BELGARD®

Technical Resource Guide

WHY PROS CHOOSE BELGARD

EXPERTISE

For over 25 years, Belgard has led the hardscape category with proven installation standards and training. Our Belgard Authorized Contractors and certified installers are backed with technical support and resources from takeoff to final walkthrough.

QUALITY

Belgard pavers and walls are engineered for long-term performance and beauty to reduce call-backs. Every product is backed by a transferable limited lifetime warranty, giving your customers confidence in your work.

INNOVATION

Belgard invests over 20,000 R&D hours each year to develop new hardscape systems, textures and installation solutions that help you work faster and build better spaces. Our products set performance standards and keep your offering ahead of trends.

SERVICE

Belgard and the Oldcastle APG family of brands deliver national scale with local manufacturing, distribution and field support. With more than 150 locations, we help keep product available, projects on schedule and jobsites supplied.

DESIGN

Belgard design tools, pattern libraries and visualization resources help you show customers what's possible and sell more complete outdoor living projects. From simple patios to complex multi-level spaces, our portfolio supports your client's vision.

Peace of Mind With Our Lifetime Limited Warranty

- Transferable warranty
- Timely investigations
- Replacement of defective product at no charge

REGISTER YOUR WARRANTY

Belgard.com/Warranty

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BEFORE YOU BEGIN

SAFETY

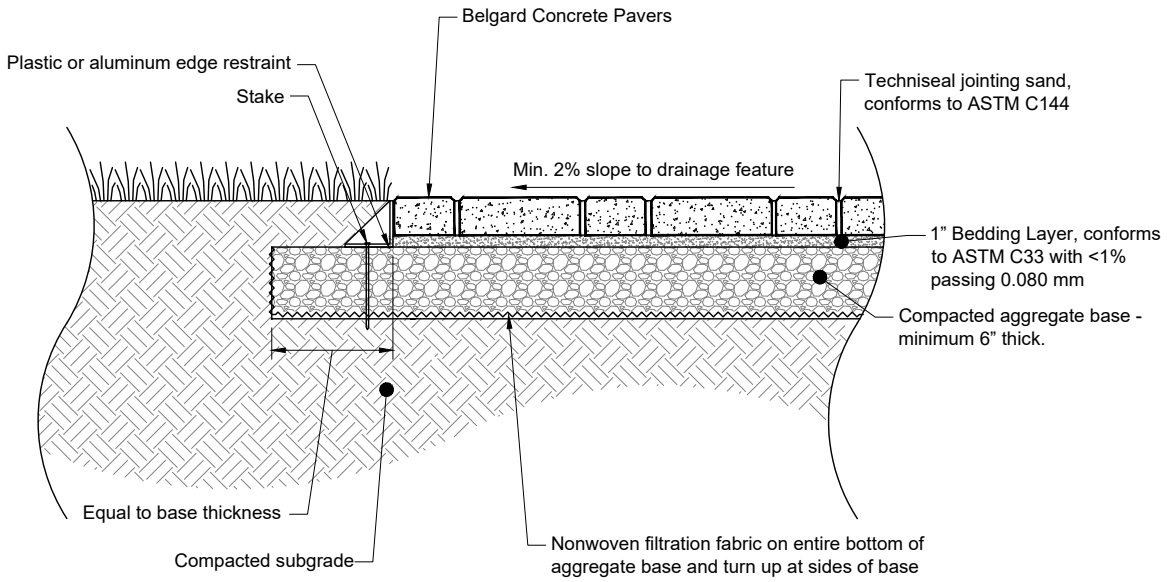
- Always call 811 and confirm the location of underground utilities prior to excavation.
- Always wear appropriate Personal Protective Equipment – such as proper eye, hand, foot, hearing, and respiratory protection – while handling, cutting or installing hardscape products. Please refer to the guidelines provided by the Concrete Masonry & Hardscape Association provided during certification. For more information on CMHA certification, visit **www.MasonryAndHardscapes.org.**

PAVERS

INSTALLATION GUIDE

Paver Installation Recommendations*

TYPICAL COMPONENTS OF INTERLOCKING CONCRETE PAVEMENT



Cross section as shown is suitable for pedestrian and residential driveways applications. Paver dimensions subject to aspect ratio requirements. Rigid concrete edge restraints required for commercial or vehicular applications. Depth of aggregate base subject to site specific conditions.

PAVER & BEDDING LAYER

MINIMUM INDUSTRY STANDARDS FOR INTERLOCKING CONCRETE PAVEMENT

Attribute	Guidelines
Paver Joint Width[1]	1/16–in to max. 3/16–in
Paver Surface Flatness	±3/8–in 10-ft
Lippage	1/8" max
Paver aspect ratio (l:t) (length divided by thickness)	max. 4:1 for pedestrian & driveways max. 3:1 for street/parking
Joint fill depth	max.1/2-in measured from top of pavement
Bond lines	±1/2-in max. over 50-ft
Surface slope for drainage	min. 2%
Minimum paver thickness	3 1/8-in for street/parking 2 3/8-in for pedestrian & driveways
Bedding layer thickness	1-in nominal

BASE LAYER

Attribute	Guidelines
Top of base surface variation	± 3/8-in over 10-ft
Base thickness variation	+ 3/4-in to -1/2-in
Compaction	min. 98% standard Proctor
Over-excavation (dense graded bases)	greater of 6-in or equal to base thickness
Geotextile	as needed

Minimum base thickness

Sidewalks, patios, pedestrian	4-in
Residential driveways	6-in
Parking lot/residential street	8-in

NOTES:

*These guidelines do not apply to permeable pavers, slabs, concrete grid or tumbled pavers.

These guidelines are consistent with minimum industry guidelines established by the Concrete Masonry & Hardscapes Association.

[1]Joint width measured with a ruler from inside edge of paver to inside edge paver between adjacent pavers. Installer should maintain uniform joints of 1/8" for most standard product applications to ensure proper joint infill.

Paving Systems Installation Guide

SITE PREPARATION

Prior to excavation notify local utility companies to ensure digging does not damage underground utilities. Excavate area a minimum of 8" below finished grade (in freeze-thaw climates or site requiring additional base, 10 or 12" excavation may be needed). Be sure to over excavate a minimum of 6" beyond the perimeter of the paver area.

Compact subgrade to 98% Standard Proctor density and ensure the subgrade slopes 1-2% in the desired direction. Place the proper geotextile over the subgrade and up along the side walls if required (a separation fabric can prevent the migration of soil into the base layer).

BASE INSTALLATION

Add 4-8" of base material or more if required in the design. Compact to 98% Standard Proctor density in 2-4" lift thickness increments. The maximum lift thickness is based on the type of compaction equipment used. Use road base material (dense-graded aggregate) commonly used in your project area.

INSTALL THE EDGE RESTRAINTS

Install edge restraints.

Install paver edge restraint on compacted base. Options include spiked plastic, steel or aluminum edging. If poured-in-place concrete curbs are used as a restraint, they should be placed on compacted aggregate in accordance with local requirements. Edge restraints must be installed at the correct level. A minimum of 1" vertical restraining surface should be available for contact with the side of the paver. Follow the installation instructions of the edge restraint manufacturer.

INSTALL THE BEDDING SAND

Place at least two pipes of 1-inch outside diameter directly on the base. Place them 6 to 8 feet apart and parallel to each other. Add nominal 1" uncompacted bedding sand layer and screed to level. Use concrete sand. Masonry sand, screenings or stone dust should never be used. The sand should be moist but not wet or saturated.

Use a screed bar or a straight piece of wood to screed the sand smooth.

Pull the screed bar across the pipes several times until the area of sand is perfectly smooth. Remove the pipes and fill the voids with sand. Level these areas with a trowel. Don't walk on or disturb the screeded and leveled sand.

Install bedding sand.

PLACE THE CONCRETE PAVERS

Start in the corner, if you have one in your design, and check to see that it is a 90-degree corner. Place a border course around the entire edge, then place the pavers in the desired pattern.

Continue to screed bedding sand and place pavers on the sand while maintaining consistent joint widths. Use a string line to keep pavers straight.

Cut pavers as needed to fill in at the edges next to the border course. Use a diamond blade to cut the pavers.

Place pavers.

Compact pavers.

COMPACT THE PAVERS

A vibratory plate compactor with a minimum compaction force of 5,000 lbs. should be used for standard concrete pavers. For larger-format paving slabs (> 12x12 in.) use a roller compactor.

SPREAD DRY JOINT SAND OVER THE SURFACE

Sweep some sand into the joints, then vibrate and compact it into the joints, sweeping and compacting as you go. Filling the joints with sand will take several passes with the plate compactor. After initial compaction, jointing sand will settle,re-apply jointing sand and re-compact as needed.

NOTE: Belgard recommends using polymeric jointing sand to fill the joints between pavers, which helps to stabilize the sand in the joints and control insects and weeds. Belgard® carries Techniseal® products such as HP NextGel Jointing sand. Make sure to follow all manufacturer recommendations in using and applying these products.

HELPFUL HINT FOR PAVER PROTECTION

Manufacturers of plate compactors recommend the use of mats or membranes between the compactor and pavers to protect the pavers from surface damage. Most plate compactor manufacturers sell accessories for this purpose including roller attachments for use on slabs.

Pavers with profiled tops and non-tumbled pavers are more susceptible to damage from plate compactors. We recommend that you always protect the pavers with any of the following materials between the paver and the plate compactor.

- Cardboard
- Thin carpeting
- Luan plywood
- Urethane rubber mat

Paver Maintenance

Concrete paving products can last generations when placed on a well-prepared base and installed in accordance with industry guidelines and Belgard recommendations.

JOINT SAND

Loss of joint sand can occur in paving areas subject to wind, surface water runoff scour, vehicular traffic, or on sloped surfaces. Joint sand loss greater than 1/2 in. (measured from the bottom of the chamfer) requires joint infill replacement. To minimize joint sand maintenance, utilize Techniseal polymeric jointing sand based on project-specific conditions. Always follow manufacturer's recommendations when using polymeric jointing sand.

PREVENTING WEEDS AND INSECTS

Weeds can germinate between pavers from windblown seeds lodged in the joints. Weeds can be removed by hand or with herbicides. Take care in using herbicides to not damage adjacent vegetated areas. Use biodegradable products that won't damage other vegetation or pollute water supplies when washed from the pavement surface.

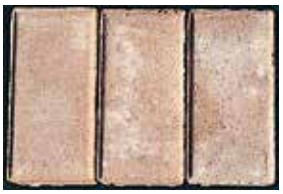
CLEANING PAVERS AND SLABS

Concrete pavers and slabs are produced with pigments integrally mixed within the concrete at the time of production. Over time, dirt, wear, food and oil stains will affect the appearance of the paver surface. Pavers that are installed properly with a 2% pitch will drain quickly and carry most surface sediment to the edge of pavement or to storm drain inlets. Stains should be addressed quickly by using a cleaner & brush appropriate for the type of stain and hosed to the nearest drain inlet. This process will serve most paver surfaces and will not require additional attention beyond the use of leaf blowers to remove grass clippings, leaves and other surface clutter.

Stains that cannot be removed with common cleaning agents, may require use of paver cleaners as provided by Techniseal using brushes and low flow water to rinse the cleaning material from the paver surface. High pressure sprayers are typically used by professional contractors experienced with paver cleaning and joint sand replacement.

Paver surfaces may be enhanced or protected from food and oil stains by applying a paver sealer after use of a cleaner. Sealers should be applied after one year of service to allow for any potential efflorescence to dissipate from your pavement system.

Efflorescence (calcium carbonate) is a white powder-like deposit which can appear on any concrete product. Efflorescence does not affect the structural performance or durability of concrete pavers and can appear within months of installation and may wear away. If there is a need to remove these deposits, best results can be obtained by using Techniseal efflorescence cleaner. More guidance is available from www.Techniseal.com or your local Belgard representative.



Pavers with effloescence

Pavers after cleaning

STRUCTURAL REPAIRS

Interlocking concrete pavements may require structural repairs during the life of the pavement to correct pavement distresses and to maintain an acceptable level of service. Corrective action if needed should be evaluated by an engineer. Broken or cracked pavers that impact the structural performance of the pavement can be removed and replaced. Follow industry guidelines for paver reinstatement best practices.

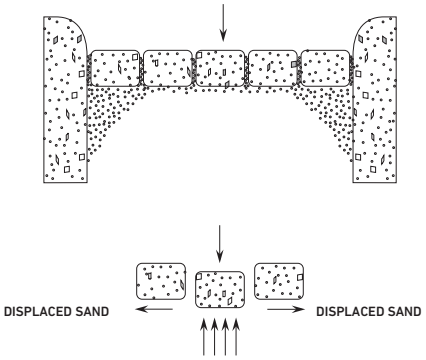
SNOW AND ICE REMOVAL

Concrete pavers and slabs offer freeze-thaw durability and can resist damage from deicing salts such as sodium chloride (rock salt) when properly used. Calcium chloride can be used in moderation if air temperatures are below 14 degrees Fahrenheit. Belgard recommend using sodium chloride for most applications. Always follow manufacturer's instructions for use and application of proprietary deicing products including applications rates. Snow and ice can be removed with shovels or plows like any other pavement. Used rubber or plastic shovels or plows to prevent scratching of the pavers, particularly if the paver is textured.

Understanding Interlocking Concrete Pavement

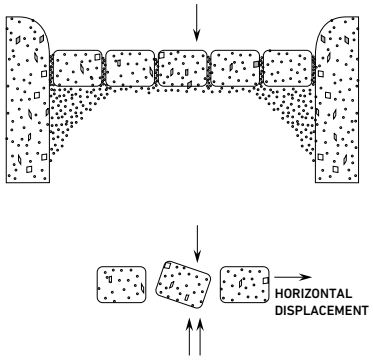
Interlocking concrete pavements (ICP) are flexible pavements designed to spread loads imposed on a small area of the pavement surface through a base layer (or series of layers or sub-bases) to a large enough area of the soil subgrade that the soil subgrade can support the load without rutting.

The unique aspect of interlocking concrete pavements is that the pavers interlock to help spread the imposed loads. There are three kinds of interlock: vertical, rotational and horizontal.



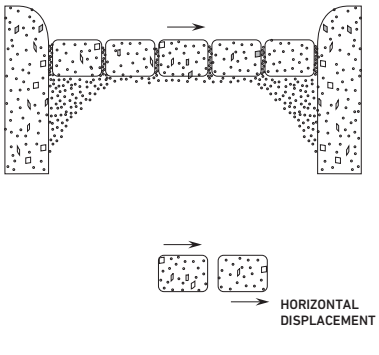
VERTICAL INTERLOCK

This is achieved by the shear transfer of loads to surrounding units through the sand in the joints. This shear transfer also prevents one paver from moving vertically in relationship to its neighbor(s).



ROTATIONAL INTERLOCK

This is achieved through use of the proper paver thickness in relationship to load and use and by a perimeter edge restraint. A slight crown constructed into the pavement will increase rotational interlock and the load bearing capacity of the pavement.



HORIZONTAL INTERLOCK

This is achieved through the use of laying patterns that minimize the length of uninterrupted joint lines and disperse forces from braking, turning and accelerating vehicles. Certain geometrically interlocking paver shapes enhance horizontal interlock. Herringbone laying patterns provide the most effective horizontal interlock and should always be used in vehicular applications.

Variables that impact pavement performance:

JOINT WIDTHS - consistent joint widths of approximately 1/8-in

JOINT SAND - properly selected joint sand

PAVER THICKNESS - 60mm (2⅜-in) for pedestrian and some residential driveways

80mm (3⅛-in) for heavy and industrial vehicle applications

EDGE RESTRAINT - non-moving fixed edge restraint

LAYING PATTERN - minimize length of uninterrupted joint lines in all directions. The most commonly used pattern is Herringbone.

PAVER SHAPE - the length and width of the paver is an important consideration, particularly for vehicular applications. The aspect ratio (length divided by thickness) can provide guidance on application and distinguish between installation methods for pavers and slabs. Slabs have aspect ratios greater than 4.

Tools, Supplies and Equipment

Most of the tools, supplies and equipment needed to install pavers are common to contractors involved in residential site work. The heavier and more expensive equipment may be easily rented if the work volume justifies the purchase. Some tools have been designed especially to facilitate the installation of pavers and are available through your Authorized Belgard Distributor. Personal Protective Equipment should comply with OSHA requirements and procedures defined by your company's safety plan.

QTY	
1	Folding 6 ft. ruler
1	4 ft. Level
2	16 ft. Tapes
1	Torpedo Level
1	100 ft. Tape
1	Line Level
1	Steel or Aluminum Carpenter Square
1	Mason Trowel - Rectangular
1	Claw Hammer
1	Mason Trowel - Pointed
1	Mason Hammer
1	Mason Wood Float
1	3 lb. Maul
1	4 in. Brickset (Mason Chisel)
1	12 lb. Sledge Hammer
1	Pair Metal Snips
1	Rubber or Deadblow Hammer
1	Shovel(s) Square Point

QTY	
1	Steel Garden Rake
1	Shovel(s) Round Point
1	Push Broom
1	Slim Jim Pry Bar
1	Contractor's Wheel Barrow
1	36 in. Crow Bar
1	Screed Board (Magnesium) or 10 ft.-12 ft. wood 2x4's
2	Large Flat Blade Screw Drivers
6	Screed Rails 3/4 in. ID Steel Pipe or 1 in. Square Steel tubing approximately10 ft. long (a couple of 4 ft. pieces are handy)
1	Hacksaw
1	Carpenter's Saw
1	Plumb Bob
1	Garden Hose (75 ft.-100 ft.)
1	Chalk Line
1	Hand Tamper

Some special tools designed specifically for the ICP industry are:

- Paver Cart - to transport full straps of pavers
- Paver Extractor - to remove installed pavers
- Dead Blow Rubber Hammer - to help adjust pavers
- Paver Scribe - to mark pavers for cutting
- Paver Adjuster - to move installed pavers to straighten lines

Personal Safety and Comfort Supplies:

- Eye Protection
- Ear Protection (muffs or plugs)
- Respiratory protection
- Steel Toed Shoes
- Gloves
- Knee Pads
- Back Support
- Finger Tape
- First Aid Kit
- Water Cooler

Expendable Supplies :

- Mason String Line
- Chalk for Chalk Line
- Marking Crayon (keel)
- Flagging Tape
- 2 ft. Wood Stakes
- Diamond Saw Blades
- Fuel & Oil
- Spray Marking Paint

Equipment:

Installation equipment may be owned or rented. The most common equipment needed is:

- Builders level or transit level with tripod and rod. Laser levels are excellent.
- Vibratory plate compactor rated minimum 5000 ft. lbs.
- Masonry saw
- Table saw, wet or dry, or a hand held cut-off saw. Either should be gasoline powered. A hand-held cut-off saw is the most flexible and productive.

Heavy Equipment:

- Skid-Steer Loader capable of lifting 5000 lbs. - equipped with interchangeable bucket, forks and rotary broom
- Vibratory Roller - used for subgrade and base compaction on larger jobs
- Jumping Jack Compactor - for compacting trenches
- Backhoe - for excavation (especially demolition)
- Dump Truck - to haul excavated materials and to deliver material to job site

Construction Guidelines

UTILITY LOCATION

Before beginning any phase of the construction process, make sure that all underground utilities, services and structures have been located and clearly marked on the ground surface in all areas involved in the construction process including access lanes. In many areas, a single number, such as Miss Utilities, may be called.

Items to be located are:

- Electrical
- Sanitary sewer
- Gas
- Septic tank
- Water supply
- Telephone
- Storm sewer
- Cable TV
- Drainfield
- Irrigation piping

Double check; there may be other items particular to the jobsite.

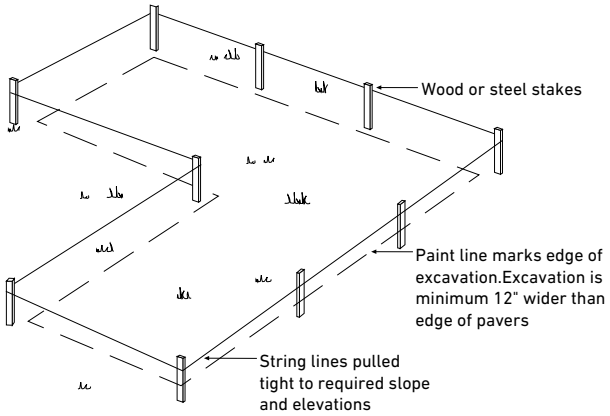
SITE ACCESS

Before any demolition, delivery or construction equipment is allowed on site, make sure that there are no hazardous conditions such as overhead electric lines in the way. Plan all activities so that no damage will occur to existing pavements, structures, trees, shrubbery, gardens or other site amenities.

LAYOUT

Identify the area to be excavated and mark it on the ground with spray paint. Make sure the area to be excavated is at least 12 in. wider on all outside edges than the size of the pavement.

Place grade stakes with string lines just outside the area to be excavated, making sure that the excavation is at least 12 in. wider than the edge of pavement. Mark the elevations on the stakes so that the depth of excavation can be checked as it progresses. Use nylon mason's line and set it at the finished elevation of the pavement. Measure all excavations and base thickness from these lines. Set the initial elevations and check them at the beginning of each day with a builders level. Make sure the stakes have not been moved or interfered with.



Job Layout and Staking

String lines set at final or finished elevations should be sloped. All lines (and final elevations of the pavement) should slope away from the house or building. The minimum recommended slope is 1.5 percent or a drop of 3/16 in. for every foot of pavement. Many pavements are sloped at 2 percent or 1/4 in. per every foot of pavement as this will better facilitate drainage. The maximum slope for comfortable walking is 7 degrees or about 12 percent. A builders level should be used to establish elevations using marks on stakes set around the area to be paved.

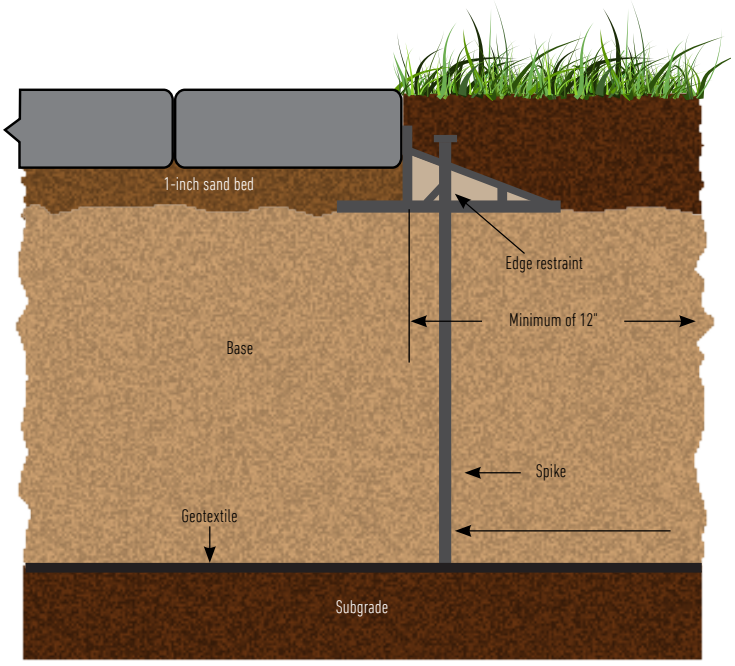
EXCAVATION / SUBGRADE

Make sure that the area to be excavated is at least 12 in. wider than the limits of the pavers. This provides a firm base to support the edge of the pavement and the edge restraint.

Make sure that the depth to be excavated is measured from finished pavement surface elevations and is marked on all grade stakes. The bottom of excavations, below finished pavement elevation, should equal the total thickness of the designed base, sand bed (after paver installation and compaction) and the paver being used.

Try not to disturb the subgrade below the planned excavation depth. Over excavation is costly and can cause future problems.

When all excavation is completed, compact the subgrade with a vibratory plate compactor. Make sure that compaction is thorough, uniform and complete. If soft spots are encountered, they should be removed and backfilled with the material to be used for the base. If the subgrade is too wet to compact, allow it to dry or try adding a few inches of dry base material before compacting.



EXAMPLE:

Base (compacted)	6-in
Sand bedding	1-in
Paver thickness	2⅜-in
Total Depth	9⅜-in

BASE

The dense graded aggregate base material should be spread in layers of uniform thickness then compacted. The thickness of the layer depends on the method of compaction and the planned use of the pavement. While compaction of the subgrade and base layers is key to the performance of any pavement. Place the base in two or three lifts for most residential installations. Compact the base material with a reversible plate compactor of at least 7,000 lbf or a vibratory roller.

Place and compact the base material as recommended, making sure to keep the material lightly dampened. If free water appears on the base surface during compaction, the material is too wet and should be allowed to dry.

Be sure to thoroughly compact along edges, in corners and around structures. These are the most difficult areas to treat and the most apt to cause future settlement problems.

Do not use frozen base material and do not place base material over a frozen subgrade.

When proper compaction of the base has been achieved, the surface should be smooth, leave no areas into which the bedding sand can migrate. It may be necessary to fill any such areas with a finer material then recompact. The finished base surface should be flat (no more than 3/8 in. plus or minus variation under a 10 ft. straight edge) and uniformly true to grade.

EDGE RESTRAINTS

Restraints hold the pavers tightly together, enabling consistent interlock of the units across the entire pavement. They prevent pavers from spreading due to horizontal forces from tires and minor settlement. Edge restraints are designed to remain stationary while receiving occasional impacts from tires.

There are two general types of edge restraints. Those made elsewhere and installed at the site include precast concrete, plastic, cut stone, aluminum, and steel. Restraints formed on-site are made of poured-in-place concrete.

Full-depth precast concrete or cut stone edging generally extends the depth of the base material. They can be compacted soil (not subject to heaving), compacted aggregate or concrete backfield. The preferred method of installation with vehicular pavements is for the curb to rest on the compacted aggregate road base.

Partial-depth precast concrete edge restraints may be used for residential and light-duty commercial applications. These precast units are anchored on a compacted aggregate base with steel spikes. The spikes are typically 3/8 in. diameter. Depending on the design, the top on the concrete edge can be hidden or exposed.

Aluminum and steel edging should be selected to provide a smooth vertical surface against the pavers. L-shaped edging provides additional stability. Stakes fastened to the edging should be below the pavers or on the outside of the restraints. Steel should be painted or galvanized so that rust does not stain the pavers. Spikes to secure steel and aluminum edging should extend well into the base course. Consult manufacturer's literature for recommended spacing of the spikes. Aluminum and steel edgings are manufactured in different thicknesses. The thickest edging is recommended when pavers are subjected to vehicular traffic.

Plastic edging installs quickly and will not rust or rot. Plastic edging should be specifically designed for use with pavers. It can be used with light-duty residential, commercial or on some heavy-duty industrial applications, depending on the design. It should be firmly anchored into the compacted aggregate base course with steel spikes. Consult the manufacturer's literature for the recommended spacing of the spikes. Edging for planting beds and lower gardens is not an acceptable restraint for interlocking concrete pavements.

Elevations should be set accurately for restraints that rest on the base. For example, 2 3/8 in. thick pavers with 1 ¼ in. of bedding sand would have a base elevation set 3 in. below that of the finish elevation of the pavers. This allows ¼ in. settlement from compaction and ⅛ in. for minor settling over time.

Restraints formed on-site, poured-in-place concrete curbs, or combination curb and gutters required by municipalities make suitable restraints for pavers. Exposed concrete edges should have a ⅛ in. radius edge to reduce the likelihood of chipping. As with precast, the side of the curbs should extend well below the sand bedding course.

Troweled concrete from a bag mix, or batched on-site, can be applied without forms against edge pavers and on the compacted base if the mix is polymer modified to be frost damage resistant. This type of edge restraint is typically limited to warm-weather climates and non-vehicular applications. If the top of the concrete edge is recessed and slopes away from the pavers, grass can grow next to them. The depth below the surface of the pavers must be sufficient to prevent the concrete from becoming a heat sink that dries the grass and topsoil. This edge restraint is suitable for pavers subjected to pedestrian traffic and for residential driveways. Troweled edges should be at least 6 in. wide. Steel reinforcing should be placed in the concrete to increase service life.

SAND SETTING BED

Loose screed the washed concrete sand to an uniform thickness of 1 in. over the compacted base course. In no case should the sand be greater than 1-1/2 in. thick. Do not use masonry sand, play sand, stone dust.

If the edge restraint has already been installed, the screed board may be notched to ride on the edge restraint on one or both ends. The notch should be cut to allow for the screeding of a 1 in. thick sand layer.

If the edge restraint cannot be used to carry the screed board, screed rails must be used. The rails should be sized to allow for a 1 in. thick sand bed. For example, a 3/4 in. iron pipe (3/4 in. is the inside pipe diameter) has an outside diameter of approximately 1 in.

Place the screed rails parallel to each other and close enough together to enable the screed board to be pulled along the rails without falling off. Set the top of the rails to the desired elevation below grade lines and stabilize by hand packing sand along both sides of the rail.

Place the washed concrete sand between the screed rails and rough screed with a shovel, steel rake or lute. Excess sand makes the screed board difficult to pull. Place screed board on the rails and draw forward leaving a smooth surface. Fill in and rescreed any open streaks.

When a screed rail is no longer needed, it should be carefully removed and the void filled with sand and hand floated. Do not compact the sand setting bed before laying pavers.

PAVERS

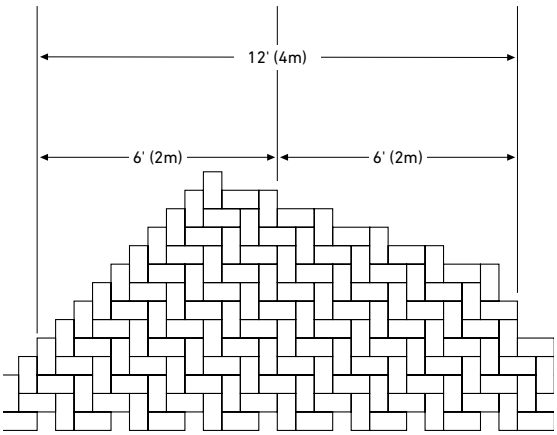
Plan your installation to begin along a straight line and preferably in a corner which is easily accessible. Make absolutely certain that the beginning corner is a true 90 degree angle. If the intersection of two sides is not a true 90 degree angle, you must establish a 90 degree starting point.

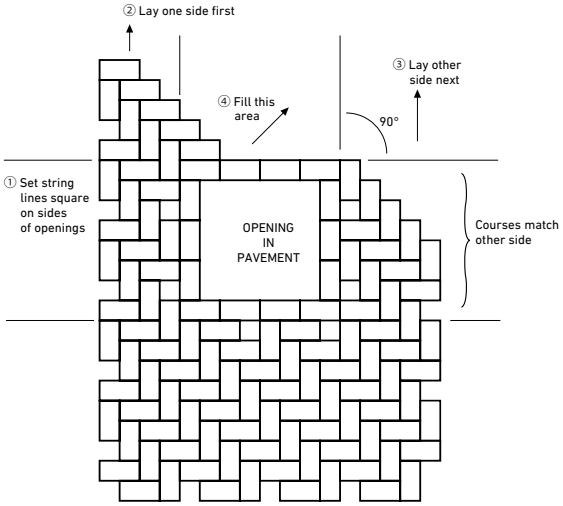
In most projects, the pavers, regardless of paver shape, are laid in patterns and radii or curves are cut into the pavement after the field pavers have been laid but not compacted. Straight joint lines are important and not only make the finished pavement look clean and sharp but make installation much easier.

To keep joint lines straight, parallel string lines or chalk lines snapped on the sand setting bed should be used. The lines should be spaced five to ten feet apart with the spacing equal to the laying modulus of the paver shape being installed. This can be determined by laying a course of pavers in the proper pattern with 1/8 in. joints and measuring the distance between at the desired line separation distance.

