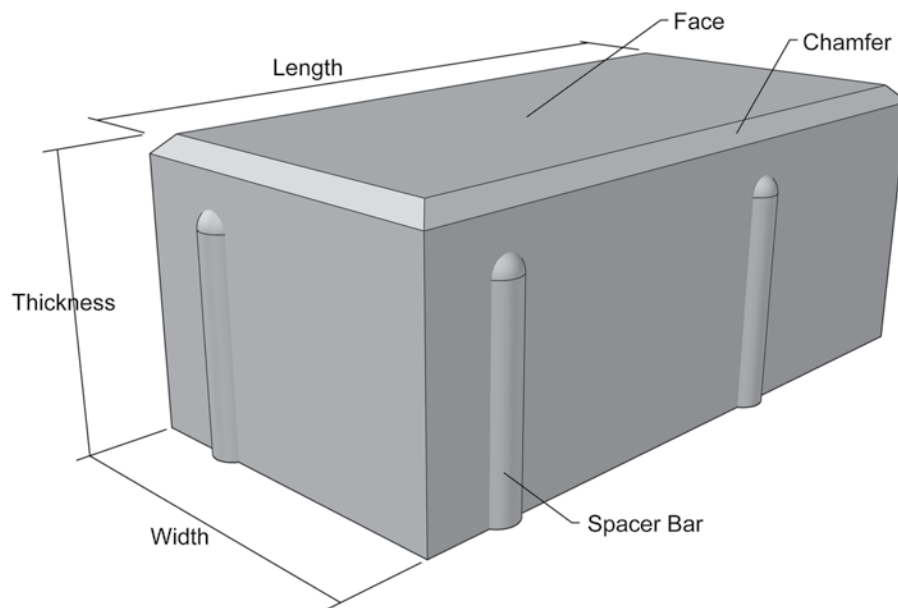


# SECTION 8: Selection and Installation of Concrete Pavers

## Section 8 Part A: Selecting Pavers for Various Applications

As a rule, interlock among pavers used for pedestrian areas and residential driveways is achieved with 2 3/8 in. (60 mm) thick units. For vehicular pavements including streets, industrial port and airport pavements, 3 1/8 in. (80 mm) thick pavers are used since loads are higher. Herringbone laying patterns should be used in these pavements, as they offer greater resistance to horizontal “creep” from turning, braking, and accelerating tires.



Some pavers have chamfers around the perimeter of the face. The main purpose of a chamfer is to reduce the potential for chipping of the paver face during shipment. Chamfers also aid in the drainage of water from the pavement surface. Spacer bars, included on some pavers, help to maintain a minimum space between pavers so that sand can be placed into the joints.

### Concrete Paver Standards

There are two paver standards in North America, one for Canada and one for the U.S. The Canadian standard is published by the Canadian Standards Association (CSA). It is called CSA-A231.2 Precast Concrete Pavers. The standard requires that units have an average minimum compressive strength of 7,200 psi (50 MPa) based on testing a cube or core cut from them. Meeting dimensional tolerances for the

length, width and height of each unit are also required. Dimensions for length, width and thickness are agreed upon by supplier and purchaser. Tolerances for these dimensions are  $\pm 2$  mm for length and width and  $\pm 3$  mm for the height.

The CSA standard has a rigorous freeze-thaw deicing salt durability test. Units are completely immersed in a 3% saline solution and placed through 49 freeze-thaw cycles. The units must not lose more than 500 grams/m<sup>2</sup> of total surface area after 49 cycles. If the pavers lose less than 225 grams/m<sup>2</sup> after 28 cycles, they have then met the standard without continuing to 49 cycles.

The paver standard used in the U.S. is published by the American Society for Testing and Materials (ASTM). It is called ASTM C 936, Standard Specification for Solid Concrete Interlocking Paving Units. This standard requires a minimum average compressive strength of 8,000 psi (55 MPa) from a whole or half paver, maximum average water absorption of 5%, conformance to freeze-thaw in tap water (no salts) and abrasion durability tests. Like the CSA standard, dimensional tolerances are required in ASTM C 936 as well. These are  $\pm 1/16$  in. (1.6 mm) for length and width and  $\pm 1/8$  in. (3.2 mm) for the height.

The manufacturer can provide copies of the CSA or ASTM standards and test results from an independent testing laboratory. The results should verify that their concrete pavers meet the standards that pertain to the respective country. Test results should be requested at least annually.

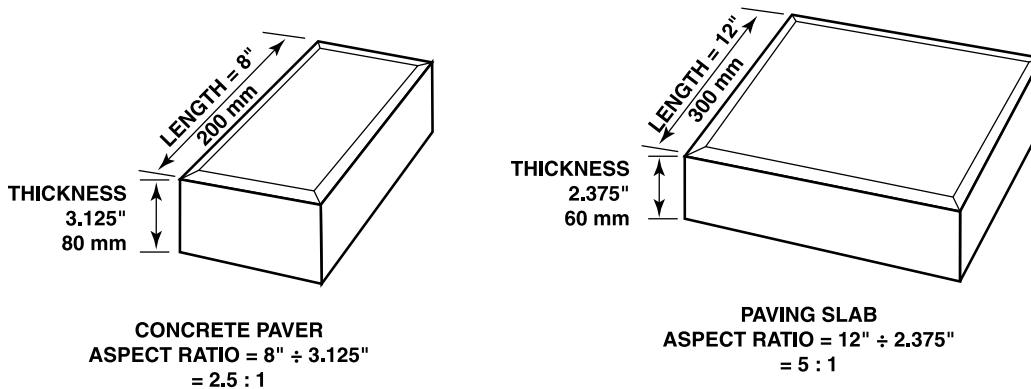
## Section 8 Part B: Aspect Ratio and Its Effect on Applications

There are many shapes and sizes of concrete unit paving available. They generally fall into two categories, interlocking concrete pavers and concrete paving slabs. Contractors should be aware of some principles that distinguish one product group from the other. These principles can help guide product selection and installation.

The rule of thumb for selecting the right size units for pedestrian and vehicular application depends on two important ratios. One is the ratio of overall length to width, or plan ratio. If it is roughly between 2:1 and 3:1, the unit generally can be placed in an interlocking pattern. Interlocking patterns have proven to provide greater stability and structural support than other laying patterns when subjected to vehicular traffic.

