

COUNTRY MANOR[®]

DESIGN AND CONSTRUCTION MANUAL

Old World Charm



ANOTHER GREAT PRODUCT FROM ...

KEYSTONE
RETAINING WALL SYSTEMS

COUNTRY MANOR®

Keystone Retaining Wall Systems is proud to bring you another great wall system....Country Manor!

This dry stacked yet mechanically connected wall evokes the old world charm of a mason crafted wall. Imagine an English countryside lane or a European estate wall... now you have the idea of Country Manor. Random and rugged yet blended with color and character, these high strength concrete modules appear as natural stone, but have the latest built-in technology of the Keystone pin assured connection.

Whether for castle or home...graceful curves, monumental corners and free standing parapets are all part of the charm of Country Manor from Keystone...The first, and last name you need to know for the finest site solutions!

◆ UNMATCHED FLEXIBILITY



CORNERS



CURVES

Assembly of the varying length Country Manor units will result in a random layout, with the texture, color and appearance of an old world stone wall. Walls can be built as low height gravity landscape walls or, taller soil reinforced wall structures capable of handling surcharge loads!



UNIT TYPES

◆ Large Unit*
60 lbs. (27 kg)
6"h x 10"d x 16"/14"w
(150mm x 250mm x 400mm/350mm)



Medium Unit*
40 lbs. (18 kg)
6"h x 10"d x 12"/10"w
(150mm x 250mm x 300mm/250mm)



Small Unit*
25 lbs. (11 kg)
6"h x 10"d x 6"/4"w
(150mm x 250mm x 150mm/100mm)



Universal Cap Unit*
(two sides textured)
24 lbs. (11 kg)
3"h x 10"d x 14"/8"w
(75mm x 250mm x 350mm/200mm)



*unit dimensions, weight and color may vary by region.

*Positive Mechanical Connection
with Keystone Fiberglass Pins*



Vertical, Battered and Parapet Options



Simplicity of Construction

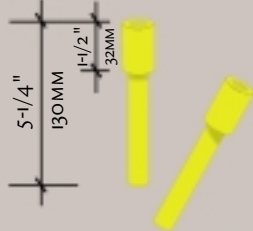


*Wall Solutions from Gravity to
Soil Reinforced.*

◆ FIBERGLASS PINS FOR INTERCONNECTION AND ALIGNMENT

◆ **Fiberglass Pins**

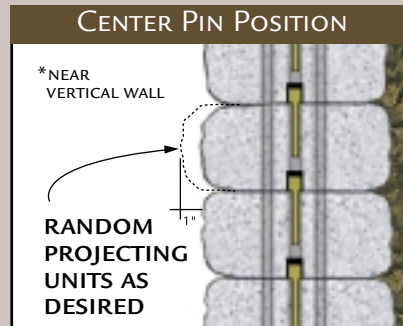
- 5 - 1/4" (130mm) long
- 1 - 1/4" (32mm) shoulder length
- 1/2" (13mm) diameter at pin shaft
- 3/4" (20mm) diameter at shoulder



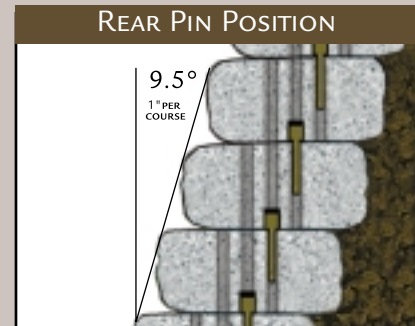
OPTION:

Front hole position allows for intermittent and random use of pulling a unit forward to create more variation and offset to the wall face.

Keystone interlocking connection and alignment pins are made from high strength pultruded fiberglass. Minimum short beam shear strength is 6400 psi.



The center pin position will build a wall in the "near vertical" position. Near vertical has a positive batter of approximately 1°. Always pull units toward wall face to engage pins as final construction step when placing units.



Using this pin position on all courses will build the wall with an approximate 9.5° batter (setback). This is a 1" setback for each 6" vertical wall.

◆ **GENERAL PRODUCT INFORMATION**

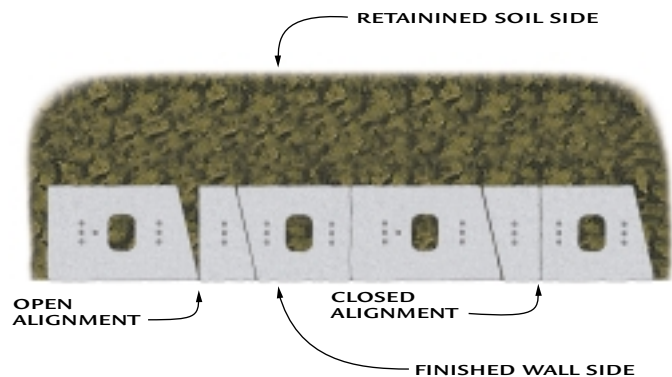
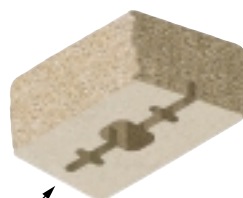
When building with the Country Manor product the units can be oriented in two different positions. For retaining walls, either the open or closed positions will work. For parapets, columns, pilasters, etc., where the wall face can be seen from more than one side, the closed alignment position should be used. When using the "open" position, be sure that drainage aggregate (1/2" - 3/4" crushed stone) is used to fill in the gap and restrict the flow of retained soil.



Each unit has sets of 3 alignment holes (front, middle, back) to allow walls to be built at "near vertical", 9.5° batter (setback) or the occasional random unit pulled forward by 1" (25mm) for aesthetic variation. Place a single pin at each set.

Due to the receiving channel on bottom surface of the units on the course above interlocking with the pins from the course below, walls can be built with positive mechanical connection in 90° corners, curves and straight wall geometry without loss of connection or strength.

Closed end of channel at unit bottom allows for finished end aesthetics on 90° corners, pilasters and wall end conditions.



Note: Units should be backfilled to a minimum 1'-0" with drainage fill of 1/2"-3/4" crushed stone. If retained soil is drainable "granular" material, then a filter membrane can be used directly against the back face of the wall to eliminate flow of fine soils through the wall face.



BASIC STEPS



1. PREPARE THE BASE LEVELING PAD

Remove all surface vegetation and debris. Do not use this material as backfill. After selecting the location and length of the wall, excavate the base trench to the designed width and depth. Start the leveling pad at the lowest elevation along wall alignment. Step up in 6" (150mm) increments with the base as required at elevation changes in the foundation. Level the prepared base with 6" (150mm) of well-compacted granular fill (gravel, road base, or 1/2" to 3/4" [10 - 20 mm] crushed stone). Compact to 95% Standard Proctor or greater. **Do not use PEA GRAVEL or SAND for leveling pad.**



2. INSTALL THE BASE COURSE

Place the first course of Country Manor units end to end (with corners touching) on the prepared base. The long groove (receiving channel) on the unit should be placed down and the three pin holes should face up, as shown. Make sure each unit is level - side to side and front to back. Leveling the first course is critical for accurate and acceptable results. For alignment of straight walls, use a string line aligned on the unit pin holes for accuracy.



3. INSERT THE FIBERGLASS PINS

Place the fiberglass pins into the holes of the Country Manor Units (note: place one pin only per each grouping of 3 holes). The pins create an automatic setback for additional courses. According to wall requirements and design, place pins in the middle hole for near vertical alignment or the holes nearest the embankment for a 9.5 +/- setback per course. The front pin hole (towards the face of the wall) can be used randomly to allow a forward projection of a specific unit for accent and variation in the wall appearance.



4. INSTALL DRAINAGE FILL, BACKFILL AND COMPACTION

Once the pins have been installed, provide 1/2" - 3/4" (10 - 20mm) crushed stone drainage fill behind the units to a minimum depth of 12" (305mm). Fill open spaces between units and open cavities/ cores with the same drainage material. Proceed to place backfill in maximum 6" (150mm) layers and compact to 95% Standard Proctor with the appropriate compaction equipment.



5. INSTALL ADDITIONAL COURSES

Place the next course of Country Manor units over the fiberglass pins, fitting the pins into the long receiving channel recess of the units above. Pull the Country Manor units toward the face of the wall until they make full contact with the pins. If pins do not connect with channel but align in open core of upper unit, place drainage fill in core to provide unit interlock with pin.