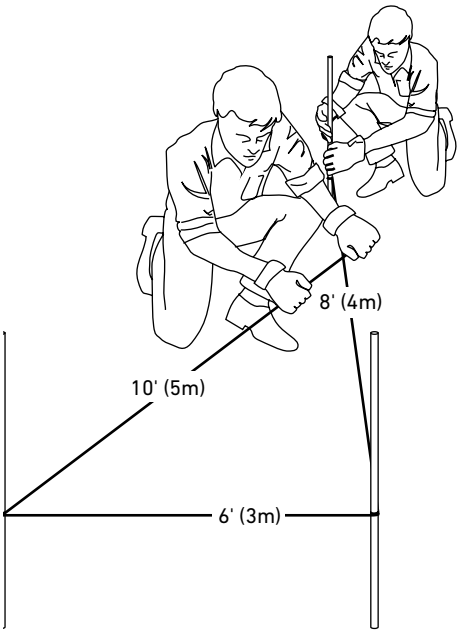
Procedure:

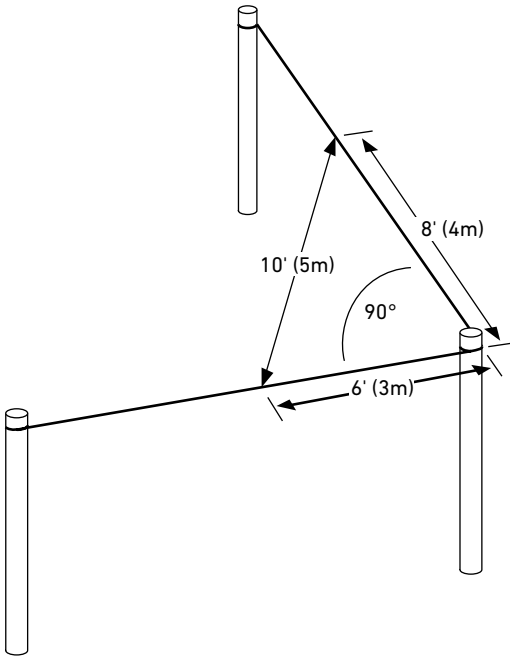
- Snap a string line on the screeded sand in the center of the area(s) to be placed.
- The line should be perpendicular to the laying face.
- Place pavers in the given laying pattern on both sides of the line.
- If additional lines are snapped, they should be parallel to each other. Check this by measuring the distances at the opposite ends of each line. They should be equal.
- If they are not parallel, they can be erased and snapped again. Parallel chalk lines snapped in bedding sand or string lines pulled above sand and pavers. Parallel string lines are also used to pave around openings in the pavement such as manholes or swimming pools. Pull perpendicular string or snap chalk lines on all four sides of the opening.
- For best results pull and install pavers from multiple pallets
- Install a border course whenever possible to allow for cuts to made in the field rather than the perimeter.





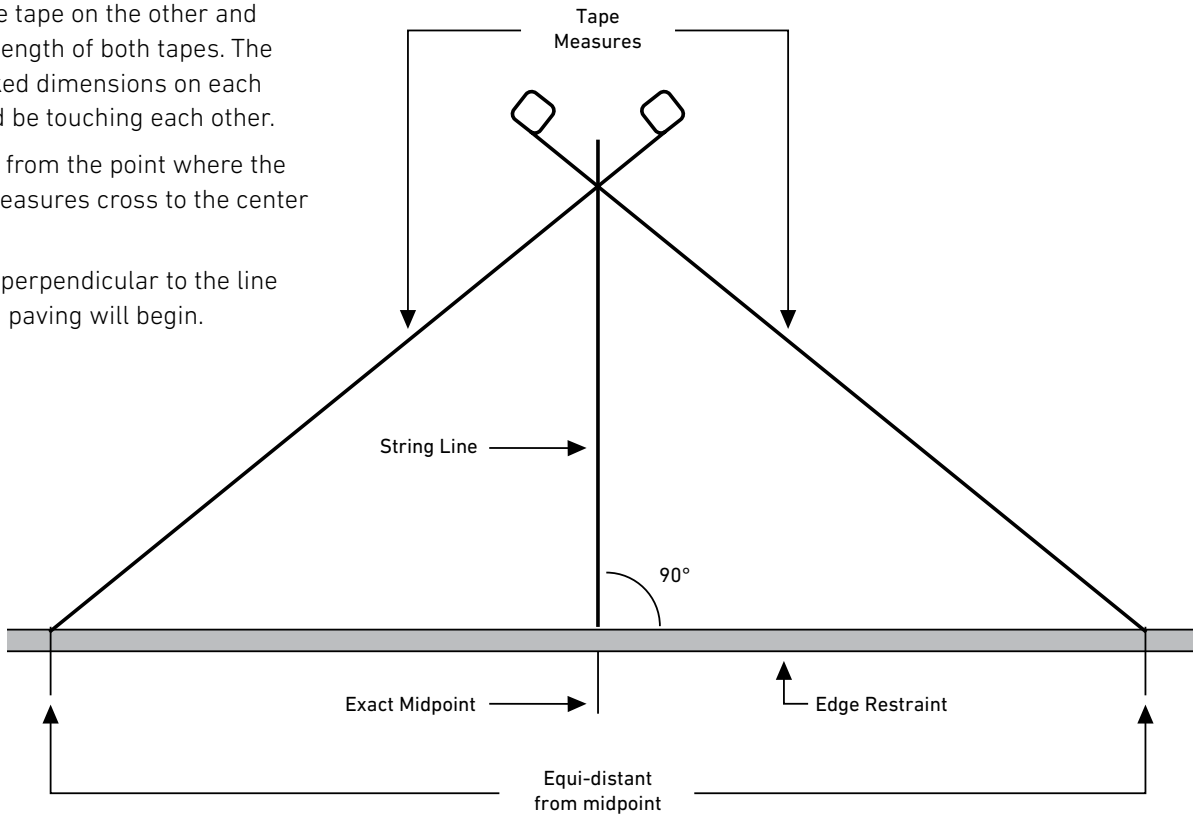
3:4:5 Triangle may be used to establish a 90 degree angle or to check existing corners:





A quick way to establish a line perpendicular to an edge (no corner walls) is with the following procedure:

- Measure and mark the length of the edge, or line, from which paving will begin. The line can be 10-20 ft. (3-7m.) long. This line is where an edge restraint will be placed, or where one is already placed.
- Mark exactly the half way point on the line that was just measured. In other words, divide the line in half.
- Take one tape measure and extend it from the other end of the line at an angle toward the center. Be sure the tape extends past the middle of the line by a foot or two (0.2m.-0.6m).
- Take a second tape measure and extend it from the other end of the line at an angle toward the center.
- Overlap one tape on the other and match the length of both tapes. The same marked dimensions on each tape should be touching each other.
- Snap a line from the point where the two tape measures cross to the center of the line.
- This line is perpendicular to the line from which paving will begin.

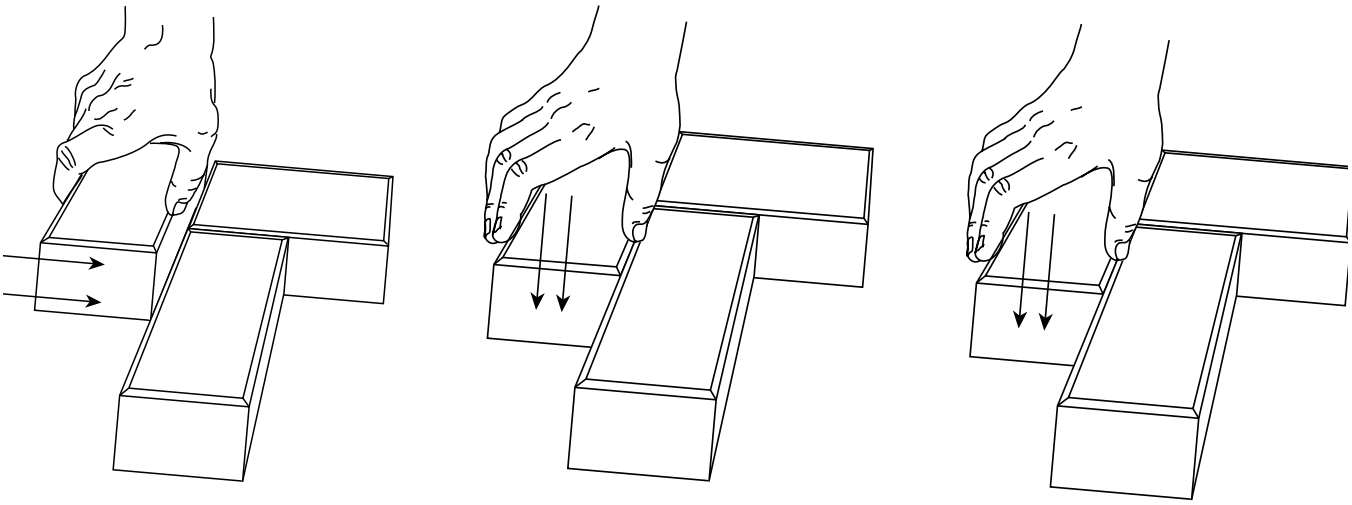


STARTING LAYING PATTERNS

Starting the first few rows of the pavement requires attention to the order of placing the pavers. The proper order for beginning herringbone patterns with a rectangular paver is illustrated below. The installation begins at a 90 degree corner.

When placing the pavers, it is important to maintain consistent joint spacing of 1/16 in. to 3/16 in. Consistent joint width of approximately 1/8 in. will spread loads (vertical interlock) better than wider joints. Consistent joint spacing will result in a neat and orderly appearance of the finished pavement.

The 1/16 in. spacer ribs molded into the sides of pavers are to ensure a minimal joint and that at least some sand can enter the joints between pavers. **They are not intended to be the spacing mechanism.** The "click and drop" method is an efficient way to maintain consistent joints.



Click and Drop Procedure:

- While holding a paver, the bottom 1/4 in. to 1/2 in. should "click" firmly against the top portion of the side of the pavers already placed.
- Do not hit the previously placed pavers so hard that they move.
- Release grip, dropping the paver an inch or so directly downward. A slight pressure with fingers will ensure that the paver does not move away from those already placed.

CUTTING PAVERS

Pavers may be cut with any one of three basic pieces of equipment. They are:

- Mechanical or guillotine splitter
- Masonry saw
- Hand-held cut-off saw

Mechanical or guillotine cutters are relatively inexpensive to buy but produce the least desirable results. Masonry saws may be either gasoline engine or electric motor driven. They may be hand-held or mounted on a stand. Hand-held cut-off saws are the most convenient and produce the best overall combination of quality and productivity.

Paver Cutting Tips

Diamond saw blades come in wet or dry versions. Dry blades may be run wet but wet blades should never be run dry. Use of water with either type blade extends blade life.

Care must be taken to make sure that the slurry (mixture of water and cutting dust) from wet saws or dust from dry saws is washed off installed pavers immediately before it dries. Surrounding structures, vegetation and automobiles should be protected from the dust. Cut-off saws with dust collection capability have recently become available. Check with your Authorized Belgard Dealer for the proper cutting equipment.

Cutting Procedure

Mark lines to be cut with a lumber pencil or crayon, chalk, welders soapstone or water-base liquid marker. Do not use a permanent marker. It is best to use a color which is easily visible against the color of the paver. Curved lines may be marked by using a garden hose as a guide.

The pavement will perform best if the size of cut units left in the pavement is as large as possible. Thin pieces tend to break or displace with time and use. Cut units receiving tire loads should not be less than one third of the whole paver when possible. Cut and place all edger pieces before compacting the pavers and applying joint sand.

PAVEMENT COMPACTION AND JOINT SANDING

Compaction of the pavers and begins the process of vertical interlock by forcing some of the bedding into the joints from the bottom.

On small jobs, compaction should take place after all pavers, including cut edges, are in place. On jobs lasting more than one day, all pavers placed should be compacted and the joints filled at the end of the workday. Do not compact or fill joints within 3 ft. of any unrestrained or incomplete edge. Do not spread joint sand before initial compaction of pavement.

If using a gasoline powered vibratory plate compactor with a minimum compaction force of 5000 ft. lbs..

Compacting Procedure

- Start on one edge of the pavement and compact the perimeter.
- Compact in overlapping rows on the rest of the pavement.
- Compact the pavement again but in the opposite direction. All pavers will need to be exposed to at least two passes of the compactor.
- The operator looks for broken pavers just behind the plate compactor and marks them while compacting. The broken pavers are removed with a paver extractor and replaced with whole units.

JOINT SANDING

After compaction of pavement and replacement and recompaction of replacement pavers, spread the joint sand. Dry sand works best, so if the sand is damp, allow it to dry. Sweep the dry sand into the joints. Do not use play sand or sandbox sand. After the initial sweeping, the filling of the joints can be expedited by alternating sweeping and passes of the vibratory plate compactor. Continue until all joints are filled. It is a good idea to reinspect a job two to three weeks after completion at which time it may be necessary to re-sweep sand into the joints.

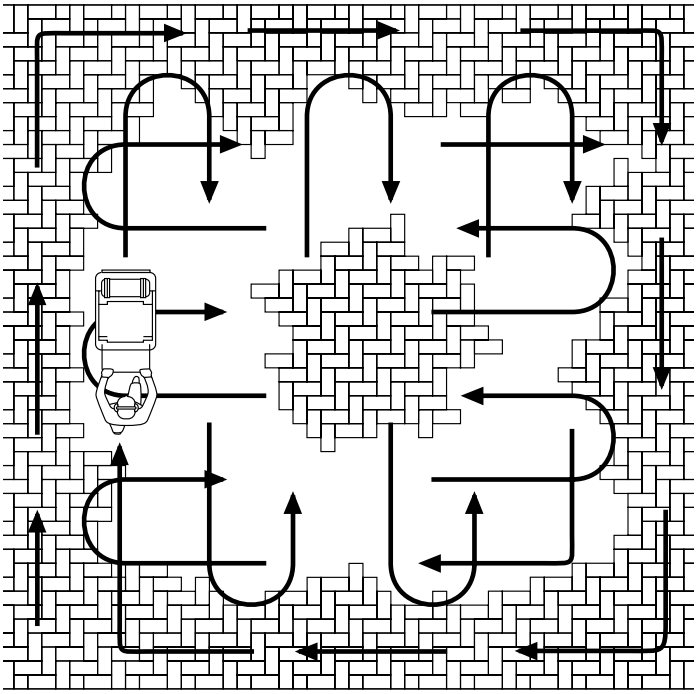
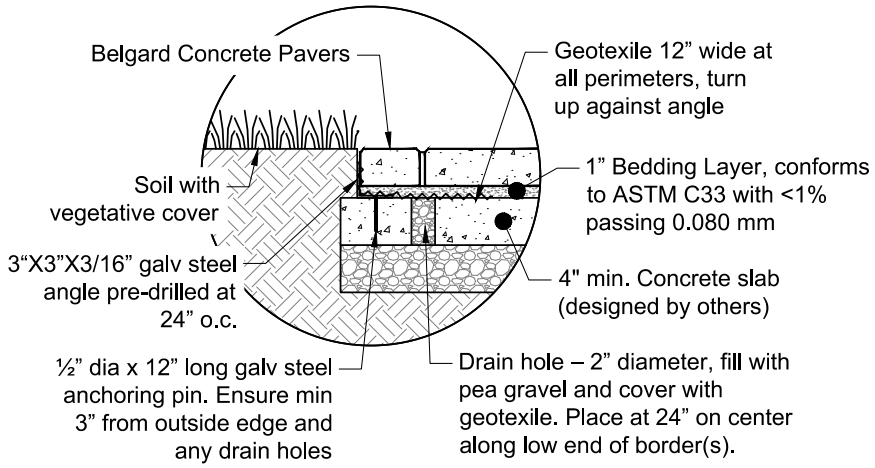


Figure 3 Right

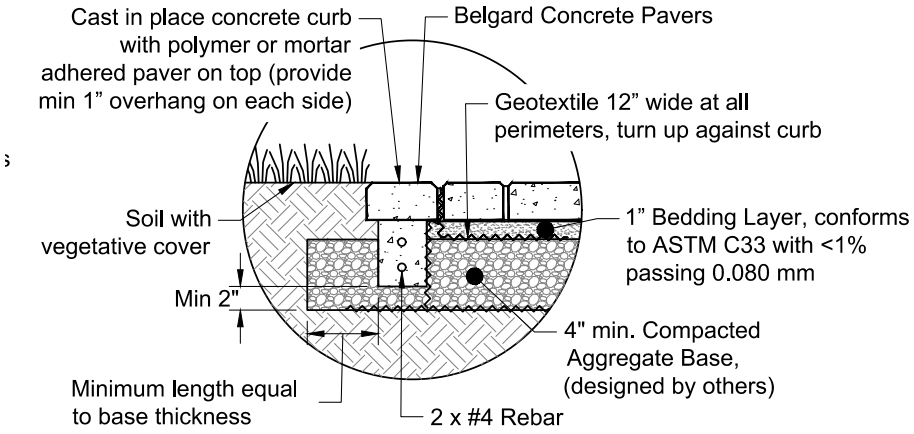
Compaction sequence working from the perimeter to the center of the pavement. All pavers should have two passes of the plate vibrator over them prior to filling the joints. After the joints are filled with sand, follow the same compaction sequence from the perimeter to the center. It is a good idea to reinspect a job two to three weeks after completion at which time it may be necessary to re-sweep sand into the joints.

COMPLETION OF PROJECT

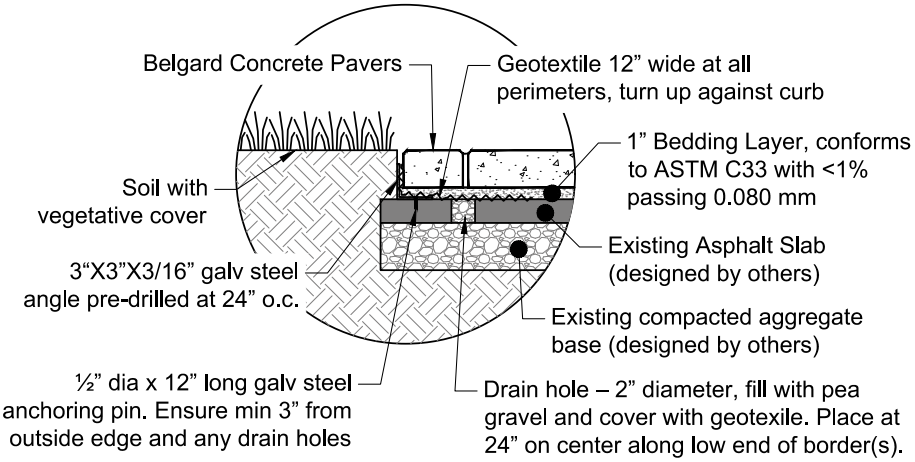
When the installation has been completed, clean up the site. Some pavers of each shape and color used may be left with owner for possible future replacement. Store these pavers neatly where the owner directs. Walk the job with the owner and address any problems immediately. Review maintenance procedures with the owner and leave information regarding care and maintenance with him/her.



EDGE RESTRAINT - SAND SET ON CONCRETE BASE



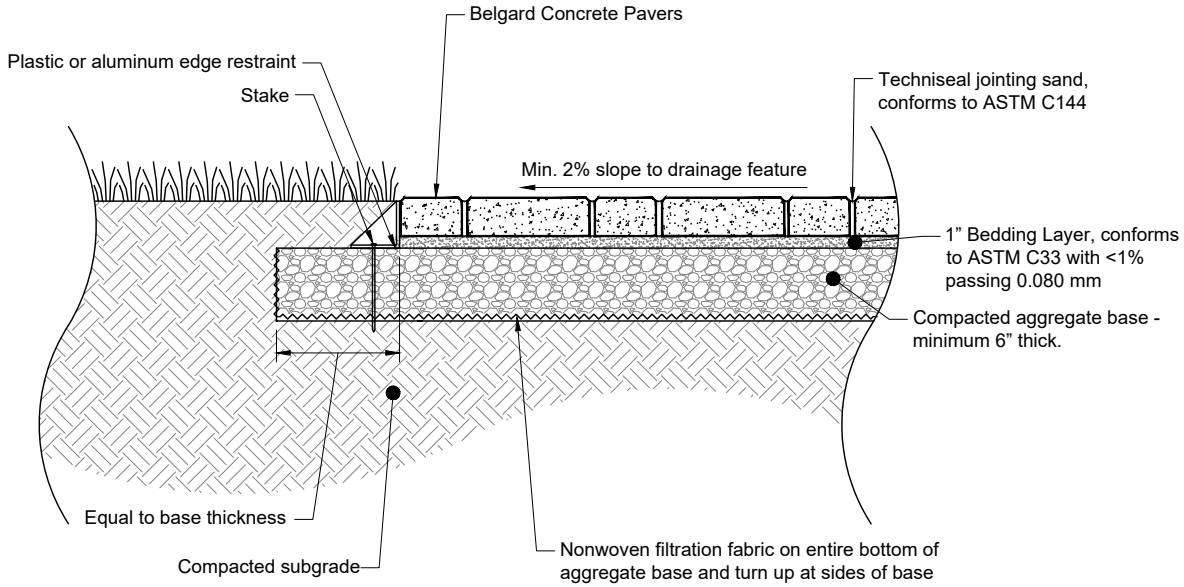
EDGE RESTRAINT - SAND SET ON AGGREGATE BASE



EDGE RESTRAINT - SAND SET ON EXISTING ASPHALT BASE

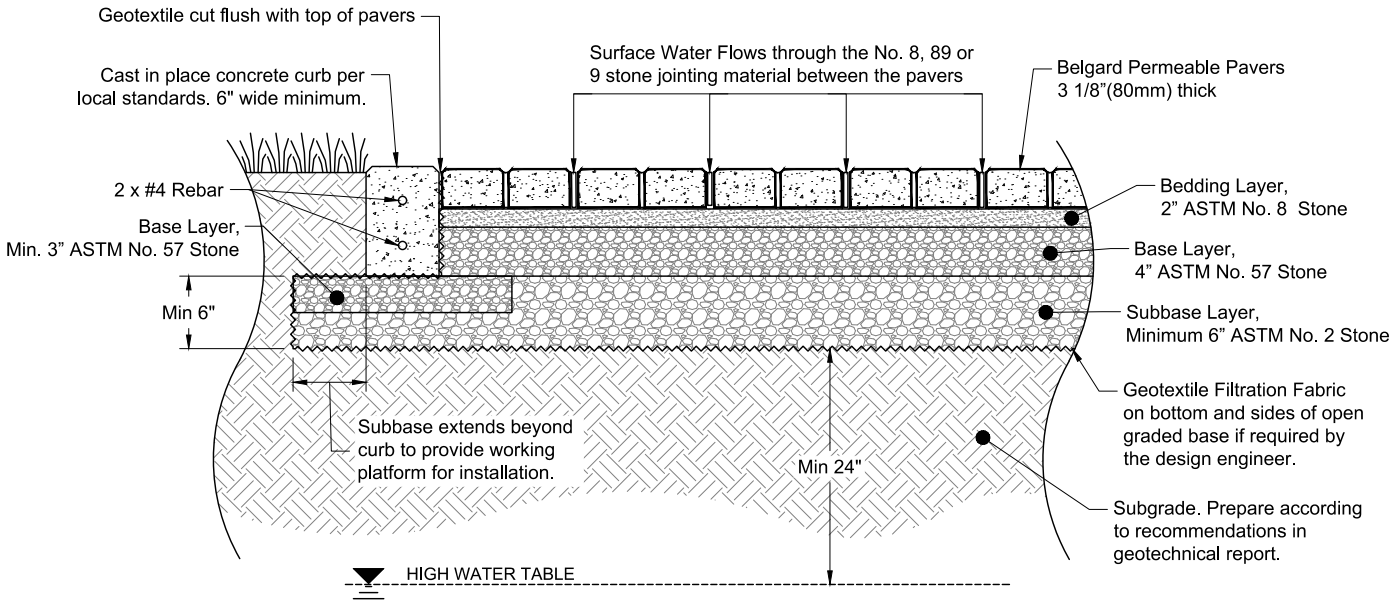
Permeable Pavement Typical Detail

RESIDENTIAL APPLICATIONS



Cross section as shown suitable for pedestrian and residential driveways applications. Paver dimensions subject to aspect ratio requirements. Depth of aggregate base subject to site specific conditions.

COMMERCIAL APPLICATIONS



Design Notes:
1. Depth of subbase subject to site specific hydraulic and structural requirements. Contact Belgard Commercial for design assistance.
2. Paver dimensions subject to aspect and plan ratio requirements based on traffic loading.

Cross section as shown suitable for commercial and vehicular applications. Underdrains may be required for partial infiltration conditions subject to soil permeability properties.

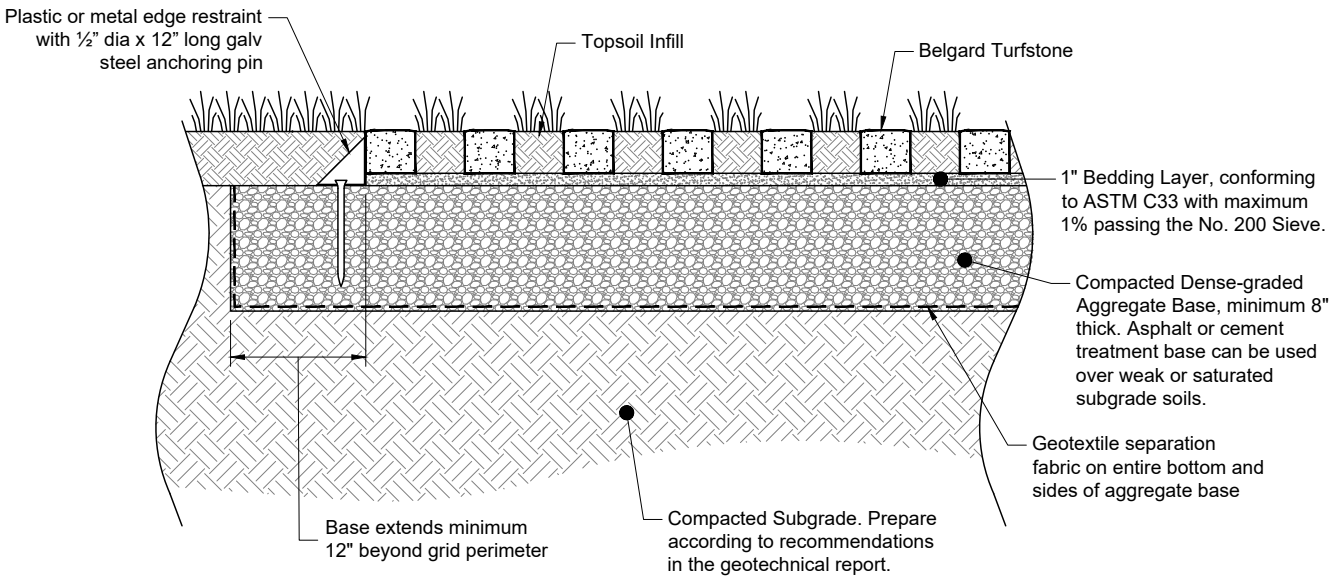
Turfstone Installation Guidelines

Turfstone is a concrete grid pavement used to create "green" pathways capable of supporting infrequent vehicular traffic. Turfstone is an acceptable solution for emergency access lanes and occasional fire truck loading if properly designed.

The minimum dense-graded aggregate base thickness should be 8". Open-graded aggregate is not recommended.

The following additional design and installation recommendations are suggested for any Turfstone project:

- Slope applications should be limited to 8:1 or 12.5% for vehicular applications.
- Subgrade shall be compacted to 95% of standard Proctor density.
- Base shall be dense-graded aggregate in accordance with local road base criteria and shall be compacted to 98% standard Proctor density.
- A drainage geotextile should be installed to separate the subgrade from the base material and side walls.
- A 1" thick leveling sand bed shall be used to set the Turfstone grid units with a nominal joint spacing between 1/8" and 1/4". The units should not be touching each other.
- Infill typically consists of topsoil. Irrigation is recommended to establish and maintain healthy grass cover. Sweep topsoil into the joints and voids and vibrate until completely filled. Topsoil should be re-applied if needed after initial consolidation. Aggregate infill instead of topsoil may be suitable in some applications.
- Grass infill should not be exposed to tire traffic until it is well established.
- An edge restraint for all Turfstone applications is required.



Design Notes:

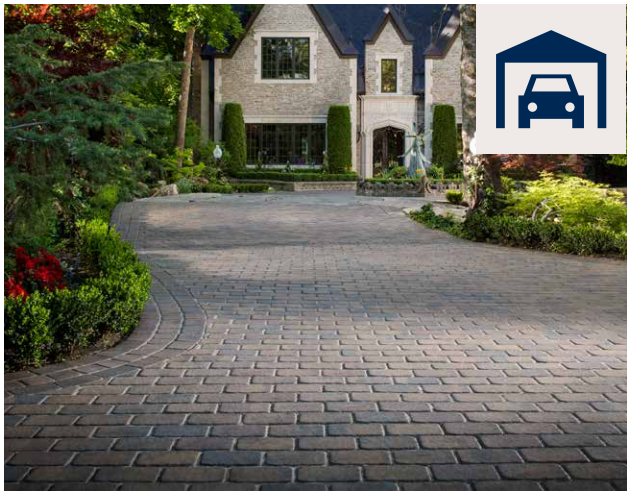
1. Cross section as shown is suitable for light vehicular applications, including parking lots, emergency access or residential driveways.
2. Depth of aggregate base subject to site specific conditions (traffic loading, soil conditions, groundwater levels, climatic conditions).
3. An edge restraint for all Turfstone applications is required. Commercial vehicular applications should utilize a 6" wide concrete curb for containment.

How to Select the Right Paver for Your Application

The following icons provide general recommendations for both standard and permeable paving products. A pavement design professional should confirm that the product selected is suitable for the site-specific conditions such as subgrade soil properties, slope, drainage conditions, and traffic loading.

PEDESTRIAN

Designated for areas that are pedestrian only – walkways, patios and other pavement areas not subjected to any vehicular traffic. **All** Belgard paver and slab products are suitable for this application.



RESIDENTIAL DRIVEWAYS

Pavement used primarily for residential driveways, but also includes golf cart paths, commercial plazas, courtyards and pathways exposed to only light maintenance equipment, including infrequent heavy fire truck or maintenance equipment. Belgard pavers with a **minimum thickness of 60 mm and a maximum aspect ratio of 4:1** is suitable for this application. 60 mm multi-piece paver systems up to 12" in length is also acceptable for residential driveways with an appropriate base dependent on site conditions. 80 mm thick slabs up to a length of 18 inches can be used in residential driveways subjected to only cars with adequate base thickness and subgrade soil strength. Typical lifetime ESALs should be < 7,500 maximum and heavy vehicles must be < 1 per day on average.

LIGHT VEHICULAR

Pavements used for low-traffic municipal or commercial parking lots, including access ways where only cars and light trucks are anticipated. Belgard pavers with a **minimum thickness of 80 mm and a maximum aspect ratio of 4:1** is suitable for this application. Typical lifetime ESALs must be < 30,000 ESALs and maximum heavy vehicles should be < 5 per day on average.

HEAVY VEHICULAR

Pavements designated for regular vehicular traffic, including commercial parking lots, access roads where heavy vehicles are a regular component of the daily traffic volume. Belgard pavers with a minimum thickness of 80 mm and a maximum ratio of 3:1 is suitable for this application. Herringbone laying pattern is recommended on all roadways. Typical lifetime ESALs typically are > 30,000 ESALs and > 5 heavy vehicles per day.

PORCELAIN

INSTALLATION GUIDE

Porcelain Pavers

Belgard Porcelain Pavers are formed by pressing, followed by vitrification. This process involves the total fusion into a single material made from natural raw materials (sand, quartz, feldspars, kaolin, clays and inorganic pigments) which, when fired at temperatures above 1227° C (2240° F), are transformed into a product with exceptional hardness, ultra-low absorption rate and unmatched mechanical characteristics. Belgard porcelain pavers are eco-compatible and ecolabel-certified. Each unit is 20 mm (0.79") standard thickness or ¾" nominal thickness and is durable enough to withstand use in exterior applications.

