



## 4-21.1 General

Saw cuts should be straight, clean, and vertical. If the surface is being torn or chipped, the slab is either too "green," the saw is dull, or is turning too slowly, or is traveling ahead too rapidly. Sawing may be done dry or with water. Be sure the water doesn't have oil in it from a leak in the equipment. If sawing is being done next to a traffic lane, be sure dust or water is not causing problems for vehicles.

## 4-21.2 Sawed Contraction Joints

The sawing of joints is one method used to control random cracking in concrete pavements. Joint sawing should conform to the depth and width shown on the plans. Concrete joints should be laid out according to SDD 13C18.

A crack is induced at selected locations where planes of weakness or "joints" are created by sawing. As the time of sawing is important, it is helpful to keep in mind the behavior of concrete slabs and the changes that occur under varying temperature conditions.

Under normal summer conditions, pavements placed early in the day are subjected for a longer period to the higher daytime temperatures, which augment the internal heat generated in the concrete by the hydration process. The maximum temperature is reached in six to eight hours, after which it begins to drop, and contraction stresses are set up. These are the stresses that cause pavements to crack. The maximum temperatures of pavements placed at later hours become lower and the contraction stresses gradually diminish, thus reducing the tendency to crack.

It is necessary to saw transverse joints as soon as it can be done without excessive tearing. Sawing should be completed by midnight unless the condition of the pavement prevents it. If sawing must be deferred until the following day, it should not be resumed until the air temperature is quite warm and contraction stresses have diminished.

Early morning is an ideal time to examine un-sawed pavement for cracks that may have occurred adjacent to a proposed joint location. If a crack has developed, sawing should be omitted at the joint location.

Joints must be sawed in a double-phase operation if the joint is to be sealed. The initial cut is made as soon as the saw can be operated without damage to the pavement. After the curing period has expired, the second cut is made coincident with the first to the required dimensions.

It may be desirable to employ the "skip" method of sawing to relieve stresses in the pavement. In this method, the initial cut of every third joint is made as soon as possible, and the initial cuts of the remaining joints are then done as soon as practicable.

## 4-21.3 Transverse Construction Joints

Construction joints are formed at the end of the day's run or whenever paving is discontinued for a period of time in which the concrete would attain its initial set. A header board that conforms to the true cross section of the pavement should be used to form the end of the slab. Holes should be drilled in the header for the insertion of tie bars at their proper locations. An alternative method is to use a "split header" consisting of two boards with a gap between, through which the tie bars are hand inserted into the fresh concrete.

Only concrete of good quality should be placed against the header, and it must be thoroughly vibrated with hand vibrators. Mortar and laitance and segregated concrete brought ahead by the finishing equipment should be wasted over the forms. Header boards for continuously reinforced pavement must be constructed to permit easy disassembly, and steel reinforcement extending beyond the header must be supported and secured to preclude movement.

Construction joints are to be edged to a radius of 1/4 inch or less.

### 4-21.3.1 Placing Construction Joints

In addition to the "tied" construction joint shown on SDD 13C11 and SDD 13C13, contractors will be allowed the option of placing construction joints in the following manner:

#### 4-21.3.1.1 End of a Day's Paving Run

1. Run the paver out of concrete and allow the concrete to set.
2. Make a full depth transverse saw cut, "normal" to the centerline, at a point along the slab that will provide the desired transverse and longitudinal profile, as well as the minimum distance specified on the standard detail drawing from the last contraction joint. Sawing of the concrete to create the construction joint should be done in conjunction with routine transverse joint sawing operations. If damage to the slab occurs as a result of sawing,

sawing must cease until such time as it can be completed without further damage.

3. The following morning (minimum of 10 hours after conclusion of the previous day's paving), remove the concrete to be wasted and drill holes in the vertical face of the construction joint. If damage to the slab occurs as a result of drilling, drilling must cease until such time as it can be completed without further damage. In the event of severe damage to the slab as a result of drilling or any other circumstances, the engineer may require that a new construction joint be sawed beyond the damaged concrete, or in extreme cases, removal of the concrete to the nearest contraction joint.
4. Drilled holes in the face of the construction joint must conform to the following dimensions:
  - Mid-depth of slab
  - 12 inches center-to-center, starting 6 inches from the edge of slab
  - 9 inches deep
  - Hole diameter = diameter of the dowel + 1/8 inch
5. After completion of the drilling operation a non-shrinking high strength epoxy mortar must be injected into the back of each hole and dowel bars must be inserted in the holes in accordance with [standard spec 416.3.7](#).
6. 1- 1/4 inch x 18 inches dowel bars must be inserted in the holes to one-half their length and be parallel with the centerline and grade. If the pavement is 10 inches or greater in thickness, dowel bars should be 1-1/2 inch diameter.
7. Construction joints must be saw cut in conjunction with the second stage sawing of adjacent contraction joints if the joints are to be sealed.

