Color
The natural materials that we use in our paving stones and retaining wall products deliver a range of colors that closely match color samples in catalogs, spec books, color swatch books and online photos. However, NewLine cannot guarantee exact color matching. Our pavers and walls can vary slightly in color depending on environmental conditions. Therefore, colors shown are approximate representations of standard colors and shouldn’t be expected to be an exact match. Final color selections should be made at your local dealer from stock product or displays. NewLine always recommends immediately verifying the product and color upon receipt. If there are any discrepancies, contact your local dealer before continuing your project. Installation of the product constitutes its acceptance. Proper installation enhances the overall color of pavement. Units should be randomly picked from at least two pallets when installing. This creates an attractive and subtle blending of color.

Efflorescence
Our warranty does not apply to efflorescence. Efflorescence is a whitish, powderlike deposit that can appear on the surface of concrete pavers. When cement hydrates, calcium hydroxide is formed. A reaction occurs between the calcium hydroxide and carbon dioxide (from the air) to form water-insoluble calcium carbonate, which is then called efflorescence. Efflorescence does not have an effect on the structural performance or durability of the concrete pavers. NewLine includes admixtures in their concrete pavers to help minimize efflorescence, but efflorescence is a natural occurrence in all concrete products. NewLine does not warrant concrete pavers and/or walls that it manufactures against the appearance of efflorescence. Efflorescence may appear immediately or within months following installation. It may remain for months or some of it may wear away. Deposits may be removed from the concrete paver surface by using proprietary efflorescence-removers. Before purchasing or applying any chemicals to remove deposits, please consult your local dealer for efflorescence removal chemicals.

Polymeric Haze
Polymeric haze from the use of polymeric joint sand may appear on your concrete products if the sand was not removed from the surface of the paver properly. This does not affect the integrity of the product or your installation. The hazing will weather away naturally with time and rain. It can be removed with a specialized cleaner; you are advised to contact your contractor or the polymeric sand company used for advice on recommendations. NewLine accepts no responsibility or liability for this occurrence.

Construction Residue
A by-product of cutting with a saw is residue-filled water or concrete dust. Residue-filled water or re-hydrated dust can cling to the surface and leave a concrete stain. It is recommended to wash and remove the water or concrete dust from the surface of the pavers before it dries. Construction residue can also happen through soil disturbance or environmental elements. These contaminants should be removed immediately but do not affect the integrity of the product or your installation. NewLine accepts no responsibility or liability for these occurrences.

Compactor and Snow Removal
NewLine pavers with textured surfaces have high and low points on the surface that give it more of an aesthetic appeal. However, pavers with textured surfaces are susceptible to surface scuffing when they are compacted into place. Therefore, these types of pavers should always be compacted with plate compactors that incorporate a protective mat or other medium between the plate compactor and the surface of the NewLine pavers. This system will help ensure that paver surface scuffing is kept to a minimum. These protective mediums include: rubber matting, thin carpet or cardboard. Manufacturers of plate compactors are able to recommend other products that also can be used for this purpose. For further information on interlocking concrete paver details, technical information and recommended construction practices, visit ICPI at www.icpi.org.

A plate compactor should not be used on our York Tile or Overlay pavers. Also, snow removal equipment should have the proper spacing, bumpers and rubber blade guards to protect the surface of the pavers. NewLine will not be held responsible for damage caused by the misuse of compaction or snow removal equipment which leaves scuff marks or burns on pavers.
Hardscape Lifetime Transferable Warranty

NewLine Hardscapes backs our manufactured paver and wall products with a lifetime transferable warranty, guaranteeing our products against manufacturing defects. This warranty is for residential construction only, and is applicable where products have been correctly installed to meet industry specifications. Color variances and the appearance of efflorescence do not constitute a warranty claim. Any defective products will be replaced; however, replacement labor and transportation costs are not included in this warranty. All warranty claims must be made prior to the removal or disposal of the defective product. We will honor this transferable warranty with a proof of purchase (invoice or delivery ticket).

NOTE: This warranty does not apply to any breakage, chipping or other deterioration that was caused by improper design or installation which does not comply with applicable codes, the ICPI, NCMA and recognized work procedures. Please visit www.icpi.org or www.ncma.org for more information on installation specifications. This warranty does not apply to any damage resulting from a natural disaster or from a deliberate and/or negligent act on the part of the purchaser, owner of the building, installer or any third party.
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Our “blue crab” icon appears next to paver products that can be laid as permeable units.

The “do not use plate compactor” icon appears next to paver products that should not be machine tamped.
The Rosetta® portfolio of products accurately recreates the look and feel of a natural setting for your project.

Rosetta products are produced using wet-cast concrete with integral color, giving them the most natural, multi-toned appearance on the market today. What sets Rosetta apart is the richness of shapes found in each collection. Rosetta products are inspired by -and modeled after- natural stones.

Rosetta products are engineered to exacting specifications that ensure your project will stand the test of time. Technical resources for Rosetta products are available at www.DiscoverRosetta.com.
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Kodah™

Description: Wall | Texture: Chiseled | Applications: Freestanding Walls, Retaining Walls up to 4’ w/o Geogrid 12’ w/ Geogrid

Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet or piece</th>
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<tr>
<td>Kodah Wall Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-piece system –</td>
<td></td>
<td>21 sf</td>
<td>18</td>
<td>2400 lbs</td>
</tr>
<tr>
<td>all on one pallet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>extra large</td>
<td>42 x 10½ x 6</td>
<td>6</td>
<td>200 ±</td>
<td></td>
</tr>
<tr>
<td>large</td>
<td>30 x 10½ x 6</td>
<td>3</td>
<td>140 ±</td>
<td></td>
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<td>medium</td>
<td>21 x 10½ x 6</td>
<td>6</td>
<td>100 ±</td>
<td></td>
</tr>
<tr>
<td>small</td>
<td>12 x 10½ x 6</td>
<td>3</td>
<td>50 ±</td>
<td></td>
</tr>
<tr>
<td>Kodah Corner Unit</td>
<td>21 x 10½ x 6</td>
<td>31½ sf</td>
<td>24</td>
<td>2400 lbs</td>
</tr>
</tbody>
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Colors

- ash
- canyon
- saddle
Kodah™

Typical Wall Construction Details - Reinforced Installation

This page shows typical construction details for reinforced Kodah retaining walls. This drawing represents the major components required in wall construction. Specific details including geotextile reinforcement layers, drainage details, soil requirements, etc. shall be per the engineered design for the wall.

Kodah Retaining Wall Installation Notes

1. Review all plans and specifications for the project. Make sure you understand the detailed design for the project before starting construction.

2. Leveling pad excavation should be to the depth shown in the engineered plans for the wall, but at least 6" below the elevation of the bottom block in the wall. Width should be a minimum of 29" which will provide 6" in front of and 12" behing the bottom block.

3. Existing foundation soil (soil below wall) should be compacted to a minimum of 95% of standard proctor. Foundation soil should be firm, dry and free of debris, stones, roots, etc. Consult a soils engineer if in doubt.

4. Place leveling pad material as specified in the wall design. Compact using a vibrator plate compactor.

5. Install a 4" diameter perforated drain pipe in the lowest portion of the free-draining stone, either on the bottom of the crushed stone leveling pad or immediately on top of the slow-draining road gravel leveling pad, depending on the detailed design. Daylight the drain pipe at the ends and/or through the face of the wall to allow for drainage. Connection to an active storm sewer should only be made under the direction of a professional engineer.
6. Walls shall have the bottom course(s) buried to the depth shown on the engineered design. A minimum depth of 6” is required for all walls.

7. Place the bottom course of wall blocks. Takes care to level the blocks both parallel and perpendicular to the wall.

8. Backfill the first 12” behind the blocks and triangle shaped areas between the blocks with ASTM No. 57 drainstone. Place a layer of non-woven geotextile fabric immediately behind the drainstone and then place the retained or reinforced soil.

9. Drainstone and backfill shall be placed in maximum 6” lifts and compacted to a minimum of 95% of standard proctor. Hand compaction with a vibratory plate compactor shall be used within 3’ of the retaining blocks. All compaction equipment shall be large enough to achieve desired compaction, but not so large as to move the wall blocks. Monitor the wall blocks for movement during compaction and rectify if required prior to proceeding.

10. Place successive units, drainstone, and compacted backfill to the desired grade/wall height. Make sure the wall blocks are setback a minimum of 3/4” for every 6” of wall height.

11. The top of the wall must be graded to direct surface water away from the wall.

12. Coping layer should be adhere with a concrete adhesive.

Additional Requirements for Geogrid Installation (if required)

13. Geogrid layers shall be installed to the lengths and elevations detailed in the wall design.

14. Geogrid shall be placed starting at the face of the retaining block and extending into the reinforced soil. Take care to install the geogrid with the strong direction (roll direction) into the reinforced soil zone and not parallel to the wall.

15. Use this next layer of blocks to secue the front end of the geogrid. Make sure the geogrid is as close as possible to the front face of the wall without being visible. Pull the geogrid taut to eliminate any folds and pretension the geogrid. Pin or secure the back edge of the geogrid before placing the reinforced fill.

16. Place and compact drainstone and reinforced fill starting at the back of the blocks and continuing back into the retained soil. Drainstone and reinforced fill shall be placed in maximum 6” thick layers and compacted to 95% of standard proctor. Hand compaction with a vibratory plate shall be used within 3’ of the retaining wall blocks. All compaction equipment shall be large enough to achieve desired compaction, but not so large as to move the wall blocks. Monitor the wall blocks for movement during compaction and rectify if required prior to proceeding.

17. Tracked construction equipment shall not be used directly on the geogrid. A minimum of 6” of fill is required between tracked equipment and geogrid to prevent damage to the grid. Rubber-tired equipment may pass over the geogrid when traveling at low speeds of 5 mph or less.

18. Avoid any sudden stopping or turning of construction equipment in the reinforced fill zone to prevent moving or damaging the geogrid layers.

19. Follow geogrid manufacturer’s requirements, including requirements for vertical separation and overlap of geogrid.

Typical Freestanding Wall Construction Details

The following are typical construction details for freestanding Kodah walls. Kodah freestanding walls are intend-
Kodah™

Description: Wall | Texture: Chiseled | Applications: Freestanding Walls, Retaining Walls up to 4’ w/o Geogrid 12’ w/ Geogrid

ed to be low walls (24” or lower) used in a garden or patio setting. Taller walls, walls intended to act as railing or barriers, walls constructed in other settings, or walls subject to applied loads will require project specific engineering.

Freestanding Installation Notes

1. Leveling pad excavation should be to the depth shown in the engineered plans for the wall, but at least 6” below the elevation of the bottom block in the wall. Width should be a minimum of 23” which will provide 6” in front of and behind the bottom block.

2. Existing foundation soil should be compacted to a minimum of 95% of standard proctor. Foundation soil should be firm, dry, and free of debris, stones, roots, etc. Consult a soils engineer if in doubt.

3. Place crushed stone or well-graded road gravel leveling pad material as specified. Compact using a vibrator plate compactor.

4. Walls shall have the bottom course buried to the depth shown on the design. Walls are typically buried a minimum of 6”.

5. Place the bottom course of wall blocks. Take care to level the blocks both parallel and perpendicular to the wall. Adjacent blocks should be placed so the tapers on the sides are going opposite directions to provide a uniform wall face with no gaps on either side of the wall.

6. Place successive units to the desired wall height.

7. Concrete adhesive is required between all blocks and the coping layer of a freestanding wall. Adhesive shall be specially formulated for outdoor use with concrete retaining wall products.

Curved Wall Details

The taper on the sides of Kodah blocks allow for construction of a wide range of curved walls.

1. Minimum radius curves are shown which can be constructed without saw-cutting a significant number of blocks. Larger radius curves can be created by leaving a larger gap between blocks on the backside of the wall. The gaps must be filled with drainstone.
2. When retaining walls are constructed with batter, the radius on the outside curves becomes smaller with each course due to the block setback. For proper construction, the radius of the bottom course must be larger than the minimum radius so upper courses will have significant room for construction. Increase the bottom course at least 1" for every row of block in the wall.

3. When retaining walls are constructed with the batter, the radius on the inside curves becomes larger with each course due to the block setback.

Column Construction Details

Columns make nice ends to freestanding walls, formal stair openings, stand-alone monuments, and other areas to enhance your Kodah project. Basic steps of column construction are shown here. Feel free to expand on the ideas and bring your own creativity into creating a custom project.
**SILTEY SAND, CLAYEY SAND**

No back slope, no toe slope, no surcharge ($\phi = 28^\circ$, $\gamma = 120$pcf)

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

1. These drawings are for reference only.
2. Final designs for construction must be prepared by a registered professional engineer using the actual conditions of the proposed site. Wall stability, incl. global stability, must be verified for site specific conditions.
3. Final wall design must address both internal and external drainage and shall be evaluated by the professional engineer who is responsible for the wall design.
4. Geogrid Layers are to be placed on TOP of the course of blocks shown. For example, BLK 2 = 5’ indicates that you place a 5’ long layer of geogrid on top of the 2nd course of blocks.
5. Length of geogrid is measured from the front of the Kodah blocks.
6. Slope Stability and Seismic conditions are not included in these guides and must be analyzed based on site specific conditions.
7. These guides assume a flat “toe” slope at the bottom of the wall. Toe slopes must be analyzed based on site conditions.
8. Minimum Factors of Safety for the assumed conditions shown above are 1.5 for sliding, 2.0 for overturning (1.5 for non-reinforced section), and 2.0 for bearing capacity.
9. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls, 3rd Ed.
10. Reinforced and Backfill soils are to be compacted to 95% maximum density (Standard Proctor).
11. All Kodah Specifications are to be followed.
**Kodah™**

**Description:** Wall  |  **Texture:** Chiseled  |  **Applications:** Freestanding Walls, Retaining Walls up to 4’ w/o Geogrid 12’ w/ Geogrid

### SILTEY SAND, CLAYEY SAND

**No back slope, no toe slope, 100 psf surcharge (φ = 30°, γ = 120 pcf)**

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

---

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11. All Kodah Specifications are to be followed.
**Kodah™**

Description: Wall | Texture: Chiseled | Applications: Freestanding Walls, Retaining Walls up to 4’ w/o Geogrid 12’ w/ Geogrid

**SILTEY SAND, CLAYEY SAND**

1:3 (18.4°) back slope, no toe slope, no surcharge (ϕ = 30°, γ = 120 pcf)

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

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3. Final wall design must address both internal and external drainage and shall be evaluated by the professional engineer who is responsible for the wall design.
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5. Length of geogrid is measured from the front of the Kodah blocks.
6. Slope Stability and Seismic conditions are not included in these guides and must be analyzed based on site specific conditions.
7. These guides assume a flat “toe” slope at the bottom of the wall. Toe slopes must be analyzed based on site conditions.
8. Minimum Factors of Safety for the assumed conditions shown above are 1.5 for sliding, 2.0 for overturning (1.5 for non-reinforced section), and 2.0 for bearing capacity.
9. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls, 3rd Ed.
10. Reinforced and Backfill soils are to be compacted to 95% maximum density (Standard Proctor).
11. All Kodah Specifications are to be followed.
**Kodah™**

**Description:** Wall | **Texture:** Chiseled | **Applications:** Freestanding Walls, Retaining Walls up to 4’ w/o Geogrid 12’ w/ Geogrid

## FINE TO MEDIUM SAND

**No back slope, no toe slope, no surcharge (\(\phi = 30^\circ\), \(\gamma = 120 \text{ pcf}\))**

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

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5. Length of geogrid is measured from the front of the Kodah blocks.
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7. These guides assume a flat “toe” slope at the bottom of the wall. Toe slopes must be analyzed based on site conditions.
8. Minimum Factors of Safety for the assumed conditions shown above are 1.5 for sliding, 2.0 for overturning (1.5 for non-reinforced section), and 2.0 for bearing capacity.
9. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls, 3rd Ed.
10. Reinforced and Backfill soils are to be compacted to 95% maximum density (Standard Proctor).
11. All Kodah Specifications are to be followed.
**Kodah™**

Description: **Wall** | Texture: **Chiseled** | Applications: **Freestanding Walls, Retaining Walls up to 4' w/o Geogrid 12' w/ Geogrid**

**FINE TO MEDIUM SAND**

No back slope, no toe slope, 100 psf surcharge ($\phi = 30^\circ$, $\gamma = 120$ pcf)

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

1. These drawings are for reference only.
2. Final designs for construction must be prepared by a registered professional engineer using the actual conditions of the proposed site. Wall stability, incl. global stability, must be verified for site specific conditions.
3. Final wall design must address both internal and external drainage and shall be evaluated by the professional engineer who is responsible for the wall design.
4. Geogrid Layers are to be placed on TOP of the course of blocks shown. For example, BLK 2 = 5' indicates that you place a 5' long layer of geogrid on top of the 2nd course of blocks.
5. Length of geogrid is measured from the front of the Kodah blocks.
6. Slope Stability and Seismic conditions are not included in these guides and must be analyzed based on site specific conditions.
7. These guides assume a flat “toe” slope at the bottom of the wall. Toe slopes must be analyzed based on site conditions.
8. Minimum Factors of Safety for the assumed conditions shown above are 1.5 for sliding, 2.0 for overturning (1.5 for non-reinforced section), and 2.0 for bearing capacity.
9. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls, 3rd Ed.
10. Reinforced and Backfill soils are to be compacted to 95% maximum density (Standard Proctor).
11. All Kodah Specifications are to be followed.
**Kodah™**

Description: Wall  |  Texture: Chiseled  |  Applications: Freestanding Walls, Retaining Walls up to 4’ w/o Geogrid 12’ w/ Geogrid

**FINE TO MEDIUM SAND**

1:3 (18.4°) back slope, no toe slope, no surcharge ($\phi = 30^\circ$, $\gamma = 120$ pcf)

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

---

1. These drawings are for reference only.
2. Final designs for construction must be prepared by a registered professional engineer using the actual conditions of the proposed site. Wall stability, incl. global stability, must be verified for site specific conditions.
3. Final wall design must address both internal and external drainage and shall be evaluated by the professional engineer who is responsible for the wall design.
4. Geogrid Layers are to be placed on TOP of the course of blocks shown. For example, BLK 2 = 5’ indicates that you place a 5’ long layer of geogrid on top of the 2nd course of blocks.
5. Length of geogrid is measured from the front of the Kodah blocks.
6. Slope Stability and Seismic conditions are not included in these guides and must be analyzed based on site specific conditions.
7. These guides assume a flat “toe” slope at the bottom of the wall. Toe slopes must be analyzed based on site conditions.
8. Minimum Factors of Safety for the assumed conditions shown above are 1.5 for sliding, 2.0 for overturning (1.5 for non-reinforced section), and 2.0 for bearing capacity.
9. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls, 3rd Ed.
10. Reinforced and Backfill soils are to be compacted to 95% maximum density (Standard Proctor).
11. All Kodah Specifications are to be followed.
**Kodah™**

**Description:** Wall  |  **Texture:** Chiseled  |  **Applications:** Freestanding Walls, Retaining Walls up to 4’ w/o Geogrid 12’ w/ Geogrid

**DENSE WELL-GRADED SAND, SAND AND GRAVEL**

No back slope, no toe slope, no surcharge \( (\phi = 34^\circ, \gamma = 120 \text{ pcf}) \)

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

1. These drawings are for reference only.
2. Final designs for construction must be prepared by a registered professional engineer using the actual conditions of the proposed site. Wall stability, incl. global stability, must be verified for site specific conditions.
3. Final wall design must address both internal and external drainage and shall be evaluated by the professional engineer who is responsible for the wall design.
4. Geogrid Layers are to be placed on TOP of the course of blocks shown. For example, BLK 2 = 5’ indicates that you place a 5’ long layer of geogrid on top of the 2nd course of blocks.
5. Length of geogrid is measured from the front of the Kodah blocks.
6. Slope Stability and Seismic conditions are not included in these guides and must be analyzed based on site specific conditions.
7. These guides assume a flat “toe” slope at the bottom of the wall. Toe slopes must be analyzed based on site conditions.
8. Minimum Factors of Safety for the assumed conditions shown above are 1.5 for sliding, 2.0 for overturning (1.5 for non-reinforced section), and 2.0 for bearing capacity.
9. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls, 3rd Ed.
10. Reinforced and Backfill soils are to be compacted to 95% maximum density (Standard Proctor).
11. All Kodah Specifications are to be followed.
**Kodah™**

Description: Wall  |  Texture: Chiseled  |  Applications: Freestanding Walls, Retaining Walls up to 4’ w/o Geogrid 12’ w/ Geogrid

---

**DENSE WELL-GRADED SAND, SAND AND GRAVEL**

*No back slope, no toe slope, 100 psf surcharge (φ = 34°, γ = 120 pcf)*

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

1. These drawings are for reference only.
2. Final designs for construction must be prepared by a registered professional engineer using the actual conditions of the proposed site. Wall stability, incl. global stability, must be verified for site specific conditions.
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5. Length of geogrid is measured from the front of the Kodah blocks.
6. Slope Stability and Seismic conditions are not included in these guides and must be analyzed based on site specific conditions.
7. These guides assume a flat “toe” slope at the bottom of the wall. Toe slopes must be analyzed based on site conditions.
8. Minimum Factors of Safety for the assumed conditions shown above are 1.5 for sliding, 2.0 for overturning (1.5 for non-reinforced section), and 2.0 for bearing capacity.
9. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls, 3rd Ed.
10. Reinforced and Backfill soils are to be compacted to 95% maximum density (Standard Proctor).
11. All Kodah Specifications are to be followed.
**Kodah™**

**Description:** Wall  |  **Texture:** Chiseled  |  **Applications:** Freestanding Walls, Retaining Walls up to 4' w/o Geogrid 12' w/ Geogrid

### DENSE WELL-GRADED SAND, SAND AND GRAVEL

1:3 (18.4°) back slope, no toe slope, no surcharge ($\phi = 34^\circ$, $\gamma = 120$ pcf)

This page shows preliminary guides for soil reinforcement required to construct a wall with Rosetta Kodah blocks in the conditions noted below. The geogrid reinforcement is Mirafi Miragrid 3XT.

1. These drawings are for reference only.
2. Final designs for construction must be prepared by a registered professional engineer using the actual conditions of the proposed site. Wall stability, incl. global stability, must be verified for site specific conditions.
3. Final wall design must address both internal and external drainage and shall be evaluated by the professional engineer who is responsible for the wall design.
4. Geogrid Layers are to be placed on TOP of the course of blocks shown. For example, BLK 2 = 5' indicates that you place a 5’ long layer of geogrid on top of the 2nd course of blocks.
5. Length of geogrid is measured from the front of the Kodah blocks.
6. Slope Stability and Seismic conditions are not included in these guides and must be analyzed based on site specific conditions.
7. These guides assume a flat “toe” slope at the bottom of the wall. Toe slopes must be analyzed based on site conditions.
8. Minimum Factors of Safety for the assumed conditions shown above are 1.5 for sliding, 2.0 for overturning (1.5 for non-reinforced section), and 2.0 for bearing capacity.
9. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls, 3rd Ed.
10. Reinforced and Backfill soils are to be compacted to 95% maximum density (Standard Proctor).
11. All Kodah Specifications are to be followed.
Outcropping

Description: Wall  |  Texture: Stone  |  Applications: Retaining Walls up to 6’ w/o Geogrid, 20’ w/ Geogrid

- **Pallet A**
  - 12” x 3’6”
  - 12” x 5’
  - 12” x 4’
  - 12” x 5’6”

- **Pallet B**
  - 6” x 2’
  - 6” x 4’
  - 6” x 3’
  - 24” x 4’

- **Pallet C**
  - 6” x 2’
  - 18” x 5’
  - 6” x 3’
  - 24” x 4’

- **Corner Pallet**
  - 12” x 3’6”
  - 12” x 5’
  - 12” x 4’

### Colors
- ash
- canyon
- saddle

### Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet or piece</th>
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</thead>
<tbody>
<tr>
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<td>18 sf</td>
<td>4</td>
<td>4000 ±</td>
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</tr>
<tr>
<td></td>
<td>42 x 12</td>
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<td></td>
<td>66 x 12</td>
<td>1</td>
<td>1150 ±</td>
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</tr>
<tr>
<td>Pallet B</td>
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<td>4000 ±</td>
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<tr>
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<td>Pallet C</td>
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<td>24 x 6</td>
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<td></td>
<td>48 x 24</td>
<td>1</td>
<td>1800 ±</td>
<td></td>
</tr>
<tr>
<td>Corner Pallet</td>
<td>18 sf</td>
<td>4</td>
<td>4000 ±</td>
<td></td>
</tr>
<tr>
<td>Pallet</td>
<td>42 x 12</td>
<td>1</td>
<td>750 ±</td>
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<tr>
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<td>48 x 12</td>
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<td>60 x 12</td>
<td>1</td>
<td>1100 ±</td>
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</tr>
<tr>
<td></td>
<td>66 x 12</td>
<td>1</td>
<td>1150 ±</td>
<td></td>
</tr>
</tbody>
</table>
Installation Requiring Geogrid:

Please visit discoverrosetta.com for detailed cross-sections of geogrid reinforced Outcropping walls. For Rosetta Outcropping installations, do no overlap, geogrid over top of blocks. Instead, run the geogrid directly up the back of the blocks. In addition to this reinforcement, a Paraweb strap must be installed through each lifting hook in the back of the Outcropping blocks. Please see standard details for Reinforced Outcropping Walls for further information.

Place and compact drainstone and reinforced fill following the procedure used to set the bottom and upper courses of blocks. It is important to place and compact stone and reinforced fill starting at the back of the retaining blocks and extending into the reinforced soil zone. This will help eliminate “bunching” of the geogrid reinforcement.

Reinforce zone fill material is typically a sand or a gravel with less than 5% fines (material passing the No. 200 sieve). This material is usually classified as a GW, GP, SW, or SP. It is very important that you only use the fill material specified in your project design drawings and specifications.

Place retained soil immediately between the reinforced soil zone and the back of the excavation. Material should be placed in loose lifts of 8” (200 mm) maximum and compacted to 95% maximum density as determined by a standard proctor test (ASTM D698). Bring the reinforced and retained soil up to grade at the same time. At no time should the elevation of the reinforced soil be more than 1 block higher than the retained soil.

Tracked construction equipment should not be used directly on the geogrid. A minimum of 6” (150 mm) of fill is required between tracked equipment and geogrid to prevent damage to the grid. Rubber-tired equipment may pass over the geogrid when traveling at low speeds of 5 mph (8km/h) or less. Avoid any sudden stopping or turning of construction equipment in the reinforced fill zone to prevent moving or damaging the geogrid layers.

Follow geogrid manufacturer’s requirements, including requirements for vertical separation and overlap of geogrid.

For All Installations
Never stack blocks more than one course above grade of backfill.

Outcropping layout notes:

One of the unique features of the Rosetta Outcropping system is multiple block heights. To provide a uniform wall batter with multiple height blocks, the setback of the blocks varies proportionally with the block height. The setback in blocks is achieved with shear heels which are cast into the Rosetta blocks. For a 6” high block, the
Outcropping

Description: Wall | Texture: Stone | Applications: Retaining Walls up to 6’ w/o Geogrid, 20’ w/ Geogrid

sehar heels are 1.5” deep (1/2 times 3”). For a 12” high block, the sehar heels are 3” deep (1 times 3”). For a 24” high block, the sehar heels are 6” deep (2 times 3”).

To ensure proper wall alignment and to account for the multiple height blocks and varying setbacks, you have to adjust the bottom row of blocks based on their height. Set up a traditional string line for the back of the wall, then offset the blocks per the following figure.

Rosetta blocks have shear heels to help with wall integrity and provide a setback from lower blocks in the wall, this causing the wall to batter back. The batter is important to the engineering design to the wall, and it must be accounted for during construction of a curved wall section.

If you are constructing an outside (convex) curve, the wall batter will cause the blocks higher in the wall will have a shorter radius around the curve than the lower blocks. This will cause the higher blocks to “grow” in the wall layout pattern. (This is similar in concept to the inside lane of a race track is shorter than the outside lane.) The result is a potential overlap between some of the blocks in the wall. The best way to deal with this overlap is to saw cut the end of the smaller block, which allows the blocks to fit tightly together and all the sehar heels to be properly engaged. This saw cut is typically made on an angle to match the taper on the block you are abutting.

If you are constructing an inside (concave) curve, the wall batter will cause the block higher in the wall will have a longer radius around the curve than lower blocks. The important step when constructing a inside curve is to keep all blocks tight together. In most cases, the blocks will touch somewhere along the sides of the blocks, not at the back of the blocks. If needed, you can trim the ends off some blocks to prevent gaps from opening up between blocks. When constructing a curve with a short radius, voids may form at the back of the wall where two blocks meet. If this happens simply fill the void areas with filter fabric and drainstone.

Please note that the length dimensions shown for Rosetta blocks are rounded for reference. The actual length of the constructed wall will vary slightly from the pattern dimensions shown. Each pattern is made up of a (2) A pallets, (2) B Pallets, and (1) C Pallet.

Rosetta has two corner blocks to help make a a 90° corner in the wall. The corner blocks are four-sided, and can be installed with alternating faces exposed to maintain a more random look.

The size of the corner blocks have been chosen to account for the wall batter in both directions. Two 6” high corner blocks are typically stacked on top of each other and placed on top of a 12”. The corner blocks are intended to be stepped back 3” in both directions. In a few areas, you may need to trim a small part of the corner blocks near the back of the wall to avoid interference with the sehar heels on adjacent blocks. See the sample pattern shown here, which details how to make a 90° corner with (4) A pallets, (4) B pallets, (2) C pallets, (3) 12” high corner blocks, and (4) 6” high corner blocks.
Outcropping

Description: Wall  |  Texture: Stone  |  Applications: Retaining Walls up to 6’ w/o Geogrid, 20’ w/ Geogrid
Outcropping

Description: Wall  |  Texture: Stone  |  Applications: Retaining Walls up to 6’ w/o Geogrid, 20’ w/ Geogrid
### SILTEY SAND, CLAYEY SAND WITH AN INTERNAL ANGLE OF FRICTION ($\phi$) = 28°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- No surcharge, no back slope, no front slope

<table>
<thead>
<tr>
<th>Wall Height (ft)</th>
<th>Wall Bury Depth (ft)</th>
<th>Leveling Pad Depth (ft)</th>
<th>Paraweb Strap Length (ft)</th>
<th>Paraweb Hook Depth (ft)</th>
<th>Geogrid Layout</th>
<th>Approx. Geogrid syd/LF wall (sq m/m wall)</th>
<th>Approx. Paraweb ft/LF wall (m/m wall)</th>
</tr>
</thead>
<tbody>
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<td>0.5 (0.15)</td>
<td>15.0 (4.57)</td>
<td>Type V.P.</td>
<td>2XT</td>
<td>1.5 (0.46) 3.0 (0.91)</td>
<td>4.0 (1.22)</td>
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<td>4.0 (1.22) 4.0 (1.22)</td>
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<tr>
<td>7.0 (2.13)</td>
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<td>15.0 (4.57)</td>
<td>Type V.P.</td>
<td>2XT</td>
<td>1.0 (0.30) 3.0 (0.91)</td>
<td>4.0 (1.22)</td>
</tr>
<tr>
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<td>Length</td>
<td>2XT</td>
<td>3.0 (0.91) 3.0 (0.91)</td>
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<tr>
<td>8.0 (2.44)</td>
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<td>0.5 (0.15)</td>
<td>15.0 (4.57)</td>
<td>Type V.P.</td>
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<td>1.0 (0.30) 4.0 (1.22)</td>
<td>4.0 (1.22)</td>
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<td>15.0 (4.57)</td>
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<td>Length</td>
<td>2XT</td>
<td>3.0 (0.91) 5.0 (1.52)</td>
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<td>Length</td>
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<td>15.0 (4.57)</td>
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<td>Length</td>
<td>3XT</td>
<td>3.0 (0.91) 9.0 (2.74)</td>
<td></td>
</tr>
</tbody>
</table>

Wall heights greater than 15’ (4.57m) are achievable.

**NOTES:** The above chart was prepared by Rosetta® Hardscapes LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate; however, Rosetta® Hardscapes LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer using the actual conditions of the proposed site.

1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m3).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCMC’s Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
7. All Rosetta® Hardscapes LLC Wall System Specifications are to be followed.
8. Each Rosetta® block must be connected into the reinforced soil mass with individual Paraweb® geosynthetic straps. The straps are to be wrapped around the galvanized lift hook on the back of the block.
9. The 6” and 12” high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18” high and 24” high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.
**SILTEY SAND, CLAYEY SAND WITH AN INTERNAL ANGLE OF FRICTION**

\[ \phi = 28^\circ \]

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 100 psf (4.79 kPa) Live Load Surcharge, No Back Slope, No Front Slope

### Wall Specifications

<table>
<thead>
<tr>
<th>Wall Height (ft)</th>
<th>Bury Depth (ft)</th>
<th>Leveling Pad Depth (ft)</th>
<th>Paraweb 30 Strip Length/ Hook ft</th>
<th>Geogrid Layout</th>
<th>Approx. Paraweb syd/LF wall (sq m/m wall)</th>
<th>Approx. Paraweb ft/LF wall (m/m wall)</th>
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<td>18.0 (5.49)</td>
<td>Type V.P. Length</td>
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<td>0.8 (2.29) 31.3 (31.32)</td>
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<td>Type V.P. Length</td>
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<td>1.2 (3.20) 36.5 (36.54)</td>
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<td>18.0 (5.49)</td>
<td>Type V.P. Length</td>
<td>2XT 3.5 (1.07) 4.0 (1.22) 6.0 (1.83) 5.5 (1.68)</td>
<td>1.5 (4.11) 41.8 (41.76)</td>
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<td>Type V.P. Length</td>
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<td>18.0 (5.49)</td>
<td>Type V.P. Length</td>
<td>3XT 3.0 (0.91) 5.0 (1.52) 5.5 (1.68) 5.0 (1.52)</td>
<td>3XT 3.0 (0.91) 5.0 (1.52) 5.5 (1.68) 5.0 (1.52)</td>
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<td>3XT 4.0 (1.22) 6.5 (1.98) 6.5 (1.98) 5.5 (1.68) 5.0 (1.52)</td>
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<td>Type V.P. Length</td>
<td>3XT 4.5 (1.37) 7.0 (2.13) 7.5 (2.29) 7.0 (2.13)</td>
<td>3XT 4.5 (1.37) 7.0 (2.13) 7.5 (2.29) 7.0 (2.13)</td>
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<td>3XT 8.0 (2.44) 8.0 (2.44) 8.0 (2.44) 8.0 (2.44)</td>
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<td>3XT 9.0 (2.74) 9.0 (2.74) 9.0 (2.74) 9.0 (2.74)</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120#pcf (18.9 kN/m³).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Design criteria are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
7. All Rosetta® Hardscapes LLC Wall System Specifications are to be followed.
8. Each Rosetta® block must be connected to the reinforced soil mass with individual Paraweb geosynthetic straps. The straps are to be wrapped around the galvanized lift hook on the back of the block.
9. The 6” and 12” high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18” high and 24” high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.

Final designs for construction purposes must be performed by a registered Professional Engineer using the actual conditions of the proposed site.
Silty sand, clayey sand with an internal angle of friction (φ) = 28°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 250 psf (11.96 kPa) Live Load Surcharge, No Back Slope, No Front Slope

### Table: Geogrid Layout

<table>
<thead>
<tr>
<th>Wall Height ft (m)</th>
<th>Wall Bury Depth ft (m)</th>
<th>Leveling Pad Depth ft (m)</th>
<th>Paraweb 30 Strap Length/Hook ft (m)</th>
<th>Approx. Geogrid (sq yd/lf wall) (sq m/m wall)</th>
<th>Approx. Paraweb (ft/lf wall) (m/m wall)</th>
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<td>5.5 (1.68)</td>
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<td>5.4 (14.94)</td>
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<td>8.0 (2.44)</td>
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<td>104.4 (104.40)</td>
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</tbody>
</table>

Wall heights greater than 15' (4.57m) are achievable.

NOTES: The above chart was prepared by Rosetta® Hardscapes LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate; however, Rosetta® Hardscapes LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer using the actual conditions of the proposed site.

1. Unit weight of 28, 30, 34, and 40 soils is assumed to be 12pcf (18.6 kN/m³).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCEMA’s Design Manual for Segmental Retaining Walls (2nd ed.)
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Back fill material to be compacted to 95% standard proctor.
7. All Rosetta® Hardscapes LLC Wall System Specifications are to be followed.
8. Each Rosetta® block must be connected to the reinforced soil mass with individual Paraweb® geosynthetic straps. The straps are to be wrapped around the galvanized lift hook on the back of the block.
9. The 6” and 12” high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18” high and 24” high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.
Silty sand, clayey sand with an internal angle of friction ($\phi$) = 28°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 1:2.5 (21.8°) Back Slope, No Surcharge, No Front Slope

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<tr>
<th>Wall Height ft (m)</th>
<th>Wall Bury Depth ft (m)</th>
<th>Levelling Pad Depth ft (m)</th>
<th>Paraweb 30 Strap Length/ Hook (ft (m))</th>
<th>Geogrid Layout</th>
<th>Approx. Geogrid syd/LF wall (sq yd/m² wall)</th>
<th>Approx. Paraweb ft/LF wall (m³/m)</th>
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<td>2XT 1.5 (0.46) 3.0 (0.91) 4.5 (1.37)</td>
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<td>1.1 (3.05) 36.5 (36.54)</td>
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<td>Type V.P.</td>
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<tr>
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<td>Type V.P.</td>
<td>3XT 3.5 (1.07) 17.5 (5.33) 17.5 (5.33)</td>
<td></td>
</tr>
</tbody>
</table>

Wall heights greater than 14' (4.27m) are achievable.

NOTES: The above chart was prepared by Rosetta® Hardscapes LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate, however, Rosetta® Hardscapes LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer using the actual conditions of the proposed site.

1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m³).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material is to be compacted to 95% standard proctor.
7. All Rosetta® Hardscapes LLC Wall System Specifications are to be followed.
8. Each Rosetta® block must be connected into the reinforced soil mass with individual Paraweb® geosynthetic straps. The straps are to be wrapped around the galvanized lift hook on the back of the block.
9. The 6” and 12” high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18” high and 24” high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.
Silty sand, fine to medium sand with an internal angle of friction ($\phi$) = 30°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- No Surcharge, No Back Slope, No Front Slope

### Geogrid Layout

<table>
<thead>
<tr>
<th>Wall Height ft (m)</th>
<th>Wall Bury Depth ft (m)</th>
<th>Leveling Pad Depth ft (m)</th>
<th>Paraweb 30 Strap Length ft (m)</th>
<th>Hook Length ft (m)</th>
<th>Geogrid Layout</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 6.0 (0- 1.83)</td>
<td>0.5 (0.15)</td>
<td>0.5 (0.15)</td>
<td>10.0 (3.05)</td>
<td>3XT</td>
<td>Vertical Placement (V.P.) of geogrid layers measured up from top of leveling pad ft (m) Geogrid length measured from the back of the blocks ft (m) Approx. Geogrid syd/LF wall (sq m/m wall) Approx. Paraweb ft/LF wall (m/m wall)</td>
</tr>
</tbody>
</table>

#### Wall heights greater than 15’ (4.57m) are achievable.

**Notes:**
- The above chart was prepared by Rosetta® Hardscapes LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate, however, Rosetta® Hardscapes LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer using the actual conditions of the proposed site.
- Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m³).
- Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
- Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls (2nd ed.).
- Global stability has not been addressed in these charts.
- The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
- Backfill material to be compacted to 95% standard proctor.
- 31
Silty sand, fine to medium sand with an internal angle of friction (φ) = 30°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 100 psf (4.79 kPa) Live Load Surcharge, No Back Slope, No Front Slope

<table>
<thead>
<tr>
<th>Wall Height (m)</th>
<th>Wall Bury Depth (ft)</th>
<th>Leveling Pad Depth (ft)</th>
<th>Paraweb 30 Strap Length/Hook (ft)</th>
<th>Geogrid Layout</th>
<th>Approx. Geogrid syd/LF wall (sq m/ m wall)</th>
<th>Approx. Paraweb strap length/LF wall (m/ wall)</th>
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<td>0.5 (0.15)</td>
<td>0.5 (0.15)</td>
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<td>5.0 (1.52)</td>
<td>6.0 (1.83)</td>
<td>6.0 (1.83)</td>
<td>16.0 (4.88)</td>
<td>Type V.P. Length</td>
<td>2XT 1.5 (0.46) 4.0 (1.22)</td>
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</tr>
<tr>
<td>7.0 (2.33)</td>
<td>7.0 (2.33)</td>
<td>7.0 (2.33)</td>
<td>16.0 (4.88)</td>
<td>Type V.P. Length</td>
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<td>8.0 (2.44)</td>
<td>8.0 (2.44)</td>
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<td>Type V.P. Length</td>
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<td>2XT 3.5 (0.91) 4.0 (1.22)</td>
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<td>11.0 (3.35)</td>
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<td>Type V.P. Length</td>
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Wall heights greater than 14" (4.27m) are achievable.