PORCELAIN PAVERS ADVANTAGES:

- Freeze thaw resistant — They are 100% frost-free and their properties remain unaltered at temperatures ranging from -51.1° to + 60° C (-60° F to +140°F).
- Color durability — Color is fused by vitrification, becoming an integral part of the porcelain surface and is not affected by elements.
- Easy installation—Perfect fit and for fast installs.
- Low absorption rate—Spills, salt and other materials will not seep into pours.
- Easy to clean — Household cleaners can be used to wipe down spills and dirt; can even be pressure washed with a low-pressure washing device* (see pressure washing warning below).*
- Stylish—Matches what homeowners are currently doing inside the home.
- Durable — High breakage loads of up to 3,500 lbs (1587 kg) per foot based on ASTM-C648.
- Resistant — High compressive strength and ultra-low absorption rate creates a dense surface that resists mold, moss, dirt and other staining.
- Skid-resistant — Structured paver top textures create slip-resistant surfaces for safety; perfect for around pools/spas or in wet climates.
- Modular Design — With superior accuracy in dimensional sizing and linear sides, the slabs allow for perfectly executed installations with tight and accurate lines.
- Light weight — 16.8 kg (37 lbs) for the 24"x24" paver permit for easy installation, removal and serviceability and even reusability (Excluding adhered installations).
- Available in colors that have a Solar Reflectance (SR) values that qualify for potential LEED points. Light colored pavers that can qualify for heat island mitigation credit must have initial SR values greater than or equal to 0.33.
- Impermeable — Deicing salt and other deicing materials can be used without concern of damage.

* It is important that all pressure washing of your porcelain pavers be done with a low pressure washer with a maximum of 1600 psi and nothing more powerful. When pressure washing your installation, care should be taken to prevent damage to the grout (adhesive and grout installations) and some re-sanding will be necessary when power washing an installation with sand or polymeric sand joints.

SPECIALTY TOOLS FOR PORCELAIN PAVER CONSTRUCTION:

- Wet cut tile saw equipped with a diamond blade manufactured for wet cutting porcelain, or dry saw with vacuum. The saw should be designed to safely cut a 24 inch length porcelain paver.
- A paver clamp for easy handling, which can be used to both install and remove pavers.
- The use of gloves is highly recommended while handling and installing porcelain slabs.
- Appropriate notched trowels and grout float tools for cementitious adhesive and grout installation. The appropriate tool selection would be based on the adhesive and grout manufacturer's recommendation.
- Pallets of porcelain pavers are manufactured and shipped with a heavy-duty plastic protective pallet cover, and the individual porcelain pavers are packaged in protective cardboard boxes. To prevent damage to your pavers, do not remove the protective cardboard boxes until you are ready to install them.
- Caution: Removing pavers from their protective packaging and handling multiple loose stones together creates the possibility for chipping.

Once the heavy-duty plastic pallet covers have been removed from the pallet, the unused boxed pavers should be protected from the elements to insure the integrity of the protective cardboard boxes.

CLEANING & MAINTENANCE FOR PORCELAIN PRODUCTS

Post-laying cleaning is obligatory after on-site work. Inadequate or late removal of the grouting used on the flooring joints can leave marks difficult to remove and create a cement film able to absorb all types of dirt, thus giving the impression that it is the material that has become dirty.

It is indispensable to dissolve and remove these residues completely using buffered acids diluted in water (follow the instructions on the packs of the products used), which must then be removed completely and quickly, rinsing the floor with plenty of water to avoid residues or drops on the floor which could damage the tiles.

Allow the product to act on the wet floor, without letting it dry and rubbing it with colorless rags. Next, rinse it thoroughly with water to ensure that the floor is free of detergent residues. If necessary, repeat the operation.

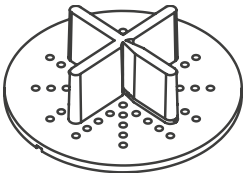
We suggest performing a preliminary wash on a sample surface of a few square meters. If the test is successful, extend clearing over the entire surface. When you have done the above wash, carry out a basic or alkaline wash using degreasing detergents. This is because acid can leave grease on the floor, which could contribute to retaining dirt.

Porcelain Paver Installation

Each of the following option details will include specific information relative to the selected installation. Base thicknesses vary between different geographical and climatic locations, and the contractor will be installing typical base thicknesses for paving installations in their location.

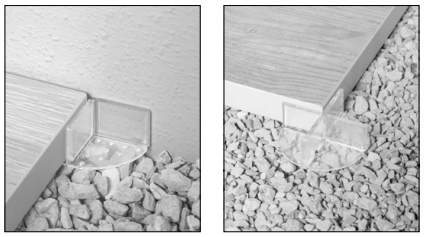
Installing porcelain pavers requires the bedding course sand to be pre-compacted and then struck off with a screed to the required thickness as shown in the detail drawings. The porcelain pavers are not compacted, and therefore, the sand layer beneath them requires pre-compaction. Do not compact dry sand, but insure the sand has a 5 to 6% moisture content so that it will compact cohesively and allow for a smooth strike off finish.

INSTALLATION INFORMATION THAT MUST BE FOLLOWED:



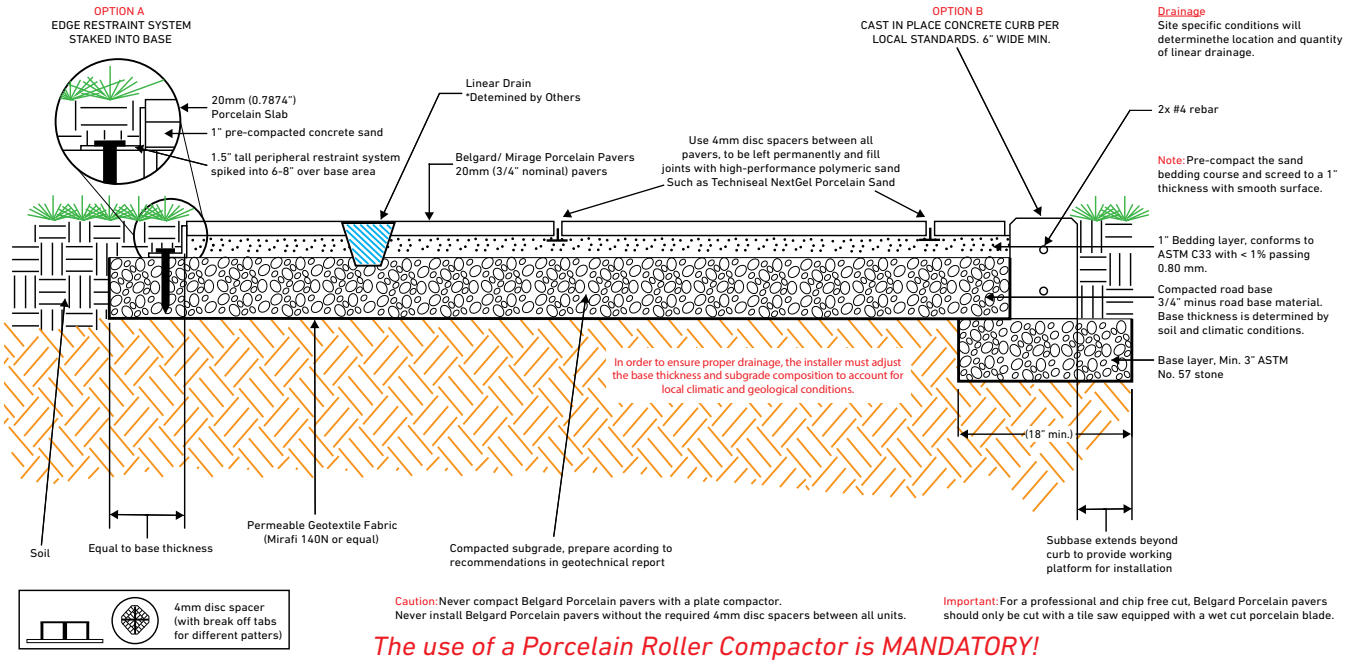
4 mm spacers

- NEVER compact porcelain pavers with a plate compactor.
- ALWAYS pre-compact and strike off your sand leveling course before installing your porcelain pavers in sand set installations.
- Porcelain pavers should only be wet cut with a tile saw equipped with a wet cut porcelain blade.
- NEVER install porcelain pavers without the required 4 mm spacing between them. The porcelain pavers should never be installed with a porcelain to porcelain contact. Plastic 4 mm spacers (shown at right) should be used on Sand Set and Permeable installations. The photo on the left illustrates the spacer installed in a perspective to support and space 4 paver corners and the photo on the right illustrates the installed spacer snapped apart (as designed) to form Space T that supports 2 paver corners. This versatility will permit your porcelain pavers to be installed in a stack bond pattern, a running bond patterns, as well as a flush installation against another structure.



- For a 100 sq. ft. project, approximately 34 spacers are needed; this allows for overages if needed.

SAND SET OVER COMPACTED ROAD BASE INSTALLATION (PEDESTRIAN FOOT TRAFFIC)



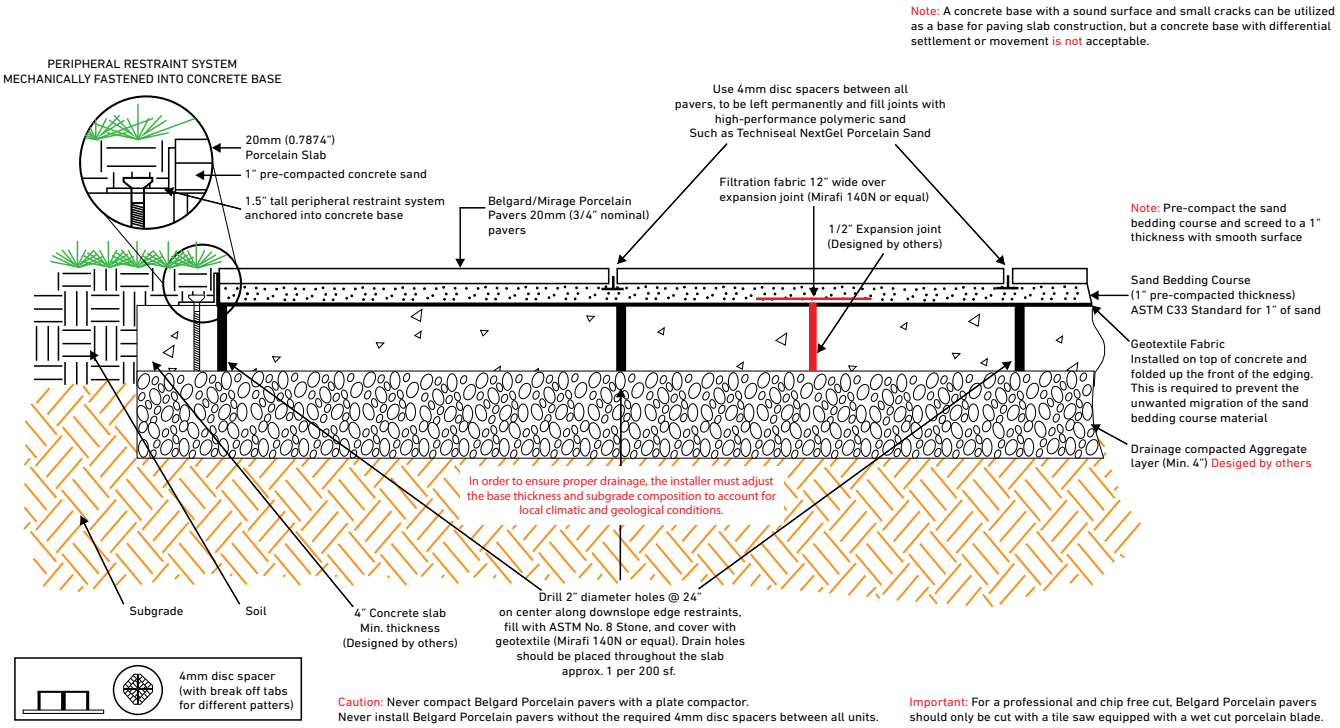
The use of a Porcelain Roller Compactor is MANDATORY!

INSTALLATION NOTES:

- Follow the detailed drawing above.
- Base material is to be over based 6 to 8 inches beyond the edge of the pavement.
- Precompact the sand bedding course and screed to 1-in thickness with smooth surface.
- The required edge restraint system is a low-profile edge restraint with a vertical height of 1½-in as shown in the drawing.
- Insure that pavement is constructed with a 1 ½ to 2 percent slope that it is pitched away from any building.
- Insure the plastic 4 mm spacers are installed at all corners of the installed pavers.

Belgard porcelain pavers can also be installed as a permeable system. Replace sand with a 2 inch thick bedding course or a ⅜ inch crushed open grade aggregate. Replace ¾ minus base with a ¾ crushed open grade aggregate.

SAND SET OVER CONCRETE OVERLAY INSTALLATION (PEDESTRIAN FOOT TRAFFIC)

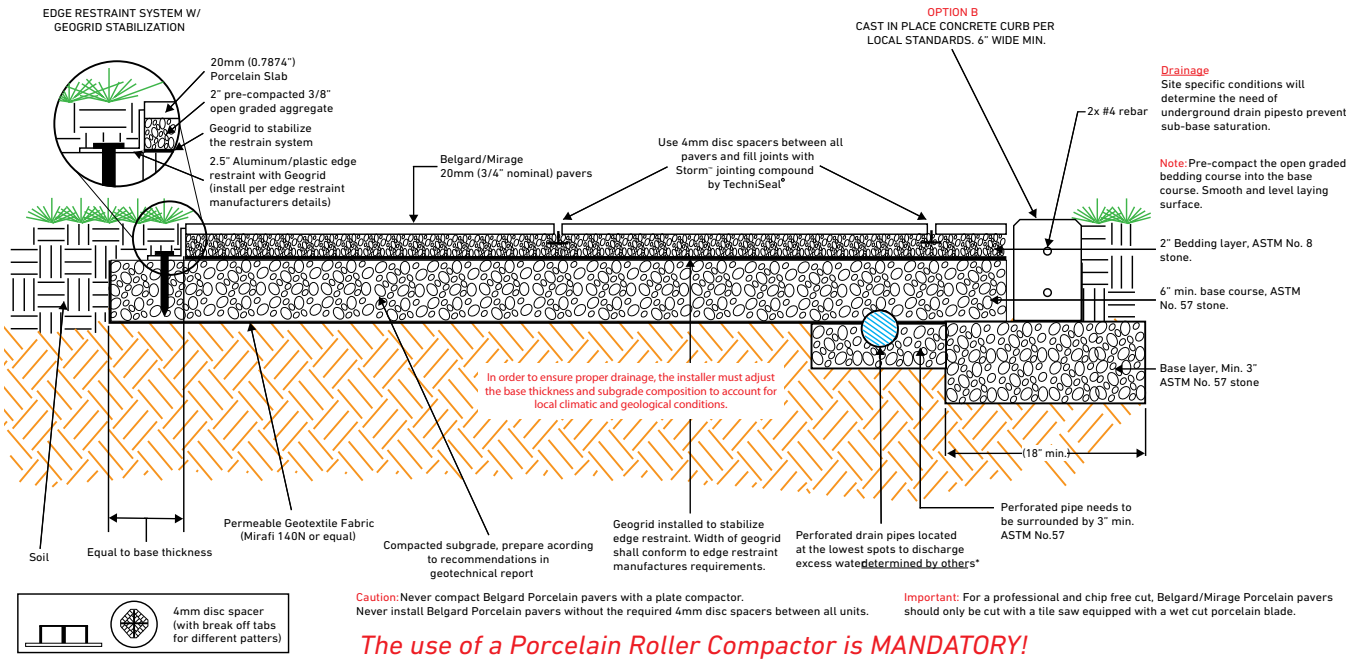


The use of a Porcelain Roller Compactor is MANDATORY!

INSTALLATION NOTES:

- The required edge restraint system is a low-profile edge restraint with a vertical height of 1½ inches as shown in the drawing.
- Precompact the sand bedding course and screed to 1-in thickness with smooth surface.
- Mechanically anchor edge restraint into the concrete base.
- Insure geotextile is installed directly on top of the concrete to contain the bedding sand.
- Insure that pavement is constructed with a 1½ to 2 percent slope and that it is pitched away from any building.
- Insure the plastic 4 mm spacers are installed at all corners of the installed pavers.

GRAVEL SET OVER OPEN-GRADED AGGREGATE INSTALLATION

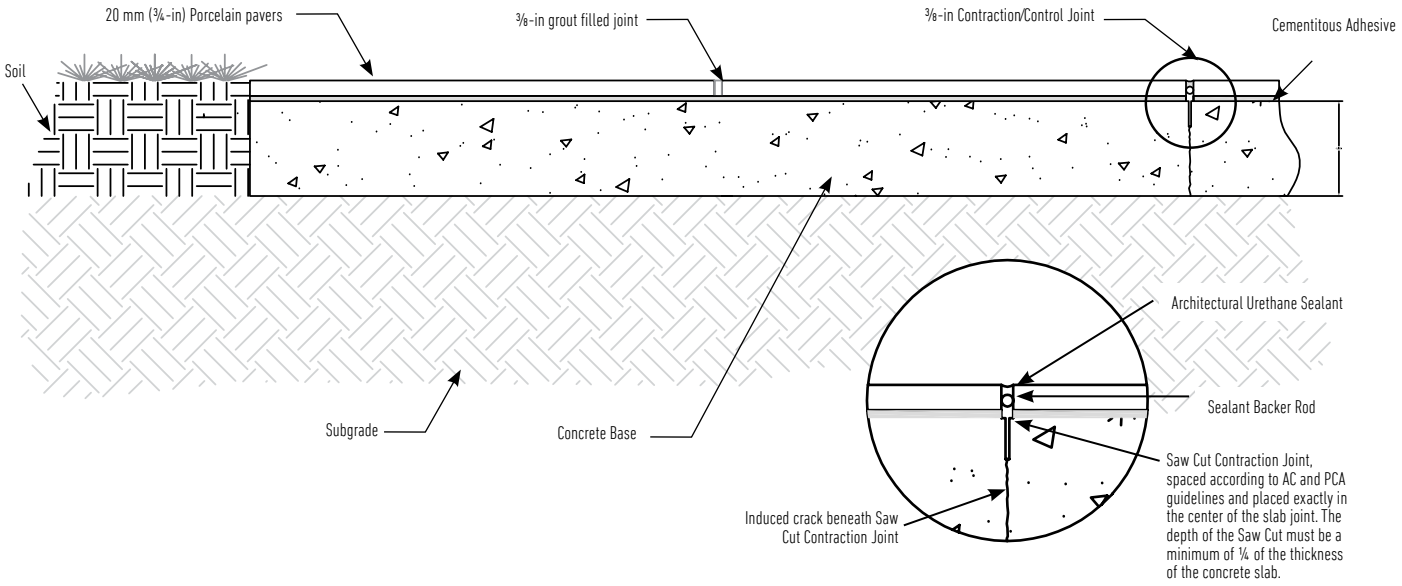


The use of a Porcelain Roller Compactor is MANDATORY!

INSTALLATION NOTES:

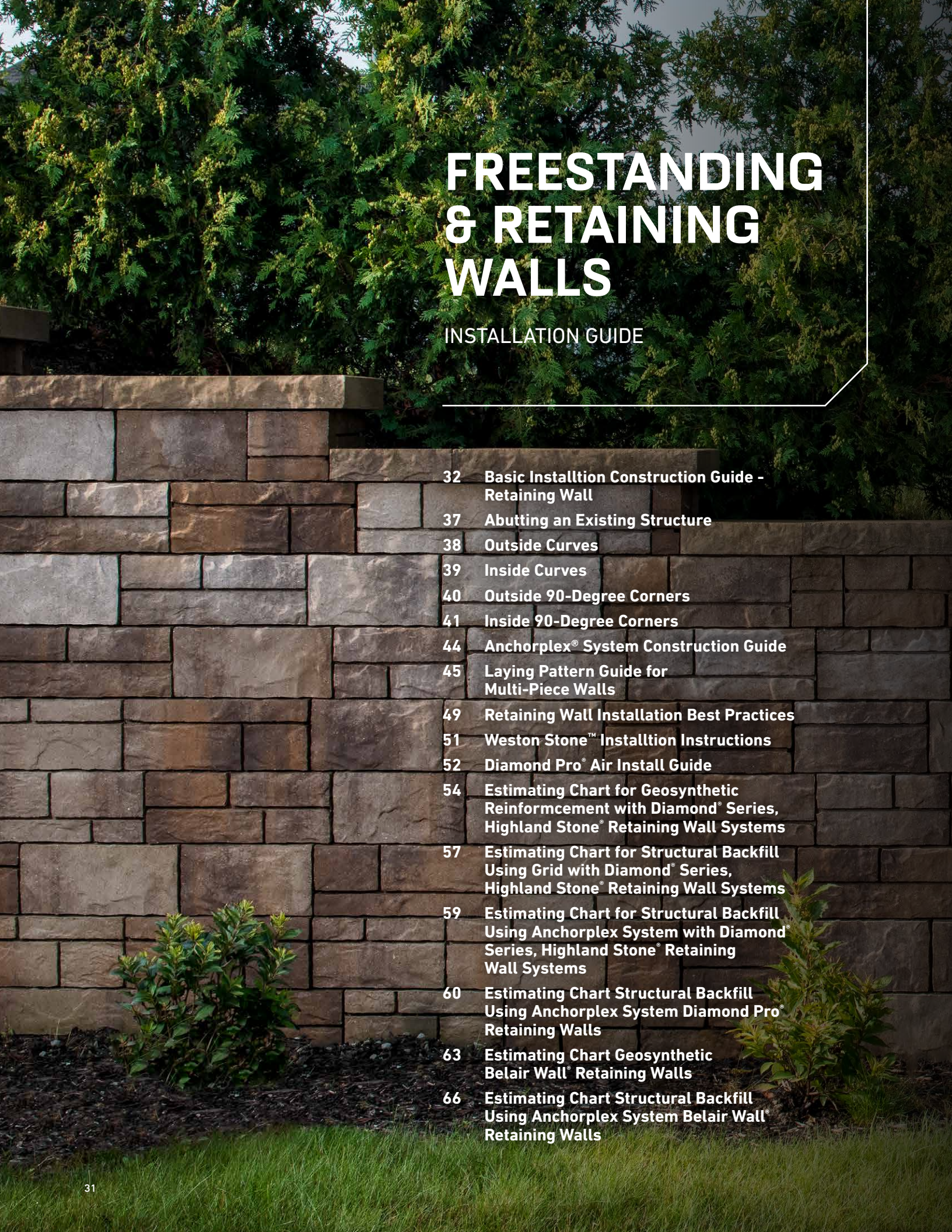
- Weather, soil type and job conditions should be considered when choosing the best installation method. Follow the detail drawing.
- The required edge restraint system for this installation has a vertical height of 2½ inches as shown in the drawing. Follow the edge restraint manufacturer's recommendations for the use of their product in permeable applications regarding geogrid usage and placement to maintain the performance of their edging.
- Ensure that pavement is constructed with a 2 percent slope and that it is pitched away from any building.
- Ensure the 4 mm spacers are installed between all pavers.
- The open-graded aggregate should be clean and free from foreign matter, manufactured from crushed rock and conform to ASTM C33 size No. 57. Do not use recycled aggregates or rounded river gravel.
- Additional Drainage: If the project has fine-grained soils, silts or clays, and contributing water sources such as downspouts or groundwater, it is important to install a perforated pipe underdrain to prevent saturation of the subgrade. Make sure underdrain has an acceptable discharge location.
- When installing porcelain planks (12 x 48 & 8 x 48), always lay the pattern of 1/3's. These should not be placed next to each other at 50 percent.
- Roller Compactor recommended for all compaction with Porcelain products

CEMENTITIOUS ADHESIVE OVERLAY, CONCRETE BASE INSTALLATION (LIGHT VEHICULAR TRAFFIC)



INSTALLATION NOTES:

- Insure that pavement is constructed with a 2 percent slope and that it is pitched away from any building.
- For Cementitious adhesive and grout installation, refer to the manufacturer's specific technical instructions for outdoor installations.
- For concrete foundation slabs that are not large enough to require contraction / control joints, a minimum 4 mm (⅛" to 3/16") grout joint is acceptable, but for larger concrete foundation slabs that do require contraction / control joints, the joint width should be ⅜". It is absolutely imperative that all contraction / control joints be located in the joint line of installed porcelain pavers and not beneath a paver.
- Caution: If a Porcelain Paver is installed over a control joint, the paver will reflectively crack along the contraction / control joint beneath it.



FREESTANDING & RETAINING WALLS

INSTALLATION GUIDE

Basic Installation Construction Guide – Retaining Wall

STAKE OUT THE WALL

- Have a surveyor stake out the wall's placement. Verify the locations with the project supervisor.

EXCAVATION

- Excavate for the leveling pad according to the lines and grades shown on the approved plans, and excavate enough soil behind the wall for the geogrids material, if needed.
- The trench for the leveling pad should be at least 12 inches wider than the block you are installing and 6 inches below the bottom of the block. *See Diagram 1.*

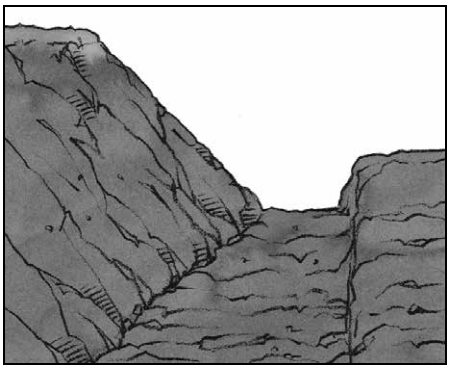


Diagram 1 – Excavation

LEVELING PAD

- An aggregate leveling pad is made of compactable base material of ¾-inch minus (with fines).
- The pad must extend at least 6 inches in front of and behind the first course of block and be at least 6 inches deep after compaction.
- If the planned grade along the wall front will change elevation, the leveling pad may be stepped up in increments of the block height to match the grade change. Start at the lowest level and work upward whenever possible.
- Compact the aggregate and make sure it's level front to back and side to side. *See Diagram 2.*

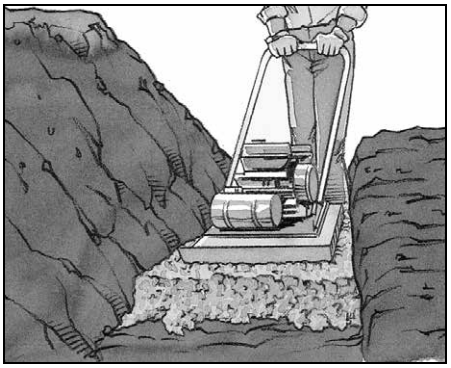


Diagram 2 – Leveling Pad

BASE COURSE

- This is the most important step in the installation process. Bury the base course of block a minimum of 6 inches or as shown on the plans.
- Begin laying block at the lowest elevation of the wall. Remove the rear lip (if applicable) of the block by hitting from the back so that it will lie flat on the leveling pad. *See Diagram 3.*
- Place first block and level, front to back and side to side; lay subsequent blocks in the same manner.
- Place the blocks side by side, flush against each other, and make sure they are in full contact with the leveling pad.
- If the wall is on an incline, don't slope the blocks; step them up so they remain consistently level.
- Use string line along the back edge of block to check for proper alignment.
- For multi-piece products, use the largest unit, 18 inches wide, for the base course.
- Fill cores (if applicable) and voids between blocks with ¾-inch free-draining aggregate prior to laying the next course of block. Clean any debris off the top of the blocks. *See Diagram 4.*
- Install any location devises, such as pins, prior to placing the second course of blocks.

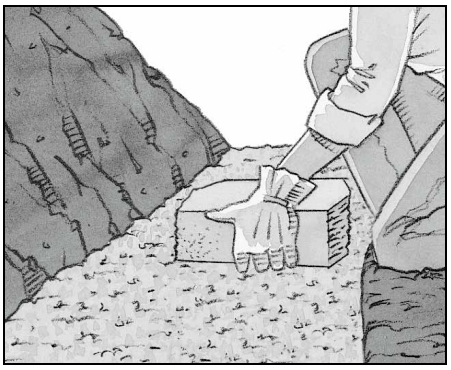


Diagram 3 – Base Course

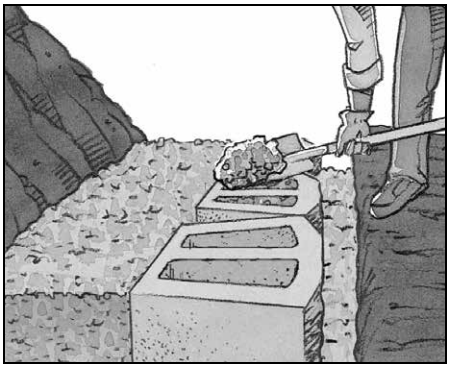


Diagram 4 – Core Fill

CONSTRUCTION OF SUBSEQUENT COURSES

- Clean any debris off the top of the blocks.
- Place the second course of blocks on top of the base course. Maintain running bond. Pull each block forward as far as possible to ensure the correct setback. *See Diagram 5.*
- Fill cores (if applicable) and voids between blocks with ¾-inch free-draining aggregate prior to laying the next course of block. Clean any debris off the top of the blocks.
- Backfill with ¾-inch free-draining aggregate directly behind the block, adding 6 inches at a time followed by proper compaction. Fill thickness will be dependent on compaction equipment.
- Add retained soil behind the aggregate. Compact before the next course is laid.
- Don't drive heavy equipment near the wall. Self-propelled compaction equipment should not be used within 3 feet from the back of the wall.
- Keep the wall bond by placing units in a staggered relationship to the course beneath.
- You may need partial units to stay on bond. A saw with a diamond blade is recommended for cutting partial units. Use safety glasses and other protective equipment when cutting.

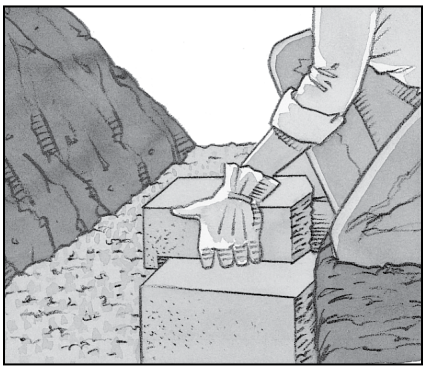
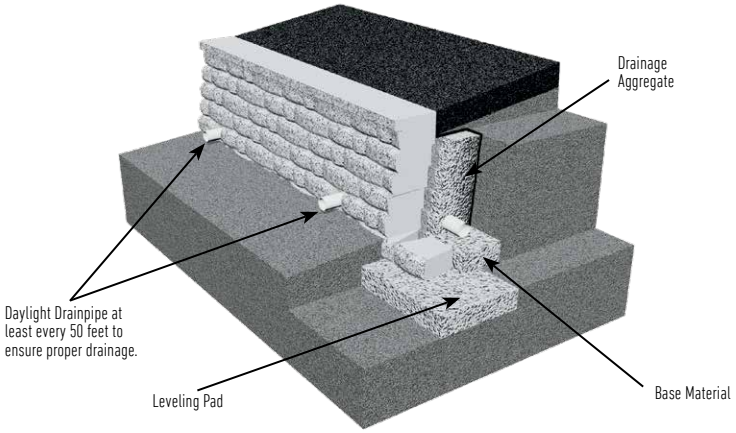


Diagram 5 – Next Course Construction

DRAINAGE DESIGN

- Each project is unique. The grades on your site will determine at what level to install the drainpipe.
- Place the drainpipe as low as possible behind the wall so water drains down and away from the wall into a storm drain or to an area lower than the wall. *See Diagram 6.*
- Fill in the area behind the blocks with ¾-inch free-draining aggregate, at a minimum of 12-inches from behind the back of the block or 24-inches from the front of the block, whichever is greater.
- You may need to place and backfill several courses to achieve the proper drainage level. *See Diagrams 7 and 8.*
- The drainpipe outlets should be spaced not more than every 50 feet and at low points of the wall. In order for the gravel fill to function properly, it must keep clear of regular soil fill. See below diagram of daylight drainage system.



