This Technical Bulletin is the third in a series of informational papers that provide application ideas and "how-to" tips for VERSA-LOK Retaining Wall Systems.

CURVES AND CORNERS

VERSA-LOK standard units have a unique ability to provide a wide range of retaining wall curves and corners. Inside (concave), outside (convex) and serpentine curves are constructed with the same basic VERSA-LOK units by simply changing the alignment of units in the wall. Proper pinning, course to course, is accomplished on all types of curves and radiuses while maintaining a consistent 3/4" setback for each course.

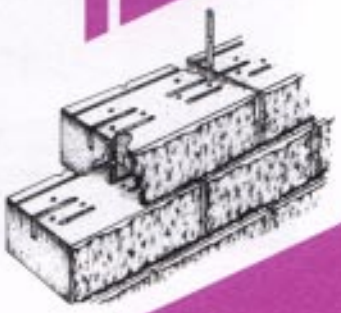
The same standard unit is used to build 90° inside and outside corners, and by sawing or splitting the solid unit, structurally stable corners ranging upward from 25° (outside), and up to 140° (inside) can also be built. This flexibility and adaptability is unmatched by any other modular retaining wall system. VERSA-LOK's versatility provides freedom to design the type of wall that blends in with and complements any surrounding landscape or architecture.

CURVES

Concave, convex and serpentine VERSA-LOK walls are made simply by fanning or bringing the tails of the units together. The trapezoidal shape of the standard unit allows various radiuses to be constructed while maintaining structural stability of the wall and tight vertical joints between adjoining units at the face of the wall.

Construction procedures are basically the same for curved and straight wall sections. (Foundation preparation, backfill and compaction requirements remain the same.) If the wall contains both straight and curved sections, start with the straight section and work into the curves. Whenever possible, complete the entire first (base) course before proceeding to the second. Elongated receiving slots in each unit allow for easy pinning as the wall progresses. Maintaining a half bond (any unit starting at the midpoint of the unit below), is not required for the units to pin properly.

VERSA-LOK®
Retaining Wall Systems



Curves (cont.)

Bond on VERSA-LOK walls can vary, but vertical joints must always be tight fitting at the face. Never gap units on the exposed face.

Convex (Outside) Curves

For convex curves, decrease space between backs of units, always keeping front joints tightly aligned. The minimum outside radius that can be constructed is 8'-0" without cutting any of the units (Figure 1). However, establishing a minimum radius for the top course of a few inches greater (8'-2" to 8'-4") is recommended to allow for creep, or in the event additional courses need to be added in the future. Because the units set back 3/4" per course, the radius of the curves becomes tighter as the wall goes higher; therefore, you need to "backward plan" the radius of the base course. The example below shows how to calculate the base course radius when the radius for the top course is known.

Example

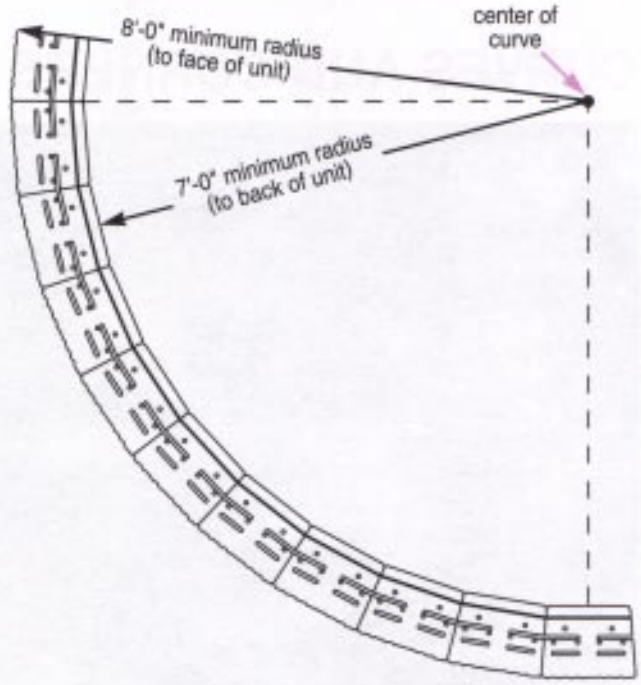
This example would be used only if you were building a four foot high convex curved wall and your desired radius at the face of the top course was 8'-2". The base course radius in this example would be 8'-7 1/4".