NOTES: The above chart was prepared by Rosetta® Hardscapes LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate, however, Rosetta® Hardscapes LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer using the actual conditions of the proposed site.

1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m3).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
7. All Rosetta® Hardscapes LLC Wall System Specifications are to be followed.
8. Each Rosetta® block must be connected to the reinforced soil mass with individual Paraweb® geosynthetic straps. The straps are to be wrapped around the galvanized lift hook on the back of the block.
9. The 6” and 12” high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18” and 24” high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.
# Silty sand, fine to medium sand with an internal angle of friction ($\phi$) = 30°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 250 psf (11.96 kPa) Live Load Surcharge, No Back Slope, No Front Slope

## Wall Specifications

### Geogrid Layout

<table>
<thead>
<tr>
<th>Wall Height ft (m)</th>
<th>Wall Bury Depth ft (m)</th>
<th>Levy- ing Pad Depth ft (m)</th>
<th>Paraweb 30 Strap Length ft (m)</th>
<th>Approx. Geogrid syd/LF wall (sq m/m wall)</th>
<th>Approx. Paraweb ft/LF wall (m/m wall)</th>
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</tbody>
</table>

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1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m3).
2. Minimum factors of safety are 1.5 for sidling, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
7. All Rosetta® Hardscapes LLC Wall System Specifications are to be followed.
8. Each Rosetta® block must be connected into the reinforced soil mass with individual Paraweb® geosynthetic straps. The straps are to be wrapped around the galvanized lift hook on the back of the block.
9. The 6” and 12” high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18” high and 24” high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the block.
Siltey sand, fine to medium sand with an internal angle of friction (\(\phi\)) = 30°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 1:2.5 (21.8°) Back Slope, No Surcharge, No Front Slope

<table>
<thead>
<tr>
<th>Wall Height (ft)</th>
<th>Wall Bury Depth (ft)</th>
<th>Leveling Pad Depth (ft)</th>
<th>Paraweb 30 Strap Depth (ft)</th>
<th>Geogrid Layout</th>
<th>Approx. Geogrid syd/LF wall (sq ft/m wall)</th>
<th>Approx. Paraweb ft/LF wall (m/m wall)</th>
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</thead>
<tbody>
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<td>0.5 (0.15)</td>
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<td>0.5 (0.15)</td>
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<td>0.5 (0.15)</td>
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<td>Type V.P. Length</td>
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Wall heights greater than 15' (4.57/m) are achievable.

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1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m3).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCMA's Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
Dense well-graded sand, sand and gravel with an internal angle of friction(\(\phi\)) = 34°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- No Surcharge, No Back Slope, No Front Slope

### Geogrid Layout

<table>
<thead>
<tr>
<th>Wall Height ft (m)</th>
<th>Wall Bury Depth ft (m)</th>
<th>Leveling Pad Depth ft (m)</th>
<th>Paraweb 30 Strap Hook ft (m)</th>
<th>Approx. Geogrid syd/LF wall (sq ft/m wall)</th>
<th>Approx. Paraweb strap ft/LF wall (m/m wall)</th>
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<td>6.5 (1.98)</td>
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<td>8.0 (2.44)</td>
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</table>

Wall heights greater than 15' (4.57m) are achievable.

### Footnotes
1. Unit weight of 28", 30", 34" and 40" soils is assumed to be 120pcf (18.0 kN/m³).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCMA's Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
7. All Rosetta walls are to be constructed in compliance with the Rosetta Wall System Specification. Specifications are to be followed.
8. Each Rosetta® block must be connected to the reinforced soil mass with individual Paraweb® geosynthetic straps. The strap needs to be pre-looped around the galvanized lift hook on the back of the block.
9. The 6" and 12" high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18" and 24" high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.

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Dense well-graded sand, sand and gravel with an internal angle of friction ($\phi$) = 34°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 100 psf (4.79 kPa) Live Load Surcharge, No Back Slope, No Front Slope

### Outcropping

**Description:** Wall  |  **Texture:** Stone  |  **Applications:** Retaining Walls up to 6’ w/o Geogrid, 20’ w/ Geogrid

<table>
<thead>
<tr>
<th>Wall Height (ft)</th>
<th>Wall Bury Depth (ft)</th>
<th>Leveling Pad Depth (ft)</th>
<th>Paraweb 30 Strap Length (ft)</th>
<th>Hook Depth (ft)</th>
<th>Geogrid Layout</th>
<th>Approx. Geogrid syd/LF wall (sq ft/m)</th>
<th>Approx. Paraweb ft/LF wall (m/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5.0 (0 - 1.52)</td>
<td>See Gravity charts</td>
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<td>2XT 4.0 (1.22)</td>
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<td>0.5 (0.15)</td>
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<td>Type V.P. Length</td>
<td>2XT 1.0 (0.30)</td>
<td>3.0 (0.91)</td>
<td>2XT 3.0 (0.91)</td>
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<td>0.5 (0.15)</td>
<td>11.0 (3.35)</td>
<td>Type V.P. Length</td>
<td>2XT 1.0 (0.30)</td>
<td>4.0 (1.22)</td>
<td>2XT 4.0 (1.22)</td>
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<td>10.0 (3.05)</td>
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<td>6.0 (1.83)</td>
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<tr>
<td>15.0 (4.57)</td>
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<td>8.0 (2.44)</td>
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</tbody>
</table>

Wall heights greater than 14’ (4.27m) are achievable.

NOTES: The above chart was prepared by Rosetta® Hardscapes LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate, however, Rosetta® Hardscapes LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart’s is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer using the actual conditions of the proposed site.

1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m³).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCECA’s Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
7. All Rosetta® Hardscapes LLC Wall System Specifications are to be followed.
8. Each Rosetta® block must be connected to the reinforced soil mass with individual Paraweb® geosynthetic straps. The straps are to be wrapped around the galvanized lift hook on the back of the block.
9. The 6” and 12” high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18” high and 24” high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.
### Dense well-graded sand, sand and gravel with an internal angle of friction ($\phi$) = 34°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 250 psf (11.96 kPa) Live Load Surcharge, No Back Slope, No Front Slope

### Geogrid Layout
- Grid type specified for each layer
- Vertical Placement (V.P.) of geogrid layers measured up from top of leveling pad (ft (m))
- Geogrid length measured from the back of the blocks (ft (m))

<table>
<thead>
<tr>
<th>Wall Height (ft)</th>
<th>Wall Bury Depth (ft)</th>
<th>Levelling Pad Depth (ft)</th>
<th>Paraweb 30 Strap Length/Pad Hook (ft)</th>
<th>Geogrid Type</th>
<th>V.P. (ft)</th>
<th>Approx. Geogrid (sq m/m wall)</th>
<th>Approx. Paraweb (ft/LF wall) (m/m wall)</th>
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<tr>
<td>0 - 3.0 (0 - 0.91)</td>
<td></td>
<td></td>
<td></td>
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<td>2XT</td>
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<td>3.0 (0.91)</td>
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<tr>
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<td>3.5 (1.07)</td>
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<td>7.0 (2.13)</td>
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<td>8.0 (2.44)</td>
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<td>56.5 (56.55)</td>
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</table>

Wall heights greater than 15' (4.57m) are achievable.

Notes:
1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m3).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls (2nd ed.).
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
7. All Rosetta® Hardscapes LLC Wall System Specifications are to be followed.
8. Each Rosetta® block must be connected to the reinforced soil mass with individual Paraweb® geosynthetic straps. The straps are to be wrapped around the galvanized lift hook on the back of the block.
9. The 6" and 12" high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18" high and 24” high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
10. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.
Outcropping

Description: Wall | Texture: Stone | Applications: Retaining Walls up to 6' w/o Geogrid, 20' w/ Geogrid

Dense well-graded sand, sand and gravel with an internal angle of friction ($\phi$) = 34°

- Soil Reinforced with Mirafi Miragrid
- Facing Blocks Connected to Reinforced Soil Mass with Paraweb Geosynthetic Strap
- 1:2.5 (21.8°) Back Slope, No Surcharge, No Front Slope

Wall Height (ft) | Wall Bury Depth (ft) | Leveling Pad Depth (ft) | Paraweb 30 Strap Length/ Hook ft (m) | Geogrid Layout | Grid type specified for each layer | Vertical Placement (V.P.) of geogrid layers measured up from top of leveling pad ft (m) | Geogrid length measured from the back of the blocks ft (m) | Approx. Geogrid syd/LF wall (sq ft/m wall) | Approx. Paraweb strap length/ft/LF wall (m/m wall)
---|---|---|---|---|---|---|---|---|---
0 - 5.0 (0 - 1.52) | See Gravity charts |

Wall heights greater than 15’ (4.57 m) are achievable.

NOTES: The above chart was prepared by Rosetta® Hardscapes LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate, however, Rosetta® Hardscapes LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer using the actual conditions of the proposed site.

1. Unit weight of 28°, 30°, 34° and 40° soils is assumed to be 120pcf (18.9 kN/m3).
2. Minimum factors of safety are 1.5 for sliding, 2.0 for overturning and 2.0 for bearing capacity.
3. Designs are in general accordance with NCMA’s Design Manual for Segmental Retaining Walls (2nd ed.)
4. Global stability has not been addressed in these charts.
5. The wall design shall address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final wall design.
6. Backfill material to be compacted to 95% standard proctor.
7. Outworking must be performed by a registered Professional Engineer using the actual conditions of the proposed site.
8. The 6" and 12" high Rosetta® blocks have one galvanized lift hook and require one strap per block. The 18" and 24" high Rosetta® blocks have two galvanized lift hooks and require two straps per block.
9. Paraweb strap length in chart is total length. Since the strap is looped around the lift hook, the strap extends half the total distance behind the blocks.

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Belvedere Wall

Description: Wall  |  Texture: Stone  |  Applications: Freestanding & Retaining Walls up to 4' w/o Geogrid, 12' w/ Geogrid

Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet or piece</th>
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<td>72</td>
<td>2475 lbs</td>
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<td>6 x 9 x 18</td>
<td>12</td>
<td>67 ±</td>
<td></td>
</tr>
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<td>6&quot; medium</td>
<td>6 x 9 x 12</td>
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<td>42 ±</td>
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<td>12</td>
<td>21 ±</td>
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</tr>
<tr>
<td>3&quot; small</td>
<td>3 x 9 x 6</td>
<td>12</td>
<td>10 ±</td>
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<td>3&quot; unit</td>
<td>3 x 9 x 15</td>
<td>16</td>
<td>30 ±</td>
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Colors

ash  |  |  | canyon  |  |  | saddle
Belvedere Coping & Caps

Description: Coping/Caps | Texture: Stone | Applications: Capping Walls

Pallet Information

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<th>Product/Unit</th>
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<th>pcs/pallet</th>
<th>wt./pallet</th>
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<td></td>
<td>2¼ x 10¼ x 6</td>
<td>24</td>
<td>10 ±</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2¼ x 10¼ x 12</td>
<td>24</td>
<td>20 ±</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2¼ x 10¼ x 18</td>
<td>12</td>
<td>30 ±</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2¼ x 10¼ x 18</td>
<td>6</td>
<td>30 ±</td>
<td></td>
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<tr>
<td></td>
<td>2¼ x 10¼ x 18</td>
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<td>30 ±</td>
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<tr>
<td>Column Cap</td>
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</table>

Colors

- ash
- canyon
- saddle
Typical Retaining Wall Construction Details

This page shows typical construction details for Belvedere retaining walls. These drawings are representative of major components required in wall construction. Specific details including geotextile reinforcement layers, drainage details, soil requirements, etc. shall be per engineered design for wall.

- This drawing is for reference only.
- Final design for construction for must be prepared by a registered Professional Engineer using the actual conditions of the proposed site.
- Final wall design must address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the wall design.
- Block size and placement shown are for reference only Individual Belvedere blocks will vary with installation pattern.
Belvedere freestanding walls are intended to be low walls (24” or lower) used in a garden or patio setting. Taller walls, walls intended to act as railing or barriers, walls constructed in other settings, or walls subject to applied loads will require project specific engineering.

- This drawing is for reference only.
- Final design for construction for walls subject to any loading must be prepared by a registered Professional Engineer.
- Block size and placement shown are for reference only individual Belvedere blocks will vary with installation pattern.

This page shows typical construction details for making curved retaining walls with Belvedere blocks. The taper on the side of the blocks allow for construction of a wide range of curves in both retaining and freestanding walls.

Notes:

1. These details show curved retaining walls.

2. Minimum radius curves are shown which can be constructed without saw cutting a significant number of blocks. Larger radius curves can be created by leaving a larger gap between blocks on the back side of the wall. The gaps must be filled with drainstone.

3. When retaining walls are constructed with batter, the radius on outside curves becomes smaller with each course due to the block setback. For proper construction, the radius of the bottom course must be larger than the minimum radius so upper courses will have sufficient room for construction.

4. When retaining walls are constructed with a batter, the radius on inside curves becomes larger with each course due to the block setback.
Belvedere

Description: Wall | Texture: Stone | Applications: Freestanding & Retaining Walls up to 4’ w/o Geogrid, 12’ w/ Geogrid

Curved Freestanding Walls:

Curved freestanding walls can also be built. Typically, the blocks have to be field adjusted to make the desired curve. Front and back faces will alternate and blocks trimmed as needed to provide a tight fit between blocks with no gaps on either side of the freestanding wall.

Note: Walls are shown without batter for clarity. Blocks in a retaining wall should be adjusted slightly in place and trimmed as needed to allow wall construction with proper batter.

Pillar Construction Details

This page shows typical construction details for Belvedere pillars. Pillars make nice ends to Freestanding walls, formal stair openings, stand-alone monuments, and other areas to enhance your Belvedere project. The basic steps of pillar construction are shown here. Feel free to expand on these ideas and bring your own creativity into creating a custom project.

**Step 1**
Place (4) 3” or 6” high corner blocks with the taper facing into the center of the pillar.

**Step 2**
Place the second row of (4) of the corner blocks with the taper facing into the center of the pillar. Typically if the first row is built with 6” corner blocks, the second row is built with 3” corner blocks.

**Step 3**
Continue with subsequent rows to the desired pillar height. One pallet of corner blocks will make a 24” x 24” x 36” high column.

**Step 4**
Place a column cap to finish the pillar. The column cap can be cored as needed for installation of a light.

This example shows a freestanding wall with pillars on each end. The wall can either be constructed flush with the pillars, or blocks trimmed to interlock the end of the wall with the pillar.
Corner Construction Details

This page shows typical construction details for making 90º corner with Belvedere Blocks. Some basic concepts are shown here. Plan to take some time to properly work corners into the larger retaining and free-standing wall patterns.

Note: Walls are shown without batter for clarity. Blocks in a retaining wall should be adjusted slightly in place and trimmed as needed to allow wall construction with proper batter.

Interlocking Corner

Place block in an overlapping, interlocking pattern at corner for added wall stability.

NOTES: Retaining walls are typically constructed with the front face of the block exposed. The v-shaped notches which appear on the back of wall between adjacent blocks must be filled with drainstone. The blocks shown above are labeled, for example, 4F would indicate the front (or longer) face of block 4, and 2B would indicate the back (or shorter) face of block 2.

*These patterns are NOT required and are presented for reference only. They are most useful for long, straight retaining walls.
Belvedere

Description: Wall | Texture: Stone | Applications: Freestanding & Retaining Walls up to 4’ w/o Geogrid, 12’ w/ Geogrid

24” High Vertical End - Left
Wall section Shown = 11.67 sqft (1/2 Wall Pallet)
Note: Vertical End Jogs in and out approximately 1” between blocks.

24” High Vertical End - Right
Wall section Shown = 11.67 sqft (1/2 Wall Pallet)
Note: Vertical End jogs in and out approximately 1” between blocks.
**Dimensional Wall, Coping & Cap**

Description: **Wall** | Texture: **Hand Hewn** | Applications: **Freestanding & Retaining Walls up to 2 ½’**

- **Straight Unit**
- **Wedge Unit**
- **Short coping**
- **Long coping**
- **Finished end coping**
- **Dimensional column cap**

### Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight Unit</td>
<td>4 x 8 x 12</td>
<td>25 sf</td>
<td>75</td>
<td>2100 lbs</td>
</tr>
<tr>
<td>Wedge Unit</td>
<td>4 x 8 x 12-7½</td>
<td>33 sf</td>
<td>100</td>
<td>2000 lbs</td>
</tr>
<tr>
<td>Column Cap</td>
<td>2½ x 24 x 24</td>
<td>EA</td>
<td>6</td>
<td>954 lbs</td>
</tr>
<tr>
<td>Coping units all on one pallet</td>
<td>63 ft</td>
<td>36</td>
<td>1950 lbs</td>
<td></td>
</tr>
<tr>
<td>Short Coping</td>
<td>2½ x 12½ x 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Coping</td>
<td>2½ x 12½ x 24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finished End Coping</td>
<td>2½ x 12½ x 19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Colors

- **ash**
- **canyon**
- **saddle**
**Dimensional Wall, Coping & Cap**

Description: **Wall | Texture: Hand Hewn | Applications: Freestanding & Retaining Walls up to 2 1/2'**

---

Retaining / Freestanding Wall

- **Dimensional Wall Blocks**
- **Drainstone**
- **Geotextile Fabric**
- **Drain**
- **Leveling Pad**
- **Dimensional Coping** (Optional; Refer to Page 20 For Additional info.)

Actual weight may vary. Packaging may vary by location. Check with local supplier for details.
Dimensional Flagstone

Description: Slab | Texture: Hand Hewn | Applications: Patios, Walkways & Driveways

Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>All six shapes - one pallet</td>
<td>N/A</td>
<td>98 sf</td>
<td>48</td>
<td>2350 lbs</td>
</tr>
<tr>
<td>8 layers/pallet</td>
<td>1 layer = 1 pattern</td>
<td>12¼ sf/layer</td>
<td>6 shapes/layer</td>
<td></td>
</tr>
</tbody>
</table>

Colors

- ash
- canyon
- saddle
**Dimensional Flagstone**

Description: **Slab**  |  Texture: **Slate**  |  Applications: **Patios, Walkways & Driveways**

---

**Dimensional Flagstone Cross-Section**

- Dimensional Flagstone Slabs (2" (45mm) Thick)
- Jointing Sand between Slabs
- Coarse Bedding Sand (1" (25 mm) Thick)
- Compacted Gravel Base (6" (150 mm) Thick)
- Woven geotextile (Optional)
- Compacted Existing Sub-Grade

---

**Walkway Layout**

**Patio Layout**
**Grand Flagstone**

Description: **Slab** | Texture: **Slate** | Applications: **Patios, Walkways, Pool Decks**

Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomly-sized shapes, all 1 ¾” thick: Features 4 different 4-piece patterns 2 layers of each pattern per pallet 8 layers per pallet 11 ¾ sf per layer</td>
<td>90 sf*</td>
<td>30</td>
<td>2160 lbs</td>
</tr>
</tbody>
</table>

* Assumes ⅝” joint

Colors

- ash
- canyon
- saddle
**Grand Flagstone**

**Description:** Slab  |  **Texture:** Slate  |  **Applications:** Patios, Walkways, Pool Decks

**Installation**

**Safety**
Make safety your top priority when installing Grand Flagstone. Before starting your project, be sure to address the following points:

- Contact your local utility marking service prior to making any excavation.
- Always wear the appropriate personal protective equipment (PPE) including the following: gloves, steel toed boots, safety glasses, hearing protection (when cutting slabs), and any other needed safety gear.
- Grand Flagstones are heavy. Follow proper lifting techniques to avoid back injury. Also, use two people to set the larger pieces.
- Be sure to follow all governmental safety regulations.

**Planning And Project Layout**
The first step in installing Grand Flagstone is to plan your project. Slab layout and placement is important to insure a functional and good looking project. This guide presents several items for you to consider when planning your project. Remember, Grand Flagstone is suitable for pedestrian loading only (patios, walkways, etc), and will not support the load of a vehicle.

Once you have planned your project, you will need to lay out the project area. Mark out the area of the installation with marking paint. Mark a second line 12” outside of the first line. This second line indicates the area to be excavated. This over excavation will allow for proper base installation.

**Excavation And Base Preparation**
The excavation depth required for the installation of Grand Flagstone is a minimum of 8.75” (218 mm). Once the excavation depth has been established, compact the sub-grade to 95% standard proctor using a plate tamper.

At this point, you have the option to lay a woven geo-textile down before applying any granular base materials. This geo-textile will serve to keep separation between the compacted gravel base and sub-grade soils. It is also useful when you have weak sub-grade soils.

**Place The Compacted Gravel Base**
Begin by spreading granular base material in the excavated area using the first of two 3” (75mm) lifts.

Compact the first 3” (75 mm) lift to 95% standard proctor using water as needed and a plate tamper.

Add the second lift of 3” (75 mm) granular material to make a total of 6” (150 mm) of granular material.

Compact the second 3” (75 mm) lift of granular material using water as needed and a plate tamper to 95% standard proctor.

**KEY POINT:** When installing granular base materials, be sure to consider proper grades to prevent water from standing on the surface and make sure water is directed away from building structures.
Installation Of Bedding Sand
Using screed rails on the compacted granular base apply bedding sand at a maximum thickness of 1” (25 mm). By using a screed board along the top of the screed rails the bedding sand will level evenly.

Place Grand Flagstone
Begin laying the individual pieces of Grand Flagstone on the screed-ed bedding sand according to your detailed project plan.

Separate individual pieces approximately 3/8” (10 mm) from each other. When pieces are set with this gap, a full pallet will produce 90 square feet (8.36 m²) of coverage.

To ensure proper color distribution, take layers from several bundles at one time. Cut units as needed to finish edges.

Do not compact Grand Flagstone once product has been laid.

Once the Grand Flagstone pieces are installed, fill all joints with a jointing sand suitable for large joints. Sweep the sand into the joints between flagstones until the joints are completely filled. Follow the jointing sand manufacturer’s recommendations for wetting the sand. You may need to repeat this process with more dry sand in a few days to completely fill the joints between individual slabs.

You may also want to apply a sealer to protect the Flagstone slabs from spills and stains. Always use a high quality sealer specifically formulated for wetcast concrete.

Things To Consider When Planning Your Project
Grand Flagstone has been designed to allow for quick and easy installation. Consider the following items when you are planning your project.

Grand Flagstone Packaging
Grand Flagstone is palletized in layers of slabs. Each layer has the same outside dimensions as every other layer, allowing them to be used anywhere in the layout pattern.

A standard pallet consists of 8 layers of slabs and weighs 2,000 lb (980 kg). When placed with a 3/8” (10 mm) wide joint, each full pallet produces 90 square feet (8.36 m²) of coverage.
**Grand Flagstone**

Description: **Slab** | Texture: **Slate** | Applications: **Patios, Walkways, Pool Decks**

**Interlocking Layers**
Each layer of Grand Flagstone slabs on a pallet is an interlocking set. Each interlocking set, or layer, of slabs will also interlock with all other layers.

**NOTE:** Layers shown below are for reference only. Any layer fits with any other layer. Blend layers randomly. For optimal color blends, mix layers from multiple pallets.

**Layout Orientation**
Layout orientation is important with Grand Flagstone. Due to the interlocking nature of the sets of slabs, there is a long, unbroken joint between rows. Often, the irregular nature of the Grand Flagstone limits how noticeable these unbroken joints are in the finished project. However, the lines become slightly more pronounced when you are looking parallel to the unbroken joints than when you are looking at them on an angle.

To limit this effect, Grand Flagstone layers should be laid at a 45 degree angle from the most common viewing point. This viewing point would most likely be a patio entrance or step location.

If there is a secondary walkway or viewing point, align the Grand Flagstone layers so the rows are as close to 45 degree angle from the secondary viewing point as possible.
Reducing Long, Unbroken Lines In The Layout Pattern

Long, unbroken lines can be reduced by placing a single piece of Grand Flagstone between interlocking sets of slabs. Follow these simple steps:

1. Start by placing the interlocking slabs.

2. Place a new piece of Grand Flagstone over the interlocking slabs, making sure to straddle the joint you want to break-up.

3. Mark the outline of the new slab. Remember to include approximately 3/8” (10 mm) outside the new slab for a joint.

4. Remove the new slab, sawcut the original slabs, and remove the small pieces which have been cut.

5. Place the new slab in the space you just created.

Procedure For Installing Cracked Pieces:

Individual pieces of Grand Flagstone can crack either during delivery to the job or during on-site handling prior to placement. Typically less than 5% of the pieces will crack. There are two methods to deal with cracked pieces.

The first method is to use the cracked pieces to fill in around the edge of the project where there is always a need for small pieces.

The second method is to use the cracked pieces to enhance the layout pattern. Since Grand Flagstone is designed to create an irregular flagstone walking surface, an extra crack simply provides another joint line in the Grand Flagstone pattern. Place the cracked pieces next to each other with a 3/8” (10 mm) joint between them. The joint is filled with polymeric jointing sand just like all the other joints. If necessary, the cracked pieces may need to be trimmed to create a smoother edge or provide a larger joint to match all the other joints in your project.

Overlapping Construction

In some instances it is easier to lay the Grand Flagstone patio and then trim for installation of other features. A typical example is the installation of a freestanding Belvedere seat wall around the edge of a Grand Flagstone patio. The steps are as follows:

1. Prep the area for the patio and seat wall. Remember to excavate any extra depth for the wall embedment and stone leveling pad.
2. Build the Grand Flagstone patio. Allow individual pieces to overhang the desired edge of the finished area.

3. Mark the wall location, cut and remove the Flagstone pieces, and then install the seat wall.

Making A Walkway
Grand Flagstone is designed for fast, simple installation of a walkway. The individual layers interlock on the ends, providing fast construction of an irregular pattern.

The layers of slabs are installed in the long direction. A full pallet of Grand Flagstone will produce a 38” (0.96 m) wide by 28’-0” (8.53 m) long walkway.

A slight curve can be made in a walkway by setting the individual pieces so there is a larger gap on one side of the piece than on the other. For a more pronounced curve, cut the pieces to fit. (See sketch.)

The edges of the slabs can be left as is to provide an irregular edge which will move in and out slightly. If a smooth edge is desired, sawcut the individual pieces as needed.

Making A Right Angle Turn In A Walkway
Right angle turns are simple to make with Grand Flagstone.

1. Begin by constructing a standard walkway. Start construction at the turn or measure carefully to ensure that you will be at the end of a layer of slabs when you reach the turn.

2. Place the next layer at 90° (or whatever angle you would like to turn) and mark the outside edges of the previous layer.

3. Sawcut the individual pieces so they will fit together properly.

4. Continue with construction of the walkway in the new direction.
Step Collection

Description: Step | Texture: Hand Hewn | Applications: Steps

Irregular Steps

7”H x 2’D x 5’L

7”H x 2’4”D x 4’L

7”H x 2’2”D x 3’½’L

Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps palletized with 2x ea/blended pieces</td>
<td>N/A</td>
<td>6</td>
<td>3300 lbs</td>
<td></td>
</tr>
<tr>
<td>2x per pallet:</td>
<td>7 x 24 x 60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2x per pallet:</td>
<td>7 x 28 x 48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2x per pallet:</td>
<td>7 x 26 x 42</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimensional Steps

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 x 18 x 48 Step</td>
<td>EA</td>
<td>6</td>
<td>3050 lbs</td>
</tr>
</tbody>
</table>

Colors

ash

canyon

saddle
Begin the step installation process by measuring the total rise required and calculating the number of steps to be used. Each step has a 5 1/2" or 7" rise, but should be sloped approximately 1/2" such that the back of the step is higher than the front of the step. This slope will facilitate surface water drainage. With appropriate sloping, the net rise of each step is 6" or 7 1/2". Divide the total rise by 6" or 7 1/2" to get the number of steps required. Next, calculate the tread width. Generally, when the grade allows, a 12" or wider tread is desirable. To calculate the tread width, divide the total allowable horizontal run minus the width of the top step, by the number of steps minus one. The one less will account for the top step.

Consider the following example:
Total rise = 42", Total horizontal run = 108", Width of top step = 24",
Rise of steps = 5 1/2"
Number of steps = 42" ÷ 6"/Step = Steps
Tread Depth = (108"-24") ÷ (7-1) = 14" Tread Depth

Excavate and grade the area for the first step. Steps should be placed on at least 3" of free draining soil, such as sand or peastone. Compact soil to a minimum of 95% Standard Proctor. Place step with either forks or straps using a small excavator or skid-steer to lift the piece into place. Practice safe handling procedures during this process.

Fill behind each step with free draining soil and compact to 95% standard proctor. Remember to slope fill to allow for proper drainage when next step is placed. Continue placing steps in this manner until finish grade is reached.

- This drawing is for reference only.
- Block size and placement shown are for reference only. Individual steps will vary with installation pattern.
Fire Pits

Description: Fire Pits | Texture: Stone/Hand Hewn | Applications: Fire Pits

Belvedere Fire Pit

Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m palate</th>
<th>pcs/pallet</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belvedere Round Pit</td>
<td>58 outside dia.</td>
<td>EA</td>
<td>52</td>
<td>1200 lbs</td>
</tr>
<tr>
<td>Belvedere Round Pit</td>
<td>37 inside dia.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belvedere Round Pit</td>
<td>14½ high</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimensional Fire Pit

Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m palate</th>
<th>pcs/pallet</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensional Square Pit</td>
<td>44 x 44 x 12</td>
<td>EA</td>
<td>48</td>
<td>1109 lbs</td>
</tr>
<tr>
<td>Dimensional Square Pit</td>
<td>Metal insert is optional</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Colors

- ash
- canyon
- saddle
Fire Pits

Description: Slab  |  Texture: Hand Hewn  |  Applications: Fire Pits

INSTRUCTIONS: For both Round & Square Fire Pit Kits

1. Familiarize yourself with the construction details shown on this page.

2. Mark out the location for your fire pit. Note dimensions shown are nominal so mark an area slightly larger than shown.

3. Excavate for drain stone base (approx. 6”)

4. Fill excavation with drain stone, level, and compact.

5. Place and center steel ring on prepared base.

6. Place blocks per the pattern. (For Round Kit, keep Blocks 1 1/2” off steel ring)

WARNING: Do not place Rosetta Fire Pits directly on Rosetta Flagstone product or any comparable concrete product or slab as high heat can adversely affect the integrity of the product.

ADDITIONAL INSTRUCTIONS FOR ROUND FIRE PIT ONLY

7. After placing blocks around the ring, adjust the blocks in or out to make the circle close and fit tight. If the blocks do not close the circle, move all blocks slightly in. If the blocks seem too long, move the blocks slightly out.

8. Place caps in circle around fire pit. Adjust the caps in or out to make them fit tightly together.

Note: Not suitable for large fires. Fire size should not allow flame to contact Caps on Round Fire Pit.
Superior Steppers

Description: Slab | Texture: Hand Hewn | Applications: Stepping Stones

Pallet Information

<table>
<thead>
<tr>
<th>Product/Unit</th>
<th>Dimensions (in)</th>
<th>u/m pallet</th>
<th>pcs/pallet</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 randomly-sized</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>shapes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2x each size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 piece = 3¾ sf</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>27 x 21 x 2*</td>
<td>52 sf</td>
<td>16</td>
<td>1300 lbs</td>
</tr>
</tbody>
</table>

* approximate size

Palletization

2,400 lbs/pallet
18 units/pallet
4 unique sizes
24 unique textures

Installation Information

Installation on Superior Steppers is easy! Simply place the product on the directly on the ground. You can place the steppers on grass, gravel, mulch, etc.

Colors

ash                  
canyon               
saddle

newlinehardscapes.com
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Paver Finishes

Chamfered
A classic finish that is characteristic of traditional brick. Features beveled edges.
- Holland Stone™
- Aqua-Flo™
- Enviro-Flo™
- Terrace Stone™ Smooth

Aged
Provides a time-worn, weathered effect to the look of the paver.
- English Cobble™
- English Cobble™ 4-Piece
- English Cobble™ Circle Kit

Traditional
With rounded “pillowed” edges, the traditional finish provides a soft, padded appearance to the paver.
- Classic Cobble™
- Classic Cobble™ 4-Piece
- Classic Cobble™ Circle Kit
- Alleyway Cobble™

Textured/Aged
This finish includes both a textured relief to the face, as well as an antiquing process, aging it to appear like old cobblestones.
- Carriage Stone™

Slate
This specialty finish gives the patio tile a texture similar to Pennsylvania Bluestone or slate.
- York Tile™
- Terrace Stone™
Concrete Paver Installation

ICPI provides construction guidelines to design professionals and installers of interlocking concrete pavements. Several resources are available on this website that review the steps necessary for constructing interlocking concrete pavements.

This pavement structure is commonly used for both pedestrian and vehicular applications. Pedestrian areas, driveways, and areas subject to limited vehicular use are paved with units 2 3/8 in. (60 mm) thick. Streets and industrial pavements should be paved with units at least 3 1/8 in. (80 mm) thick.

Compaction of the soil subgrade and aggregate base materials are essential to the long-term performance of interlocking concrete pavements.

Installation steps typically include job planning, layout, excavating and compacting the soil subgrade, applying geotextiles (optional), spreading and compacting the sub-base and/or base aggregates, constructing edge, restraints, placing and screeding the bedding sand, placing concrete pavers, compacting concrete pavers, sweeping in jointing sand and final compaction.

**Installation Basics**

**Note:** Compaction of the soil subgrade is recommended to at least 98% standard Proctor density per ASTM D 698 for pedestrian areas and residential driveways. Compaction to at least 98% modified Proctor density per ASTM D 1557 is recommended for areas subject to heavy vehicular traffic. Stabilization of the subgrade and/or base material may be necessary with weak or saturated subgrade soils.

**Note:** Local aggregate base materials typical to those used for highway flexible pavements are recommended, or those conforming to ASTM D 2940. Compaction of aggregate is recommended to not less than 98% Proctor density in accordance with ASTM D 698 is recommended for pedestrian areas and residential driveways. 98% modified Proctor density according to ASTM D 1557 is recommended for vehicular areas. Mechanical tampers are recommended for compaction of soil subgrade and aggregate base in areas not accessible to large compaction equipment. Such areas can include that around lamp standards, utility structures, building edges, curbs, tree wells and other protrusions.

**Note:** Prior to screeding the bedding sand, the recommended base surface tolerance should be ± 3/8 in. (±10 mm) over a 10 ft. (3 m) straight edge. See ICPI Tech Spec 2, Construction of Interlocking Concrete Pavements for further guidance on construction practices.

**Note:** The elevations and surface tolerance of the base determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies in the base surface with additional bedding sand or by other means. Therefore, the surface elevations of the base should be checked and accepted by the General Contractor or designated party, with written certification to the paving subcontractor, prior to placing bedding sand and concrete pavers.

**Acceptance of Site Verification of Conditions:**

General Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.

Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
Verify that geotextiles, if applicable, have been placed according to drawings and specifications.
Verify that [Aggregate] [Cement-treated] [Asphalt-treated] [Concrete] [Asphalt] base materials, thickness, [compacted density], surface tolerances and elevations conform to specified requirements.
Provide written density test results for soil subgrade, [aggregate] [cement-treated][asphalt-treated][asphalt]
Concrete Paver Installation

base materials to the Owner, General Contractor and paver installation subcontractor.  
Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage inlets.  
Do not proceed with installation of bedding sand and interlocking concrete pavers until [subgrade soil and] base conditions are corrected by the General Contractor or designated subcontractor.

Preparation

A. Verify base is dry, certified by General Contractor as meeting material, installation and grade specifications.  
B. Verify that base [and geotextile] is ready to support sand, [edge restraints,] and, pavers and imposed loads.  
C. Edge Restraint Preparation:  
   • Install edge restraints per the drawings [and manufacturer’s recommendations] [at the indicated elevations].  
   • **Note:** Retain the following two subparagraphs if specifying edge restraints that are staked into the base with spikes.  
   • Mount directly to finished base. Do not install on bedding sand.  
   • The minimum distance from the outside edge of the base to the spikes shall be equal to the thickness of the base.

Installation

A. Spread bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 1 1/2 in. (40 mm) thickness. Spread bedding sand evenly over the base course and screed rails, using the rails and/or edge restraints to produce a nominal 1 in. (25 mm) thickness, allowing for specified variation in the base surface.  
   • **Do not disturb** screeded sand.  
   • Screeded area shall not substantially exceed that which is covered by pavers in one day.  
   • Do not use bedding sand to fill depressions in the base surface.  
   **Note:** When initially placed on the bedding sand, manually installed pavers often touch each other, or their spacer bars if present. Joint widths and lines (bond lines) are straightened and aligned to specifications with rubber hammers and pry bars as paving proceeds.  
B. Lay pavers in pattern(s) shown on drawings. Place units hand tight without using hammers. Make horizontal adjustments to placement of laid pavers with rubber hammers and pry bars as required.  
   **Note:** Contact manufacturer of interlocking concrete paver units for recommended joint widths.  
C. Provide joints between pavers between [1/16 in. and 3/16 in. (2 and 5 mm)] wide. No more than 5% of the joints shall exceed [1/4 in. (6 mm)] wide to achieve straight bond lines.  
D. Joint (bond) lines shall not deviate more than ±1/2 in. (±15 mm) over 50 ft. (15 m) from string lines.  
   • Fill gaps at the edges of the paved area with cut pavers or edge units.  
E. Cut pavers to be placed along the edge with a [double blade paver splitter or] masonry saw.  
   **Note:** Specify requirements for edge treatment in paragraph below.
Concrete Paver Installation

F. [Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized. All cut pavers exposed to vehicular tires shall be no smaller than one-third of a whole paver.] [Cut pavers at edges as indicated on the drawings.]

G. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and joint sand.

H. Use a low-amplitude plate compactor capable of at least minimum of 4,000 lbf (18 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the sand. Remove any cracked or damaged pavers and replace with new units.

I. Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. This will require at least 4 to 6 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.

J. All work within 6 ft. (2 m) of the laying face must shall be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut and compacted pavers with joint sand to prevent exposed bedding sand from becoming saturated from rainfall.

K. Remove excess sand from surface when installation is complete.

Note: Excess joint sand can remain on surface of pavers to aid in protecting their surface especially when additional construction occurs after their installation. If this is the case, delete the article above and use the article below. Designate person responsible for directing timing of removal of excess joint sand.

L. Allow excess joint sand to remain on surface to protect pavers from damage from other trades. Remove excess sand when directed by [Architect].

