SECTION 101- JONTS IN CONCRETE ROAD SLABS

2317. Joints are necessary to allow for volume changes caused by:

a. Shrinkage during drying and hardening.
b. Temperature changes.
c. To avoid crack in the concrete slab.

The formation of joints is the slowest and most difficult part of laying concrete roads, but their omission or faulty construction may lead to failure of the slab.

Figure 23-10: Concrete Joint

2318. Spacing of joints and size of gap.

a. Transverse joints. Dimensions applicable in UK are given in Table 77.

b. Longitudinal joints. Spacing is normally at 11 ft 6 ins or 12 ft, or as may be require to suit construction machinery.

2319. Design of joints.

a. Transverse expansion joints. A load transfer device is normally required (see Para 483). A typical design is illustrated in Figure 47.

b. Transverse contraction joints.

(1) Butt joints (see Figure 48 (a)). Always used in alternative bay construction.

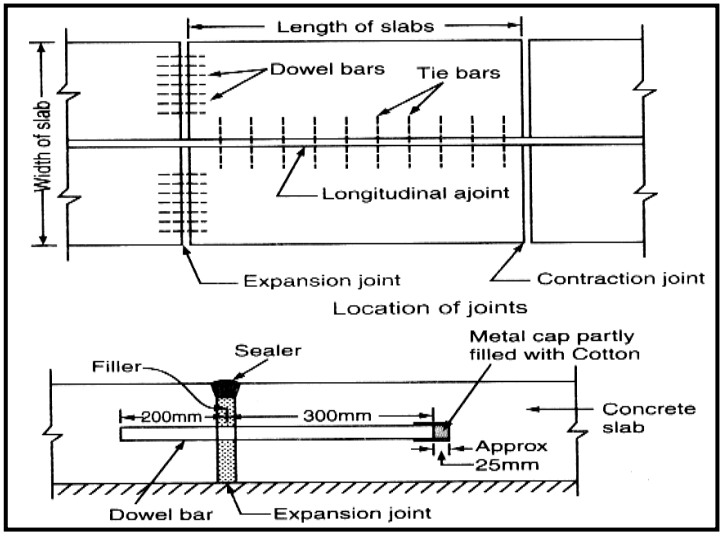

Figure 23-11: Butt Joint

(2) Dummy joints (see Figure 48 (b)). Used in continuous construction. A fillet is inserted into the top surface of the slab, and is subsequently replaced by selling compound and if necessary filler.

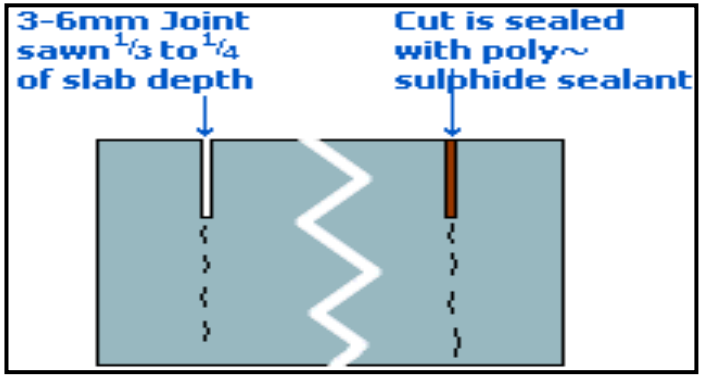

Figure 23-12: Dummy Joint

(3) Sawn joints. Gaps can be cut by a circular "diamond" saw when concrete has hardened, filler and sealing compound being inserted as required.

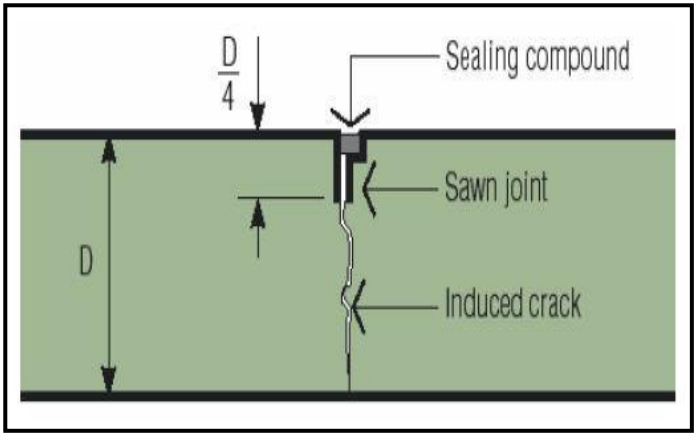

Figure 23-13: Sawn joints

c. Longitudinal joints.

(1) Butt joints. Joints exactly similar to those used as transverse contraction joints can be used in either alternate bay or continuous construction.

(2) Tongue and groove (see Figure 48 (b)). The groove is formed by a shaped beam attached to the framework. Makes a good load transfer device for longitudinal joints. Not recommended for transverse joints. Not effective in slabs less than 8 ins thick.

