

## CONCRETE IN PRACTICE

### CIP 6

## What, Why & How? Joints in Concrete Slabs

### WHAT Are Joints?

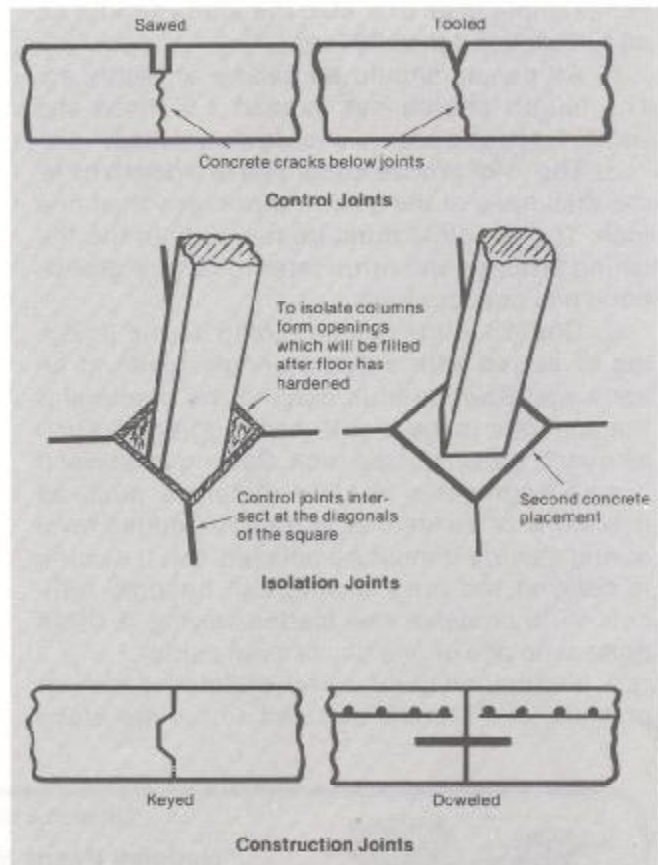
Although concrete expands and contracts with changes in moisture and temperature the general overall tendency is to shrink and, therefore, crack. Irregular cracks are unsightly and difficult to maintain. Joints are simply pre-planned cracks.

Some forms of joints are:

a. Control (contraction) joint—These joints are constructed to create planes of weakness so that cracks will occur at the desired location.

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, lightpoles and other obstructions. They permit movement of the slab and help minimize cracking caused when such movements are restrained.

c. Construction 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.



## 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, if its natural tendency to shrink is 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 preexisting cracks may become wider.

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

## 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 in feet should not exceed 2.5 times the thickness in inches. For example in an 8 in. slab the joints should be no further apart than 20 feet.

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 depth of  $\frac{1}{4}$  the thickness of the slab, but not less than one inch. 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 sawed with a carborundum blade at an early age. Sawed joints may not be practical if the concrete is made with hard aggregate such as quartz gravel or trap rock. Sawing is easier if coarse aggregates contain materials such as limestone or sandstone. If the joint edges ravel during sawing it must be delayed, but if sawing is delayed too long sawing can become difficult. With abrasive saw blades sawing is often done at an age of one day or even earlier.

e. Premolded joint filler, building paper or polyethylene should be used to isolate slabs

from building walls or footings. At least two inches 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 1 by 2 inch strip, nailed to bulkheads or form boards, can be used in slabs that are at least 5 inches 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.

### References

1. ACI 302.1, "Guide for Concrete Floor and Slab Construction," ACI Manual of Concrete Practice.
2. "Slabs on Grade," ACI Concrete Craftsman Series, American Concrete Institute, Detroit, MI.
3. "Cracks in Concrete: Causes, Prevention, Repair," a collection of articles from Concrete Construction Magazine, June, 1973.

### 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 control joints and joint filling materials as outlined in specifications.



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