M. Surface shall be broom clean after removal of excess joint sand.

Field Quality Control

A. The final surface tolerance from grade elevations shall not deviate more than ± 3/8 in. (±10 mm) under a 10 ft (3 m) straightedge.

B. Check final surface elevations for conformance to drawings.

Note: For installations on a compacted aggregate base and soil subgrade, the top surface of the pavers may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.

C. The surface elevation of pavers shall be 1/8 in. to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

Note: For pedestrian access routes maximum elevation should not exceed ¼ in. (6 mm).

D. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.

Note: Cleaning and sealing may be required for some applications. See ICPI Tech Spec 5, Cleaning and Sealing Interlocking Concrete Pavements for guidance on when to clean and seal the paver surface, and when to stabilize joint sand. Delete article below if cleaners, sealers, and or joint sand stabilizers are not applied.
Concrete Paver Installation

Cleaning, Sealing, Joint Sand Stabilization

A. Clean, seal, apply joint sand stabilization materials between concrete pavers in accordance with the manufacturer’s written recommendations.

Protection

A. After work in this section is complete, the General Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.

Recommended Installation Techniques - Overlay Pavers

1. Verify existing surface is suitable to accept thin paver overlays. Height variations due to cracking or settling must be structurally corrected prior to installation.
2. Border restraints are created by adhering the outside pavers to the existing surface with thin set or concrete adhesive. Make certain the height of the border is consistent with that of the field.

Note: never use a plate tamper to compact thin paver products!

3. Use washed concrete sand as a base over existing concrete surfaces. Depending on the minor variations in the deck, use a 1/4" to 1/2" layer of this concrete sand that conforms to ASTM C33 grading requirements.
4. Extensions for deck drains and skimmer lids are to be used on pool decks.
5. Using a wet saw or other appropriate cutter, make precise cuts avoiding ragged or damaged edges. No paver less than 1/3 of the original size should be installed.
6. To create the interlock, sweep concrete sand or an approved overlay-specific polymeric sand into the joints.
Terrace Stone (Slate & Smooth Textures)

Description: Slab | Texture: Slate or Chamfered | Applications: Patios, Footpaths, Sidewalks

Laying Patterns

3 Stone Random Runningbond 100% mixed bundle

3 Stone Random 100% mixed bundle

Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-pc system</td>
<td>124</td>
<td>230 (mixed)</td>
<td>2983</td>
</tr>
<tr>
<td>10 layers/pallet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4¾ x 9½ x 2⅜</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9½ x 9½ x 2⅜</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9½ x 14¼ x 2⅜</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Colors

coastal tan  fieldstone  granite  mesquite  mountain ridge  palmetto

Color samples for reference only. Actual product colors may vary.
Description: Slab | Texture: Slate | Applications: Patios, Walkways, Pool Decks

Laying Patterns

Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-pc system</td>
<td>120</td>
<td>100</td>
<td>3260</td>
</tr>
<tr>
<td>6 x 12 x 2 1/8</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 x 12 x 2 1/8</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 x 18 x 2 1/8</td>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Colors

- coastal tan
- fieldstone
- granite
- mesquite
- mountain ridge
- palmetto

Color samples for reference only. Actual product colors may vary.
Classic Cobble™

Description: Paver | Texture: Traditional | Applications: Patios, Walkways, Pool Decks

Classic Cobble Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 x 6 x 2(\frac{3}{4})</td>
<td>113</td>
<td>420</td>
<td>3014</td>
</tr>
<tr>
<td>6 x 9 x 2(\frac{3}{4})</td>
<td>120</td>
<td>300</td>
<td>3182</td>
</tr>
<tr>
<td>6 x 6 x 3(\frac{3}{4})**</td>
<td>90</td>
<td>336</td>
<td>3360</td>
</tr>
<tr>
<td>6 x 9 x 3(\frac{3}{4})**</td>
<td>96</td>
<td>240</td>
<td>3960</td>
</tr>
</tbody>
</table>

** Special order.

Classic Cobble Combo Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-piece combo pallet</td>
<td>120</td>
<td>330</td>
<td>3193</td>
</tr>
<tr>
<td>6 x 6 x 2(\frac{3}{4})</td>
<td>2.4</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>6 x 9 x 2(\frac{3}{4})</td>
<td>9.6</td>
<td>240</td>
<td></td>
</tr>
</tbody>
</table>

Colors

- coastal tan
- fieldstone
- granite
- mesquite
- palmetto

Accent Colors*

- charcoal
- desert sand
- mocha

* Accent colors available in half-pallets of 6x6s and 6x9s. Color samples for reference only. Actual product colors may vary.
**Classic Cobble™**

Description: Paver | Texture: Traditional | Applications: Patios, Walkways, Pool Decks

### 1 Piece Laying Patterns

- **90° Herringbone - 100% 6 x 9 rectangle**
- **45° Herringbone - 100% 6 x 9 rectangle**
- **Stack Bond - 100% 6 x 6 rectangle**

### 2 Piece Laying Patterns

- **I Pattern - 25% 6 x 6; 75% 6 x 9**
- **Herringbone - 25% 6 x 6; 75% 6 x 9**
- **Running Bond - 40% 6 x 6; 60% 6 x 9**

### Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once.
  Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements.
  Cutting may be required.
Classic Cobble 4-Piece™

Description: Paver  |  Texture: Traditional  |  Applications: Patios, Walkways, Pool Decks

Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Piece</td>
<td>110</td>
<td>330</td>
<td>2939</td>
</tr>
<tr>
<td>3 x 6 x 2 1/4</td>
<td></td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>6 x 6 x 2 1/4</td>
<td></td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>6 x 9 x 2 1/4</td>
<td></td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>9 x 9 x 2 1/4</td>
<td></td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Colors

- coastal tan
- fieldstone
- granite
- mesquite
- palmetto
**Classic Cobble Circle Kit™**

**Description:** Paver  | **Texture:** Traditional  | **Applications:** Patios, Walkways, Pool Decks

**Laying Patterns**

| Row | Center Stone | Large Tapers | Large Tapers | Rectangles | Small Tapers | Small Tapers | Small Tapers | Rectangles | Rectangles | Rectangles | Rectangles | Small Tapers | Small Tapers | Small Tapers | Rectangles | Rectangles | Rectangles | Rectangles | Rectangles | Rectangles | Rectangles | Rectangles | Rectangles | Rectangles |
|-----|-------------|--------------|--------------|------------|-------------|-------------|-------------|------------|------------|------------|------------|-------------|-------------|-------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 0   | 1           |              |              |            |             |             |             |            |            |            |            | 28          |              |             |            |            |            |            |            |            |            |            |            |            |            |
| 1   |              | 8            |              | Large Tapers|             |             |             |            |            |            |            | 28          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 2   |              | 8            | Large Tapers | Rectangles |             |             |             |            |            |            |            | 28          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 3   |              | 24           | Small Tapers |            |             |             |             |            |            |            |            | 28          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 4   |              | 24           | Small Tapers | Rectangles |             |             |             |            |            |            |            | 28          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 5   |              | 20           | Small Tapers | Rectangles |             |             |             |            |            |            |            | 28          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 6   |              | 24           | Small Tapers | Rectangles |             |             |             |            |            |            |            | 28          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 7   |              | 28           | Small Tapers | Rectangles |             |             |             |            |            |            |            | 28          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 8   |              | 32           | Small Tapers | Rectangles |             |             |             |            |            |            |            | 32          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 9   |              | 31           | Small Tapers | Rectangles |             |             |             |            |            |            |            | 32          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |
| 10  |              | 37           | Small Tapers | Rectangles |             |             |             |            |            |            |            | 34          | Rectangles   |             |            |            |            |            |            |            |            |            |            |            |            |

Note: start with 2 small tapers (one facing normal and one inverted), then alternate.

Row 9 completes the 10' circle.

**Pallet Information**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 ft. dia. x 2¾”</td>
<td>104</td>
<td>480</td>
<td>3440</td>
</tr>
</tbody>
</table>

**Colors**

coastal tan  | fieldstone  | granite  | mesquite  | palmetto

* Color samples for reference only. Actual product colors may vary.
**English Cobble™**

Description: **Paver**  |  Texture: **Aged**  |  Applications: **Patios, Walkways, Pool Decks**

---

**6" x 6"**  
**6" x 9"**

**Pallet Information**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 x 6 x 2¾&quot;</td>
<td>113</td>
<td>420</td>
<td>3014</td>
</tr>
<tr>
<td>6 x 9 x 2½&quot;</td>
<td>120</td>
<td>300</td>
<td>3182</td>
</tr>
<tr>
<td>6 x 6 x 3½&quot;**</td>
<td>90</td>
<td>336</td>
<td>3360</td>
</tr>
<tr>
<td>6 x 9 x 3¾&quot;**</td>
<td>96</td>
<td>240</td>
<td>3960</td>
</tr>
</tbody>
</table>

**Accent Colors**

- coastal tan
- fieldstone
- granite
- mesquite
- palmetto
- riverbed beige

**Colors**

**Accent Colors**

- charcoal
- desert sand
- mocha

---

* Accent colors available in half-pallets of 6x6s and 6x9s. Color samples for reference only. Actual product colors may vary.
**English Cobble™**

Description: **Paver**  |  Texture: **Aged**  |  Applications: **Patios, Walkways, Pool Decks**

1 Piece Laying Patterns

- 90° Herringbone - 100% 6 x 9 rectangle
- 45° Herringbone - 100% 6 x 9 rectangle
- Stack Bond - 100% 6 x 6 rectangle

2 Piece Laying Patterns

- 1 Pattern - 25% 6 x 6; 75% 6 x 9
- Herringbone - 25% 6 x 6; 75% 6 x 9
- Running Bond - 40% 6 x 6; 60% 6 x 9

Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.
English Cobble 4-Piece™

Description: Paver | Texture: Aged | Applications: Patios, Walkways, Pool Decks

Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Piece</td>
<td>110</td>
<td>330</td>
<td>2939</td>
</tr>
<tr>
<td>3 x 6 x 2 1/8</td>
<td></td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>6 x 6 x 2 1/8</td>
<td></td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>6 x 9 x 2 1/8</td>
<td></td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>9 x 9 x 2 1/8</td>
<td></td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Colors

coastal tan | fieldstone | granite | mesquite | palmetto | riverbed beige
**English Cobble Circle Kit™**

**Description:** Paver  |  **Texture:** Aged  |  **Applications:** Patios, Walkways, Pool Decks

![Diagram of the English Cobble Circle Kit](image)

**Pallet Information**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 ft. dia. x 2%</td>
<td>104</td>
<td>480</td>
<td>3440</td>
</tr>
</tbody>
</table>

**Colors**

- Coastal tan
- Fieldstone
- Granite
- Mesquite
- Palmetto
- Riverbed beige

*Row 10 completes the 11’ circle.*
Description: Paver | Texture: Textured/Aged | Applications: Patios, Walkways, Pool Decks

Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Piece</td>
<td>110</td>
<td>330</td>
<td>2939</td>
</tr>
<tr>
<td>3 x 6 x 2(\frac{3}{4})</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 x 6 x 2(\frac{3}{4})</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 x 9 x 2(\frac{3}{4})</td>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 x 9 x 2(\frac{3}{4})</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Colors

- coastal tan
- fieldstone
- granite
- mesquite
- palmetto
- riverbed beige

*Color samples for reference only. Actual product colors may vary.*
Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

Laying Patterns

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>90° Herringbone</td>
<td>100% 4 x 8 rectangle</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>45° Herringbone</td>
<td>100% 4 x 8 rectangle</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Basketweave</td>
<td>100% 4 x 8 rectangle</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Stack Bond</td>
<td>100% 4 x 8 rectangle</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Running Bond</td>
<td>100% 4 x 8 rectangle</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
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</table>

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sl/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 x 8 x 2½</td>
<td>120</td>
<td>540</td>
<td>3002</td>
</tr>
<tr>
<td>4 x 8 x 3½**</td>
<td>96</td>
<td>432</td>
<td>3240</td>
</tr>
</tbody>
</table>

** Special Order

Colors

- auburn
- coastal tan
- fieldstone
- granite
- mesquite
- palmetto

Accent Colors*

- charcoal
- desert sand
- mocha

* Accent colors available in half-pallets of 6x6s and 6x9s. Color samples for reference only. Actual product colors may vary.
Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 x 12 x 2¾</td>
<td>67½</td>
<td>135</td>
<td>1787</td>
</tr>
</tbody>
</table>

Colors

coastal tan  fieldstone  granite  mesquite  palmetto  mountain ridge

Accent Colors*

charcoal  desert sand  mocha

* Accent colors available in half-pallets of 6x6s and 6x9s. Color samples for reference only. Actual product colors may vary.
**Overlay Collection™**

**Description:** Paver  |  **Texture:** Traditional  |  **Applications:** Patios, Walkways, Pool Decks

![6" x 6" Paver](image1)

![6" x 9" Paver](image2)

**Overlay Product Dimensions (in)**

<table>
<thead>
<tr>
<th>Product</th>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classic Cobble™</td>
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</table>

**Installation Tips**

1. Verify existing surface is suitable to accept thin paver overlays. Height variations due to cracking or settling must be structurally corrected prior to installation.

2. Border restraints are created by adhering the outside pavers to the existing surface with thin set or concrete adhesive. Make certain the height of the border is consistent with that of the field.

   **Note:** never use a plate tamper to compact thin paver products!

3. Use washed concrete sand as a base over existing concrete surfaces. Depending on the minor variations in the deck, use a 1/4” to 1/2” layer of this concrete sand that conforms to ASTM C33 grading requirements.

4. Extensions for deck drains and skimmer lids are to be used on pool decks.

5. Using a wet saw or other appropriate cutter, make precise cuts avoiding ragged or damaged edges. No paver less than 1/3 of the original size should be installed.

6. To create the interlock, sweep concrete sand or an approved overlay-specific polymeric sand into the joints.

**Pallet Information**

**Colors**

![Coastal Tan](image3)

![Fieldstone](image4)

![Palmetto](image5)

**Accent Colors**

![Charcoal](image6)

![Desert Sand](image7)

![Mocha](image8)

* Accent colors available in half-pallets of 6x6s and 6x9s. Color samples for reference only. Actual product colors may vary.
Permeable interlocking concrete pavement (PICP) is a durable cost-effective solution for compliance to national, state/provincial and municipal stormwater regulations. PICP can reduce runoff and pollutants from walkways, patios, driveways, parking lots, alleys, parking lanes, and low volume streets. The surface consists of solid concrete pavers with small, stone-filled joints that allow water to flow into highly permeable, open-graded bedding, base, and subbase aggregates. The spaces among the aggregates store water and enable infiltration into the soil subgrade rather than generating surface runoff. The paver joints provide 100% surface permeability.
## Section Contents

NewLine Permeable Pavers (Pages 83-95)

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</tr>
<tr>
<td>Aqua-Flo</td>
<td>90</td>
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ICPI provides construction guidelines to design professionals and installers of interlocking concrete pavements. Several resources are available on this website that review the steps necessary for constructing interlocking concrete pavements.

This pavement structure is commonly used for both pedestrian and vehicular applications. Pedestrian areas, driveways, and areas subject to limited vehicular use are paved with units 2 3/8 in. (60 mm) thick. Streets and industrial pavements should be paved with units at least 3 1/8 in. (80 mm) thick.

Compaction of the soil subgrade and aggregate base materials are essential to the long-term performance of interlocking concrete pavements.

Installation steps typically include job planning, layout, excavating and compacting the soil subgrade, applying geotextiles (optional), spreading and compacting the sub-base and/or base aggregates, constructing edge, restraints, placing and screed ing the bedding sand, placing concrete pavers, compacting concrete pavers, sweeping in jointing sand and final compaction.

### Installation Basics

**Note:** The elevations and surface tolerance of the soil subgrade determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies excavation and grading of the soil subgrade with additional bedding materials. Therefore, the surface elevations of the soil subgrade should be checked and accepted by the General Contractor or designated party, with written certification presented to the paver installation subcontractor prior to starting work.

A. Acceptance of Site Verification of Conditions:

1. **General Contractor** shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.

   **Note:** Compaction of the soil subgrade is optional and should be determined by the project engineer. If the soil subgrade requires compaction, compact to a minimum of 95% standard Proctor density per ASTM C 698. Compacted soil density and moisture should be checked in the field with a nuclear density gauge or other test methods for compliance to specifications. Stabilization of the soil and/or base material may be necessary with weak or continually saturated soils, or when subject to high wheel loads. Compaction will reduce the permeability of soils. If soil compaction is necessary, reduced infiltration may require drain pipes within the open-graded subbase to conform to local storm drainage requirements.

   - Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
   - Provide written density test results for soil subgrade to the Owner, General Contractor and paver installation subcontractor.
   - Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage pipes and inlets.

2. Do not proceed with installation of bedding and interlocking concrete pavers until subgrade soil conditions are corrected by the General Contractor or designated subcontractor.
Preparation

A. Verify that the soil subgrade is free from standing water.

B. Stockpile joint/opening filler, base and subbase materials such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.

C. Edge Restraint Preparation:
   • Install edge restraints per the drawings [at the indicated elevations].

Installation

Note: The minimum slope of the soil subgrade is typically 0.5%. Actual slope of soil subgrade will depend on the drainage design and exfiltration type. All drain pipes, observation wells, overflow pipes, and (if applicable) geotextiles, berms, baffles and impermeable liner should be in place per the drawings prior to or during placement of the subbase and base, depending on their location. Care must be taken not to damage drainpipes during compaction and paving. No mud or sediment can be left on the base or bedding aggregates. If they are contaminated, they must be removed and replaced with clean materials. Base/subbase thicknesses and drainage should be determined using ICPI’s Permeable Interlocking Concrete Pavements manual and Permeable Design Pro software.

A. General

1. Any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities shall be removed before application of the [geotextile] and subbase materials.

2. Keep area where pavement is to be constructed free from sediment during entire job. [Geotextiles] Base and bedding materials contaminated with sediment shall be removed and replaced with clean materials.

3. Do not damage drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during installation. Report any damage immediately to the project engineer.

B. Geotextiles

1. Place on [bottom and] sides of soil subgrade. Secure in place to prevent wrinkling from vehicle tires and tracks.

2. Overlap a minimum of [0.3 m (12 in.)] [0.6 m (24 in.)] in the direction of drainage.

C. Open-graded subbase and base

Note: Compaction of areas or sites that cannot accommodate a roller vibratory compactor may use a minimum 13,500 lbf (60 kN) vibratory plate compactor with a compaction indicator. At least two passes should be made over each lift of the subbase and base aggregates.

1. Moisten, spread and compact the No. 2 subbase in 4 to 6 in. (100 to 150 mm) lifts [without wrinkling or folding the geotextile. Place subbase to protect geotextile from wrinkling under equipment tires and tracks.]

2. For each lift, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 t (8 T) vibratory roller until there is no visible movement of the No. 2 stone. Do not crush aggregate with the roller.

3. The surface tolerance of the compacted No. 2 subbase shall be ±2 1/2 in. (± 65mm) over a 10 ft (3 m) straightedge.

4. Moisten, spread and compact the No. 57 base layer in one 4 in. (100 mm) thick lift.
Permeable Paver Installation

- On this layer, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10t (8 T) vibratory roller until there is no visible movement of the No. 57 stone. Do not crush aggregate with the roller.

**Note:** At the option of the designer, this supplemental test method bracketed in items 5 through 9 below can be used to establish a consistent methodology for in-situ density data collection of open-graded aggregate base layer (typically ASTM No. 57 stone). This test method can assist contractors in reaching adequate job site compaction and offer an additional level of confidence for the project owner and designer. This test method is appropriate for pavement subject to consistent vehicular traffic such as parking lots and roads. It is not needed for pedestrian areas and residential driveways. Other test methods should be considered to check consistent compaction of the soil subgrade (when specified), the aggregate subbase and base layers, and the pavers. These include stiffness measurements using a Geogauge per ASTM D 6758 or a Zorn Lightweight Deflectometer per ASTM E 2835.

5. Use part of the compacted base area as a control strip for density testing by the [Testing Company].
   - The [Testing Company] shall supply nuclear moisture/density gauges and ancillary equipment required to conduct density and moisture content measurements for compaction of the No. 57 aggregate drainage layer. Qualified testing laboratory operators/gauges may conduct compaction testing. Each gauge operator shall be trained in the safe operation, transportation and handling of the gauge. The registered owner of the gauge shall have and maintain a valid Radioisotope License for each gauge.
   - Each gauge shall have been calibrated within the last 12 months, either by the manufacturer or other qualified agent, against certified density and moisture reference blocks. The density standard count and the moisture standard count shall be within 2 percent and 4 percent respectively, of the most recent calibration values. A certificate of calibration for each gauge shall accompany each gauge.

6. Target Density
   - Determine a target density on the control strip during under the following conditions:
     a. after initial placement and compaction of the base aggregate layer
     b. when there is a perceptible change in the appearance or gradation of the aggregate,
     c. when there is a change in the source of aggregate.
   - Test field density according to ASTM D 2922 Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (shallow Depth). Field density tests shall be performed on compacted base materials to determine within acceptable limits of a target density.

7. Control Strip
   - The Testing Company shall construct a control strip for the determination of a target density consisting of a single uniform lift as specified in the contract documents, but not more than 4 in. (100 mm) thick and covering approximately 600 yd² (500 m²) in area. No testing shall be performed within 10 ft (3 m) from any unrestrained outside edge of the work area. The control strip may be incorporated into the project upon acceptance of density measurements by the Testing Company.
   - During construction of the control strip, the surface of the aggregate shall be visibly moist and maintained as such throughout construction and compaction.
   - After initial placement of the aggregate base material, the compaction equipment shall make two passes over the entire surface of the control strip. Field densities and field moisture contents, using the backscatter/indirect method, shall be determined at five randomly selected locations at least 15 ft (5 m) apart. The dry density and moisture content shall be calculated for each of these locations and the averages shall be used as initial values. The maximum compacted thickness of the aggregate base layer measured for density shall be 4 in. (100 mm).
   - The compaction equipment shall then make two additional passes over the entire surface of the control
strip. After compaction, three separate, random field density and moisture content determinations shall be made, using the backscatter/indirect method, and a new average dry density and moisture content shall be calculated.

- If the new average dry density exceeds the previous value by more than 1.2 pcf (20 kg/m³) then two additional passes of the equipment shall be carried out as described above. If the new average dry density does not exceed the previous value by more than 1.2 pcf (20 kg/m³), then compaction of the control strip will be considered satisfactory and complete.

- Upon satisfactory completion of the control strip, an additional seven (7) field density and moisture tests, using the backscatter/indirect method, shall be taken at random locations and the dry density and moisture content values shall be determined. The final dry density and moisture content of the control strip shall be the average of these seven values plus the three most recent values obtained upon completion.

8. Compaction

   a. Use a smooth dual or single smooth drum, minimum 10 t (8 T) vibratory roller or a minimum 13,500 lbf (60 kN), reversible vibratory plate compactor with a compaction indicator without crushing the aggregate base.

   b. Compact aggregates without crushing them.

9. Test Report

   The test report shall include the following:

   1. Project description.
   2. Sketch of test area and test locations.
   3. Aggregate type and layer thicknesses.
   4. Aggregate characteristic properties: gradation, void ratio, bulk density.
   5. Compaction equipment type and weight.
   6. Static or vibratory compaction.
   7. Number of passes of the compaction equipment.
   8. Test number and location.
   9. Individual and average field wet density, moisture content, and dry density values determined after each compaction operation in accordance with ASTM D 2922 Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).
   10. Calculation of target density.

• The surface tolerance the compacted No. 57 base should not deviate more than ±1 in. (25 mm) over a 10 ft (3 m) straightedge.

Note: As an alternative test method, in-place density of the base aggregate may be checked per ASTM D
Permeable Paver Installation

4254. Compacted density should be 95% of the laboratory index density established for the base layer.

D. Bedding layer
   • Moisten, spread and screed the No. 8 stone bedding material.
   • Fill voids left by removed screed rails with No. 8 stone.
   • The surface tolerance of the screeded No. 8 bedding layer shall be ±3/8 in (10 mm) over a 10 ft (3 m) straightedge.
   • Do not subject screeded bedding material to any pedestrian or vehicular traffic before paving unit installation begins.

E. Permeable interlocking concrete pavers and joint/opening fill material
   • Lay the paving units in the pattern(s) and joint widths shown on the drawings. Maintain straight pattern lines.
   • Fill gaps at the edges of the paved area with cut units. Cut pavers subject to tire traffic shall be no smaller than 1/3 of a whole unit.
   • Cut pavers and place along the edges with a [double-bladed splitter or] masonry saw.
   • Fill the openings and joints with [No. 8] stone.
   Note: Some paver joint widths may be narrow and not accept most of the No. 8 stone. Use joint material that will fill joints such as washed ASTM No. 89 or No. 9 stone.
   • Remove excess aggregate on the surface by sweeping pavers clean.
   • Compact and seat the pavers into the bedding material using a low-amplitude, 75-90 Hz plate compactor capable of at least 5,000 lbf (22 kN). This will require at least two passes with the plate compactor.
   • Do not compact within 6 ft (2 m) of the unrestrained edges of the paving units.
   • Apply additional aggregate to the openings and joints if needed, filling them completely. Remove excess aggregate by sweeping then compact the pavers. This will require at least two passes with the plate compactor.
   • All pavers within 6 ft (2 m) of the laying face must be left fully compacted at the completion of each day.
   • The final surface tolerance of compacted pavers shall not deviate more than ±3/8 (10 mm) under a 10 ft (3 m) long straightedge.
   • The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

Field Quality Control

A. After sweeping the surface clean, check final elevations for conformance to the drawings.

B. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.
   
   Note: The surface of the pavers may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.

C. The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

D. Bond lines for paver courses: ±½ in. (±15 mm) over a 50 ft (15 m) string line.

E. Verify the surface infiltration at a minimum of 100 in./hour using test method C 1781.
Protection

A. After work in this section is complete, the General Contractor shall be responsible for protecting work from sediment deposition and damage due to subsequent construction activity on the site.

B. PICP installation contractor shall return to site after 6 months from the completion of the work and provide the following as required: fill paver joints with stones, replace broken or cracked pavers, and re-level settled pavers to initial elevations. Any additional work shall be considered part of original bid price and with no additional compensation.

Typical Permeable Paver System Cross-Section
**Alleyway Cobble TM**

**Description:** Paver  |  **Texture:** Traditional  |  **Applications:** Patios, Walkways, Pool Decks

---

**Laying Patterns**

- **Herringbone - 100% mixed bundle**
- **Running Bond - 100% mixed bundle**

---

**Installation Tips**

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

---

**Pallet Information**

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<thead>
<tr>
<th>Dimensions (in)</th>
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<th>wt./pallet</th>
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<td>5 x 8 x 3½</td>
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<tr>
<td>5 x 9 x 3½</td>
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<td>56</td>
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**Colors**

- coastal tan
- granite

*Color samples for reference only. Actual product colors may vary.*
Laying Patterns

90° Herringbone
100% 4 x 8 rectangle

45° Herringbone
100% 4 x 8 rectangle

Running Bond
100% 4 x 8 rectangle

Basketweave
100% 4 x 8 rectangle

Stack Bond
100% 4 x 8 rectangle

Installation Tips

• Begin laying pavers at a corner, following a string or chalk line to keep lines straight.

• To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.

• Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

Pallet Information

<table>
<thead>
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<th>Dimensions (in)</th>
<th>sf/pallet</th>
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<td>4¾ x 9½ x 3¾</td>
<td>100</td>
<td>320</td>
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Colors

costal tan
granite

* Color samples for reference only. Actual product colors may vary.
Enviro-Flo™

Description: Paver | Texture: Chamfered | Applications: Patios, Walkways, Pool Decks

6" x 9"

Laying Patterns

<table>
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<tr>
<td>45° Herringbone</td>
<td>100% 4 x 8 rectangle</td>
<td></td>
</tr>
<tr>
<td>Running Bond</td>
<td>100% 4 x 8 rectangle</td>
<td></td>
</tr>
</tbody>
</table>

Installation Tips

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
- To ensure good color distribution, take pieces from several pallets at once. Remove paving stones in stacks rather than layers.
- Pallet configuration for some products may not exactly meet pattern requirements. Cutting may be required.

Pallet Information

<table>
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<th>Dimensions (in)</th>
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<td>3200</td>
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Colors

- coastal tan
- granite

* Color samples for reference only. Actual product colors may vary.
**Laying Patterns**

<table>
<thead>
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<th>Stack Bond</th>
<th>Running Bond</th>
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<table>
<thead>
<tr>
<th>Stack Bond 90° Turn</th>
<th>Running Bond 90° Turn</th>
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</thead>
<tbody>
<tr>
<td>100% 16 x 16 square</td>
<td>100% 16 x 16 square</td>
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</table>

**Installation Tips**

- Begin laying pavers at a corner, following a string or chalk line to keep lines straight.
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**Pallet Information**

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**Colors**

pewter

*Color samples for reference only. Actual product colors may vary.*
Wall Systems

With NewLine, tearing down the walls that separate us is as easy as, well, building them! Our product line includes a selection of retaining and double-sided walls ideal for flowerbeds, terraces, columns, seating walls, outdoor kitchens, and more.

Walls can transform your outdoor environment into the perfect space for entertaining, giving you all the more reason to sit back with a refreshing drink and enjoy the view.
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General Wall Excavation Process

Step 1 - Planning

- Mark the bottom and top of the wall excavation location with spray paint or stakes
- Establish proper elevation bottom and top of wall before excavating
- Organic Materials should not be used in Structural Backfill Zone
- Store and protect Structural Backfill Materials from inclement weather during construction

Step 2 - Excavation

- Excavate and prepare Sub Base Leveling Pad Trench 6" below first course
- Leveling Pad trench is approximately 2.5' to 3' wide
- Normal wall Burial Depth or Embedment
- Depth is 6" to 12" or one block
- Excavate cut line to a 2 to 1 slope or greater
- Back of wall excavation depth into the bank should be 12" beyond the back of the Sub Base Leveling Trench

Step 3 - Sub Base Compaction

- Excavate and prepare Sub Base Leveling Pad Trench 6" below first course
- Leveling Pad trench is approximately 2.5' to 3' wide
- Normal wall Burial Depth or Embedment
- Depth is 6" to 12" or one block
- Excavate cut line to a 2 to 1 slope or greater
- Back of wall excavation depth into the bank should be 12" beyond the back of the Sub Base Leveling Trench
General Wall Excavation Process

Step 4 - Base Stabilization

• (Optional) place 5' to 6' wide Base Stabilization Fabric on top of leveling pad trench
• Base Stabilization Fabrics will help prevent sub base materials from mixing with the gravel base leveling pad during compaction
• Fabric also provides extra Structural Bearing Stability to the base leveling pad

Step 5 - Rough Leveling Pad

• Place Well Graded Gravel (also known as Road Base Aggregates) on top of fabric in the leveling pad trench approximately 6" deep
• Rough grade gravel with a rake close to finish base elevation

Step 6 - Compact Leveling Pad

• Compact the Gravel Leveling Pad to 95% Standard Proctor Density or greater
• Correct Moisture Content in the gravel will help in reaching proper compaction
General Wall Excavation Process

Step 7 - Level Screed Pipes

- Place first 3’ long Screed Pipe across the trench at one end of the wall or at the lowest elevation
- Scratch a trench for the pipe in the compacted gravel with a chipping hammer
- Use a 2’ level or Laser Level to set the Screed Pipe to the proper level
- Gravel is added underneath and around the Screed Pipe to support while leveling
- Place the second Screed Pipe across the trench approximately 9’ from the first Screed Pipe
- Level the second Screed Pipe to the same elevation as the first Screed Pipe by using a 4’ level on top of a Screed Board, Straight Edge or with a Laser Level
- Continue to place and level Screed Pipes the full length of the trench leveling pad or until reaching a base elevation change

Step 8 - Extra Gravel

- Place or remove extra Well Graded Gravel (also known as Road Base Aggregates) level to the top of the Screed Pipes as needed
- (If more than 1 ½ inches of loose gravel is added, repeat the compaction steps again before screeding)

Step 9 - Screeding Leveling Pad

- Screed the gravel leveling pad with a Screed Board or Straight Edge across the trench on top of two Screed Pipes
- The coarser the gravel the more back and forth the screeding action when drawing the Screed across the leveling pad
- Too much pressure on the screed straight edge may dislodge the level of the Screed Pipes while screeding
- A second screed pass may be needed to insure an accurate level has been achieved
- Continue to screed the leveling pad until completing the full length of the trench or up to the first elevation change
General Notes

• Units may vary due to texturing processes and unit sizes by region. Verify unit type, size, weight availability by region. Units may vary up to 1” (25mm) + due to texture variations.

• Clean out pin holes and receiving channel as required to assemble wall. During manufacturing, some concrete crumbs may deposit in these areas and should be removed to permit pins to be placed in the appropriate holes and receiving channel.

• Cut or split units as required (with a mason saw, hydraulic break or chisel and hammer) for corners, caps or wherever units need to be altered to allow construction to be finalized. (Cuts produce smooth finish; splits produce textured finish.)

• When cutting concrete units, always wear safety goggles, gloves and filter mask per manufacturer’s recommendations.

• Use exterior grade construction adhesive for all units in parapet walls, columns, etc. where wall is built freestanding (not retaining soil). Use vertical bead of adhesive between units in freestanding wall to avoid daylight view through wall units. Use adhesive as required at 90° corners or where pins do not interconnect units.
Care & Precautions of Building Segmental Retaining Walls

The Segmental Retaining Wall (SRW) is constructed of concrete masonry units, geogrid soil reinforcement fabric, and compacted backfill. The structure’s performance is sensitive to any post construction activities that may damage components, increase loading conditions, and/or reduce overall stability. The following list is intended to provide guidelines for the proper care of a SRW.

1. The area behind the wall that contains geogrid soil reinforcement fabric (reinforced zone) is the primary structural component of the wall system. Do not, under any circumstances, excavate through, drill through, or otherwise damage this reinforcement fabric without written approval of the design engineer of record.

2. The drain line at the base of the wall (if required and installed) was stubbed out to daylight or for final connection to storm drainage systems by others. Please insure that all connections are made to proper drain outlets and that any drains outlets to daylight are not buried.

3. The wall is normally constructed over a crushed stone base. No digging or excavation shall be done within 3 feet horizontally from bottom face of wall or to such depth that would compromise the integrity of the wall foundation.

4. All water must be diverted away from the base of wall to avoid erosion and undermining of the foundation after installation. This includes temporary site grading during construction and final site grading.

5. Landscape watering and surface drainage above the wall should be designed in consultation with the Civil and Geotechnical engineer and performed in such away to avoid standing water, water cascading over the wall, and infiltration (saturation) of the reinforced zone.

6. Do not increase the height of the existing wall as constructed with more block units without the written approval of the design engineer of record.
7. Do not add a slope or increase the steepness of a back slope beyond what was considered in the original grading plan and wall design without written approval of the design engineer of record.

8. Do not add additional surcharges within a lateral distance of twice the overall height of the structure(s) without written approval of the design engineer of record or unless considered in the original wall design. This would include fences, sound walls, landscaping walls, swimming pools, buildings, garages, etc.

9. Do not operate heavy equipment, within four feet of top of wall face. The surcharge from equipment weight can push the upper wall units out resulting in unacceptable misalignment.

10. Segmental retaining walls are flexible structures (vs. rigid as in CMU walls) and are subject to some post construction settlement and movement. All structures (i.e. sidewalks, pavements, curbs, trash enclosures, utility lines, etc.) should be designed to handle some ground movement and not be connected directly to the wall units.

11. The retaining walls should be periodically inspected to verify that drainage measures are functioning properly, erosion has not occurred along the top, ends, or bottom and any unanticipated movement or deflection of the wall system noted and evaluated by a qualified engineer.

12. Over time the wall face may begin to show a white flaky material and may especially be noticeable post construction. This material is called efflorescence. Efflorescence occurs when moisture evaporates from the wall face, and the naturally occurring soluble salts and bases, or the calcium carbonate (calcium hydroxide in the cement mixes with carbon dioxide in the air) is left on the face. This efflorescence is only an aesthetic concern and will not affect the structural performance of the wall. Efflorescence can typically be removed by dry brushing followed by flushing with clean water. In tougher cases power washing with clean water will also aid the clean up process. For additional information and removal options reference NCMA Tek bulletin 8-3A.
**Yorkshire™**

Description: **Wall** | Texture: **Smooth Tumbled** | Applications: **Freestanding Walls, Seating Walls, Pillasters, Columns, Fire Pits**

Laying Patterns

*Random - 100% Standard Unit*

*Running Bond - 100% Standard Unit*

Installation Tips

- Rotate standard units within the wall for unique and random patterns. Consider recessing blocks to add further interest. Cutting may be required.
- Create pillars and columns with ease. Run electrical conduit through the open center of the column to create attractive outdoor lightposts.

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 x 12 x 8</td>
<td>30</td>
<td>90</td>
<td>2588</td>
</tr>
</tbody>
</table>

NOTE: It is recommended to glue each course with an approved concrete adhesive.

Colors

coastal tan | fieldstone | granite | mesquite | palmetto

Color samples for reference only. Actual product colors may vary.
Calculate Materials Needed

First, determine the height, length & depth of your wall application. It is important to determine upfront whether you want to build an 8” or 12” deep wall.

Second, calculate the amount of wall block units needed. Use the following calculation:

For 8” Deep Walls:
Length: _____ x Height: ______ = ______ x 3 = ______ Units Needed

For 12” Deep Walls:
Length: _____ x Height: ______ = ______ x 4.5 = ______ Units Needed

Prepare Footing

For Small Garden Walls:
• Prepare the footing by digging a trench 16” wide and 4-6” below grade. Note: you will bury 1” of block for every 8” of exposed wall height. Also add 4” for the depth of the base stone material.
• Compact soil well before installing base material. This will help prevent settling.
• Add footing base material (crusher run: 3/4”), and compact well, keeping it level.

For Freestanding Patio Walls:
• Make sure your base area is clean & level before laying the wall units.
• Place pallets of product close to your work area, and choose units from multiple pallets if possible, to ensure a good range of color throughout the wall.

Lay The Block Units

• Install the base course by positioning the blocks on the prepared stone base (side-by-side). Level the units side-to-side and front-to-back, using a carpenter’s level. Use a string line to verify straightness.
• Install additional courses, offsetting the joints to maximize wall strength.
• Use concrete adhesive to adhere each course as you lay. Maximum wall height for Yorkshire™ Wall is 3 ft. Walls higher than 3 ft. require engineering design. Please note, certain soil conditions (poorly draining) or slopes behind the wall may reduce maximum wall height. Consult an engineer if these conditions are present.
• Finish the wall by adhering the top course or cap with concrete adhesive.

Installation Tips

• Avoid vertical lines that span more than 1 1/2 ft. in height.
• Begin at one edge, laying the blocks as indicated in your pattern.
• When building a curve or serpentine in your wall, some cutting of units may be necessary to keep the units on bond.
Column and Pilaster Construction Guide: Yorkshire™ Wall

Columns:
Columns increase wall stability when used with a freestanding wall. You can locate a column in the middle or end of a wall.

The open space in the center of a column permits reinforcement or electrical wiring if needed.

End-Of-Wall Columns:
To construct columns at the end of a wall, cut 1 column unit in half for the 2nd, 4th and additional even-numbered courses.

Stack column units in a rotating pattern for each course, staggering the bond. 1 column unit half is used every two courses.

Glue each course of column units with a concrete adhesive.

Through-The-Wall Columns:
On the first course, use full column units to start the column. Then split the wall units to fit.

On the second course, split two column units in half to fill in the corners. Continue construction by alternating courses.

Glue all column courses with a concrete adhesive.