Plan Ratio		Pedestrian Loads	Vehicular Loads
less than 2:1	Reduced interlock	✓	
2:1 up to 3:1	Effective interlock, structural support	✓	✓
more than 3:1	Reduced structural support	✓	

The other important ratio is the overall length of a unit to its thickness, or aspect ratio. When this ratio exceeds 4:1, units should not be used in streets and parking lots. Pavers having ratios between 3:1 and 4:1 generally can be used in residential drives. Figure 8-1 illustrates these differences.



**Figure 8-1: Aspect Ratio = Length ÷ Thickness**

Units with length to thickness aspect ratios between 3:1 and 4:1 are generally not subject to flexing and cracking under vehicular loads. Those with an aspect ratio of 3:1 can be used in all vehicular applications. For example, pavers 4 in. by 8

in. by 3 1/8 in. (100 mm wide by 200 mm long by 80 mm thick) rectangular pavers have an aspect ratio of 200: 80 or 2.5:1. This makes them suitable for streets.

Aspect Ratio		Pedestrian Load	Residential Driveways Loads	Vehicular Loads
4:1 or more	Reduced rotational and vertical interlock	✓		
between 3:1 and 4:1		✓	✓	
3:1 or less	Higher rotational and vertical interlock	✓	✓	✓

In U.S. and Canadian product standards for concrete pavers, a concrete paver is defined as having a maximum aspect ratio of 4:1, and a minimum thickness of 2 3/8 in. (60 mm). In addition to aspect ratio and thickness, both standards have maximum surface area requirements. The U.S. standard requires the maximum surface area less than or equal to 100.25 in.<sup>2</sup> (0.065 m<sup>2</sup>) and the Canadian standard requires the maximum surface area to be less than or equal to 144 in.<sup>2</sup> (0.090 m<sup>2</sup>).

The definitions do not include larger *paving slabs*. Generally they have an aspect ratio greater than 4:1, a minimum thickness of 2 in. (50 mm) and surface areas greater than those defined in the above paver standards. Slabs are also incorrectly called concrete pavers. They will be referred to as paving slabs in this course. These range in a variety of sizes larger than 10 in. x 10 in. (250 mm x 250 mm). These range in a variety of sizes larger than 10 in. x 10 in. (250 mm x 250 mm), depending on the thickness and resulting aspect ratio.

Users tend to confuse interlocking concrete pavers with paving slabs as being appropriate for the same applications. They are not. The thinner, larger paving slabs are not suited for vehicular traffic because they may flex and crack from loads. Interlocking concrete pavers, however, can be used in either vehicular or pedestrian applications.

Interlocking concrete pavers contribute greater structural bearing and load spreading capacity than thinner paving slabs. When properly installed, interlocking concrete pavers are tightly fitted together with sand filled joints. The sand transfers loads to surrounding units, reducing the load on the compacted aggregate base and soil subgrade.

Interlocking concrete pavers have more vertical area on their sides to “lock up” and distribute loads to their neighbors. Paving slabs, however, have less vertical surface for interlock and spreading loads (unless they are very thick). They rely on their larger horizontal area to spread loads. Interlock is incidental to their structural performance and load bearing capacity, whereas, with interlocking concrete pavers, interlock is critical to them.

The larger paving slabs are generally not compacted into bedding sand, since the slabs may crack under the force of the plate compactor. In many cases the bedding sand is screeded smooth and compacted prior to placing the larger slabs. The joints, usually 1/16 in. to 1/8 in. (2–3 mm) wide, are then filled with sand.

As discussed in a previous section, pre-compaction of the bedding sand is not necessary, even detrimental to interlocking concrete pavers achieving interlock. Since interlock is not a factor in the load spreading of paving slabs, the bedding sand may be pre-compacted. However, the same guidelines for bedding sand under concrete pavers apply to sand under paving slabs. The thickness should be nominal 1 in. (25 mm), maintained as consistently as possible, and not be used to compensate for depressions in the surface of the base.

To summarize, concrete pavers and concrete paving slabs are two different products. They are installed differently and they spread applied loads differently. Therefore, care in product selection and installation will save potential problems after the job is done.



## Section 8 Part C: Paver Installation

### Maintaining Consistent Joints with the Click and Drop Method

Consistent joint widths contribute to spreading loads evenly as they are applied to pavers. Tight joints (with sand in them) will spread loads better than wide ones. Consistent joint widths also give a neat and orderly visual appearance.

The easiest way to maintain joint consistency during paving is by the “click and drop” method. This method will create a consistent joint of about 1/16 in. to 1/8 in. (2–3 mm).

#### Procedure:

- While holding a paver, the bottom 1/4 in.–1/2 in. (7–13 mm) should click firmly against the top portion of the sides of the pavers already in the sand.
- Don't click the pavers on the sand so hard that they move.
- Release grip, dropping the paver an inch or so (25–30 mm) directly downward.