6. CAPPING THE WALL

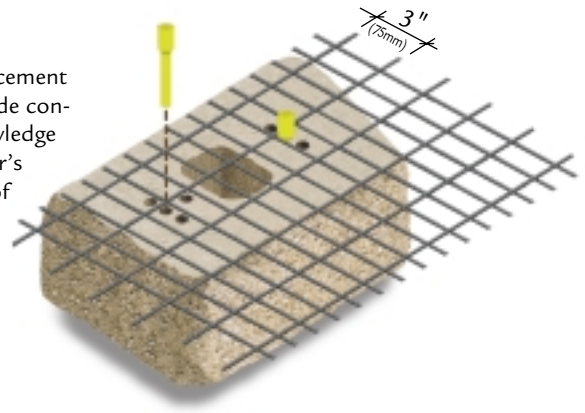
Clean off the last course of Country Manor in preparation for the cap or coping to finalize the wall. With units dry and clean, use construction adhesive (Keystone Kapseal) or mortar for a mechanical bond. Install the Country Manor 3" (75mm) capping unit, architectural precast concrete or cut stone as a coping element. Cap may be flush or overhanging as required by aesthetics and design.

GENERAL NOTES:

- Units may vary due to texturing processes and unit sizes by region. Verify unit type, size, weight availability by region. Units may vary up to 1" ± (25mm) due to texture variations.
- Clean out pin holes and receiving channel as required to assemble wall. During manufacturing, some concrete crumbs may deposit in these areas and should be removed to permit pins to be placed in the appropriate holes and receiving channel.
- As required for pin interlock, remove the solid end of the receiving channel at bottom of unit. Remove only if pin from unit below strikes this area.
- Cut units as required (with a mason saw, hydraulic break or chisel and hammer) for corners, caps or wherever units need to be altered to allow construction to be finalized.
- When cutting concrete units, always wear safety goggles, gloves and filter mask.
- Use Keystone Kapseal or equal construction adhesive for all units in parapet walls, columns, etc. where wall is built free-standing (not retaining soil). Use vertical bead of adhesive between units in free-standing wall to avoid daylight view through wall units. Use adhesive as required at 90° corners or where pins do not interconnect units on succeeding courses.

◆ GEOGRID SOIL REINFORCEMENT

Taller or more critical walls having surcharge loads require the use of geogrid reinforcement material to reinforce a cohesive soil mass directly behind the retaining wall and provide connection to the concrete facing units. Geogrid properties and wall design require knowledge of wall heights, soil friction properties (PHI angle), surcharge loads and manufacturer's requirements for specific geogrid types and strength capabilities. For general design of limited height walls, refer to the "Design Charts" on page 15 of this brochure. For conditions beyond these basic charts, consult a qualified engineer. To install geogrid into your wall, continue the installation process with the following steps.



EXCAVATE REINFORCED SOIL AREA: Remove existing soils in the reinforced soil area to the maximum embedment length of the geogrid design. Level soil behind the wall prior to placement of each geogrid layer.

CUT GEOGRID: Cut sections from geogrid roll to the specified length (embedment depth) by Design Charts or Engineers design analysis. Check manufacturer's criteria for biaxial or uniaxial geogrids. In most cases, the correct orientation is to roll the geogrid perpendicular to the wall face.

INSTALL GEOGRID: Place geogrid over the Country Manor shouldered pins already in place. NOTE: Allow approx. 3" (75mm) of geogrid material to rest on the unit top surface ahead of the pin (from pin to face of wall). This will ensure that the next course above will be fully supported on geogrid. Place all sections of geogrid, to abut each other or overlap side to side as per manufacturers instructions.

SECURE GEOGRID: Pull the pinned geogrid taut to eliminate loose folds. Stake or secure back edge of geogrid before backfill and compaction. As possible, compact from back of wall area towards embankment to avoid loosening geogrid or putting compaction pressure on wall. Remove stakes, as required, once backfill is placed.

INSTALL NEXT COURSE OF COUNTRY MANOR UNITS.

Follow steps 3-5 (page 4) until next geogrid layer or completion of wall.

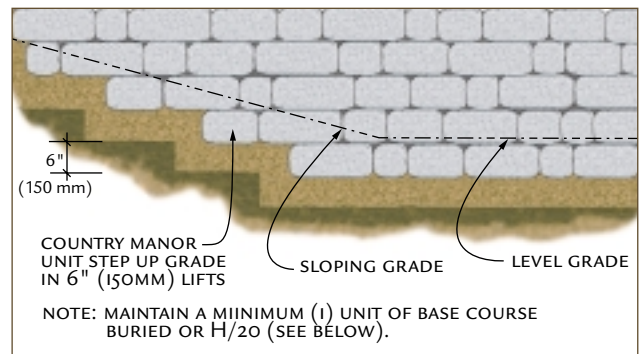
◆ STEPPED FOOTING (Leveling Pad)

Leveling pad options:

- Compacted free draining granular fill (inorganic)
- Class #5 road base (or similar designation)
- 3/8" - 3/4" crushed stone
- Non-reinforced concrete (2000 psi)

Leveling pad thickness: 6" (150mm) ±

Always start wall at lowest elevation of site location where wall is to be constructed. Build step-ups in leveling pad to match concrete unit thickness. When using non-reinforced concrete for the leveling pad option, it is very critical that the step-ups match the Country Manor unit thickness! With a concrete leveling pad, there are few options for correction if the step-up is built higher than the unit height.

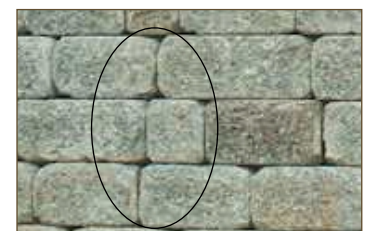


◆ EMBEDMENT

Unit embedment below the grade line shall be a minimum of one unit buried, under all conditions, along with a general provision of H/20 (wall height divided by 20) for total wall embedment of taller walls. Note H=total height of wall from top of base leveling pad to top of wall. Consult a qualified engineer for sloping grade conditions in front of wall or steep slopes and surcharges above wall. Deeper embedment may be required in areas prone to surface scouring due to run-off water flowing along the grade line, or in areas where freestanding walls are desired and frost depths require deeper foundations.

◆ PATTERN & APPEARANCE

"Rule of Thumb" for bond pattern between courses: Construct the wall using the units as they come off each shipping pallet. Randomly utilize the various unit shapes trying to avoid a repetition of same unit size frequency along a horizontal line (some unit repetition will be aesthetically acceptable). Avoid stack bonding of unit joints (vertical line between adjoining units) for more than (2) courses vertically. If some units seem to have a corner missing or too much texturing in a specific area, use these units at the wall base or orient them to the soil side of the wall to hide imperfections.

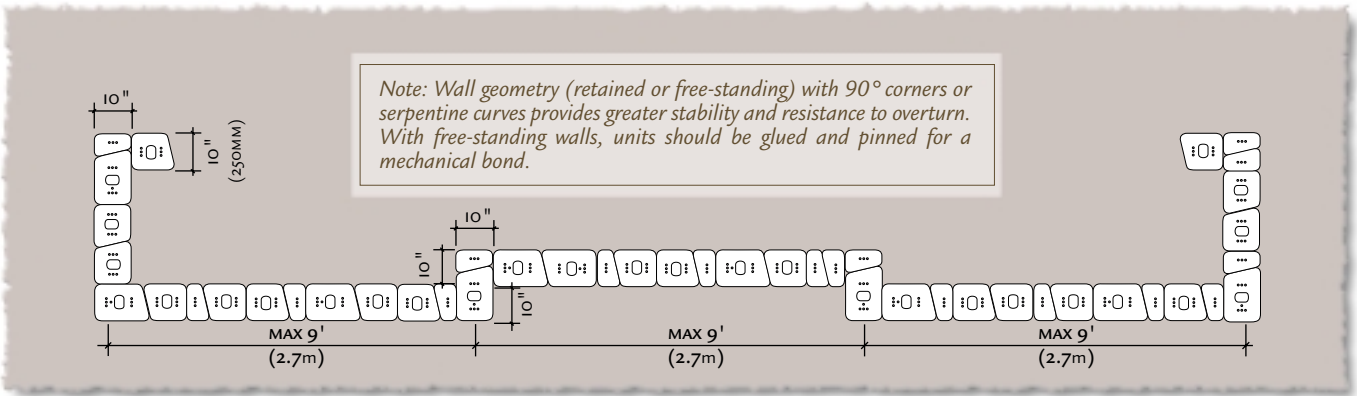
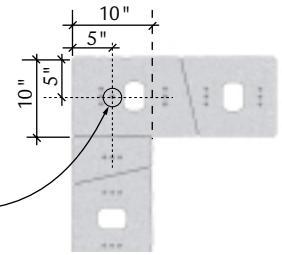


Avoid "stack bond" conditions where more than (2) courses create weak areas in the wall.

