# Concrete Tech Tip
# # 6

# Joints in Concrete

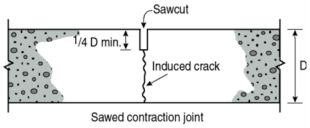
Reviewed and revised 2019

## 1. WHAT are Joints?

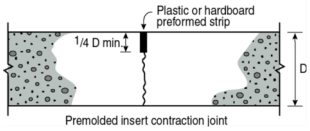
Although concrete expands and contracts with changes in moisture and temperature the general overall tendency is to shrink and, therefore, crack. Irregular cracks are unsightly and difficult to maintain. Joints are simply preplanned cracks.

Some forms of joints are:

A) Contraction (formerly control) joint - These joints are constructed to create planes of weakness so that cracks will occur at the desired location.

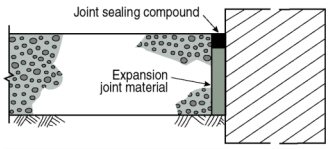


Sawed contraction joint

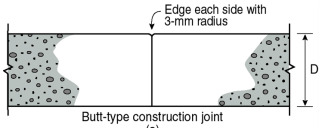


Premolded insert contraction joint

B) Isolation (expansion) joints - They separate or isolate slabs from other parts of the structure such as walls, footings, or columns, and driveways and patios from sidewalks, garage slabs, stairs, light poles and other obstructions. They permit movement of the slab and help minimize cracking caused when such movements are restrained.




C) Constructions joints - These are joints that are placed at the end of a day's work. In slabs they may be designed to permit movement and/ or to transfer load. Often in reinforced concrete a conscious effort is made to clean the joint and bond the next day's work.



Butt-type construction joint
(a)

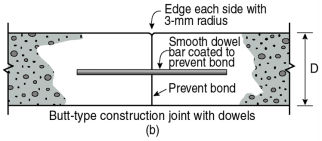
## 2. WHY Are Joints Constructed?

Concrete cracks cannot be prevented entirely, but they can be controlled and minimized by properly designed joints, because:

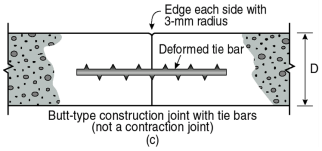
A) Concrete is weak in tension and, therefore, has a natural tendency to shrink if restrained, tensile stresses develop and cracks are likely to occur.

B ) At early ages, before the concrete dries out, most cracking is caused by temperature changes or by the slight contraction that takes place as the concrete sets and hardens. Later, as the concrete dries it will shrink further and either additional cracks may form or existing cracks may become wider

C) Joints provide relief for the tensile stresses and are less objectionable than random cracks.



Butt-type construction joint with dowels
(b)



Butt-type construction joint with tie bars
(not a contraction joint)
(c)


References:

1. Joints in Concrete Construction, ACI 224.3R, American Concrete Institute, Farmington Hills, MI.
2. Guide for Concrete Floor and Slab Construction, ACI 302.1R, American Concrete Institute, Farmington Hills, MI.
3. Slabs on Grade, Concrete Craftsman Series CCS-1, American Concrete Institute, Farmington Hills, MI.
4. Joint Planning Primer, Concrete Construction, August 1997.
5. Bruce A. Suprenant, Saw cutting Joints in Concrete, Concrete Construction, January 1995.
6. Concrete in Practice # 6: Joints in Concrete Slabs on Grade with permission from the National Ready-Mixed Concrete Association
7. Cement Association of Canada *'Design and Control of Concrete Mixtures: The Guide to Application, Methods and Materials Eighth Canadian Edition, 2011.*



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**3. HOW to Construct Joints**

Joints must be carefully designed and properly constructed if uncontrolled cracking of concrete flatwork is to be avoided. The following recommended practices should be observed.

A) The maximum joint spacing should not exceed 25 times the thickness. For example, in a 100mm thick slab, the joints should be no further apart than 2.5 meters.

B) All panels should be square or nearly so. The length should not exceed 1.5 times the width. L-shaped panels should be avoided.

C) The joint groove should have a minimum depth of 1/4 the thickness of the slab, but not less than 25mm. Tooled joints must be run early in the finishing process and rerun later to assure groove bond has not occurred.

D) Control joints can be tooled during finishing or saw-cut at an early age. Saw-cutting should commence as soon as there is no occurrence or observation of excessive raveling (damage to joint caused by dislodging aggregates rather than cutting them).

E) Premoulded joint filler, building paper of polyethylene should be used to isolate from building walls or footings. At least 50mm of sand over the top of a footing will also prevent bond to the footing.

F) To isolate columns from slabs, form circular or square openings which will not be filled until after the floor has hardened. Slab control joints should intersect at the openings for columns. If square openings are used around columns the square should be turned at 45 degrees to have the control joints intersect at the diagonals of the square.

G) If the slab contains wire mesh, cut out alternate wires across control joints. Note that wire mesh will not prevent cracking. Mesh tends to keep the cracks and joints tightly closed.

H) Construction joints key the two edges of the slab together, either to provide transfer of loads or to help prevent curling or warping of the two adjacent edges. Galvanized metal keys are preferred for interior slabs, however, a beveled 25mm by 50mm strip, nailed to bulkheads or form boards, can be used in slabs that are at least 125mm thick to form a key which will resist vertical loads and movements. Metal dowels can also be used in slabs that will carry heavy loads. Dowels must be carefully lined up and parallel or they may induce restraint and cause random cracking at the end of the dowel.

I) Joints in industrial floors subject to heavy traffic require special attention to avoid spalling of joint edges. Such joints should be filled with a material capable of supporting joint edges. Manufacturer's recommendations and performance records should be checked before use.

**Follow These Rules for Proper Jointing**

1) Plan exact location of all joints before construction
2) Provide isolation joints between slabs and columns, walls and footings, and at junctions of driveways with walks, curbs or other obstructions.
3) Provide contraction joints and joint filling materials as outlined in specifications.

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