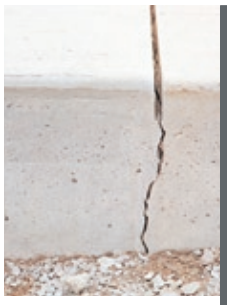


TECHNICAL SPECIFICATIONS

Proper Concrete Jointing Details to Control Random Cracking

RMCAO

The Power of Concrete

Shrinkage is an unavoidable fact of concrete construction. The key to a successful concrete project is understanding how to minimize shrinkage and knowing what steps to take to avoid random concrete cracking.

The primary factors that result in concrete shrinkage and/or cracking include:

- Settlement of the sub-grade
- Chemical shrinkage of the concrete
- Temperature and moisture changes in the concrete
- Application of loads to the concrete surface
- Restraint of concrete movement during either expansion or contraction.

The actual amount of concrete shrinkage is governed by:

- The concrete's raw constituents
- The unit water content of the mix
- The drying conditions that the concrete is exposed to
- The size and shape of the concrete element.

Once these facts are known, the designer and contractor can properly address concrete shrinkage by selecting the appropriate concrete thickness and layout, installing the necessary concrete jointing systems and utilizing the correct amount of reinforcement in suitable locations.

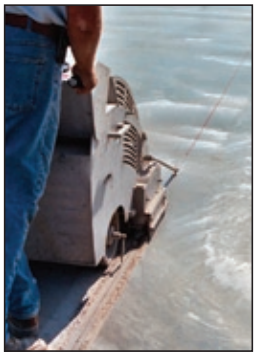


Photo courtesy of CAC

Methods to minimize the volume change of concrete and reduce internal stresses from a mix design standpoint include:

- Lowering the unit water content of the concrete as much as practical
- Using the largest practical size of coarse aggregate in order to minimize the paste content of the mix
- Utilizing well graded aggregate blends which exhibit low shrinkage
- Minimizing the water demand of the concrete by utilizing supplementary cementing materials
- Avoid admixtures that increase drying shrinkage (i.e. calcium chloride based accelerators).

Basics of Unreinforced Concrete Slab-on-Grade Construction

Photo courtesy of CAC

As stated previously, concrete shrinks in all directions as it cures. Whether the concrete will crack due to material shrinkage alone is dependent on the shape of the concrete, the thickness of the concrete and the restraint supplied by subgrade or adjacent elements. If the concrete is free to move then no stresses are created and the concrete doesn't crack. To avoid random concrete cracking we utilize a system of joints (isolation, contraction & construction) to force the concrete cracking to follow specific lines (See photo above).

The basic rules for layout of these joints are as follows:

- The maximum joint spacing should not exceed 24 to 36 times the thickness of the slab
- The resulting panels created by these joints should be as square as possible. The length/width ratio of the panels should never exceed 1.5
- Joint depths should be at least ¼ the depth of the slab
- Contraction joints should be located at all "re-entrant" corners (corners with angles greater than 90°) to prevent radial cracking
- "T" intersections of contraction joints should be avoided since the random cracks will tend to continue through into the next slab.

The basic jointing systems are as follows:

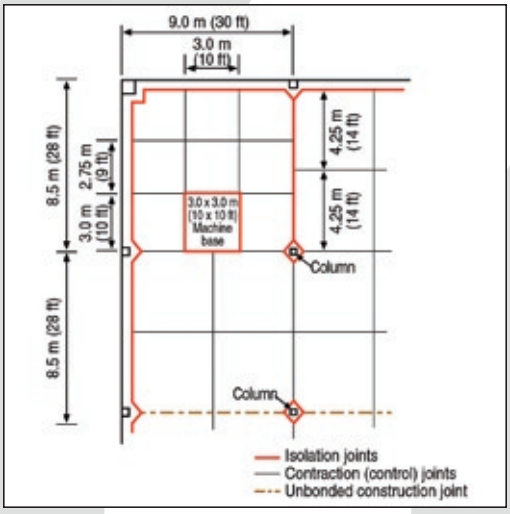
Isolation Joints: Joints that permit both horizontal and vertical movement between the slab and the adjacent concrete (see diagram 1). The purpose of this joint is to completely separate the two concrete elements (since they may move independently of each other) and to provide space for both expansion and contraction of the concrete. These joints are typically 13 mm in thickness and are constructed of a compressible material.