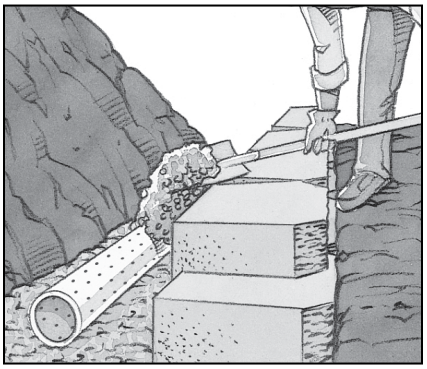


Diagram 6 – Drainage

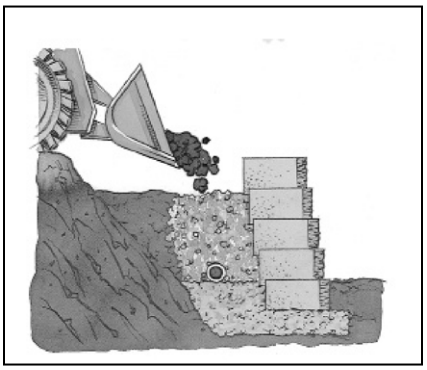


Diagram 7 – Backfill

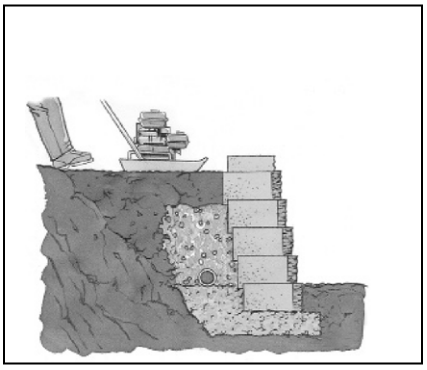


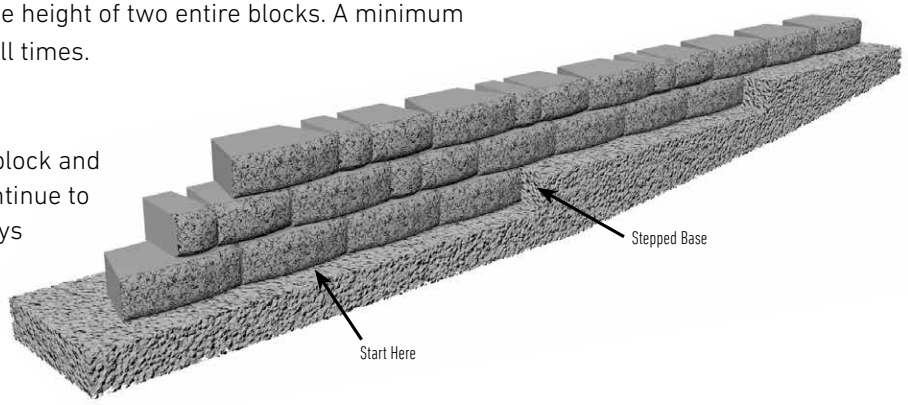
Diagram 8 – Compaction

STEPPING UP THE BASE AT LOWEST POINT

Walls built on a sloping grade require a stepped base. Begin excavation at the lowest point and dig a level trench into the slope until it is deep enough to accommodate the base material and the height of two entire blocks. A minimum embedment of 6 inches is required at all times.

STEP-UP

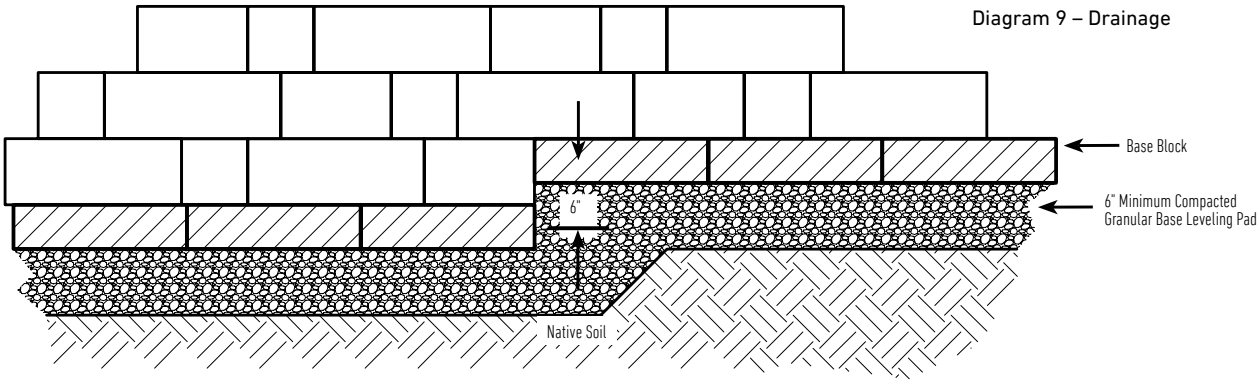
At this point, step up the height of one block and begin a new section of base trench. Continue to step up as needed to top of slope. Always bury at least one full unit at each step, maintaining a minimum embedment of 6 inches at all times.



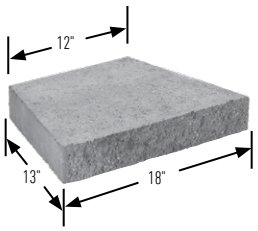
STEPPING UP THE BASE USING THE U START BASE BLOCK

Walls built on a sloping grade require a stepped base. Begin excavation at the lowest point and dig a level trench, 24 inches wide, into the slope until it is deep enough to accommodate the base material, the base block and enough depth to maintain a minimum of 6 inches of embedment after stepping up.
See Diagram 9.

Diagram 9 – Drainage

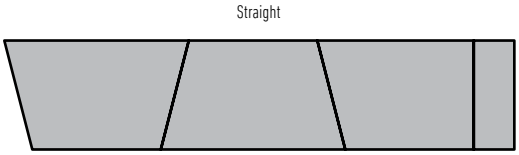


XL™ CAP



STRAIGHT WALL

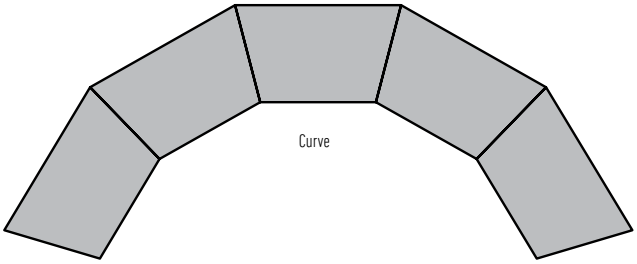
The XL™ cap must be laid alternately, short and long faces for a straight line. Always start capping from the lowest elevation. Once caps are aligned, caps should be glued in place using a concrete adhesive.



CURVES

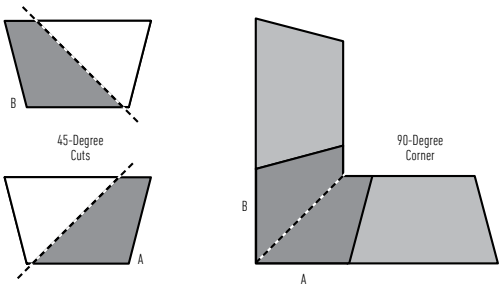
Lay out the cap units side by side with the same face facing out (long faces for outside curves; short face to inside curves). If there's a need to adjust for project's radius, make cuts at least every other cap as needed for the most pleasing aesthetic.

- Minimum radius with XL™ cap: 2 feet 2 inches



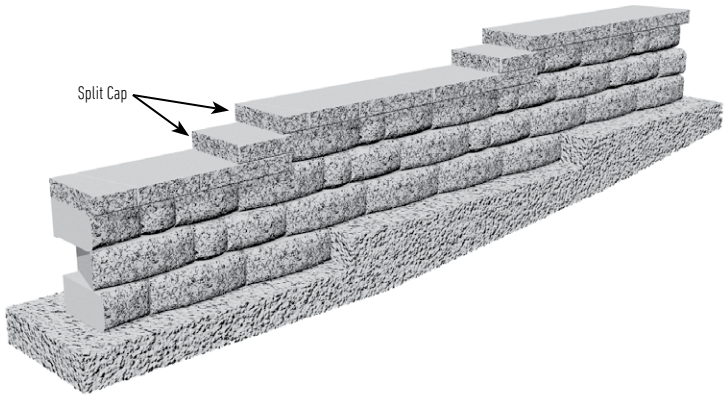
90-DEGREE CORNERS

Saw-cut two caps to achieve a 45-degree mitered corner.



STEPPING UP CAPS WITH XL™ CAP

If the wall elevation changes, caps can be stacked where the wall steps up. Begin laying caps at the lowest elevation change and work your way toward the next step up. Split* a cap unit to fit. Place the split unit directly on top of the capped portion of the wall with all three split faces exposed.



FINISHING WITH XL™ CAP

After layout is complete and caps are saw-cut or split to size, carefully place concrete adhesive on wall top course and then place caps.

*Note: To split a block, use a hydraulic splitter or split manually by using a hammer and chisel to score the block on all sides. Pound the chisel on the same line until the block splits. If partial unit sides are not exposed, use a saw with a diamond blade to achieve a tighter fit.

GEOSYNTHETIC REINFORCEMENT (IF REQUIRED)

- Geosynthetic reinforcement is recommended for walls taller than the gravity height determined for the project, or walls situated in poor soils, supporting a driveway, etc. Consult an engineer for design assistance.
- Check the wall construction plan for which courses will need geogrids.
- Clean any debris off the top layer of blocks.
- Measure and cut the geogrids to the design length in the plans.
- Many geosynthetic reinforcements have a design strength direction, which must be laid perpendicular to the wall.
- Place the front edge of the geogrids on top of the block, making sure it's within 1 inch of the face of the block. Correct placement ensures that you maximize the connection strength and keep the batter consistent.
- Apply the next course of blocks to secure it in place.
- A minimum of 6 inches of backfill is required prior to operating vehicles on the geogrids. Avoid sudden turning or braking.

COMPACTION

- Place the backfill soil behind the drainage aggregate and compact to 95% standard PROCTOR density with a hand-operated compactor.
- Make sure the aggregate is level with or slightly below the top of the course.
- Place soil in front of the base course and compact. The base course should be buried.
- Continue to fill and compact.

FINISH GRADE AND SURFACE DRAINAGE

- Protect the wall with a finished grade at the top and bottom.
- To ensure proper water drainage away from the wall, use 8 inches of soil with low permeability. This will minimize water seeping into the soil and gravel fill behind the wall. *See Drainage Swales.*

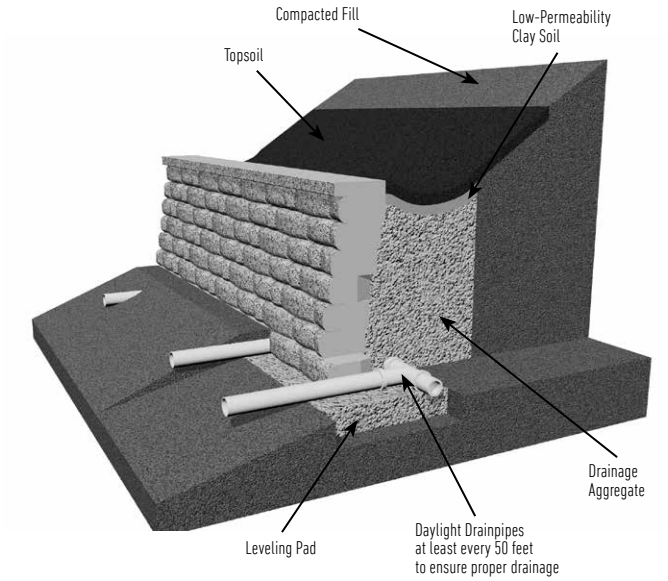
SITE CLEANING AND RESTORATION

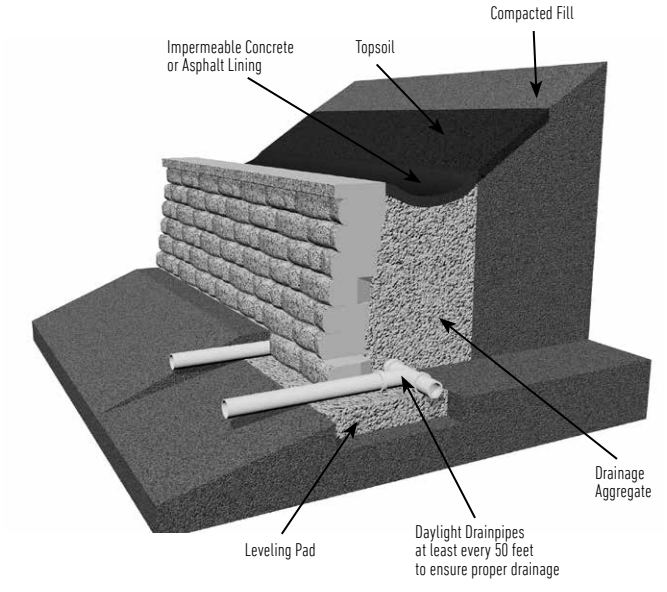
- Brush off the wall and pick up any debris left from the construction process.
- Notify the job superintendent in writing of the project's completion and that it is ready for final inspection and acceptance.
- Planting vegetation in front and on top of the wall will help reduce the chance of erosion.

Following the best practices for construction will ensure the successful installation of Anchor™ & Belgard® products.

DRAINAGE SWALES

- Design and performance of most retaining walls are based on keeping the reinforced zone relatively dry. Appropriate drainage swales to help control water should be designed into the wall construction plan.





SAFETY NOTE: Always use appropriate equipment, including safety glasses or goggles and respirators, when splitting, cutting or hammering units. Refer to the CMHA Segmental Retaining Wall Installation Guide at www.CMHA.org.

Abutting an Existing Structure

FIRST COURSE

Begin with the first block next to the wall and place the first course. Place filter fabric behind the first two units and extend it 2 feet along the existing structure.

First Course

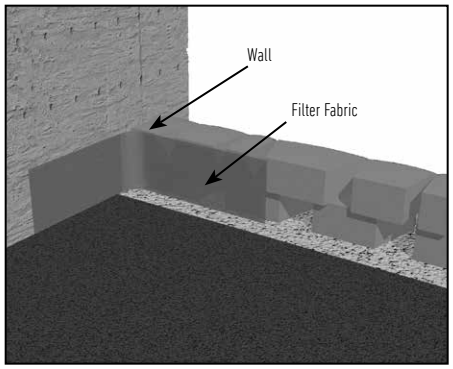
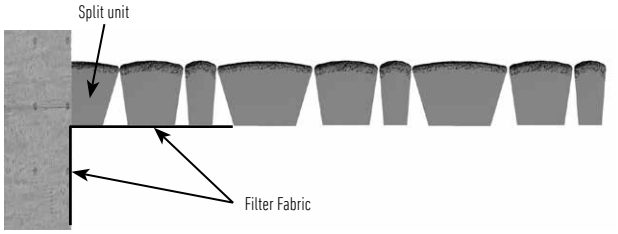


Diagram 10 – Extend Filter Fabric

SECOND COURSE

Build second course with standard installation techniques.
A split unit is shown but may not be necessary in every installation.
Extend filter fabric to the top edge of the final course. *See Diagram 10*.
A rubber membrane may be placed between the units and a non-concrete wall to prevent moisture damage to the structure.



Second Course

Note: To split a block, use a hydraulic splitter or split manually by using a hammer and chisel to score the block on all sides. Pound the chisel on the same line until the block splits. If partial unit sides are not exposed, use a saw with a diamond blade to achieve a tighter fit.

Outside Curves

CALCULATE THE RADIUS

When building an outside curve, begin by determining the desired radius of the top course. This will be the smallest radius in the wall and must not be less than the minimum radius for the wall system used.

To determine the approximate base course radius:

1) Add ¼-inch to the setback of the block used. Multiply that by the number of courses in the finished wall.
2) Add desired radius length of the top course to the result of step 1. This number equals the approximate radius length of the base course.
3) To determine the radius for the front edge of the trench, add 6 inches to the approximate radius length of the base course.

Example: Setback of the Highland Stone® product is 1⅛-inch. The wall is 8 courses high. The desired radius of the wall measured to the front of the block on the top course is 6 feet.

1) Setback multiplied by number of courses
   1⅛" + ¼" = 1⅜" x 8 courses = 11"
2) Desired radius plus setback
   6' + 11" = 6'11"
3) Front of trench
   6'11" + 6" = 7'5"

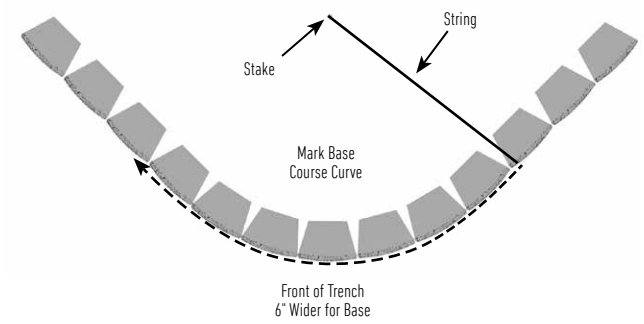
Pro Tip

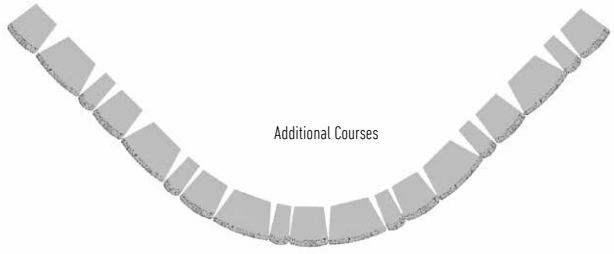
Subtract the depth of the block if you prefer to mark the curve from the back of the block.

LAY OUT THE TRENCH

Drive a stake into the ground at the desired radius point of the curve. Attach a string and rotate it in an arc at the desired length to mark the curve in the soil. Dig the trench.

BASE COURSE





Using the existing radius point stake and string, mark the base course curve on the leveling pad. Align the front of the block with the marked curve and ensure level placement from side to side and front to back.

ADDITIONAL COURSES

On each course, some of the rear lip of each block must be in contact with the back of the units below to ensure structural stability. The setback of the block will cause the radius of each course to gradually decrease and eventually affect the running bond of the wall. To maintain proper running bond, use partial units as needed. Once a split or cut unit is cut to size, glue in place with a concrete adhesive.

Inside Curves

CALCULATE THE RADIUS

Check the wall plan to determine the radius of the top course. This will be the biggest radius in the wall. You will need it to determine the radius at the base course, which will be the smallest radius of the wall and must not be less than the minimum for the block system used.

A QUICK WAY TO DETERMINE THE BASE COURSE RADIUS:

1) Add ¼-inch to the setback of the block used. Multiply that by the number of courses in the finished wall.
2) Subtract the result of step 1 from the radius of the top course. This number equals the approximate radius length of the base course.
3) To determine the radius for the front edge of the trench, subtract 6 inches from the approximate radius length of the base course.

Example: The setback of the Highland Stone® product is 1⅛-inches. The wall is 8 courses high. The desired radius of the wall measured to the front of the block on the top course is 10 feet.

1) Setback multiplied by number of courses
   1⅛" + ¼" = 1⅜" x 8 courses = 11"
2) Desired radius minus setback
   10' - 11" = 9'1"
3) Front of trench
   9'1" - 6" = 8'7"

Pro Tip

Add the depth of the block if you prefer to mark the curve from the back of the block.

LAY OUT THE TRENCH

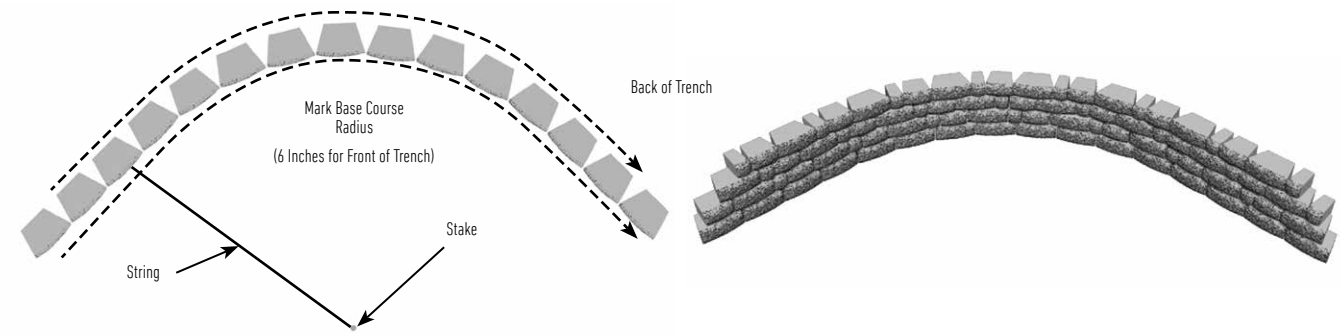
Drive a stake into the ground at the desired radius point of the curve. Attach a string and rotate it in an arc at the desired length to mark the curve in the soil. Dig the trench.

BASE COURSE

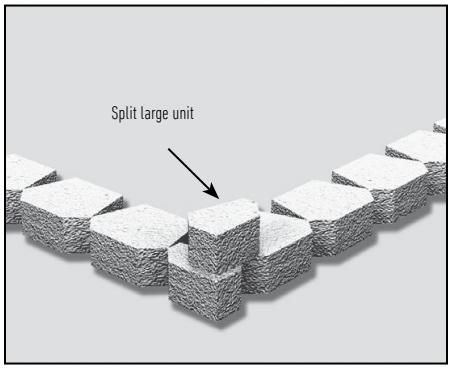
Using existing radius point stake and string, mark the base course curve on the leveling pad. Align the front of the block with the marked curve and ensure level placement from side to side and front to back.

ADDITIONAL COURSES

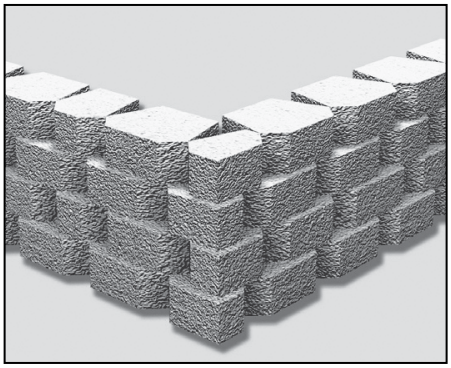
On each course, some of the lips of each block must be in contact with the back of the units below to ensure structural stability. If not, use construction adhesive to adhere blocks together. To maintain proper running bond, use partial units as needed. Once a split unit is cut to size, glue in place with a concrete adhesive.



Outside 90-Degree Corners
FOR SYSTEMS WITHOUT A CORNER UNIT



Outside 90-Degree Corner
without Corner Unit



Additional Courses

BASE COURSE

To build an outside 90-degree corner, begin by splitting a unit in half. Place this unit with both split faces out at the corner. If needed, remove the rear lip so that the block lies flat. Then lay the rest of the base course working from the corner block out.

ADDITIONAL COURSES

Begin the next course with the other half of the split unit faced in the opposite direction at the corner.
Place the second and third blocks on either side of the corner unit. Once the corner unit is in position, glue block in place with a concrete adhesive. Continue to alternate the corner unit orientation with each course and always use a concrete adhesive on the corner units. Use cut or split units as necessary to maintain running bond.

Outside 90-Degree Corners
FOR SYSTEMS WITHOUT A CORNER UNIT

90-degree corners are built by alternating corner/column units so the long side is on different sides of the wall. Build the pattern from the corner unit when possible. Install corner units level from front to back.

Depending on the wall layout, there may be a need to go off the pattern and randomly place wall blocks near the corner. Set back corner units to reflect the batter of the wall block units and glue from bottom to top.

Outside 90-Degree Corner
with Corner/Column Unit

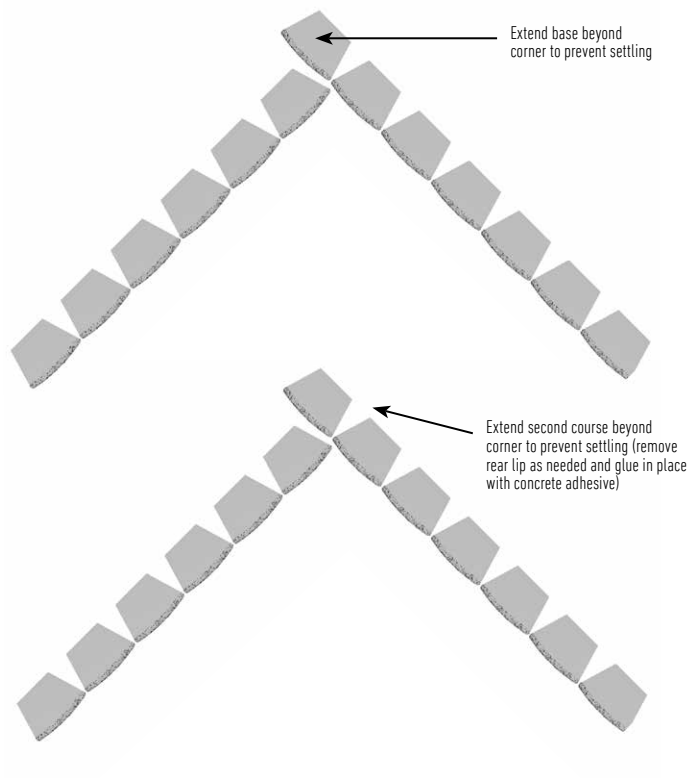
Note: To split a block, use a hydraulic splitter or split manually by using a hammer and chisel to score the block on all sides. Pound the chisel on the same line until the block splits. If partial unit sides are not exposed, use a saw with a diamond blade to achieve a tighter fit.

Inside 90-Degree Corners

Example Inside 90-Degree Corner

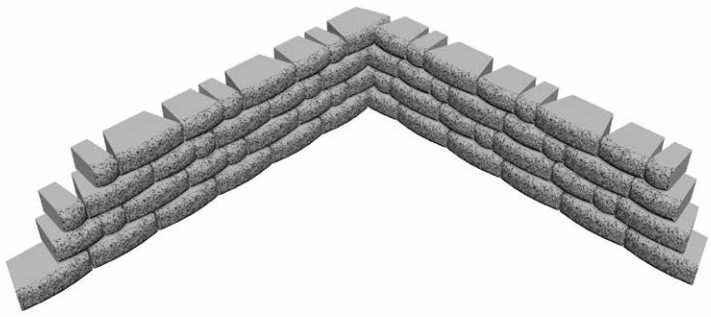
BASE COURSE

To create an inside 90-degree corner, begin by placing a block at the corner. Then lay a second block perpendicular to the first and continue laying out the rest of the base course working from the corner out. Make sure to construct the base course according to standard site prep and installation procedures.



ADDITIONAL COURSES

On the second course, place all blocks on bond along one side of the corner. Once the second course of one wall is established, begin the second course of the adjacent wall. Split units or units of varying sizes may be required on this wall to maintain running bond. Continue to alternate the corner unit orientation with each course and always use a concrete adhesive on the corner units.



NOTE: To split a block, use a hydraulic splitter or split manually by using a hammer and chisel to score the block on all sides. Pound the chisel on the same line until the block splits. If partial unit sides are not exposed, use a saw with a diamond blade to achieve a tighter fit.

STEPS IN A CURVED WALL

These drawings show Highland Stone®, Diamond® and Diamond Stone Cut® step units.
Caps or pavers can be used for treads. Check local building codes for any tread depth standards.

BASE COURSE

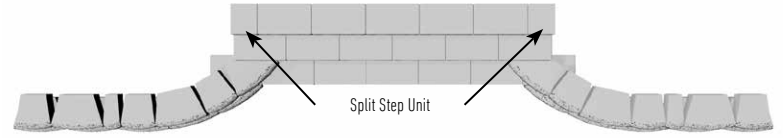
Thoroughly compact the leveling pad. Lay out the base course according to the wall design.
Place step units first, working from the center to each side. Remember, it is very important to backfill and compact behind and along the sides of each course of step units.

FIRST STEP COURSE

Place the first course of step units directly on top of the base course so there is no setback.
Stagger them from the previous course and glue in place.

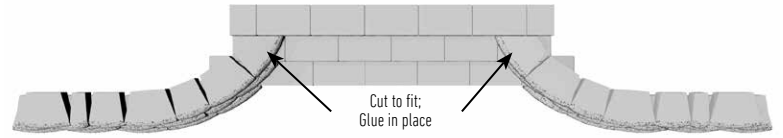
SECOND STEP COURSE

Add the second course of steps, staggering them from the previous course to maintain running bond.
Overlap the lower course by a minimum 2 inches and glue to lower course. Place and compact base material prior to installing next course.



NEXT WALL COURSE

Place a block near the second course of steps, maintaining running bond with the base course. Measure and cut a block to fit the space remaining between the step unit and the next course of the wall. Place the unit in the wall, making sure that both vertical edges fit tight against both the step and standard unit. Remove the rear lip on the blocks when necessary, and angle the blocks flush with the face of the previous course. Glue in place with a concrete adhesive. Repeat these steps until the wall is finished.

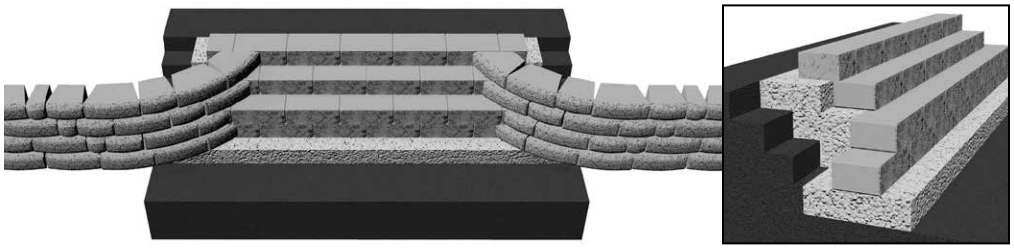


ADDITIONAL COURSES

Beginning in the center, add the third course of steps, lining up the units with the first course.
Overlap a minimum 2 inches and glue in place. Repeat until the steps are finished.

Drainage Tip

Drain pipe can be placed behind the lowest step units at grade or behind each wall adjacent to the steps.

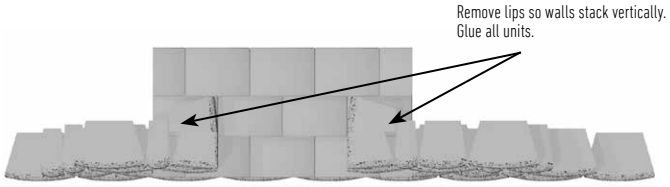


STEPS IN A 90-DEGREE WALL

These drawings show Highland Stone®, Diamond® and Diamond Stone Cut® step units.
Caps or pavers can be used for treads. Check local building codes for any tread depth standards.

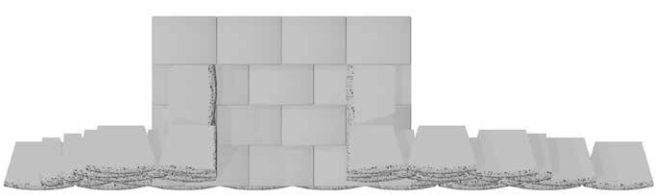
BASE COURSE

Thoroughly compact the leveling pad. Lay out the base course according to the wall design. Place step units first, working from the center to each side. Remember, it is very important to backfill and compact behind and along the sides of each course of step units.