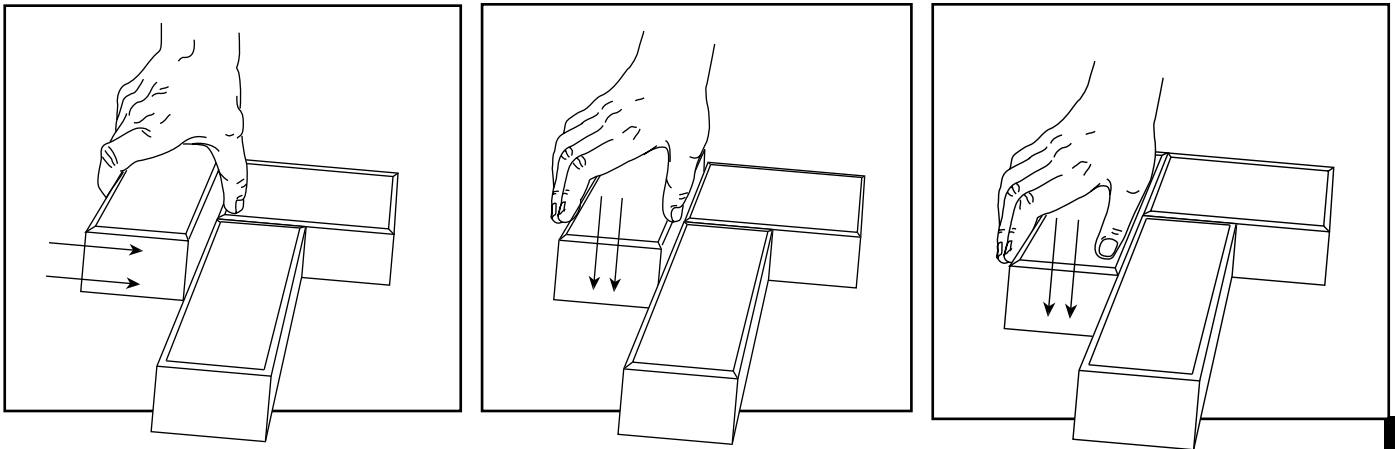


Figure 8-2: Click and drop

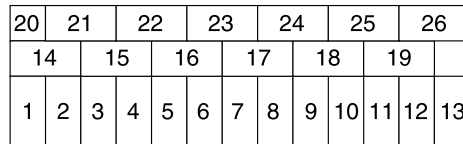
### Starting Laying Patterns

Starting the first few rows requires attention to the order of placing the units. This establishes the rhythm and pattern for the remaining courses. The order for starting runner, parquet, and herringbone patterns are illustrated when starting from a corner. Other shapes have variations in their order of placing. Manufacturer's literature will often show this.

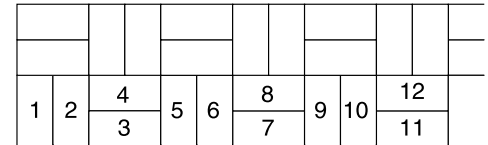
Pavers should be taken from different pallets and not from a single pallet or cube. Mixing the pavers ensures a blend of the colors. If there's only one color of pavers on the job, installing pavers from several pallets at the same time will hide slight variations in that color.

Many jobs will have the pavers start from the middle of the pavement. This may be done for several reasons. First, pavers may flow onto the site faster if

**Figure 8-3:**  
Starting  
Runner and  
Parquet  
patterns  
from corner.

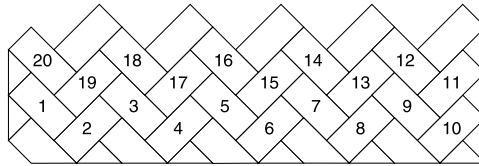


**Runner Pattern**

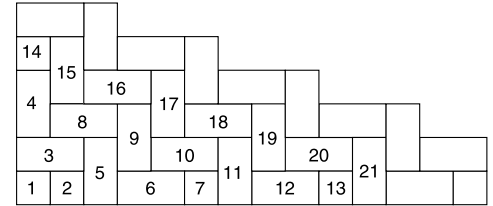


**Parquet Pattern**

**Figure 8-4:**  
Starting  
Herringbone  
patterns  
from corner.



**45° Herringbone Pattern**



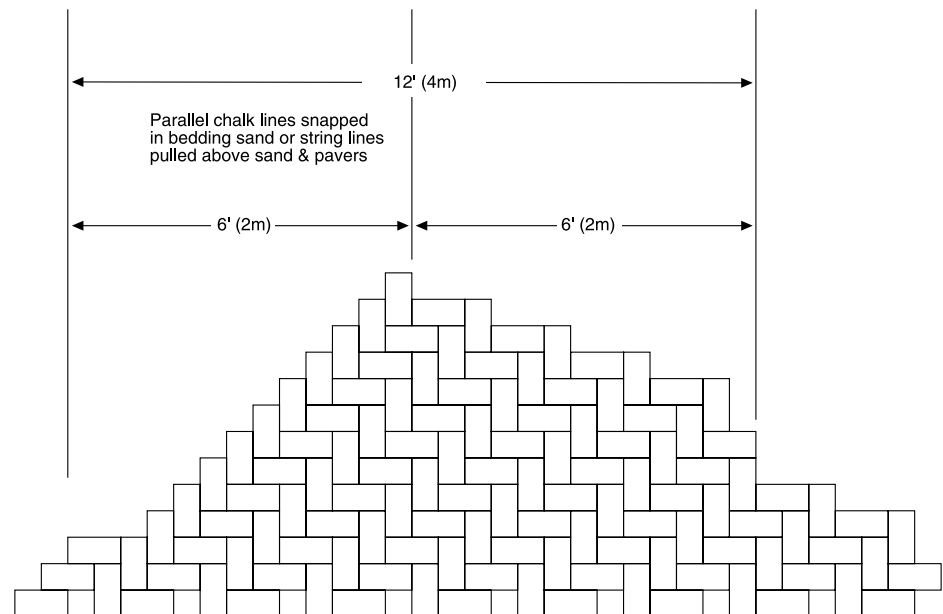
**90° Herringbone Pattern**

paving begins at the center of the pavement, rather than from a corner location. Second, by starting at the center, a wider laying face is possible. A wider laying face allows more people to place pavers. This can increase productivity. Third, cut units along the edges of the pavement will be practically the same size on both sides. Their symmetrical appearance is attractive on narrow pavements such as driveways and patios. It is not important on large areas where both sides of the pavement can't be viewed at the same time. Finally, starting at the middle of the pavement may be necessary because there may be no perpendicular corners from which to begin the laying patterns.

### Holding Straight Lines

Lines that are held straight will produce an impressive appearance and help maintain consistent joint widths. This is done by snapping lines with a chalk box and string every six to ten feet (2–3 m) down the length of the screeded sand. On most jobs, string lines are laid to keep the lines of the paver joints running straight.

**Figure 8-5:**  
Marking  
parallel lines  
and creating a  
pyramid-shaped  
laying face.





**Procedure:**

- Snap a string line on the screeded sand in the center of the area(s) to be placed.
- The line should be perpendicular to the laying face.
- Place pavers in the given laying pattern on both sides of the line.
- If additional lines are snapped, they should be parallel to each other. Check this by measuring the distances at the opposite ends of each line. They should be equal.
- If they are not parallel, they can be erased and snapped again.

