CHAPTER 10

JOINTS

10-1. General. Joints are constructed in concrete pavements to permit contraction and expansion of pavement without irregular cracking and as a construction expedient to separate the paved area into strips necessary for the handling and placing of concrete. There are three general types of joints: construction, contraction, and expansion.

10-2. Construction joints.

a. Longitudinal construction joints. These joints formed between paving lanes at the spacing indicated will be either thickened edge, keyed, keyed and tied, or doweled, as indicated. The keyed joint is critical insofar as dimensions are concerned. It is essential that both key dimensions and location of key in the joint conform with the design requirements. Key dimensions are based on pavement thickness, each thickness requiring a different key size. When stationary forms are used, metal molds for forming the keyway will be securely fastened to the concrete forms so that molds will not be displaced by paving operations. When slip-form pavers are used to form keyed joints, the keyway will be formed by means of preformed metal keyway liners, which are inserted during paving. The metal liners may be shaped as they are fed through the paver from continuous strips, or they may be preformed sections bolted together before insertion through the paver. It is recommended that the metal liners be left in place. When slip-form pavers are used to form keyed and tied joints, bent tie bars will be inserted into the plastic unconsolidated concrete through a metal keyway liner as described above. The tie bars will be straightened after the concrete has hardened. The bent bars should be inspected to insure that the radius of curvature at the bend is equal to or larger than the specified minimum radius of curvature for the grade steel being used. When stationary forms are used, all dowels will be placed by the bonded-in-place method. Either one-piece dowels or split dowels of the threaded type will be used. Dowels will be held accurately and securely in place by being fastened to the forms. When slip-form pavers are used, dowels will be placed by bonding the dowels into holes drilled into the hardened concrete with rotary core-type drills that can be maintained in a position parallel to the surface of the pavement and perpendicular to the face of the edge of the slab in a longitudinal direction. The diameter of the hole should not be more than 1/8 inch larger than the diameter of the dowel bar. The dowels will be securely bonded and proper alinement attained. Continuous inspection will be required to insure that the dowels are securely bonded and that they are alined properly both horizontally and vertically. The method used for inserting the epoxy-resin grout into the hole will place sufficient grout to completely surround the dowel and prevent voids within the grout.

b. Transverse construction joints. When concrete placement is stopped or interrupted for 30 minutes or longer, these joints are installed across the pavement lane. Insofar as practicable, these joints will be installed at the location of a planned joint.

10-3. Expansion joints. When expansion joints are required within a pavement, joint assemblies supporting both joint filler and dowels will be installed before placing concrete. Accurate location and alinement of joint filler and dowels are necessary for proper functioning of joints. Since checking of embedded items in joints installed within a paving lane is extremely difficult, it is essential that assemblies used for supporting embedded items be rigidly constructed and capable of resisting all movement and distortion during paving operations. Great care and continuous inspection are required during placing and finishing of concrete near joints to avoid displacement of joint filler and dowels. Additional hand vibration will be required around the joint assemblies to insure adequate consolidation. The Contractor is required to provide a template for checking the position of dowels.

10-4. Contraction joints.

a. General. All contraction joints will be a dummy-groove type with the load transfer being provided by an interlock of aggregate and concrete in the fracture plane below the joint groove or by an aggregate interlock and dowels. Where dowels are required across transverse contraction joints, suitable dowel-supporting assemblies will be used and care taken to assure proper alinement of dowels in the completed pavement. Requirements for dowel supports have been discussed in paragraph 10-3. Where tie bars are required in longitudinal dummy joints, suitable supporting devices will be provided for holding tie bars in place during paving operations, or the bars may be installed in front of the paver by insertion into the unconsolidated freshly placed concrete. The device for inserting the bars will be mounted on the paver and will automatically insert the bars to the specified depth and at the required spacing.

b. Joint types. Contraction joints may be constructed by sawing a groove in hardened concrete or installing a suitable insert in freshly placed concrete. Sawing of joints eliminates manipulation of freshly placed concrete after placement and provides the best conditions for obtaining a smooth surface at the joint. However, sawing time is critical, and cracking will occur at the wrong place if the joints are not sawed at the proper time. The filler-type joint forms a weakened plane in the freshly placed concrete, which induces fracturing of concrete at the joint, permits continuous curing of pavement, and provides protection for the joint until removed or depressed in preparation for sealing of joints. Although sawed joints have been used successfully on many projects, excessive cracking has occurred in some instances, and special effort is required to insure that sawing is accomplished at the proper time. When sawing cannot be accomplished

without undue uncontrolled cracking, provisions will be made for using inserts. Sawing of longitudinal contraction joints is specified as sawing time and is not critical for these joints. Filler-type joints may be approved for longitudinal contraction joints when it is demonstrated that these joints can be properly installed with vibratory equipment. The filler must be maintained in a vertical position and in proper alinement in the finished pavement.

c. Installation of insert-type joints. Insert-type joints will be installed immediately after all machine finishing operations are completed. The machine for installing the insert will have a vibratory bar that cuts a groove in concrete and simultaneously installs an insert in required locations. The intensity of vibration on the bar will be variable as necessary to form the groove in the freshly mixed concrete. Inserts must be the proper depth for the concrete being placed because the load transfer between the slabs depends on the interlock of aggregate below the formed portion of the joint, and material that is not deep enough will not produce cracking at the proper location. Insert material must be placed flush with the surface to not more than 1/8 inch below the surface. The surface of the pavement will be finished with a vibratory float; hand floating should not be permitted. When finishing concrete, after installation of insert, care must be taken not to work an excessive amount of fine material to the surface and adjacent to the insert. Excessive fines will cause scaling of the surface and spalling of the joint.

d. Sawing of transverse contraction joints.

(1) Method. Transverse and longitudinal contraction joints will be constructed to conform with details and dimensions as designed. Saw cuts will be made to the depth indicated to insure that cracking occurs as planned. Joints will be constructed by sawing a groove in the hardened concrete with a power-driven saw.

(2) Time. No definite time for sawing joints can be specified because of the many factors that may influence the rate of hardening of concrete, such as air and concrete temperatures during placement, ambient temperatures, weather conditions, curing and protection, cement content, and mix characteristics. The basic rule for satisfactory sawing is: be prepared to saw as soon as the concrete is ready for sawing regardless of the time of day or night. During hot weather, when most pavements are constructed, the concrete usually will be ready for sawing about 6 to 12 hours after placing. Since concrete is placed mainly during daylight hours, a large portion of sawing will have to be done at night, and adequate lighting must be provided for this purpose. Although a clean, sharp cut is desirable, a small amount of raveling at the top of the saw cut is not objectionable when early sawing is necessary to avoid uncontrolled cracking. Sawing too early, however, will be guarded against to prevent excessive washing and undercutting of concrete in the joint. The proper time for sawing the joints will

be determined for prevailing conditions on the job during each concrete placement. Since conditions may change from day to day, it is desirable that the saw operator be experienced in sawing pavement joints.

(3) Sawing sequence. Transverse joints will be sawed consecutively in the same sequence as the concrete is placed in the lane. Sawing of alternate joints in the pavement is undesirable because concrete tends to tear ahead of the saw cut when intermediate joints are sawed. This procedure also reduces the uniformity of fracturing of joints, which may result in excessive opening at some joints. Before sawing each joint, the concrete will be examined closely for cracks, and the joint will not be sawed if a crack has occurred near the joint. Sawing will be discontinued in any joint where a crack develops ahead of the saw cut.