CORNERS

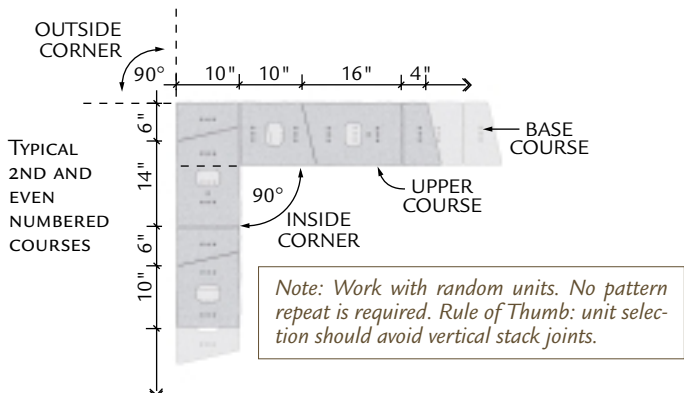
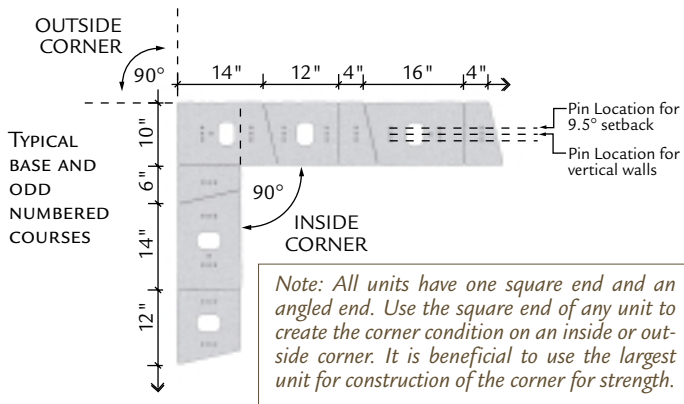
With Country Manor, corners are a natural part of your creative design. All Country Manor units are capable of being used in a 90° corner due to having one end square and (3) sides textured. This allows units to build retaining and free-standing structures with 1,2 or 3 faces exposed. For taller walls, it is recommended the “Large Unit” be used at corners to achieve greater strength through overlap and interlock with units above and below.

The large unit has an extra pin position for connection to the next course above in a 90° corner which runs in a perpendicular orientation.



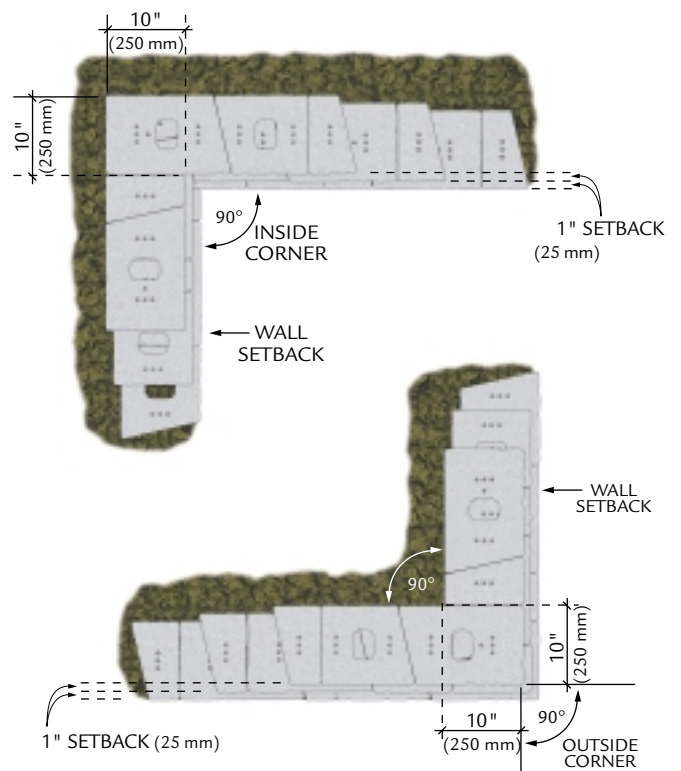
NEAR VERTICAL CORNERS

Unit dimensions may vary somewhat from what is shown on this detail. Contact your local product representative for exact dimensions for the Country Manor product in your area.



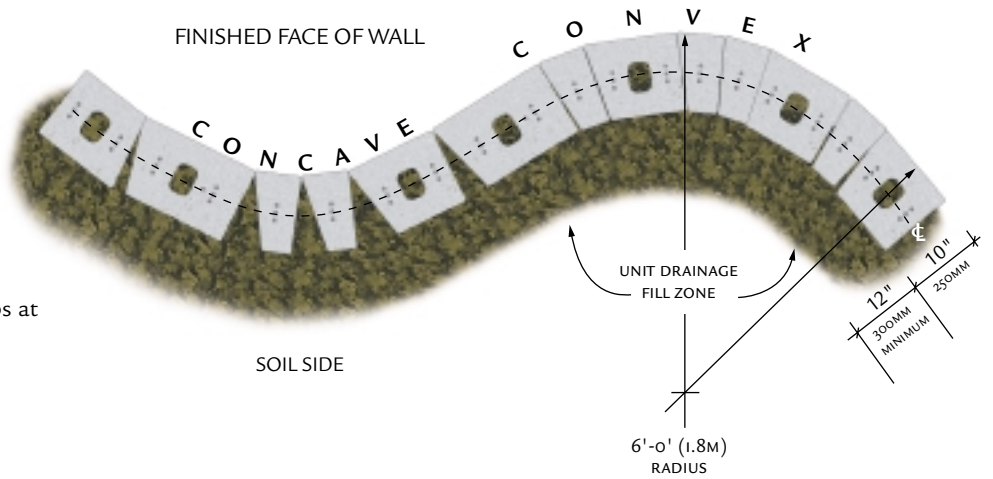
CORNERS WITH SETBACK

Corners with a positive setback build in a similar random course pattern to the near vertical corner. In the setback version, each course of pins are set in the 1" offset position. Units shift laterally as required to achieve the 1" setback.

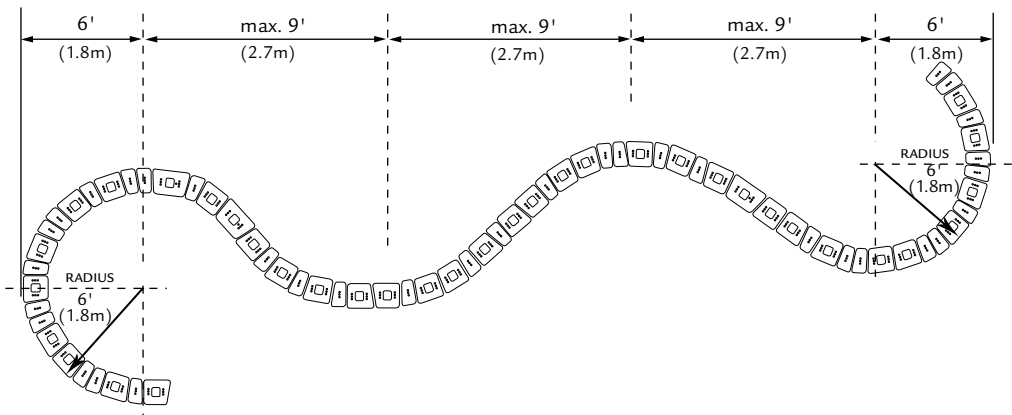


CURVES

The Country Manor design makes it easy to construct a variety of serpentine curves. Convex and concave curves will add gentle grace, beauty and strength to any installation. For retaining walls, place the units to follow the desired curve. If unit to unit geometry creates small “V” shaped voids on the retained side, this is not a problem. Just fill these areas with drainage fill. For parapet walls where units are exposed on two sides, select the proper unit layout that provides tight closed-end conditions for all units to avoid a gapped look on either side of the parapet or cut units as required to avoid gaps at free-standing conditions.



Note: To build smaller radii, the use of the shorter units and some cutting may be required.