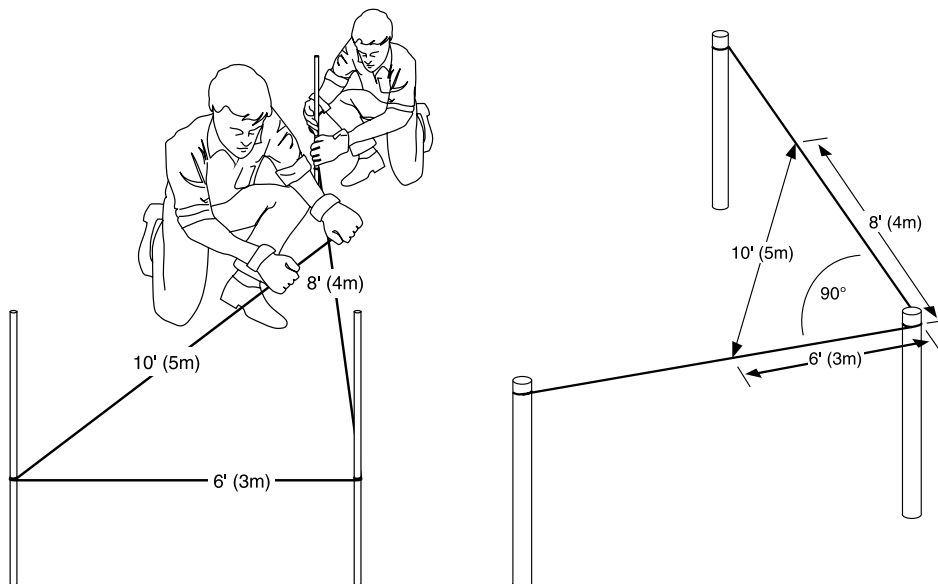
**Establishing Perpendicular Lines**

Another technique that helps in keeping joint lines straight with herringbone patterns is by building a pyramid-shaped laying face (See Figure 8-5). A string line is pulled, or line snapped, on the bedding sand. The line is perpendicular to the edge from which paving begins. The perpendicular line is the center of the pyramid. Paving begins with two installers, each one working on either side of this line. The pyramid takes shape as paving progresses. This method works well for paving open areas where there are no corners from building or curbs. The pyramid shape of the paved area has a longer laying face than one that is straight. Since this increases the length of the laying face, there is more room to work, and possibly more room for workers to place pavers.

Depending on the project, most string lines should be perpendicular to a starting line or edge restraint. However, in many jobs restraints are curved or not installed straight. In either case they don't make a perpendicular edge against which to lay pavers. A wall or corner that *appears* perpendicular may not be 90° square with the direction of the string lines and joint line of the pavers.

**Procedure:**

- Place one stake in the corner and another stake 10 ft (5 m) from the first stake along one edge of the corner to be squared. Tie a string tightly between these two stakes and place a mark on the line 6 ft (3 m) from the corner.



**Figure 8-6:** String lines may be used to check for squareness to the edges by using the 3-4-5 triangle. Once this right angle is established, string lines can be laid and pavers can be laid easily, especially when working from a corner. A right angle is laid out with a mason's line, stakes, and a measuring tape. Laying out a 3-4-5 angle requires two people.

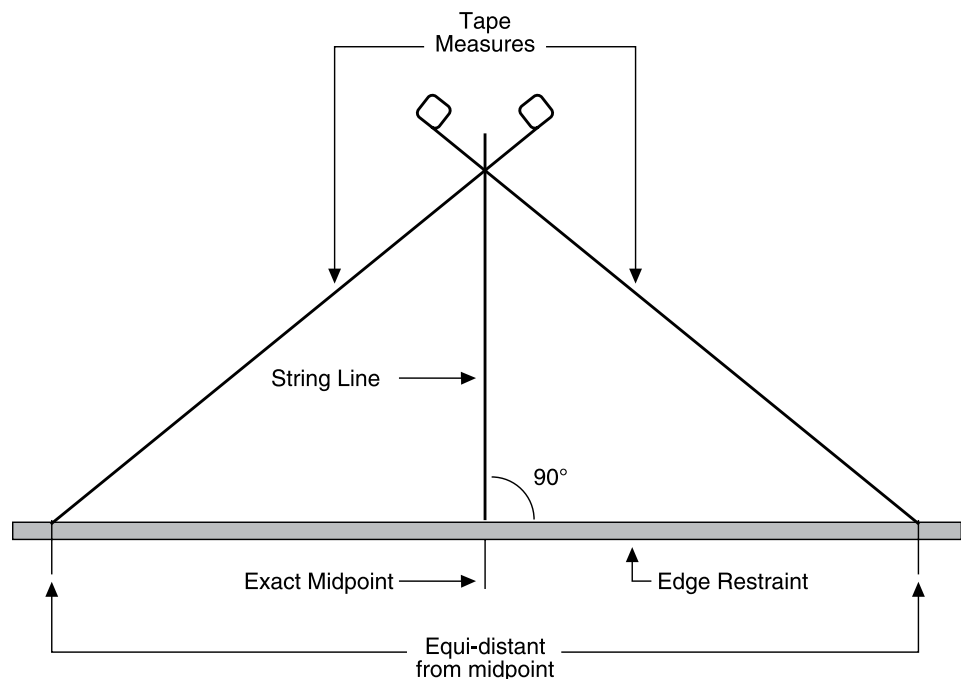
- Place another stake ten feet (5 m) from the corner stake along the other edge of the corner to be squared. Visually place this stake as close as possible to  $90^\circ$ . Tie a string tightly between these two stakes and place a mark on the line 8' from the corner.
- With a tape measure, measure between the 6 ft (3 m) mark and the 8 ft (4 m) mark. This measurement should be exactly 10 ft if the corner is square. If this measurement is not exactly 10 ft (5 m), move one of the edge lines until this diagonal measurement is exactly 10 ft (5 m). This indicates a  $90^\circ$  angle or a square corner.

