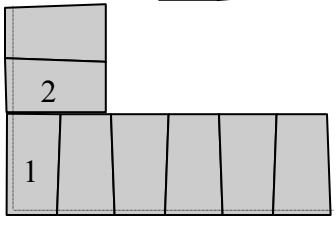
Double Split Single Split Alternating Split Inset/Outset Options

WEDGE CAP INSTALLATION



Placing the units in an alternating pattern creates a straight section.

By placing units with the wide face positioned the same way, curves can easily be laid out. The minimum curve is 2.4m (8'). Radii of greater than or less than 2.4m (8') will require cutting to achieve a tight fitting cap.

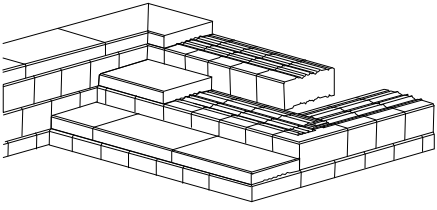


90^0 corners can easily be created using two closed end Wedge Caps (there is one closed end unit per layer of Wedge Cap units). To allow Unit 2 to sit flat, the interlocking ridges on the underlying Standard Unit (directly below the closed end portion of the Wedge Cap) need to be knocked off.

BUILDING STEPS WITH PARKWALL/PARKWALL CLASSIC

When constructing steps, Parkwall/Parkwall Classic Standard units are used for the risers and side walls, while 12" Cap Stone are used for the treads. Step Fillers are recommended in lieu of backfill below risers. Using Pisa Light® for steps is not recommended.

PERPENDICULAR STEPS

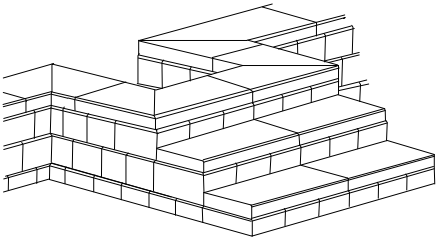


This is simply a series of inside and outside corners, with the cross wall (riser) being stepped back 300m (12") per course.

For each course, construct the inside and outside corners (see page 51), and then place the necessary units in between. Position the coping units and secure with adhesive.

The next course is placed with the front face of the riser units touching the back of the coping stone on the lower step. Some trimming of the interlock ridges on the outside corner will be necessary.

OUTSIDE STEPS

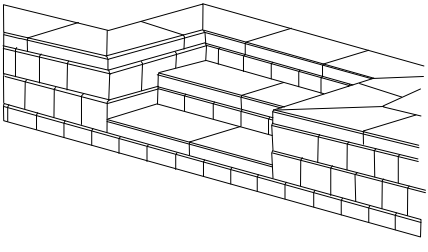


First, assemble two outside corners and two inside corners for the bottom course. At the outside corners, chop part of the interlock ridges off the corner units and position/secure the coping. Fill in with aggregate or additional standard units.

Place the next riser in contact with the back of the coping unit for the previous riser. Some chopping will again be necessary on the corner units.

When constructing vertical side wall steps against a setback retaining wall, remember to adjust the layout of the inside (back) corners to account for the difference in wall slopes.

INSET STEPS



First, assemble the two outside corners and sidewalls, with a distance of one riser length in between. For setback retaining walls, see the previous instructions.

Place the first riser and associated filler units on the same foundation elevation as the side walls. Position and secure the coping. The next course is placed with the front face of the riser units touching the back of the coping stone on the lower step.