4-ft. wall = 8 courses (7 setbacks)
1 setback = 3/4"; 7 setbacks = 5 1/4"
Desired radius of finished wall : 8'-2"
8'-2" + 5 1/4" = 8'-7 1/4". This is your starting (base course) outside radius.

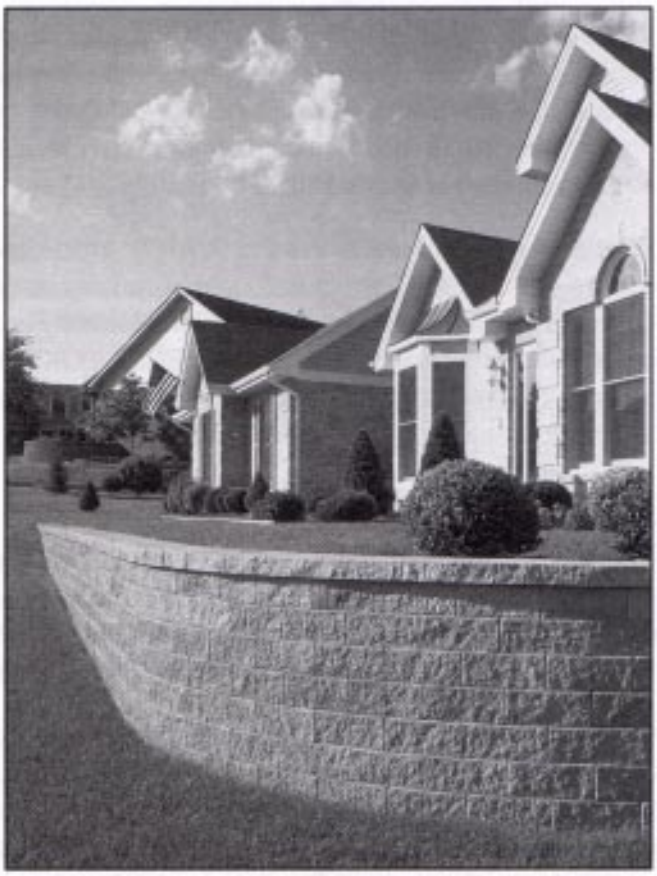
Outside Curve Table

Wall height (in feet)	Number of courses	Bottom course outside radius	Minimum outside radius for top course
4 ft.	8	8'-7 1/4"	8'-2"
3.5 ft.	7	8'-6 1/2"	"
3 ft.	6	8'-5 3/4"	"
2.5 ft.	5	8'-5"	"
2 ft.	4	8'-4 1/4"	"
1.5 ft.	3	8'-3 1/2"	"
1 ft.	2	8'-2 3/4"	"
.5 ft.	1	8'-2"	"

FIGURE 1 **Top Course Convex (Outside) Curve Plan**



These are minimum (face and back) radiuses at the top of the wall that can be achieved without cutting any unit.

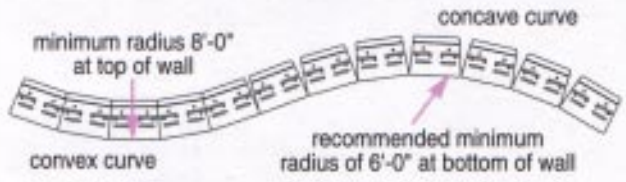


Careful base course planning for convex curves is important when building tight curves.