FIRST STEP COURSE

Place the first course of step units directly on top of the base course so there is no setback.
Stagger them from the previous course and glue in place.

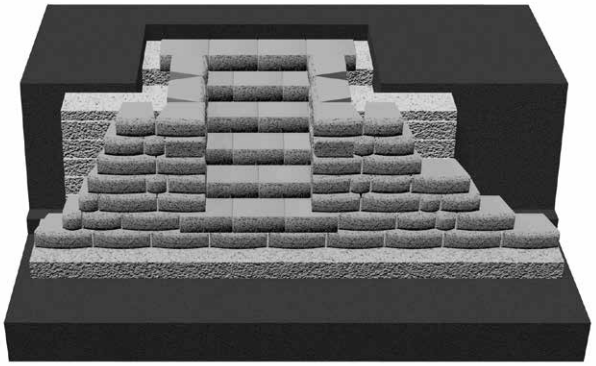


SECOND STEP COURSE

Add the second course of steps, staggering them from the previous course to maintain running bond.
Overlap the lower course by a minimum 2 inches and glue to lower course. Place and compact base material prior to installing next course.

SECOND WALL COURSE

Build the second course of the wall. Corner units are used at the end of steps tied into wall and glued in place. Alternate long and short direction of corner unit every other row.

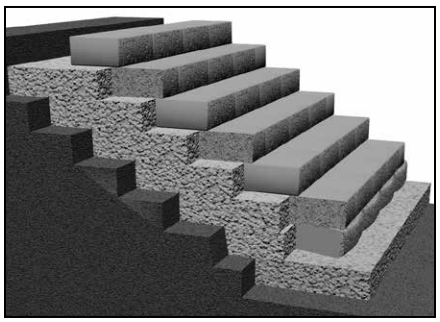


THIRD STEP COURSE

Beginning in the center, add the third course of steps, lining up the units with the first course. Overlap the lower course by 2 inches and glue to lower course.

ADDITIONAL COURSES

Build the third course of the wall.
Repeat these steps until the wall is finished.



Anchorplex® System Construction Guide

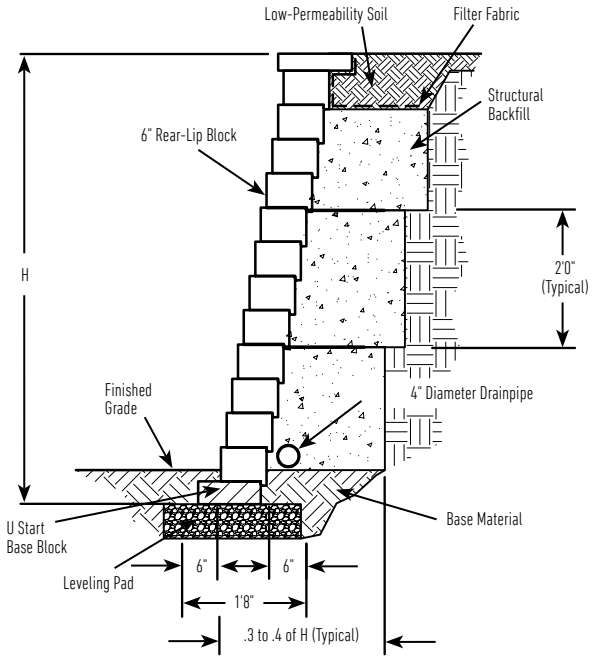
HOW TO USE THIS GUIDE

Use this information to gain a general understanding of the basics of building retaining walls with the Anchorplex system. Do not use this in lieu of construction drawings provided by a qualified engineer. contact the Oldcastle® APG customer care center at 1-877-295-5415 for more information about designing and building with the Anchorplex system.

ABOUT THE ANCHORPLEX® SYSTEM

The Anchorplex system is a retaining wall built with Oldcastle® products and self-compacting structural backfill, also known as "no-fines" concrete, which is a highly-porous mixture of clean stone, cement and water. The mixing ratios (by weight) of aggregate to cementitious material should be between 6:1 and 7:1. The mixing rate (by weight) of water to cementitious material should be no more than 1:2. The resulting material, upon curing, should have at least 25 percent voids.

EXAMPLE: 6" MULTI-PEICE RETAINING WALL SYSTEM USING THE ANCHORPLEX SYSTEM

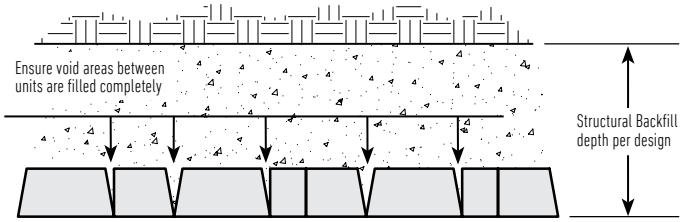


RETAINING WALL CONSTRUCTION

Setting out the wall and excavation is no different for an Anchorplex system construction than for conventional construction, except that the amount of excavation will probably differ. Construction of the leveling pad, base course, subsequent courses and drainage is no different for an Anchorplex system construction than for conventional construction.

INSTALLATION OF STRUCTURAL BACKFILL

After completion of the leveling pad, base course, drainpipe installation and stacking block 2 feet above grade, the first lift of structural backfill that meets Anchor Wall Systems' specifications can be installed. Do not exceed 2 feet vertical stacking of block before placing a lift of structural backfill.



The structural backfill can be placed directly from delivery vehicle or with skid-type loader or other equipment. It should be placed behind the blocks and worked into all voids and cores of the blocks (if applicable). When properly formulated, the structural backfill will not leak through the face of the wall.

After installation of the first lift of structural backfill, install additional courses and repeat the process. Place additional lifts every 8 to 24 inches depending on site conditions and project scale. Subsequent pours can be made as soon as the structural backfill in the previous lift has set — usually within 2 to 3 hours.

INSTALLATION OF FILTER FABRIC

Place a layer of filter fabric over the structural backfill and up the back of the top course and the cap. Then fill behind the top course and cap with low-permeability soil.

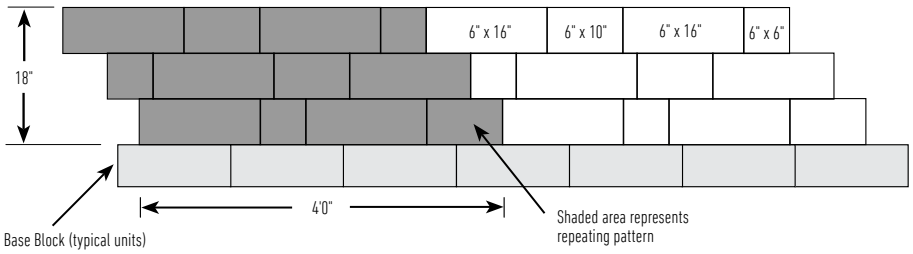
CAPPING & FINISHING

Follow standard practice when capping the wall. Protect the wall with a finish grade at the top and bottom.

Laying Pattern Guide for Multi-Piece Walls

USING A PATTERN FOR SINGLE-HEIGHT RETAINING WALLS

When using a pattern, begin at one edge, laying the units as indicated. Install at least one repeat of the pattern to establish the pattern before proceeding to the next course. Stagger the patterns as shown to avoid vertical bonds.



Blocks required	
6 Sets	
12	6" x 16"
6	6" x 10"
6	6" x 6"

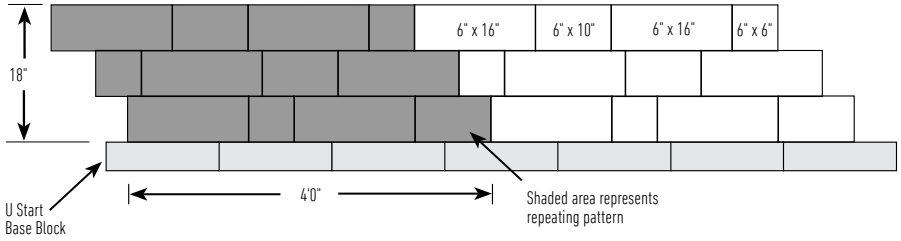
Blocks required	
3 Sets	
6	6" x 16"
3	6" x 10"
3	6" x 6"

One set of 6-inch-high retaining wall blocks consists of 2 large units, 1 medium unit and 1 small unit, and is 2 square feet.

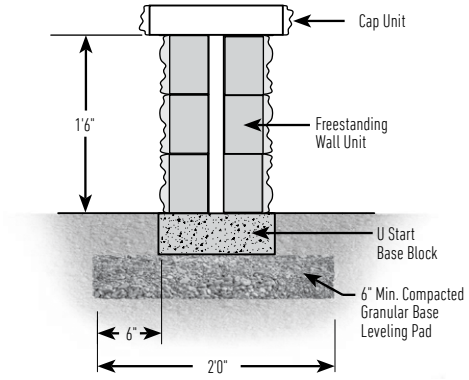
6" Multipiece wall system, 18-inch by 4-foot pattern = 6 sq. ft.

USING A PATTERN FOR FREESTANDING WALLS

One set of 6-inch-high blocks consists of 2 large units, 1 medium unit and 1 small unit, and is 1 square foot of two sided wall.



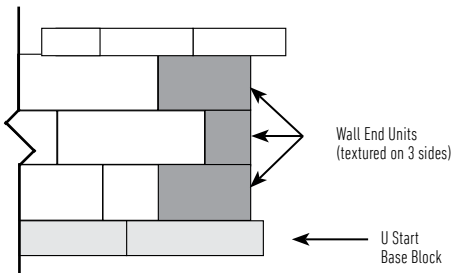
Note: These freestanding wall installation patterns show only one side of the freestanding wall. The same number of blocks are needed to build the other side of a freestanding wall when using Belair Wall 2.0 and Brisa freestanding wall systems. Freestanding wall installation patterns are measured in length by height of one side of the wall, and are expressed in square feet. Sets of blocks required include the number of blocks needed to build both sides of the wall.



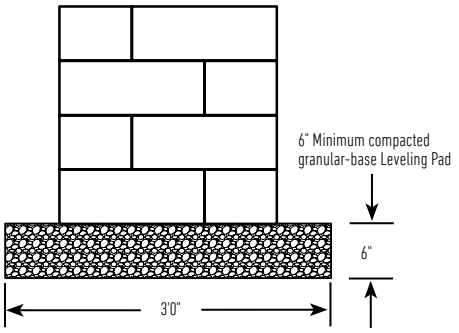
TYPICAL CROSS SECTION

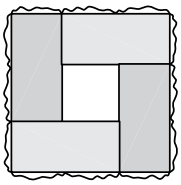
ENDING A WALL WITH WALL ENDS

Start pattern next to a wall end unit if the wall does not end with a column. Every other wall end is cut in half. Glue all pieces in place using concrete adhesive.



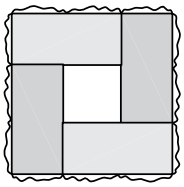
COLUMN CONSTRUCTION



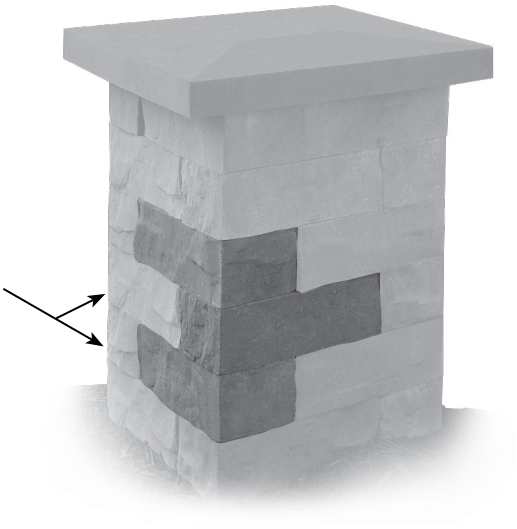


Course A

Stager Corner/Column
Units to maintain bond



Course B

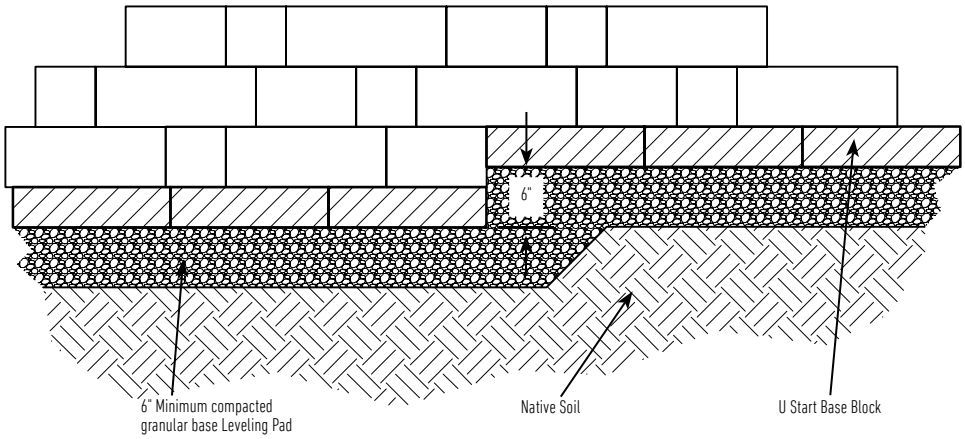


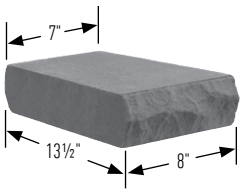
STEPPING UP THE BASE AT LOWEST POINT

Walls built on a sloping grade require a stepped base. Begin excavation at the lowest point and dig a level trench into the slope until it is deep enough to accommodate the base material and height of one entire block.

STEP-UP

At this point, step up the height of one block and begin a new section of base trench.
Continue to step up as needed to top of slope. Always bury at least one full unit at each step.



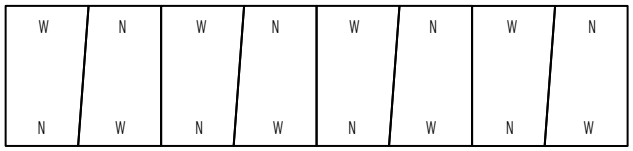


TRAPEZOID DOUBLE-SIDED CAP

The double-sided cap has a right-angle side and an offset-angle side. The caps can be used in any of four directions since there is no specific top or bottom.

STRAIGHT WALL

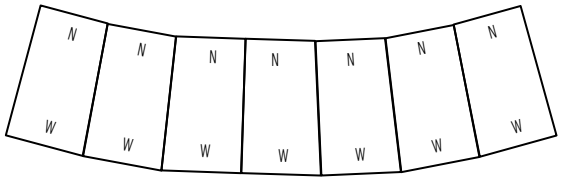
The cap must be laid alternately, narrow (N) and wide (W) faces, for a straight line. Always start capping from the lowest elevation.



CURVES

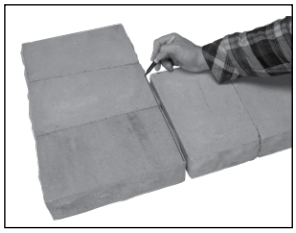
Lay out the cap units side by side with same face facing out (wide faces for outside curves; narrow faces for inside curves). Occasional cutting of some pieces may be necessary.

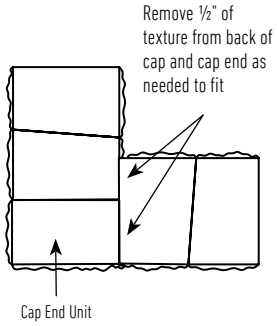
Minimum radius: 7'6"



90-DEGREE CORNERS WITH CAP END

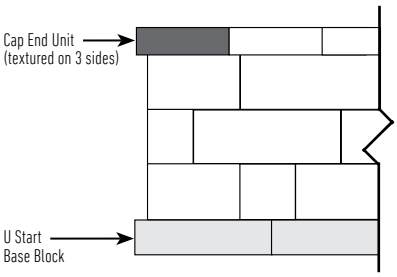
Using a Cap End unit.





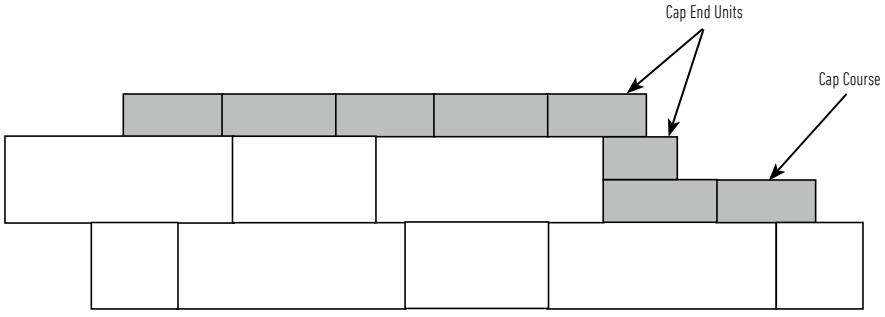
FINISH WITH A CAP END

Do not cut the cap end, cut an interior cap if needed.



STEPPING UP CAPS WITH CAP ENDS

If a wall elevation changes, caps can be stacked where the wall steps up. Begin laying caps at the lowest elevation and work your way toward the next step-up. Cut a cap unit to fit. Place the cut unit directly on top of the capped portion of the wall with the cut side hidden from view. If not using a Cap End, place the trapezoid double-sided cap so that the side with the arrow is hidden.



NOTE: To split a block, use a hydraulic splitter or split manually by using a hammer and chisel to score the block on all sides. Pound the chisel on the same line until the block splits. If partial unit sides are not exposed, use a saw with a diamond blade to achieve a tighter fit.

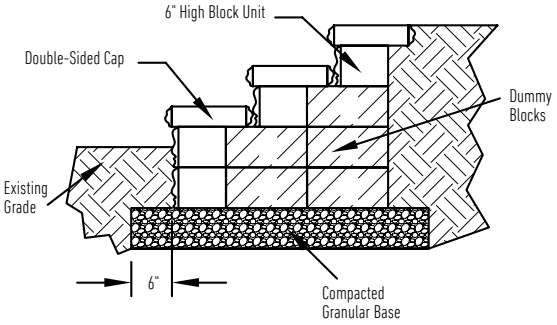
STEP CONSTRUCTION

When constructing steps, you must consider whether it is a fill or a cut-grade situation. Construction is similar, but varies in the amount of dummy units required.

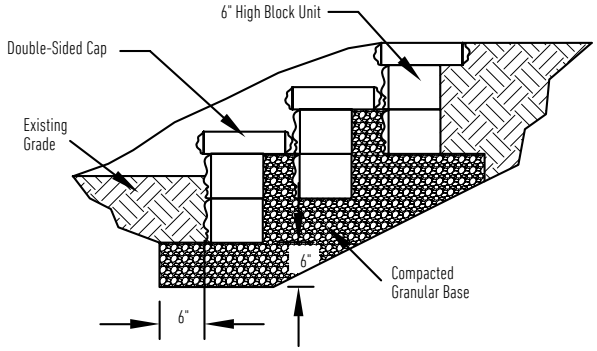
A fill step will have a base course of dummy units in the entire footprint of the steps. For each additional step, add dummy units behind the facing units for stability. There are two methods for creating the step facing. Use sets of either 6-inch-high or 3-inch-high units. A cut-grade set of steps will use one layer of dummy blocks under each step, effectively stepping up the grade.

All applications will require some sort of tread to cover the facing units.

USING FILL SCENARIO



USING CUT SCENARIO



Retaining Wall Installation Best Practices

STEPPING UP THE BASE

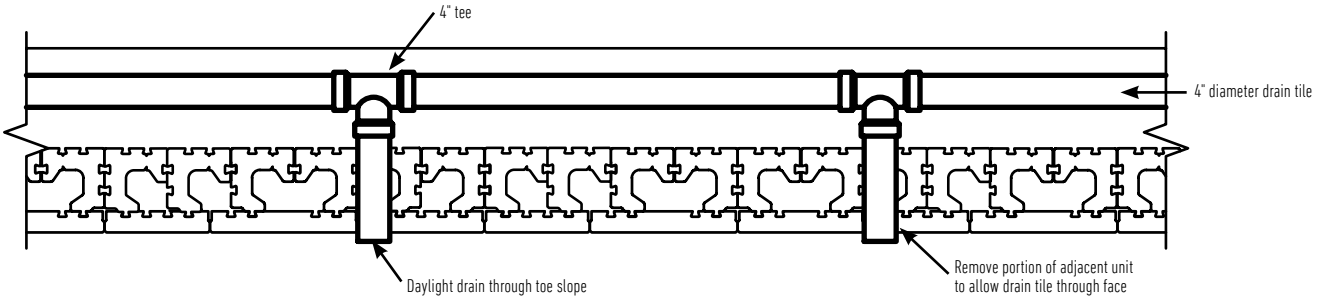
- Walls built on a sloping grade require a stepped base.
- Begin excavation at the lowest point and dig a level trench into the slope until it is deep enough to accommodate the base material and one entire block.
- At this point, step up the height of one block and begin a new section of base trench. Continue to step-up as needed to top of slope. Always bury at least one full unit at each step. See Diagram 7.

Diagram 7—Stepping up the base

DRAINAGE (PER PLAN)

- Each project is unique. The grades on the site will determine at what level to install the drainpipe. Place the drainpipe (4-inch perforated piping) so water drains down and away from the wall into a storm drain, or daylight just above grade. See Diagram 8.
- Fill in the area behind the blocks with clean drainage aggregate, at least 1 foot from the wall. You may need to place and backfill several courses to achieve the proper drainage level.
- The outlet pipes should be spaced not more than every 50 feet and at low points of the wall. In order for the drainage aggregate to function properly, it must keep clear of regular soil fill.

Diagram 8—Daylight



REINFORCED BACKFILL PLACEMENT AND COMPACTION (PER PLAN)

- Place reinforced backfill in 6 to 8 inch loose lifts and compact to the densities specified on the approved wall construction plans. See Diagram 9.
- Only hand-operated compaction equipment is allowed within 3 feet of the back of the wall.
- If the compaction equipment is too small to achieve the required compaction, thinner lifts should be used.
- Install each subsequent course in a similar manner. Repeat procedure to the extent of the wall height.

Diagram 9—Compaction

GEOSYNTHETIC REINFORCEMENT PLACEMENT (PER PLAN) BATTERED WALL INSTALLATION ONLY

- Refer to the approved wall construction plans for the reinforcement type, strength, and placement location. Measure and cut the reinforcement to the lengths shown on the plans.
- Ensure the reinforced backfill is placed and compacted flush with the top of the units and is graded reasonably flat prior to reinforcement placement. Clean any debris off the top layer of blocks prior to reinforcement placement.
- The reinforcement has a primary strength direction, which must be laid perpendicular to the wall face.
- Place the reinforcement within 1 inch of the front of the units. See Diagram 9.
- Apply the next course of blocks to secure the reinforcement in place. Insert Universal Connector into one of the mortise on the back of the modular block to create the proper setback. Pull the reinforcement hand taut and place staples, stakes, or fill at the back of the reinforcement to keep tension during placement of drainage aggregate and reinforced backfill.
- Place a minimum of 6 inches of reinforced backfill prior to operating equipment above the reinforcement. Avoid sudden braking or turning on fill placed over the reinforcement.

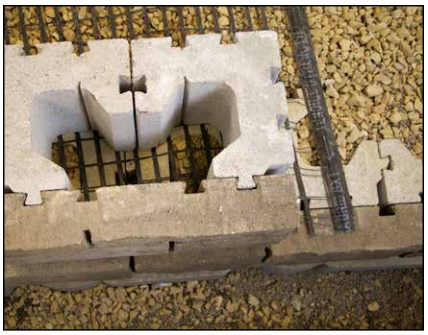


Diagram 9—Action

Diagram 10—Low permeable soil

FINISH GRADE AND SURFACE DRAINAGE

- Protect the wall with a finished grade at the top and bottom. To ensure proper water drainage away from the wall, use 6 inches of soil with low permeability and seed or plant to stabilize the surface. See Diagram 10.
- Consult the wall design engineer if water may be directed behind the wall. If needed, create a swale to divert water away from the wall. This will minimize water seeping into the soil and drainage aggregate behind the wall.

SITE CLEANING AND RESTORATION

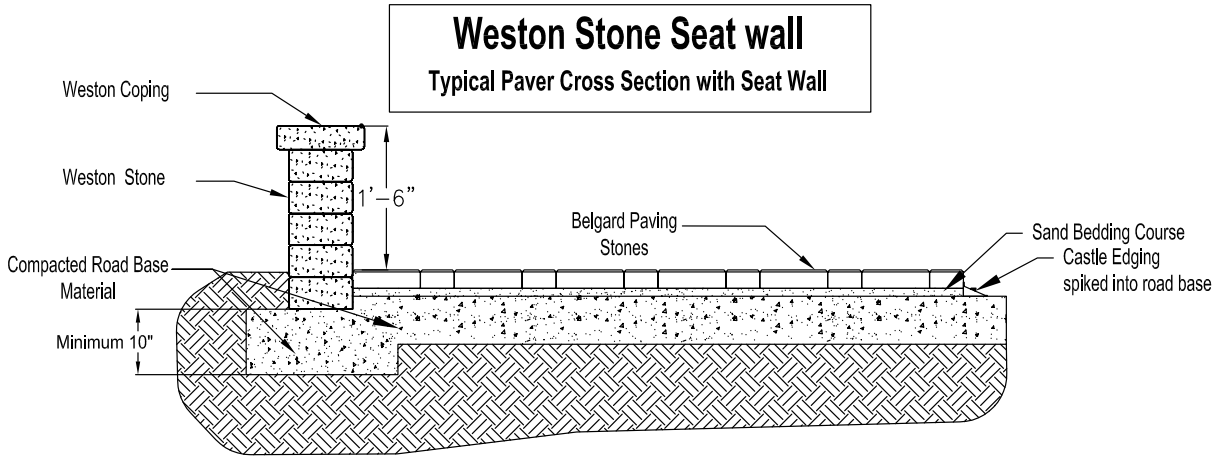
- Brush off the wall and pick up any debris left from the construction process. Notify the job superintendent in writing of the completion and that it is ready for final inspection and acceptance.
- Planting vegetation in front and on top of the wall will help reduce the chance of erosion.
- Following these best practices for construction will ensure the success of your retaining wall system. These instructions are meant as general guidelines. Site-specific conditions may warrant additional installation requirements.
- Oldcastle® APG recommends you consult a professional engineer to design walls over 4 feet high, and have compaction tested by a qualified geotechnical engineer.

Weston Stone™ Installation Instructions

This is a pinless system. Maximum wall height is 2 feet. Contact your Belgard sales representative or dealer for assistance.

Weston Stone wall units must be glued with a quality construction adhesive to develop the necessary mechanical bond. All measurements herein are approximate. Natural materials are used in the manufacturing of this product.

TYPICAL CROSS SECTION WITH WESTON STONE SEAT WALL



Diamond Pro® Air Install Guide

Diagram 1 - Excavation

Diagram 2 - Leveling Pad

Diagram 3 - Base Course

STAKE OUT THE WALL

- A surveyor shall locate the proposed base of wall location. Verify the wall location with the project supervisor.

EXCAVATION

- Excavate for the leveling pad to the lines and grades shown on the approved plans and excavate enough soil behind the wall for the geosynthetic reinforcement material (if required.)
- The trench for the leveling pad should be at least 2 feet wide and a minimum to bury the first course below grade, plus 6 inches for the leveling pad. See Diagram 1.

LEVELING PAD

- An aggregate leveling pad is made of compactible base material of 3/4-inch minus with fines.
- If the planned grade along the wall front will change elevation, the leveling pad may be stepped up by the height of the block (typically 8-inch increments) to match the grade change. Always start at the lowest level and work upward.
- Compact the 6 inch (minimum thickness) aggregate leveling pad, using ordinary compaction methods, to provide a level, hard surface on which to place the base course. Mist lightly with water before compaction, if needed. See Diagram 2.
- For walls with step-ups in the base course, extra care should be given to properly compact the aggregate leveling pad at the step-up locations.

BASE COURSE

- This is the most important step in the installation process.
- Begin laying block at the lowest elevation of the wall, whenever possible.
- Place first block and level, front to back and side to side; lay subsequent blocks in the same manner.
- Use string along back edge of the block to check for proper alignment. See Diagram 3.
- Place the blocks side by side, flush against each other, and make sure the blocks are in full contact with the leveling pad. Level front to back and side to side. See Diagram 4.
- If the wall in on an incline, don't slope the blocks. Step them up so they remain consistently level.
- Place soil in front of the base course and compact after each course is laid.

Diagram 4 - Base Course

Diagram 5 - Core Fill

Diagram 6 - Reinforcement

DEVELOPED BY ANCHOR DIAMOND WALL INDUSTRY EXPERTS

FOR MORE INFO VISIT

Belgard.com/Diamond-Pro-Air

CONSTRUCTION OF THE NEXT COURSE

- Place 12 inches (minimum) of drainage aggregate between, and directly behind the wall units. Fill voids in wall units with free drainage aggregate. Place backfill soil and compact. Only lightweight hand operated compaction equipment is allowed within 3 feet from the back of the wall. See Diagram 5.
- Remove excess fill from top of units before placement of the next course.
- Place the next course of block over the locator lugs using the alignment cores. Align locator lugs into the core of unit. Pull each block forward as far as possible to engage the locator lugs. Maintain running bond with row below.
- On curves, use partial unites to stay on bond. A circular saw with a masonry blade is recommended for cutting partial units. Use safety glasses and other protective equipment when cutting.

DRAINAGE DESIGN (PER DESIGN)

- Each project is unique. The grades on the site will determine at what level to install the drainpipe. Place the drainpipe (4-inch perforated piping) so water drains down and away from the wall into a storm drain, or daylight just above grade.
- Fill in the area behind the blocks with clean drainage aggregate, at least 1 foot from the wall. You may need to place and backfill several courses to achieve the proper drainage level.
- The outlet pipes should be space not more than every 50 feet and at low points of the wall. In order for the drainage aggregate to function properly, it must keep clear of regular soil fill.

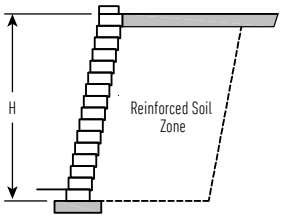
REINFORCED BACKFILL PLACEMENT AND COMPACTION (PER PLAN)

- Place reinforced backfill in 6 to 8 inch loose lifts and compact to the densities specified on the approved wall construction plans.
- Only hand operated compaction equipment is allowed within 3 feet from the back of the wall.
- If the compaction equipment is too small to achieve the required compaction, thinner lifts should be used.
- Install each subsequent course in a similar manner. Repeat procedure to the extent of wall height.

REINFORCEMENT PLACEMENT (PER PLAN)

- Refer to the approved wall construction plans for the reinforcement type, strength, and placement location. Measure and cut the reinforcement to the lengths shown on the plans.
- Ensure the reinforced backfill is placed and compacted flush with the top of the units and is graded reasonably flat prior to reinforcement placement. Clean any debris off the top layer of blocs prior to reinforcement placement.
- The reinforcement has a primary strength direction, which must be laid perpendicular to the wall face.
- Place the reinforcement within 1 inch of the front of the units. See Diagram 6.
- Place the next course of units. Pull the reinforcement hand taut and place staples, stakes, or fill at the back of the reinforcement to maintain reinforcement tension during placement of drainage aggregate and reinforced backfill.
- Place a minimum of 6 inches of reinforced backfill prior to operating equipment above the reinforcement, Avoid sudden braking or turning on fill placed over reinforcement.

