



CROSSVILLE®

Porcelain Tile Panels

crossvilleinc.com

Crossville's Technical Manual / Guidelines

3+, 5+ and 5.6

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*Information listed here is subject to change.
Please refer to Crossvilleinc.com for the latest,
most accurate information.*

Your exclusive source for
Laminam in the United States

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1. THE PRODUCT

1.1 Product and Installation Compliance

These gauged porcelain tile panels are produced with an innovative tile technology. By pressing without the traditional die-mold commonly used throughout the tile industry, then firing with highly controlled kilns at a temperature of approximately 2200 degrees F, this breakthrough process successfully eliminates tension within the tile panel creating a uniformly large flat piece that can be cut or trimmed with precise accuracy.

Both 3+, 5+, and 5.6mm thicknesses comply with the ANSI 137.3 product standard for gauged porcelain tile and gauged porcelain tile panels/slabs. **All installation systems are to utilize the ANSI A108.19 standard for interior installations, or the ANSI A108.20 standard for exterior installations, applicable TCNA Handbook detail, and the installation guidelines detailed in this manual.**

1.2 3+ Porcelain Tile Panels 1 METER x 3 METER

The 3+ porcelain tile panels have a fiberglass mesh permanently adhered to the back for additional strength and flexibility.

- Interior walls, ceilings and countertops
- Exterior Walls per exterior direct bond guidelines in section 9
- Cut to size is available with additional lead time and cost. Check with Crossville customer service for details (931-484-2110).

1.3 5.6 Porcelain Tile Panels 1 METER x 3 METER and 5+ Porcelain Tile Panels 1.2 METER x 3 METER

- Interior Floors slab on grade, below grade, or above grade concrete and over well-bonded and properly prepared tile, on, below, or above grade
- Laminam 5.6mm and 5+ porcelain tile panels over substrates supported by wood framing shall utilize TCNA Handbook details F141-15 STONE or F250-15 STONE. Consult the installation materials manufacturer you are using to confirm acceptability of this recommendation.
- Interior walls, ceilings and countertops
- Exterior Walls per exterior direct bond guidelines in section 9
- Interior Stairs constructed per TCNA S151 - consideration should be given to appropriate DCOF and wear/impact resistance. Pre-formed stair nosing profiles should be considered.
- Cut to size is available with additional lead time and cost. Check with Crossville customer service for details (931-484-2110).

2. PACKING SPECIFICATIONS

2.1 1 METER X 3 METER

	3+ Porcelain Tile Panels	5.6mm and 5+ Porcelain Tile Panels
PIECE	32.29 sq. ft. / piece	32.29 sq. ft. / piece
LBS / PIECE	54.25 lbs. / piece	93.81 lbs. / piece

Crossville porcelain tile panels arrive in oversized crates. These crates require a minimum of 44" fork length for side lift, and a minimum of 84" fork length for end lift. Crossville will ship its crates a maximum of 4 crates high, in sets of 2. Only the bottom crate of each banded pair will have fork lift entry from both sides. Customers can handle these shipments with 5000 pound capacity fork lifts and 84" forks. Please contact Crossville for logistical assistance with container orders.

FIG. 1 FLAT CRATE



LAM-CRATE (L 124in x W 44in)

FIG. 2 A FRAMES



LAM-CRATE144X33 (L 144in x W 33in)

LAM-CRATE124X44 (L 124in x W 44in)

Note: Check with Crossville Customer Service for costs, shipping, and weight details (931-484-2110).

3. MATERIAL HANDLING

3.1 Fork Lift Requirements

STANDARD FORK LIFT-SIDE

Handling of the crate – we recommend 44" forks to handle the crate from the side. Important to have 44" forks so they extend all the way across the crate to support the back runner. As shown in fig. 3.

CROSS RUNNERS

Shipments of crates will load with the narrow end of the crate facing out. Unloading will require a fork truck with a minimum of 84" forks and 5000 pound lift capacity.

If you have a fork length shorter than 84" you will miss the cross-runner and cause damage, especially when tilting back.

As shown in fig. 4 & 5.

It is important to support the cross runners. You can see the cross-runners in fig. 4.

3.2 Ideal Handling Equipment

96" CRATE TRUCK / PALLET JACK

A crate truck or pallet jack is recommended to move crates in your warehouse. These units have 96" forks to lift crates straight up without tilting. 96" extended fork pallet jacks are also available from U-Line (800-295-5510) or Vestil (800-348-0868).

3.3 Manual Handling and Storage

Handling Video - <http://www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel>

Two installers should handle the tile panels, always keeping it perpendicular to the floor while protecting the corners from impact (fig. 7). Grip gloves are required when lifting and moving the tile panels to ensure positive hold and to protect hands against fiberglass backing and tile edges (3+ and 5+).

Position the tile panels on the long side allowing them to lean against a supporting wall while keeping cardboard or wooden strips suitably spaced beneath them (fig. 8).

- **CAUTION** - Flat crates come equipped with metal corner collars for stacking. To avoid injury be sure to cover or remove these metal collars. (fig. 9).

FIG. 9



FIG. 3 – CRATE OR A-FRAME

standard fork lift - side



FIG. 4 – CRATE OR A-FRAME – CROSS RUNNERS

view of crate with 84" forks underneath



FIG. 5 – CRATE OR A-FRAME – CROSS RUNNERS Underside view with 84" forks



FIG. 6 – CRATE TRUCK FORKS & PALLET JACK



FIG. 7



FIG. 8



3. MATERIAL HANDLING

3.4 Suction Cup Frames

To aid in handling the 1 meter x 3 meter and 1.2 meter x 3 meter (39.4" x 118.1") (47.2" x 118.1") porcelain tile panels, especially those weakened by drilled holes or openings and to assist the wall/floor application, a suitable frame with suction cups can be used. (fig. 10a, 10b, & 11) Visit Crossvilleinc.com for a comprehensive tool list.

Always double check the adhesion of the suction cups on the porcelain tile panels prior to lifting.

4. INSTALLATION

4.1 Installation Standard

All interior installations shall be with accordance with ANSI A108.19. All exterior installations shall be with accordance with ANSI A108.20.

4.2 Current Applications for 3+

- Interior Walls
- Exterior Walls (see section 9)
- Ceilings
- Countertops
- 3+ Porcelain Tile Panels are NOT rated for floor applications
- 3+ can be used on walls in a concave or convex direction as long as the radius (r) of the curve equals or exceeds 5 meters (16.4 feet) - applies only to 3+ in full meter length (10 feet) (fig. 12)
- Tile over tile or other hard surfacing materials (walls) - consult setting material manufacturer for appropriate primer or other specific bonding requirements. Existing substrates must comply with section 4.7.