Concave (Inside) Curves

Concave curves are constructed by merely fanning (opening up) the spacing between the backs of adjacent units. The minimum recommended radius, as measured to the face of the wall, for an inside curve is 6'-0" at the bottom of a wall (Figure 2). Tighter curves can be built and pinned, but the appearance of the wall becomes ragged; structurally there is no problem.

FIGURE 2 Serpentine Wall Detail



How to Lay Out a Curve

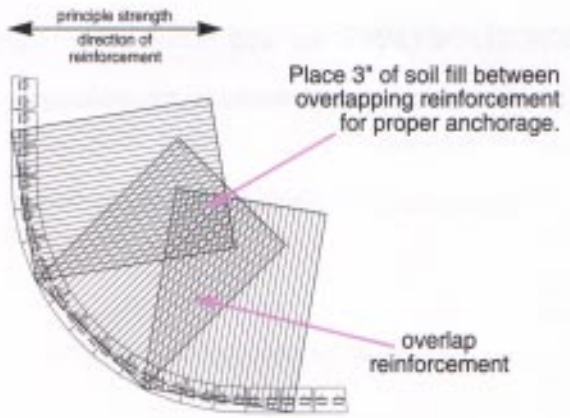
1. Stake the center of the curve.
2. Swing layout line from center, marking the radius for bottom (base) course. See curve table.
3. Excavate and prepare base for the wall.
4. Place first unit on the radius desired.
5. Place adjacent units, check radius as you proceed.

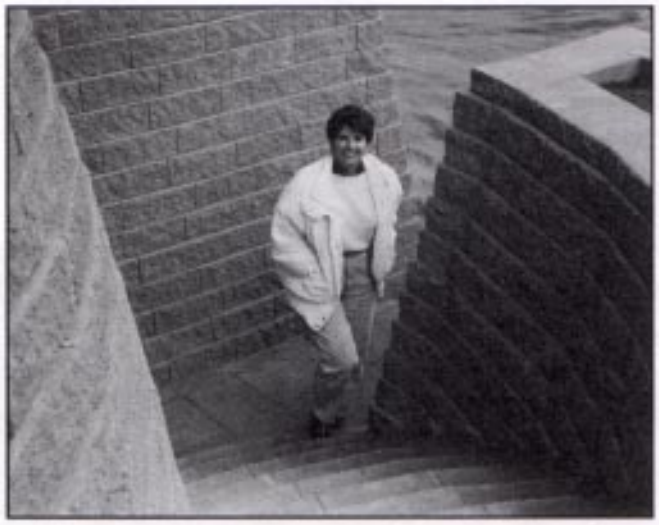
REINFORCEMENT PLACEMENT FOR CURVED AND SERPENTINE WALLS

Convex Curves

See Figure 3 for general reinforcement placement guidelines; for specific instructions, refer to manufacturer's manual.

FIGURE 3 Convex Curve



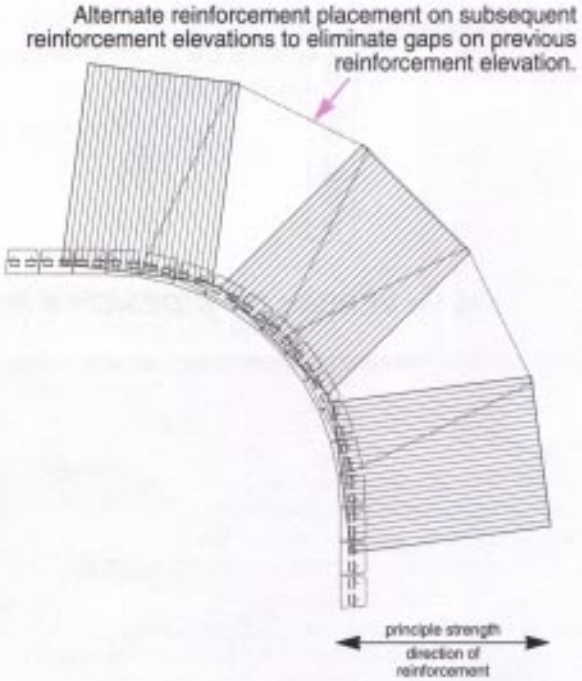


Inside and outside curves, serpentine walls and a wide variety of steps are all possible with the standard VERSA-LOK unit.