Contraction Joints: Joints that permit horizontal movement of the slab and induce controlled cracking at preselected locations (see diagram 2). These joints are typically created by grooving the concrete while it is still in the plastic state or cutting the concrete in its hardened state once it has obtained sufficient strength (typically 4 – 12 hours after placement).

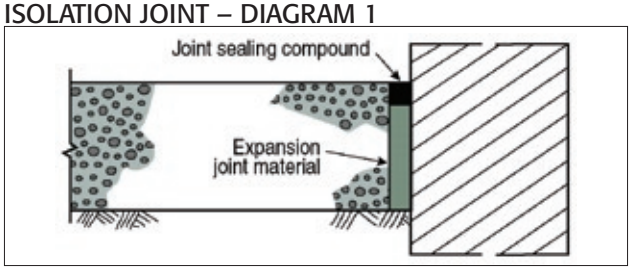
Construction Joints: Joints that are stopping places in the process of construction (see diagram 3). The person designing the joint layout has the option with construction joints to have them act as a contraction joint and allow horizontal movement only (diagram 3-b) or to create a fully bonded joint with deformed rebar and not permit either horizontal or vertical movement (diagram 3-c).

Proper jointing layout is performed before the concrete is placed by utilizing the basic rules above to determine the maximum joint spacing and then reviewing the plan view of the project to determine the proper locations of the three basic jointing types (see below). Concrete placement should never occur until a proper joint layout drawing has been prepared, reviewed and approved.

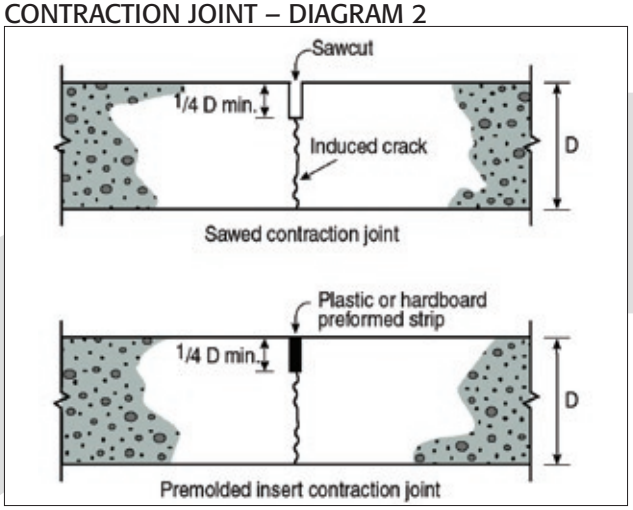
TYPICAL JOINT LAYOUT



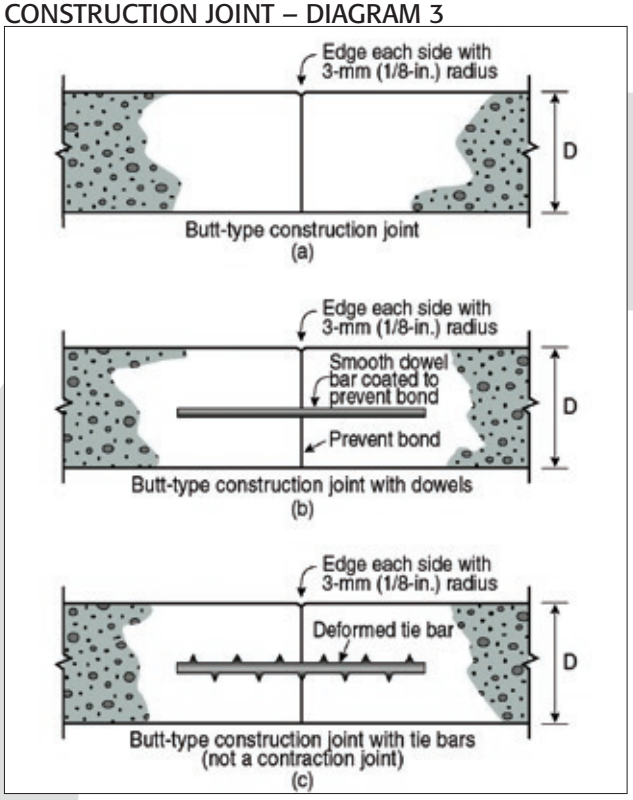
ISOLATION JOINT – DIAGRAM 1



CONTRACTION JOINT – DIAGRAM 2



CONSTRUCTION JOINT – DIAGRAM 3



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2 Design and Control of Concrete Mixtures – 7th Canadian Edition, Cement Association of Canada

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