4.3 Current Applications 5.6 and 5+

- Interior Walls
- Exterior Walls (see section 9)
- Ceilings
- Countertops
- Interior Floors slab on grade, below grade, or above grade concrete.
- Interior Floors tile over tile on slab on grade, below grade, or above grade concrete.
- Deflection requirements for above grade installations to be per TCNA Handbook: "Floor systems over which tile will be installed shall be in compliance with the IRC for residential applications, the IBC for commercial applications, or applicable building codes. Maximum allowable deflection under live load not to exceed $L/360$ ".
- Interior Stairs constructed per TCNA S151 - consideration should be given to appropriate DCOF and wear/impact resistance. Pre-formed stair nosing profiles should be considered.
- Acceptable substrates to be in accordance with Tile Council of North America (TCNA) and ANSI guidelines.
- For tile over tile or other hard surfacing materials applications refer to specific setting material manufacturer recommendations for additional surface preparation including primers or other specific bonding requirements.

FIG. 10a



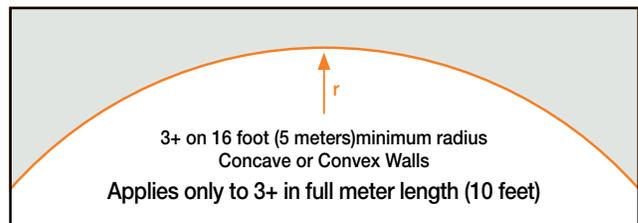
10b



FIG. 11



FIG. 12



- 5.6mm and 5+ porcelain tile panels over substrates supported by wood framing shall utilize TCNA Handbook details F141-15 STONE or F250-15 STONE. Consult the installation materials manufacturer you are using to confirm acceptability of this recommendation.
- 5.6mm and 5+ porcelain tile panels should not be used in installations exposed to steel wheel traffic.
- 5.6mm and 5+ porcelain tile panels when specified for heavy commercial applications (shopping malls, airports, hospitals) require additional considerations for membranes, grouts, and movement joint materials. Consult tile and setting material manufacturer for recommendations, also see movement joints section 4.8. Extra heavy commercial (food plants, dairies) applications are not recommended.
- If a membrane is required on floors, 5.6mm and 5+ porcelain tile panels have been found acceptable for all applications, including heavy commercial applications, using liquid trowel applied crack isolation membranes (see section 8 for specific products). 5.6mm and 5+ porcelain tile panels are continuously being tested for use with other crack isolation, sound reduction, and uncoupling membranes, etc. to verify their specific performance. As performance of these membranes is confirmed they will be added to the website at, www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel

4. INSTALLATION

4.4 Countertops

Extruded foam boards (1½ to 2 inches) from manufacturers such as Schluter and Wedi are the preferred method of countertop installation for both the 3+,5+, and the 5.6 mm. Their ease of installation, inherent water/vapor resistance, and high density composition eliminate many of the stresses that can be created with the traditional layered approach of plywood, backer board, and/or mortar beds. Crossville has found the following steps insure full supportive coverage and precise cutting of the combined assembly: **Step 1**, the installation of the extruded foam board to the base cabinets. **Step 2**, the 3+ or 5.6 should then be installed to the extruded foam board following the mortar application method detailed in Section 5.8 of this Technical Guide. **Step 3**, allow the assembly to cure 24 hours. **Step 4**, measure and template all cut outs in the countertop, cut from the top down using right angle grinder, diamond tipped hole saw and utility knife. When using these materials the respective manufacturer's instructions and detailed installation guidelines should be followed. If using a traditional installation approach TCNA Handbook details C511, C512 or C513 should be followed.

4.5 Suitable Substrates – Walls, Ceilings and Floors 3+/5+/5.6 (Interior and Exterior)

- Existing ceramic tile or other surfacing materials - see section 4.2
- Appropriate backer boards for tile as referenced and detailed by the TCNA Handbook for Ceramic Tile Installation
- Properly prepared concrete and CMU walls
- Gypsum board/dry wall (Interior dry areas only)
- Mortar beds in accordance with ANSI A108.1B

4.6 Suitable Substrates – Floors 5.6 and 5+

- Slab on grade, below grade, or above grade concrete in accordance with ANSI A108 and TCNA Handbook
- Existing ceramic tile or other surfacing materials over slab on grade, below grade, or above grade concrete (well bonded and properly prepared) - see section 4.3
- Mortar beds over concrete in accordance with ANSI A108.1B
- 5.6mm and 5+ porcelain tile panels over substrates supported by wood framing shall utilize TCNA Handbook details F141-15 STONE or F250-15 STONE. Consult the installation materials manufacturer you are using to confirm acceptability of this recommendation.
- 5.6mm and 5+ can be used on walls, suitable substrates as designated in section 4.5 (interior and exterior)

4.7 Substrate Requirements – Walls, Ceilings and Floors

The installation contractor should examine substrates and advise General Contractor and Architect of existing conditions and surface contamination which will require correction before the work commences.

Substrates are to comply with deflection requirements called for by International Building Code (IBC), International

Residential Code (IRC), or applicable local building code.

Maximum substrate variation not to exceed 1/8" in 10' (3mm in 3m) and 1/16" in 24" (1.5mm in 60 cm) when measured from surface high points with a straight-edge, floors may require self-leveling underlayments or recessed slabs designed to accept a properly prepared mortar bed.

In order to achieve accurately comparable labor quotes the specification must contain language indicating that the work is to be bid assuming the substrates are within the required tolerances. If the substrates are found not to be within those tolerances, language and/or pricing should be included in the installation contractor's bid or submittals which qualifies which trade is to do the work needed to bring the substrate into required tolerances. (Include in CSI Div. 3 & 9).

4.8 Movement Joints

Refer to Tile Council of North America (TCNA) Detail EJ-171 for industry guidelines.

Existing joints in substrate are to be carried through the porcelain tile panels. Movement joints are required where the tile panels meet restraining surfaces (e.g. perimeter walls, curbs, columns, corners, etc.) and at all changes in-plane in the tile work.

Joints are to be clean and free of all contaminants and thin-set mortar.

- The edges of the porcelain tile panels are not eased or beveled making them susceptible to damage from heavy rolling loads and impact. Full and flush movement and grout joints should be specified to minimize edge impact. For installations subjected to heavy/hard rubber wheeled rolling loads, prefabricated commercial grade movement joints are recommended.
- Minimum Shore A hardness rating of 25 or greater (per the TCNA Handbook) should be specified for all movement joints in traffic situations. Compressible joint fillers with less than a Shore A hardness of 25 should not be used.
- All expansion joints specific to structural movement: material types and placement should be specified by architectural/engineering authority on the project.
- For interior walls and floors an 1/8 inch movement joint installed every 20 feet will accommodate the needed movement of the tile layer on grade, below grade, or above grade* (all other requirements such as perimeter joints etc. in EJ-171 should followed).
 - **Assuming a class 25 sealant installed at 70°F, using a high temperature of 105°F and a low temperature of 40°F.*
 - *If specific movement joint requirements need to be calculated, use the anticipated temperature differentials, the appropriate class of sealant and a thermal expansion coefficient of 6.5×10^{-6} in/in/°C.*
- For exterior movement joints see section 9.