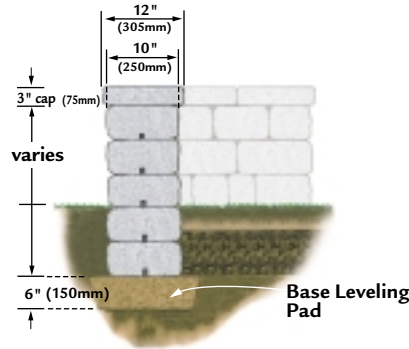
Note: Curves can be built in both convex (outward) and concave (inward) layouts using the “near vertical” or 1” setback options. For free-standing walls, always build in the vertical position.

Note: Curved walls may require cutting of cap/coping units to fit the specific radius. See general notes under “installation” regarding caution and personal protection during cutting of units.



FREE STANDING WALL APPLICATIONS

With Country Manor, the option of building free standing walls to various plan geometry and limited heights is an integral part of the system. From low border walls, which define the edge of patios and decks to free standing entry monuments, pilasters and parapets walls, the following details highlight the use of interlocking geometry to provide strength and resistance to overturn forces.



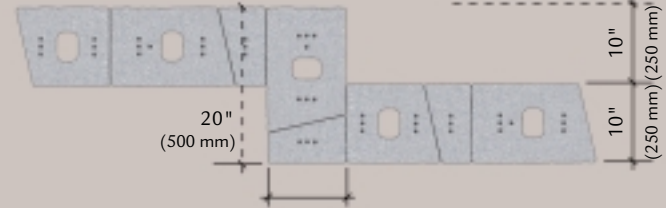
FREE STANDING BORDER WALL

WALL OFFSET

- ◆ provides strength to parapet wall due to overturn resistance
- ◆ allows for change in wall direction
- ◆ an opportunity for aesthetic geometry.

Notes: 1. 10" offset of 2 parallel walls is the minimum dimension for this condition. Continuous offsets @ maximum 9'-0" O.C. will provide strength at parapet walls in coordination with construction adhesive (Keystone Kapseal) and/or vertical reinforcement as required by engineer. 2. It is important to use unit combinations at the offset location where 2 units combined together equals 20" in length.

TYPICAL BASE AND ODD NUMBERED COURSES



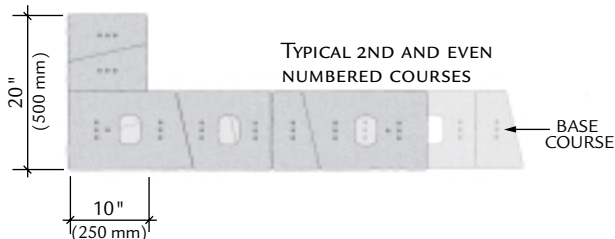
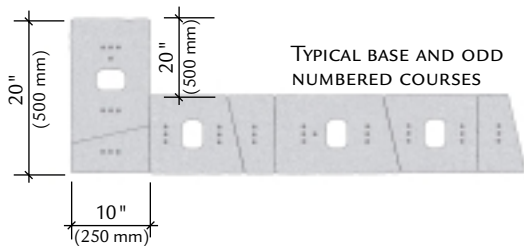
TYPICAL 2ND AND EVEN NUMBERED COURSES



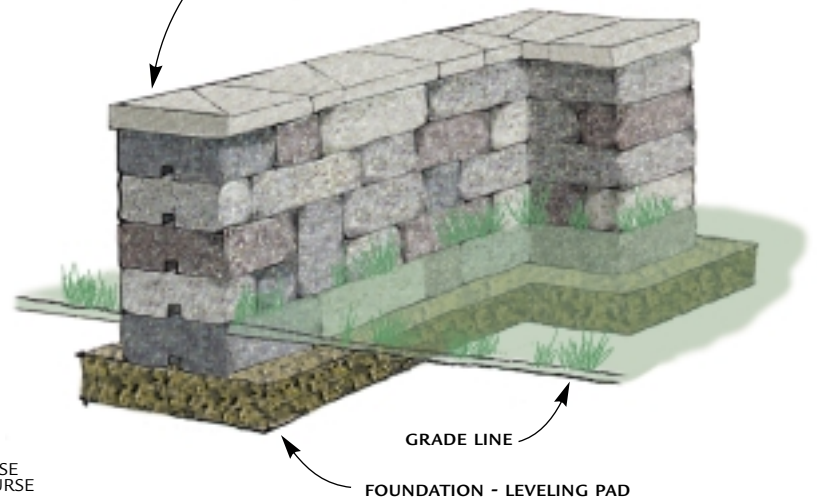
WALL OFFSET CONDITION IS STRENGTHENED WHEN UNITS ARE OVERLAPPED VERSUS STACKED.

"L" RETURN END

This detail offers stability and strength to resist overturn forces at the termination end of a free standing wall.



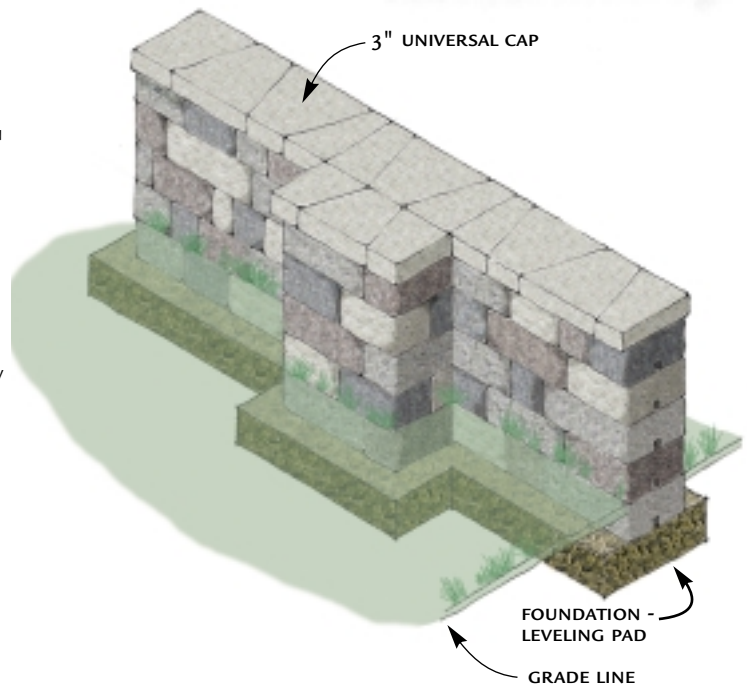
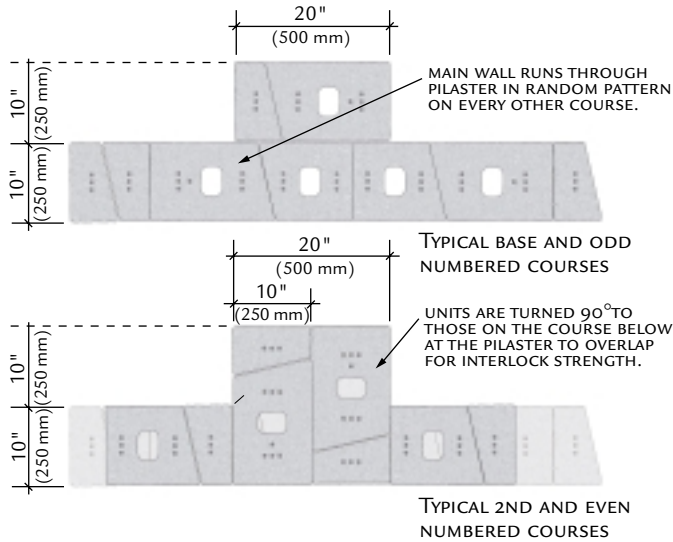
3" CAP SHOWN: OPTIONS: (CUT STONE, PRECAST CONCRETE OR OTHER MASONRY MATERIALS)



◆ FREE STANDING WALL APPLICATIONS

PILASTER DETAIL

The pilaster detail creates a deeper wall section which can provide stability for a retaining structure, free standing wall or parapet.