Concave Curves

On inside curves, simply diverge reinforcement from the face as shown in Figure 4. If specification calls for the covering of all gaps in reinforcement, use the following method to complete the placement of reinforcement at specified elevations: place additional reinforcement on the course of units directly above the specified elevation (see dotted lines) so that it completely covers the gap. Keep successive layers of reinforcement from touching. Cover all gaps with reinforcement before backfilling.

FIGURE 4 Concave Curve



CORNERS

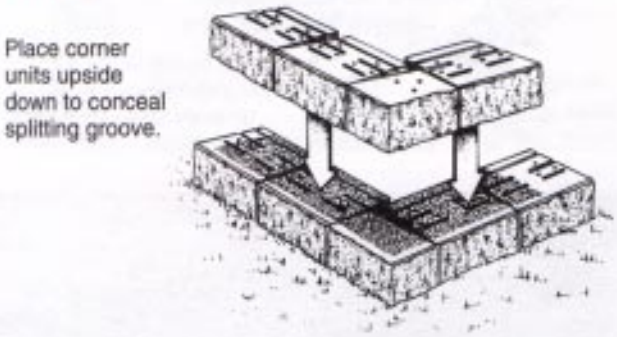
The solid, standard VERSA-LOK unit provides simplicity and flexibility for the construction of structurally stable corners. Not only does the VERSA-LOK system allow for easy construction of 90° inside and outside corners, but also for custom built corners at various angles.

In all cases, corner joints should be tight fitting with no gaps in the face. If filler pieces are needed to complete the wall, stagger their placement – never stack them – and stay away from corners. Never cut pieces smaller than four inches; cut two full units instead to fill the gap. For appearance and for wall stability, saw filler pieces rather than splitting them.

Outside 90° Corners

Outside 90° corners are started by splitting a standard full size unit in half and alternating half units at the corners as shown in Figure 5. Do not miter corners. Turn half units upside down at corners to conceal splitting groove. Always adhere these half units to the wall using VERSA-LOK Concrete Adhesive, as they do not pin. Starting with a half unit on a 90° outside corner will create a 3/4 bond in the wall. This bond will change as the wall goes up due to the 3/4" setback per course in both directions from the corner. Whenever building walls with outside corners in them, always start at the corners and build the walls, in both directions, from there.

FIGURE 5 Outside 90° Corner



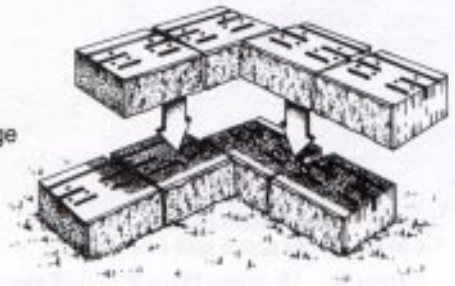
Inside 90° Corners

Half units are not required to start an inside corner; merely alternate the placement of a full-size VERSA-LOK unit past the inside corner (approximately 12" on the base course) as shown in Figure 6.

Careful planning is critical to successful projects, especially when several design elements are involved.

VERSA-LOK's alignment system provides unmatched construction versatility.

FIGURE 6 Inside 90° Corner



REINFORCEMENT PLACEMENT FOR CORNERS

At 90° outside corners, alternate the principle reinforcement direction whenever sections overlap (Figure 7). At 90° inside corners (Figure 8), reinforcement details may vary with the type of geogrid used. Check your reinforcement manufacturers' guidelines.