4. INSTALLATION

4.9 Install with Qualified Labor: See ANSI A108.19 section 10.

Due to the unique material characteristics and unconventional installation techniques required of gauged porcelain tiles and gauged porcelain tile panels/slabs, this work requires installers who are equipped with the proper tools and have acquired sufficient product knowledge, training, and installation experience through the completion of an Installer Qualification Program.

Installer Qualification Programs

- Installer certified by Advanced Certification for Tile Installers (ACT) program for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.
- Installer completion of a comprehensive installation program (See details in informative appendix C) provided by the manufacturer of gauged porcelain tiles or gauged porcelain tile panels/slabs or setting materials for gauged porcelain tiles and gauged porcelain tile panels/slabs.
- Installer completion of a comprehensive installation program provided by the International Masonry Institute (IMI) tile layer programs or the National Tile Contractors Association (NTCA).

Find a list of Trained Contractors at:
www.crossvilleinc.com/locate

5. INSTALLATION PROCESS

5.1 Installation Standard

All interior installations shall be in accordance with ANSI A108.19.
All exterior installations shall be in accordance with ANSI A108.20.

5.2 Installation Recommendations

For the most efficient and consistent cutting of the Crossville porcelain tile panels, Crossville recommends a scoring, rail cutting system like the Sigma Kera Cutter Rail System (fig. 13) or the Montolit Flash Line (fig. 14).

Visit Crossvilleinc.com for a comprehensive tool list.

5.3 Portable Work Stations

Crossville also recommends that portable workstations be assembled to insure proper support and fabrication of the tile panels.

Portable work stations consist of:

- ¾" cabinet grade plywood cut into three, 4 foot square sections each
- (4) hinge plates with 4 chain mount cotter pins (fig. 15)
- (2) 2" flat aluminum strips screwed to each end of the center piece to reinforce & maintain table flatness
- (4) heavy duty collapsible sawhorses (fig. 16)

FIG. 13



FIG. 14



FIG. 15 - Underside of the Assembled Work Station



FIG. 16



5. INSTALLATION PROCESS

5.4 Recommended Equipment

- Trowels - Euro Trowel, Raimondi Flow Ridge, or Superior Premium Notch for application to the floor or wall substrate and for application to back of the tile panel (fig. 18). The Flow Ridge and Premium Notch come in various notch heights, see fig. 17 for appropriate notch size for application to the back of the tile panel and the substrate.
- Pressure pliers for snapping the scored 3+ tile panels (fig. 19)
- The Sigma Separator provides precise pressure when breaking the score line, particularly helpful with the thicker 5.6mm and 5+ (fig. 20)
- Raimondi coated beat in paddle - Part # LTBBLF (fig. 21)
- Right angle grinder for L-cuts and electrical box cuts
- 4" continuous rim diamond blade such as Alpha LM0438
- Diamond rimmed hole saw (fig. 22)
- MLT Lippage Tuning System (fig. 23)
- 60-400 grit diamond hand pads for edge smoothing & removal of excess fiberglass backing (fig. 24)
- Grip gloves for handling the tile panels
- Safety glasses
- 3+, 5+ and 5.6 porcelain tile panels tiles require a two person crew minimum
- Dust and Mist Respirator:
The 3+ tile panels have a reinforcing fiberglass mesh, the residue can be irritating to skin, eyes and lungs

Visit Crossvilleinc.com for a comprehensive tool list.

5.5 Use of Rail Cutters

Cutting and Drilling Video - www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel

- First, clean the surface of the tile panel and the suction cups to ensure better suction to the face of the tile panel.
- Use a rail cutter (fig. 25) to score the porcelain tile panel surface from end to end. Begin the scoring process with a small backward motion then proceed forward continuously with a firm downward pressure on the scoring handle. Note: A smaller diameter cutting wheel may be preferable for pebbled or textured finishes.
- The rail will provide guidance and precision to the cut. Maintain a smooth, firm continuous movement. Do not interrupt or restart.
- With the suction cups still attached, use the rail cutter as a handle to maneuver and reposition the scored tile panel to the edge of the work table.
- Center the pressure pliers (3+) or separator (5.6mm or 5+) over the score line on **one** end of the tile panel. Gently apply pressure and the tile panel will break (fig. 19 & 20). Once the material starts to break down the score line, you may, depending on the width of the piece you are trying to remove, need to use hand pressure to work the break from the starting point to the other end of the tile.

FIG. 17

Trowel	Back of Tile	Substrate
Raimondi Flow Ridge (Walls)	6mm	10mm
Custom Superior (Walls)	Medium	Large
Raimondi Flow Ridge (Floors)	10mm	10mm
Custom Superior (Floors)	Large	Large

FIG. 18



FIG. 19



FIG. 20



FIG. 21



Part # LTBBLF

FIG. 22



FIG. 23



FIG. 24



FIG. 25



5. INSTALLATION PROCESS

5.5 Use of Rail Cutters (cont'd)

- For the 3+ and 5+ material, fold the tile panel past 90 degrees and cut the fiberglass backing using a utility knife, then remove the cut piece.
- Use a 60-400 grit diamond pad to ease the cut edge and remove the excess fiberglass backing - most effective and dust is minimized when used wet (fig. 24).

5.6 Cutting and Drilling

Cutting and Drilling Video - www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel

- Use diamond rimmed hole saws in various diameters.
- DO NOT USE HAMMER DRILLS.
- Moderate pressure and speed are enough to minimize bit-walk at start of drilling process. Water will cool the tile and provide lubrication to the drill bit.
- For large radius or curved cuts a diamond grit jig saw blade by Bosch (T130DG) provides good results.

5.7 Dry Cutting Electrical Boxes

Cutting and Drilling Video - www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel

- It is recommended for electrical box cuts, before using a right angle grinder for the straight cuts (fig. 29), that four pilot holes should be drilled in each corner (fig. 27), these holes will help relieve surface tension and vibration where the straight cuts intersect.
- Cutting must be from the tile panel face to the back, fully supporting the underside of the tile panel on a flat surface. This process will greatly reduce stress and avoid cracking.
- For smaller cuts and corner cuts the use of a simple high quality glass cutter such as the TOYO Pistol Grip Super Cutter (800-505-6311) and adjustable straight edge can be a useful alternative (fig. 28). In addition manual tile cutters and right angle grinders with a proper dry cut porcelain blade are also effective.

