CONCRETE SASK

TECH TIP #6

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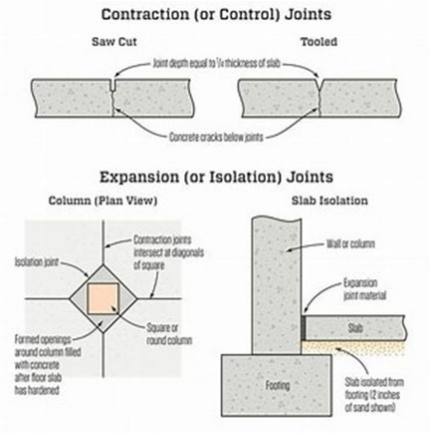
JOINTS IN CONCRETE SLABS-ON-GRADE

WHAT are joints?

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

Joints in concrete slabs can be created by forming, tooling, saw cutting and by placement of joint formers.



Types of joints include:

- **Contraction Joints** are intended to create weakened planes in the concrete and control where the cracks, resulting from dimensional changes, will occur.
- **Isolation or Expansion Joints** separate or isolate slabs from other parts of the structure, such as walls, columns, footings, driveways and patios from sidewalks, garage slabs, stairs, light poles and other points of restraint. They permit horizontal and vertical movement between adjoining parts of the structure and help minimize cracking when such movements are restrained.
- **Construction Joints** are surfaces where two successive placements of concrete occur. They are typically placed at the end of a days work but may be required when concrete placement is stopped for a period such that the previously placed concrete has set and hardened. They may also be designed in slabs to permit movement and/or transfer load. The location of construction joints should be planned. It may be desirable to achieve bond and continue reinforcement through a construction joint to transfer load.

WHY are joints constructed?

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

- Concrete is weak in tension and if its natural tendency is to shrink is restrained, tensile stresses that exceed its tensile strength can develop, resulting in cracking.
- 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 pre-existing cracks may become wider.
- Joints provide relief from the tensile stresses, are easy to maintain and are less objectionable than uncontrolled or irregular 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:

- The maximum joint spacing should not exceed 30 times the thickness. For example, in a 100mm thick slab, the joints should be no further apart than 3 meters. It is further recommended that joint spacing be limited

to a maximum of 4.6m.

- All panels should be square or nearly so. The length should not exceed 1.5 times the width. L shaped panels should be avoided.
- The joint groove should have a minimum depth of 1/4 the thickness of the slab, but not less that 25mm. Timing of the jointing operation depends on the method used.
- Tooled joints must be run early in the finishing process and rerun later to assure groove bond has not occurred.
- Early entry dry cut joints are generally run 1 to 4 hours after completion, depending on the concrete's setting characteristics. These joints are typically not as deep as conventional saw-cut process but should be a minimum of 25mm in depth.
- Raveling during saw cutting is affected by the strength of the concrete and aggregate characteristics. If the joint edges ravel during sawing, it must be delayed. However, if delayed too long, sawing can become difficult and uncontrolled cracking may occur.
- Use pre-molded joint filler, such as impregnated asphalt fiber sheeting, compressible foam strips, or similar materials to isolate slabs from building walls or footings. At least 50mm of sand over the top of a footing will also prevent bond to the footing.
- 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.
- 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.
- 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 125 mm 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.
- 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:

- Plan exact location of all joints before construction.
- Provide isolation joints between slabs and columns, walls and footing, and at junctions of driveways with walks, curbs or other obstructions.
- Provide control joints and joint filling materials as outlined in specifications.

References:

1. Joints in Concrete Construction, ACI 224.3R, American Concrete Institiue, Farmington Hills, MI.
2. Guide for Concrete Floor and Slab Construction, ACI 302.1R, American Concrete Institute, Farmington Hills, MI.
3. Slabs on Grade, ACI Concrete Craftsman Series CCS-1, American Concrete Institute, Farmington Hills, MI.
4. Joint Planning Primer, Concrete Construction, August 1997
5. CIP 6: Joints in Concrete Slabs-On-Grade, National Ready-Mixed Concrete Association
6. CAN CSA A23.1-24/A23.2-24