FIGURE 7 Outside Corner

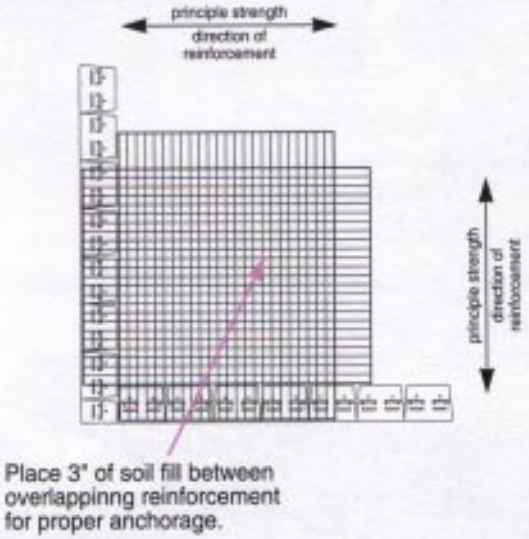
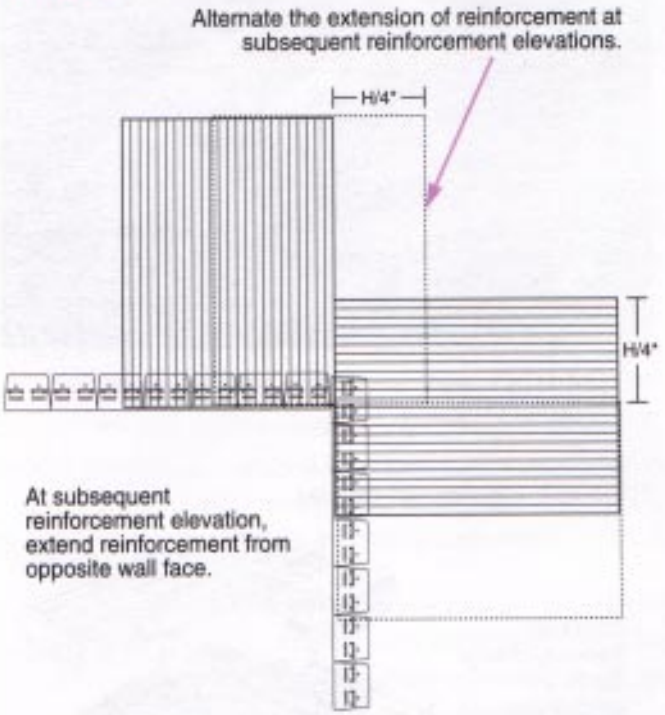


FIGURE 8 Inside Corner



*Extend reinforcement beyond wall face a distance equal to 1/4 of the height of the wall (H).

Example: 12' wall - H/4 = 3' Extension = H/4 = 3'

Custom Built Corners

A variety of custom inside and outside corners (other than 90°) can be made with the standard VERSA-LOK unit. Use the illustrations provided in Figures 9 through 13A as guidelines when designing and building custom VERSA-LOK corners.

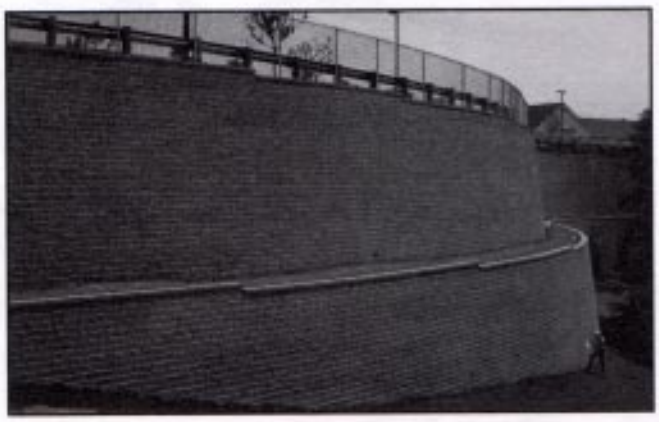
The sets of illustrations for each corner arrangement represent alternate courses. Split the units where textured faces are desired and visible; saw cut the units when straight edges are needed to fit tightly next to adjacent units.