5.8 Mortar Application

All interior installations shall be in accordance with ANSI A108.19.
All exterior installations shall be in accordance with ANSI A108.20

Crossville has found through its training and testing that maximum edge to edge coverage is achieved through a series of the following best practices (and the embedding techniques listed in section 5.9):

FIG. 26



FIG. 27



FIG. 28

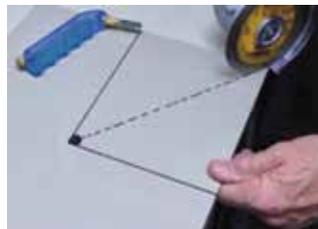


FIG. 29



- Mix the chosen mortar to the recommended consistency, providing maximum open time and greater adjustability when the tile panel is placed. Consult mortar manufacturer for appropriate mix ratios for use with porcelain tile panels.
- Mist down the substrate with a garden sprayer or damp sponge (no pooling or standing water) to make sure the moisture in the thin-set is not lost too quickly and the open time is not reduced (saturated surface dry).
- Be sure to scratch/key the mortar into the substrate and tile panel with the flat side of the trowel before combing.
- Overspread the mortar by at least an inch wider than the tile panel you plan to embed. This is to ensure full support of mortar at the tile edges.
- Use the appropriate trowel (fig. 17 & 18) to apply the mortar to the wall, floor, or countertop and to the back of the tile panel.
- Mortar ridges on both the tile panel back and substrate must be parallel to each other, combing at right angles to the long side of the tile panel. Use the appropriate trowels and troweling technique (hold at least a constant 45° angle) and take care to keep the ridges straight and of consistent height. This is crucial to achieving maximum coverage. (fig 30)
- On both floors and walls the resulting embedded mortar layer (using the double coat approach) will be approximately 5mm (slightly less than 1/4 inch)

5.9 Application of the Tile Panel to the Substrate

Wall Installation Video - Cutting and Drilling Video - www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel

- **WALLS:** Use the suction cupped frame to place the mortared tile panel onto the substrate and align prior to its removal. (fig. 32 & 33)
- **WALLS:** Using a rubber grout float or Raimondi coated beat in paddle, tamp the centerline of the tile panel along its entire length prior to removing the suction cupped frame to provide initial adhesion of the tile panel to the wall. Once the suction cupped frame has been removed use a high-speed sander with pad or the Raimondi coated beat in paddle, work from the centerline of the tile panel outward to the edges, this pressure will collapse the ridges, force air from behind, and maximize edge to edge coverage. A traditional 2 x 4 beat in

5. INSTALLATION PROCESS

5.9 Application of the Tile Panel to the Substrate (cont'd)

block and rubber mallet should not be used as it places too much point load on the tile face and can cause fracturing/cracking of the tile panel.

- **WALLS:** When installing multiple tile panels, lippage control straps and caps are required to minimize lippage between tile panel edges. The lippage control systems are designed only to fine tune lippage between tile edges, the main alignment of tile edges should be accomplished through proper mortar application and embedding techniques. After the **first** tile panel has been installed and the mortar has been spread for the second tile panel, place the straps uniformly along the edge of the **first** tile panel (two inches from the corner and approximately every 10 inches along the length). DO NOT move the strap once in place, as this will create a void under the tile. DO NOT apply the lippage control cap at this time. Once the second tile panel is in place and the same embedding procedure described above is accomplished insert the appropriate grout spacer and lippage control cap and then cinch down the lippage control caps tightly to bring adjoining tile edges into alignment. (fig. 34 & 37)
- **WALLS:** Using a high-speed sander with pad, work along the edges of the tile panel and between each of the lippage control straps and caps, some additional tightening of the caps may be necessary. The combined use of a vibrating sander and cap tightening effectively increases mortar coverage along the vulnerable edge of the tile panel while at the same time minimizing edge lippage. (fig. 34)

Floor Installation Video - <https://www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel>

- **FLOORS:** Use the suction cupped frame to place the mortared tile panel onto the substrate and align prior to its removal. (fig. 35 & 36)
- **FLOORS:** Insuring maximum coverage between the tile panel and the substrate is critical to a successful installation. Crossville has found through its training and testing that the mortar application techniques described in section 5.8 along with the specific walking pattern described below is the most reliable and efficient way to eliminate voids in the mortar while maximizing edge to edge coverage (fig. 30 & 31). Care should be taken to remove any dried mortar or other debris from footwear.

Start at the center point of the tile panel, and walk with small shuffling steps the full length of the tile taking care to stay only in the center portion, then return to the starting point and take small shuffling steps across the widths of the tile panel compressing the mortar ridges and forcing any entrapped air to escape along the tile panel's edge. Continue this shuffling process until the entire tile panel has been compressed in the mortar. This process should take approximately 4 - 6 minutes for a full 1Mx3M tile panel.

Visit [Crossvilleinc.com](https://www.crossvilleinc.com) for a video detailing the walk in process
See page 18 for the walk in process diagram.

FIG. 30



FIG. 31



FIG. 32



FIG. 34



FIG. 33



5. INSTALLATION PROCESS

5.9 Application of the Tile Panel to the Substrate (cont'd)

Coverage Video - www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel

- **FLOORS:** When installing multiple tile panels, lippage control straps and caps are required to minimize lippage between tile panel edges. The lippage control systems are designed only to fine tune lippage between tile edges, the main alignment of tile edges should be accomplished through proper mortar application and embedding techniques. After the **first** tile panel has been installed and the mortar has been spread for the second tile panel, place the straps uniformly along the edge of the **first** tile panel (two inches from the corner and approximately every 10 inches along the length). **DO NOT** move the strap once in place, as this will create a void under the tile. **DO NOT** apply the lippage control caps at this time. Once the second tile panel is in place and the same embedding procedure described above is accomplished insert the appropriate grout spacers and lippage control caps and then cinch down the lippage control caps tightly to bring adjoining tile edges into alignment. (fig. 34 & 37)
- **FLOORS:** Using a high-speed sander with pad, work along the edges of the tile panel and between each of the lippage control straps and caps, some additional tightening of the caps may be necessary. The combined use of a sander and cap tightening effectively increases mortar coverage along the vulnerable edge of the tile panel while at the same time minimizing edge lippage. (fig. 34)
- **FLOORS:** Due to room configuration or job size it will be necessary to work **ON** freshly installed tile panels. When doing so, the use of a large piece of masonite or double walled heavy cardboard works well to protect the face of the tile from tool damage or ground in construction dirt, as well as disperse concentrated weight. Freshly set tiles should not be walked on after 60 minutes. This is to ensure that the bonding mortar is not compromised as it begins to cure.
- **WALLS & FLOORS:** When cleaning excess mortar from the substrate make sure to leave the gaps open at the edge of the tile panel by cutting the mortar down and pulling away from the tile edges in a parallel direction to the ridges. This will facilitate further removal of air and collapse of the mortar ridges during the embedding procedures.
- **WALLS & FLOORS:** Remove excess mortar from the tile panel's surface and "clean-out" between the joints to the full depth (1/8" or 1/4") of the tile panel while mortar is still fresh, this will insure an adequate amount of grout to fill the joint. **Take extra time and be thorough on this step.**
- **WALLS & FLOORS:** Lippage control systems that allow for removal and replacement of the cap (after bringing the tiles into alignment) will allow for effective removal of excess mortar around the strap while the mortar is still fresh. **DO NOT** move the strap once in place, as this will create a void under the tile. After completing the removal of excess mortar, replace the caps on the straps and retighten to ensure

FIG. 35



FIG. 36



FIG. 37



complete alignment of the tile edges. **This will reduce the possibility of damage to the tile the following day when clearing the grout joint of cured mortar.**

Video at: www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel

- **WALLS & FLOORS:** For ending a day's work that will continue the next day, the most crucial step is to make sure the last tile panel is fully embedded and is checked with a straight edge for flatness/squareness across the surface before leaving it to cure. Consult the lippage control device manufacturer for their procedure of how to address ending one day's work that will tie a cured tile panel into a new tile panel the next day.
- Grout application times can vary from 24 hours to 72 hours; refer to specific guidelines from the grout manufacturer.