#### 4-21.3.1.2 Planned Concrete Pavement Gaps

1. The two construction joints resulting from planned gaps must be constructed by applying the rules set forth above for construction joints at the end of a day's run.
2. Since there is no urgency for early drilling of holes in the vertical face of the construction joints, this operation should be delayed closer to the time when paving of the temporary gap is expected.
3. Since gaps can have a wide variation as to length, great care should be exercised in planning their location. This applies to locating the construction joints both in relation to transverse contraction joints outside the gap limits, as well as any required contraction joints between the construction joints when the gap is poured.
4. Dowel basket assemblies should be placed at all contraction joints required between construction joints in gap areas.

#### 4-21.3.1.3 When Paving Away From the Construction Joint

1. Remove the header, if applicable.
2. Uncover the tie bars, if applicable.
3. Grease the dowel bars lightly, if applicable.
4. Pre-wet the base.
5. Place concrete against the header or saw-cut slab end. Consolidate with hand-held vibrators, with particular attention paid to the area around dowels or tie bars.
6. Position the paver next to the slab end. Be sure no part touches the tie bars, dowels, or hardened concrete.
7. Use the paver to place, consolidate, and finish concrete, proceeding away from the joint.
8. Hand finish the fresh concrete at the joint to plan elevation and typical section. Check the evenness with a straightedge per [standard spec 415.3.11.5](#).

#### 4-21.4 Longitudinal Construction Joints

A longitudinal construction joint is formed when a pavement is placed to partial width and the first lane of pavement acts as a form for the concrete in the second lane. Because finishing defects at the edge of the original lane will be reflected into the second lane, careful attention should be directed to the finishing in both lanes to prevent an uneven surface across the joint which will cause poor riding qualities or create obstructions to surface drainage.

Tie bars across the joint should be carefully installed at the correct spacing and skew as shown on the detail drawing. Bar shields, when used, should be placed and maintained tightly against the forms so the second half of the bar is completely exposed when the forms are removed.

[Standard spec 415.3.1.2](#) of the standard specifications provides that the slip-form paver must be equipped with a suitable mechanical device that can accurately and positively space and position tie bars and will permit satisfactory insertion by mechanical or manual means. It is essential the contractor's equipment and methods are reviewed to ensure that adequate bond and true, non-slumping pavement edges will result.

Positioning of the tie bars should be checked during placement to ensure they are being inserted level and at the correct depth, spacing and skew.

Edge slump is limited to 1/10 inch. If edge slump is in excess of this requirement, correction should be made at once.

#### **4-21.5 Expansion Joints**

Expansion joints may be formed at bridge approaches and where specified in urban construction to absorb the pressure exerted by pavement through temperature expansion and "growth." The performed filler should conform to the cross section of the pavement and have its top edge 1/2 inch below the pavement surface. Concrete at the face of the joint must be thoroughly consolidated by spud vibrators.

The joint must be edged to a 1/2-inch radius, or less. Refer to [standard spec 415.3.11.7](#).

#### **4-21.6 Cleaning and Sealing Joints**

The following discussion applies only to projects on local highways where joint sealing has been requested by the local government and approved by WisDOT. WisDOT no longer allows the curing, sealing, or filling of joints in concrete pavement on highways under their jurisdiction. Local streets and roads for which WisDOT has project administration responsibility only (no project financing) may have joints sealed if the local government has expressed a preference for sealing and WisDOT has concurred.

Proper cleaning of the joints is essential if a long lasting seal is to be obtained. In all cases, the cut should be blown clear of dirt and should be dry before sealing. The saw cut is cleaned with compressed air or pressurized water. Be sure there is no oil in the air or water as a result of equipment leaks. The saw cut must be absolutely clean if the joint sealer is to adhere to the side walls of the cut.

A backer rod will then be inserted into the clean saw cut and pushed down to the correct depth. This forms the base for the joint sealer. The backer rod should be tight against the sides of the cut; be sure the right size of rod is used.

When cold-poured silicone joint material is used, the joint must be completely dry. If there is any moisture present in the joint at the time of sealing, a skin will form on the sides of the sealant, preventing adhesion to the concrete. Following a rain or damp weather, all of the moisture must be removed from the joint before sealing. The contract special provisions will specify which type sealant is to be used. The plan may also contain a special detail drawing.

Cold-poured silicone is most frequently used. Although cold-poured silicone is an improvement over the old hot-poured sealers, frequent failures are experienced. Most of these failures can be attributed to inadequate cleaning and drying of the joint or faulty installation procedures. A check of many joints sealed with cold-poured silicone indicates the sealant has adhered to only the upper edge of the joint and not to the sides. Dirt or moisture on the sides of the joint prevents adhesion. Also, it is likely that insufficient pressure was used during the extrusion of the sealant into the joint to ensure full contact with the sides of the joint. To ensure positive contact the joint must also be carefully "tooled" after extrusion. The surface of the sealant after tooling must be concave upward, and lie about 1/4 inch below the pavement surface.

If the joint sealer is of the solid pre-formed elastomeric compression seal type, it will be necessary to lubricate the seal or joint faces before installation. A special tool is used for installation; sharp instruments that may puncture the seal must not be used.