Pilaster In A Running Wall:
Pilasters are located on one side of a wall, and add stability and elegance.

To build a pilaster, stack column units in a rotating pattern for each course.

Cut wall units as indicated.

Glue each course of units in the pilaster with a concrete adhesive.

For more installation tips and videos, visit us on the web at: newlinehardscapes.com
Ashland™

Description: Wall  |  Texture: Smooth Tumbled  |  Applications: Freestanding Walls, Seating Walls, Pillasters, Columns, Fire Pits

NOTE: It is recommended to glue each course with an approved concrete adhesive.

Dimensions (in) | sf/pallet | total pieces | wt./pallet
---|---|---|---
4 x 8 x 9 | 36 | 144 | 2768

Pallet Information

Please follow the general installation instructions found on page 95.

Colors

costal tan  |  fieldstone  |  granite  |  mesquite

Color samples for reference only. Actual product colors may vary.
**Suffolk™**

**Description:** Wall  |  **Texture:** Split Tumbled  |  **Applications:** Freestanding Walls, Seating Walls, Pillasters, Columns, Fire Pits

**Wall Unit**
- 9" x 12" x 4"

**Cap**
- 7½" x 12" x 2¼"
- 10" x 12" x 2½"

---

Please follow the general installation instructions found on page 95.

**Pallet Information**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
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<tr>
<td>Wall Unit</td>
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<td>120</td>
<td>3650</td>
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<tr>
<td>Cap</td>
<td>F: 2½ x 12 x 7½</td>
<td>N/A</td>
<td>144</td>
<td>2214</td>
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<tr>
<td>R: 2½ x 10 x 7½</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** It is recommended to glue each course with an approved concrete adhesive.

**Colors**
- Coastal Tan
- Fieldstone
- Granite
- Mesquite

Color samples for reference only. Actual product colors may vary.
Description: Wall  |  Texture: Smooth Tumbled  |  Applications: Freestanding, Seating & Retaining Walls up to 4’, Pillasters, Columns, Fire Pits

Stonegate™

Description: Wall | Texture: Smooth Tumbled | Applications: Freestanding, Seating & Retaining Walls up to 4’, Pillasters, Columns, Fire Pits

Stonegate products use DOM pins to ensure proper wall alignment. Pins sold separately.

Pallet Information

<table>
<thead>
<tr>
<th>3&quot; High Units</th>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - Piece Pallet</td>
<td>3 x 6 x 10</td>
<td>34</td>
<td>144</td>
<td>3264</td>
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<tr>
<td>Small Unit</td>
<td>3 x 6 x 10</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium Unit</td>
<td>3 x 11 x 10</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Unit</td>
<td>3 x 17 x 10</td>
<td>48</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6&quot; High Units</th>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
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</thead>
<tbody>
<tr>
<td>3 - Piece Pallet</td>
<td>3 x 6 x 10</td>
<td>34</td>
<td>72</td>
<td>3300</td>
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<tr>
<td>Medium Unit</td>
<td>6 x 11 x 10</td>
<td>24</td>
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<td></td>
</tr>
<tr>
<td>Large Unit</td>
<td>6 x 17 x 10</td>
<td>24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>lf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot; Square Cap</td>
<td>3 x 12 x 12</td>
<td>54</td>
<td>54</td>
</tr>
</tbody>
</table>

Colors

coastal tan  | fieldstone  | granite  | mesquite  | palmetto

Color samples for reference only. Actual product colors may vary.
**Stonegate™ Contemporary**

**Description:** Wall  |  **Texture:** Smooth Tumbled  |  **Applications:** Freestanding, Seating & Retaining Walls up to 4', Pillasters, Columns, Fire Pits

---

**Pallet Information**

<table>
<thead>
<tr>
<th>Units</th>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot; High Units</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
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<tr>
<td>Small Unit</td>
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</tr>
<tr>
<td>Medium Unit</td>
<td>3 x 11 x 10</td>
<td></td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Large Unit</td>
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<td></td>
</tr>
<tr>
<td>6&quot; High Units</td>
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<tr>
<td>3 - Piece Pallet</td>
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<td>Small Unit</td>
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<tr>
<td>Medium Unit</td>
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<tr>
<td>Large Unit</td>
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</tr>
<tr>
<td>3&quot; Square Cap</td>
<td>3 x 12 x 12</td>
<td>54</td>
<td>54</td>
<td>2057</td>
</tr>
</tbody>
</table>

**Colors**

- Coastal tan
- Fieldstone
- Granite
- Mesquite
- Palmetto

Color samples for reference only. Actual product colors may vary.
Stonegate™ Installation

Description: Wall  |  Texture: Smooth Tumbled  |  Applications: Freestanding, Seating & Retaining Walls up to 4', Pillasters, Columns, Fire Pits

Laying Patterns

Laying Pattern 1

Laying Pattern 2

Laying Pattern 3 (pattern 1 and 2 combined)
Calculate Materials Needed (Info needed for this product Yorkshire is below)

First, determine the height, length & depth of your wall application. It is important to determine upfront whether you want to build an 8" or 12" deep wall.

Second, calculate the amount of wall block units needed.

For 8" Deep Walls:
Length: _____ x Height: ______ = ______ x 3 = ______

For 12" Deep Walls:
Length: _____ x Height: ______ = ______ x 4.5 = ______

Geogrid Soil Reinforcement

Taller walls, or walls supporting surcharge loads, require the use of geogrid reinforcement material to reinforce a soil mass directly behind the retaining wall and provide connection to the concrete facing units. Geogrid properties and wall design require knowledge of wall heights, soil properties (Phi angle and moist unit weight), surcharge loads and manufacturer’s requirements for specific geogrid types and strength capabilities.

See the Design Charts in the back of this manual for assistance in determining the lengths and placement locations. A qualified professional should be consulted for final design assistance.

Excavate Reinforced Soil Area: Remove existing soil in the reinforced soil zone to the maximum embedment length of the geogrid design. Level and compact soil behind the wall prior to placement of each geogrid layer.

Cut Geogrid: Cut sections from the geogrid roll to the specified length (embedment length). Check manufacturer’s criteria for biaxial or uniaxial geogrids. In most cases, the correct orientation is to roll the geogrid perpendicular to the wall face.

Install Geogrid: Place geogrid over the Keystone shouldered pins already in place. Note: allow approximately 3" (76mm) of geogrid material to rest on the unit top surface ahead of the pin (from pin to face of wall). This will ensure that the next course above will be fully supported on geogrid. Place all sections of geogrid, abutting each other side-to-side as per manufacturers’ instructions.

Secure Geogrid: Pull the pinned geogrid taut to eliminate loose folds. Stake or secure the back edge of geogrid before backfill and compaction. Compact from back of wall area toward embankment to avoid loosening geogrid or putting compaction pressure on wall. Remove stakes, as required, once backfill is placed.

Install next course of wall units.
Stonegate™ Installation

Description: Wall | Texture: Smooth Tumbled | Applications: Freestanding, Seating & Retaining Walls up to 4’, Pillasters, Columns, Fire Pits

Corners With Setback
Corners with a positive setback build in a similar random course pattern to the near vertical corner. In the setback version, each course of pins is set in the 1” (25mm) offset position. Units shift laterally as required to achieve the 1” (25mm) setback.

Curves
The Stonegate/Stonegate Contemporary unit design makes it easy to construct a variety of serpentine curves. Convex and concave curves will add gentle grace, beauty and strength to any installation.

Retaining Walls: Place the units to follow the desired curve. If unit-to-unit geometry creates small V-shaped voids on the retained soil side, just fill these areas with drainage fill.

Parapet Walls: When units are exposed on two sides, select the proper unit layout that provides tight closed-end conditions for all units to avoid a gapped look on either side of the parapet. Cutting of units may be required to avoid gaps in freestanding walls.

Radius: The minimum radius that can be built using the random pattern of units without cutting or using a disproportionate amount of the smaller units is 4.5’ (1.4m). To build smaller radius, a larger proportion of small units and some cutting may be required.

Step Designs
The Keystone Stonegate wall system can be used on your step/stair projects with the following considerations:

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

Note: A cemented soil composite can help shape the step/stair foundation and eliminate the need to double stack the “tread” units.
**Stonegate™ Installation**

**Description:** Wall  |  **Texture:** Smooth Tumbled  |  **Applications:** Freestanding, Seating & Retaining Walls up to 4’, Pillasters, Columns, Fire Pits

---

**Capping / Coping Options**

The 3” (76mm) high cap unit has two textured sides allowing the unit to have either textured side as a finished face for straight and curved wall applications. The 12” (305mm) depth from face to face of the cap allows for a 1” (25mm) overhang or “shadow” effect over each side of the wall below. For retaining walls, the overhang can be eliminated if desired by pushing the cap back flush with wall plane. Use exterior grade construction adhesive to fasten caps in place.

The two parallel faces of the universal cap unit are textured such that either side can be the finished face.

Small gaps between cap units or some cutting may be required to achieve specific cap course radii.

---

**Unit Dimension Combinations**

When developing the wall design and layout for straight or curved walls with corners, offsets, pilasters, etc., use the following guidelines. Due to all units being 10” (254mm) deep (between parallel faces), it is best to work in increments of 10” (254mm) for geometry offset. In reviewing the design details in this brochure, note that all geometry offsets are measurements of 10” (254mm), 20” (508mm), 30” (762mm), etc. For running walls, either straight or curved, work in even dimensional increments for single units or combination of units as shown below. Build walls in random layout, adjusting with unit selection or unit cutting as required to fit between fixed dimension points.

*Note: Some manufacturers offer different unit sizes which yield greater dimensional variation and layout options. Consult with your local manufacturer/distributor for additional information.*

---

*Provide handrail/railing/fence as per local building code. The railing/fence posts should be grouted into sleeves placed within the wall backfill during construction. Consult Keystone or a local engineer for guidance.*
**Vertical Unit Orientation**
A creative design option is to occasionally place units vertically in the wall to provide a break of horizontal lines. To span two 6" (152mm) high courses, use the unit with the 12" (305mm) length. The pins will not interlock in this position, so use exterior grade construction adhesive to fasten this unit in place. Make sure the unit above the 12" (305mm) vertical piece spans over or beyond the 6" (152mm) width of the vertical unit, resting on the units at each side.

**Freestanding Wall Applications**
When considering freestanding wall conditions of any height, the designer must consider the requirements of geometry and internal reinforcing to resist overturning and seismic forces (where applicable). Reinforced footings/foundation depth must be considered to provide support and bearing as applied to soil and frost conditions. Due to the variable nature of each site situation, a qualified engineer should be consulted for appropriate design in accordance with local building codes.

The design details shown on the next few pages are for concept representation only and are not intended to represent final design. Consult a qualified engineer for specific design considerations.

**Freestanding Border Wall**
With the Keystone Stonegate wall system, you have the added option of building unreinforced freestanding walls to various plan geometry and limited heights. From low border walls, which define the edge of patios and decks, to freestanding entry monuments, pilasters and parapets walls Stonegate/Stonegate Contemporary uses this interlocking geometry to achieve wider wall areas which provide strength and resistance to overturning forces.

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

A typical column corner utilizes a 20" x 20" (508mm x 508mm) column geometry to develop an integrated pier at the end of a running wall. This detail offers visual aesthetic interest and provides strength at the end of the freestanding wall.

**Column Top Options:**
- Landscape lighting/entry
- Planter with flowers or ornamentals
- Yard figurine/sculpture
- Mailbox
- Street address monument
Wall Offset
- Wider wall geometry (footprint) provides greater strength for parapet walls, to resist overturning.
- Offsets allow for graceful changes in wall direction.
- Offsets are an opportunity for aesthetic geometry and landscape feature areas.

Notes:
- The minimum offset for two parallel walls as shown in the details on this page, is 10" (254mm). Continuous offsets @ maximum 10'-0" (3m) O.C. will provide strength at parapet walls in coordination with exterior grade construction adhesive and/or vertical reinforcement as required by engineer.
- It is important to use overlapping unit combinations at the offset location where two units combined together equal 20" (508mm) in length (see plan geometry above).
- Details showing freestanding wall applications are showing partial sections of walls. The unfinished ends, with channel openings visible, are not meant to portray a finished condition.

“L” Return End
Similar to column corners, this detail offers stability and strength to resist overturning forces at the end of a freestanding wall.
Pilaster Detail
The pilaster detail creates a deeper wall section within the wall which can provide stability for a retaining structure, freestanding wall or parapet.

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

Terrace Wall Proximity Evaluation

For walls where $L_1 \leq H_1 \times 2$, then the walls are to be considered as a composite and the entire wall height ($H$) needs to be considered in the design.

For walls where $L_1 \geq H_1 \times 2$, then the walls typically are analyzed separately. Walls built on slopes $\geq 3:1$ or on soft soils need to be analyzed for “global stability”. Consult a qualified engineer.
**Stonegate™ Installation**

**Description:** Wall  |  **Texture:** Smooth Tumbled  |  **Applications:** Freestanding, Seating & Retaining Walls up to 4', Pillasters, Columns, Fire Pits

**Design Considerations**

**Design Assumptions**

- Friction angle (PHI) for earth pressure calculations of geogrid reinforced walls is evaluated at 26°, 30° and 34° only. For other soil type analysis, refer to the KeyWall® design software program or consult with a qualified engineer.
- Moist weight of the three soil types indicated is 120 lb./ft3 (19kN/m2).
- Sliding calculations use 6” (152mm) crushed stone leveling pad as compacted foundation material.
- All backfill materials are compacted to 95% Standard Proctor density.
- The term “vertical” is a wall built to a near vertical alignment having a slight positive setback (1°+).
- The information provided herein is for preliminary design use only. A qualified engineer should be consulted for design and analysis of structures. Keystone Retaining Wall Systems LLC assumes no liability for the improper use of this information.

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**Reinforced Wall: Near Vertical Detail**

**Reinforced Wall: Setback Detail 9.5°+ Batter**

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**Gravity Wall: Near Vertical Detail**

**Gravity Wall: Setback Detail 9.5°+ Batter**

---

**Reinforced Wall: Near Vertical Detail**

**Reinforced Wall: Setback Detail 9.5°+ Batter**
Design Notes
For low (non-structural) landscape retaining walls, Country Manor/Stonegate units can be constructed as a non-reinforced gravity wall as shown in the chart below. This chart is for retaining walls in the “near vertical” option.

Gravity Walls (Maximum unreinforced wall height)

<table>
<thead>
<tr>
<th>Maximum Height*</th>
<th>Near Vertical</th>
<th>9.5 +/- Batter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>3H:1V</td>
</tr>
<tr>
<td>sand / gravel phi = 34°</td>
<td>2'-0&quot; (0.6m)</td>
<td>1'-6&quot; (0.45m)</td>
</tr>
<tr>
<td>silty sand phi = 30°</td>
<td>1'-6&quot; (0.45m)</td>
<td>1'-6&quot; (0.45m)</td>
</tr>
<tr>
<td>silt / lean clay phi = 26°</td>
<td>1'-6&quot; (0.45m)</td>
<td>1'-0&quot; (0.3m)</td>
</tr>
</tbody>
</table>

*Height does not include 3" (76mm) cap

Note: use pins and construction adhesive at low border/parapet walls.
Stonegate™ Installation

Silt/Lean Clay: φ=26°, γ=120 pcf (19kN/m³)

The following charts assume the use of a coated polyester geogrid with a minimum allowable design strength of:

LTDS = 750 plf (10.9 kN/m) or Tal = 500 plf (7.3 kN/m)

*For construction of near vertical batter (center pin hole), construct with positive batter by tilting units back towards fill on leveling pad.

Elevation drop along the 10'' (254mm) width of the block to be 3/8'' (10mm).

*For construction of near vertical batter (center pin hole), construct with positive batter by tilting units back towards fill on leveling pad. Elevation drop along the 10'' (254mm) width of the block to be 3/8'' (10mm).

The information provided herein is for preliminary design use only. A qualified engineer should be consulted for design and analysis of structures. Keystone Retaining Wall Systems LLC assumes no liability for the improper use of this information. Information on specific geogrids is available from the geogrid manufacturer.
Stonegate™ Installation

Description: Wall | Texture: Smooth Tumbled | Applications: Freestanding, Seating & Retaining Walls up to 4’, Pillasters, Columns, Fire Pits

Silty Sand: $\phi=30^\circ$, $\gamma=120\text{pcf (19kN/m}^3$)

The following charts assume the use of a coated polyester geogrid with a minimum allowable design strength of:

LTDS = 750 plf (10.9 kN/m) or Tal = 500 plf (7.3 kN/m)

*For construction of near vertical batter (center pin hole), construct with positive batter by tilting units back towards fill on leveling pad. Elevation drop along the 10”(254mm) width of the block to be 3/8”(10mm).

Case 1

Reinforced Walls (near vertical*)

Case 2

Reinforced Walls (near vertical*)

Case 3

Reinforced Walls (near vertical*)

Case 1

Reinforced Walls (9.5° ± setback)

Case 2

Reinforced Walls (9.5° ± setback)

Case 3

Reinforced Walls (9.5° ± setback)

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Stonegate™ Installation

Description: Wall | Texture: Smooth Tumbled | Applications: Freestanding, Seating & Retaining Walls up to 4’, Pillasters, Columns, Fire Pits

Sand/Gravel: $\phi = 34^\circ$, $\gamma = 120$ pcf (19kN/m$^3$)

The following charts assume the use of a coated polyester geogrid with a minimum allowable design strength of:

- LTDS = 750 plf (10.9 kN/m) or Tal = 500 plf (7.3 kN/m)

*For construction of near vertical batter (center pin hole), construct with positive batter by tilting units back towards fill on leveling pad. Elevation drop along the 10”(254mm) width of the block to be 3/8”(10mm).

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**WALLS**

**Napa™**

**Description:** Wall  |  **Texture:** Split Tumbled  |  **Applications:** Freestanding, Seating, & Retaining Walls up to 4’, Columns

<table>
<thead>
<tr>
<th>Texture</th>
<th>Applications</th>
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<tr>
<td>Smooth Tumbled</td>
<td>Freestanding, Seating, &amp; Retaining Walls up to 4’, Pillasters, Columns</td>
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**3” High Units**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>s/f/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - Piece Pallet</td>
<td>26</td>
<td>120</td>
<td>2694</td>
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<tr>
<td>Small Unit</td>
<td>3 x 6 x 9</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Medium Unit</td>
<td>3 x 11 x 9</td>
<td></td>
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<tr>
<td>Large Unit</td>
<td>3 x 17 x 9</td>
<td></td>
<td>40</td>
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</table>

**6” High Units**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>s/f/pallet</th>
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<tbody>
<tr>
<td>3 - Piece Pallet</td>
<td>26</td>
<td>60</td>
<td>2754</td>
</tr>
<tr>
<td>Small Unit</td>
<td>6 x 6 x 9</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Medium Unit</td>
<td>6 x 11 x 9</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Large Unit</td>
<td>6 x 17 x 9</td>
<td></td>
<td>20</td>
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**Corner/Column**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
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<tbody>
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<td>6” High Unit</td>
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**Corner/Column**

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<tr>
<th>Dimensions (in)</th>
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<tbody>
<tr>
<td>3” Rectangle Cap</td>
<td>3 x 15 x 1½</td>
<td>45</td>
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</table>

*final column dimensions 25” x 25” x 72”

**Colors**

- coastal tan
- fieldstone
- granite
- mesquite
- palmetto

*Color samples for reference only. Actual product colors may vary.*
### Pallet Information

<table>
<thead>
<tr>
<th>High Units</th>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
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<td>20</td>
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<tr>
<td>Large Unit</td>
<td>3 x 17 x 9</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>6” High Units</td>
<td>Dimensions (in)</td>
<td>sf/pallet</td>
<td>total pieces</td>
<td>wt./pallet</td>
</tr>
<tr>
<td>3” Small Unit</td>
<td>6 x 6 x 9</td>
<td>26</td>
<td>60</td>
<td>2754</td>
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<tr>
<td>Medium Unit</td>
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<td></td>
</tr>
<tr>
<td>Large Unit</td>
<td>6 x 17 x 9</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Corner/Column*</td>
<td>Dimensions (in)</td>
<td>sf/pallet</td>
<td>total pieces</td>
<td>wt./pallet</td>
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<td>3 x 15 x 11½</td>
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</table>

*final column dimensions 25” x 25” x 72”

### Colors

- coastal tan
- fieldstone
- granite
- mesquite
- palmetto

Color samples for reference only. Actual product colors may vary.
**Prepare The Leveling Pad**

Excavate for the leveling pad. The trench should be a minimum of 20 inches wide and should be 6 inches deeper than the block. The height of the wall will determine the number of units to bury. As a rule of thumb, you will bury 1” of block for every 8” of exposed wall height. Create a leveling pad of compacted base material that extends a minimum of 6 inches in front of and 6 inches behind the wall units. This pad should also be at least 6 inches deep after compaction.

**Base Course**

Once the pad is compact and level, begin placing the units. It is recommended to use only the large units for your base course, as they are easier to level than using several smaller units. Center the units on the pad. The ends of the units should be in contact. The base course must be buried below grade and should be included when calculating total wall height.

**Building The Wall**

Units can be placed in any order to form an aesthetically pleasing layout. The simplest is one that incorporates large, medium and small units. The units should be installed so the ends are in complete contact with each other. Remember to keep the wall on bond by placing units in a staggered relationship to the course beneath. Repeat this process to complete the wall. Note, during this process to install the proper reinforcement grid in applications where needed.

For best results, use a filter fabric, which should be placed directly behind the wall extending from the bottom of the base course to the middle of the top course. This will minimize material coming through the rough-hewn face texture of these products. We recommend a non-woven, 4 to 6-ounce fabric.

Glue the top two courses and caps in place with a concrete adhesive.

**Outside Curves: Calculating A Radius**

When building an outside curve, begin by calculating the 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 block system used.

To calculate the approximate radius of the top course: Add 1/4 inch to the setback of the block used. Multiply that amount by the number of courses in the finished wall. Then subtract the result from the radius of the base course. This number equals the calculated radius of the top course.

Radius Base Course. Drive a stake into the ground at the desired center of the curve. Attach a string and rotate it in a circle around the stake to mark the radius in the soil. Align the back of the block with the curve and ensure level placement from side to side and front to back.

Radius Additional Courses. On each course, the 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 block is cut to size, glue it in place with a concrete adhesive.

**Inside Curves: Calculating A Radius**

Check the wall plan to determine the radius of the base course. This will be the smallest radius in the wall and must not be less than the minimum for the block system used.

Radius Base Course. Drive a stake into the ground at the desired center of the curve. Attach a string and rotate it in a circle around the stake to mark the radius in the soil. Align the back of the block with the curve and ensure level placement from side to side and front to back.
Radius Additional Courses. On each course, the 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 increase and eventually affect the running bond of the wall. To maintain proper running bond, use partial units as needed. Once a block unit is cut to size, glue in place with a concrete adhesive.

Most retaining walls are designed assuming 100 percent coverage of the reinforcement. When building an inside curve, the back edges of the reinforcement will fan out, producing slight gaps. In order to ensure 100 percent coverage, additional lengths of reinforcement are used to fill those gaps on the next course of blocks. To prevent slippage, don’t overlap the grid on any given course.

Outside 90-Degree Corners
Base Course. To build an outside 90° corner, begin by splitting a large block in half. Place this block with both split faces outward at the corner. 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 second course with the other half of the large block. Place the second and third blocks on either side of the corner block. Once the corner block is in position, glue it in place with a concrete adhesive. Continue to alternate the corner block orientation with each course and always use a concrete adhesive.

Inside 90-Degree Corners
Base Course. To create an inside 90° 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. Remove the rear lip so the block lies flat. Make sure to construct the base course according to standard site prep and installation procedures described earlier.

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. Block placement in the corner should alternate direction with each succeeding course.

Ending A Wall
Split a large unit into pieces—sized as needed. Do not use pieces smaller than 6 inches wide. If needed, cut the second-to-last piece and make the last piece the appropriate size. Smaller pieces should be glued into place with a concrete adhesive. After splitting the end piece, use a hammer and chisel to create a rounded appearance to match the manufactured split blocks.

End-Of-Wall Columns:
To construct columns at the end of a wall, cut 1 column unit in half for the 2nd, 4th and additional even-numbered courses. Stack column units in a rotating pattern for each course, staggering the bond. 1 column unit half is used every two courses. Glue each course of column units with a concrete adhesive.

Through-Wall Columns:
On the first course, use full column units to start the column. Then split the wall units to fit. On the second course, split two column units in half to fill in the corners. Continue construction by alternating courses. Glue all column courses with a concrete adhesive.
**StoneLedge™**

**Description:** Wall  |  **Texture:** Split Tumbled  |  **Applications:** Freestanding, Seating, & Retaining Walls up to 4', Columns, Fire Pits

**Pallet Information**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3&quot; High Units</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - Piece Tapered</td>
<td>30</td>
<td>60</td>
<td>2640</td>
</tr>
<tr>
<td>Small Unit</td>
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<tr>
<td>Medium Unit</td>
<td>3 x 9 x 10</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Large Unit</td>
<td>3 x 12 x 10</td>
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<td></td>
</tr>
<tr>
<td><strong>6&quot; High Units</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - Piece Tapered</td>
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<td>60</td>
<td>2640</td>
</tr>
<tr>
<td>Small Unit</td>
<td>6 x 6 x 10</td>
<td>20</td>
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</tr>
<tr>
<td>Medium Unit</td>
<td>6 x 12 x 10</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Large Unit</td>
<td>6 x 18 x 10</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Corner/Column</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot; High Unit</td>
<td>6 x 18 x 9</td>
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<td>2560</td>
</tr>
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<td><strong>Caps</strong></td>
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<td>total pieces</td>
</tr>
<tr>
<td>3&quot; Tapered Cap</td>
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<td>48½</td>
<td>45</td>
</tr>
<tr>
<td>R: 3 x 12 x 12½</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&quot; Rectangle Cap*</td>
<td>3 x 15 x 11½</td>
<td>52½</td>
<td>42</td>
</tr>
</tbody>
</table>

*Available in PA, NJ, DE, & MD
**Final column dimensions 27" x 27" x 72"*

**Colors**

- Coastal tan
- Fieldstone
- Granite
- Mesquite

Color samples for reference only. Actual product colors may vary.

NewLine Hardscapes is a licensed producer of StoneLedge™ by CornerStone Wall Solutions.
**StoneLedge Retaining Walls**

StoneLedge™ is a double-sided, multi-sized, tapered unit system that possesses the hand finished look of quarried stone. It is ideal for creative residential or commercial segmental retaining wall projects ranging from the simple to the complex. Designed to add the elegance of natural stone to any yard or property, StoneLedge™ is suitable for many applications including retaining walls, stairs, planters and terraced patios. The amazing flexibility, unique quarried face, and the endless creative random patterns make StoneLedge™ an excellent choice for value, beauty, durability and ease of construction.

**Vertical**

![Vertical Diagram]

**Setback**

![Setback Diagram]

**Shadow**

![Shadow Diagram]
**StoneLedge™**

Description: **Wall** | Texture: **Split Tumbled** | Applications: **Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits**

6” StoneLedge Retaining Walls

- **Vertical**
- **Setback**
- **Shadow**
- **Jumper**
6” StoneLedge Freestanding Walls

**Vertical**

**Shadow**

**Jumper**
3” StoneLedge Retaining Walls

**Vertical**

**Setback**

**Shadow**
3” StoneLedge Freestanding Walls
Combination StoneLedge™ Ashlar: Retaining Wall System

Be Creative

Here is your chance to show off your creative side. The options for StoneLedge™ patterns are endless. We challenge you to pick up a pallet of both 3” and 6” units to create your own personalized walls.

You can integrate your own creative pattern with any design feature you like such as curved walls, corners, stairs, barbecue stands, tree rings, and so much more.

Pattern 1

Pattern 1
Combination StoneLedge™ Ashlar: Freestanding Wall System

**Be Creative**

Here is your chance to show off your creative side. The options for StoneLedge™ patterns are endless. We challenge you to pick up a pallet of both 3” and 6” units to create your own personalized walls.

You can integrate your own creative pattern with any design feature you like such as curved walls, corners, stairs, barbecue stands, tree rings, and so much more.

**Pattern 1**

![Pattern 1 Image]
**StoneLedge™**

**Description:** Wall  |  **Texture:** Split Tumbled  |  **Applications:** Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

**Base Course Pattern**
- Place the StoneLedge™ units in a random ashlar pattern using the 3 sizes in the same ratio as they come in each pallet.
- The StoneLedge™ units will have the connector holes facing up with the connector slots facing down.
- Place each unit on top of the leveling pad in such a way as not to disturb the level gravel.
- Continue to install the StoneLedge™ base units until the length of the wall or the first elevation change of the base occurs.

**Using a Jumper**
- To install a Jumper unit, the StoneLedge™ flag connector is placed in the back holes of the lower units. The 12” standard unit is turned on end in the wall with the back of the unit resting on the back flag connector.
- To insure a random stagger pattern, cross the vertical joints as often as possible throughout the wall.
**StoneLedge™**

**Description:** Wall  |  **Texture:** Split Tumbled  |  **Applications:** Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

**Flag Connectors**

- The StoneLedge™ wall can be built in a batter (setback), vertical position, or shadow (multi-setback).
- Place the flag connectors in the forward connector holes with the flag in the back position to create a batter or rotate the flag forward to create a vertical wall.
- Place the flag connectors in the forward connector holes or back connector holes with the flags in a back or forward position to create a random Shadow (multi-setback) wall.
StoneLedge™

Description: Wall | Texture: Split Tumbled | Applications: Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

Lay First Course
- Remove the Screed Pipe from the leveling pad
- Place a steel stake or a StoneLedge™ unit at either end of the leveling pad to establish the back of the first course of units
- Secure tightly a string line to the stakes or StoneLedge™ units at either end which will provide the guide to line up the back of each StoneLedge™ base unit
- Connector holes can also be used for aligning units if back of units are irregular
- The distance of the string line between the steel stakes or StoneLedge™ units may vary due to heavy winds

Level Units
- Remove the Screed Pipe from the leveling pad
- Place a steel stake or a StoneLedge™ unit at either end of the leveling pad to establish the back of the first course of units
- Secure tightly a string line to the stakes or StoneLedge™ units at either end which will provide the guide to line up the back of each StoneLedge™ base unit
- Connector holes can also be used for aligning units if back of units are irregular
- The distance of the string line between the steel stakes or StoneLedge™ units may vary due to heavy winds
**Impermeable Fill**

- Backfill behind, in front (toe of wall) and in the hollow cores of the units with Impermeable Materials up to the desired level of the Perforated Drain Pipe or to the top of the first course.
- Compact the Impermeable Materials behind, in front and in the hollow cores of the units.
- Sweep the top of the units clean of all rock and dirt before placing the next course of units.

**Drain Pipe Outlet**

- Perforated Drain Pipe should have adequate slope to drain water in the right direction towards each Drain Pipe Outlet.
- Drain Pipe Outlet can be every 30 or 50 feet.
- Perforated Drain Pipe can be a Sock Wrapped system to help prevent fines from migrating into the pipe.

**Backfill**

- Place and compact Backfill Materials in maximum Lifts of 6”.
- Lifts may be less than 6” depending on the type of soil or size of equipment.
- Backfill materials will be placed 12” behind the units allowing for Clear Crush Drain Gravel (Angular Aggregates free of fines) between the StoneLedge™ units and compacted Backfill Materials.
- By adding Clear Crush Drain Gravel (Angular aggregate free of fines) after compaction of the Backfill Materials, this will prevent undue pressure against the wall which can cause the units to move out of alignment. Each Lift should be compacted to 95% Standard Proctor or greater.
- The correct Moisture Content in the Backfill Materials will help in reaching proper Compaction Density.
StoneLedge™

Description: Wall | Texture: Split Tumbled | Applications: Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

Drainage Gravel
- Clear Crush Drain Gravel (Angular Aggregates free of fines) is placed in the hollow cores and 12” behind the wall units after compaction of the Backfill Materials. This will prevent undue pressure against the wall which can cause the units to move out of alignment
- Clear Crush Drain Gravel does not need to be compacted
- Sweep the top of the StoneLedge™ units clean of all rock and dirt before placing the connectors and next course of units
- Make sure the Clear Crush Drain Gravel directly behind the wall units is placed flush to the top of the units
- Make sure the Backfill Materials are as well compacted and level as possible

Continue Installation
- Continue to install each course of units and connectors following the same steps as above
- Install and compact Backfill Materials in 6” Lifts until wall is complete
- Grout around Drain Pipe Outlet to prevent Clear Crush Drain Gravel or Drainage Aggregates (Angular Aggregates free of fines) from migrating
Capping
- Complete the top of the wall with StoneLedge™ cap units
- Properly secure the cap units using a Concrete Adhesive
- Make sure all units are free of dirt and stones before installing the caps
- Place a solid bead of Concrete Adhesive around the top of each StoneLedge™ unit
- Place a bead of adhesive between each joint of the cap units

Soil Separation Fabric
- Place a 6 ft wide Soil Separating Filter Fabric on top of the backfill and drainage gravel and against the back of the last units before placing the planting soils
- The fabric will prevent planting soil fines from staining the face of the wall and migrating into the Clear Crush Drain Gravel (Angular Aggregate free of fines)

Final Grading
- Insure that final grading is done on top and bottom of the wall
- Make sure to protect newly placed planting soil from erosion during heavy rains or surface runoff
**StoneLedge™**

**Description:** Wall  
**Texture:** Split Tumbled  
**Applications:** Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

**Planning**
- Excavate and prepare Sub Base Leveling Trench 6” below first course
- Leveling Pad Trench is approximately 2.5’ to 3’ wide
- Normal wall Burial Depth or Embedment Depth is 6” to 12” or one block
- Excavate cut line to a 2 to 1 slope or greater
- Back of wall excavation depth into the bank at the base of the wall should be from the face of wall to the designed length of Geogrid

**Cut Geogrid**
- Cut Geogrid Reinforcement to the length specified in the design
- Geogrids are manufactured in two directions Uni-axial or Bi-axial. Uni-axial grid has one direction of strength and that direction has to be oriented perpendicularly to the face of the wall during installation. Bi-axial grid can be laid in two directions, perpendicular and lengthwise to the face of wall (ensure that the lengthwise direction is still in accordance to the length specified by the Engineer’s design)
- Correct geogrid orientation, strength and length is crucial to the success of the wall project
- Each Geogrid length should be laid parallel and adjacent to each other but never overlapping
- Place the StoneLedge™ flag connectors through the Geogrid apertures and into the front connector holes
**StoneLedge™**

**Description:** Wall  |  **Texture:** Split Tumbled  |  **Applications:** Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

---

**Lay Geogrid**
- Place the Geogrid as far forward on the StoneLedge™ units as possible without revealing it on the face
- Place the next course of StoneLedge™ units on top of the connectors, lower units and Geogrid
- Pull the unit forward to engage and align the units
- Complete the installation of units on the Geogrid Reinforced courses
- Make sure each unit is installed against the next unit leaving no gaps between unit joints
- Tension the Geogrid in such a way as NOT to disturb the alignment of the upper units
- Use stakes or backfill materials to maintain the tension during backfilling
- Do not drive equipment directly on top of Geogrid

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**Reinforced Backfill**
- Backfill and Compact the Reinforced Zone by placing materials from the back of the wall towards the end of the Geogrid
- Install drainage gravel in the cores 12” behind the units after placing and compacting backfill materials
- Install and compact backfill materials in 6” Lifts until wall is complete
**StoneLedge™**

Description: Wall | Texture: Split Tumbled | Applications: Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

### Base Elevation Changes

- The top of the installed base unit will be used to establish the step-up gravel leveling pad elevation.
- Make sure to backfill and compact the gravel in and around the last unit of the first course.
- Finished grade of the leveling pad should be an 1/8” to 1/4” above top of first course units to allow for a small amount of settlement.
- Repeat the above screeding steps on the second elevation gravel leveling pad.
- Place the first unit on the second course at a half bond on top of last and second last of the first course units.
- The connectors in the lower units will fit into the connector slot of the upper units. To align the wall, place a string line at the back of the units for a straight wall or place a PVC pipe for a curved wall.
- The connector holes of the second course can also be used for aligning units.
- Pull upper unit forward to engage and align units.
- The batter or set back will be 1/2”/unit (4.5 degrees or 1”/vertical foot) for a battered wall.
- Place the second unit half on the last unit and half on the second gravel leveling pad.

---

[Image of StoneLedge installation process]
Convex First Course
- If possible, start building a curve from the center and work left and right through the curve.
- Use PVC Flex Pipes to create smooth and accurate Convex curves.
- Use the back of the unit for alignment.
- Convex curves have a slight increase in batter or setback to the standard 1/2" or vertical wall.
- The taller the wall the larger the Convex first course needs to be. The radius of each additional course will be slightly smaller than the lower course.

Convex Geogrid Curve
- Each Geogrid length should be laid perpendicularly to the wall face.
- Geogrid should not overlap on the StoneLedge™ units.
- Correct geogrid orientation, strength and length is crucial to the success of the wall project.
StoneLedge™

Description: Wall | Texture: Split Tumbled | Applications: Freestanding, Seating, & Retaining Walls up to 4', Columns, Fire Pits

**Concave First Course**
- If possible, start building a curve from the center and work left and right through the curve
- Use PVC Flex Pipes to create smooth and accurate Concave curves
- Use the back of the unit for alignment
- Concave curves have a slight decrease in batter or setback to the standard 1/2" or vertical wall
- The taller the wall the smaller the Concave first course needs to be. The radius of each additional course will be slightly larger than the lower course

**Concave Geogrid Curve**
- Each Geogrid length should be laid perpendicularly to the wall face
- Geogrid should not overlap on the StoneLedge™ units
- To ensure 100% coverage, place a second layer of Geogrid centered to the unreinforced triangle zone one course above the main Geogrid layer
- Correct geogrid orientation, strength and length is crucial to the success of the wall project
Outside First Course
- Use a 90° Corner unit to build an outside corner
- Place the first 90° Corner unit on the base leveling pad to start the outside corner
- Place a StoneLedge™ unit on either side against the 90° Corner unit
- Continue to lay the StoneLedge™ base course on either side of the corner until first course is completed
- Flip and turn the second course 90° Corner overlapping the short side and half of the StoneLedge™ base unit. This unit should be pushed back 1/2” for a 4.5 degree batter or vertical for a 0 degree batter to achieve proper setback
- Continue to lay the StoneLedge™ second course on either side of the corner until second course is completed
- The 90° Corners can be glued or concrete core filled to ensure a proper course to course outside corner interlock

Outside Geogrid Corner
- Each Geogrid length should be laid perpendicularly to the wall face
- Geogrid should not overlap on the StoneLedge™ units
- Lay the 1st Geogrid corner section perpendicularly to one side of the corner
- Lay the 2nd Geogrid section perpendicularly to the other side of the corner but not overlapping the 1st Geogrid section
- Lay the secondary Geogrid layer one course above and perpendicular to the lower main Geogrid layer directional strength
- Correct geogrid orientation, strength and length is crucial to the success of the wall project
**StoneLedge™**

Description: **Wall** | Texture: **Split Tumbled** | Applications: **Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits**

**Inside First Course**
- Place the second unit at right angle and centered to the first StoneLedge™ base unit. Continue to install the StoneLedge™ base units right and left of the first inside corner units.
- Place the second unit at right angle and centered to the 1st unit on the second course.
- Make sure second course units are placed at a 1/2” (4.5 degree for a batter or vertical for a 0 degree batter) to achieve setback to the lower inside corner.
- Continue to install the units left and right of the inside corner to complete the second course of the wall.
- Repeat the above step by step installation until the wall height is completed or until reaching the first Geogrid layer.

