Chapter 2
Joints and Their Functions

2-1. General

Joints are required in most concrete construction. Concrete is subject to physical changes in length, width, height, shape, and volume of its mass when subjected to environmental changes and mechanical conditions surrounding it. The effects may be permanent contraction from drying shrinkage, carbonation, or creep; abnormal changes from chemical reactions of sulfate or alkali attacks; or simply the application of a load on the concrete. As movement of the concrete occurs and is restrained by internal or external conditions, whether permanent or transient, the concrete can relieve the internal stresses by forming a joint commonly referred to as a crack. Designers minimize the unsightly appearance of self-formed cracks by introducing joints into the concrete to accommodate for the movement without loss of structural integrity. Joints may also be used in facilitating and accommodating the construction process.

2-2. Types of Joints

a. Contraction joints. To regulate the cracking occurring from the unavoidable and unpredictable contraction of concrete, contraction joints (also referred to as control joints) are designed into the structure. Contraction joints divide a structural element into two or more smaller elements by forming a complete separation from the adjacent element. Contraction joints may be made during construction by forming the joint with a strip of wood, plastic, or metal; or after construction by saw cutting the joint. The contraction joint may be made to the full depth of the concrete or it may be only partially made and allowed to crack below the control joint the remaining depth of the concrete.

b. Expansion joints. To prevent concrete from crushing, distorting, displacing, buckling, or warping from compressional forces transmitted from abutting concrete that occurs from movement caused by expansion, expansion joints (also referred to as isolation joints) are placed into the concrete structure. Expansion joints are commonly designed to isolate structural elements from each other such as walls or columns from floors and roofs, pavements from bridge decks and piers, or where wall elements change directions. Expansion joints are commonly made during construction but may be incorporated following construction if needed. Expansion joints are made the full depth of the concrete and of sufficient width to avoid the likelihood of the abutting concrete elements from touching each other in the future. Dowels and keyways may be used across expansion joints to resist undesirable lateral or vertical movement of the concrete elements.

c. Construction joints. To assist in the construction and in the placement of concrete, construction joints are designed and created at certain locations during large massive concrete placements as scheduled interruptions. The concrete surface at the point of stoppage becomes a construction joint when the concrete placement continues. Size of placement and time are contributing factors for construction joints. Some construction joints are unavoidable due to unscheduled interruption of concreting operations. Construction joints may be designed to coincide with contraction or expansion joints where the concrete surfaces are not bonded. In monolithic placements, the two concrete surfaces may be required to be fully bonded across the construction joint for structural integrity. Construction joints may be formed in any direction depending on the placement stoppage point.

d. Special-purpose joints and cracks. Hinge joints, articulated joints, and sliding joints are special-purpose joints designed for a particular special-purpose function. Cracks are self-made joints that occur almost uncontrollably within the concrete from a variety of reasons. Most cracks affect the aesthetics of the concrete and not the structural integrity of the concrete element or structure.