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

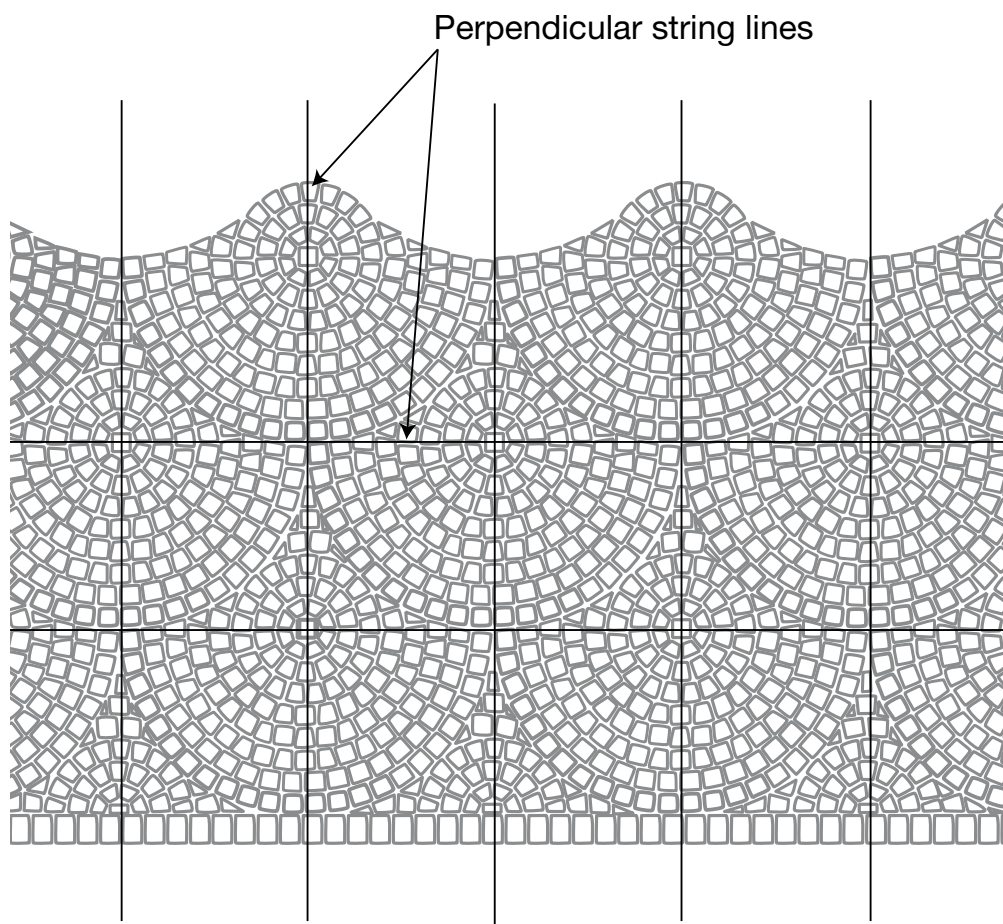
- Measure and mark the length of the edge, or line, from which paving will begin. The line can be 10–20 ft (3–7 m) long. This line is where an edge restraint will be placed, or where one already is placed.
- Mark exactly the half way point on the line that was just measured. In other words, divide the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

Figure 8-7 below illustrates this procedure.

**Figure 8-7:**  
Making a  
perpendicular  
line



**Circles and Fans**—The centers of circles and fans are established by laying string lines in both directions. A grid is established with the perpendicular lines. Each intersection string line represents the center paver for starting the fan or circle. A paver is placed at each and courses “radiate” from that center. Full circles are paved in all directions. Fans or arcs will radiate and touch adjacent fans at the same courses. This ensures that all fans are the same size. Figure 8-8 shows this procedure.



**Figure 8-8.** Perpendicular, evenly spaced string lines mark the center of circles for layout.



## Section 8 Part D: Paving Around Obstructions, Non-aligned Edges and Openings

Often string lines are needed to align the first row when edges are curved or not perpendicular to the direction of paving. This often occurs with poured curbs and building walls. Figures 8-9 and 8-10 show how to establish a straight starting line, square with the direction of paving.

### Procedure:

- Place square string or chalk lines at 90° angle.
- Lay a few square yards (m<sup>2</sup>) to these lines.
- Check the alignment with the strings.
- Straighten the pavers as needed, then continue.
- Fill the gaps against the uneven edge with cut pavers.