**Inside Geogrid Corner**
- Each Geogrid length should be laid perpendicularly to the wall face.
- Geogrid should not overlap on the StoneLedge™ units.
- Lay the 1st Geogrid corner section perpendicularly to one side of the corner and overlap h/4 through the backfill (Height of Wall ÷ 4).
- Lay the 2nd Geogrid section perpendicularly to the 1st Geogrid.
- Lay the second Geogrid layer perpendicularly and overlap h/4 through the backfill opposite to the first Geogrid layer.
- The h/4 overlap will alternate layer to layer to properly secure the inside corner.
- Correct geogrid orientation, strength and length is crucial to the success of the wall project.
**StoneLedge™**

**Description:** Wall  |  **Texture:** Split Tumbled  |  **Applications:** Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

---

**Lay First Course**
- Prepare the sub-base and base leveling pad by following Gravity StoneLedge™ Installation Steps 1 to 9
- Build each step in sequence with each course of the regular wall units for best results of wall to step interlock
- First course of step units will be totally buried
- Backfill behind the first course units with gravel, then compact and level flush to the top of the first course

Option: unit cores can be filled with concrete for greater stability

**Lay Second Course**
- Place the second course of units on top of the base units with connectors in a batter position
- Place a second row of buried units in the back of the second riser units
- Backfill behind the second course of units with gravel, then compact and level flush to the top of the second course

**Lay Third Course**
- The third course units will be in a batter approximately .5 inch leaving 10.5 inches exposed on the front first step
- Place a third row of buried units in the back of the third riser units

**Continue Installation**
- Continue to install each course of step units following the same steps as above
- The top and final step does not need buried units

**Continue Installation**
- StoneLedge™ 12 inch deep cap units can be used as a stair tread
- Option: Pavers, Patio Slabs or Natural Stone can also be used as a stair tread
- Use concrete adhesive to attach Step Caps
StoneLedge™

Description: Wall  | Texture: Split Tumbled  | Applications: Freestanding, Seating, & Retaining Walls up to 4', Columns, Fire Pits

Lay First Course
- Prepare the sub-base and base leveling pad by following Gravity StoneLedge™ Installation Steps 1 to 9
- Build each step in sequence with each course of the regular wall units for best results of wall to step interlock
- First course of step units will be totally buried
- Backfill behind the first course units with gravel, then compact and level flush to the top of the first course

Option: unit cores can be filled with concrete for greater stability

Lay Second Course
- Place the second course of units on top of the base units with connectors in a batter position
- Place a second row of buried units in the back of the second riser units
- Backfill behind the second course of units with gravel, then compact and level flush to the top of the second course

Lay Third Course
- The third course units will be in a batter approximately .5 inch leaving 10.5 inches exposed on the front first step
- Place a third row of buried units in the back of the third riser units

Continue Installation
- Continue to install each course of step units following the same steps as above
- The top and final step does not need buried units

Continue Installation
- StoneLedge™ 12 inch deep cap units can be used as a stair tread
- Option: Pavers, Patio Slabs or Natural Stone can also be used as a stair tread
- Use concrete adhesive to attach Step Caps
**Leveling Pad**
- Ensure that you have properly installed your base levelling pad. For a proper leveling pad concrete or Well Graded Gravel (also known as Road Base Aggregates) can be used
- It must be a minimum of 8” thick
- Once completed, place and level the StoneLedge™ unit blocks as shown

**Second Course**
- Flip and turn the second course corner units upside down to create an overlapping bond
- Place second course of the StoneLedge™ corner units directly on top of the first course
- Clear Crush Drain Gravel (Angular Aggregates free of fines) should be placed in the cores and middle of pillar (concrete core filling optional) use a dry concrete mix to prevent leaching of cement
- Concrete Adhesive should be applied to all units to ensure course to course interlock

**Additional Courses**
- Repeat Step 1 and Step 2 until desired height of pillar has been reached

**Completion**
- Complete the pillar with a Pillar Cap
- Secure the Pillar Cap with a concrete adhesive
StoneLedge™

Description: Wall | Texture: Split Tumbled | Applications: Freestanding, Seating, & Retaining Walls up to 4', Columns, Fire Pits

Case A
Exposed Hgt/m/cap
Grid Sq Yd per Ln Ft
# Block per Ln Ft
# Cap per Ln Ft
2' 6'' 0.444 3.75 .75
3' 8'' 0.809 5.25 .75
4' 0'' 0.917 6.75 .75
5' 0'' 1.444 8.25 .75
6' 0'' 2.083 9.75 .75
7' 0'' 3.33

Case B
Exposed Hgt/m/cap
Grid Sq Yd per Ln Ft
# Block per Ln Ft
# Cap per Ln Ft
2' 6'' 0.869 3.32 1.00
3' 8'' 0.872 5.75 1.50
4' 0'' 1.500 8.25 2.06
5' 0'' 2.056 9.75 2.78
6' 0'' 2.778 12.75 4.19

Case C
Exposed Hgt/m/cap
Grid Sq Yd per Ln Ft
# Block per Ln Ft
# Cap per Ln Ft
2' 6'' 0.444 3.75 .75
3' 8'' 0.809 5.25 .75
4' 0'' 0.917 6.75 .75
5' 0'' 1.444 8.25 .75
6' 0'' 2.083 9.75 .75
7' 0'' 3.33
Description: Wall  |  Texture: Split Tumbled  |  Applications: Freestanding, Seating, & Retaining Walls up to 4', Columns, Fire Pits
### StoneLedge™

**Description:** Wall  
**Texture:** Split Tumbled  
**Applications:** Freestanding, Seating, & Retaining Walls up to 4’, Columns, Fire Pits

#### Case A
- **Exposed Height/cap:** 2’ 0”, 3’ 0”, 4’ 0”, 5’ 0”, 6’ 0”, 8’ 0”
- **Grid Sq. Yd. per Lin. Ft.:**
  - 2’ 0”: 0.444
  - 3’ 0”: 0.889
  - 4’ 0”: 0.889
  - 5’ 0”: 1.361
  - 6’ 0”: 1.964
  - 8’ 0”: 3.222
- **# Block per Lin. Ft.:**
  - 2’ 0”: 3.35
  - 3’ 0”: 5.25
  - 4’ 0”: 6.75
  - 5’ 0”: 8.25
  - 6’ 0”: 9.75
  - 8’ 0”: 12.75
- **# Cap per Lin. Ft.:**
  - 2’ 0”: 0.75
  - 3’ 0”: 0.75
  - 4’ 0”: 0.75
  - 5’ 0”: 0.75
  - 6’ 0”: 0.75
  - 8’ 0”: 0.75

#### Case B
- **Exposed Height/cap:** 2’ 0”, 3’ 0”, 4’ 0”, 5’ 0”, 6’ 0”, 8’ 0”
- **Grid Sq. Yd. per Lin. Ft.:**
  - 2’ 0”: 0.444
  - 3’ 0”: 0.889
  - 4’ 0”: 0.889
  - 5’ 0”: 1.361
  - 6’ 0”: 1.964
  - 8’ 0”: 3.222
- **# Block per Lin. Ft.:**
  - 2’ 0”: 3.35
  - 3’ 0”: 5.25
  - 4’ 0”: 6.75
  - 5’ 0”: 8.25
  - 6’ 0”: 9.75
  - 8’ 0”: 12.75
- **# Cap per Lin. Ft.:**
  - 2’ 0”: 0.75
  - 3’ 0”: 0.75
  - 4’ 0”: 0.75
  - 5’ 0”: 0.75
  - 6’ 0”: 0.75
  - 8’ 0”: 0.75

#### Case C
- **Exposed Height/cap:** 2’ 0”, 3’ 0”, 4’ 0”, 5’ 0”, 6’ 0”, 8’ 0”
- **Grid Sq. Yd. per Lin. Ft.:**
  - 2’ 0”: 0.444
  - 3’ 0”: 0.889
  - 4’ 0”: 0.889
  - 5’ 0”: 1.361
  - 6’ 0”: 2.000
  - 8’ 0”: 3.278
- **# Block per Lin. Ft.:**
  - 2’ 0”: 3.35
  - 3’ 0”: 5.25
  - 4’ 0”: 6.75
  - 5’ 0”: 8.25
  - 6’ 0”: 9.75
  - 8’ 0”: 12.75
- **# Cap per Lin. Ft.:**
  - 2’ 0”: 0.75
  - 3’ 0”: 0.75
  - 4’ 0”: 0.75
  - 5’ 0”: 0.75
  - 6’ 0”: 0.75
  - 8’ 0”: 0.75
### Description:
**Wall**

### Texture:
**Split Tumbled**

### Applications:
Freestanding, Seating, & Retaining Walls up to 4', Columns, Fire Pits

---

#### Pallet Information

<table>
<thead>
<tr>
<th>Unit</th>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
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#### Colors
- Coastal tan
- Fieldstone
- Granite
- Mesquite

*Color samples for reference only. Actual product colors may vary.*
For MiraStone installation instructions, please see installation instructions for Regal Stone/Regal Stone Pro on page 158.
Regal Stone®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’

6” high unit

6” step unit

3” universal cap

Pallet Information

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<th>Unit</th>
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<td>45</td>
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Colors

- coastal tan
- fieldstone
- granite
- mesquite

Color samples for reference only. Actual product colors may vary.
Regal Stone Rock Face®

Description: **Wall** | Texture: **Split Face** | Applications: **Freestanding & Retaining Walls up to 10’**

![6” High Unit](image1)

![6” Step Unit](image2)

![3” Universal Cap](image3)

### Pallet Information

<table>
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<tr>
<th>Unit</th>
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<td>6” Step Unit</td>
<td>6 x 16 x 12</td>
<td>16</td>
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<th>total pieces</th>
<th>wt./pallet</th>
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<td>56 1/4</td>
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### Colors

- Coastal Tan
- Fieldstone
- Granite
- Mesquite

*Color samples for reference only. Actual product colors may vary.*
**Regal Stone Pro®**

**Description:** Wall  |  **Texture:** Split Face  |  **Applications:** Freestanding & Retaining Walls up to 10’+

![](image)

8” high unit

8” corner unit

3” universal cap

---

**Pallet Information**

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<th>Unit</th>
<th>Dimensions (in)</th>
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<th>total pieces</th>
<th>wt./pallet</th>
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<td>8” Corner Unit</td>
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**Dimensions (in)**

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<td>3 x 15 x 13</td>
<td>56¼</td>
<td>45</td>
<td>2169</td>
</tr>
</tbody>
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**Colors**

coastal tan  
fieldstone  
granite  
mesquite

*Color samples for reference only. Actual product colors may vary.*
**Regal Stone Pro Rock Face®**

**Description:** Wall  |  **Texture:** Split Face  |  **Applications:** Freestanding & Retaining Walls up to 10’+

---

**8” high unit**

**8” corner unit**

**3” universal cap**

---

**Pallet Information**

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---

**Colors**

- coastal tan
- fieldstone
- granite
- mesquite

Color samples for reference only. Actual product colors may vary.
Regal Stone® & Regal Stone Pro® Installation

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

Installation

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 to the lines and grades shown on the approved plans, and excavate enough soil from behind the wall for the geosynthetic reinforcement material.
• The trench for the leveling pad should be at least 2 feet wide and 1 foot deep. See Diagram 1.

Leveling Pad
• An aggregate leveling pad is made of compactible base material of 3/4-inch minus with fines.
• The pad must extend 6 inches in front and behind the first course of block, and be at least 6 inches deep after compaction.
• Compact the aggregate and make sure it’s level. See Diagram 2.

Base Course
• This is the most important step in the installation process.
• Begin laying block at the lowest elevation of the wall whenever possible.
• Remove the rear lip of the block by hitting with a hammer and chisel from the back so that the block will lie flat on the leveling pad.
• Place first block and level, front to back and side to side; lay subsequent blocks in same manner.
• 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.
• Place soil in front of the base course and compact. Base course should be buried. Continue to fill and compact after each course is laid.
• If the wall is on an incline, don’t slope the blocks. Step them up so they remain consistently level.
• Use string along back edge of the block to check for proper alignment.

Construction Of The Next Course
• Fill voids between blocks with 3/4-inch clean drainage aggregate prior to laying the next course of block. 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 3.
• Backfill with drainage aggregate directly behind the block, adding 6 to 8 inches at a time. Add soil fill 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 4 feet of the face of the wall.

*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 circular cut-off saw with a masonry blade to achieve a tighter fit.
Regal Stone® & Regal Stone Pro® Installation

Description: **Wall** | Texture: **Split Face** | Applications: Freestanding & Retaining Walls up to 10’/+  

- You’ll need partial units 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**
- Each project is unique. The grades on your 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 5.
- 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. See Diagram 5 and 6.

**Compaction**
- Shovel the backfill soil behind the drainage aggregate and compact the backfill with a hand-operated compactor.
- Make sure the aggregate is level with or slightly below the top of the base course.
- Base course should be buried. Continue to fill and compact after each course is laid.

**Reinforcement (If Required)**
- Geosynthetic reinforcement is recommended for walls taller than 4 feet 6 inches, 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 reinforcement.
- Clean any debris off the top layer of blocks.
- Measure and cut the reinforcement to the design length in the plans.
- The reinforcement has a design strength direction, which must be laid perpendicular to the wall.
- Place the front edge of the material on the top course, 1 inch from the face of the block.
- Apply the next course of blocks to secure reinforcement material in place.
- To keep it from wrinkling, pull the reinforcement taut and pin the back edge in place with stakes or staples.
- Add drainage aggregate behind the blocks; then add the soil and compact it. It is ideal to fill from the wall toward the cut. See Diagram 6.
- A minimum of 6 inches of backfill is required to provide cushioning prior to operating vehicles on the reinforcement. Avoid sudden turning or braking when operating vehicles on the reinforcement area. See Diagram 6.

*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 circular cut-off saw with a masonry blade to achieve a tighter fit.
Capping A Wall
Straight wall
• Always start capping from the lowest elevation.

Outside curves
• Lay cap units side by side and cut at least every other cap to produce a uniform look.

Inside curves
• In most circumstances, making two cuts on one cap and then not cutting the adjacent caps produces the most pleasing look.

Corners
• On a 90-degree corner wall, the corner caps need to be saw-cut to achieve a 45-degree mitered corner.

Stepping up caps
• If a 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 previous step up. Split a cap unit to create a rough face on the exposed side. Place the partial cap unit directly on top of the capped portion of the wall with all three split faces exposed.

Finishing
• After layout is complete and caps are saw-cut or split to size, carefully glue in place with a concrete adhesive.

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. 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.

Safety Note: Always use appropriate equipment, including safety glasses or goggles and respirators, when splitting, cutting or hammering units.

*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 circular cut-off saw with a masonry blade to achieve a tighter fit.
Regal Stone® & Regal Stone Pro® Installation

Description: Wall  |  Texture: Split Face  |  Applications: Freestanding & Retaining Walls up to 10’/+ 

Running Bond

Straight Wall
Proper installation of a Regal Stone retaining wall requires that running bond be maintained. Running bond occurs when the blocks are centered over the vertical joints of the previous course. This adds to wall stability and makes your wall system aesthetically beautiful.

Outside Curved Wall
Any wall that is not perfectly straight will eventually run off bond. When this happens, skip a block position and place the next block into the next place where it is back on bond. Measure the remaining gap and cut or split a block to fit.

Tip: It may be possible to run the off-bond block into the soil bank to avoid cutting of partial units.

Once the partial unit is in place, glue with a concrete adhesive. Partial units should not be less than 5 inches long and should not be placed directly on top of each other. If the gap is larger than the length of one block, divide the measurement by two and put two partial units in place.

Independent Terraced Walls
For each wall to be independent of others, they must be built using a 2:1 ratio: The upper wall must be built a distance away from the lower wall of at least twice the height of the lower wall. In addition, the upper wall must also be equal to or less than the height of the lower wall. Exceptions to this general rule include weak soil conditions or where slopes exist above, below or between wall locations. For example, if the lower terrace is 3 feet tall, the distance to the upper terrace must be at least 6 feet, and the upper wall must not be higher than 3 feet.

Proper drainage is vital to maintaining stable, longlasting terraced walls. Drainpipe must be installed so that the water is directed around or under the lower wall. (Never place the drainpipe outlet for the upper wall above or behind the lower wall.)
Dependent Terraced Walls
When the distance between the lower and upper walls is less than twice the height of the lower wall, the walls become structurally dependent on each other. In this situation, it is important to take global stability into account, incorporating additional reinforcement, and longer layers, into the wall plan. In addition, structurally dependent walls require even more excavation, backfill and time; so plan ahead. Be sure to check the wall plan for specific requirements. For structurally dependent walls, consult with a qualified segmental retaining wall engineer.

Curves - Inside
Calculate the Radius
Check the wall plan to determine the radius of the base course. This will be the smallest radius in the wall and must not be less than the minimum for the block system used.

Base Course
Begin by driving a stake into the ground at the desired center of the curve. Attach a string and rotate it in a circle around the stake to mark the radius in the soil. Align each block face with the curve and ensure level placement from side to side and front to back.

Inside curves have varying minimum inside radii. Check the Product Information of the product you are using. When calculating the radius of the top course, add the setback in inches for each course used. See Product Information of the product you are using for setback.

Additional Courses
For each course, the 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 increase and eventually affect the running bond of the wall. To maintain proper running bond, use split units* as needed. Once a unit is cut to size, glue in place with a concrete adhesive.
Regal Stone® & Regal Stone Pro® Installation

Description: Wall  |  Texture: Split Face  |  Applications: Freestanding & Retaining Walls up to 10’/+  

Curves - Inside with Reinforcement
Most retaining walls are designed assuming 100 percent coverage of the reinforcement. When building an inside curve, the back edges of the reinforcement will fan out, producing slight gaps. In order to ensure 100 percent coverage, additional lengths of reinforcement are used to fill those gaps on the next course of blocks. Don’t overlap the grid on one course.

First Course With Reinforcement
Cut reinforcement to the lengths specified in the wall plan. Lay segments of reinforcement within 1 inch of the face of the wall, making sure that the strength direction of each section is perpendicular to the wall face. Avoid overlapping the reinforcement by separating each section.

Next Course
Place the next course of blocks, marking the backs of blocks to identify the middle of unreinforced areas, backfill and compact. Center subsequent sections of reinforcement on the marked blocks to ensure full reinforcement coverage. Repeat this procedure throughout the construction of the curve when reinforcement is required.

Minimum Inside Radius
The minimum radius varies by product. Please check Product Information for the product you are using at anchorwall.com.

Curves - Outside
Calculate the Radius
When building an outside radius curve, begin by calculating the radius of the top course. This will be the smallest radius in the wall and must not be less than the minimum for the block system used.

Here is the rule of thumb used to calculate the approximate radius of the top course: Add 1/4 inch to the setback of the block used. Multiply that amount by the numbers of courses in the finished wall. Then subtract the result from the radius of the base course. This number equals the calculated radius of the top course.

Base Course
Drive a stake into the ground at the desired center of the curve. Attach a string and rotate it in a circle around the stake to mark the radius in the soil. Align the front of the block with the marked curve and ensure level placement from side to side and front to back.
**Regal Stone® & Regal Stone Pro® Installation**

**Description:** Wall  |  **Texture:** Split Face  |  **Applications:** Freestanding & Retaining Walls up to 10’+/+  

**Additional Courses**
On each course, the 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 split units* as needed. Once a split unit is cut or split to size, glue in place with a concrete adhesive.

**Steps in a Curved Wall**
These drawings feature 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 previous course by 2 inches and glue to lower course. Place and compact soil fill prior to installing the next course.

**Next Wall Course**
Place a standard 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 the 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 Step Courses**
Beginning in the center, add the third course of steps, lining up the units with the first course. Overlap 2 inches and glue in place.

Drainage Tip: Drainpipe can be placed behind the lowest step units at grade. An alternative would be to place the drainpipe behind each wall adjacent to the steps.

**Corners - Inside 90°**
Regal Stone® & Regal Stone Pro® Installation

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+/+

Base Course
To create an inside 90° 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 described elsewhere on anchorwall.com.

Next Course
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 may be required on this wall to maintain running bond.

Additional Courses
Block placement in the corner should alternate direction with each succeeding course. These should be glued in place using a concrete adhesive.

Corners - Inside 90°
with Reinforcement
First Course with Reinforcement
To install reinforcement on an inside 90° corner, begin by checking the wall plan to determine reinforcement lengths and elevations. Cut reinforcement to the lengths identified in the wall plan, paying attention to the reinforcement strength direction.

Next, determine the proper placement of the reinforcement by dividing the total proposed height of the wall by four. This represents the distance that reinforcement should extend beyond the front of the adjoining wall. Measure this distance from the front of the adjoining wall and begin your grid placement here. Make sure the grid is placed within 1 inch of the face of the wall and runs along the back of the adjoining wall.

Example: If your overall wall height is 8 feet, the reinforcement extension would be 2 feet.

Place the next section of reinforcement on the adjoining wall. The reinforcement should not overlap and should lie flush with previously placed sections. Once reinforcement is in place, the next course of blocks can be installed.
Second Course with Reinforcement
The first section of reinforcement on this course is placed using the same formula to determine placement in front of the adjoining wall.

Alternate the reinforcement extension on each course where reinforcement is required.

Place the next section of reinforcement on the adjoining wall. The reinforcement should not overlap and should lie flush with previously placed sections. Once reinforcement is in place, the next course of blocks can be installed.

Corners - Outside 90°
Base Course
To build an outside 90° corner, begin by splitting a unit in half. Place this unit with both split faces out at the corner. Remove the locator lip so that the block lies flat. Then lay the rest of the base course working from the corner block out.

Next Course
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.

Additional Courses
Use split units as necessary to maintain running bond.
**Regal Stone® & Regal Stone Pro® Installation**

**Description:** Wall  |  **Texture:** Split Face  |  **Applications:** Freestanding & Retaining Walls up to 10’/+  

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**Corners - Outside 90° with Reinforcement**

**First Course with Reinforcement**  
Begin by checking the wall plan to determine reinforcement lengths and elevations. Lay a section of reinforcement near the corner of the wall, ensuring that it’s placed within 1 inch of the face of the block and running along the back of the adjacent wall.

**Additional Course with Reinforcement**  
Lay the next course of block, backfill and compact. When installing the next section of reinforcement, place within 1 inch of the face of the block and running along the back of the adjacent wall. Alternate the reinforcement extension on each course where reinforcement is required.

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**Steps in Curved Wall**  
These drawings feature 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 previous course by 2 inches and glue to lower course. Place and compact soil fill prior to installing the next course.
Next Wall Course
Place a standard 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 the 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 Step Courses
Beginning in the center, add the third course of steps, lining up the units with the first course. Overlap 2 inches and glue in place.

Drainage Tip: Drainpipe can be placed behind the lowest step units at grade. An alternative would be to place the drainpipe behind each wall adjacent to the steps.

Water Applications
With correct design and construction, our products can be successfully installed at the edge of water channels, river banks and drainage ditches.

The final design of the wall is affected by various factors, including the movement and velocity of the adjacent water, erosion and scour, the direction of water travel to the wall, the risk of flooding, as well as the soil and ground conditions where the wall is being built.

A qualified engineer should always be consulted to determine the effect of water on the wall and to design a wall that takes all these factors into account.

Consult a qualified engineer before design, construction and installation take place, and follow the engineer’s design.

Base Course
Place a filter fabric with extra length in front of the wall.

Install the leveling pad and the first course of block, including drainpipe and drainage aggregate. Wrap the extended filter fabric up along the face of the base course. Place soil fill in front of the wall and compact. Install another section of filter fabric in front of the wall to protect against erosion. Cover the fabric with a minimum of 3 inches of sand. Install larger stones, such as riprap, to hold it in place.

Next Course
Continue constructing the wall. Drainage is vital. To prevent clogging of the drainage aggregate and
Regal Stone® & Regal Stone Pro® Installation

**Description:** Wall | **Texture:** Split Face | **Applications:** Freestanding & Retaining Walls up to 10’+

drainpipe by fine-grained soils, a geosynthetic filter fabric is installed to separate the drainage aggregate from the reinforced soils.

**Additional Courses**
Continue these steps until the wall is complete. The last section of filter fabric should cover the drainage aggregate and run up against the back of the top course of block. Add fill soil and compact.

Keep in mind there are numerous issues related to water wall applications, including wave or ice impact, erosion or scour in front of the wall and ice uplift of the wall that must be considered in the use of water applications of segmental retaining walls.

For more information, consult with a qualified engineer.

**Fences**
The specific dimensions of the fence and fence post spacing are required to accurately determine the placement of the sleeves.

Provide at least 1 inch clearance between the inside of the sleeve and the outside of the post, and allow for mortar and grout. Install the sleeves according to the wall plan during the construction of the wall.

If the fence is at least 3 feet behind the wall face, generally no additional reinforcement is required.

If the fence is installed within 3 feet from the face of the wall, there may be some load transferred to the wall from wind, snow or pedestrians. Additional reinforcement around the fence sleeves may be needed. Consult a suitably qualified engineer before installation takes place.

Walls should not be completed and sleeves then ‘punched’ through the already installed backfill and reinforcement layers after construction is complete. This may result in damage to the reinforcement grids and lead to subsequent failure of the wall.

Carefully cut the reinforcement cross (weft) straps to allow the reinforcement to fit around the sleeve without distortion or additional tension being introduced to the grid when in its final location.

Grout the fence post into the sleeve after the wall is built.
Capping a Wall

**Straight Wall**
Trapezoidal caps must be laid alternately short and long faces for a straight line. Rectangular caps should have the finished side out. Always start capping from the lowest elevation.

**Outside Curves**
Lay out the cap units side by side and cut at least every other cap to produce a uniform look. Start with the long side of the cap facing out and adjust to the radius.

**Inside Curves**
Lay cap units side by side with the short side facing out. In most circumstances, making two cuts on one cap and then not cutting the cap on either side produces the most pleasing look.

**Corners**
On a 90° corner wall, the corner caps need to be sawcut to achieve a 45° mitered corner.

**Stepping Up Caps**
If a wall elevation changes, caps can be stacked where the wall steps up. Begin laying caps at the lowest elevation change and work your way back toward the previous step up. Split a cap unit to create a rough face on the exposed side. Place the half unit directly on top of the capped portion of the wall with all three split faces exposed. Rectangular caps with one finished side should be saw-cut to fit and a manufactured side exposed.

**Finishing**
After layout is complete and caps are saw-cut or split to size, carefully glue with a concrete adhesive.
Regal Stone® & Regal Stone Pro® Installation

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+/+

Estimating Chart for Geosynthetic Reinforcement No Slopes / No Surcharges
Regal Stone® & Regal Stone Pro® Installation

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+ 

Estimating Chart for Geosynthetic Reinforcement 3:1 Crest Slope
Regal Stone® & Regal Stone Pro® Installation

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+/+

Estimating Chart for Geosynthetic Reinforcement 100 PSF Surcharge
Our CornerStone 100 product is provided in different corner & cap palletizing, as well as different color options, depending upon which NewLine dealer location your product is secured. Please see below, based upon dealer location states:

### PA, NJ, DE, MD, DC, WV Locations

![8” high unit](image1)

![8” corner unit](image2)

![4” rectangular cap](image3)

### VA, NC Locations

![8” high unit](image4)

![8” corner unit](image5)

![3” tapered cap](image6)

### Pallet Information

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<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
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<td>8 x 18 x 12</td>
<td>40</td>
<td>40</td>
<td>3300</td>
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<tr>
<td>8” Corner Unit</td>
<td>8 x 18 x 9</td>
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<td>4” Rectangular Cap</td>
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<td>72</td>
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<td>3400</td>
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### Colors

- Coastal tan
- Fieldstone
- Granite
- Mesquite

Color samples for reference only. Actual product colors may vary.

NewLine Hardscapes is a licensed producer of CornerStone® 100 by CornerStone Wall Solutions.
Cornerstone 100® Installation

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

Installation Gravity Wall

Planning
- Mark the bottom and top of the wall excavation location with spray paint or stakes
- Establish proper elevation bottom and top of wall before excavating
- Organic materials should not be used in structural backfill zone
- Store and protect structural backfill materials from inclement weather during construction

Excavation
- Excavate and prepare sub base leveling pad trench 6” below first course
- Leveling pad trench is approximately 2.5’ to 3’ wide
- Normal wall burial depth or embedment depth is 6” to 12” or one block (for more information refer to design manual)
- Excavate cut line to a 2 to 1 slope or greater
- Back of wall excavation depth into the bank should be 12” beyond the back of the sub base leveling trench

Sub Base Compaction
- Compact sub base to 95% standard proctor density or greater
- Remove any organic or poor soils in the sub base and replace with proper structural fill materials before compacting

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Cornerstone 100®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

Base Stabilization
- (Optional) place 5’ to 6’ wide base stabilization fabric on top of leveling pad trench
- Base stabilization fabrics will help prevent sub base materials from mixing with the gravel base leveling pad during compaction
- Fabric also provides extra structural bearing stability to the base leveling pad

Rough Leveling Pad
- Place well graded gravel (also known as road base aggregates) on top of fabric in the leveling pad trench approximately 6” deep
- Rough grade gravel with a rake close to finish base elevation

Compact Leveling Pad
- Compact the gravel leveling pad to 95% standard proctor density or greater
- Correct moisture content in the gravel will help in reaching proper compaction
**Cornerstone 100®**

**Description:** Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

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**Level Screed Pipes**
- Place first 3’ long screed pipe across the trench at one end of the wall or at the lowest elevation
- Scratch a trench for the pipe in the compacted gravel with a chipping hammer
- Use a 2’ level or laser level to set the screed pipe to the proper level
- Gravel is added underneath and around the screed pipe to support while leveling
- Place the second screed pipe across the trench approximately 9’ from the first screed pipe
- Level the second screed pipe to the same elevation as the first screed pipe by using a 4’ level on top of a screed board, straight edge or with a laser level
- Continue to place and level screed pipes the full length of the trench leveling pad or until reaching a base elevation change

**Extra Gravel**
- Place or remove extra well graded gravel (also known as road base aggregates) level to the top of the screed pipes as needed
- (If more than 1 ½ inches of loose gravel is added, repeat the compaction steps again before screeding)

**Screeding Leveling Pad**
- Screed the gravel leveling pad with a screed board or straight edge across the trench on top of two screed pipes
Cornerstone 100®

Description: Wall  |  Texture: Split Face  |  Applications: Freestanding & Retaining Walls up to 10’+

- The coarser the gravel the more back and forth the screeding action when drawing the screed across the leveling pad
- Too much pressure on the screed straight edge may dislodge the level of the screed pipes while screeding
- A second screed pass may be needed to insure an accurate level has been achieved
- Continue to screed the leveling pad until completing the full length of the trench or up to the first elevation change

Remove Securelugs
- Cornerstone® base units will have the securelugs removed before placing on the leveling pad
- Place each unit on top of the leveling pad in such a way as not to disturb the level gravel

Lay First Course
- Remove the screed pipes from the leveling pad
- Place a steel stake or a cornerstone® unit at either end of the leveling pad to establish the back of the first course of units
- Secure tightly a string line to the stakes or cornerstone® units at either end which will provide the guide to line up the back of each cornerstone® base unit
- The distance of the string line between the steel stakes or cornerstone® units may vary due to heavy winds

Level Units
- Units are laid snug together and parallel to the straight or curved line
- A rubber mallet should be used if unit height and alignment adjustment is needed
- Use a short 2’ level to make sure the units are level front to back
- Use a 4’ level to make sure the units are level unit to unit along the length of the wall
- Correct batter and straight horizontal lines in the completed cornerstone® wall depend on the accuracy of the base leveling pad and units
**Cornerstone 100®**

**Description:** Wall  |  **Texture:** Split Face  |  **Applications:** Freestanding & Retaining Walls up to 10’+

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**Impermeable Fill**
- Backfill behind, in front (toe of wall) and in the hollow cores of the units with impermeable materials up to the desired level of the perforated drain pipe or to the top of the first course.
- Compact the impermeable materials behind, in front and in the hollow cores of the units.
- Sweep the top of the units clean of all rock and dirt before placing the next course of units.
- Sweeping should create a 1/2“ void in the core to accommodate the securelug’s interlock

**Drain Pipe Outlet**
- Perforated drain pipe should have adequate slope to drain water in the right direction towards each drain pipe outlet.
- Drain pipe outlet can be every 30 or 50 feet.
- Perforated drain pipe can be a sock wrapped system to help prevent fines from migrating into the pipe.

**Backfill**
- Place and compact backfill materials in maximum lifts of 8”.
- Lifts may be less than 8” depending on the type of soil or size of equipment.
- Backfill materials will be placed 6” to 12” behind the units allowing for clear crush drain gravel (angular aggregates free of fines) between the cornerstone® units and compacted backfill materials by adding clear crush drain gravel (angular aggregate free of fines) after compaction of the backfills materials, this will prevent undue pressure against the wall which can cause the units to move out of alignment.
**Cornerstone 100®**

**Description:** Wall  |  **Texture:** Split Face  |  **Applications:** Freestanding & Retaining Walls up to 10’+

- Each lift should be compacted to 95% standard proctor or greater
- The correct moisture content in the backfill materials will help in reaching proper compaction density

**Drainage Gravel**
- Clear crush drain gravel (angular aggregates free of fines) is placed in the hollow cores and 6” to 12” behind the wall units after compaction of the backfill materials. This will prevent undue pressure against the wall which can cause the units to move out of alignment
- Clear crush drain gravel does not need to be compacted
- Sweep the top of the cornerstone® units clean of all rock and dirt before placing the next courses
- Make sure the clear crush drain gravel directly behind the wall units is placed flush to the top of the units
- Make sure the backfill materials are as well compacted and level as possible

**Continue Installation**
- Continue to install each course of units following the same steps as above
- Install and compact backfill materials in 8” lifts until wall is complete
- Grout around drain pipe outlet to prevent clear crush drain gravel or drainage aggregates (angular aggregates free of fines) from migrating
**Cornerstone 100®**

Description: **Wall**  |  Texture: **Split Face**  |  Applications: **Freestanding & Retaining Walls up to 10’+**

**Capping**
- Complete the top of the wall with cornerstone® cap units
- Properly secure the cap units using a concrete adhesive
- Make sure all units are free of dirt and stones before installing the caps
- Place a solid bead of concrete adhesive around the top of each cornerstone® unit
- Place a bead of adhesive between each joint of the cap units

**Soil Separation Fabric**
- Place a 6 ft wide soil separating filter fabric on top of the backfill and drainage gravel and against the back of the last units before placing the planting soils
- The fabric will prevent planting soil fines from staining the face of the wall and migrating into the clear crush drain gravel (angular aggregate free of fines)

**Final Grading**
- Insure that final grading is done on top and bottom of the wall
- Make sure to protect newly placed planting soil from erosion during heavy rains or surface runoff
Installation Geogrid Wall

Planning

- Excavate and prepare sub base leveling trench 6” below first course
- Leveling pad trench is approximately 2.5’ to 3’ wide
- Normal wall burial depth or embedment depth is 6” to 12” or one block (for more information refer to design manual)
- Excavate cut line to a 2 to 1 slope or greater
- Back of wall excavation depth into the bank at the base of the wall should be from the face of wall to the designed length of geogrid

Cut Geogrid

- Cut geogrid reinforcement to the length specified in the design
- Geogrids are manufactured in two directions uni-axial or bi-axial. Uni-axial grid has one direction of strength and that direction has to be oriented perpendicularly to the face of the wall during installation. Bi-axial grid can be laid in two directions, perpendicular and lengthwise to the face of wall (ensure that the lengthwise direction is still in accordance to the length specified by the engineer’s design)
- Correct geogrid orientation, strength and length is crucial to the success of the wall project
- Each geogrid length should be laid parallel and adjacent to each other but never overlapping

Lay Geogrid

- Place the geogrid as far forward on the cornerstone® units as possible without revealing it on the face
- Place the next course of cornerstone® units on top of the lower
units and geogrid at a half bond

- The two securelugs will fit securely into the hollow cores of the two units below and lock the geogrid into the gravel core
- Pull the unit forward to engage and align the securelugs
- Complete the installation of units on the geogrid reinforced courses
- Make sure each unit is installed against the next unit leaving no gaps between unit joints
- Tension the geogrid in such a way as not to disturb the alignment of the upper units
- Use stakes or backfill materials to maintain the tension during backfilling
- Do not drive equipment directly on top of geogrid

**Reinforced Backfill**

- Backfill and compact the reinforced zone by placing materials from the back of the wall towards the end of the geogrid
- Install drainage gravel in the cores and 6” to 12” behind the units after placing and compacting backfill materials
- Install and compact backfill materials in 8” lifts until wall is complete
Cornerstone 100®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

Base Elevation Changes
- The top of the installed base unit will be used to establish the step up gravel leveling pad elevation
- Make sure to backfill and compact the gravel in and around the last unit of the first course
- Finished grade of the leveling pad should be an 1/8” to 1/4” above top of first course units to allow for a small amount of settlement
- Repeat the above scrreeing steps on the second elevation gravel leveling pad
- Place the first unit on the second course at a half bond on top of last & second last of the first course units.
- The two securelugs will fit into the hollow cores of the two units below. To align the wall, place a string line at the back of the units for a straight wall or place a pvc pipe for a curved wall
- Pull upper unit forward to engage and align units
- The batter or set back will be 5/8”/unit (4.5 Degree or 1”/vertical foot)
- Place the second unit half on the last unit and half on the second gravel leveling pad. Ensure that the securelug is removed on the leveling pad side of the unit
Cornerstone 100®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

Convex Curves

Convex First Course
- If possible, start building a curve from the center and work left and right through the curve
- Use PVC flex pipes to create smooth and accurate convex curves
- Use the back of the unit for alignment
- Remove one or both cornerstone® wings when building a convex curve
- Build each course of units by starting at the same place and the same bond as the last course
- Convex curves have a slight increase in batter or setback to the standard 5/8"
- The taller the wall the larger the convex first course needs to be. The radius of each additional course will be slightly smaller than the lower course
- Cornerstone® minimum concave curve is approximately 3.6 Foot radius

Convex Geogrid Curve
- Each geogrid length should be laid perpendicularly to the wall face
- Geogrid should not overlap on the CornerStone® units
- Correct geogrid orientation, strength and length is crucial to the success of the wall project
**Cornerstone 100®**

Description: **Wall**  |  Texture: **Split Face**  |  Applications: **Freestanding & Retaining Walls up to 10’+**

**Concave Curves**

**Concave First Course**
- If possible, start building a curve from the center and work left and right through the curve
- Use PVC Flex Pipes to create smooth and accurate concave curves
- Use the back of the unit for alignment
- Build each course of units by starting at the same place and the same bond as the last course
- Concave curves have a slight decrease in batter or setback to the standard 5/8”
- The taller the wall the smaller the concave first course needs to be. The radius of each additional course will be slightly larger than the lower course
- CornerStone® minimum concave curve is approximately 3.6 foot radius

**Concave Geogrid Curve**
- Each geogrid length should be laid perpendicularly to the wall face
- Geogrid should not overlap on the CornerStone® units
- To ensure 100% coverage, place a second layer of geogrid centered to the unreinforced triangle zone one course above the main geogrid layer
- Correct geogrid orientation, strength and length is crucial to the success of the wall project
Cornerstone 100®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

Outside Corners

Outside First Course
- Use a 90° corner unit to build an outside corner
- Place the first 90° corner unit on the base leveling pad to start the outside corner
- Place a CornerStone® unit on either side against the 90° corner unit
- Continue to lay the CornerStone® base course on either side of the corner until first course is completed
- Flip and turn the second course 90° corner overlapping the short side and half of the CornerStone® base unit. This unit should be pushed back 5/8” to achieve proper setback
- Continue to lay the CornerStone® second course on either side of the corner until second course is completed
- The 90° Corners can be glued or concrete core filled to ensure a proper course to course outside corner interlock

Outside Geogrid Corner
- Each geogrid length should be laid perpendicularly to the wall face
- Geogrid should not overlap on the CornerStone® units
- Lay the 1st geogrid corner section perpendicularly to one side of the corner
- Lay the 2nd geogrid section perpendicularly to the other side of the corner but not overlapping the 1st geogrid section
- Lay the secondary geogrid layer one course above and perpendicular to the lower main geogrid layer directional strength
- Correct geogrid orientation, strength and length is crucial to the success of the wall project

NewLine Hardscapes is a licensed producer of CornerStone® 100 by CornerStone Wall Solutions.
Inside Corners

Inside First Course

• Place the second unit at right angle and centered to the first CornerStone® base unit. Continue to install the CornerStone® base units right and left of the first inside corner units.