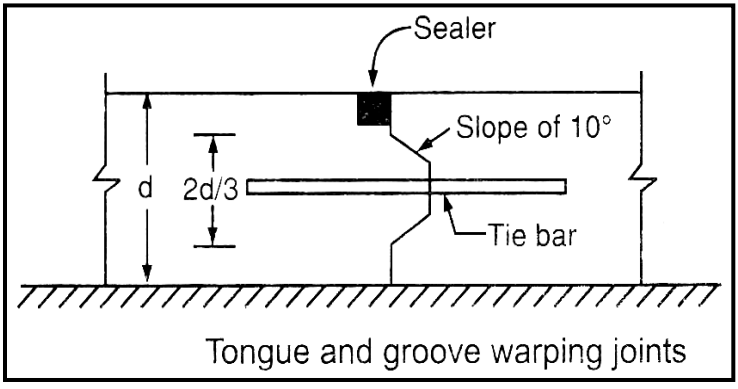

Figure 23-14: Tongue and Groove Warping Joints

TABLE 23.7 SPACING AND WIDTH OF TRANSVERSE JOINTS IN CONCRETE ROAD SLABS*

Serial No	Thickness of slab (ins)	Weight of reinforcement (lb sq yd)	Weather	Expansion joints ł		
				Maximum spacing ± (ft)	Width of gap (ins)	Contraction joints spacing ± (ft)
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Plain Portland cement concrete slabs-						
1.	8	-	Warm Cold	120 90	1	15
2.	6	-	warm cold	90 60	1	15
Reinforced concrete slabs						
3.	10	14	warm Cold	150 150	¾ 1	- -
4.	8	10	warm Cold	120 120	¾ 1	- -
5.	6	7	warm Cold	80 80	¾ 1	- -
6.	4	5	warm Cold	40 40	½ ¾	- -

* The dimensions given allow for a temperature rise from that at which concrete is laid up to the maximum likely in UK. In more extreme climates, spacing should be reduced.

ł If desired, narrower expansion joints may be used at closer spacing, provided that the total expansion space per unit length of road is not reduced.

± The spacing given are for slabs laid on waterproof paper or on a reasonably smooth sub-grade. In other cases the spacing should be reduced.

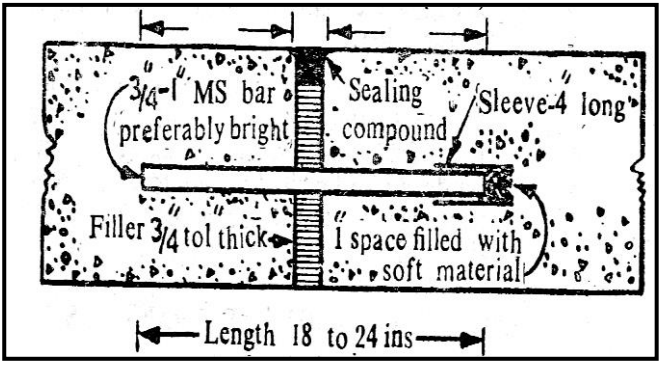

Figure 23-15: Dowel bar used as Load Transfer Device

2320. Load transfer devices.

a. Requirement. The aim is to prevent relative movement between adjoining slabs and to avoid the cracking of edges under impact. Load transfer devices should always be provided in slabs placed on fine grained or frost -active soils.

b. Methods.

(1) Dowel bars (see Figure 23.15). Commonly used in both expansion and contraction joints.

(2) In transverse joints in unreinforced slabs, the bars should be ¾ in diameter, spaced at 12 in centers. Length varies from 18 to 24 ins. loading 20 ins is normally satisfactory. Bright mild steel should be used if available and the sliding end should be sawn, as shearing leaves burrs.

(3) In longitudinal joints ¾ in tie bars, 3 ft 6 ins long, should be set at 24 in centers.

c. Dowel plants. These are difficult to place and should be used only at T-junction. A continuous MS plate is used, usually about 4 ins wide by ¼ in thick.

d. Tongue and groove. See para 557(c) (2) and Figure 23.16(b).

e. Extra strength. On poor sub-grades it may pay to use as sub base of lean mix concrete or soil cement to provide adequate support at transfer points.