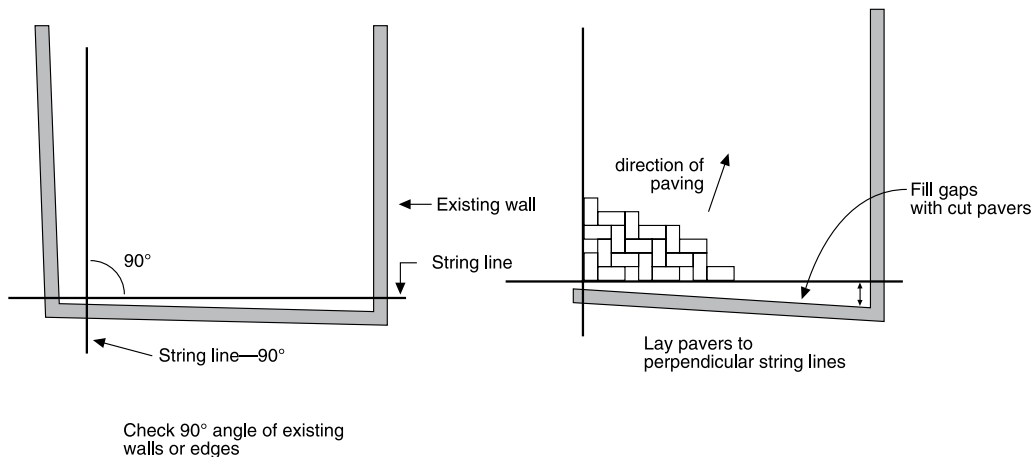


Figure 8-9: Squaring an uneven corner

Figure 8-10: Filling the corner

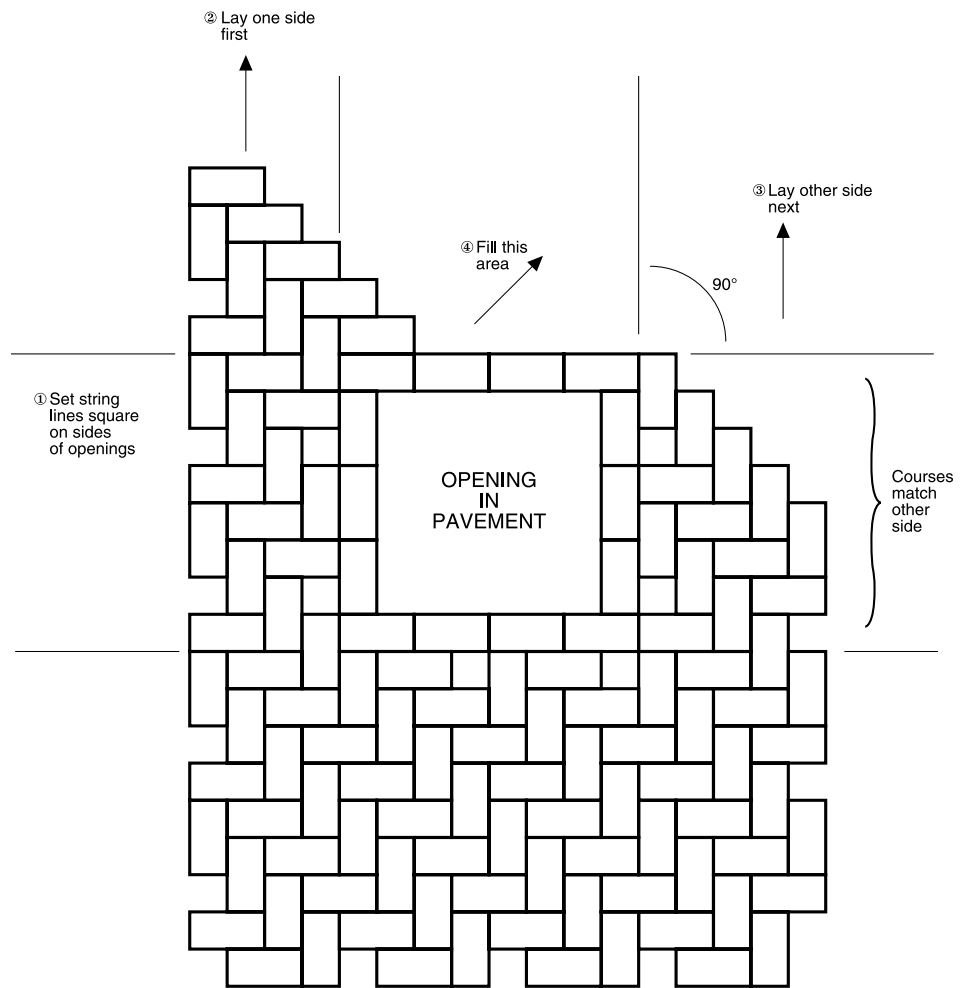
Pavers around openings are handled in a similar manner. Openings can be tree wells, utility structures, gardens and even swimming pools. There must be an adequate edge restraint in place around the opening against which to place the pavers. This is typically, plastic, steel, aluminum or concrete.

### Procedure:

- Pull perpendicular string or snap chalk lines on all four sides of the opening.
- Lay pavers on one side, then the other.
- Count the courses needed to surround the opening on each side. They should be equal in number on both sides.
- Then fill around the remaining side of the opening.
- Cut pavers to fit and fill against the edge restraints around the opening.

**Tip:** Place a border of full-sized pavers (soldier, string, or sailor course) against the edge restraint. This makes a neater appearance than placing cut pavers against the edge of the opening. See Figure 8-11.

**Figure 8-11:**  
Paving around  
an opening or  
obstruction



## Section 8 Part E: Cutting Equipment and Techniques

Most jobs with concrete pavers involve cutting. Pavers are typically cut along the edge of the pavement, around planters or drainage inlets, or when there is a change of pattern. Logos, or letters, can be cut and placed in a field of pavers. Contrasting colors can be used to highlight these areas.

There are three basic tools for cutting pavers. One is called a mechanical splitter, the second a powered masonry saw, and the third a hand-held powered quick saw. A mechanical splitter may be referred to as a paver splitter, stone cutter, or guillotine. It is a non-motorized piece of equipment that relies on leverage, or hydraulic action, to cut a paver. See Figures 8-12, 8-13 and 8-14.

In the jaws of the machine splitter are two hardened pieces of steel that cut by pinching the paver. If the blades are smooth and the paver is dense, a mechanical cutter can produce a cut with a fairly flat face. Absence of either condition can produce an uneven, bumpy appearance on the vertical cut face. An uneven surface will make the unit difficult or impossible to install in the pavement.

A key to using a mechanical splitter is placing the unit between the blades at a slight angle. When cut, this position will produce an angled face on the cut or "under cut." Since the bottom of the paver is slightly shorter than the top, the unit should easily slip into its designated opening in the pavement. The bottom of the paver should not be more than 1/4 in. (6 mm) shorter than the top surface. If there is a big difference, the top of the joint may not fill with sand, and the unit may shift and chip.

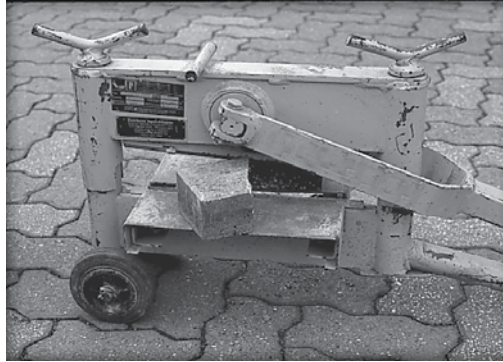


Figure 8-12:  
Paver splitter



Figure 8-13:  
Wet saw

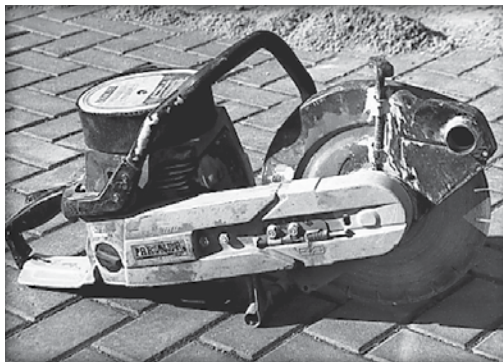


Figure 8-14:  
Dry saw  
(Quick or chop saw)

Masonry saws should use a diamond blade. It produces a smooth, precise cut. Masonry saws are gasoline or electric powered. Most masonry saws can run either wet or dry. When water is used, it provides lubrication and reduces wear on the blade. If water is supplied to the saw, anticipating a nearby faucet in planning the job will save delays and money. If possible, use clean water and do not recirculate it as it will likely stain the pavers.