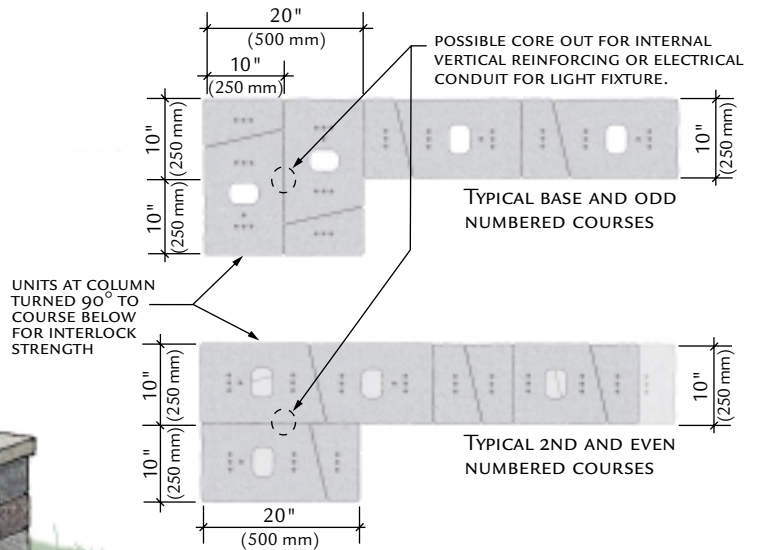
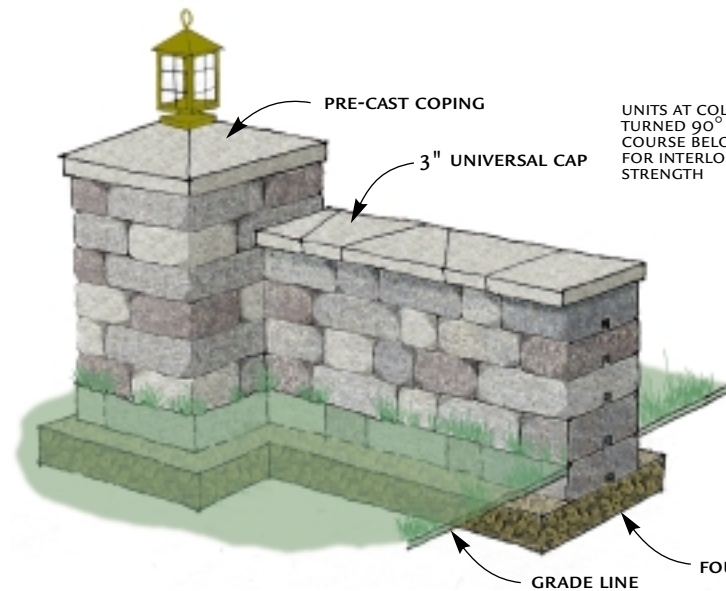


COLUMN CORNER

Similar to the "L" Return End wall detail, the column corner utilizes a 20"x20" column geometry to develop a pier at the end of a running wall. This detail offers visual aesthetic interest as well as provides strength for the free standing wall termination point.

COLUMN DETAIL OPTIONS:

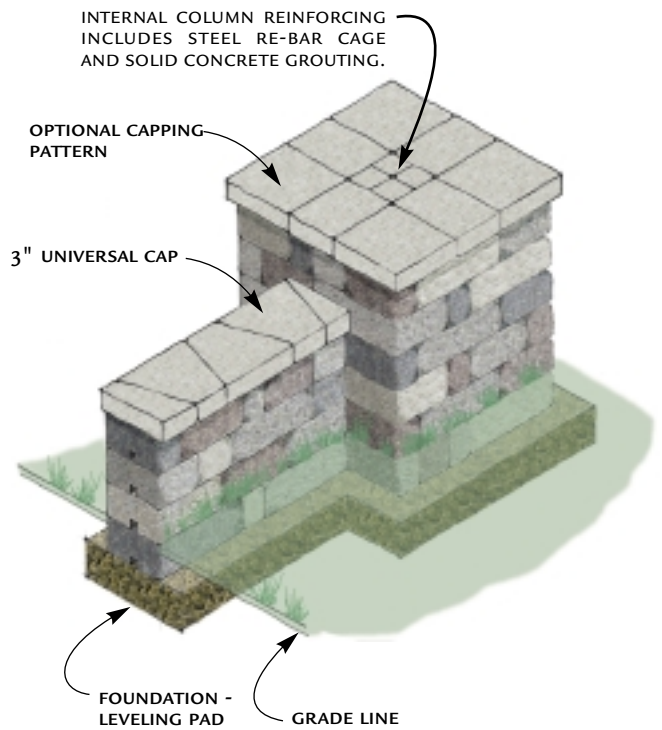
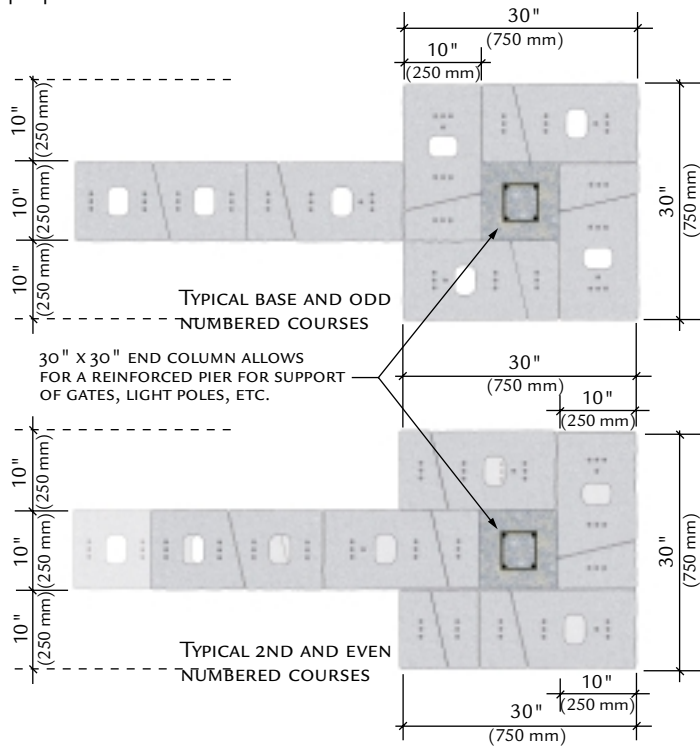
- LANDSCAPE LIGHTING
- PLANTER WITH FEATURE FLOWERS OR ORNAMENTALS
- YARD FIGURINE/SCULPTURE.



FREE STANDING WALL APPLICATIONS

WALL END COLUMN

The wall end column is a larger version of the “Column Corner” detail on page 9. The benefit of this design option is the development of internal reinforcement to provide for greater strength and height, along with a larger footprint dimension for aesthetic purposes.

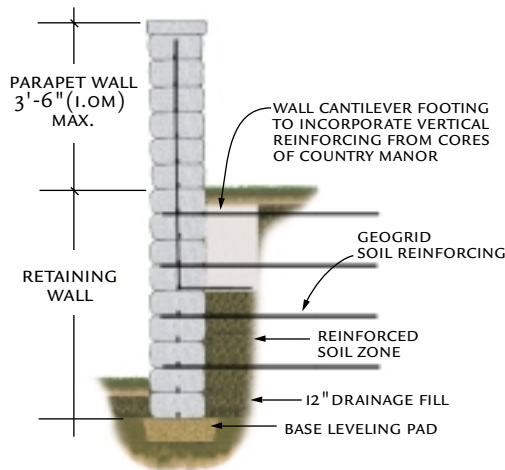


With internal column reinforcing, the designer must consider the need for a concrete footing of appropriate design for bearing and load support. In freeze/thaw zones, footing depth of a rigid/reinforced structure will require a founding below frost depth. See local building code requirements or consult a qualified engineer.

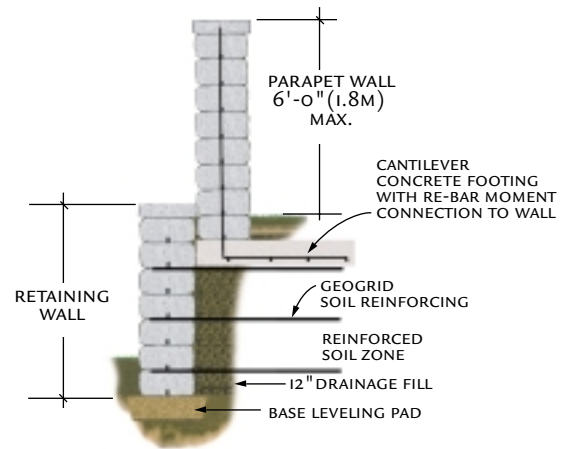
PARAPET / LOW FENCE WALLS

When adding a parapet or low fence above a Country Manor retaining wall structure, an additional cantilevered footing is required to connect the vertical reinforcing from the wall and provides the necessary resistance to overturning. Wall offsets and pilasters will offer additional resistance to overturn. Consult a qualified engineer for evaluation of loads, design and local code requirements.