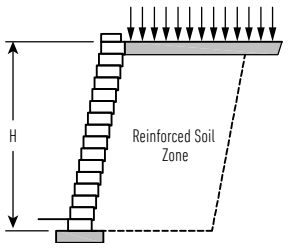
Estimating Chart for Geosynthetic Reinforcement with Diamond® Series, Highland Stone® & Sterling® Wall Retaining Wall Systems



NO SLOPES & NO SURCHARGES

	CLAY & SILT SOILS Φ = 26° γ = 120 pcf (19kN/m³)	SILTY/CLAYEY SAND SOIL Φ = 30° γ = 120 pcf (19kN/m³)	CLEAN SAND AND GRAVEL SOIL Φ = 34° γ = 120 pcf (19kN/m³)
4'-0" (1200mm) 8 courses	4.5-FT (1350mm) 4.5-FT (1350mm) 4.5-FT (1350mm) 4.5-FT (1350mm)	4.0-FT (1350mm) 4.0-FT (1350mm)	4.0-FT (1350mm) 4.0-FT (1350mm)
6'-0" (1800mm) 12 courses	6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm)	5.0-FT (1500mm) 5.0-FT (1500mm) 5.0-FT (1500mm)	4.5-FT (1350mm) 4.5-FT (1350mm) 4.5-FT (1350mm)
8'-0" (2400mm) 16 courses	7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm)	6.0-FT (1800mm) 6.0-FT (1800mm) 6.0-FT (1800mm) 6.0-FT (1800mm)	6.0-FT (1800mm) 6.0-FT (1800mm) 6.0-FT (1800mm) 6.0-FT (1800mm)
10'-0" (3000mm) 20 courses	8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm)	7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm)	7.0-FT (2100mm) 7.0-FT (2100mm) 7.0-FT (2100mm) 7.0-FT (2100mm) 7.0-FT (2100mm)
12'-0" (3600mm) 24 courses	WALL DESIGN TO BE PERFORMED BY A PROFESSIONAL ENGINEER	8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm)	8.0-FT (2400mm) 8.0-FT (2400mm) 8.0-FT (2400mm) 8.0-FT (2400mm) 8.0-FT (2400mm) 8.0-FT (2400mm)

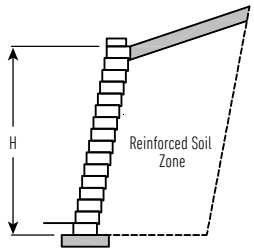
Estimating Chart for Geosynthetic Reinforcement with Diamond® Series, Highland Stone® & Sterling® Wall Retaining Wall Systems



250 PSF SURCHARGE

	CLAY & SILT SOILS $\phi = 26°$ $\gamma = 120$ pcf (19kN/m^3)	SILTY/CLAYEY SAND SOIL $\phi = 30°$ $\gamma = 120$ pcf (19kN/m^3)	CLEAN SAND AND GRAVEL SOIL $\phi = 34°$ $\gamma = 120$ pcf (19kN/m^3)
4'-0" (1200mm) 8 courses	6.0-FT (1800mm) 6.0-FT (1800mm) 6.0-FT (1800mm) 6.0-FT (1800mm)	5.0-FT (1500mm) 5.0-FT (1500mm)	4.0-FT (1350mm) 4.0-FT (1350mm)
6'-0" (1800mm) 12 courses	7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm)	6.0-FT (1800mm) 6.0-FT (1800mm) 6.0-FT (1800mm)	5.0-FT (1500mm) 5.0-FT (1500mm) 5.0-FT (1500mm)
8'-0" (2400mm) 16 courses	8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm)	7.0-FT (2100mm) 7.0-FT (2100mm) 7.0-FT (2100mm) 7.0-FT (2100mm)	6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm)
10'-0" (3000mm) 20 courses	WALL DESIGN TO BE PERFORMED BY A PROFESSIONAL ENGINEER	8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm)	7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm)
12'-0" (3600mm) 24 courses	WALL DESIGN TO BE PERFORMED BY A PROFESSIONAL ENGINEER	9.5-FT (2850mm) 9.5-FT (2850mm) 9.5-FT (2850mm) 9.5-FT (2850mm) 9.5-FT (2850mm) 9.5-FT (2850mm)	8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm)

Estimating Chart for Geosynthetic Reinforcement with Diamond® Series, Highland Stone® & Sterling® Wall Retaining Wall Systems

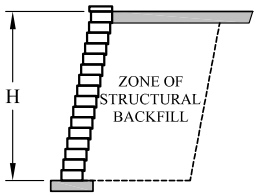


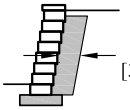
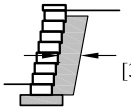
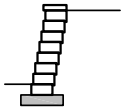
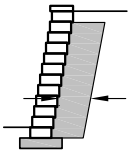
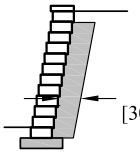
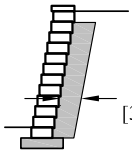
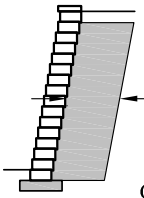
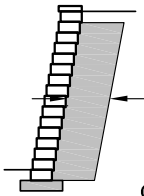
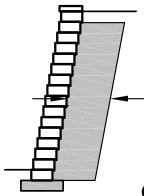
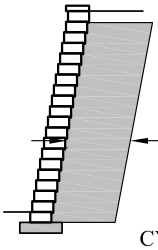
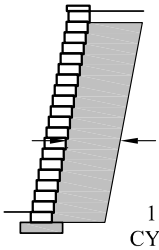
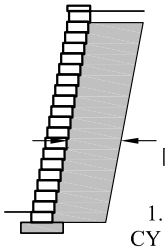
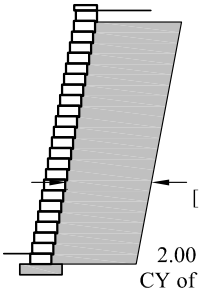
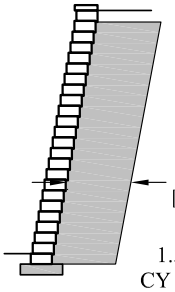
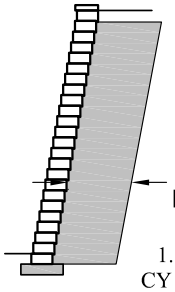
3:1 CREST SLOPE

	CLAY & SILT SOILS Φ = 26° γ = 120 pcf (19kN/m³)	SILTY/CLAYEY SAND SOIL Φ = 30° γ = 120 pcf (19kN/m³)	CLEAN SAND AND GRAVEL SOIL Φ = 34° γ = 120 pcf (19kN/m³)
4'-0" (1200mm) 8 courses	4.5-FT (1350mm) 4.5-FT (1350mm) 4.5-FT (1350mm) 4.5-FT (1350mm)	4.0-FT (1350mm) 4.0-FT (1350mm)	4.0-FT (1350mm) 4.0-FT (1350mm)
6'-0" (1800mm) 12 courses	6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm)	5.5-FT (1550mm) 5.5-FT (1550mm) 5.5-FT (1550mm)	5.0-FT (1500mm) 5.0-FT (1500mm) 5.0-FT (1500mm)
8'-0" (2400mm) 16 courses	8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm)	7.0-FT (2100mm) 7.0-FT (2100mm) 7.0-FT (2100mm) 7.0-FT (2100mm)	6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm) 6.5-FT (1950mm)
10'-0" (3000mm) 20 courses	WALL DESIGN TO BE PERFORMED BY A PROFESSIONAL ENGINEER	8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm) 8.5-FT (2550mm)	7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm) 7.5-FT (2250mm)
12'-0" (3600mm) 24 courses	WALL DESIGN TO BE PERFORMED BY A PROFESSIONAL ENGINEER	11.5-FT (3450mm) 11.5-FT (3450mm) 11.5-FT (3450mm) 11.5-FT (3450mm) 11.5-FT (3450mm) 11.5-FT (3450mm)	9.0-FT (2700mm) 9.0-FT (2700mm) 9.0-FT (2700mm) 9.0-FT (2700mm) 9.0-FT (2700mm) 9.0-FT (2700mm)

Estimating Chart for Structural Backfill Using Grid with Diamond® Series, (6") Highland Stone® Retaining Wall Systems

NO SLOPE / NO SURCHARGE



	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
4'-0" (1200 mm) 6 Courses	 1'-0" [300 mm] 0.22 x Wall Length = CY of Structural Backfill	 1'-0" [300 mm] 0.22 x Wall Length = CY of Structural Backfill	
6'-0" (1800 mm) 9 Courses	 1'-6" [450 mm] 0.44 x Wall Length = CY of Structural Backfill	 1'-0" [300 mm] 0.33 x Wall Length = CY of Structural Backfill	 1'-0" [300 mm] 0.33 x Wall Length = CY of Structural Backfill
8'-0" (2400 mm) 12 Courses	 2'-6" [750 mm] 0.89 x Wall Length = CY of Structural Backfill	 2'-0" [600 mm] 0.74 x Wall Length = CY of Structural Backfill	 2'-0" [600 mm] 0.74 x Wall Length = CY of Structural Backfill
10'-0" (3000 mm) 15 Courses	 3'-0" [900 mm] 1.30 x Wall Length = CY of Structural Backfill	 2'-6" [750 mm] 1.11 x Wall Length = CY of Structural Backfill	 2'-6" [750 mm] 1.11 x Wall Length = CY of Structural Backfill
12'-0" (3600 mm) 18 Courses	 4'-0" [1200 mm] 2.00 x Wall Length = CY of Structural Backfill	 3'-0" [900 mm] 1.56 x Wall Length = CY of Structural Backfill	 3'-0" [900 mm] 1.56 x Wall Length = CY of Structural Backfill

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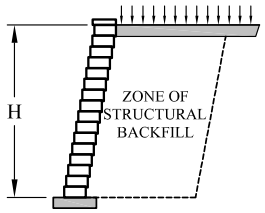
Estimating Chart for Structural Backfill Using Grid with Diamond® Series, (6") Highland Stone® Retaining Wall Systems

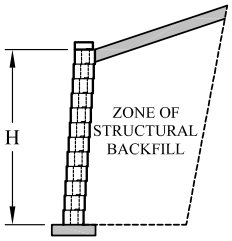
250 PSF SURCHARGE



	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
4'-0" (1200 mm) 6 Courses	2'-6" [750 mm] 0.44 x Wall Length = CY of Structural Backfill	1'-6" [450 mm] 0.30 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.22 x Wall Length = CY of Structural Backfill
6'-0" (1800 mm) 9 Courses	3'-6" [1050 mm] 0.89 x Wall Length = CY of Structural Backfill	2'-0" [600 mm] 0.56 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.33 x Wall Length = CY of Structural Backfill
8'-0" (2400 mm) 12 Courses	4'-0" [1200 mm] 1.33 x Wall Length = CY of Structural Backfill	2'-6" [750 mm] 0.89 x Wall Length = CY of Structural Backfill	2'-0" [600 mm] 0.74 x Wall Length = CY of Structural Backfill
10'-0" (3000 mm) 15 Courses	Wall design to be performed by a professional engineer	3'-0" [900 mm] 1.30 x Wall Length = CY of Structural Backfill	2'-6" [750 mm] 1.11 x Wall Length = CY of Structural Backfill
12'-0" (3600 mm) 18 Courses	Wall design to be performed by a professional engineer	3'-6" [1050 mm] 1.78 x Wall Length = CY of Structural Backfill	3'-0" [900 mm] 1.56 x Wall Length = CY of Structural Backfill

Estimating Chart for Structural Backfill Using Anchorplex System with Diamond® Series, (6") Highland Stone® Retaining Wall Systems

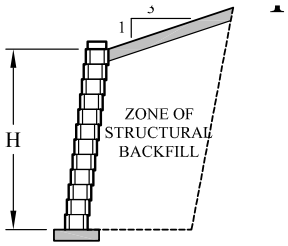
3:1 CREST SLOPE



	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
4'-0" (1200 mm) 6 Courses	2'-0" [600 mm] 0.37 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.22 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.22 x Wall Length = CY of Structural Backfill
6'-0" (1800 mm) 9 Courses	3'-6" [1050 mm] 0.89 x Wall Length = CY of Structural Backfill	1'-6" [450 mm] 0.44 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.33 x Wall Length = CY of Structural Backfill
8'-0" (2400 mm) 12 Courses	5'-0" [1500 mm] 1.63 x Wall Length = CY of Structural Backfill	2'-6" [750 mm] 0.89 x Wall Length = CY of Structural Backfill	2'-0" [600 mm] 0.74 x Wall Length = CY of Structural Backfill
10'-0" (3000 mm) 15 Courses	Wall design to be performed by a professional engineer	3'-0" [900 mm] 1.30 x Wall Length = CY of Structural Backfill	2'-6" [750 mm] 1.11 x Wall Length = CY of Structural Backfill
12'-0" (3600 mm) 18 Courses	Wall design to be performed by a professional engineer	4'-0" [1200 mm] 2.00 x Wall Length = CY of Structural Backfill	3'-0" [900 mm] 1.56 x Wall Length = CY of Structural Backfill

Estimating Chart Structural Backfill Using AnchorPlex® System Diamond Pro® Retaining Walls

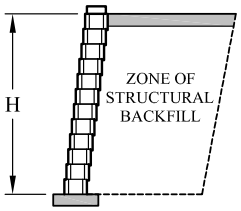
3:1 CREST SLOPE

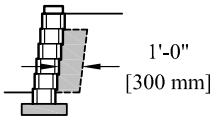
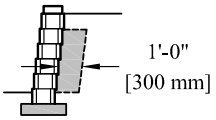
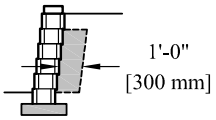
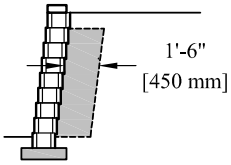
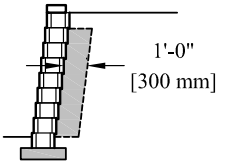
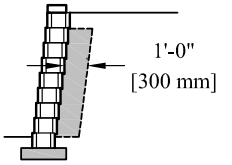
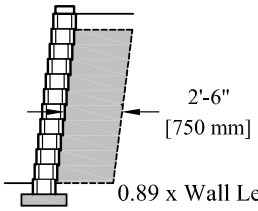
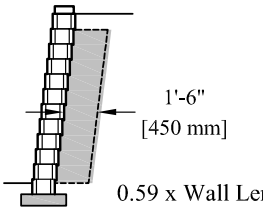
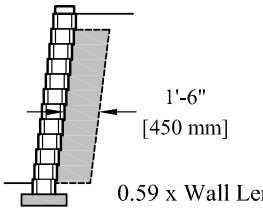
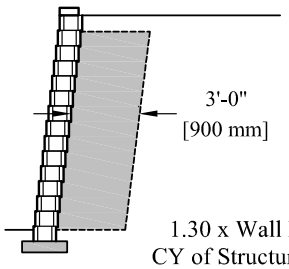
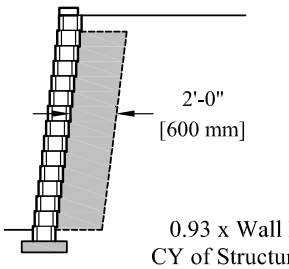
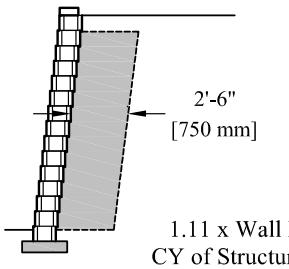
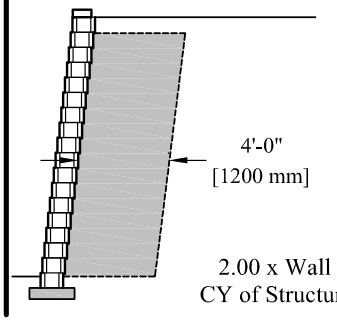
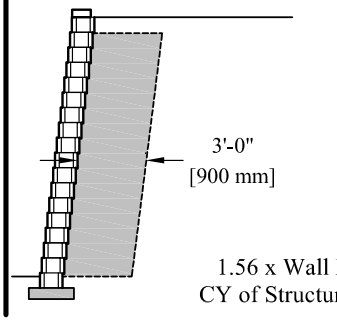
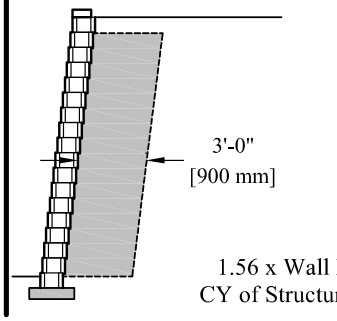


	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
4'-0" (1200 mm) 6 Courses	2'-0" [600 mm] 0.37 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.22 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.22 x Wall Length = CY of Structural Backfill
6'-0" (1800 mm) 9 Courses	3'-6" [1050 mm] 0.89 x Wall Length = CY of Structural Backfill	1'-6" [450 mm] 0.44 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.33 x Wall Length = CY of Structural Backfill
8'-0" (2400 mm) 12 Courses	5'-6" [1650 mm] 1.78 x Wall Length = CY of Structural Backfill	2'-6" [750 mm] 0.89 x Wall Length = CY of Structural Backfill	1'-6" [450 mm] 0.59 x Wall Length = CY of Structural Backfill
10'-0" (3000 mm) 15 Courses	Wall design to be performed by a professional engineer	3'-6" [1050 mm] 1.48 x Wall Length = CY of Structural Backfill	2'-6" [750 mm] 1.11 x Wall Length = CY of Structural Backfill
12'-0" (3600 mm) 18 Courses	Wall design to be performed by a professional engineer	4'-0" [1200 mm] 2.00 x Wall Length = CY of Structural Backfill	3'-0" [900 mm] 1.56 x Wall Length = CY of Structural Backfill

Estimating Chart Structural Backfill Using AnchorPlex® System Diamond Pro® Retaining Walls

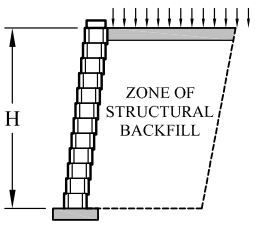
NO SLOPE / NO SURCHARGES



	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
4'-0" (1200 mm) 6 Courses	 0.22 x Wall Length = CY of Structural Backfill	 0.22 x Wall Length = CY of Structural Backfill	 0.22 x Wall Length = CY of Structural Backfill
6'-0" (1800 mm) 9 Courses	 0.44 x Wall Length = CY of Structural Backfill	 0.33 x Wall Length = CY of Structural Backfill	 0.33 x Wall Length = CY of Structural Backfill
8'-0" (2400 mm) 12 Courses	 0.89 x Wall Length = CY of Structural Backfill	 0.59 x Wall Length = CY of Structural Backfill	 0.59 x Wall Length = CY of Structural Backfill
10'-0" (3000 mm) 15 Courses	 1.30 x Wall Length = CY of Structural Backfill	 0.93 x Wall Length = CY of Structural Backfill	 1.11 x Wall Length = CY of Structural Backfill
12'-0" (3600 mm) 18 Courses	 2.00 x Wall Length = CY of Structural Backfill	 1.56 x Wall Length = CY of Structural Backfill	 1.56 x Wall Length = CY of Structural Backfill

Estimating Chart Structural Backfill Using AnchorPlex® System Diamond Pro® Retaining Walls

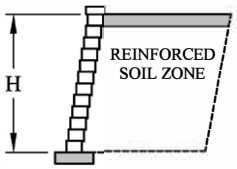
250 PSF SURCHARGE



	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
4'-0" (1200 mm) 6 Courses	2'-6" [750 mm] 0.44 x Wall Length = CY of Structural Backfill	1'-6" [450 mm] 0.30 x Wall Length = CY of Structural Backfill	1'-4" [400 mm] 0.27 x Wall Length = CY of Structural Backfill
6'-0" (1800 mm) 9 Courses	3'-6" [1050 mm] 0.89 x Wall Length = CY of Structural Backfill	2'-0" [600 mm] 0.56 x Wall Length = CY of Structural Backfill	1'-0" [300 mm] 0.22 x Wall Length = CY of Structural Backfill
8'-0" (2400 mm) 12 Courses	4'-0" [1200 mm] 1.33 x Wall Length = CY of Structural Backfill	2'-6" [750 mm] 0.89 x Wall Length = CY of Structural Backfill	1'-6" [450 mm] 0.44 x Wall Length = CY of Structural Backfill
10'-0" (3000 mm) 15 Courses	Wall design to be performed by a professional engineer	3'-0" [900 mm] 1.30 x Wall Length = CY of Structural Backfill	2'-6" [750 mm] 1.11 x Wall Length = CY of Structural Backfill
12'-0" (3600 mm) 18 Courses	Wall design to be performed by a professional engineer	3'-6" [1050 mm] 1.78 x Wall Length = CY of Structural Backfill	3'-0" [900 mm] 1.56 x Wall Length = CY of Structural Backfill

Estimating Chart Geosynthetic Belair Wall® Retaining Walls

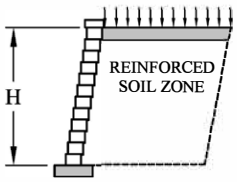
NO SLOPES / NO SURCHARGES



	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
2'-0" (600 mm) 4 Courses	4.0' (1200 mm)	NO REINFORCEMENT REQUIRED	NO REINFORCEMENT REQUIRED
3'-0" (900 mm) 6 Courses	4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm)
4'-0" (1200 mm) 8 Courses	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)
5'-0" (1500 mm) 10 Courses	4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm)	4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm)	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)
6'-0" (1800 mm) 12 Courses	5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm)	5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm)	4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm)

Estimating Chart Geosynthetic Belair Wall® Retaining Walls

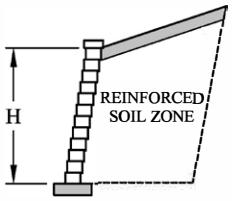
250 PSF SURCHARGE



	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
2'-0" (600 mm) 4 Courses	4.0' (1200 mm)	4.0' (1200 mm)	NO REINFORCEMENT REQUIRED
3'-0" (900 mm) 6 Courses	4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm)
4'-0" (1200 mm) 8 Courses	4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm)	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)
5'-0" (1500 mm) 10 Courses	5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm)	4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm)	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)
6'-0" (1800 mm) 12 Courses	5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm)	5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm)	4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm)

Estimating Chart Geosynthetic Belair Wall® Retaining Walls

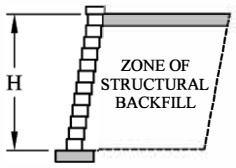
3:1 CREST SLOPE

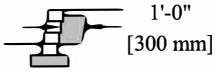
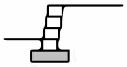
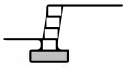
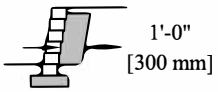
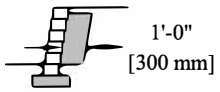
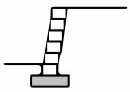
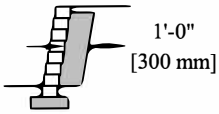
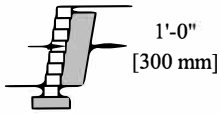
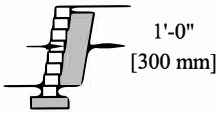
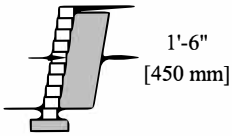
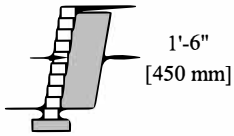
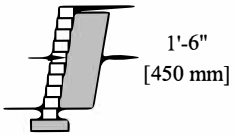
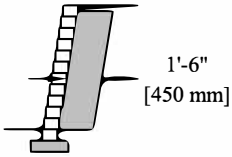
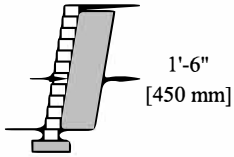
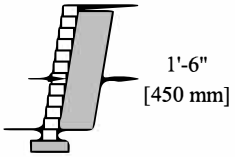


	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
2'-0" (600 mm) 4 Courses	4.0' (1200 mm)	4.0' (1200 mm)	NO REINFORCEMENT REQUIRED
3'-0" (900 mm) 6 Courses	4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm)
4'-0" (1200 mm) 8 Courses	4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm)	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)	4.0' (1200 mm) 4.0' (1200 mm) 4.0' (1200 mm)
5'-0" (1500 mm) 10 Courses	5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm)	5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm)	4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm) 4.5' (1350 mm)
6'-0" (1800 mm) 12 Courses	6.5' (1950 mm) 6.5' (1950 mm) 6.5' (1950 mm) 6.5' (1950 mm) 6.5' (1950 mm)	5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm) 5.5' (1650 mm)	5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm) 5.0' (1500 mm)

Estimating Chart Structural Backfill Using AnchorPlex® System Belair Wall® Retaining Walls

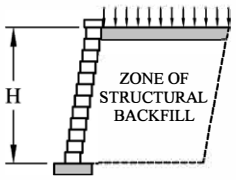
NO SLOPE / NO SURCHARGE

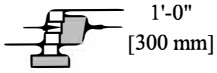
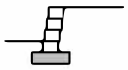
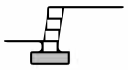
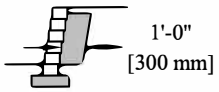
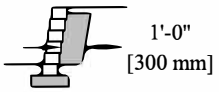
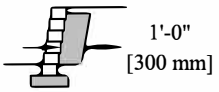
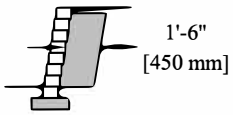
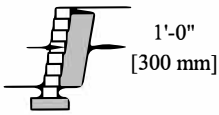
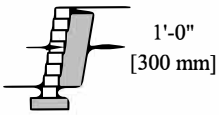
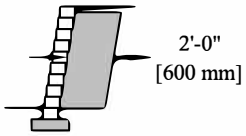
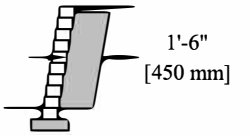
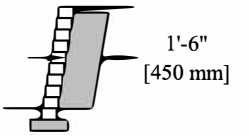
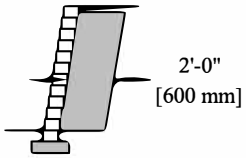
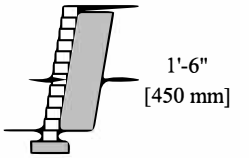
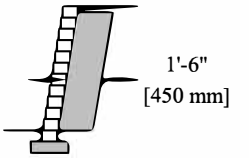


	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
2'-0" (600 mm) 4 Courses	 0.08 x Wall Length = CY of Structural Backfill		
3'-0" (900 mm) 6 Courses	 0.12 x Wall Length = CY of Structural Backfill	 0.12 x Wall Length = CY of Structural Backfill	
4'-0" (1200 mm) 8 Courses	 0.16 x Wall Length = CY of Structural Backfill	 0.16 x Wall Length = CY of Structural Backfill	 0.16 x Wall Length = CY of Structural Backfill
5'-0" (1500 mm) 10 Courses	 0.29 x Wall Length = CY of Structural Backfill	 0.29 x Wall Length = CY of Structural Backfill	 0.29 x Wall Length = CY of Structural Backfill
6'-0" (1800 mm) 12 Courses	 0.35 x Wall Length = CY of Structural Backfill	 0.35 x Wall Length = CY of Structural Backfill	 0.35 x Wall Length = CY of Structural Backfill

Estimating Chart Structural Backfill Using AnchorPlex® System Belair Wall® Retaining Walls

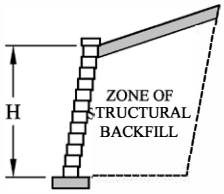
250 PSF SURCHARGE

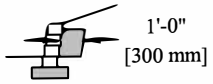
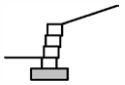
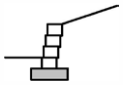
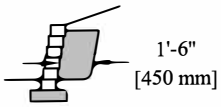
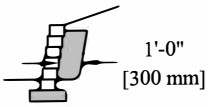
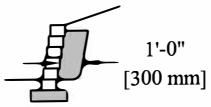
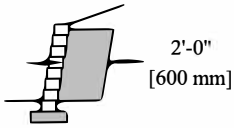
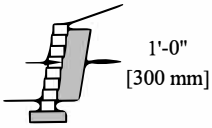
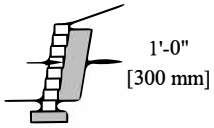
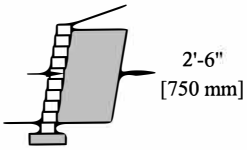
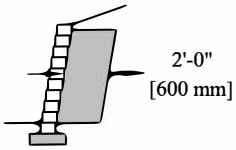
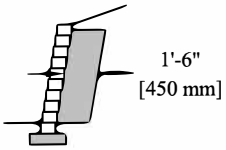
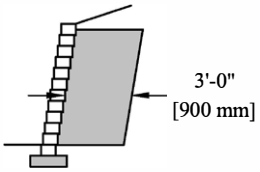
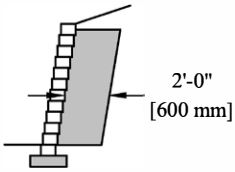
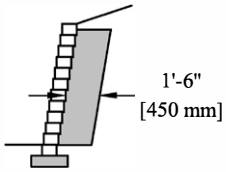


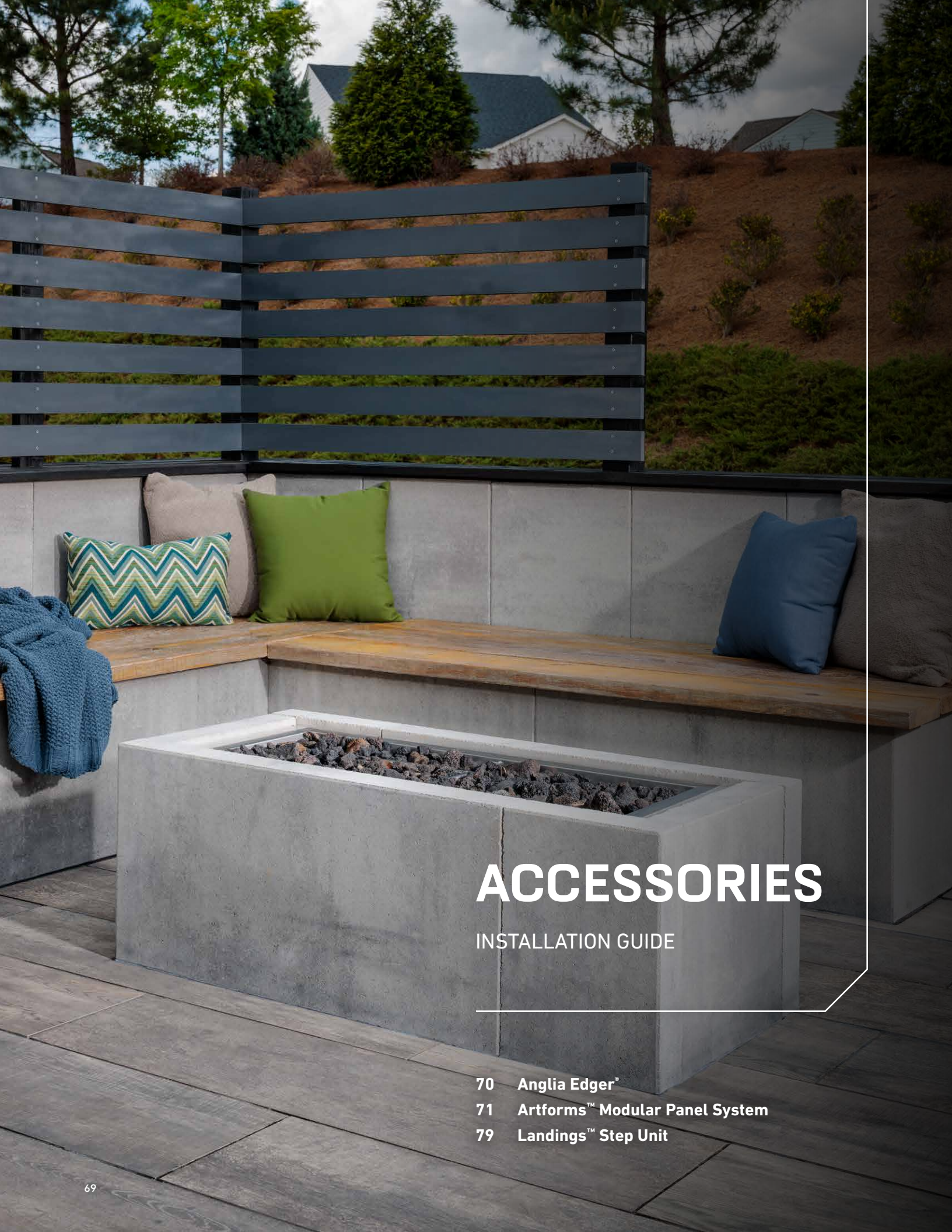
	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
2'-0" (600 mm) 4 Courses	 0.08 x Wall Length = CY of Structural Backfill		
3'-0" (900 mm) 6 Courses	 0.12 x Wall Length = CY of Structural Backfill	 0.12 x Wall Length = CY of Structural Backfill	 0.12 x Wall Length = CY of Structural Backfill
4'-0" (1200 mm) 8 Courses	 0.24 x Wall Length = CY of Structural Backfill	 0.16 x Wall Length = CY of Structural Backfill	 0.16 x Wall Length = CY of Structural Backfill
5'-0" (1500 mm) 10 Courses	 0.39 x Wall Length = CY of Structural Backfill	 0.29 x Wall Length = CY of Structural Backfill	 0.29 x Wall Length = CY of Structural Backfill
6'-0" (1800 mm) 12 Courses	 0.46 x Wall Length = CY of Structural Backfill	 0.35 x Wall Length = CY of Structural Backfill	 0.35 x Wall Length = CY of Structural Backfill