A by-product of cutting with a wet masonry saw is residue-filled water. This can stain pavers, so wash and remove the water from the pavers before it dries. Better still, cut in an area where drainage from the saw doesn't run on pavers or on nearby areas where there might be pedestrian or car traffic.

Hand-held dry saws (also called quick or chop saw) are gas powered, with engines similar to those used on chain saws. Since they don't need water or electricity, dry saws are completely portable. Dust can be their biggest problem, so check the wind direction and take care to cut in an area where dust will not settle on cars, windows, flowers, shrubs, etc. Some contractors set up temporary cardboard or plywood walls to contain the dust. Some use vacuum equipment and a hose to collect dust right at the blade. This is highly recommended. A hand held dry saw with a 12 in. (0.3 m) blade can cut about 4 ft. (1.2 m) or larger radius.

## Basic Rules

Always mark a paver before cutting. Put a V on the line to show exactly where the cut should be made. The saw blade should meet the tip of the V. The side of the paver with the V is the end that will not be used. While crayons and pencils are used to mark pavers, welder's soap stone works very well. Marks will endure dust and water from cutting and they will eventually wear away.

Cut pavers are generally not re-used. It is usually not worth the time to sort them and find ones that fit an opening. A time-saving exception is when the paver pattern is centered and it creates cut units on one side where the remaining pieces can be used on the other. For example, 45° herringbone pattern can create cut units that can be used on both sides of the pavement. However, where there is space it is faster to overpave both sides and cut them to fit within spiked edge restraints installed after the cuts. In addition, 90° herringbone patterns require half units to fill the edges. Both ends of cut half units can be placed along the edges.

For pedestrian areas and driveways, the rule of thumb is that cut pieces should be no less than 3/8 in. (10 mm) wide. If installed, small slivers of concrete pavers can crack and become unsightly. On the practical side, it is difficult to cut a piece thinner than this with a mechanical splitter. If a masonry saw is used, pieces smaller than this dimension are highly susceptible to being caught by the blade and being thrown from the saw.

A sharper appearance can be created by shifting the pavers behind the edge several feet (meters) so as to eliminate any gaps under 3/8 in. (10 mm). This should be done before compacting the pavers. Shifting the field of pavers to eliminate this gap may be difficult or impossible along a narrow area such as a sidewalk. In these cases, precise layout and double-checking measurements between the edge restraints will avoid gaps.



Good judgement should be exercised in sizing cut pavers that will be exposed to vehicles. Cut units should not be less than 3/8 in. (10 mm) in size. Pieces smaller than this can either crack or work their way out from repeated exposure to tires.

## Bring the Saw to the Work

A common scene at a paver site is this: pavers are marked for cutting, brought to the saw operator, cut, brought back to edge and placed. This is an inefficient procedure because it involves two or three people walking most of the time rather than paving. Whenever possible, the saw should be brought to the pavers to be cut, not the pavers to the saw. One person can perform this operation. This efficiency can be accomplished by using cart-mounted masonry saws, or cutting the pavers in-place on the bedding sand with a quick saw.

For example, masonry saws can be mounted on a wheeled cart for easy movement around the site. Marked pavers can then be reached by the operator, cut and placed along the edge. The operator can move down the edge to the next area. Typical productivity is 25 to 30 ft (6 to 9 m) per person per hour. Blades typically last 400-600 linear ft (120-180 m) for dry or wet 12 in. (300 mm) diameter quick saws, 14 in. (530 mm) diameter table saw blades can last 1500 (dry) to 2000 (wet) lineal feet. Besides using dry or wet saw, blade wear depends on the hardness of the aggregates in the concrete pavers.



**Figure 8-15:** Wheeled dry saw increases speed and accuracy for paver cutting. However, they wear out saw blades faster and require great attention to safety during cutting.

A hand-held quick saw can be used to cut pavers in-place on the bedding sand. The edge pavers are not restrained, but will have edge restraints installed after cutting is complete. See Figure 8-15.

The pavers should not be compacted before cutting. Those to be cut with a quick saw along a straight line are marked with a chalk line. The bedding sand and pavers should extend past the edge that pavers are to be cut by 8 to 10 in. (200 to 250 mm). This adds stability during cutting. The saw blade should be set to the thickness of the pavers. Some saws have a special attachment to control the depth of the cut and hold the saw in position for easier movement along the pavers.

Increased regulation of silica dust on construction sites is changing preferences for cutting equipment. ICPI encourages the use of gasoline powered saws that do dry cutting. The saw should be attached to a dust collection system. While collections systems are expensive, they are less expensive than fines from agencies that regulate safety on construction sites. Furthermore, collection

systems make the site cleaner for everyone and greatly reduce dirt on windows, plants, cars, etc.

*Above all, wear ear protection and safety glasses when cutting with powered saws. Always wear a dust mask when cutting with dry cut saws. A rubber apron will keep clothes from getting soaked when using a wet saw. Overalls will keep debris from getting on clothing or skin while using a dry saw. Wear safety boots to protect feet from injury when using all types of cutting equipment.*

Maintenance of saws is key to their long life and that of the diamond saw blades. Air filters should be checked replaced regularly or the engines will not operate. Oil bath filters require less time in maintenance and are effective in removing dust. Saw blades should be checked for squareness and warping. An out-of-square or warped blade will wear faster because it is using the sides of its teeth to cut rather than the fronts. Also check the steel sides of the blades for wear and reduced thickness. This type of wear is common with saw blades used on a hand-held dry saw. Keep in mind that saw bearings wear quickly due to cutting and dust. Follow the manufacturer's recommendations on when these should be replaced.