• Place the second unit at right angle and centered to the 1st unit on the second course.

• Make sure second course units are placed at a 5/8” setback to the lower inside corner.

• Continue to install the units left and right of the inside corner to complete the second course of the wall.

• Repeat the above step by step installation until the wall height is completed or until reaching the first geogrid layer.

Inside Geogrid Corner

• Each geogrid length should be laid perpendicularly to the wall face.

• Geogrid should not overlap on the CornerStone® units.

• Lay the 1st geogrid corner section perpendicularly to one side of the corner and overlap h/4 through the backfill (Height of Wall ÷ 4).

• Lay the 2nd geogrid section perpendicularly to the 1st geogrid.

• Lay the second geogrid layer perpendicularly and overlap h/4 through the backfill opposite to the first geogrid layer.

• The h/4 overlap will alternate layer to layer to properly secure the inside corner.

• Correct geogrid orientation, strength and length is crucial to the success of the wall project.
Cornerstone 100®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

Steps

Base Leveling Pad

- When building steps, exercise the same care used in typical wall construction
- Prepare the sub-base and base leveling pad by following "Gravity CornerStone® Installation" steps 1 to 9
- Build each step in sequence with each course of the regular wall units for best results of wall to step interlock

Lay First Course

- CornerStone® first base units will have the SecureLugs removed before placing on the leveling pad
- First course of step units will be totally buried
- Backfill behind the first course units with gravel, then compact and level flush to the top of the first course
- Do not fill the step units’ hollow cores with gravel if you plan to use concrete

Lay Second Course

- Place the second course of units on top of the base units
- Place a second row of units back to back behind the second course of units on half bond
- Backfill behind the second course of units with gravel, then compact and level flush to the top of the second course

NewLine Hardscapes is a licensed producer of CornerStone® 100 by CornerStone Wall Solutions.
Cornerstone 100®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

- Do not fill the step units’ hollow cores with gravel if you plan to use concrete

Lay Third Course
- Place the third course of units on the lower backward facing units with the SecureLugs placed into the 2 hollow cores of the lower units on half bond
- Pull the units forward to lock the SecureLugs into the lower backward units
- The third course units will be in a forward batter approximately 1.5 inch leaving 10.5 inches exposed on the front first step
- Place a second row of units back to back behind the third course of units on half bond

Continue Installation
- Continue to install each course of step units following the same steps as above
- The top and final step does not need backward units

Concrete Core Steps
- Concrete filling the cores of all the step units will provide for greater stair stability
- Concrete core fill flush to the top of the units
- Use a steel bar to hand vibrate the cores to insure proper filling
- Option: Unit cores can be filled with gravel but must be well compacted

Stair Treads
- CornerStone® 12 inch deep cap units can be used as a stair tread
- Option: pavers, patio slabs or natural stone can also be used as a stair tread

8” Riser Cross Section
- The 12 inch cap will overhang the step units by approximately 1.5 inch on each step
- The riser will be a full 8 inches using the above installation
- Properly secure the cap units using a concrete adhesive
- Make sure all units are free of dirt and stones before installing
- Place a bead of adhesive between each joint of the caps

Lower Step Risers
- Lower risers can be made such as 6” or 7” by lowering the buried units 1 to 2 inches below the top of the
Cornerstone 100®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

backward buried unit

- Larger treads can be created by moving the buried units back off the forward step course 3 to 4 inches to create a 15 to 16 inch tread
- A variety of riser heights and tread lengths can be created to suit your project

Installation 27” Pillar

Leveling Pad

- Excavate and prepare your sub base leveling pad
- Install leveling pad of well graded gravel (also known as road base aggregates) a minimum of 8” (200 mm) thick and 40” (1000 mm) square. Compact to 95% standard proctor density
- Install the first 4 corner units perpendicular and square to each other
- Ensure first base course is level and square to the center of the pad
- Bury the first course completely for stability

Second Course

- Place second course of the CornerStone® 90° corner units directly on top of the first course
- Flip and turn the second course corner units upside down to create an overlapping bond
- Clear crush drain gravel (angular aggregates free of fines) should be placed in the cores and middle of pillar
- (concrete core filling optional) use a dry concrete mix to prevent leaching of cement
- Concrete adhesive should be applied to all units to ensure course to course interlock

Additional Courses

- Repeat step 1 and step 2 until desired height of pillar has been reached
Cornerstone 100®

Description: Wall | Texture: Split Face | Applications: Freestanding & Retaining Walls up to 10’+

Completion
- Complete the pillar with a pillar cap
- Secure the pillar cap with a concrete adhesive *Pillar cap approximately 32” (508mm)
Compac®

Description: **Wall**  |  Texture: **Split Face**  |  Applications: **Freestanding & Retaining Walls up to 10’+**

8” high unit
8” corner unit
4” rectangle cap

Compac® products use straight pins to ensure proper wall alignment. Pins sold separately.

For Compac installation instructions, please see installation instructions for CornerStone 100 on page 175.

### Pallet Information

<table>
<thead>
<tr>
<th>Unit</th>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
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<td>8 x 18 x 12</td>
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<td>45</td>
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<tr>
<td>8” Corner Unit</td>
<td>8 x 18 x 9</td>
<td>30</td>
<td>30</td>
<td>3200</td>
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<td>4” Rectangle Cap</td>
<td>4 x 18 x 12</td>
<td>72</td>
<td>48</td>
<td>3400</td>
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### Colors

- coastal tan
- fieldstone
- granite
- mesquite

Color samples for reference only. Actual product colors may vary.
When it comes to details, NewLine leaves no stone unturned. We offer a variety of hardscape accessories such as steps, fire pits, wall caps, and column caps to add style and elegance to your new patio or walkway, so that you can appreciate even the tiniest details of living outside.
## Section Contents

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<td>Yorkshire Square Fire Pit</td>
<td>210-211</td>
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<td>215</td>
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</tbody>
</table>
Landmark Porcelain Tiles

Description: Porcelain Tile | Texture: Slate | Applications: Patios, Walkways, Pool Decks

Bluestone & Flagstone (3-Piece System)

AVAILABLE SIZES (each sold separately)

24” x 24”
Large

12” x 24”
Medium

12” x 12”
Small

Pallet Information

<table>
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<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
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<td>150</td>
<td>1370</td>
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<td>12 x 24 Medium</td>
<td>124</td>
<td>64</td>
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<tr>
<td>24 x 24 Large</td>
<td>233</td>
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</table>

Landmark porcelain tiles are 3/4” thick.
NOTE: ALL SIZES ARE NOMINAL.

Colors

BLUESTONE LOOK

FLAGSTONE LOOK

full color

pink-tan
Landmark Porcelain Tiles

Description: Porcelain Tile  |  Texture: Slate  |  Applications: Patios, Walkways, Pool Decks

24" x 24" Slab

Pallet Information

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>sf/pallet</th>
<th>total pcs</th>
<th>wt./pallet</th>
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<tbody>
<tr>
<td>24 x 24</td>
<td>233</td>
<td>60</td>
<td>2196</td>
</tr>
</tbody>
</table>

Landmark porcelain tiles are 3/4" thick.
NOTE: ALL SIZES ARE NOMINAL.

Colors

CONCRETE LOOK  LIMESTONE LOOK  SLATE LOOK

simply grey  

limestone  

vintage slab  

multi-color dark
Landmark Porcelain Tiles

Description: Porcelain Tile | Texture: Slate | Applications: Patios, Walkways, Pool Decks

12" x 48" Plank

Pallet Information

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<th>Dimensions (in)</th>
<th>sf/pallet</th>
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<th>wt./pallet</th>
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<tbody>
<tr>
<td>12 x 48</td>
<td>124</td>
<td>32</td>
<td>1171</td>
</tr>
</tbody>
</table>

Landmark porcelain tiles are 3/4" thick.
NOTE: ALL SIZES ARE NOMINAL.

Colors

WOOD LOOK

soul walnut
soul grey
Our Landmark porcelain tile product line is so simple, elegant and functional, that the challenge of installation is not “How can I install porcelain tile?” but rather, “Where else do I want to install porcelain”. Porcelain tiles may be installed using a traditional mortared bed, the more modern over sand and limestone, to the eco-friendly permeable method, or even the budget-conscious elevated deck or pedestal application.

01 USING GATOR BASE/GATOR TILE SYSTEM
A way of laying tiles that allows you to support the tiles directly on Gator Base and using Gator Spacers to provide uniform spacing and unparalleled stability.

02 OVER REINFORCED CONCRETE*
A way of laying tiles that allows you to create perfectly stable surfaces of incredible resistance.

* When installed over reinforced concrete (4” minimum) using a thinset/thickset mortar suitable for porcelain tiles.

03 OVER DECKING.
Traditional deck made with wood and porcelain tiles.

03 RAISED FLOORS.
Tiles matched with a support structure for raised high-performing floors that also leaves sufficient room for under-floor inspection.
**Landmark Porcelain Tiles - Installation**

01 **USING GATOR TILE (RECOMMENDED)**

**Installation Step 1 • Excavation of the new Gator Tile area**
(A) Excavate the new Gator Tile area. The depth required is calculated by adding Porcelain Tile height, Gator Base, Gator Spacer, bedding sand, plus any soft organic material that has to be removed. Excavate the perimeter an extra 6” (15 cm) wider on all sides than the tile area required.

**Installation Step 2 • Levelling and compacting of the base**
(A) Ensure a slope of at least 1 degree away from any structure, such as a house.  
(B) The native soil needs to be compacted using a plate compactor or hand tamper.

**Installation Step 3 • Addition of geo-fabric GF4.4, levelling and compacted bedding sand**
(A) Lay down a non-woven Gator Fabric GF 4.4 geotextile (minimum 100 LBF) and cover the entire excavated area.  
(B) Spread an even layer of sand to a depth of maximum 3/4 inch (19 mm). The levelling and compacting of the bedding sand will be the last step prior to installing the Gator Base.  
(C) Water the sand prior to using a hand compactor and/or plate compactor, compact the 3/4 inch (19 mm) of bedding sand until you obtain a final height of 1/2 inch (13 mm) of compacted bedding sand, that should reflect the final tiled surface.

**Installation Step 4 • Installation of the Gator Base**
(A) Make sure to install the Gator Base on the extended excavation area (total excavation should be 6 inches [15 cm] wider on each side than the final tiled area).  
(B) Start laying the Gator Base units ensuring Gator Base interlocks with the tongue & groove system.

**Installation Step 5 • Installation of Porcelain tile and Gator Spacer**
Gator Spacers should receive a generous amount of Alliance polyurethane glue on each quadrant. Install the Porcelain Tile on the Gator Spacer, apply pressure or tap the tiles with a rubber mallet at all corners. This will ensure that the tiles are adhering to the Gator Spacer. The Gator Spacer will be left in the tile installation permanently, ensuring proper alignment and stability of your project for years to come.

**Installation Step 6 • Installation of Gator Tile Edge and Gator Screws**
Install Gator Tile Edge on the Gator Base using Gator Base Screws, make sure that Gator Tile Edge rests firmly against the tiles. Use Gator Base Screws at every second hole.
Installation Step 7 • Sweeping, compacting and blowing of the Gator tile Sand (When using the gator tile sand, porcelain tiles must be installed on a gator base foundation, using the gator tile systems.)

(A) When emptying the bag of GATOR TILE SAND, spread it onto the dry, tiled surface. When sweeping the GATOR TILE SAND, spread it over a small area before moving onto the next, while making sure to fill in the joints.

(B) It is now time to compact the sand into the joints using a roller compactor or rubber mallet. Do not use a plate compactor. Repeat filling and compacting of the tile joints. Finally, sweep the surface with a fine bristle broom and remove all excess sand. Ensure the sand is 1/8 inch (3 mm) lower than the tile chamfers.

(C) Finally, use a blower to blow off all sand residue laying on the tile surface.

Installation Step 8 • Gator Tile Sand water activation steps

(A) Shower water on a specific area of 100 sf, wait no longer than 2 to 3 minutes.

(B) Shower and rinse simultaneously on a section of approximately 100 sf, to eliminate any GATOR TILE SAND residue left on the tiles. Wait no longer than 2 to 3 minutes.

(C) Shower and rinse simultaneously, to eliminate any GATOR TILE SAND residue. Any residue should go directly into the tiled joints. However, stop showering when you see water retention on the tiled joints. Wait no longer than 2 to 3 minutes. Note: Repeat the directions of STEPS 8a to 8c for all other areas that have not been showered with water.

(D) Use a leaf blower to remove any excess water remaining on the tiled crevices. This blowing action is necessary to help remove any remaining GATOR TILE SAND residue left on tiled surfaces from the previous steps.

WATER ACTIVATION (IMPORTANT NOTES)

- Work in manageable sections, ideally about 100 sq. ft. at a time, depending on temperature.
- Do not allow GATOR TILE SAND to wash out of joint.
- Never allow tiled surface to dry out during the water activation phase.
- Watering must be started at the lowest point of the tiled surface.
- Use a watering gun connected to a hose. Setting should be set to shower.
- IMPORTANT: The water used in steps 8a to 8c will activate a bonding action as well as condensing GATOR TILE SAND in the joints. It is important to water the GATOR TILE SAND a total of 3 times, as per steps 8a, 8b and 8c. To little water will not properly activate the GATOR TILE SAND and will reduce the final performance.
**Landmark Porcelain Tiles - Installation**

02 **OVER REINFORCED CONCRETE.**

Porcelain tiles can be installed using thinset/thickset mortar appropriate for use with porcelain tiles. In a short 24 hours your floor will be ready for foot traffic. This method offers the most stable and most durable floor covering that is able to withstand foot traffic up to light vehicular traffic.

**RECOMMENDED INSTALLATION:**
Install tiles over 4" minimum thick reinforced concrete, using a thinset/thickset mortar suitable for porcelain tiles. After placing tiles on mortar, allow at least 24 hours for mortar to set, before allowing foot traffic on tiles.

03 **OVER DECKING.**

Porcelain tiles combined with a grate system allows porcelain tiles to be utilized in conjunction with an existing or new construction wood deck, as long as the deck structure is constructed soundly and according to local codes. The honeycomb plastic grate is installed as the substrate for the porcelain tile.

Insure the plastic 3/16" (4 mm) spacers are installed at all corners of the installed pavers, in order to prevent tiles from touching each other (and potentially chipping) and to allow better water drainage.

04 **RAISED FLOORS.**

Porcelain tiles in 20mm thickness lend themselves perfectly to floors with a suspended installation. The adjustable stand (purchased separately) means being able to create an air space under the floor in which to lay electrical conduit or plumbing. The raised flooring system is easy to manage, allows you to configure the underlying wiring or plumbing systems based on specific needs and also to change its configuration any time a new look is needed.

**RECOMMENDED INSTALLATION:**
Porcelain tiles are installed onto pedestal supports with a distance of a 1/4" between adjacent tiles once the underlying footing has been duly layered with water-proofing materials. In this way, there is a technical gap below the foot-plan that can be easily inspected by lifting the tiles.
Fire Pits

ASHLAND (round)
STONELDGE (round)
SUFFOLK (round)
YORKSHIRE (square)
YORKSHIRE (rectangle)
Ashland™ Fire Pit

Description: Fire Pit | Texture: Smooth Tumbled | Applications: Fire Pits

Ashland™ Round Pit

Optional steel insert (works with or without coping)

Optional 4-piece radius coping.

Pallet Information

<table>
<thead>
<tr>
<th>Unit</th>
<th>Dimensions (in)</th>
<th>total pcs</th>
<th>wt./pallet</th>
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<tbody>
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<td>1685</td>
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<td>outside diameter: 50 inside diameter: 29½</td>
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</table>

Colors

- coastal tan
- fieldstone
- granite
- mesquite

Coping Colors

- charcoal
- mocha
- sand

Color samples for reference only. Actual product colors may vary.
**Foundation**
Place and compact a level base with gravel extended beyond the Ashland Fire Pit by at least 4 inches. The surface of the leveling pad should extend below grade by 2 inches. If you are using a concrete paver base, place the Ashland Fire Pit directly onto the base. Fill the bottom with 2-4 inches of sand for drainage.

**The First Layer of Block**
Lay out the Ashland Fire Pit with a 32.5” diameter from the inside wall. Use 17 blocks per layer. Adjustments to the circle of blocks may be necessary to ensure alignment as the blocks should fit tightly together. Ensure the first layer is level.

**Additional Layers**
Glue the second layer of blocks above the first layer using a concrete-approved adhesive. Each layer should offset so that each stone is centered with the center of the two stones beneath.

---

**Important Note:**
Burning large items or trash in fire pits may cause damage to block units. Our fire features are designed strictly for small campfires. NewLine recommends a steel insert to protect block and coping units. NewLine will not be held liable for any damage to the fire pit or coping if an insert is not used.
**StoneLedge™ Fire Pit**

Description: **Fire Pit**  |  Texture: **Split Tumbled**  |  Applications: **Fire Pits**

![StoneLedge™ Round Pit](image)

*StoneLedge™ Round Pit (shown with coping)*

![Optional steel insert](image)

*Optional steel insert (works with or without coping)*

![Optional 4-piece radius coping](image)

*Optional 4-piece radius coping*

**Pallet Information**

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<th>Unit</th>
<th>Dimensions (in)</th>
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<td>1740</td>
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<tr>
<td>StoneLedge™ 4-piece Coping</td>
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<tr>
<td>Round Steel Insert</td>
<td>diameter: 28</td>
<td>n/a</td>
<td>35</td>
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</tbody>
</table>

**Colors**

- coastal tan
- fieldstone
- granite
- mesquite

**Coping Colors**

- charcoal
- mocha
- sand

Color samples for reference only. Actual product colors may vary.


**StoneLedge™ Fire Pit**

*Description: Fire Pit | Texture: Split Tumbled | Applications: Fire Pits*

**Foundation**
Place and compact a level base with gravel extended beyond the StoneLedge Fire Pit by at least 4 inches. The surface of the leveling pad should extend below grade by 2 inches. If you are using a concrete paver base, place the Ashland Fire Pit directly onto the base. Fill the bottom with 2-4 inches of sand for drainage.

**The First Layer of Block**
Lay out the StoneLedge Fire Pit with a 30° diameter from the inside wall. Use 20 blocks per layer (13 medium, 7 small). Start each layer by setting one medium unit. Then place one small unit followed by two medium units in a repeating pattern. Adjustments to the circle of blocks may be necessary to ensure alignment as the blocks should fit tightly together. Ensure the first layer is level.

**Additional Layers**
Glue the second layer of blocks above the first layer using a concrete-approved adhesive. Each layer should offset to avoid joints lining up on the block above or below.

---

**Important Note:**
Burning large items or trash in fire pits may cause damage to block units. Our fire features are designed strictly for small campfires. NewLine recommends a steel insert to protect block and coping units. NewLine will not be held liable for any damage to the fire pit or coping if an insert is not used.

---

Stagger the stones so that each stone is centered with the center of the two stones beneath.
Suffolk™ Fire Pit

Description: Fire Pit | Texture: Split Tumbled | Applications: Fire Pits

Suffolk™ Round Pit

Optional 2-piece steel ring (works with or without coping)

Optional 4-piece radius coping.

Pallet Information

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Colors

- coastal tan
- fieldstone
- granite
- mesquite

Coping Colors

- charcoal
- mocha
- sand

Color samples for reference only. Actual product colors may vary.
Suffolk™ Fire Pit

Description: Fire Pit | Texture: Split Tumbled | Applications: Fire Pits

Foundation
Place and compact a level base with gravel extended beyond the Suffolk Fire Pit by at least 4 inches. The surface of the leveling pad should extend below grade by 2 inches. If you are using a concrete paver base, place the Suffolk Fire Pit directly onto the base. Fill the bottom with 2-4 inches of sand for drainage.

The First Layer of Block
Lay out the Suffolk Fire Pit with a 50” diameter from the inside wall. Use 17 blocks per layer. Adjustments to the circle of blocks may be necessary to ensure alignment as the blocks should fit tightly together. Ensure the first layer is level.

Additional Layers
Glue the second layer of blocks above the first layer using a concrete-approved adhesive. Each layer should offset so that each stone is centered with the center of the two stones beneath.

Important Note:
Burning large items or trash in fire pits may cause damage to block units. Our fire features are designed strictly for small campfires. NewLine recommends a steel insert to protect block and coping units. NewLine will not be held liable for any damage to the fire pit or coping if an insert is not used.
Yorkshire™ Square Fire Pit

Description: Fire Pit  |  Texture: Smooth Tumbled  |  Applications: Fire Pits

Yorkshire™ Square Pit
(Available in PA, DE, NJ, MD, DC)

Optional basic steel insert for Yorkshire Square Pit

Pallet Information

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<tr>
<th>Unit</th>
<th>Dimensions (in)</th>
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</thead>
</table>
| Yorkshire™ Square Pit | outside: 44 x 44 x 16
inside: 28¾ x 28¾ x 16 | 50         | 1142       |
| Square Steel Insert   | 27¾ x 27¾ x 9¾   | n/a       | 75         |

Colors

coastal tan  | fieldstone  | granite  | mesquite

Coping Colors

charcoal  | mocha  | sand

Color samples for reference only. Actual product colors may vary.
Yorkshire™ Square Fire Pit

Description: Fire Pit | Texture: Smooth Tumbled | Applications: Fire Pits

Foundation
Place and compact a level base with gravel extended beyond the Yorkshire Fire Pit by at least 4 inches. The surface of the leveling pad should extend below grade by 2 inches. If you are using a concrete paver base, place the Yorkshire Fire Pit directly onto the base. Fill the bottom with 2-4 inches of sand for drainage.

The First Layer of Block
Lay out the Yorkshire Fire Pit in a square design with 28” x 28” from the inside wall. Use 12 blocks per layer. Adjustments to the blocks may be necessary to ensure alignment as the blocks should fit tightly together. Ensure the first layer is level.

Additional Layers
Glue the second layer of blocks in a reversed pattern above the first layer using a concrete-approved adhesive. The third layer should be reversed again to offset the joints as seen in the illustration. Finally, reverse the last course of block and glue in place.

Layer 1 (44” Wide)
Layer 2 (44” Wide)
Layer 3 (44” Wide)
Layer 4 (44” Wide)

Stagger the stones so that each stone is centered with the center of the two stones beneath.

Important Note:
Burning large items or trash in fire pits may cause damage to block units. Our fire features are designed strictly for small campfires. NewLine recommends a steel insert to protect block and coping units. NewLine will not be held liable for any damage to the fire pit or coping if an insert is not used.
Yorkshire™ Rectangle Fire Pit

Description: Fire Pit | Texture: Smooth | Applications: Fire Pits

Yorkshire™ Rectangle Pit

Optional steel insert with cooking grate for Yorkshire Rectangle Pit

Pallet Information

<table>
<thead>
<tr>
<th>Unit</th>
<th>Dimensions (in)</th>
<th>total pcs</th>
<th>wt./pallet</th>
</tr>
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<tr>
<td>Yorkshire™ Rectangle Pit</td>
<td>outside: 56 x 44 x 16 inside: 24 x 36 x 16</td>
<td>65</td>
<td>1885</td>
</tr>
<tr>
<td>Rectangle Steel Insert w/ Cooking Grate</td>
<td>35½ x 23½ x 9</td>
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</tr>
</tbody>
</table>

Colors

- coastal tan
- fieldstone
- granite
- mesquite

Coping Colors

- charcoal
- mocha
- sand

Color samples for reference only. Actual product colors may vary.
Yorkshire™ Rectangle Fire Pit

Description: Fire Pit | Texture: Smooth | Applications: Fire Pits

**Foundation**
Place and compact a level base with gravel extended beyond the Yorkshire Fire Pit by at least 4 inches. The surface of the leveling pad should extend below grade by 2 inches. If you are using a concrete paver base, place the Yorkshire Fire Pit directly onto the base. Fill the bottom with 2-4 inches of sand for drainage.

**The First Layer of Block**
Lay out the Yorkshire Fire Pit in a rectangle design with 28” x 40” from the inside wall. Use 14 blocks per layer. Adjustments to the blocks may be necessary to ensure alignment as the blocks should fit tightly together. Ensure the first layer is level.

**Additional Layers**
Glue the second layer of blocks in a reversed pattern above the first layer using a concrete-approved adhesive. The third layer should be reversed again to offset the joints as seen in the illustration. For the final layer, place the block perpendicular to the previous layer to create a finished cap. Then glue again, keeping the glue in the center of the units.

Stagger the stones so that each stone is centered with the center of the two stones beneath.

Important Note:
- Burning large items or trash in fire pits may cause damage to block units. Our fire features are designed strictly for small campfires.
- NewLine recommends a steel insert to protect block and coping units. NewLine will not be held liable for any damage to the fire pit or coping if an insert is not used.
Caps, Steps & Treads

Description: Caps/Steps/Tread | Texture: Chiseled Edge | Applications: Capping Walls, Steps

Flat Column Cap

Light-top Column Cap

Rock Face Wall Cap

Rock Face End Cap

Rock Face Landscape Step

Rock Face Step Tread

Pallet Information

<table>
<thead>
<tr>
<th>Column Caps</th>
<th>Dimensions (in)</th>
<th>total pcs</th>
<th>wt./ pc.</th>
<th>wt./pallet</th>
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<td>210</td>
<td>1260</td>
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<th>wt./ pc.</th>
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<tr>
<td>Rock Face Wall Cap</td>
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<td>1920</td>
</tr>
<tr>
<td>Rock Face End Cap</td>
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<th>wt./ pc.</th>
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<tr>
<td>Rock Face Step Tread</td>
<td>51 x 12 x 2¼</td>
<td>16</td>
<td>120</td>
<td>1920</td>
</tr>
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</table>

Colors

charcoal  mocha  sand

Color samples for reference only. Actual product colors may vary.
**Napa® Curbstone & Edgestone Edging**

**Napa® Curbstone**

![Curbstone Image]

**Description:** Edging  | **Texture:** Split Tumbled/Chiseled  | **Applications:** Edging

**Pallet Information**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>Lf/pallet</th>
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<th>wt./pallet</th>
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<td>2784</td>
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**Colors**

coastal tan  
fieldstone  
granite  
mesquite

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**Edgestone**

![Edgestone Image]

**Pallet Information**

<table>
<thead>
<tr>
<th>Dimensions (in)</th>
<th>Lf/pallet</th>
<th>total pieces</th>
<th>wt./pallet</th>
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<tbody>
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</tr>
</tbody>
</table>

**Colors**

coastal tan  
fieldstone  
granite  
mesquite

Color samples for reference only. Actual product colors may vary.
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Efflorescence is a fact of life with most concrete. We are hearing more about efflorescence related issues because of the popularity of stained floors. As the trend to have exposed concrete floors grows, the industry is struggling with the problem of unsightly efflorescence, especially when it is trapped under a film forming sealer. This is not to say that exterior decorative concrete is immune from efflorescence issues, but problems with interior floors pose a greater challenge and are the focus of this discussion.

This article is meant to be a common sense overview of the major efflorescence issues. We will suggest realistic preventative measures to control the conditions that encourage efflorescence and we will offer remedial suggestions. We will offer useful explanations of this complex phenomenon in practical terms without a lengthy detailed chemical analysis.

Decorative contractors usually get the first phone call when efflorescence shows up on a stained floor. Many things may have contributed to a particular efflorescence plagued project, the least of which may be the work performed by the stain contractor who in most cases is unaware of the preexisting conditions that caused the efflorescence. Stain contractors, concrete finishers, builders, general contractors, the design community and owners are all affected by issues related to efflorescence. We hope this discussion clarifies some of the issues so that efflorescence is better understood and the appropriate measures are taken to prevent its occurrence. The costs associated with efflorescence prevention are minimal when compared to the cost and inconvenience of the remedies, especially when the space is occupied. Efflorescence in itself is not a health problem although it might indicate moisture levels sufficient to support mold. Efflorescence is not a structural issue. It is an aesthetic issue, an issue we would all like to avoid.

**Definition of Efflorescence:**

Efflorescence is the white powdery substance on the surfaces of unsealed concrete and the white blush seen with sealed floors. Efflorescence is caused by vapor migrating through the slab bringing soluble salts to the surface of the concrete. Efflorescence is normally worn off or washed away on unsealed concrete surfaces. In stubborn cases, a mild acid rinse or even a light sandblasting may be necessary. Efflorescence that becomes trapped under sealer is unsightly and is even more conspicuous on darker floors.

In worst case scenarios where the vapor cannot pass through the top coat, a urethane and/or an epoxy for instance, hydrostatic pressure can build to create water blisters indicating delamination of the top coat from the concrete. Blistering is rarely seen with acrylics. Acrylic sealers allow the vapor to pass through, but the salt deposits remain behind creating the unsightly blush that prompts owners to call the stain contractor.

**Contributing Factors:**

Efflorescence requires the movement of moisture. Without moisture movement there would be no efflorescence on the surface to create the problem. Unfortunately, too many finishers (non-ACI Certified Finishers) routinely introduce large amounts of unnecessary “water of convenience” to the mix in order to facilitate concrete placement. Primary efflorescence is caused by the water in the concrete evaporating from the slab leaving behind the soluble salts on the concrete surface. The fact that these salts are actually more soluble in colder temperatures coupled with increased bleed water in cold weather increases the likelihood of efflorescence showing up after winter concrete placement. Contributing further to efflorescence with cold weather pours is the use of calcium chloride to accelerate the set time. High slump concrete and the addition of calcium chloride are major contributors to efflorescence.

Secondary efflorescence is often described as water coming from underneath the slab or water that is introduced from the surface. Likely sources of secondary efflorescence would be a saturated base material, an improperly drained site or excessive amounts of water used by the decorative flooring contractor during his cleaning process -
rinsing off the acid stain residue, for example. When extra mix water and extra soluble salts from calcium chloride are added to concrete placed in cool weather followed by more water from the decorative processes, some degree of efflorescing is bound to occur.

Testing for Vapor Transmission:

Even if some answers are provided it behooves the contractor to do some independent fact finding to determine the current vapor transmission rate (VTR). Probably the oldest test method is the Plastic Sheet Test (ASTM-D-4263) which is taping down a clear 18” X 18” sheet of poly and checking 16 hours later for condensation or for a darkened concrete surface. Both are indications of vapor transmission. Another surface moisture test is The Calcium Chloride Test which quantifies the rate of vapor transmission. This is a covered dish that is weighed before and after a twenty four hour period. Both are cost effective measures in determining whether vapor is active.

A note of caution when using these testing methods...the plastic sheet and chloride tests will track moisture movement near the top only. When the atmospheric conditions are similar to the slab conditions the tests might not indicate significant vapor transmission because movement happens when the ambient conditions differ from the slab conditions. Moisture migrates and moves toward cool temperatures. Vapor emissions migrate and move toward heat. Imagine the consequences of the following unpleasant, but very real scenario... the project is completed, the contractor has been paid, the delighted owner takes possession and turns on the HVAC causing vapor in the slab to move towards the warmth or the lower humidity of the conditioned space bringing the whitish minerals with it. If the sealer is acrylic the vapor will pass through leaving the efflorescence. If urethanes or epoxies are on the floor, hydrostatic pressure may build and possibly cause delamination. Efflorescence can occur months or even years after the contractor has left the job due to circumstances similar to those just described or from seasonal ground water seeping under the slab. Testing the surface may not be enough to guarantee an efflorescence free project for years to come. It is important to determine the source and the rate of vapor transmission before prescribing a remedy.

More accurate testing technology such as the $1,000 Protimeter Moisture Measurement System (ASTM Standard F-2170-02) uses a probe to measure the presence of moisture on and below the concrete surface along with the relative humidity, dew point and temperature. Two non invasive hand held devices using similar technology are the Aquant ($300) which measures surface moisture to a depth of 10 – 20 mm and the Tramex Concrete Encounter Moisture Meter ($450) which transmits a signal ½ “ deep and projects a moisture measurement for 4”.

Determine ahead of time if efflorescence is a likely problem waiting to happen on your project:

- Are there signs of efflorescence now?
- Is the property properly drained?
- Does surface water run towards the foundation?
- Is there a French drain system?
- How old is the slab, what time of year was it poured?
- Was the concrete placed on a saturated sub grade?
- Was the concrete placed directly on a vapor retarder?
- Was a granular material placed over the vapor retarder (vapor barrier being the outdated term) and was the base saturated?
- If a vapor retarder was used, was it carefully taped at penetrations, around the plumbing, for instance? Did the mix design include fly ash?
- Was a waterproofing admixture used?
- Was calcium chloride used?
- How much “water of convenience” was added to the concrete?
- Was a curing compound or liquid densifier applied?

Answers to at least some of these questions can give a decorative contractor a heads up before wading into a project completely uninformed and unprepared.
Contractor’s Guide To Efflorescence

benefit of these tools is their accuracy in measuring the moisture levels well beneath the surface whether there is any current movement or not. Given the financial risk, not to mention damage to a contractor’s reputation it makes sense for a contractor to explore procedures that more clearly indicate subsurface conditions in order to avoid the efflorescence problems caused by moisture.

We mentioned that a well drained site and a vapor retarder are deterrents to efflorescence. The case can be made for placing the concrete directly on the vapor retarder or over granular material on top of the vapor retarder. The argument against the granular material is that it may become a saturated “blotter” before the slab is poured adding even more water that has only one way to leave. Finishers argue that there will be too much bleed water resulting in dusting, but a 4” slump with water reducers and a well graded mix will show very little bleed water. Elevated slabs are quite common in commercial construction and they are not placed on a blotter material. The really important factor here is minimizing water in all the important areas...the sub grade, the concrete and the procedures performed by the decorative contractor. These all require some amount of water, but keeping water to a minimum helps ensure that efflorescence is controllable.

To give an idea how much water may be available to bring soluble salts to the surface when these factors are not given any consideration let us consider a typical residential slab pour...assume we have a 2” thick blotter course of sand residing between the concrete slab and a vapor retarder. Dry sand weighs approximately 100 pounds per cubic foot. Wetted to achieve compaction, this sand could easily contain 10% moisture by weight, or 10 pounds of water per cubic foot of sand. It will take approximately 167 cubic feet of sand to cover 1,000 square feet of vapor retarder. That figures out to each 1,000 square feet of concrete surface having 1,670 pounds, or 200 gallons of water sitting on the underside of the slab with no where to go but up! Add that amount of water to another 60 or 70 extra gallons of “water of convenience” added by the finisher and we may have 270 gallons of extra water moving towards the surface whenever surface conditions are warmer or drier than the slab itself. There is another aspect of this foreboding picture...this porous slab we have described acts like a hard sponge with large pores and capillaries throughout the matrix, able to wick moisture up and quite willing to act as a hard sponge, capable of absorbing hundreds of pound of water from the cleaning processes employed by the decorative flooring contractor.

Proactive Measures:

Efflorescence reducing measures are: site surface drainage; a well graded concrete mix with a water reducer to minimize paste; concrete not exceeding a 4” slump; that the concrete be well consolidated (one man vibratory screeds do a great job); placed directly on a vapor retarder and cured in some fashion. All these factors contribute to a concrete that has a minimum amount of bleed water with a lesser pore and capillary network that will resist rather than facilitate absorption and movement of moisture...in other words, a dense and relatively impermeable concrete slab.

Now for more specifics...an option to the vapor retarder is a waterproofing admixture to help prevent efflorescence. This is added to the concrete at the plant, but it has a downside. It can pose real problems for the stain contractor since a common ingredient, stearic acid, is hydrophobic in the same way that powdered release agents for stamped concrete are so the waterproofed concrete does not readily accept either acid stains or water base stains. Suggestions in this case would be to open the surface with a sanding screen or a gelled acid to create some degree of profile enabling a better mechanical bond for the water borne stain.

Helpful mix design factors include ordering a well graded a mix from the ready mix producer. The advantage gained from a well graded mix design is the reduction of the weakest part of concrete, the cement paste (cement and water), making for a denser concrete than with a standard mix. Another important mix design consideration is the replacement of 15% to 20% of the Portland cement with fly ash which contributes significantly to lessening efflorescence. Fly ash brings three important benefits to reducing efflorescence. Fly ash reduces the amount of Portland cement and free lime as well as chemically binding up a portion of the free lime and salts that cause efflorescence. In addition, fly ash requires less water again resulting in a denser paste which aids in keeping moisture from traveling up from the bottom and from the top down. Water reducers of course, are also helpful at minimizing the amount of water and a reduction of cement (paste).
The closer a mix design gets to the desired water cement ratio of .45 pounds of water to pounds of cement, the fewer efflorescence issues arise, especially with a mix including fly ash. And forget the old notion that you can’t use integral color with fly ash, you can. Keeping multiple pours consistent with the mix design, sub grade conditions and finishing practices will produce consistent results. Heads up on this one... cold concrete and cold ambient temperatures encourage efflorescence because the salts are actually more soluble in colder temperatures plus concrete tends to bleed more in cooler weather further encouraging the upward transportation of moisture and its passenger, soluble salts. Follow ACI 306 Cold-Weather Concreting procedures whenever possible including raising the placement temperature of the concrete to 60 degrees and then cover overnight to retain the heat. This will encourage a more dense pore and capillary structure and help close down the moisture transportation routes.

Curing becomes important as we recognize that moisture moves much more slowly through denser concrete from either direction. When concrete is kept moist for a longer period, especially the first few days, more capillaries and pores fill partially or completely to form a denser and more impermeable matrix that discourages the migration of moisture and soluble salts. Conversely concrete that is placed at a high slump and not cured acts as a sponge, full of miniature raceways allowing easy movement of moisture from the bottom up and top down. Cure and seal membrane type cures poses a problem in that the membrane has to be removed to accept acid stains, so they are not often used. One manufacturer has a thermal degrading wax that breaks down with hot water. Water borne stains are becoming popular and manufacturers are working to formulate compatible curing membranes that will accept subsequent staining. Wet curing is difficult because it must be continuous and may create discoloration if a plastic sheet has wrinkles.

Not an Uncommon Set of Circumstances:
Scenario of potential efflorescence consequences of a fast track project: Imagine the consequences of a fast track project...restaurants have to be the worst...with an acid stained floor on a slab as we just described, a few months old poured late in the year. The grand opening is early spring. The decorative contractor, being the sincere person he or she is, has proposed an upgrade from the acrylic sealer in the specifications to an epoxy or urethane because of the heavy foot traffic. The suggestion was approved, epoxy sealer it is. Our contractor goes into the project without a clue about the sub grade conditions, vapor retarder, mix design, admixtures, etc. There is one more complication all too familiar to staining contractors...the schedule. The superintendent greets our contractor friend on Monday with the news that the floor needs to be serviceable Friday morning so that the kitchen stoves and ovens can be dragged in. Our contractor feels a bit overwhelmed, but plans the work: clean up the drywall mud today; stain tonight; clean the residue Tuesday, apply epoxy Wednesday, Thursday is cure day, Friday is open for light traffic. This seems workable, life is good. No matter that the heat is not yet on in the building and the floor is not fully cured out. Our contractor friend, by the way, does not have floor scrubbers. Mops and buckets make up the clean up and water removal equipment. This is not an uncommon set of circumstances. What do you suppose the chances are that the stained and sealed floor will escape with no efflorescence?
Contractor’s Guide To Efflorescence

Secondly, some contractors are following the application of acid stains with silicate type non-film forming sealers generically described as chemical hardeners, densifiers and soluble chloride reducers within a few days of concrete placement. Efflorescence is reduced as the silicate causes the matrix to become denser as we described earlier. The contractor has the option of adding conventional membrane forming sealers if subsequent VTR tests indicate acceptable levels.