5. INSTALLATION PROCESS

5.10 Grouting

WALLS

- Crossville has found that there are many lippage control systems available. For timing and method/timing of removal refer to lippage control system manufacturer's requirements.
- 2mm to 3mm grout joint size is recommended.
- All grout types or appropriate caulking material are also acceptable for wall installations. See Selection Guide, page 17.
- Install and clean per manufacturer's instructions.

FLOORS

- **Polished finishes require a penetrating sealer (impregnator) prior to grouting.**
- Crossville has found that there are many lippage control systems available. For timing and method/timing of removal refer to lippage control system manufacturer's requirements.
- Use a minimum of 3mm (1/8") grout joint size. The edges of the porcelain tile panels are not eased or beveled, making them susceptible to damage from heavy rolling loads and impact. Full and flush movement joints and grout joints should be specified to minimize edge impact.
- For residential and light commercial applications the use of sanded grout is acceptable. For heavy rolling load applications epoxy grout is recommended to protect the edges from impact.
- Setting mortars and their recommended cure times can vary significantly from 72 hours to 7 days. Therefore it is critical to refer to the specific mortar manufacturer's requirements for opening the floor to foot traffic.
- Install and clean per manufacturer's instructions.

5.11 Edge Treatments and Profiles

To complete and finish the installation, profiles for corners, deco-bands, edges, and movement joints are available from quality suppliers such as Blanke, Schluter, or Profilitec (fig. 38-40).

- 3+: 6.0-8.0 mm profiles recommended
- 5.6mm or 5+: 8.0-10.0 mm profiles recommended
 - Follow manufacturer's instruction for placement/insertion of profiles into the tile work. Ensure that supporting mortar is present at the edge of the tile.
- For other edge finishing techniques see (fig. 41-42)

See page 7 for information on movement joints.

FIG. 38



FIG. 39

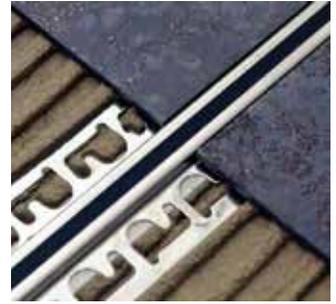


FIG. 40



3+, 5+ and 5.6mm Using Profiles

FIG. 41



5.6mm or 5+ Field Applied Bullnose

FIG. 42



5.6mm or 5+ Back Mitered & Epoxied

5. INSTALLATION PROCESS

5.12 Critical Review Points

- Proper fork length (84") for handling crates from the end.
- Review list and knowledge of tools.
- Prior to applying mortar, make sure to clean the back of the tile and the substrate to remove any dust or other contaminants.
- Coverage: use mortar manufacturer's recommended mortar mix ratio, directional troweling perpendicular to the long edge of the tile panel, embedding techniques.
- Maximize edge coverage and minimize lippage: lippage control systems, high speed sander along the perimeter edge & between the lippage control straps.
- Using the tools and best practices to minimize lippage between tiles to 1/64" (0.4mm) or less will greatly increase the finished installations ability to withstand the rolling loads used in most commercial applications.
- Using grouting techniques that insure the grout joint remains full and flush will also aid in the finished installation's ability to withstand edge impact. Particularly with epoxy grouts, use a new epoxy float with unworn sharp edges. Use steady pressure to overfill the joint and force epoxy grout into any remaining voids beneath the tile panel edge. For installations subjected to heavy/hard rubber wheeled rolling loads, the use of prefabricated commercial grade movement joints is recommended.

6. CARE AND MAINTENANCE

6.1 Initial Care and Maintenance

The single-most important step for future daily maintenance involves the complete removal of grout film/residue and construction dirt after the Crossville porcelain tile panel products have been installed. Refer to the grout manufacturer's printed instructions for proper mixing, curing, and cleaning instructions. These are critical when working with epoxy grouts.

In most cases, Crossville porcelain tile panels can be cleaned successfully by scrubbing the installation with hot water and a neutral detergent, followed by a thorough rinsing.

For further details and specific recommendations please refer to Crossville's Care and Maintenance Guide at crossvilleinc.com or call Crossville Technical Services at 931-484-2110.

7. TECHNICAL PERFORMANCE

7.1 Product Standard

Both 3+, 5+ and 5.6mm comply with ANSI 137.3-2017 product standard for gauged porcelain tiles and gauged porcelain tile panels/slabs.

7.2 Product Specifications

PHYSICAL AND CHEMICAL PROPERTIES	NORM TEST METHOD	3+, 5+ and 5.6mm
Size	Laminam	Maximum deviation on the side +/- 0.5 mm
Size	Laminam	Maximum deviation on the diagonal +/- 1.0 mm
Weight kg/m ²	Laminam	3+ Average value 8.2 5.6mm Average Value 14
Surface Quality (% Of Tiles With No Visible Flaws)	ISO 10545-2	> 95%
Water Absorption	ASTM C373	Average value ≤ 0.1%
Breaking Load In Newtons	ISO 10545-4	3+ Average value 700 5.6mm and 5+ Average Value 1100
Bending Strength In N/mm ² (MOR)	ISO 10545-4	3+ Average value 50 5.6mm and 5+ Average Value 50
MOHS Scale of Hardness	UNI EN 101	≥ 6
Resistance To Deep Abrasion	ISO 10545-6	≤ 175 mm ³
Coefficient Of Linear Thermal Expansion (10-6/°C)	ISO 10545-8	6.6
Resistance To Thermal Shock	ISO 10545-9	Resistant
Chemical Resistance	ISO 10545-13	No visible effect
Stain Resistance	ISO 10545-14	Class 5
Frost Resistance	ISO 10545-12	Resistant
Flame Spread and Smoke Development	ASTM E84-12a.	Flame Spread = 0 Smoke Develop = 15

8. MORTAR AND GROUT SELECTION GUIDE

* Consult mortar manufacturer for appropriate mix ratios for use with porcelain tile panels and for the proper mortar for specific applications.