PARAPET WALL/RETAINING WALL COMBINATION



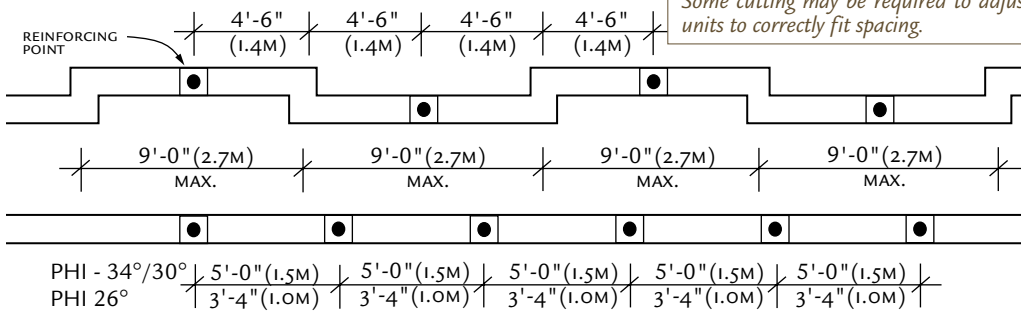
PARAPET WALL SEPARATE FROM RETAINING WALL



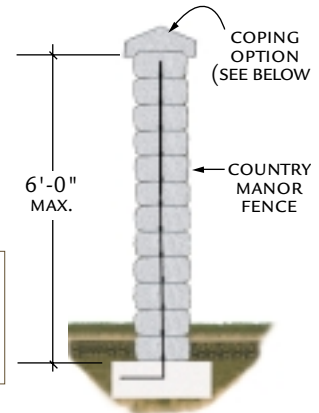
FENCE WALLS

Provide internal vertical reinforcing to resist overturn due to loads. Options: Post tensioned fence reinforcement system (Proto II or equal) utilizes compression between reinforced footing, tension rod and compression plate. An alternative to the post tension system is a reinforced footing using steel re-bar at vertical intervals with grouted cores. Both options require the aligning of unit vertical cores (approx. 4" x 4" in size) to provide for re-bar and grout. Note: Offsets and pilasters offer additional strength to resist overturn. Space vertical re-bar accordingly. Consult a qualified engineer for local code oriented design and on-center locations for vertical cores.

WALL PLAN VIEW



Note: To achieve this, set cored units over re-bar from footing and then infill with random units between reinforcing points. Some cutting may be required to adjust units to correctly fit spacing.

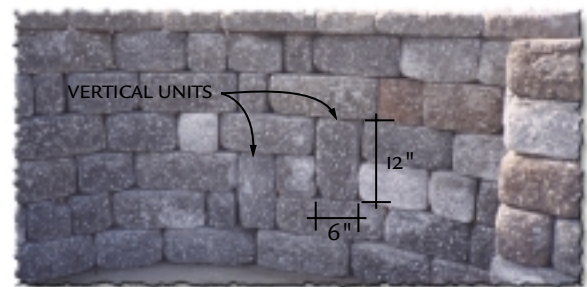


Note: Size footing to meet structural requirements to resist overturn due to physical and wind lateral loads along with providing bearing capacity relative to soil capacity.

SOIL PHI ANGLE	BEARING CAPACITY	CONCRETE	VERT. REINF. O.C. OFFSET	FOOTING SIZE
PHI 34°	3000 psf	3500 psi (24MPa)	5'-0" (1.5m)	8" (200mm) THICK X 24" (610mm) WIDE
PHI 30°	2800 psf	3500 psi (24MPa)	5'-0" (1.5m)	8" (200mm) THICK X 30" (760mm) WIDE
PHI 26°	2000 psf	3500 psi (24MPa)	3'-4" (1.0m)	8" (200mm) THICK X 36" (910mm) WIDE

VERTICAL UNIT ORIENTATION

A creative design option is to place units vertically to provide a break of horizontal lines. To span two 6" high courses, use the unit with the 12" length. Place vertical units in a random pattern along wall. Use Keystone Kapseal construction adhesive to fasten. Fiberglass pins do not work in this position. Make sure the unit above the 12" vertical piece spans beyond the 6" width of the vertical unit, resting on the units at each side.

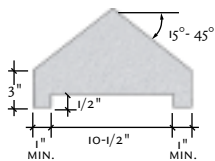
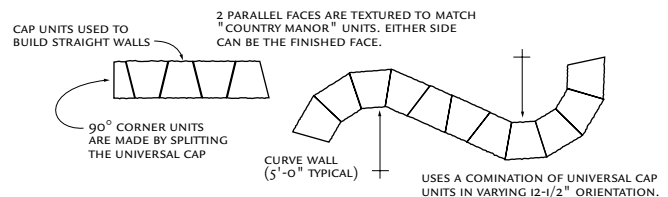


CAPPING/COPING OPTIONS

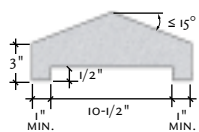
The Universal Cap is 3" high with two sides textured allowing the unit to provide straight & curved wall capping. The 12" depth to the Universal Cap allows for a 1" (25mm) overhang or "shadow" effect on the cap. For retaining walls, this can be eliminated if desired by pushing cap back flush with wall plane. Use Keystone Kapseal construction adhesive to fasten caps in place.

Precast and cut stone copings are also an option.

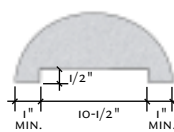
UNIVERSAL CAPS:



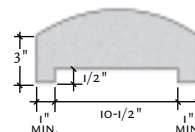
HIGH POINT



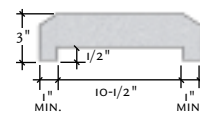
SHALLOW POINT



ROUND



MUSHROOM

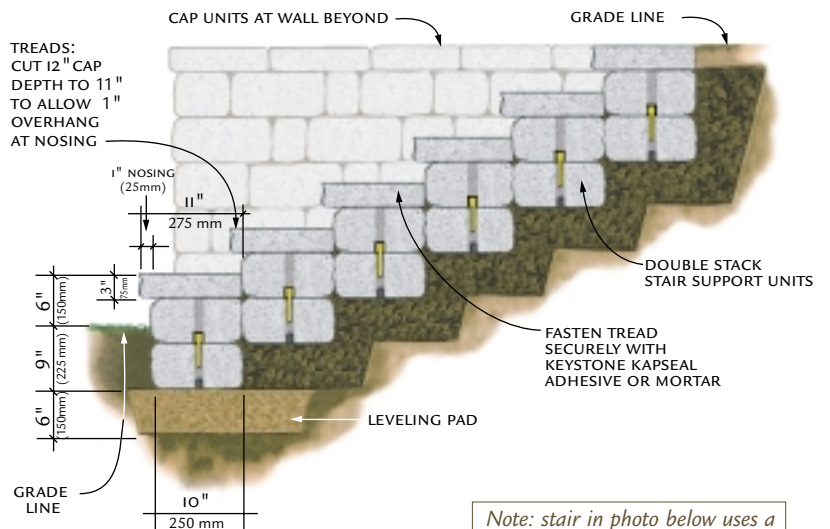


CHAMFERED

STAIR / STEP DESIGNS

Country Manor can be used on your stair/step projects with the following considerations.

- Provide same leveling pad material at stair/step foundation as used on Country Manor walls.
- Compact leveling pad material to a minimum 95% Standard Proctor. Note: adding cement can provide the additional benefit of firming up this area in a cemented soil composite.
- Double stack base support units to create foundation to stair. Use pins and construction adhesive as required for a unified stair/step assembly.



Note: stair in photo below uses a cut stone concrete tread option



Provide handrail / railing as per local building code. Core drill for handrail and secure with non-shrink grout as required. Core drill should go through cap unit into the base support units.