What to do when Efflorescence shows up under the Sealer:

What are the options when efflorescence rears its ugly head? A fast fix might be to use toluene, xylene or another coat of solvent base acrylic which reemulsifies the original sealer and clears the blush. If vapor continues to come up through the slab though, the condition will most likely reappear. Be aware that if the space is occupied there can be health issues because of solvents like toluene and xylene.

The most prudent course of action includes stripping the sealer in order to conduct a test to determine the rate of vapor transfer and then develop a remedial strategy. It is important to get it right the second time so take time to diagnosis the causes as best you can with the information available. One of the more expensive hand held digital instruments may prove to be a valuable tool because they are able to get accurate moisture reading below the surface of the slab. Once the moisture levels are established a sealer can chosen based upon the manufacturer’s recommendations.

Remember that some manufacturers have the vapor inhibiting, non-film forming sealers that we mentioned earlier. These may reduce the vapor transmission rate to a level appropriate for a heavier bodied more abrasion resistant top coat for use in high foot traffic situations.

Where slabs have continued to have efflorescence problems even after the application of a lithium or silicate densifier contractors have used a finish or polish, which are industrial grade “mop and glow” - low build, low solids micronized acrylic water based products as the final treatment. These finishes and polishes can also be used over film forming sealers to add abrasion resistance.

In most efflorescence cases, the decorative flooring contractor inherited the problems that contributed to creating the efflorescence. Diagnosing the causes of efflorescence after the floor has been sealed can be difficult. It is important to determine how much moisture exists in the slab, the source of the moisture and also whether conditions, like seasonal ground water might contribute more moisture in the future. Consider vapor testing and resist the quick fix. Finally, contractors may elect to avoid warranty language where sealers are concerned or they may choose to specifically define typical vapor transmission problems. The decorative adage of “test, test, and test” holds especially true for interior stained floors. It means doing a VTR test whenever you suspect there may be the potential for efflorescence problems. Happy staining and remember – you don’t have to take every job that comes your way.
Purpose

This technical bulletin gives construction guidelines to design professionals and contractors of interlocking concrete pavements. The bulletin reviews the steps in constructing an aggregate base, bedding sand and concrete pavers. This pavement structure is commonly used for pedestrian and vehicular applications. Pedestrian areas, driveways, and areas subject to limited vehicular use are paved with units 23/8 in. (60 mm) thick. Streets and industrial pavements should be paved with units at least 31/8 in. (80 mm) thick.

It is recommended that ICPI Certified Installers be utilized for the construction of interlocking concrete pavement. These individuals have attended training and have demonstrated their knowledge of the guidelines, materials and techniques specific to interlocking concrete pavement. ICPI maintains a list of Certified Installers on www.icpi.org.

Aggregate bases stabilized with asphalt or cement are recommended under very heavy loads, and over weak or saturated soil subgrades. These are sometimes used when adequate aggregates are not available or when a stabilized base is more economical than unstabilized aggregate. Refer to Tech Spec 4–Structural Design of Interlocking Concrete Pavement for Roads and Parking Lots when looking for additional information regarding the structural design of the base and subbase. Tech Spec 4 is based on the design methods detailed in ASCE 58-10 Structural Design of Interlocking Concrete Pavements for Municipal Streets and Roadways.

Concrete pavers made in the U.S. should meet the requirements established in the American Society for Testing and Materials (ASTM) C936, Standard Specification for Solid Interlocking Concrete Paving Units. Requirements of this standard include a minimum average compressive strength of 8,000 psi (55 MPa), average absorption no greater than 5%, resistance to at least 50 freeze-thaw cycles with average material loss not exceeding 1%, and conformance to abrasion resistance tests.

Concrete pavers made in Canada are required to meet requirements set forth by the Canadian Standards Association CSA-A231.2 Precast Concrete Pavers. This standard requires a minimum average cube compressive strength of 7,250 psi (50 MPa) or 5,800 psi (40 MPa) at delivery. There should be no greater than 500 g/m2 of material lost after 50 freeze thaw test cycles while immersed in water with a 3% saline solution.

Installation steps include job planning, layout, excavating and compacting the soil subgrade, applying geotextiles (optional), spreading and compacting the sub-base and/or base aggregates, constructing edge restraints, placing and screeding the bedding sand, and placing concrete pavers. For larger installations mechanical placement of pavers may be more economical. Refer to Tech Spec 11–Mechanical Installation of Interlocking Concrete Pavements for additional information.

Job Planning

Prior to excavating, check with the local utility companies to ensure that digging does not damage underground pipes or wires. Many localities have one telephone number to call at least two days before excavation for marking utility line locations. Overhead clearances should be checked so that equipment does not interfere with wires. Site access by vehicles and equipment should be established so that the job can be built without delays.

Layout

In preparing for excavation, the area to be removed should be marked with stakes. See Figure 1. The stakes should be a slight distance away from the area to be removed so that they are not removed during excavation. The stakes should be marked to establish grades, or have string lines pulled and tied to them. Slopes should be a minimum of 1.5%. In the case of roads, the minimum longitudinal slope should be 1% with a minimum cross slope of 2%. Grade stakes should be checked periodically during the job to be sure that they have not been disturbed.
Excavating, Drainage and Compacting the Soil Subgrade

During and after excavation, the soil should be inspected for organic materials or large rocks. If organic materials, roots, debris, or rocks remain, they should be removed and replaced with clean, compacted aggregate backfill material. Free-standing water saturating the soil should be removed. After it is removed, low, wet areas can be stabilized with a layer of crushed stone and/or cement.

Typical 4 in. (100 mm) diameter perforated drainage pipes surrounded with minimum 3 in. (75 mm) of No. 57 or similar open-graded stone is wrapped in woven or non-woven geotextile as specified by the designer. The surface of the stone is even with the top of the compacted soil subgrade. The stone and geotextile pipe assembly is placed along the pavement perimeter to remove excess water in the subgrade soil and base. The perforated pipe should be sloped and directed to outlets at the sides or ends of the pavement. The pipe outlets should be covered with screens to prevent animal ingress. Drain pipes are recommended in clay soils or other slow draining soils subject to vehicular traffic. Soil subgrade drainage extends pavement performance to the extent that the small additional investment is returned many times in additional pavement service years.

Compaction of the soil subgrade is critical to the performance of interlocking concrete pavements. See Figure 2. Adequate compaction will minimize settlement. Compaction should be at least 98% of standard Proctor density as specified in ASTM D698. However, modified Proctor density (ASTM D1557) is preferred, especially for areas under constant vehicular traffic. This compaction standard may not be achievable in extremely saturated or very fine soils. Stabilization of the soil subgrade may be necessary in these situations.

Compaction equipment varies with the type of subgrade soil. Manufacturers of compaction equipment can provide guidance on which machines should be applied to various types of soil. Table 1 gives general guidance on applying the right machines to various soil types.

Monitoring soil moisture content is important to reaching the compaction levels described above. Soil moisture and density measurements should be taken to control and verify the degree of compaction. The moisture content and compacted density of the subgrade soil should be checked for compliance to specifications before installing geotextiles.

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Construction of Interlocking Concrete Pavements

Applying Geotextiles (Optional)

Geotextile may be used in areas where soil remains saturated part of the year, where there is freeze and thaw, or over clay and moist silty subgrade soils. See Figure 3. As a separation layer, geotextiles prevent the migration of soil into the aggregate base under loads, especially when saturated, thereby reducing the likelihood of rutting. When geotextiles are used they preserve the load bearing capacity of the base over a greater length of time than placement without them. Woven or nonwoven fabric may be used under the base with a maximum apparent opening size of 0.60 mm as testing using ASTM D4751. Table 2 lists minimum requirements of geotextiles for soil separation. These requirements are from AASHTO M288-15 Standard Specification for Geotextile Specification for Highway Applications. The minimum down slope overlap should be at least 12 in. (300 mm). Overlap requirements for low strength subgrades are detailed in Table 3.

Table 1. Guide to the Application of Compaction Equipment to Various Soils (Courtesy of Vibromax 2000 Co.)

<table>
<thead>
<tr>
<th>NON-COHESIVE</th>
<th>COHESIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>Clay</td>
</tr>
<tr>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>50%</td>
<td>75%</td>
</tr>
<tr>
<td>75%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Rammers* (Jumping Jacks) & Sheep Foot Rollers

Reversible Plates

Reversible Plate with Extension Plates

Forward Plates

Vibratory Rollers

Static Rollers

Normal Range

Testing Recommended

*Rammers work very well in sand if confined, as around abutments, foundations, etc.

Figure 3. Application of the geotextile under aggregate base.
Construction of Interlocking Concrete Pavements

Table 2. Geotextile Requirements for Separation per AASHTO M288

<table>
<thead>
<tr>
<th>Geotextile Class</th>
<th>Class I*</th>
<th>Class II*</th>
<th>Class III*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elongation</td>
<td>ASTM D4632</td>
<td>&lt;50%</td>
<td>&gt;50%</td>
</tr>
<tr>
<td>Permittivity</td>
<td>ASTM D4491</td>
<td>0.02 sec⁻¹</td>
<td></td>
</tr>
<tr>
<td>Apparent Opening Size</td>
<td>ASTM D4751</td>
<td>0.024 in [0.60 mm] maximum average roll value</td>
<td></td>
</tr>
<tr>
<td>Ultraviolet Stability</td>
<td>ASTM D4355</td>
<td>&gt;50% after 500 hr exposure</td>
<td></td>
</tr>
</tbody>
</table>

a The severity of the installation conditions generally dictates the required geotextile class. Class I is the most severe and Class III is the least severe.
b All numeric values represent MARV in the weaker principal direction.
c When sewn seams are required.
d The required tear strength for woven monofilament geotextiles if 250 N.
e Default Value. Permittivity of the geotextile should be greater than the soil.

Table 3. Geotextile Overlap Requirements

<table>
<thead>
<tr>
<th>Soil CBR</th>
<th>Overlap</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;3.0</td>
<td>1.0 ft [0.3 m] to 1.5 ft [0.45 m]</td>
</tr>
<tr>
<td>1.0 - 3.0</td>
<td>2.0 ft [0.6 m] to 3.0 ft [1.0 m]</td>
</tr>
<tr>
<td>0.5 - 1.0</td>
<td>3.0 ft [1.0 m] or sewn</td>
</tr>
<tr>
<td>&lt;0.5</td>
<td>Sewn</td>
</tr>
<tr>
<td>All roll ends</td>
<td>3.0 ft [1.0 m]</td>
</tr>
</tbody>
</table>

When the fabric is placed in the excavated area, it should be turned up along the sides of the opening, covering the sides of the base layer. There should be no wrinkles on the bottom. When the aggregate is dumped on the fabric, the tires from trucks should be kept off the fabric to prevent wrinkling.

Table 4. Grading Requirements for Dense Graded Aggregate per ASTM D2940

<table>
<thead>
<tr>
<th>Sieve Size (Square Openings)</th>
<th>Design Range Mass % Passing</th>
<th>Job Mix Tolerance Mass % Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bases</td>
<td>Subbases</td>
<td>Bases</td>
</tr>
<tr>
<td>2 in. (50 mm)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1¾ in. (37.5 mm)</td>
<td>95-100</td>
<td>90-100</td>
</tr>
<tr>
<td>¾ in. (19 mm)</td>
<td>70-92</td>
<td>65-75</td>
</tr>
<tr>
<td>¾ in. (9.5 mm)</td>
<td>50-70</td>
<td>45-60</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>35-55</td>
<td>30-60</td>
</tr>
<tr>
<td>No. 30 (600 µm)</td>
<td>12-22</td>
<td>10-20</td>
</tr>
<tr>
<td>No. 200 (75 µm)</td>
<td>0-8e</td>
<td>0-12d</td>
</tr>
</tbody>
</table>

a Select the Job Formula with due regard to the availability of materials and service requirements of project. Test results outside the design range are not prohibited, provided they are within the job mix tolerances.
b Determine by wet sieving. Where local environmental conditions (temperature and availability of free moisture) indicate that in order to prevent damage by frost action it is necessary to have lower percentages passing the No. 200 (0.075 mm) sieve than permitted in Table 4, appropriate lower percentages shall be specified. When specified, the material having a diameter smaller than 0.020 mm shall not exceed 3% mass.

t Ranges apply to no. 8 and no. 14 (7 and 15 mm sieve size).

Spreading and Compacting the Subbase and/or Base Aggregates

Specifications typically used by cities, states, or provinces for aggregate base materials under flexible asphalt pavements are adequate for interlocking concrete pavements. If no specifications are available use the recommended grading for the aggregate base shown in Table 4. Spread and compact the base in 4 to 6 in. (100 to 150 mm) lifts using 7,000 lb (31 kN) reversible plate compactors. Thinner lifts will be required for compactors in the 5,000 lb (22 kN) range. High force compaction equipment can compact thicker lifts. Consult with compaction equipment manufacturer for guidance. Frozen base material should not be installed, nor should material be placed over a frozen soil subgrade.
Recycled concrete aggregates (RCA) used with interlocking concrete pavement in vehicular areas should be from crushed sources certified by a state or provincial department of transportation as meeting specifications for gradation and hardness. These typically include limits on the percent passing the No. 200 (0.075 mm) sieve (generally <12%) and abrasion durability tests such as Los Angeles abrasion resistance or micro-Deval loss. No more than 30% RCA mixed with non-recycled (quarried/crushed) dense-graded aggregates are recommended for vehicular applications. For pedestrian interlocking concrete pavements, up to 100% RCA can be used. However, there is an increased risk of efflorescence passed to the concrete paver surface. While not affecting structural performance, efflorescence may be unsightly and difficult to remove. Recycled asphalt materials should follow the aforementioned guidelines.

The thickness of the base is determined by traffic, soil type, subgrade soil drainage and moisture, and climate. Sidewalks, patios and pedestrian areas should have a minimum base thickness (after compaction) of 4 in. (100 mm) over well-drained soils. Residential driveways on well-drained soils should be at least 6 in. (150 mm) thick. In colder climates, continually wet or weak soils will require that bases be at least 2 to 4 in. (50 to 100 mm) thicker.

Local, state or provincial engineering standards for base thickness can be applied to streets constructed with interlocking concrete pavers. Non freeze-thaw areas with well-drained soils should have at least a 6 in. (150 mm) thick base. Minimum base thicknesses for residential streets are 8 to 10 in. (200 to 250 mm). Greater thicknesses are often used in regions with numerous freeze-thaw cycles, expansive soils, or very cold climates. A qualified civil engineer familiar with local soils and traffic conditions should be consulted to determine the appropriate base thickness for streets and heavy-duty, industrial pavements.

Many localities determine base thickness with the 1993 Guide for the Design of Pavement Structures published by the American Association of State Highway and Transportation Officials (AASHTO). The AASHTO procedure calculates the structural number (SN) of the strength coefficients of each base and pavement layer. The SN is determined by assessing the traffic loads, soils, and environmental factors.

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Construction of Interlocking Concrete Pavements

(e.g., drainage, freeze-thaw). The layer coefficient recommended for 31/8 in. (80 mm) thick pavers on 1 in. (25 mm) bedding sand is 0.44 per inch (25 mm), i.e., the SN = 41/8 x 0.44 = 1.82. Base thicknesses can be readily determined by using the charts in ICPI Tech Spec 4–Structural Design of Interlocking Concrete Pavement for Roads and Parking Lots or ICPI Structural Design Software. This software is available for free download on www.icpi.org.

Like compaction of the soil subgrade, adequate compaction of the base is critical to minimizing settlement of interlocking concrete pavements. See Figure 4. Special attention should be given to achieving compaction standards adjacent to edge restraints, catch basins and utility structures. When spread and compacted, the aggregate base should be at its optimum moisture. Bases for pedestrian areas and residential driveways should be compacted a minimum 98% of standard Proctor density. For vehicular areas, compaction should be at least 98% of modified Proctor density as determined by ASTM D1557, or AASHTO T180. While the highest percentage compaction (100%) is preferred, it may not be achievable on weak or saturated soils. Density measurements of the compacted base should be made with a nuclear density gauge or other methods approved by the local, state or provincial transportation department. See Figure 5. Unless otherwise specified, the compacted thickness of individual lifts should be ±3/4 in. to ±1/2 in. (±19 mm to ±13 mm). Maintaining consistent lift thickness during compaction will help achieve consistent density. Variation in final base surface elevations should not exceed ±3/8 in. (± 10 mm) when tested with a 10 ft. (3 m) straightedge.

The finished surface of a compacted aggregate base should not allow bedding sand to migrate into it. If the surface will allow ingress of bedding sand, a choke course of fine material can be spread and compacted into the surface, or a bitumen tack coat can be applied. The surface of the base course and its perimeter around the edge restraints should be inspected for areas that might allow sand to migrate after installation. Such locations can be joints in curbs, around utility structures or catch basins. These areas should be covered with a geotextile fabric to prevent loss of the bedding sand.

Construciting Edge Restraints

Edge restraints are a key part of interlocking concrete pavements. By providing lateral resistance to loads, they maintain continuity and interlock among the paving units. Aluminum, steel, plastic, or concrete are typical edge restraints. Consult ICPI Tech Spec 3 on edge restraints for recommendations on applications and construction.

Edge restraints must be set at the correct level, especially if the tops of the restraints are used for screeding.
the bedding sand. Their elevations should be checked prior to placing the sand and pavers. A minimum of 1 in. (25 mm) vertical restraining surface should be in contact with the side of the paver to adequately restrain it. For heavy duty application a greater restraining surface may be warranted. Edge restraints are typically installed before the bedding sand and pavers are laid. However, some restraints can be secured into the base as the laying progresses.

**Placing and Screeding the Bedding Sand**

Bedding sand under concrete pavers should conform to ASTM C33 or CSA A23.1. This material is often called concrete sand. Masonry sand for mortar should never be used for bedding, nor should limestone screenings or stone dust. The bedding sand should have symmetrical particles, generally sharp, washed, with no foreign material. Waste screenings and stone dust should not be used, as they often do not compact uniformly and can inhibit lateral drainage of moisture in the bedding layer. ICPI Tech Spec 17—Bedding Sand Selection for Interlocking Concrete Pavements in Vehicular Applications provides additional guidance on selecting bedding sand and gradations including limits an material passing the No. 200 (0.075 mm) sieve.

Bedding sand should be spread and screeded to an uncompacted nominal 1 in. (25 mm) thickness. Frozen or saturated sand should not be installed. If there is an uneven base (due to inconsistent compaction or improper grading), the bedding sand should not be used to compensate for it. Over time, unevenness in the bedding sand will reflect through to the surface. Uneven areas on the base surface must be made even prior to placing the bedding sand.

Once the base is complete, screed pipes or rails are placed on it and the bedding sand spread over them. The sand is screeded or smoothed across the pipes with a straight and true strike board. See Figure 6. Screed pipes are removed and the resulting void filled with bedding sand. After the sand is screeded it should not be disturbed. Sufficient sand is placed and screeded to stay ahead of the placed pavers. Powered screeding machines that roll on rails and asphalt spreading machines adapted for screeding sand have been successfully used on larger installations to increase productivity.

**Placing the Concrete Pavers**

Concrete pavers can be placed in many patterns depending on the shapes. Herringbone patterns (45 or 90 degree) are recommended in all street applications, as these interlocking patterns provide the maximum load bearing support, and resist creep from starting, braking and turning tires. See Figure 7. ICPI takes a conserva-
Constrution of Interlocking Concrete Pavements

tive approach by not recognizing differences among paver shapes with respect to structural and functional performance. Certain manufacturers may have materials and data that discuss the potential benefits of shapes on functional and structural performance in vehicular applications. Chalk lines snapped on the bedding sand or string lines pulled across the surface of the pavers are used as a guide to maintain straight joint lines. Buildings, concrete collars, inlets, etc., are generally not straight and should not be used for establishing straight joint lines.

Paving units arrive at the job site packaged in bundles that are often strapped and/or wrapped to a wooden shipping pallet. Paving units should be taken from 3 or 4 bundles and not from a single one. Mixing the pavers ensures a visually consistent blend of the colors. If there’s only one color of pavers on the job, installing pavers from several bundles at the same time will diminish the appearance of slight variations in that color.

Joint widths between the pavers should be consistent and be between 1/16 and 3/16 in. (2 and 5 mm). Most pavers are made with spacer bars on their sides. These maintain a minimum joint width, allowing the sand to enter between each unit.

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Pavers without spacers are generally not placed snug against each other since string lines guide consistent joint spacing.

Cut pavers should be used to fill gaps along the edge of the pavement. Pavers are cut with a double bladed splitter or a masonry saw. See Figure 8. A saw gives a smooth cut. Gaps greater than 3/8 in. (10 mm) should be filled with cut pavers. For street applications do not cut pavers to less than 1/3 their original size. Instead fill voids with two cut pavers.

After an area of pavers is placed, it should be compacted with a vibrating plate compactor, which should be capable of exerting a minimum of 5,000 lbf. (22 kN) of centrifugal compaction force and operate at 75-90 hertz. See Figure 9. At least two passes should be made across the pavers to seat the pavers in the bedding sand and force it into the joints at the bottom of the pavers.

Dry joint sand is swept into the joints and the pavers compacted again until the joints are full. See Figures 10 and 11. This may require two or three passes of the plate compactor. If the sand is wet, it should be spread to dry on the pavers before being swept and compacted into the joints. Joint sand may be finer than the bedding sand to facilitate filling of the joints. Bedding sand also can be used to fill the joints, but it may require extra effort in sweeping and compacting. Compaction should be within 6 ft (2 m) of an unrestrained edge or laying face. All pavers within 6 ft (2 m) of the laying face should have the joints filled and be compacted at the end of each day. Excess sand is then removed. See Figure 12. The remaining uncompacted edge can be covered with a waterproof covering if there is a threat of rain. This will prevent saturation of the bedding sand, minimizing removal and replacement of the bedding sand and pavers.

Final surface elevations should not vary more than +3/8 in. (+10 mm) under a 10 ft (3 m) straightedge, unless otherwise specified. Bond or joint lines should not vary ±1/2 in. (13 mm) over 50 ft (15 m) from taut string lines. The top of the pavers should be 1/8 to 3/8 in. (3 to 10 mm) above adjacent catch basins, utility covers, or drain channels, with the exception of areas required to meet ADA design guideline tolerances. The top of the installed pavers may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevations to compensate for possible minor settling. A small amount of settling is typical of all flexible pavements. Optional sealers or joint sand stabilizers may be applied. Using stabilized sand may have advantages in areas prone to joint sand loss. See ICPI Tech Spec 5–Cleaning, Sealing and Joint Sand Stabilization of Interlocking Concrete Pavement for further guidance.

ICPI Tech Spec 9–A Guide Specification for the Construction of Interlocking Concrete Pavement helps translate construction methods and procedures described here into a construction document. Tech Spec 9 provides a tem-
Construction of Interlocking Concrete Pavements

plate for developing project-specific materials and installation specifications for the bedding and joint sand, plus the concrete pavers. Additional guide specifications and detail drawings for various applications are available at www.icpi.org as well as ICPI Tech Specs. Other ICPI Tech Specs and technical manuals should be referenced for information on design, detailing, construction and maintenance.

References


Figure 13. The completed paved area from Figure 12 receives tank traffic at the U.S. Army Proving Grounds in Aberdeen, Maryland.
SECTION 32 14 13.13
Interlocking Concrete Pavers

Note: This guide specification for manually installed concrete paver applications in the U.S. and Canada. Contact ICPI for current information and guide specifications for mechanical installation. This document should be edited to fit project conditions and location. Brackets [ ] indicate text for editing. Notes are provided on the use of a compacted aggregate base under the bedding sand and pavers. Other bases can be used such as cement or asphalt-treated aggregate, concrete or asphalt, as well as other setting materials. The user should refer to Interlocking Concrete Pavement Institute (ICPI) Details & Specifications for Interlocking Concrete Pavement at www.icpi.org for various guide specifications and detail drawings. This Section includes the term “Architect.” Edit this term as necessary to identify the design professional in the General Conditions of the Contract. Coordinate all Sections with the General Conditions as well.

PART 1 GENERAL
1.01 Summary

A. Section Includes:
   1. Interlocking Concrete Paver Units (manually installed).
   2. Bedding and Joint Sand.
   3. Edge Restraints.

B. Related Sections:
   1. Section: [ ]-Curbs and Drains.
   2. Section: [ ]-Aggregate Base.
   3. Section: [ ]-Cement Treated Base.
   4. Section: [ ]-Asphalt Treated Base.
   5. Section: [ ]-Pavements, Asphalt and Concrete.
   7. Section: [ ]-Geotextiles.

Note: Pavements subject to vehicles should be designed in consultation with a qualified civil engineer, in accordance with ASCE 58-10 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways, ICPI Interlocking Concrete Pavement Structural Design Program software, and in accordance with the ICPI Tech Spec technical bulletins. Use the current year reference. Edit ASTM and CSA references below and throughout this Section according to project location.
1.02 References

A. American Society for Testing and Materials (ASTM):
   1. ASTM C 33, Standard Specification for Concrete Aggregates.
   3. ASTM C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   5. ASTM C 936, Standard Specification for Solid Concrete Interlocking Paving Units.
   6. ASTM C 979, Pigments for Integrally Colored Concrete.
   7. ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft·lb/ft³). (600 kN·m/m³).
   8. ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft·lb/ft³). (2,700 kN·m/m³).
   9. ASTM D 2940, Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.

B. Canadian Standards Association (CSA):
   1. A231.2, Precast Concrete Pavers.
   3. A23.1-FA1, Concrete Materials and Methods of Concrete Construction.
   4. A179, Mortar and Grout for Unit Masonry.

C. Interlocking Concrete Pavement Institute (ICPI):
   1. ICPI Tech Spec technical bulletins.

D. American Society of Civil Engineers (ASCE)
   1. 58-10 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways

1.03 Submittals

A. In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Manufacturer’s drawings and details: Indicate perimeter conditions, relationship to adjoining materials and assemblies, (expansion and control joints,) concrete paver (layout,) (patterns,) (color arrangement,) installation (and setting) details.

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D. Concrete pavers:
   1. [Four] representative full-size samples of each paver type, thickness, color, finish that indicate the range of color variation and texture expected in the finished installation. Color(s) selected by [Architect] [Engineer] [Landscape Architect] [Owner] from manufacturer’s available colors.
   2. Accepted samples become the standard of acceptance for the work.
   3. Test results from an independent testing laboratory for compliance of paving unit requirements to [ASTM C 936][CSA A231.2].
   5. Manufacturer’s catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.

E. Paver Installation Subcontractor:
   1. A copy of Subcontractor’s current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

   **Note:** ICPI certifies that installers have passed an exam on installation knowledge and does not certify or guarantee the quality of installation. Job references should be carefully reviewed and verified to assist in identifying competent contractors.

   2. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names and phone numbers.

1.04 Quality Assurance

A. Paving Subcontractor Qualifications:
   1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
   2. Utilize an installer holding a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

B. Regulatory Requirements and Approvals: [Specify applicable licensing, bonding or other requirements of regulatory agencies.]

C. Mock-Ups:

   **Note:** A site visit and approval by the owner’s representative during the first day of paving may substitute for a mock-up.

   1. Install a 7 ft x 7 ft (2 x 2 m) paver area.
   2. Use this area to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), color(s) and texture of the job.
3. Evaluate the need for protective pads when compacting paving units with architectural finishes.
4. This area will be used as the standard by which the work will be judged.
5. Subject to acceptance by owner, mock-up may be retained as part of finished work.
6. If mock-up is not retained, remove and properly dispose of mock-up.

1.05 Delivery, Storage & Handling

A. General: Comply with Division 1 Product Requirement Section.
B. Refer to manufacturer’s ordering instructions and lead-time requirements to avoid construction delays.
C. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers packaging with identification labels intact.
   1. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
   2. Deliver concrete pavers to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by fork lift or clamp lift.
   3. Unload pavers at job site in such a manner that no damage occurs to the product.
D. Storage and Protection: Store materials protected such that they are kept free from mud, dirt, and other foreign materials. [Store concrete paver cleaners and sealers per manufacturer’s instructions.]

1.06 Project/Site Conditions

A. Environmental Requirements:
   1. Do not install sand or pavers during heavy rain or snowfall.
   2. Do not install sand and pavers over frozen base materials.
   3. Do not install frozen sand or saturated sand.

1.07 Maintenance

A. Extra Materials: Provide [Specify area] [Specify percentage] additional material for use by owner for maintenance and repair.

PART 2 PRODUCTS
2.01 Interlocking Concrete Pavers

Note: In addition to ASTM or CSA conformance, ASCE 58-10 recommends a maximum 3:1 aspect ratio (length ÷ thickness) and a minimum 31/8 in. (80 mm) thickness for vehicular applications. Residential driveways should use a minimum 23/8 in. (60 mm) thick units with a maximum 4:1 aspect ratio.

A. Manufacturer: [Specify ICPI member manufacturer name.].
   1. Contact: [Specify ICPI member manufacturer contact information.].

B. Interlocking Concrete Paver Units, including the following:
   1. Paver Type: [Specify name of product group, family, series, etc.].
      b. Color [and finish]: [Specify color.] [Specify finish].
      d. Size: [Specify.] inches [(Specify.)mm] x [Specify.] inches [(Specify.)mm] x [Specify.] inches [(Specify.) mm] thick.

Note: Concrete pavers may have spacer bars on each unit. Spacer bars are recommended for mechanically installed pavers and for those in heavy vehicular traffic. Manually installed pavers may be installed with or without spacer bars. Verify with manufacturers that overall dimensions do not include spacer bars.

Note: For ASTM C 936 use the following material characteristics:

e. Average Compressive Strength: 8,000 psi (55 MPa) with no individual unit under 7,200 psi (50 MPa).

f. Average Water Absorption (ASTM C 140): 5% with no unit greater than 7%.

g. Freeze/Thaw Resistance (ASTM C 1645): Resistant to 50 freeze-thaw cycles while immersed in water or a 3% saline solution (depending on conditions during service life) with no greater mass lost than 225 g/m2 of surface area after 28 cycles, or 500 g/m2 after 49 cycles. Freeze-thaw testing requirements shall be waived for applications not exposed to freezing conditions.

Note: For CSA A231.2 use the following material characteristics:

h. Minimum average cube compressive strength of 7,250 psi (50 MPa) for laboratory cured specimens or 5,800 psi (40 MPa) for unconditioned field samples.

i. Resistance to 28 freeze-thaw cycles while immersed in a 3% saline solution with no greater mass lost than 225 g/m2 of surface area after 28 years, or 500 g/m2 after 49 cycles.
2.02 Product Substitutions

A. Interlocking concrete pavers: as specified or approved equal.

2.03 Bedding And Joint Sand

A. Provide bedding and joint sand as follows:

1. Clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
2. Do not use stone dust.
3. Do not use limestone screenings or sand for the bedding that does not conform to the grading requirements of [ASTM C 33][CSA A23.1-FA1].
4. Do not use mason sand, or sand conforming to [ASTM C 144][CSA A179] for the bedding sand.

Note: If the pavement will be exposed to heavy traffic with trucks, i.e., a major thoroughfare with greater than 1.5 million 18-Kip (80 kN) equivalent single axle loads, see ICPI Tech Spec 17–Bedding Sand Selection for Interlocking Concrete Pavements in Vehicular Applications for test methods and criteria for assessing bedding sand durability. Limestone screenings will typically not meet the durability requirements outlined in Tech Spec 17. However, there are some granite materials that can meet these requirements. Tech Spec 17 recommends using concrete sand as a first preference.

5. Where concrete pavers are subject to vehicular traffic, utilize sands that are as hard as practically available.

Table 1. Grading Requirements for Bedding Sand

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>ASTM C33 Percent Passing</th>
<th>CSA A23.1 FA1 Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 in. (9.5 mm)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>95-100</td>
<td>5.0 mm</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>80-100</td>
<td>2.5 mm</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>50-85</td>
<td>1.25 mm</td>
</tr>
<tr>
<td>No. 30 (0.6 mm)</td>
<td>25-60</td>
<td>630 μm</td>
</tr>
<tr>
<td>No. 50 (0.3 mm)</td>
<td>5-30</td>
<td>315 μm</td>
</tr>
<tr>
<td>No. 100 (0.15 mm)</td>
<td>0-10</td>
<td>160 μm</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>0-1</td>
<td>80 µm</td>
</tr>
</tbody>
</table>

Note: Bedding sands should conform to ASTM C33 or CSA A23.1 FA1 gradations for concrete sand. For ASTM C33, ICPI recommends the additional limitations on the No. 200 (0.075 mm) sieve as shown. For CSA A23.1 FA1, ICPI recommends reducing the maximum passing the 80 µm sieve from 3% to 1%.
6. Sieve according to [ASTM C 136][CSA A23.2A].

7. Bedding Sand Material Requirements: Conform to the grading requirements of [ASTM C 33][CSA A23.1-FA1] with modifications as shown in Table 1.

Note: Coarser sand than that specified in Table 2 above may be used for joint sand including C 33 or A23.1 material as shown in Table 1. Use material where the largest sieve size easily enters the smallest joints. For example, if the smallest paver joints are 2 mm wide, use sand 2 mm and smaller in particle size. If C 33 or A23.1 sand is used for joint sand, extra effort may be required in sweeping material and compacting the pavers in order to completely fill the joints.

8. Joint Sand Material Requirements: Conform to the grading requirements of [ASTM C 144][CSA-A179] as shown with modifications in Table 2 or meet the requirements for bedding sand in Table 1.

Note: Specify specific components of a system, manufactured unit or type of equipment. See ICPI Tech Spec 3–Edge Restraints for Interlocking Concrete Pavements for guidance on selection and design of edge restraints.

2.04 Edge Restraints

A. Where not otherwise retained, provide edge restraints installed around the perimeter of all interlocking concrete paving unit areas as follows:

1. Manufacturer: [Specify manufacturer].

2. Material: [Plastic] [Concrete] [Aluminum] [Steel] [Pre-cast concrete] [Cut stone] [Concrete].

3. Material Standard: [Specify material standard].

2.05 Accessories

A. Provide accessory materials as follows:

Note: Delete article below if geotextile is not used.

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1. Geotextile:
   a. Material Type and Description: [Specify material type and description.]
   b. Material Standard: [Specify material standard.]
   c. Manufacturer: [Acceptable to interlocking concrete paver manufacturer] [Specify manufacturer.]

Note: Delete article below if cleaners, sealers, and/or joint sand stabilizers are not specified.

2. Cleaners] [Sealers] [Joint sand stabilizers]
   a. Material Type and Description: [Specify material type and description.]
   b. Material Standard: [Specify material standard.]
   c. Manufacturer: [Specify manufacturer.]

PART 3 EXECUTION

3.01 Acceptable Installers

A. [Specify acceptable paving subcontractors.]

3.02 Examination

A. Acceptance of Site Verification of Conditions:

1. General Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.

   a. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
   b. Verify that geotextiles, if applicable, have been placed according to drawings and specifications.

   Note: Compaction of the soil subgrade is recommended to at least 98% standard Proctor density per ASTM D 698 for pedestrian areas and residential driveways. Compaction to at least 98% modified Proctor density per ASTM D 1557 is recommended for areas subject to heavy vehicular traffic. Stabilization of the subgrade and/or base material may be necessary with weak or saturated subgrade soils.

   a. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
   b. Verify that geotextiles, if applicable, have been placed according to drawings and specifications.

   Note: Local aggregate base materials typical to those used for highway flexible pavements are recommended, or those conforming to ASTM D 2940. Compaction of aggregate is recommended to not less than 98% Proctor density in accordance with ASTM D 698 is recommended for pedestrian areas and residential driveways. Minimum 98% modified Proctor density according to ASTM D 1557 is recommended for vehicular areas. Mechanical tampers are recommended for compaction of soil subgrade and aggregate base in areas not accessible to large compaction equipment. Such areas can include that around lamp standards, utility structures, building edges, curbs, tree wells and other protrusions.

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Note: Prior to screeding the bedding sand, the recommended base surface tolerance should be ± 3/8 in. (10 mm) over a 10 ft. (3 m) straight edge. See ICPI Tech Spec 2–Construction of Interlocking Concrete Pavements for further guidance on construction practices.

Note: The elevations and surface tolerance of the base determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies in the base surface with additional bedding sand or by other means. Therefore, the surface elevations of the base should be checked and accepted by the General Contractor or designated party, with written certification to the paving subcontractor, prior to placing bedding sand and concrete pavers.

c. Verify that [Aggregate] [Cement-treated] [Asphalt-treated] [Concrete] [Asphalt] base materials, thickness, [compacted density], surface tolerances and elevations conform to specified requirements.

d. Provide written density test results for soil subgrade, [aggregate] [cement-treated][asphalt-treated] [asphalt] base materials to the Owner, General Contractor and paver installation subcontractor.

e. Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage inlets.

2. Do not proceed with installation of bedding sand and interlocking concrete pavers until [subgrade soil and] base conditions are corrected by the General Contractor or designated subcontractor.

3.03 Preparation

A. Verify base is dry, certified by General Contractor as meeting material, installation and grade specifications.

B. Verify that base [and geotextile] is ready to support sand, [edge restraints,] and, pavers and imposed loads.

C. Edge Restraint Preparation:

1. Install edge restraints per the drawings [and manufacturer’s recommendations] [at the indicated elevations].

Note: Retain the following two subparagraphs if specifying edge restraints that are staked into the base with spikes.

2. Mount directly to finished base. Do not install on bedding sand.

3. The minimum distance from the outside edge of the base to the spikes shall be equal to the thickness of the base.

3.04 Installation

A. Spread bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness. Spread bedding sand evenly over the base course and screed rails, using the rails and/or edge restraints to produce a nominal 1 in. (25 mm) thickness, allowing for specified variation in the base surface.

1. Do not disturb screeded sand.
2. Screeded area shall not substantially exceed that which is covered by pavers in one day.

3. Do not use bedding sand to fill depressions in the base surface.

**Note:** When initially placed on the bedding sand, manually installed pavers often touch each other, or their spacer bars if present. Joint widths and lines (bond lines) are straightened and aligned to specifications with pry bars as paving proceeds.

B. Lay pavers in pattern(s) shown on drawings. Make horizontal adjustments to laid pavers as required.

**Note:** Contact manufacturer of interlocking concrete paver units for recommended joint widths.

C. Provide joints between pavers between [1/16 in. and 3/16 in. (2 and 5 mm)] wide. No more than 5% of the joints shall exceed 1/4 in. (6 mm) wide to achieve straight bond lines.

D. Joint (bond) lines shall not deviate more than ± 1/2 in. (15 mm) over 50 ft. (15 m) from string lines.

E. Fill gaps at the edges of the paved area with cut pavers or edge units.

F. Cut pavers to be placed along the edge with a [double blade paver splitter or] masonry saw.

**Note.** Specify requirements for edge treatment in paragraph below.

G. [Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized. All cut pavers exposed to vehicular tires shall be no smaller than one-third of a whole paver.] [Cut pavers at edges as indicated on the drawings.]

H. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and joint sand.

I. Use a low-amplitude plate compactor capable of at least minimum of 5,000 lbf (22 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the sand. Remove any cracked or damaged pavers and replace with new units.

J. Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. This will require at least 4 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.

K. All work within 6 ft. (2 m) of the laying face must be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut and compacted pavers with joint sand to prevent exposed bedding sand from becoming saturated from rainfall.

L. Remove excess sand from surface when installation is complete.

**Note:** Excess joint sand can remain on surface of pavers to aid in protecting their surface especially when additional construction occurs after their installation. If this is the case, delete the article above and use the article below. Designate person responsible for directing timing of removal of excess joint sand.

M. Allow excess joint sand to remain on surface to protect pavers from damage from other trades. Remove excess sand when directed by [Architect].

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N. Surface shall be broom clean after removal of excess joint sand.

3.05 Field Quality Control

A. The final surface tolerance from grade elevations shall not deviate more than ± 3/8 in. (10 mm) over 10 ft (3 m). Use a straightedge, flexible straightedge or transit depending on surface slope and contours.

B. Check final surface elevations for conformance to drawings.

Note: For installations on a compacted aggregate base and soil subgrade, the top surface of the pavers may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.

C. The surface elevation of pavers shall be 1/8 in. to 3/8 in. (3 to 10 mm) above adjacent drainage inlets, concrete collars or channels.

Note: For pedestrian access routes maximum elevation should not exceed 1/4 in. (6 mm).

D. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.

Note: Cleaning and sealing may be required for some applications. See ICPI Tech Spec 5—Cleaning and Sealing Interlocking Concrete Pavements for guidance on when to clean and seal the paver surface, and when to stabilize joint sand. Delete article below if cleaners, sealers and or joint sand stabilizers are not applied.

3.06 [Cleaning] [Sealing] [Joint Sand Stabilization]

A. [Clean] [Seal] [Apply joint sand stabilization materials to concrete pavers in accordance with the manufacturer’s written recommendations.]

3.07 Protection

A. After work in this section is complete, the General Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.
AASHTO: American Association of State Highway and Transportation Officials is an association that includes U.S. state and Canadian provincial highway engineers. AASHTO publishes structural design methods for pavement, material standards and test methods, as well as many other documents on roads, highways and transportation.

Abrasion: The mechanical wearing, grinding, scraping or rubbing away (or down) of segmental concrete paving unit surface by friction or impact, or both.

Absorption: Weight of water drawn/soaked into a segmental concrete unit during immersion under prescribed conditions, typically expressed as a percentage relating to the dry weight of the unit.

ADA Design Guidelines: Americans with Disabilities Act Design Guidelines that include requirements for pavement transitions, openings, curb ramps and detectable warnings. The guidelines are administered by the U.S. Access Board.

Admixture: Prepared chemicals added to the concrete during the mixing process to improve production efficiencies and/or hardened properties such as density, absorption, efflorescence control, visual appeal, durability and strength.

Aggregate: Sand, gravel, shell, slag, or crushed stone used in road construction, base materials, mixed with cement to make concrete, or mixed with bitumen to make asphalt.

Albedo: The ratio of outbound reflected solar radiation from a pavement surface to inbound radiation.

Angularity: The sharpness of edges and corners of particles. Used to describe sand and aggregates.

Aspect Ratio: The overall length of a segmental concrete paving unit divided by its thickness. Example: A 4 in. (100 mm) wide by 8 in. (200 mm) long by 3 1/8 in. (80 mm) thick paver has an aspect ratio of 2.5. Compare to Plan Ratio.

Asphalt-treated Base: A crushed stone road base mixed with asphalt to increase its stiffness and resistance to rutting from wheel loads.

ASTM C936: American Society for Testing and Materials, Standard Specification for Solid Concrete Interlocking Paving Units. This product standard defines dimensions, dimensional tolerances, maximum absorption, minimum compressive strength, abrasion and freeze/thaw durability through various test methods.

ASTM C1319: Product standard for concrete grid paving units.

ASTM C1782: Product standard for utility or common segmental concrete paving slabs.

Aquifer: A porous, water-bearing geologic formation that yields water for consumption.

Band Cutter: A plier-like tool designed to cut metal or plastic bands around cubes and bundles of segmental concrete paving units without injury.

Base or Base Course: A material of a designed thickness placed between the segmental concrete units and bedding, and the subbase (where used) and subgrade. The base can be open-graded or dense-graded aggregate with or without cement or asphalt stabilization, asphalt or concrete.

Base Rake: A rake with a flat and toothed side to move and level aggregate base (similar in appearance to an asphalt lute). A base rake also can be used to evenly spread joint sand on the surface of segmental concrete units for faster drying.
**Bedding Layer:** The aggregate material directly below the segmental concrete unit that, amongst other things, allows for bedding of the pavement surface during installation. In non-permeable applications, it is a 1 to 1.5 inch (25 to 40mm) thick layer of natural or manufactured sand conforming to ASTM C33 or CSA A23.1 with limits on the percent passing the No. 200 (0.075 mm) sieve; commonly referred to as the bedding sand layer. In permeable applications, it is a 2 inch (50 mm) thick layer of open-graded angular aggregate typically ASTM No. 8 stone or similar sized material; commonly referred to as bedding course.

**Bedding Sand Degradation Tests:** Evaluation of the degree of attrition of sand. Tests are conducted with steel balls or other abrading devices agitated with a sand sample in a container. Pre- and post-testing sieve analyses are conducted to determine the increase in fines. The tests are used to evaluate the durability of bedding sand under heavy loads or channelized traffic. Tests are often called Micro-Deval tests.

**Bentonite Clay:** Clay with a high content of the mineral montmorillonite, usually characterized by high swelling on wetting that can be used to help seal paver joints.

**Best Management Practice (BMP):** A structural device or nonstructural program designed to reduce stormwater runoff and water pollution.

**Bishop’s Hat:** A five-sided paver often used as an edge paver with a 45° herringbone pattern.

**Bitumen Setting Bed:** A bitumen/sand mix used for the bedding layer to which a neoprene-asphalt mastic is used to adhere the segmental concrete paving units. The bituminous bedding layer is typically less than 1 in. (25mm) thick and is typically placed over a concrete base.

**Blending:** The act of mixing segmental concrete units from three of four bundles or cubes when placing them to ensure an even color distribution.

**Bulge or Belly:** Convex sides on a segmental concrete unit that result from excessive water in the concrete mix during production.

**Bundle:** Either several layers of segmental concrete units stacked vertically together, or lined up horizontally (specific to larger slabs), that are bound with plastic wrap and/or strapping, placed on pallets, and tagged for shipment to and installation at the site. Bundles not supplied with pallets are strapped together for shipment, and require clamps attached to various wheeled equipment for transportation around the site. Also known as a cube.

**Bundle Buggy:** A wheeled device (with or without an engine) specifically designed to carry a banded together portion of a cube of pavers around a job site.

**California Bearing Ratio (CBR):** A standardized soils test defined as the ratio of: (1) the force per unit area required to penetrate a soil mass with a 3 in. sq. (19 cm sq.) circular piston (approximately 2 in. (51 mm) diameter) at the rate of 0.05 in. (1.3 mm)/min, to (2) that required for corresponding penetration of a standard material. The ratio is usually determined at 0.1 in. (2.5 mm) penetration, although other penetrations are sometimes used. See ASTM D1883.

**Cation:** A positively charged atom or group of atoms in soil particles that, through exchange with ions of metals in stormwater runoff, enable those metals to attach themselves to soil particles.

**Cement-Aggregate Ratio:** The proportional weight of cement to fine and coarse aggregate in concrete.

**Cement-treated Base:** Crushed stone base mixed with cement to increase its stiffness and resistance to rutting from wheel loads.

**Cement, Portland:** Hydraulic cement produced by pulverizing clinker consisting essentially of hydraulic calcium silicates, and usually containing one or more forms of calcium sulfate.
Chamfer: A 45° beveled edge around the top of a segmental concrete paving unit usually 1/16 to 1/4 in. (2-6 mm) wide. It allows water to drain from the surface, facilitates snow removal, helps prevent edge chipping, and delineates the individual paving units.

Choke Course: A layer of aggregate placed or compacted into the surface of another layer to provide stability and a smoother surface. The particle sizes of the choke course are generally smaller than those of the surface into which it is being pressed so it blends together, but not so small as to pass through the larger material.

Clay: Fine-grained soil or the fine-grained portion of soil that can be made to exhibit plasticity (putty-like properties) within a range of water contents, and that exhibits considerable strength when air-dry. The term can designate soil particles finer than 0.002 mm.

Cluster: A group of paving units forming a single layer that is grabbed, held, and placed by a paver-laying machine typically on a bedding layer.

Coarse Aggregate: Aggregate predominantly retained on the U.S. Standard No. 4 (4.75 mm) sieve; or that portion of an aggregate retained on the No. 4 (4.75 mm) sieve.

Combined Sewer Overflows (CSOs): Overflows from the combination of stormwater and sanitary sewage in the same conveyance system. Overflows are not treated by a waste water treatment plant and instead are diverted as raw sewage into a receiving body of water.

Compaction: The process of inducing close packing of solid particles such as soil, sand, or aggregate.

Compressive Strength: The measured maximum resistance of a concrete paver to loading expressed as force per unit area such as pounds per square inch or newtons per square millimeter (megapascals).

Concrete Grid Paving Units: Segmental concrete units (generally small slabs) that have 45 to 75 percent open area. The units are no larger than 24 in. (600 mm) by 24 in. (600 mm). Aggregate or grass can be placed in the openings to promote infiltration of stormwater. Grids are generally used for intermittent parking, access lanes, abating runoff and/or controlling erosion. See ASTM C1319, Standard Specification for Concrete Grid Paving Units for product standards.

Concrete Sand: Washed sand used in the manufacture of ready-mix concrete which conforms to the grading requirements of ASTM C33 or CSA A23.1 with limits on the percent passing the No. 200 (0.075 mm) sieve. Commonly used as a bedding sand.

Course: An installed row of paving units or a row in a bundle or cube.

Creep: Slow lateral movement of segmental concrete paving units from horizontal forces such as braking tires.

Crown: The slightly convex shape of a road cross section. It is beneficial to surface drainage and interlock.

Crushed Stone: A construction material made by mechanical crushing of rocks, boulders, or large cobblestones at a quarry. All faces of each aggregate have well-defined edges resulting from the crushing operation.

Crusher Run: The total unscreened product of a stone crusher.

CSA-A231.1: Canadian Standards Association product standard for Precast Concrete Paving Slabs that defines standards for dimensions, minimum flexural strength, and durability under freeze-thaw cycles with deicing salt through various test methods.

CSA-A231.2: Canadian Standards Association product standard for Precast Concrete Pavers (interlocking units)
Glossary of Terms for Segmental Concrete Pavement

that defines standards for dimensions, minimum compressive strength, and durability under freeze-thaw cycles with deicing salt through various test methods.

**Cube(s):** See Bundle.

**Curve Number (CN):** A numerical representation of a given area’s hydrological soil group, plant cover, impervious cover, interception, and surface storage. A curve number is used to convert rainfall depth into runoff volume. PICP typically has CNs between 45 and 80. PICP can reduce the post-development CN of a site compared to the predevelopment CN.

**DCOF or Dynamic Coefficient of Friction:** A measurement that characterizes the interaction between a wet surface and a passing shoe, and that is used to assess the slip resistance of the wet surface. One DCOF measurement device is called AcuTest which simulates and measures the resistance (or force) that must be overcome to keep one object, already in motion, moving over another object. See ANSI A137.1-2012.

**Deflection:** A small temporary downward movement of a pavement structure due to traffic loads.

**Degradation Testing:** Testing of sands or aggregate to determine resistance to change in particle sizes or gradation under loading.

**Dense-Graded Aggregate:** A compacted crushed stone used in the base and subbase, and whose gradation yields very small voids between the particles with no visible space between them. Most dense-graded aggregates used in bases have particles ranging in size from 1 1/2 in. (38 mm) or 3/4 in. (19 mm) down to fines passing the No. 200 (0.075 mm) sieve.

**Density:** The mass per unit volume of a substance.

**Dentated Paver:** A paving unit with indentations formed into the sides to increase the area of their sides so that, when installed, the additional area enhances interlock among neighboring units.

**Detention Pond or Structure:** The temporary storage of stormwater runoff in an area with the objective of decreasing peak discharge rates and providing a settling basin for pollutants.

**Drainage Coefficient:** Factor used to modify the layer coefficient of pavements. The value express the extent to which pavement materials can resist weakening when wet or saturated. See Layer Coefficient.

**Dry Mix Joint Sand Stabilizer:** Joint sand treated with chemicals that when placed in contact with water, activates them to bind the sand particles together. This stabilizes the joint sand, reduces its permeability, sand loss and helps prevent weeds.

**Edge Paver or Slab:** A paving unit made with a straight, flush side, or cut straight for placement against an edge restraint.

**Edge Restraint:** A curb, edging, building or other stationary object that borders the perimeter of the segmental concrete pavement and prevents the units from moving horizontally. It can be exposed or hidden from view.

**Efflorescence:** A white deposit of calcium carbonate on concrete surfaces. It results from the reaction of calcium hydroxide with carbon dioxide from the air. The calcium hydroxide is a byproduct when cement hydrates. It is slightly soluble in water and migrates to the surface through capillary action. The calcium hydroxide remains on the surface, reacts with carbon dioxide, which forms calcium carbonate and water. This conversion, depending on weather conditions, will dissipate over time. Calcium carbonate is the most common type of efflorescence. The presence of efflorescence does not compromise the structural integrity and is not indicative of a flawed product.
**Glossary of Terms for Segmental Concrete Pavement**

**Elastic Deformation:** A reaction from applied loads where pavement returns to its original position after the load is removed. Compare to permanent deformation under Rutting.

**Elephant’s Foot:** A solid extension formed as part of the bottom of the segmental concrete paving unit typically the result of a rounding at the bottom of the mold due to excessive wear. Also known as legs.

**Embodyed Energy:** The energy used through the life-cycle of a pavement material or product to extract, refine, process, fabricate, transport, install, commission, utilize, maintain, remove, and ultimately recycle or dispose of pavement materials.

**Engraved Pavers or Slabs:** Pavers or slabs that have been engraved inscribed with letters or images created by molding during or after manufacture, via shot blasting or wet cutting. Engraved paving units can also refer to those with a cast metal plate set into the surface.

**Environmental Product Declaration or EPD:** A declaration by a manufacturer of the environmental impacts from the manufacture of a product.

**Equivalent Single Axle Loads (ESALs):** Summation of equivalent 18,000 pound-force (80 kN) single axle loads used to combine mixed traffic to a design traffic load for the design period; also expressed as Equivalent Axle Loads or EALs.

**Erosion:** The process of wearing away soil by water, wind, ice and gravity; also the detachment and movement of soil particles by the same forces.

**Face Mix or Hard Facing:** The application of a thin layer of fine aggregate and cement to the top surface of a segmental concrete paving unit. The layer is often colored and is used to provide a more intense appearance, greater abrasion resistance, or provide a base for a textured finish.

**Failure:** The point at which a pavement does not adequately service its intended use. For flexible pavements, rut depth is often a criterion for failure.

**False Joints:** Grooves on the surface of segmental concrete paving units that appear as full joints between units that contribute to the installed joint pattern. False joints can enhance the appearance of the pattern and speed installation compared to placing separate (sub) units. Sometimes called dummy grooves.

**Fines:** Silt and clay particles in a soil or aggregate, generally those smaller than the No. 200 or 0.075 mm sieves.

**Fineness Modulus:** A factor obtained by adding the total percentages by weight of an aggregate sample retained on each of a specified series of sieves, and dividing the sum by 100; in the United States the standard sieve sizes are No. 100 (0.150 mm), No. 50 (0.300 mm), No. 30 (0.600 mm), No. 16 (1.18 mm), No. 8 (2.36 mm) and No. 4 (4.75mm), and 3/8 in. (9.5 mm), 11/2 in. (37.5 mm), 3 in. (75mm), and 6 in. (150 mm).

**Finished Grade:** The final elevation of a soil, subgrade, subbase, base or pavement surface which is often indicated on construction drawings. Also Finish Elevation.

**Flash:** A thin, brittle layer of cement around the bottom edges or at the top edges of a segmental concrete paving unit composed of cement, typically due to minor leakage of liquid cement between elements of the mold assembly. Also known as Flange.

**Flexible Pavement:** A pavement structure which maintains intimate contact with and distributes loads to the subgrade. The base and subbase course materials rely on aggregate interlock, particle friction, and cohesion for stability.

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**Flexural Strength:** A property of a paver or slab that indicates its ability to resist failure in bending expressed in pounds per square inch or megapascals.

**Flowable Fill:** A low-strength concrete mix used to fill utility trenches and other excavated pavement openings; also known as unshrinkable fill or controlled low strength material (CLSM). See ASTM D6103, D6023, D6024 and D4832.

**Freeze-Thaw Durability Testing:** Tests in which segmental concrete paving units are exposed to cycles of freeze and thaw, partially or totally immersed in water, and with or without salt water.

**Frost Action:** Freezing and thawing of moisture in pavement materials and the resultant effects on them.

**Frost Heave:** The raising of a pavement surface due to the accumulation and expansion of ice in the base, subbase, and/or underlying soil or rock.

**Geogrid:** Geogrids are two dimensional or three dimensional lattices manufactured from various types of plastic. The two dimensional type are flat and have small, square, rectangular or triangular shaped openings. Three dimensional geogrids are 4 to 8 in. (100 to 200 mm) high and provide stability under loads for cohesionless soils and opengraded bases.

**Geotextiles:** Woven or non-woven fabrics made from plastic fibers used for separation, reinforcement, or drainage between pavement layers.

**Gradation:** Expression of the distribution by mass of a soil or aggregate in specified particle-size ranges. Gradation is typically expressed in percent of mass of sample passing a range of sieve sizes. See ASTM C136.

**Grade:** (noun) The slope of finished surface of an excavated area, subbase, base, or pavement usually expressed in percent; (verb) to finish the surface of same by hand or with mechanized equipment.

**Gravel:** Rounded or semi-rounded particles of rock that will pass a 3 in. (75 mm) and be retained on a No. 4 (4.75 mm) sieve which naturally occurs in streambeds or riverbanks that have been smoothed by the action of water. A type of soil as defined by the Unified Soil Classification System having particle sizes ranging from the No. 4 (4.75 mm) sieve size and larger.

**H2O Loading:** A vehicular load used by AASHTO in bridge design and mistakenly applied to pavements.

**Half Stone:** A manufactured half of a paver.

**Herringbone Pattern:** A pattern where joints are no longer than the length of 11/2 segmental concrete paving units. Herringbone patterns can be 45° or 90° depending on the orientation of the joints with respect to the direction of the traffic.

**Hotspot:** A land use that can generate highly contaminated runoff with concentrations higher than those typical to stormwater.

**Human Scale:** Using segmental concrete paving unit sizes, patterns, colors and textures next to large buildings or open areas with the intent of reducing the user perception of being overwhelmed by the large scale of these spaces.

**Hydrological Soil Group:** The soils classification system developed by the U.S. Soil Conservation Service, now the Natural Resources Conservation Service that categorizes soils into four groups, A through D, based on runoff potential. A soils have high permeability and low runoff whereas D soils have low permeability and high runoff.
**Impervious Cover:** Surfaces that do not allow rainfall to infiltrate into the underlying soil such as pavements, roofs, sidewalks, driveways, etc.

**Infiltration:** The downward movement of water through a permeable pavement system and into the subgrade soil.

**Infiltration Rate:** The rate at which water moves vertically (i.e. falls) through an unsaturated aggregate or soil, expressed in inches per hour or meters per second. See ASTM C1781, D3385 and D5093. Also the rate at which water enters a permeable pavement. Compare to Permeability.

**Interlock:** Frictional forces between segmental paving units that prevent them from rotating, or moving horizontally or vertically in relation to each other; also defined as the inability of a paving unit to move independently of its neighbors. The friction forces enable load transfer among the paving units. The three kinds of load transfer are vertical interlock, horizontal interlock and rotational interlock. Vertical interlock is achieved by shear transfer of loads to surrounding units through sand in the joints. Horizontal interlock is primarily achieved through the use of laying patterns that disperse forces from braking and accelerating vehicles. The most effective laying patterns for maintaining horizontal interlock are herringbone patterns. Rotational interlock is maintained by the paving unit being of sufficient thickness, placed closely together, and being restrained by a stationary edge such as a curb.

**Interlocking Concrete Pavement:** A segmental concrete pavement which, due to the size, shape and pattern of the units and the use of joint material between the units, has a high degree of surface interlock. A system of paving consisting of discrete, hand-sized paving units with either rectangular or dentated shapes manufactured from concrete. Either type of shape is placed in an interlocking pattern, compacted into coarse bedding sand, the joints filled with sand and compacted again to create structural interlock (load supporting and spreading).

**Joint:** The space between segmental concrete units filled with jointing sand—or with small, open-graded aggregate if the surface is designed for permeability—to prevent units from impacting against each other after installation.

**Joint Filling Sand:** Sand used to fill spaces between concrete pavers. Also called jointing sand.

**Joint Material:** Sand (in non permeable applications) or small aggregate (in permeable applications) used to fill the joints between concrete pavers or slabs and provides interlock between the units.

**Joint Sand Gap:** The vertical distance between the bottom of the chamfer on a segmental paving unit and the top of the sand in the joint.

**Joint Sand Stabilizer:** Liquid penetrating or dry mix applied or materials that provide early stabilization of joint sand, reduces its permeability, sand loss and helps prevent weeds. See Dry Mix Joint Sand Stabilizer and Liquid Penetrating Joint Sand Stabilizer.

**Joint Sand:** Sand swept into the openings between the pavers and slabs in non-permeable applications.

**Joint Spacing:** The distance between the sides of the pavers or slabs, not including the spacers, that is typically filled with joint material or permeable aggregate. The space measured does not include the chamfer.

**Jointing Material Gap:** The vertical distance between the bottom of the chamfer on a paver or slab and the top of the jointing material within the joint.

**Karst Geology:** Regions of the earth underlain by carbonate rock typically with sinkholes and/or limestone caverns.

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K-pattern: A paving pattern with one square unit surrounded by rectangular units. Sometimes called an I-pattern or muster K pattern.

Layer Coefficient: From the AASHTO flexible pavement design procedure; a dimensionless number that expresses the material strength per inch (25 mm) of thickness of a pavement layer (surface, base, or subbase). Example: The layer coefficient of 3 1/8 in. (80 mm) thick pavers and 1 in. (25 mm) bedding sand is 0.44 per in. (25 mm), therefore, the Structural Number (SN) = 4 1/8 x 0.44 = 1.82.

Laying Face: The exposed, vertical face of a row of paving units on a bedding sand layer; the working edge of the pavement where the laying of paving units occurs.

Laying Pattern: The sequence of placing paving units that creates a repetitive geometry. Laying patterns may be selected for their visual or structural benefits.

Lean Concrete: Concrete of low-cement content used as a structural base material or as flowable fill in utility trenches. LEED or Leadership in Energy and Environmental Design: A system of evaluating the sustainability of building materials and systems published by the US Green Building Council. The USGBC also publishes an evaluation system for sites called Sustainable Sites.

Life-cycle Cost Analysis: A method of calculating all costs anticipated over the life of the pavement including construction costs. Discounted cash-flow methods are generally used, typically with calculation of present worth and annualized cost. Factors that influence the results include the initial costs, assumptions about maintenance and periodic rehabilitation, pavement user and delay costs, salvage value, inflation, discount rate, and the analysis period. A sensitivity analysis is often performed to determine which variables have the most influence on costs.

Lift: A layer of spread and compacted soil fill or aggregate. The compacted soil depth achieved by compaction equipment.

Lippage: The difference in vertical distance between the surface of one paving unit and an adjacent unit. An excessive amount of lippage is sometimes called fish scale.

Liquid Penetrating Joint Sand Stabilizer: Polymer liquid spread over the surface of pavers or slabs and allowed to penetrate the joint sand. After curing, the material stabilizes the joint sand, reduces its permeability, sand loss and helps prevent weeds.

Low Impact Development: A stormwater management approach modeled after nature: manage rainfall at the source using uniformly distributed decentralized micro-scale controls.

Macro Texture: The deviations of a pavement surface from a true planar surface with dimensions generally 0.5 mm or greater or those that no longer affect tire-pavement interaction.

Markers: The use of concrete pavers or slabs with different colors, textures or shapes to mark underground utilities, traffic direction, parking stalls, lanes, pedestrian/vehicular areas, etc.

Mechanical Installation: The use of machines to lift and place layers of segmental concrete paving units on screeded sand in their final laying pattern. It is used to increase the rate of paving.

Mechanistic Design: Elastic analysis of structural response of applied loads through modeling of stresses and strains in a pavement structure.

Micro Texture: The deviations of a pavement surface from a true planar surface with dimensions generally less than 0.5 mm.
Modified Proctor Compaction Test: A variation of the Standard Proctor Compaction Test used in compaction testing which measures the density-moisture relationship under a higher compaction effort. See ASTM D1557.

Modulus of Elasticity or Elastic Modulus: The ratio of stress to strain for a material under given loading conditions.

Moisture Content: The percentage by weight of water contained in the pore space of soil or aggregate, sand or base, with respect to the weight of the solid material.

Mortar: A mixture of cement paste and fine aggregate (sand).

Mortar Sand: Sand used in mortar that typically conforms to ASTM C144 or CSA A179.

Mortar-set Paving: Pavers or slabs or adhered directly to a concrete base using mortar, and joints are filled with mortar or stabilized joint material.

Mosaics: Pavers or slabs used as pictorial maps, murals, or geometric patterns as a landmark, to emphasize an area, or suggest movement.

Multi-Colored Paver or Slab (Color Blend): A paver or slab with two or more colors. The appearance is usually variegated.

MS4: Municipal separate storm sewer system. A system of conveyances including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains. MS4s are generally owned by public agencies.

National Pollutant Discharge Elimination System (NPDES): A broad regulatory program that seeks to control water pollution by regulating point (sewage discharge) and non-point (runoff discharge) into streams, lakes and bays of the United States. The federal program is implemented at the state and local level via water pollution control plans and a permit system for sewage discharge, as well as runoff from construction sites, urban areas and farmland.

Nuclear Density Testing: The use of a nuclear density gauge to accurately and quickly assess the density and moisture content of soils and dense-graded aggregate in the field. The machine uses a probe inserted into compacted soil or aggregate base that emits very low intensity radiation. See ASTM D2922.

Observation Well: A perforated pipe inserted vertically into an open-graded base to monitor infiltration rate of water into the underlying soil.

One/One Hundred Year Storm: A probability statement on recurrence of a rainfall event that has a 100% chance of occurring within a given year/an event that has a 1% chance of occurring within a given year.

Open-graded Aggregate: Washed, crushed stone used in the joints, bedding, base and subbase of permeable pavements, and whose gradation yields large voids between the particles for water infiltration and storage. It can also be used as a drainage course below non-permeable segmental concrete pavements.

Optimum Moisture Content: The water content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.

Organic Impurities: Peat, roots, topsoil or decomposing materials in soil, sand or aggregate.

Organic Soil: Spongy, compressible soils usually consisting of peat humus or vegetative matter that have undesirable construction characteristics.
Outlet: The point at which water is discharged from a pavement system through pipes into a storm sewer or watercourse.

Partial Infiltration: A design concept in permeable pavement where some water is detained to allow for infiltration into the soil and some of the excess detained water is released through drain pipes.

Pavement Performance: The trend of serviceability under repetitive loads.

Pavement Rehabilitation: Work undertaken to extend the service life of an existing pavement. This includes placement of additional surfacing material and/or other work necessary to return an existing roadway to a condition of structural or functional adequacy. This could include the complete removal and replacement of the pavement structure.

Pavement Structure: A combination of subbase, base course, and surface course placed on a subgrade to support traffic loads and distribute it to the roadbed.

Paver Extractor: A tool used to grab a paver and remove it from the laying pattern.

Paver Splitter: A hand operated machine, sometimes hydraulically assisted, for cutting concrete pavers and some slabs; also called a guillotine splitter.

Peak Discharge Rate: The maximum instantaneous flow from a detention or retention pond, open-graded base, pavement surface, storm sewer, stream or river; usually related to a specific storm event.

Performance: The total number of vehicle or ESAL applications withstood by a pavement before it reaches failure, rehabilitation, or a lower level of serviceability.

Performance Period: The period of time that an initially constructed or rehabilitated pavement structure will last (perform) before reaching its terminal serviceability. This is also referred to as the design period or life, expressed in years. Twenty to forty years is normally used in North America.

Permeability: Measured in the laboratory, the rate of water movement through a soil column under saturated conditions, usually expressed as k in calculations per specific ASTM or AASHTO tests, and typically expressed in inches per hour or meters per second. See ASTM D2434. Compare to Infiltration.

Permeable Interlocking Concrete Pavement: A segmental concrete pavement with wide joints (typically 5 to 10 mm) between the units, and the use of open-graded aggregates for the joint, bedding, base and subbase materials, that allows for the surface infiltration of stormwater, storage, infiltration into the subgrade and discharge through an outlet.

Pervious or Permeable Surfaces/Cover: Surfaces that allow the infiltration of rainfall such as vegetated areas, grid pavers, or permeable pavers/slabs.

Plan Ratio: The overall length of a segmental concrete paving unit divided by its width. Compare to Aspect Ratio.

Plastic Limit: (1) The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil. (2) Water content at which a soil will just begin to crumble when rolled into a thread approximately 1/8 in. (3.2 mm) in diameter.

Plate Compactor: Also known as a plate vibrator, which is used to compact/vibrate the subgrade/base/subbed material, bed segmental concrete units into the bedding layer, and vibrate joint material into the unit joints.
**Porosity**: The volume of voids in a soil or aggregate divided by the total volume of the material.

**Pozzolanic Materials**: Fly ash, pozzolan, silica fume, or blast furnace slag used as substitutes for cement. They are generally used in the concrete mix to increase density and durability of concrete pavers.

**Prepared Roadbed**: In-place roadbed soils compacted or stabilized according to provisions of applicable specifications.

**Present Serviceability Index (PSI)**: A rating, usually between 0 (completely non-functional) and 5 (new/perfect) that generalizes several measurements of the condition of pavement. It is a convenient method of rating the overall condition and usefulness of a pavement over time and is from AASHTO pavement design methods.

**Pre-treatment**: BMPs that provide storage and filtering of pollutants before they enter another BMP for additional filtering, settling, and/or processing of stormwater pollutants.

**Proctor Compaction Test**: A test which measures the relationship of soil density with respect to soil moisture content under a standard compaction effort. This test identifies the maximum density obtainable at optimum moisture content. See ASTM D698.

**Progressive Stiffening**: The tendency of pavements to stiffen over time. Interlocking concrete pavement stiffens as it receives increasing traffic loads thereby offering increased structural contribution; also referred to as lock-up.

**Pumping**: The ejection of saturated bedding and joint sand, through joints or cracks or along edges of paving units when a load is applied.

**Reflecting**: Using pavers and slabs to mirror geometric patterns, shapes, colors or textures in the surrounding site.

**Retention Pond**: A body of water or structure that collects runoff for the purpose of infiltration into the subgrade. Runoff flowing into the pond that exceeds its storage capacity is released via an overflow device connected to a storm sewer or watercourse.

**Roughness Index**: The sum of the measured vertical change over a pavement surface divided by the length of pavement measured.

**Running Bond Course**: One or two courses of pavers or slabs where the lengths (long side) abut against the edge restraint. Also known as a “sailor course.”

**Running or Stretcher Bond**: A laying pattern with continuous joint lines in one direction and segmental concrete paving units are staggered from one row to the next.

**Runoff**: Water that leaves a site during and after a rainstorm.

**Runoff coefficient**: The runoff depth divided by the rainfall depth.

**Run-on**: Water, other than direct precipitation, that enters a site during or immediately after a rainstorm.

**Rutting**: Permanent deformation from repetitive traffic wheel loading that exceeds the ability of the pavement structure to maintain its original profile.

**Sailor Course**: A paver course where longer side of each paver abuts against the edge restraint.
Sand: Granular material passing the 3/8 in. (5 mm) and retained on the No. 200 (0.075 mm) sieve, made from the natural erosion of rocks, and consisting of subangular or rounded particles. Sands made by crushing of coarse aggregates are called manufactured sands.

Sand Spreaders: Broomed attachments to motorized equipment used to efficiently spread joint sand across the surface of segmental concrete pavements.

Screed Board or Strike Board: A rigid, straight piece of wood or metal used to level bedding material to proper grade by pulling across guides or rails set on the base course or edge restraints.

Screed Guides or Bars: Grade strips such as pipe that will guide the screed in producing the desired elevation of the bedding layer.

Screenings: A residual product not suitable for bedding sand. It is a by-product from the crushing of rock, boulders, cobble, gravel, blast furnace slag or concrete. Most of the aggregate passes the No. 4 (4.75 mm) sieve; typically limestone or granite.

Sealer: A material usually applied as a liquid to waterproof, enhance color, and in some cases reduce abrasion of segmental concrete pavements.

Sediment: Soils transported and deposited by water, wind, ice or gravity.

Segmental Concrete Pavement: A system of segmental concrete paving units consisting of units over a bedding layer and base (also includes subbase where required). Depending on the type of paving unit and aggregates used, the pavement system can be further characterized as an interlocking concrete pavement, permeable interlocking concrete pavement, concrete grid pavement or segmental concrete slabs.

Segmental Concrete Pavers: Concrete paving units, rectangular, square or dentated, capable of being placed with one hand into a laying pattern. The surface area is equal to or less than 101 in.2 (0.065 m2) and the overall length to thickness is 4 or less. Compare to Segmental Concrete Paving Slabs.

Segmental Concrete Paving Slab: A concrete paving unit with a surface area over 100 in.2 (0.065 m2) and with maximum length and width dimensions of 48 in. by 48 in. (1.2 m x 1.2 m). Its overall length to thickness ratio is greater than 4. Paving slabs do not rely on interlock as the principal means of load distribution.

Segmental Pavement: A pavement whose surface consists of discrete units typically made of concrete, clay, or stone.

Shrinkage: The reduction in volume in soil when moisture content is reduced.

Silt: Soil finer than 0.02 mm and coarser than 0.002 mm. Skid Resistance: A measure of the frictional characteristics of a surface with respect to tires. See ICPI Tech Spec 13.

Slip Resistance: Resistance against pedestrian slipping; defined as the ratio of a minimum tangential force necessary to initiate sliding of a pedestrian’s shoe or related device over a surface. Non-mobility impaired persons require minimum coefficient of friction values ranging from 0.2-0.3. Wheelchair users require friction values ranging from 0.5-0.7. Crutch users and those with artificial limbs require values from 0.7 to 1.0. Clean concrete pavers generally have values exceeding 0.7. See ICPI Tech Spec 13.

Slump: A measure of consistency and water content of freshly mixed concrete. Slump is the subsidence measured from a specimen immediately after removal of a cone shaped mold. See ASTM C143. Unlike ready-mixed concrete, pavers are zero slump concrete because of low water content. They are not tested for slump.
Glossary of Terms for Segmental Concrete Pavement

Soil Separation Fabric: A permeable fabric typically placed between the subgrade and the lowest layer of aggregate (base or subbase) to reduce rutting, also called a geotextile.

Soil Stabilization: Chemical or mechanical treatment designed to increase or maintain the stability of a mass of soil or otherwise to improve its engineering properties. Lime, fly ash or cement are typical chemical stabilization materials. Geotextiles and geogrids are typical mechanical materials for soil stabilization.

Solar Reflectance: ASTM C1549 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer is used to determine the solar reflectance of flat, opaque materials in a laboratory or in the field using a commercial portable solar reflectometer. This device is calibrated using specimens of known solar reflectance to determine solar reflectance from measurements at 380 nm, 500 nm, 650 nm and 1220 nm wavelengths.

Soldier Course: One or two courses of pavers or slabs where the widths (short side) abut against the edge restraint. Solid Color Unit: A segmental concrete unit with one color created by adding iron oxide, metal oxide, or other mixed metal oxide pigment to the concrete mix.

Spacer Bars or Nibs: Small protrusions on each side of the segmental concrete unit (typically 1.5 to 2 mm for non permeable pavers, up to 12mm for permeable pavers) that maintain a minimum space so jointing material can fill into the joints. Spacer bars help prevent edge chipping and spalling. Some spacer bars stop short of the top surface, and are known as “blind spacers.” They cannot be seen once the units have been installed.

Spall: A fragment, usually in the shape of a flake, detached from the edge or surface of a paving unit by a blow or sudden force, the action of weather, or pressure from adjacent pavers.

Stabilized Base: An aggregate base with cement, asphalt or other material added to increase its structural capacity.

Stabilized Subgrade: Soil subgrade stabilized with cement, lime, fly ash or other materials to increase its load bearing capacity.

Stack Bond: A laying pattern in which the joints in both directions are continuous.

Standing Screed: Aluminum screed with handles allowing one person to pull it across bedding material while standing (compared to kneeling while screeding).

Storm Water Pollution Prevention Plans (SWPPP): A principal requirement of stormwater permits issued under NPDES that identifies all potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges from the construction site. A SWPPP also describes practices to be used to reduce pollutants in stormwater discharges from the construction site and assures compliance with the terms and conditions of the construction permit. SWPPP requirements vary from state to state. (from Construction Industry Compliance Assistance Center)

Strain: The change in length per unit of length in a given direction.

Stress: The force per unit area.

Structural Number (SN): The basis of the flexible pavement design method developed by the AASHTO. It is a dimensionless number expressing the relative strength of a pavement structure. The SN is calculated from an analysis of traffic, roadbed soil conditions, and environment. The SN equals the sum of layer coefficients, with each coefficient quantifying the material strength and thickness of each pavement layer.

Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course. Aggregate sub-bases are typically made of stone pieces larger than that in bases.
Glossary of Terms for Segmental Concrete Pavement

Subgrade: The soil upon which the pavement structure and shoulders are constructed.

Sustainable Development: Development (including pavement) that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Tactile Pavers: A paver detectable by sight impaired persons due to change in color or texture from surrounding surfaces. Changes in texture are achieved with detectable warnings e.g., truncated domes.

Tensile Strength: Maximum unit stress which a paving unit is capable of resisting under axial tensile loading, based on the cross-sectional area of the specimen before loading.

Textured or Architectural Finish: Paving unit surfaces altered by the manufacturing mold or mechanical means, such as shot blasting, bush hammering, tumbling, grinding, polishing, flame treating, or washing. The purpose of such treatments is often to simulate the appearance of stone.

Time of Concentration: The time required for water to follow from the most remote point of a watershed or catchment to an outlet.

Topsoil: Surface soil, usually containing organic matter.

Unified Soil Classification System or USCS: A laboratory process of defining soil type in ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes.

Urban Heat Island: An urban area that, due to denuded landscape, impermeable surfaces, surfaces with low albedo, massive buildings, heat-generating cars and machines, and pollutants, is measurably hotter than surrounding rural areas.

Void Ratio: The volume of voids in a soil or aggregate divided by the volume of solids.

Water-Cement Ratio: The weight of water divided by the weight of cement in a concrete mixture. Segmental concrete paving units typically have a water-cement ratio of 0.27 to 0.33, lower than ordinary concrete, which contributes to strength and durability.

Wearing course: Pavement surfacing consisting of segmental concrete units with the designated joint material filling the joints on a bedding layer.

Wearing surface: The top surface that contacts traffic.

Weave or Parquet: A laying pattern where two or more paving units are placed side-by-side. Adjacent pavers are placed side-by-side, but turned 90° and alternated 90° throughout the pattern.

Zoning: Using different paving unit colors, textures, shapes, laying patterns, and surface elevations to delineate pedestrian and vehicular areas or districts.
Glossary of Terms for Segmental Concrete Pavement

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