See Crossvilleinc.com for more membrane recommendations

8.1 Manufacturer's Product Information

Manufacturer	Surface Preparation	Adhesive Systems Floors and Walls*	Grout Systems Floors and Walls	Caulks-Sealants	Crack Isolation Membranes
Ardex 888-512-7339	P4 Multipurpose primer (tile over tile) P51 & P82 primer Liquid BackerBoard AM 100	ARDEX X77 (Walls) (E90 Additive required for 3+) ARDEX S28 (Floors/Walls) ARDEX X78 (Floors)	ARDEX FL ARDEX WA Epoxy	ARDEX SX 100% Silicone	ARDEX 8+9
Blanke 800-787-5055		Tested with Laticrete 254 Platinum	Tested with Laticrete Spectralock Pro Premium Grout		Blanke Permat
BOSTIK 800-726-7845	Universal Primer Pro Bostik SL 100 or SL 175 Webcrete 95 UltraFinish Pro	Reflex Mortar Big Tile & Stone Mortar BAM Bosti-Set (Interior Walls) http://www.bostik.com/us/bosti-set/	EzPoxy EzClean Ceramic Tile Grout with 1900 Modified Epoxy Admix	Pure Silicone Caulk Chem Calk 955SL 915FS	Ultraset Advanced Gold Plus
Custom 800-272-8786 CustomTech	Skim Coat & Patch Underlayment LevelQuik Advanced Acrylic Primer LevelQuik RS Self Leveling Underlayment SpeedSlope - Rapid Setting Sloping Mortar SILK Patching & Finishing compound TechPrime A Acrylic Primer TechLevel 150 Self-Leveling Underlayment MBP Multi-Surface Bonding Primer (tile over tile)	ProLite Premium Large Format Tile Mortar (5.6mm) MegaLite Crack Prevention Large Format Tile Mortar (3+, 5+ and 5.6mm)	Polyblend Plus Prism Ultimate Performance Grout CEG-Lite Epoxy Grout	100% Silicone Sealant	RedGard RedGard SpeedCoat Custom 9240
LATICRETE 800-243-4788 x235	Laticrete 3701 Fortified Mortar Bed Laticrete NXT Plus with NXT Primer Laticrete NXT Patch Laticrete NXT Skim Laticrete Prime N Bond	Laticrete 254 Platinum Laticrete 4-XLT Laticrete 257 Titanium Laticrete Tri-Lite Laticrete MultiMax LITE	Laticrete Permacolor Grout Laticrete Permacolor Select Grout Laticrete Spectralock PRO Premium Grout	Laticrete Latasil 100% Silicone	Hydro Ban
Mapei 800-992-6273	ECO Prim Grip (tile over tile) Ultraplan M-20 Plus, Primer T Mapecem Quickpatch Ultraplan 1 Plus, Primer T Novaplan HFL, Primer T Planislope RS Planitop 330 Fast	Kerabond T/Keralastic UltraFlex LFT Keraflex Super Ultrabond ECO GPT (interior walls)	Ultracolor Plus FA Kerapoxy CQ Flexcolor CQ	Mapesil T Plus 100% Silicone Sealant	Mapelastc CI Mapelastc Aqua-Defense Mapelastc Turbo
TEC 800-832-9023	TEC Multipurpose Primer Level Set 200 Self-Leveling Underlayment Level Set 400 HF Self-Leveling Underlayment Level Set 500 HF Self-Leveling Underlayment VersaPatch Latex Modified Floor Patch and Leveler Fast Set Deep Patch	Ultimate 6 Plus TotalFlex 150 TotalFlex XMS Tile Adhesive (Interior & Exterior Walls)	Power Grout AccuColor EFX Epoxy Grout	AccuColor 100 100% Silicone Sealant	HydraFlex Waterproofing Crack Isolation Membrane

9. EXTERIOR DIRECT BOND GUIDLINES Recommended Project Requirements/Specifications

Crossville® – Exterior Surfaces Field Applied Direct Bond Method

3+, 5+ or 5.6 mm

The use of full size tile panels (1Mx3M) for ground floor installations is acceptable. For installations higher than ground floor, Crossville recommends the tile size is limited to 1.5 square meters or, at most, 39-3/8" x 59-1/16" half panels, due to logistics, open air environments, mortar/ installation limitations, as well as potential building code limitations.

FILO is not recommended in exterior applications

9.1 Code compliance and approval of building authorities

Secure documentation/approval from building authority that the project complies with the provisions of the IBC (International Building Code), local code or authorities having jurisdiction.

A: Crossville® 3+ porcelain tile panels are 3 millimeters thick, with an added layer of fiberglass mesh for increased strength and flexibility. Crossville 5.6 porcelain tile panels are 5.6 mm thick with no additional fiberglass layer (5+ with mesh). 3+, 5+ and 5.6mm are suitable for exterior direct bond applications if the project is in compliance with the International Building Code.

B: International Building Code Current Language

2009 IBC states a size limitation for exterior adhered veneers of 5 square feet with no side over 36 inches.

2012/2015 IBC (Chapter 14- Section 1405.10.2) requires that exterior adhered porcelain tile be a maximum of 24 inches in any face dimension and not more than 3 square feet in total facial area. In addition, Table 1405.2 states a minimum thickness of weather coverings (in this case porcelain tile) of ¼ inch or 6.35 mm.

2018 IBC (Chapter 14- Section 1405.10.2) requires that exterior adhered porcelain tile be a maximum of 24 inches in any face dimension and not more than 3 square feet in total facial area. In addition, Table 1405.2 states a minimum thickness of weather coverings (in this case porcelain tile) of ¼ inch or 6.35 mm.

2021 IBC (Section 1404.10.2) Exterior adhered masonry veneers-porcelain tile. - Adhered units weighing more than 3.5 pounds per square foot (0.17 kN/m²) shall not exceed 48 inches (1219 mm) in any face dimension nor more than 9 square feet (0.8 m²) in total face area and shall not weigh more than 6 pounds per square foot (0.29 kN/m²). Adhered units weighing less than or equal to 3.5 pounds per square foot (0.17 kN/m²) shall not exceed 72 inches (1829 mm) in any face dimension nor more than 17.5 square feet (1.6 m²) in total face area. Porcelain tile shall be adhered to an approved backing system. Table 1404.2 states a minimum thickness of weather coverings (in this case porcelain tile) of 1/8 inch or 3.175 mm.

C: If the project design does not meet these requirements, then the project owner, architect, or engineer should seek local code

approval for the use of a larger format porcelain tile finish material for the exterior veneer.