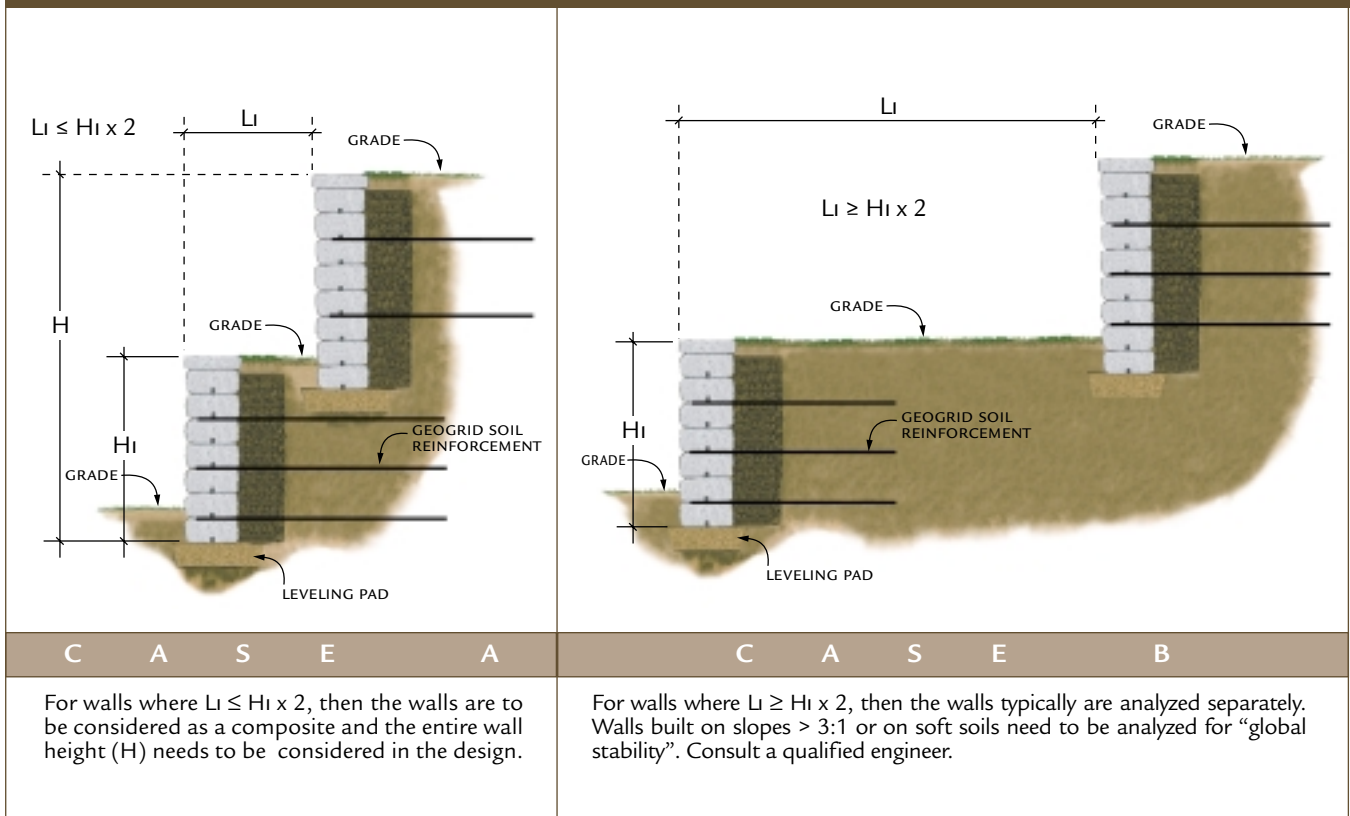


◆ TERRACES

Terraces are a pleasing way to build a taller retaining wall where aesthetics dictate the separation of walls to reduce the wall height and large mass appearance. Closely spaced terraces need to be reviewed by a qualified engineer to avoid global instability issues and to make sure soil reinforcement (geogrids) are properly designed to handle the loads for the entire wall structure. Terraced walls should be analyzed as a complete wall system versus as individual walls unless they are spread greater than twice the wall height of each terrace and the soils are free draining and granular in nature.



TERRACE PROXIMITY EVALUATION

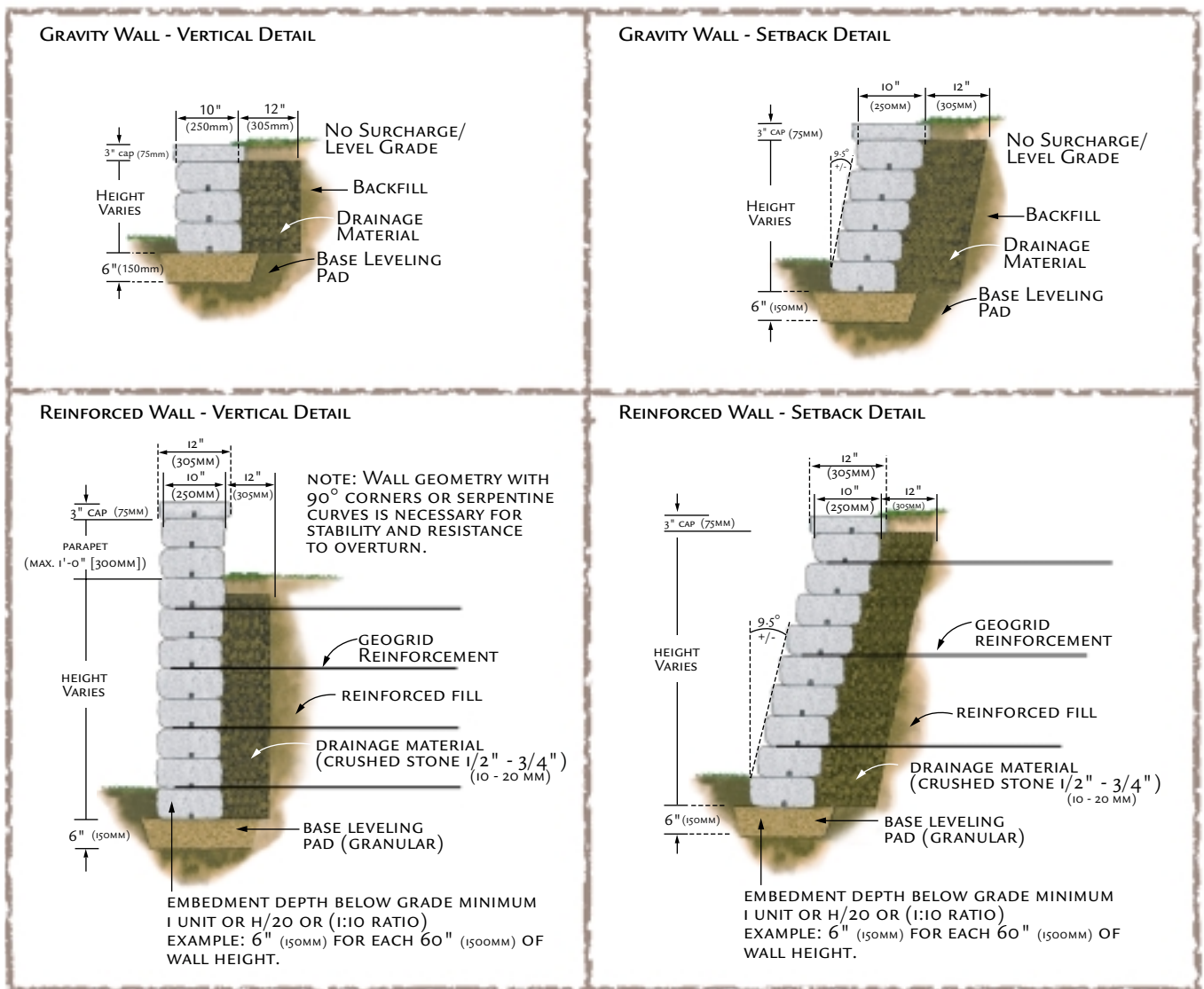


For low (non-structural) landscape walls, Country Manor can be constructed as a non-reinforced gravity wall as shown in the chart below. This chart is for retaining and free standing walls in the “near vertical” option. Note: use pins and construction adhesive at low border/parapet walls. See notes on pages 6-10 for wall plan geometry strengthening options.

DESIGN ASSUMPTIONS

- Friction angle (PHI) for earth pressure calculations of geogrid reinforced walls is 30°. For other soil type analysis, refer to Keywall Software program or consult with a qualified engineer.
- Moist weight of all soil types is 120 lb./ft.³ (19kN/m²).
- Sliding calculations use 6” (150mm) crushed stone leveling pad as compacted foundation material.
- All backfill materials are compacted to 95% Standard Proctor density.
- The term “vertical” is a wall built to a near vertical alignment having a slight positive setback (1° ±)
- The information provided herein is for preliminary design use only. A qualified engineer should be consulted for design and analysis of structures. Keystone Retaining Wall Systems, Inc. assumes no liability for the improper use of this information.