Estimating Chart Structural Backfill Using AnchorPlex® System Belair Wall® Retaining Walls

3:1 CREST SLOPE



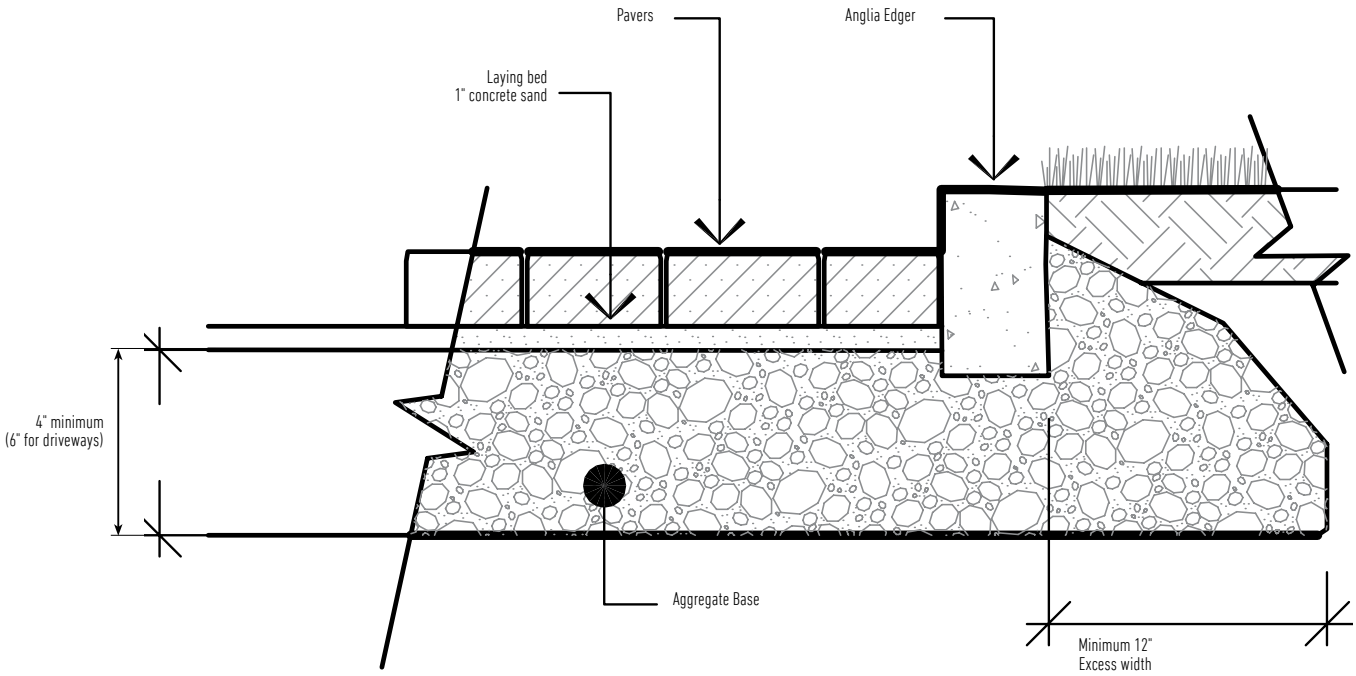
	Clay and Silt Soils φ = 26° γ = 120 pcf (19 kN/m^3)	Silty / Clayey Sand Soil φ = 30° γ = 120 pcf (19 kN/m^3)	Clean Sand and Gravel Soil φ = 34° γ = 120 pcf (19 kN/m^3)
2'-0" (600 mm) 4 Courses	 0.08 x Wall Length = CY of Structural Backfill		
3'-0" (900 mm) 6 Courses	 0.18 x Wall Length = CY of Structural Backfill	 0.12 x Wall Length = CY of Structural Backfill	 0.12 x Wall Length = CY of Structural Backfill
4'-0" (1200 mm) 8 Courses	 0.31 x Wall Length = CY of Structural Backfill	 0.16 x Wall Length = CY of Structural Backfill	 0.16 x Wall Length = CY of Structural Backfill
5'-0" (1500 mm) 10 Courses	 0.48 x Wall Length = CY of Structural Backfill	 0.39 x Wall Length = CY of Structural Backfill	 0.29 x Wall Length = CY of Structural Backfill
6'-0" (1800 mm) 12 Courses	 0.69 x Wall Length = CY of Structural Backfill	 0.46 x Wall Length = CY of Structural Backfill	 0.35 x Wall Length = CY of Structural Backfill

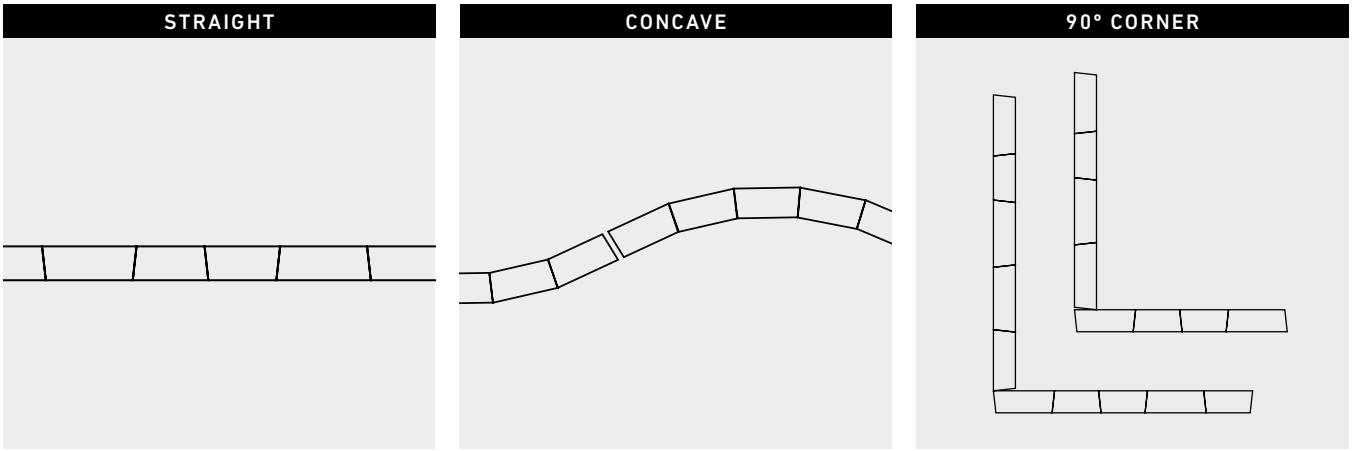


ACCESSORIES

INSTALLATION GUIDE

Anglia Edger® Installation Instructions

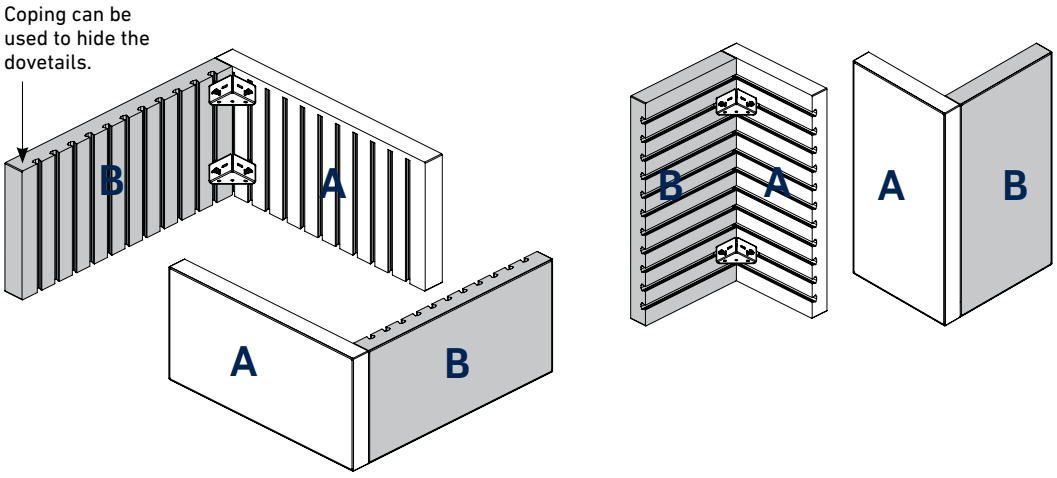




Artforms™ Panel Configurations

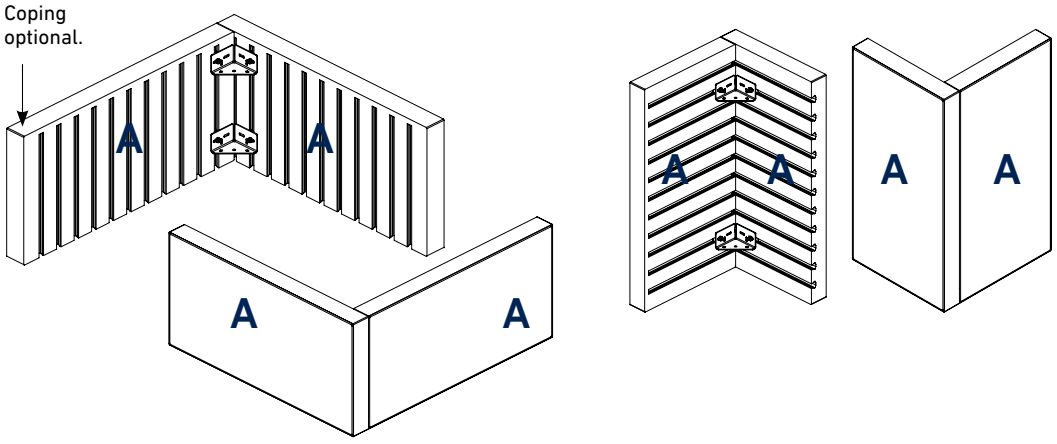
IDEAL:

This configuration uses equal number of panel A and panel B.



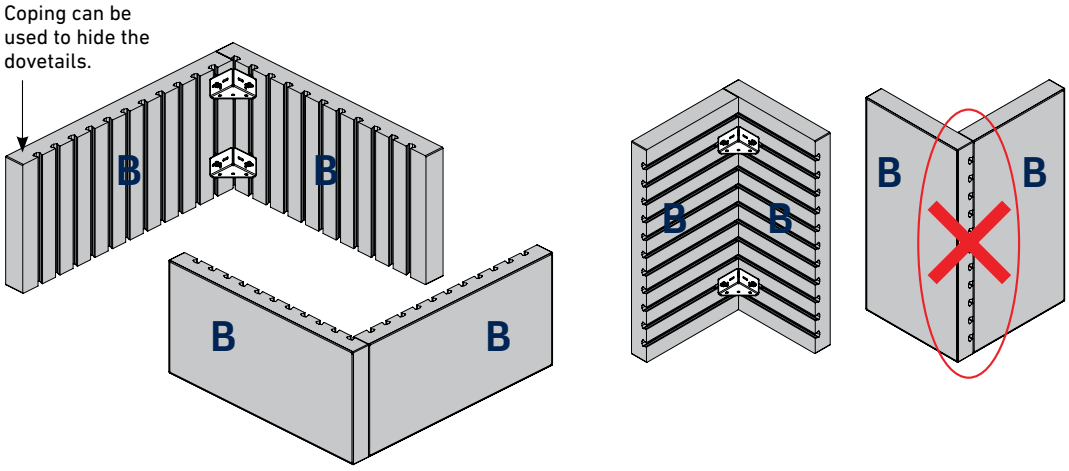
NOT OPTIMAL:

This configuration uses panel A only.



NOT RECOMMENDED:

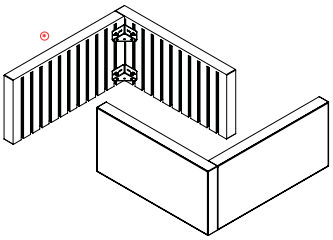
This configuration uses panel B only and the dovetails are exposed. Use ideal configuration as shown above.

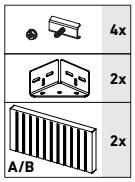


*IMPORTANT: When planning configurations, consider the amount of panel A and panel B on a pallet. 18 x 36" panels are sold in pair/layer or in full pallet only. 6 x 36 panels are sold in layer or in full pallet only.

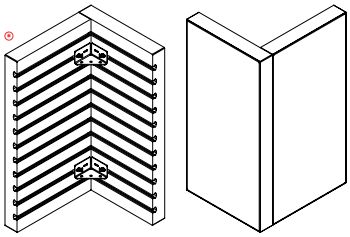
OUTER CORNER INSTALLATION

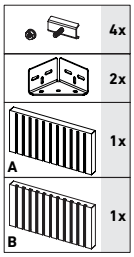
HORIZONTAL PANELS

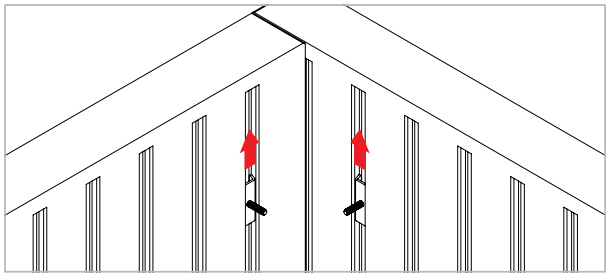


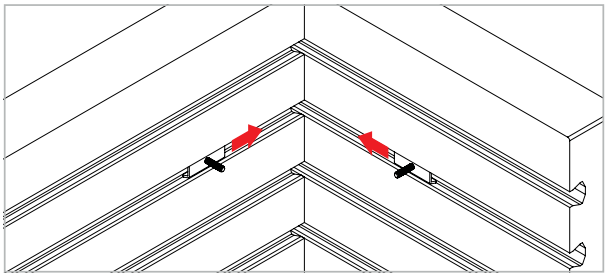


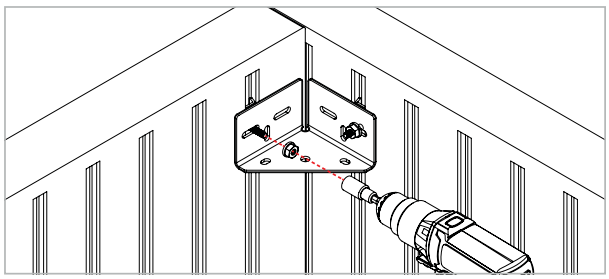
VERTICAL PANELS

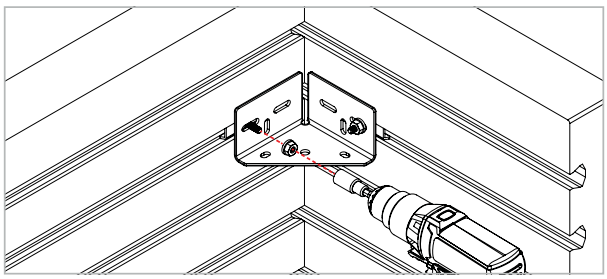








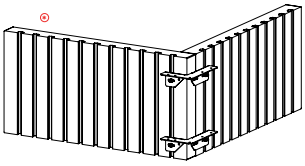


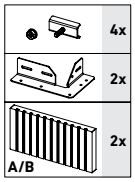


IMPORTANT: Always use a minimum of 2 outer corner brackets per corner assembly.

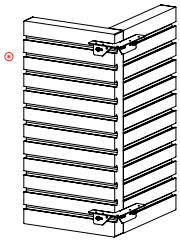
INNER CORNER INSTALLATION

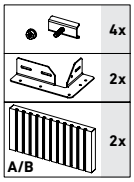
HORIZONTAL PANELS

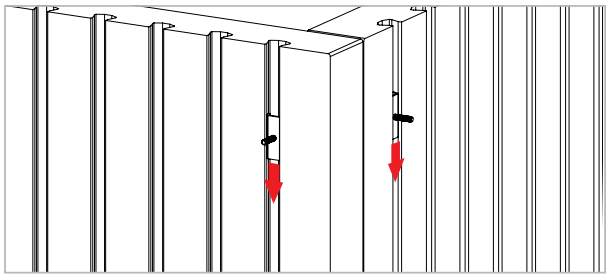


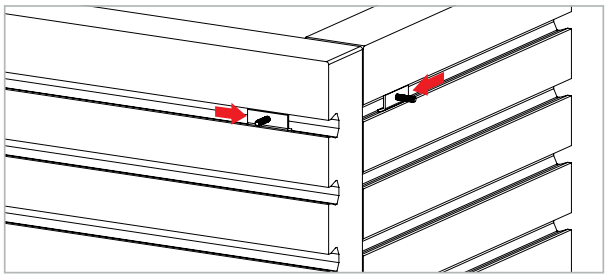


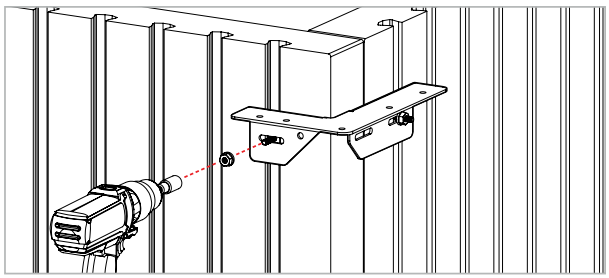
VERTICAL PANELS

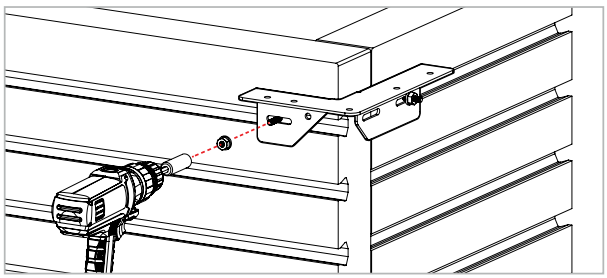








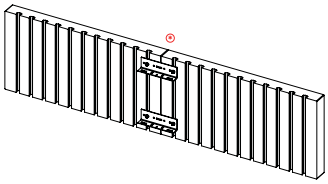


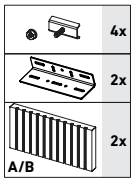


IMPORTANT: Always use a minimum of 2 outer corner brackets per corner assembly.

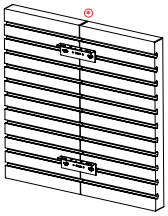
JOINING PLATE INSTALLATION

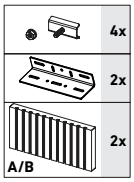
HORIZONTAL PANELS

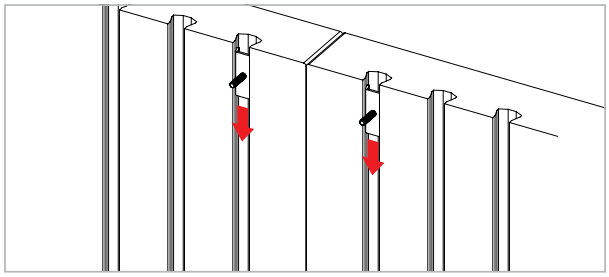


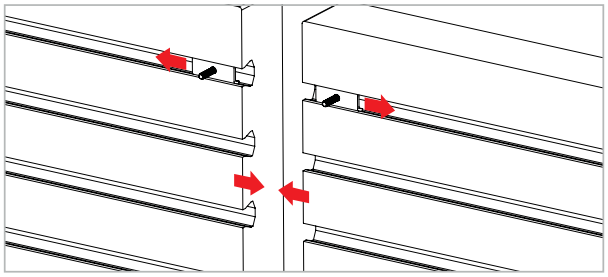


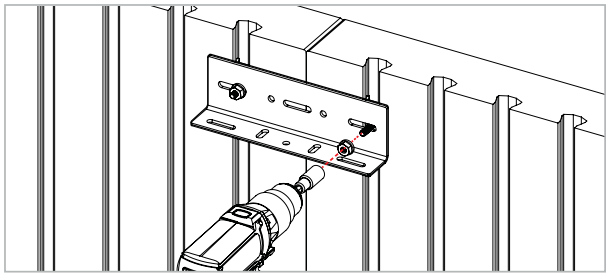
VERTICAL PANELS

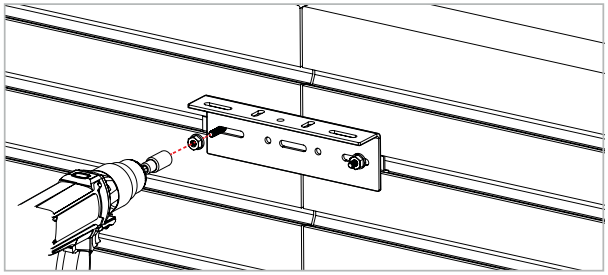








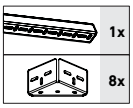


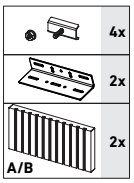


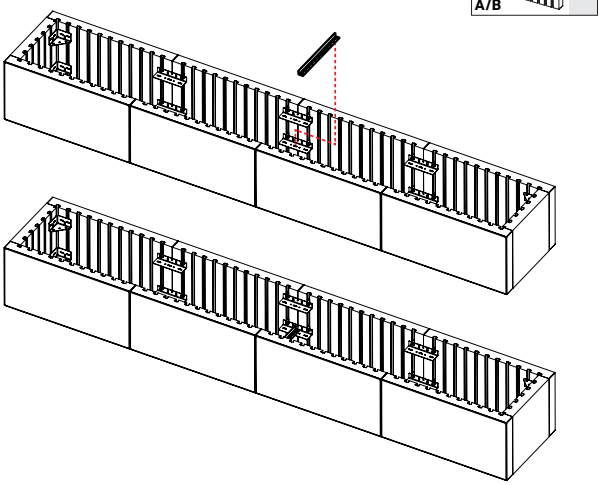
IMPORTANT: Always use a minimum of 2 joining plates when joining two parallel panels.

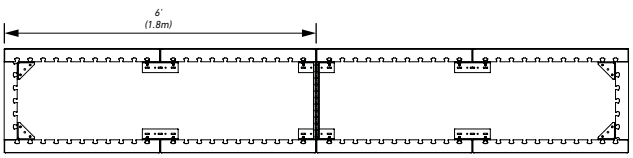
STRETCHER BAR INSTALLATION

HORIZONTAL PANELS

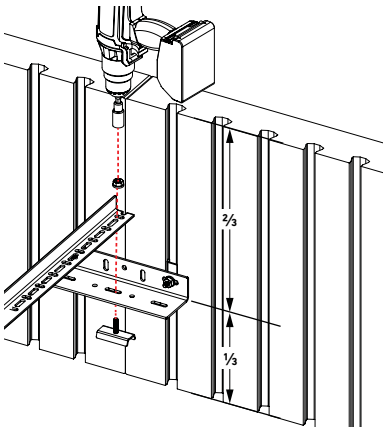




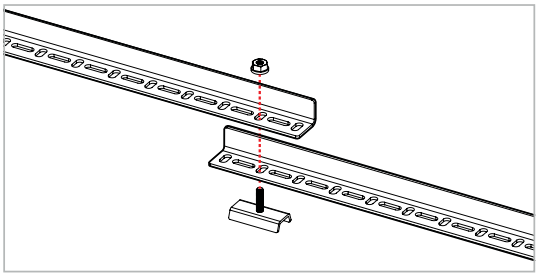




The stretcher bar keeps parallel 2 sets of panels facing each other. It is recommended to attach the stretcher bar to the joining plate every 6ft (1.8m). Place it at ⅓ of the total height from the bottom of assembly. The stretcher bar must be cut to fit distance between 2 sets of panels.

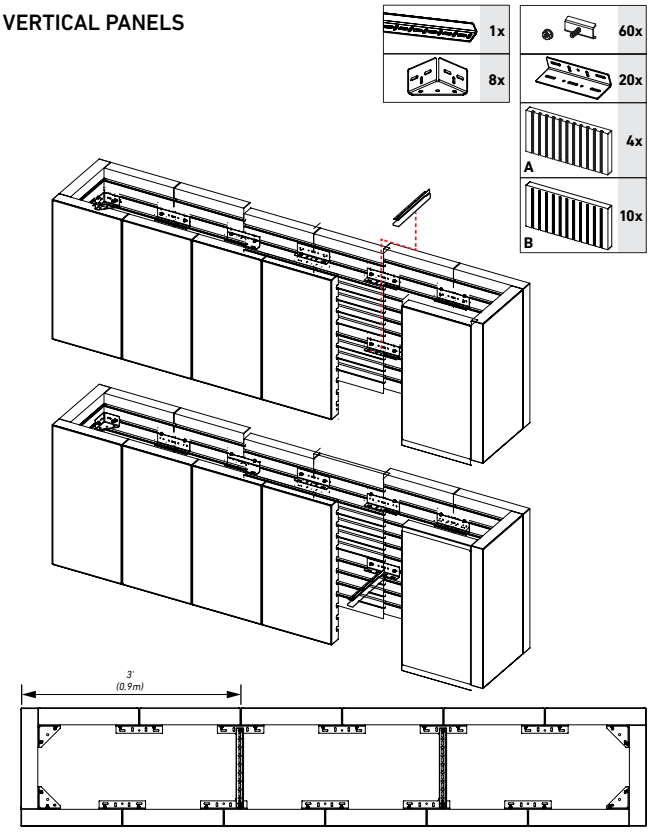


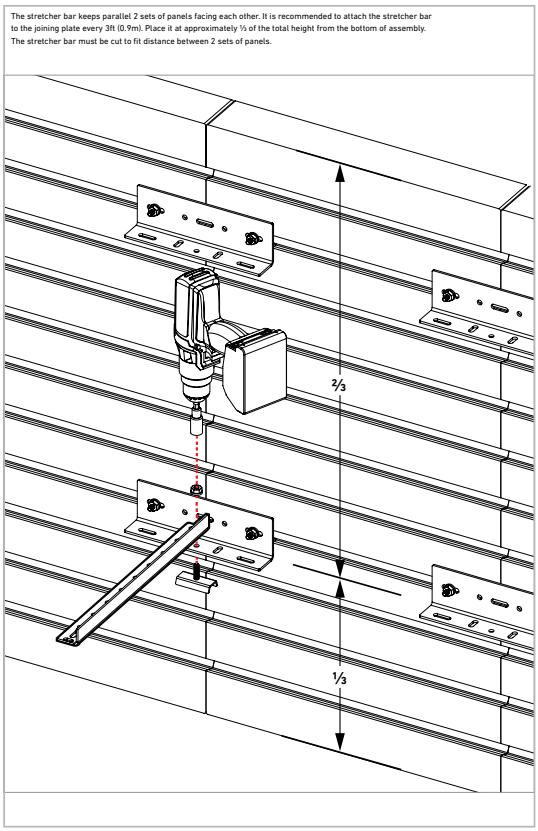
NOTE: The stretcher bar can be extended.