Section [A] 104.11 of IBC contains the generic language for obtaining this type of approval by the local building official for alternative materials. The provisions of the code are not intended to prevent the installation of any material or prohibit any design or method of construction not specifically prescribed by this code. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

9.2 Installation Methods

Movement Joints: Installation of 3+, 5 and 5.6mm on exterior walls will be in accordance with the applicable Tile Council of North America (TCNA) Handbook exterior wall details and the ANSI A108.20 installation standard. Movement joints shall be in compliance with EJ-171 of the current TCNA Handbook. While the size and interval of movement joints must be in accordance with the TCNA guidelines and specified by the architectural/ engineering authority with strict attention to the environmental demands of the project, at a minimum Crossville recommends that all joints be at least 3/16 inch and all joints treated as soft joints (no hard grouting materials in any joint)*. It is crucial that each project is evaluated individually and the architectural/ engineering authority as well as the setting material manufacturer is consulted for proper recommendations specific to the project. Crossville porcelain panels have similar expansion and contraction characteristics when compared to traditional thickness porcelain tile, their reduced thickness means that they will reach maximum thermal gain and cycle through expansion/ contraction more rapidly than a traditional thickness tile. For this reason, proper movement accommodation is extremely critical for success of the installation.

* **Note:** Joint width calculations were done using a coefficient of thermal expansion of 6.5×10^{-6} in/in/°C for the tiles and installation of a class 25 sealant material at 70°F, using a high temperature of 190°F and a low temperature of -30°F. This is assuming a maximum side length of 59-1/16" is used. If larger pieces are utilized a wider joint such as ¼ inch should be considered.

Cap Flashing: The elimination of water intrusion into the bond coat is extremely critical for success of any exterior applied veneer. Proper detailing of capping and/or flashing at the roof line, at the top of the exposed tile layer, and other appropriate openings requiring flashing is necessary. If not properly detailed, specified, and installed, efflorescence, latex leaching, and freeze thaw damage can occur.

Ensure the architect/engineer is aware of these statements and that movement joint/grout joint detail and cap flashing language is provided in the specification.

9.3 Selection of Setting Material Company

Only setting material companies with specific installation guidelines for exterior direct bond wall applications using porcelain tile panels should be considered. Ensure that the setting material company specified can provide products and installation specifications for exterior vertical application of 3+, 5+, and 5.6 mm porcelain tile panels. A list of setting material companies with experience in this application are identified in Section 8

Ensure the project architect/engineer has knowledge of the setting materials being used, and that those setting materials are specifically recommended for exterior vertical applications of porcelain tile panels. A pre-construction meeting and mock-up of appropriate scale is strongly recommended to be in the project specification.

9.4 Technical Guide

Provide this Technical Guide and for interior installations, ANSI A108.20 to the project architect/engineer and recommend the specification of the installation instructions for 3+, 5+ or 5.6mm mm that are contained in the Crossville® Porcelain Panel Technical Guide.

Language to be in the specification that references the Technical Guide and ANSI A108.20.

9.5 Qualified Labor

Crossville® Porcelain Panels have great potential in exterior vertical applications: its lightweight nature and aesthetic qualities make a great material for cladding. However, the potential for failure in outdoor environments is greatly increased when qualified labor is not utilized. Due to the unique material characteristics and unconventional installation techniques required of gauged porcelain tiles and gauged porcelain tile panels/slabs, this work requires installers who are equipped with the proper tools and have acquired sufficient product knowledge, training, and installation experience through the completion of an Installer Qualification Program.

Installer Qualification Programs

- Installer certified by Advanced Certification for Tile Installers (ACT) program for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.
- Installer completion of a comprehensive installation program (See details in informative appendix C) provided by the manufacturer of gauged porcelain tiles or gauged porcelain tile panels/slabs or setting materials for gauged porcelain tiles and gauged porcelain tile panels/slabs.
- Installer completion of a comprehensive installation program provided by the International Masonry Institute (IMI) tile layer programs or the National Tile Contractors Association (NTCA)

Informative Note: Requirements for installer qualifications shall be listed in the Tiling specification section, PART 1, QUALITY ASSURANCE. Documentation of compliance with required installer qualification criteria shall be required in the Tiling specification section, PART 1, INFORMATION SUBMITTALS.

Find a list of Trained Contractors at: Crossvilleinc.com

In addition these listings are available within Section 4.9 of this guide and in section 1.5 of the Porcelain Tile Panel Guide Specification:

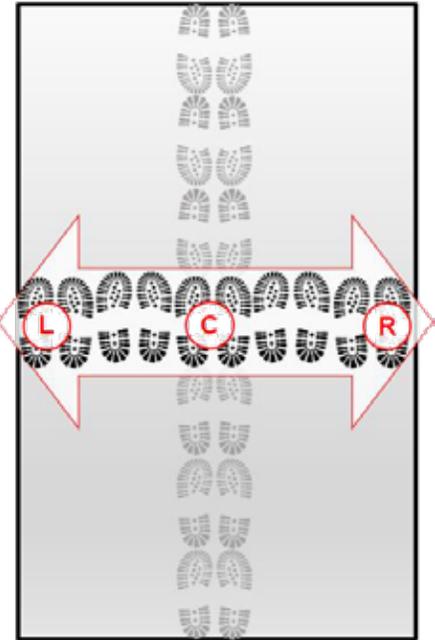
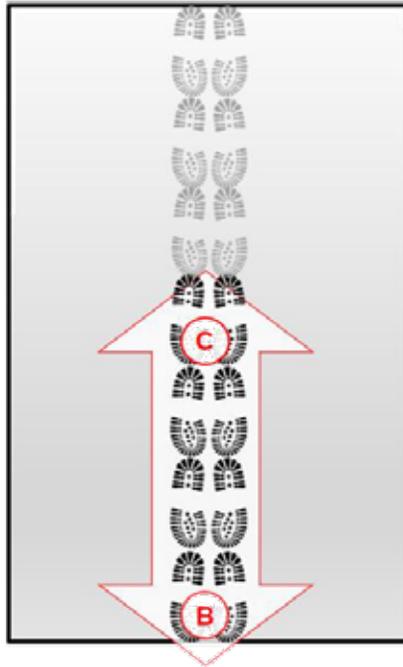
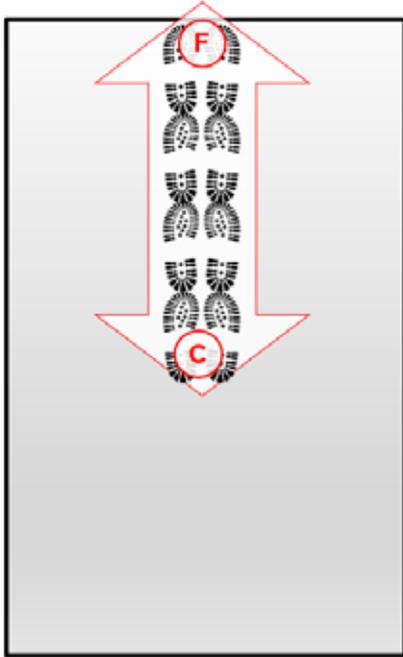
<https://www.crossvilleinc.com/Resources/Tile-101/Porcelain-Tile-Panel>

Language to be in the specification that references the labor qualifications outlined in ANSI A108.20 section 10.