GRAVITY WALLS (maximum unreinforced wall height)				
MAXIMUM HEIGHT	NEAR VERTICAL		9.5° +/- BATTER	
	Level	3H:1V	Level	3H:1V
SAND/GRAVEL PHI = 34°	2'-0" (0.6m)	1'-6" (0.45m)	3'-0" (0.9m)	2'-6" (0.75m)
SILTY SAND PHI = 30°	1'-6" (0.45m)	1'-6" (0.45m)	2'-6" (0.75m)	2'-0" (0.6m)
SILT/LEAN CLAY PHI = 26°	1'-6" (0.45m)	1'-0" (0.3m)	2'-0" (0.6m)	1'-6" (0.45m)



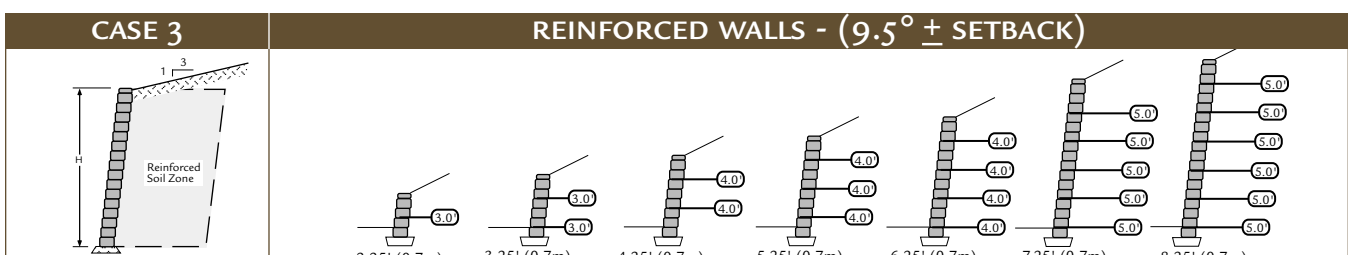
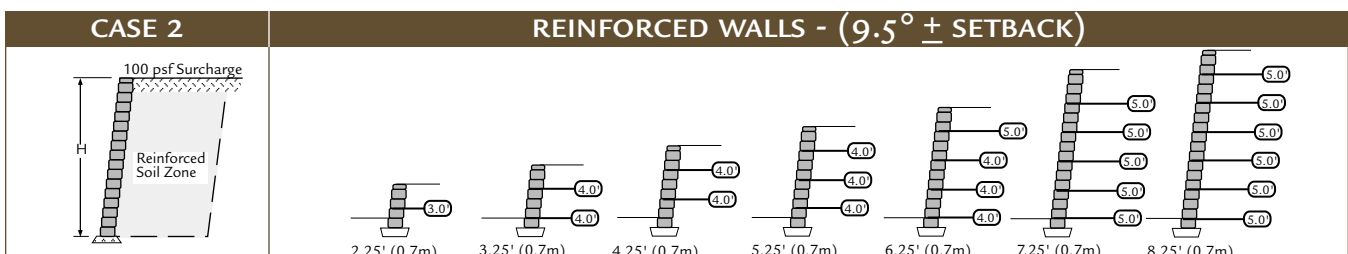
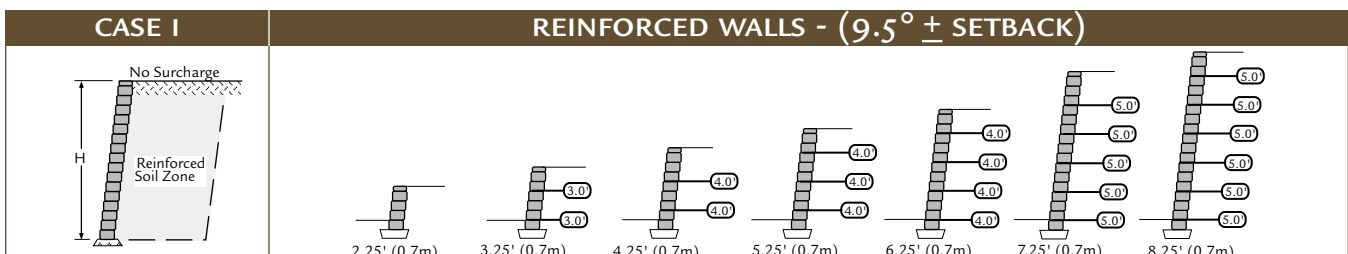
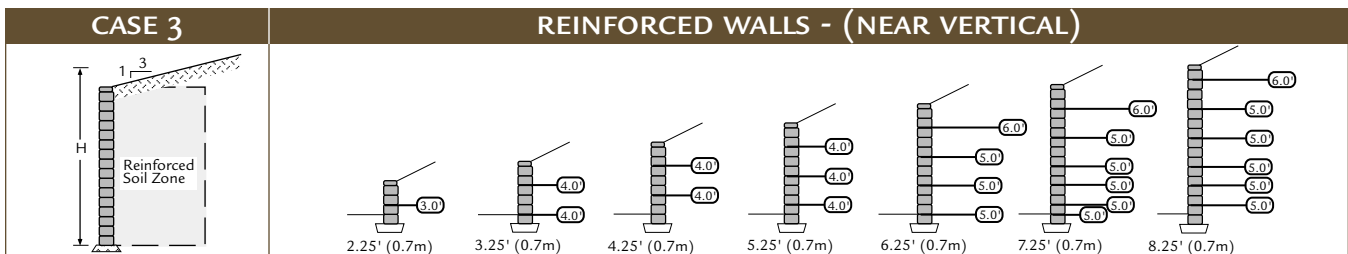
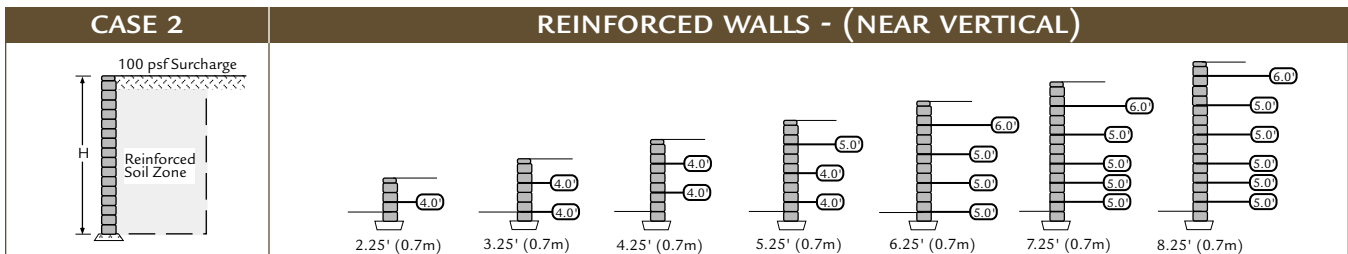
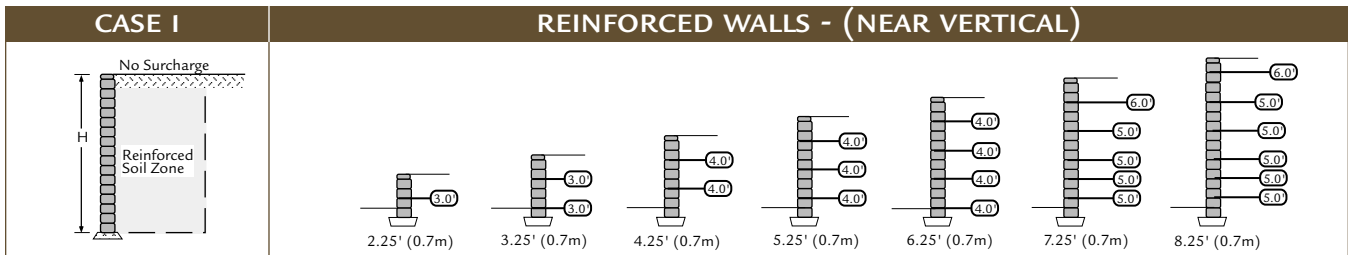
DESIGN CHARTS

SILTY SAND: $\phi=30^\circ$, $\gamma=120$ pcf (19kN/m^3)

The following charts assume the use of a lower strength geogrid and can be used safely with the following materials:

- Miragrid 2XT by Mirafi
- Statagrid 150 by Strata Systems
- Fortrac 20/13-20 by Huesker Inc.

Refer to "Design Assumptions" (page 14) for soil properties.





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