STRETCHER BAR INSTALLATION

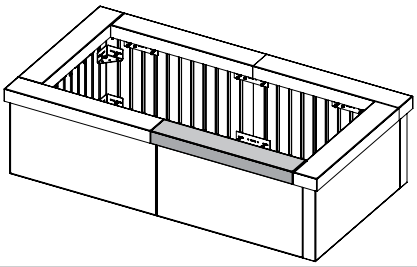
VERTICAL PANELS

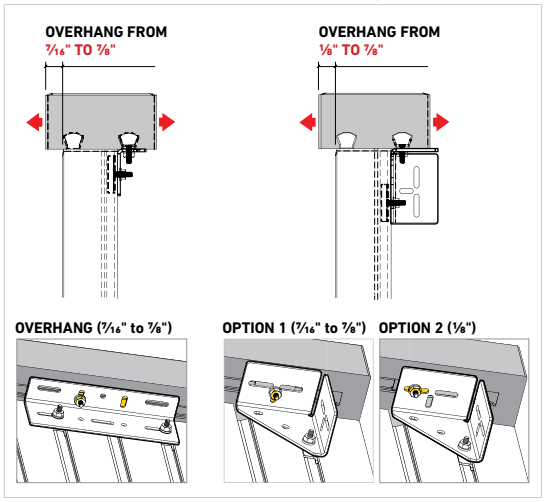




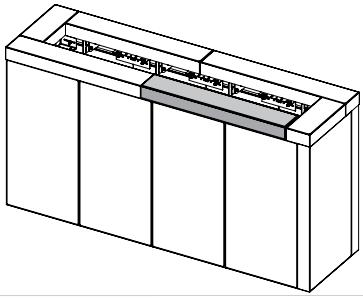
6 X 36 PANEL - COPING INSTALLATION (MECHANICALLY FIXED)

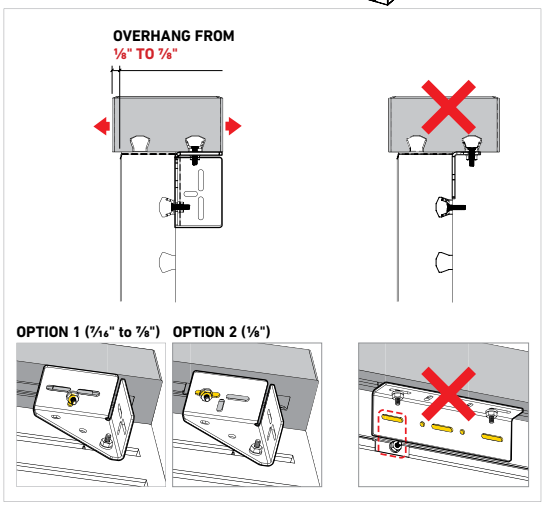
18 x 36 x 3 HORIZONTAL PANELS



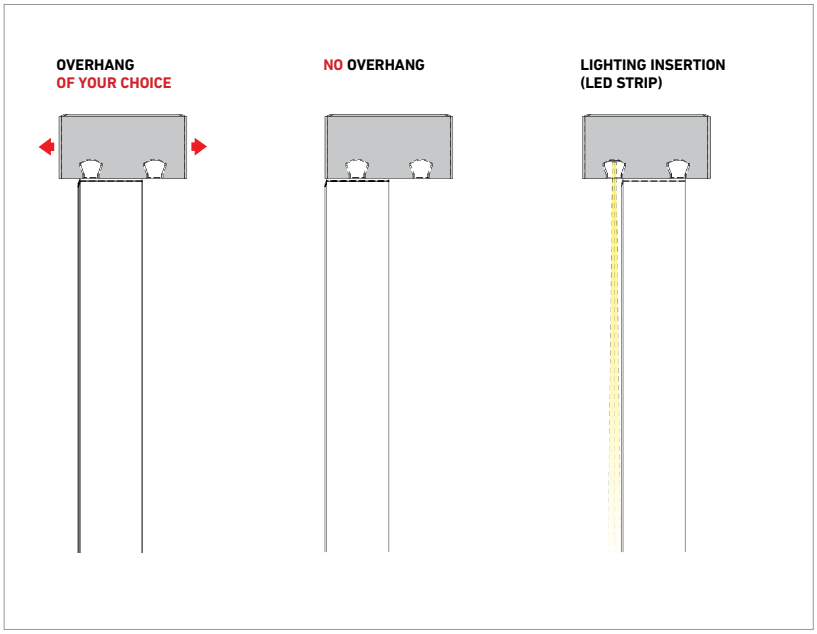


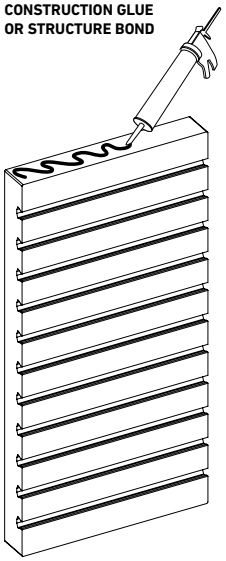
18 x 36 x 3 VERTICAL PANELS



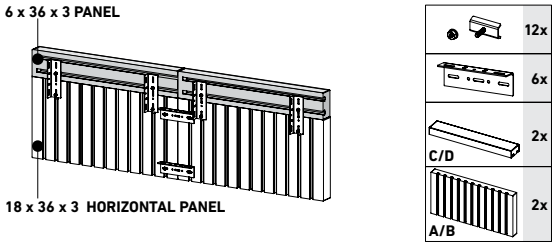


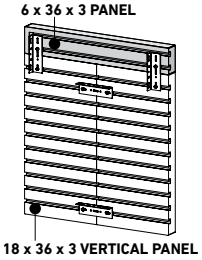
6 X 36 PANEL - COPING INSTALLATION (FIXED WITH ADHESIVE)

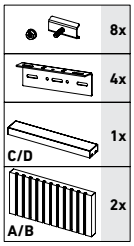


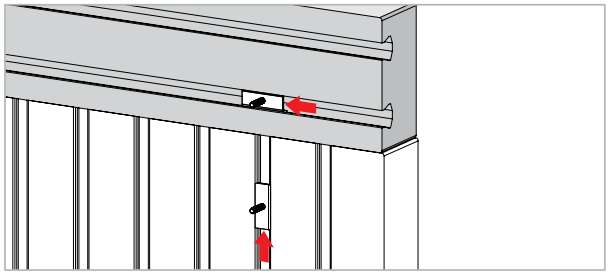


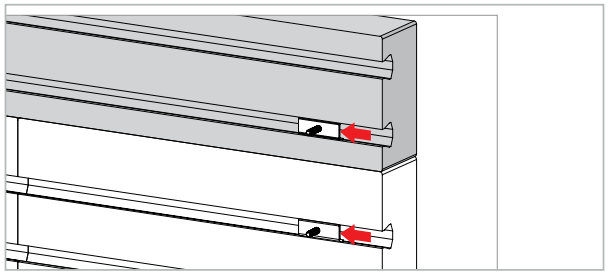
6 X 36 PANEL - ACCENT INSTALLATION

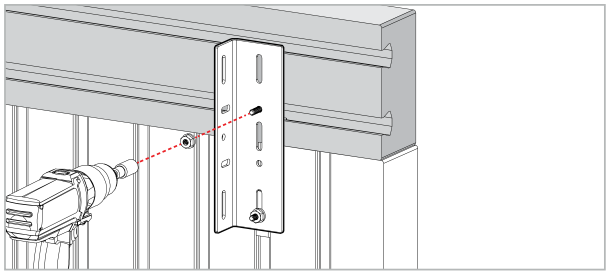


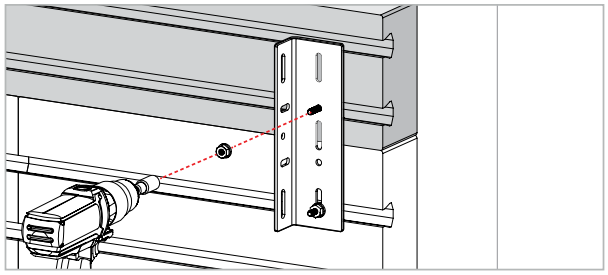






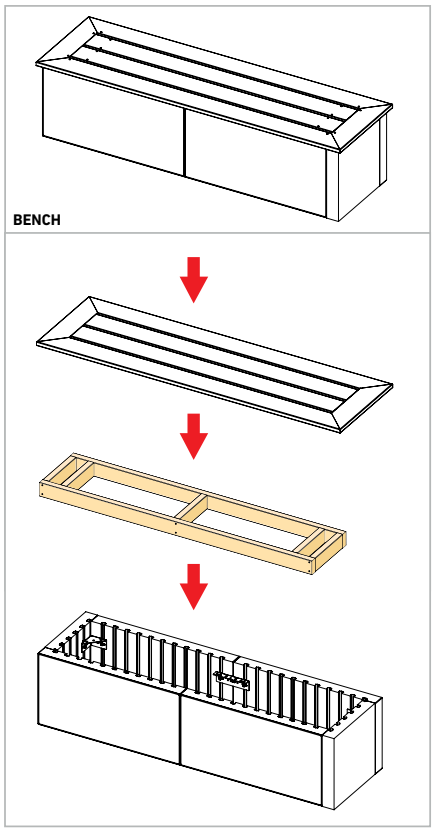


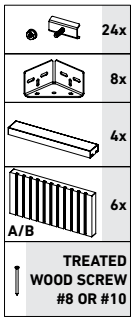


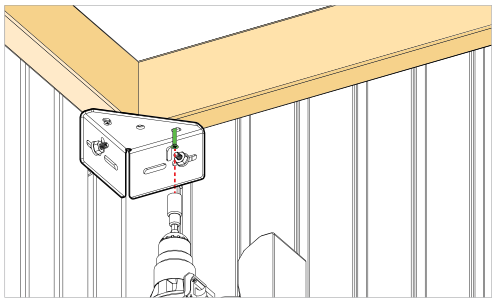


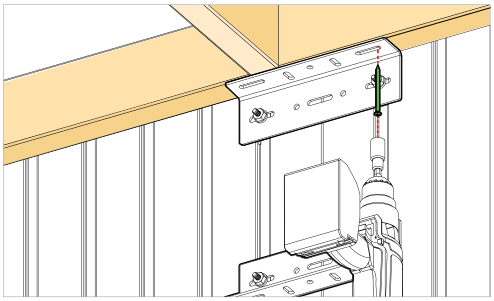
IMPORTANT: Always use a minimum of 2 joining plates when joining 6 x 36 panel with 18 x 36 panel.

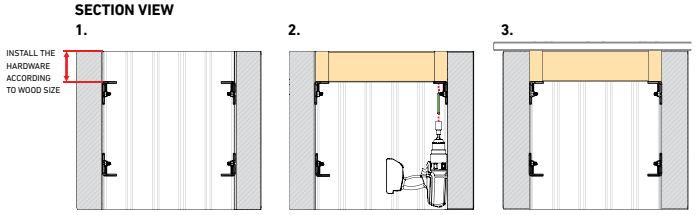
INTEGRATING WOOD





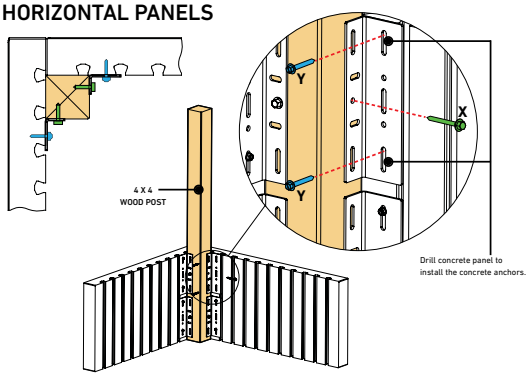


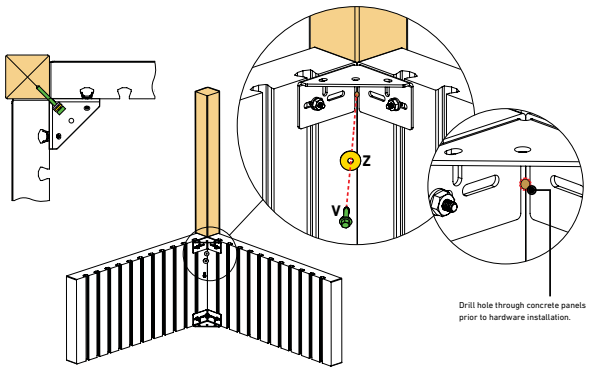




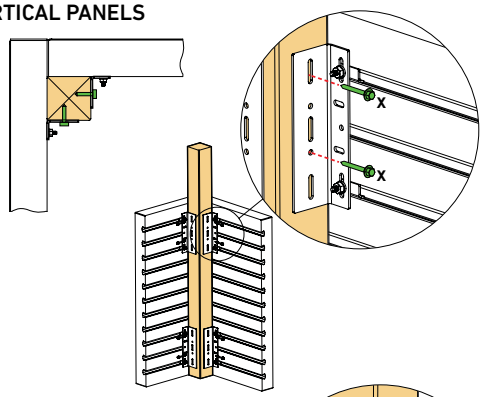
INTEGRATING 4 X 4 WOOD POSTS

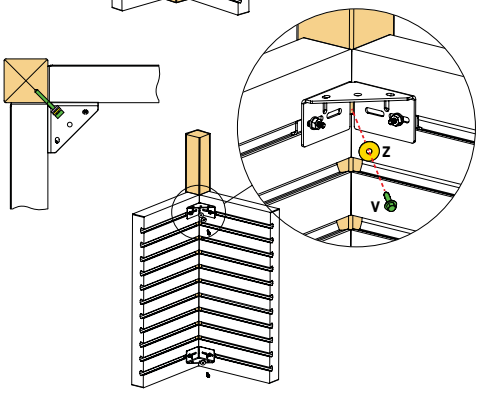
HORIZONTAL PANELS





VERTICAL PANELS



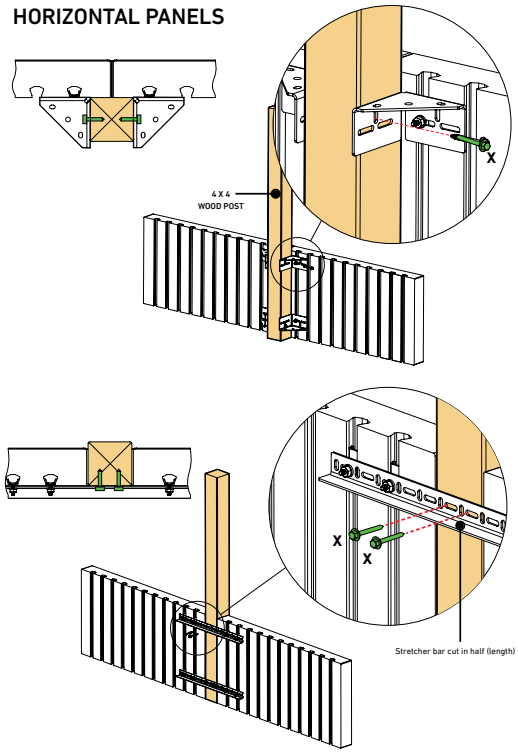


X- Stainless Steel Wood Screw Flat Head #10 x 2½
Y- Treated Concrete Anchor (Tapcon®) ¼ x 1¾ or ³⁄₁₆ x 1¾
V- Stainless Steel Lag screws ¼ x 2½ or ⁵⁄₁₆ x 2½
Z- Stainless Steel Oversized Washer ⁵⁄₁₆

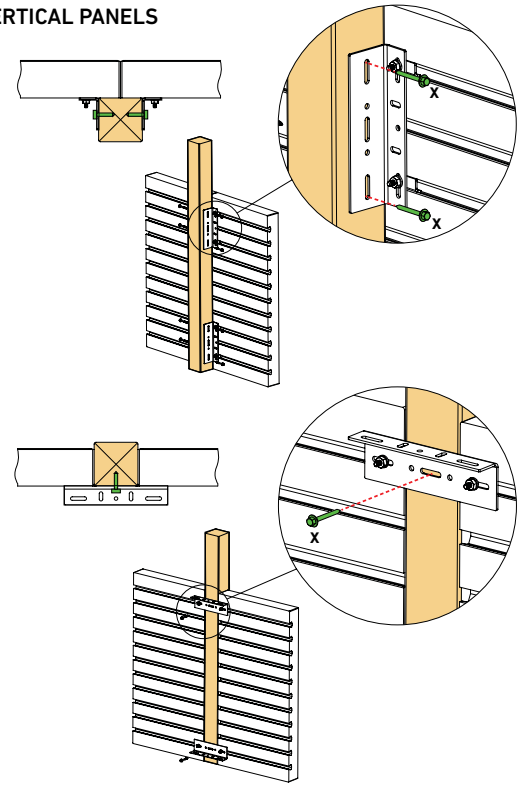
IMPORTANT: Other types of hardware (not included) may be required to make these assemblies (wood screws, concrete anchors, etc.). BELGARD is not responsable for any issue regarding other materials, accessories, other types of hardware, etc. We recommend consulting an expert/engineer to determine the design limitations of the screen panels based on wind loads.

INTEGRATING 4 X 4 WOOD POSTS

HORIZONTAL PANELS



VERTICAL PANELS

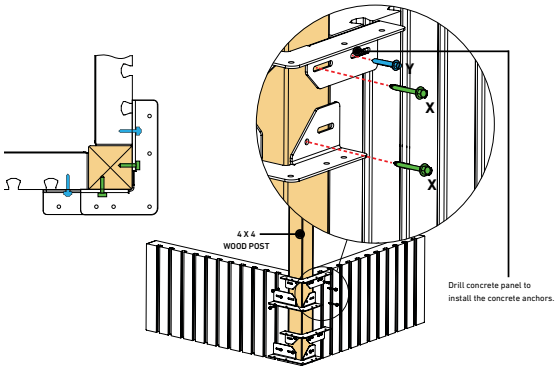


X- Stainless Steel Wood Screw Flat Head #10 x 2½
Y- Treated Concrete Anchor (Tapcon®) ¼ x 1¾ or ³⁄₁₆ x 1¾
V- Stainless Steel Lag screws ¼ x 2½ or ⁵⁄₁₆ x 2½
Z- Stainless Steel Oversized Washer ⁵⁄₁₆

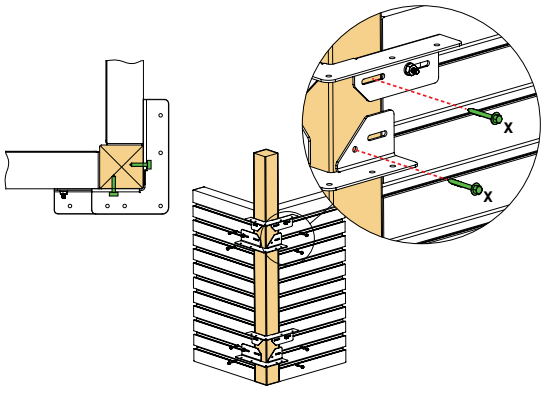
IMPORTANT: Other types of hardware (not included) may be required to make these assemblies (wood screws, concrete anchors, etc.). BELGARD is not responsable for any issue regarding other materials, accessories, other types of hardware, etc. We recommend consulting an expert/engineer to determine the design limitations of the screen panels based on wind loads.

INTEGRATING 4 X 4 WOOD POSTS

HORIZONTAL PANELS



VERTICAL PANELS



X- Stainless Steel Wood Screw Flat Head #10 x 2½
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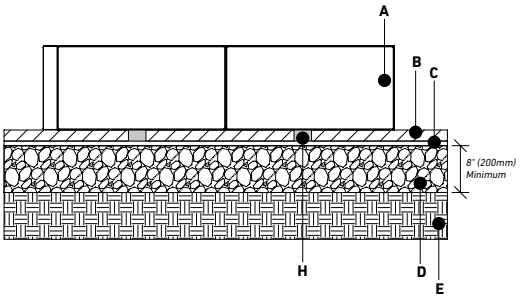
V- Stainless Steel Lag screws ¼ x 2½ or ⁵⁄₁₆ x 2½
Z- Stainless Steel Oversized Washer ⁵⁄₁₆

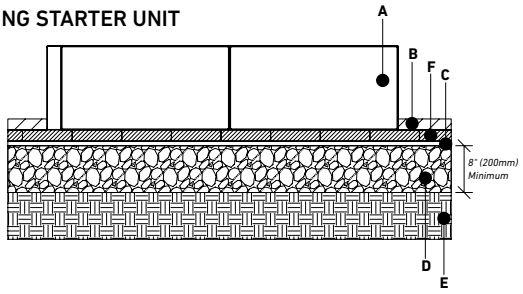
IMPORTANT: Other types of hardware (not included) may be required to make these assemblies (wood screws, concrete anchors, etc.). BELGARD is not responsable for any issue regarding other materials, accessories, other types of hardware, etc. We recommend consulting an expert/engineer to determine the design limitations of the screen panels based on wind loads.

BASE PREPARATION

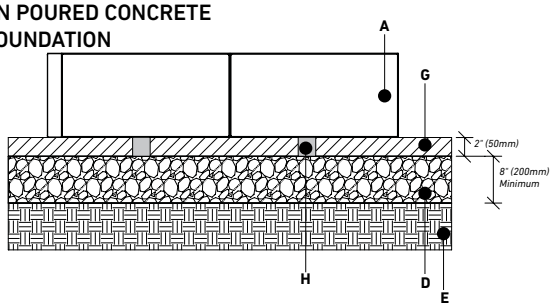
ON EXISTING PATIO



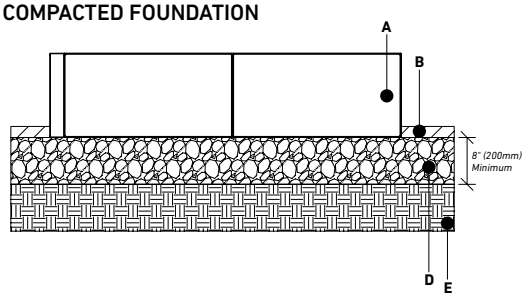
ON COMPACTED FOUNDATION USING STARTER UNIT



ON POURED CONCRETE FOUNDATION



ON COMPACTED FOUNDATION



A- **ARTFORMS** Panels
B- Slab or Paver
C- Bedding Sand 1" (25mm)
D- Compacted Aggregates 8" (200mm) minimum
E- Soil
F- Starter Unit/ Slab or Paver
G- Reinforced Poured Concrete Foundation 2" (50mm) minimum
H- Opening for Drainage

IMPORTANT: Provide adequate drainage and adjust according to soil type. Maximum height of 36" for planter box and 42" for outdoor living structure. Any higher structure must be designed by an engineer. Dimensions and information above are general recommendations only. Contact experts/engineers to validate the base preparation, the drainage, the plants & roots growth/management. The use of plastic shims can facilitate the installation of Artforms panels in order to adapt to the slope of the site.

COMPLETE ARTFORMS INSTALLATION GUIDE & SPANISH TRANSLATION

Belgard.com/Artforms

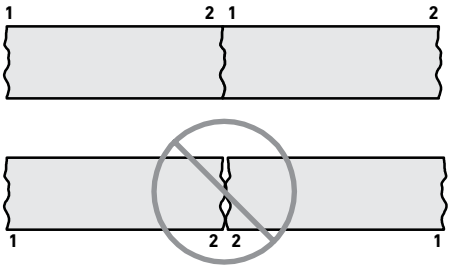
Landings™ Step Unit Installation

Each Landings™ Step Unit is manufactured with two unique face patterns. The step units are palletized and packaged for easy skid-steer loader removal. Care needs to be taken in handling these units. If a blemish occurs on one side of unit, rotate 180° before setting unit into place.

BASE COURSE

Excavate an area 6 inches deep by 1 foot longer by 1 foot wider than the installed step(s) size. Add a minimum of 6 inches of compactable base material, 3⁄4-inch minus (with fines) aggregate. Compact and level. Set unit and, if desired, add a slight pitch of no more than 1⁄4 inch toward the front of the step to shed moisture. If installing step units next to a retaining wall, keep units level from front to back.

The Textures on Sides 1 and 2 are Designed to Nest with Minimal Gapping Between the Units.



Place Units so They Nest Tightly Together.

Two unique faces on each step

STAIR TREAD

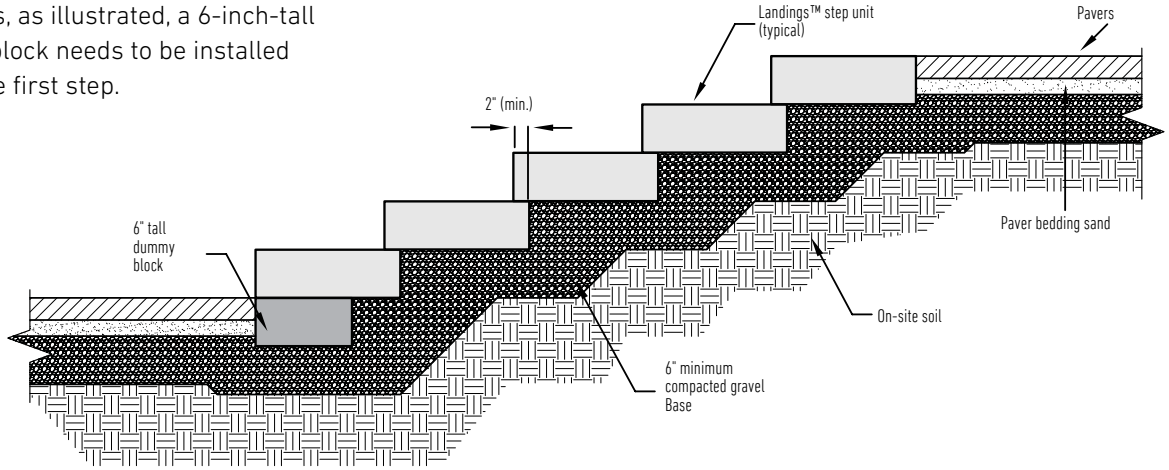
For each consecutive step, follow base course instructions, making sure the top of the base is even with the top of the previously installed unit. Recommended tread depth is a minimum of 10 inches, but no more than 16 inches. When installing steps adjacent to a finished surface such as pavers, as illustrated, a 6-inch-tall dummy block needs to be installed below the first step.

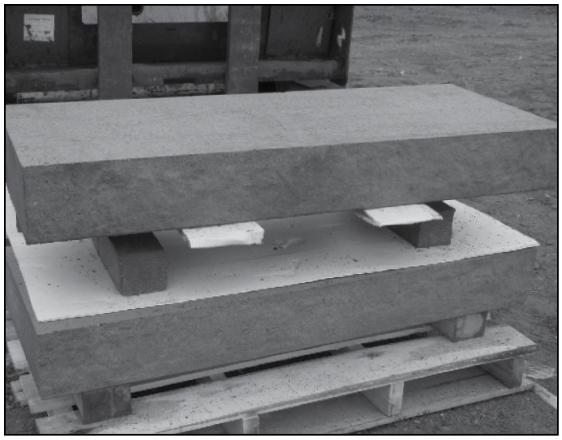
LANDING

For landing(s), follow base course instructions. Each step unit is manufactured with two unique face patterns. The face patterns are manufactured to nest together, which will create a narrower joint, providing pleasing aesthetics.

STEPS IN A 90-DEGREE WALL

When building into a retaining wall, construct the steps first and build the walls adjacent to the steps.

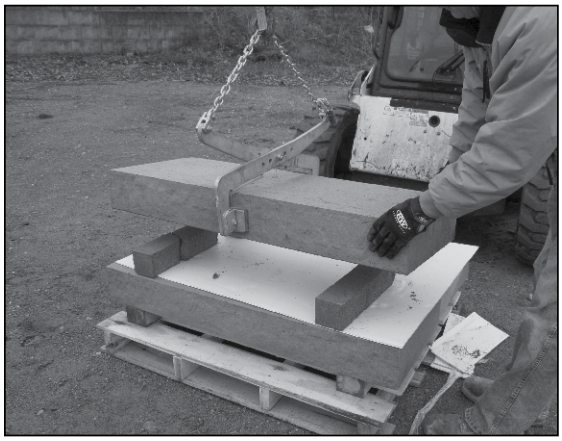




SKID-STEER LOADER

Slide forks underneath the first step unit and lift off pallet. Set the step unit onto its desired location, using a spacer to ease in fork removal.

A helpful tip to protect the step unit is to wrap the fork of the skid-steer with corrugated plastic packaging from the pallet or other protective materials. Secure to the forks.



CLAMP

Using a materials clamp, center the clamp on the step unit. Attach clamp to skid-steer or mini-excavator and slowly lift the step unit off of the pallet and move it into place. Be sure to have a second person to help guide the unit into place as the machine sets the step unit down.

STRAPS

When using a heavy-duty strap(s), start by wrapping the strap(s) around the center if using one, or close to step unit ends if two straps are being used. Cinch the strap(s) tight and attach the looped ends of the strap(s) to a skid-steer or mini-excavator. Slowly lift the step unit from the pallet and move it into place. Be sure to have a second person to help guide the unit into place as the machine sets the step unit down. Using a spacer will help to ease in the strap removal.

CART

When using a cart, place provided corrugated plastic from pallet or other protective material onto the cart to help protect the step unit. With help from a second person, slowly slide the step unit from the pallet onto the cart. Maneuver the unit carefully into place.

Videos can be found on our YouTube channel:
www.youtube.com/anchorblockmn

FIRE FEATURES

INSTALLATION GUIDE

Fire Pit Installation Guidelines

Fire pits are for outdoor use only. Construct the fire pit in accordance with all local and state fire codes.

Make sure your fire pit is located at least 10 feet from the property boundary and any building structures and does not endanger the surrounding area. Follow local setback requirements for actual distances from buildings, property lines, or sources of combustible material.

Fire pits require properly designed air vents for proper operation and safety. Ventilation, especially on propane fire pits, is crucial to release excess stored gas. Excessive heat in fire pits can cause the concrete blocks to crack or be damaged over time. It is recommended that fire pits be built with a metal liner or fire-rated brick to provide protection from high temperatures.

Ensure the area where you'll build the fire pit is level and clear of debris. Excavate an area slightly larger than the diameter of the fire pit to be installed and install 4-6" of compacted aggregate base. Tightly lay the first course of blocks ~ 4" below grade on top of the level base. Install subsequent courses by staggering the joints. Depending on the size of your fire pit and local fire codes, leave some space between the blocks near grade to allow for air to circulate. Use a level and a rubber mallet to ensure each row is level and square. Cut blocks to fit any curves or edges. Once the blocks are placed to the desired height, attach optional capping units using heat-resistant concrete adhesive. Fill the inside area with aggregate (sand, gravel, rocks) to help dissipate heat. Manage and limit the heat produced by the fire pit. Overheating can damage the blocks. Do not let the fire go unattended.

MATERIALS NEEDED

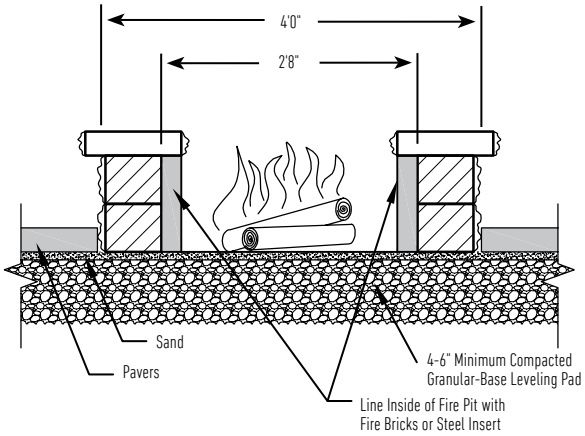
- Tamper
- Level
- Bags of Leveling Sand
- Tubes of Concrete Adhesive
- Caulk Gun
- Bags of Gravel or Lava Rock
- Shovel
- Optional Marking Paint or Chalk
- Base Material

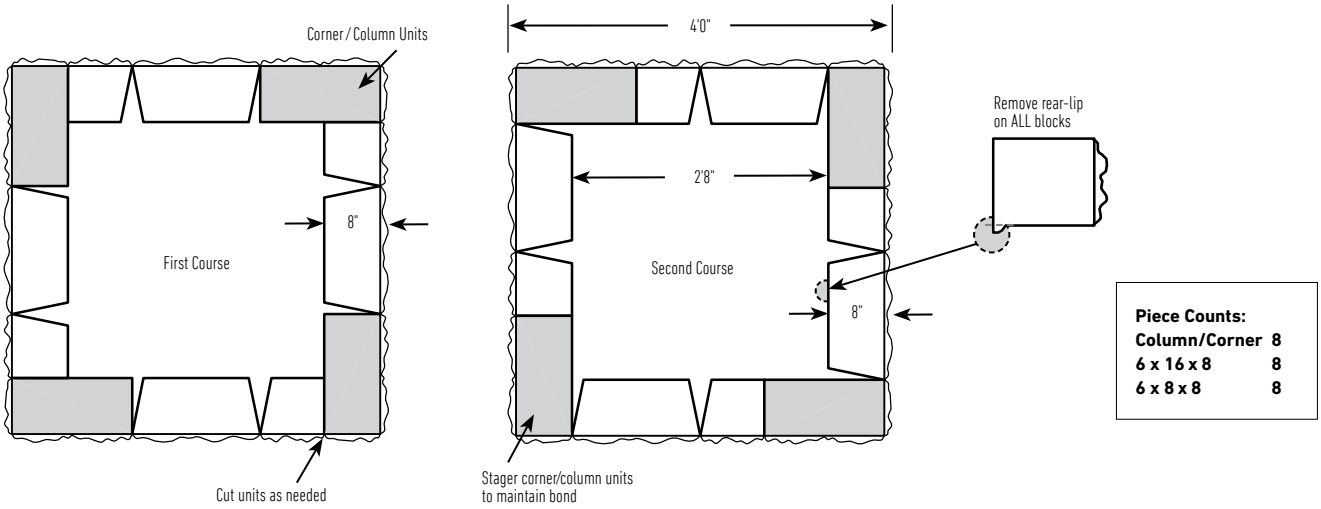
RETAINING WALL SQUARE FIRE PIT CONSTRUCTION

Inside of fire pit must be lined with a heat-resistant material.

Affix all units with construction-grade adhesive.

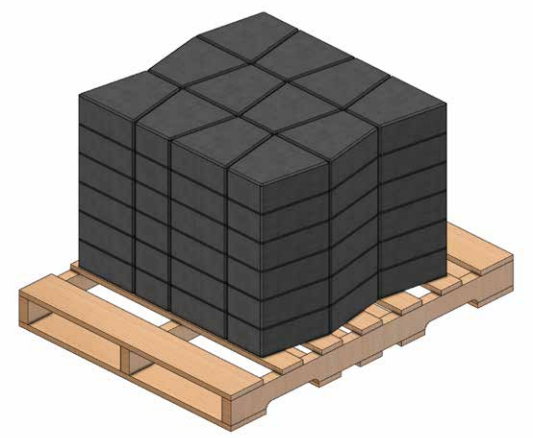
These blocks are not fireproof and could start to crack under extreme heat. These blocks are intended for landscape applications and are not fire-rated. Over time, the blocks may crack. A possible solution is to use heavy fire-rated bricks or a steel liner on the interior of an above- or below-ground fire ring/pit with the blocks outside the perimeter. Again, the heat may adversely affect landscape products, even with an interior heat-resistant barrier in place.





MELVILLE WEDGE FIRE PIT

1 pallet = 1 fire pit



72 Units/Pallet

6 Layers

72 Units/Fire Pit

4 Rows | 18 Units/Row

16" High

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