# Section 8 Part F: Compaction Equipment and Compacting Pavers

## Compaction Equipment

A centrifugal plate vibrator (plate compactor) is shown below. The compactor should have a minimum compaction force of 4,000 to 5,000 lbs. (18 to 22 kN), weighing 165 to 240 lbs (70 to 110 kg).

## Compacting the Pavers

### Starting procedure:

- Wear ear protection
- Be sure vibrator is disengaged
- Check gas and oil levels
- Adjust choke and throttle
- Start by pulling on the cord
- Adjust choke and throttle as needed

### Compacting procedure:

- Start on one edge of the pavement and compact the perimeter.
- Compact in overlapping rows on the rest of pavement.
- Compact the pavement again but in the opposite direction. All pavers will need to be exposed to at least two passes of the compactor.
- Do not compact within 6 ft (2 m) of an unrestrained edge or the pavers will creep out.

The operator looks for broken pavers just behind the plate compactor and marks them while compacting. The broken pavers are removed with a paver extractor and replaced with whole units.

Wet joint sand does not easily move down into the joints. If the sand is wet, spread it on the pavement and let it dry before it is swept and vibrated down into the joints. An asphalt lute efficiently spreads the sand on the surface to dry. Allowing the sand to dry so that it can move down into the joints will save a return trip a few weeks after the job is finished to refill the joints with sand.

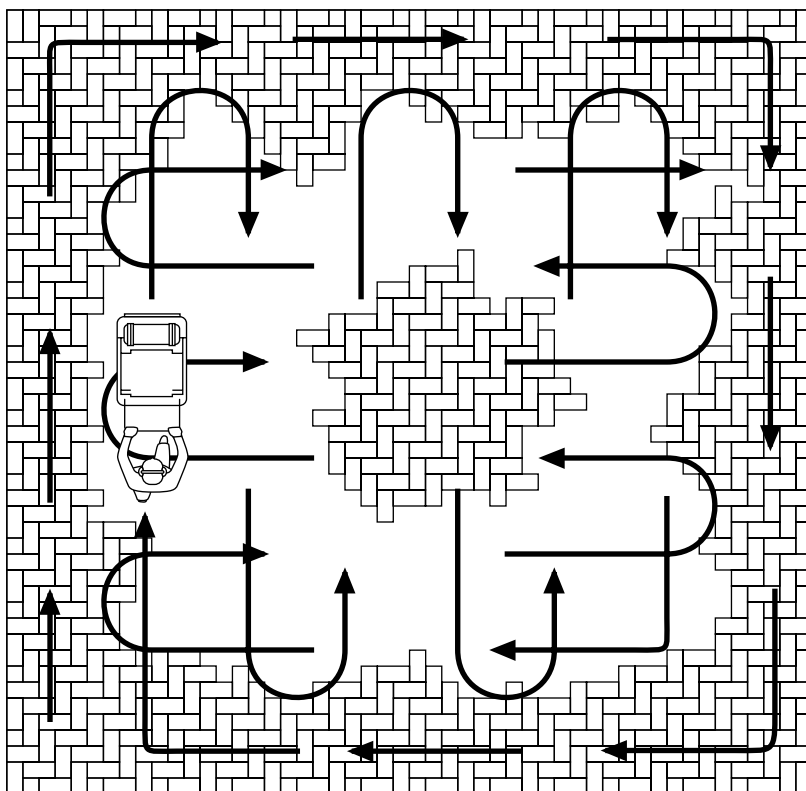
Use bagged sand if weather and temperature won't allow the sand to dry prior to filling the joints. This will save time and money. The gradation of these bagged sands should be checked for conformance to ASTM C 144 or CSA A179. Bagged sand often is evenly graded as with some play sand or sandbox sands. Evenly graded sands do not assist with interlock as well as those with a range of particle sizes.

Dry joint sand should be evenly spread across the surface of the pavers to speed movement into joints during vibration with a place compactor. A fast way



Figure 8-16:  
Plate Compactor

of spreading sand is using an asphalt lute or rake. This rake has a blade with small notches. When pulled across joint sand spread on the surface of the pavers, small lines of sand are formed. If the sand is dry, these lines of sand will roll into the joints with a pass or two of the plate compactor. This will reduce sweeping.



**Figure 8-17:**  
Compaction sequence—working from the perimeter to the center of the pavement. All pavers should have two passes of the plate vibrator over them prior to filling the joints. After the joints are filled with sand, follow the same compaction sequence from the perimeter to the center.

of compacting pavers. They include the width of the plate on the compaction machine, the amount of overlap on passes taken by the operator, the travel speed of the machine, and the thickness of the pavers. The wider the plate, the greater the area covered in each pass. Overlap should be at least 4 to 6 in. (10 to 15 cm), or about a half a paver width. Larger overlaps will waste time. Faster travel speed from a machine will cover more area. Thicker pavers will take more time to compact than thinner ones. An average production rate for compacting 1,000 sf (100 m<sup>2</sup>) of pavers is 30 minutes.

Plate compactors should be operated at full throttle operating speed. Decreasing engine speed and the vibration rate does not increase the compactive force exerted by the plate. Two persons are generally required to sweep sands into the joints. A third simultaneously uses the plate compactor to work the sand further into the joints during the sweeping process.

Some units have uneven top surfaces to replicate stone and they are sometimes called “embossed” pavers. These high spots can be scuffed and damaged by a plate compactor. When compacting such pavers, a rubber pad should be fastened to the compactor plate. If no pad is available, woven geotextile placed over the pavers when compacting has been show to prevent scuffing.

When sweeping sand into the joints, use a stiff bristle push broom. Fill the joints and leave a thin layer of excess sand. Follow the previous compaction pattern. After the compactor passes, sweep more sand into the joints until full and make another pass with the plate compactor. Sweep the joints full and remove excess sand.

At the end of each day's work, all edge pieces must be cut and placed, all paver surfaces compacted, cracked or broken pavers replaced, joints filled with sand, and the area compacted within 6 ft (2 m) of open unrestrained edges. Protecting the uncompacted, unrestrained edges with plastic or canvas during rainy weather is preferred to re-laying these areas after the storm.

Several factors affect productivity