Alternating outside corner units should always overlap; do not butt or miter corners. If corners are butted or mitered, "separate walls" can occur due to ground movement.

Oblique angled VERSA-LOK corners created this unique planter.

Saw cut to eliminate protruding material that could interfere with tight fitting face joints.

A portable hydraulic splitter makes angle splits an easy task.



Additional Custom Corners

FIGURE 10 Low Angle Outside Corner

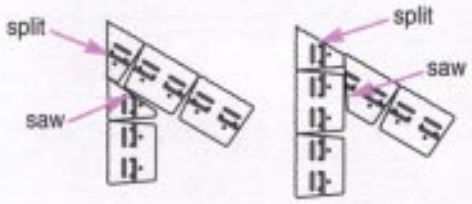


FIGURE 11 Near Right Angle Outside Corner

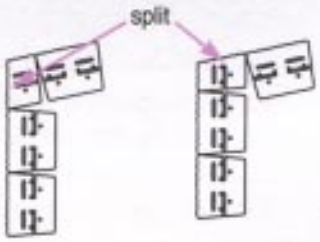


FIGURE 12 Low Angle Inside Corner

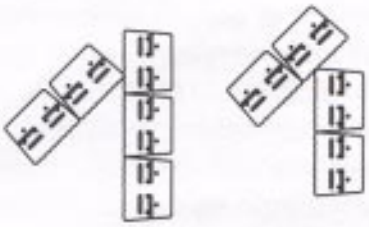


FIGURE 13 Large Angle Inside Corner

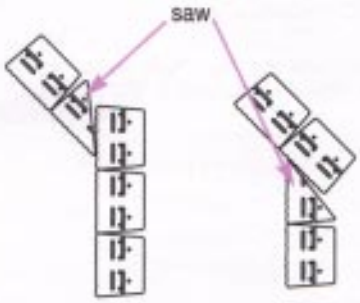
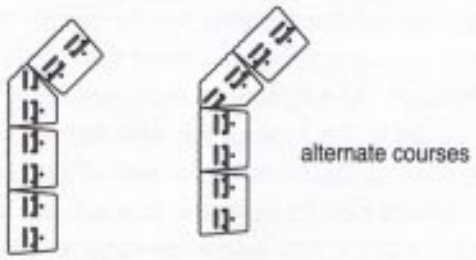
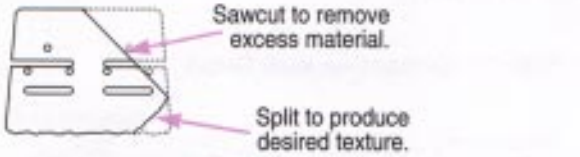


FIGURE 9 Large Angle Outside Corner





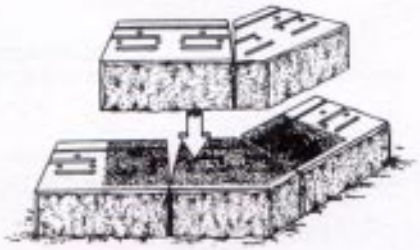
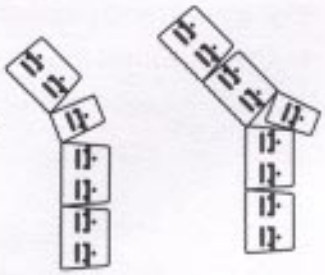


FIGURE 13A Large Angle Inside Corner (Optional)

This optional large angle inside corner does not require the special saw cuts illustrated in Figure 13.



Place full and half standard units at the desired angle.

Ask for VERSA-LOK'S *DESIGN & INSTALLATION GUIDELINES* for additional information.

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