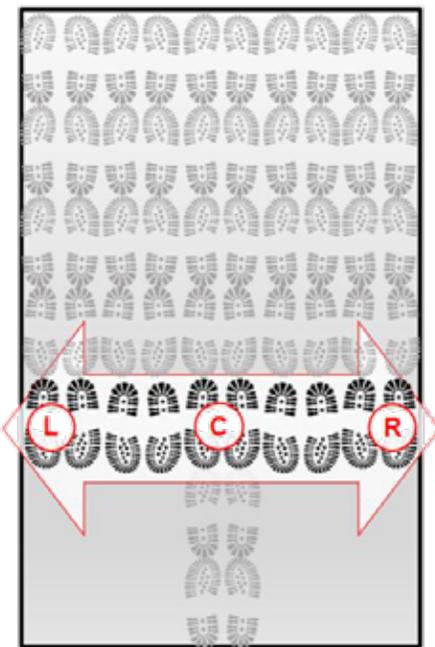
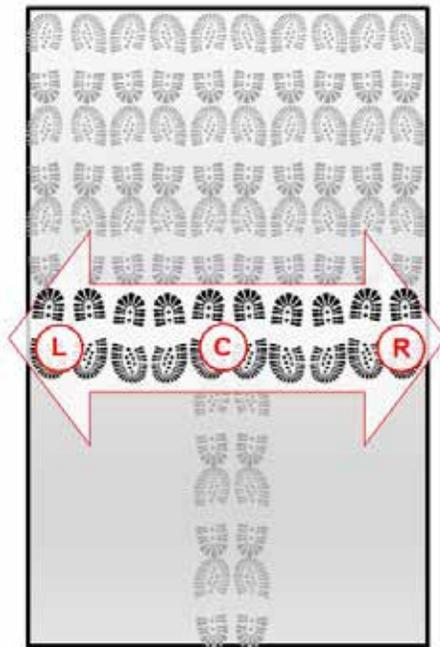
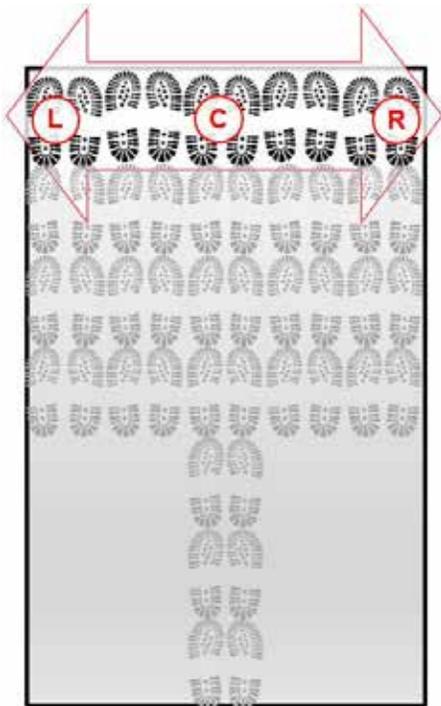
The foregoing suggested project requirements and/or specifications are offered as guidelines only. Each project has its own unique characteristics and requirements, and the project's architect/engineer and design professionals must determine the appropriate requirements and specifications in each instance.

Crossville makes no warranties or representations regarding the applicability of the foregoing guidelines to any given project, and assumes no liability for and shall not be responsible for the use or failure to use these guidelines.

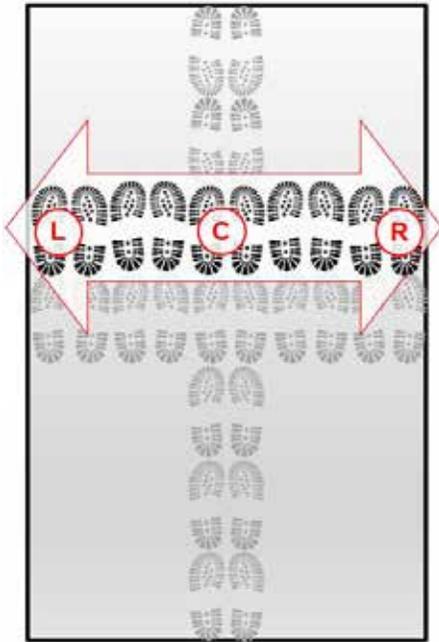
10. WALK IN PROCESS DIAGRAM



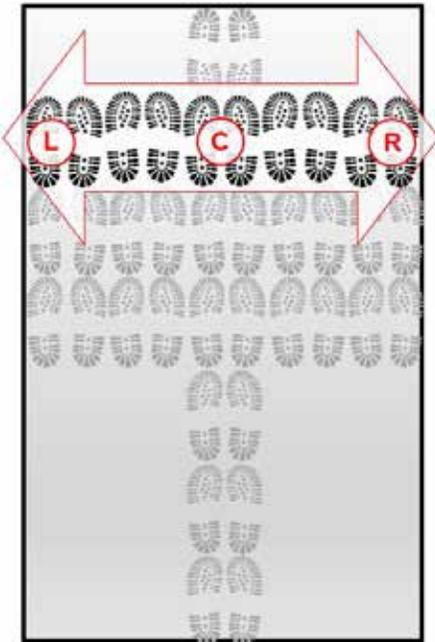
1. **C** (center) to **F** (front) to **C** (center). 2. **C** (center) to **B** (back) to **C** center. 3. **C** (center) to **L** (left) to **R** (right) to **C** (center).
 Do not step off of tile.



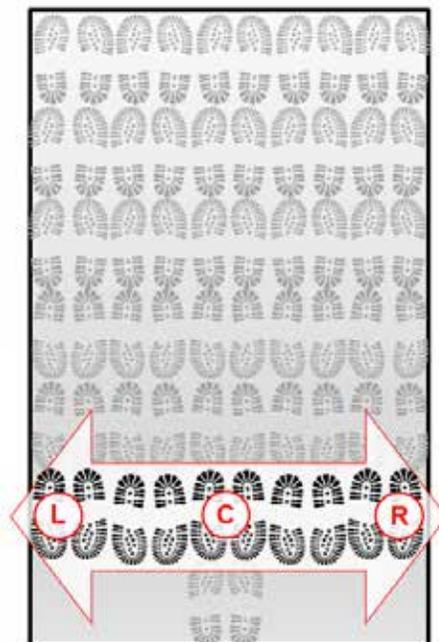
6. **C** (center) to **L** (left) to **R** (right) to **C** (center).
 Do not step off of tile.
7. **C** (center) to **L** (left) to **R** (right) to **C** (center).
 Do not step off of tile.
8. **C** (center) to **L** (left) to **R** (right) to **C** (center).
 Do not step off of tile.



4. **C** (center) to **L** (left) to **R** (right) to **C** (center).
Do not step off of tile.



5. **C** (center) to **L** (left) to **R** (right) to **C** (center).
Do not step off of tile.



9. **C** (center) to **L** (left) to **R** (right) to **C** (center).
Do not step off of tile.



10. **C** (center) to **L** (left) to **R** (right) to **C** (center).
Do not step off of tile.

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