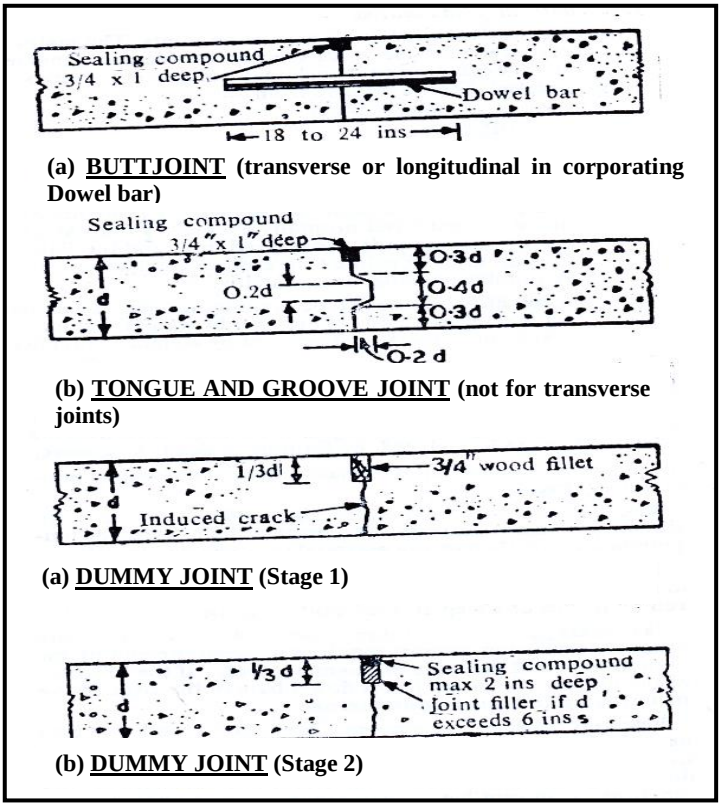

Figure 23-16: Typical Contraction Joints in Concrete Pavements

2321. Joint filling and sealing.

a. Fillers. Required in all expansion joints. The material used must be readily compressible and capable of re-expansion to its original thickness. Prefabricated fillers are made from:-

(1) Cellular rubber.
(2) Cork.
(3) Impregnated fiber board.
(4) Softwood.
(5) Plastic.

b. Sealing. All joints must be sealed. The depth of the seal should not normally exceed 1 ½ ins. Most sealing compounds are poured hot, and the joint should first be primed to ensure good adhesion. A suitable priming compound is:-

200 PEN bitumen 66 per cent by weight	blended hot
Light creosote oil 14 percent by weight	blended hot
Solvent naphtha 20 percent by weight	blended cold

Special joints

2322. Joints in tank roads.The impact of track plates often causes spelling of slab edges, especially at transverse joints. Damage is reduced by forming a deep V groove, filled with mastic asphalt or a hard bituminous sealing material (see Figure 23.17).

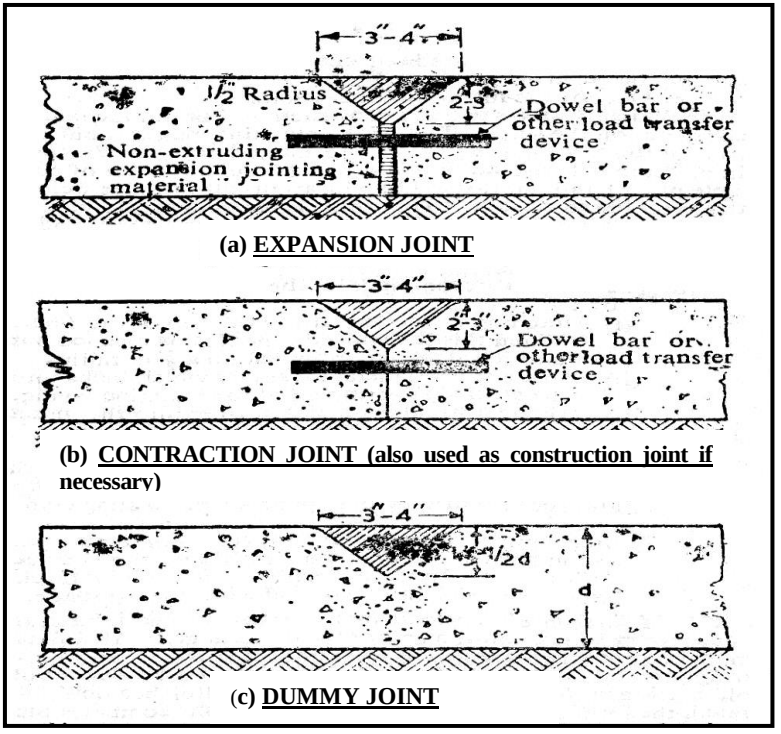

Figure 23-17: V groove

2323. Embankments. Concrete slabs often tend to slip sideways on embankments. To prevent the opening of longitudinal joints lie bars are essential (see para 557 (c) (i)).

2324. Gradients. Owing to thermal movements, slabs tend to creep downhill. On steep gradients slabs must be anchored by means of a step at their bottom ends.

2325. Road Junctions. At junctions between two concrete roads an expansion joint is required between the end of the Branch road and the edge of the main road. If the location of the junction is known insert dowel bars in the edge of the main road slab during construction.

Junctions between concrete and bituminous roads are best made by laying stone setts bedded on concrete. Bituminous material adheres to stone, and concrete can be made to do so by grouting. Unless a watertight joint is formed, the junction is susceptible to damage through the penetration of surface water.

Practical Work

2326. Placing joint filler: - In expansion joints the filler should:-

a. Rest on the subgrade of sub-base.
b. Be vertical.
c. Occupy the full width of the slab.

No difficulty arises in hand construction, but in mechanical construction the surge effect of the machine makes it difficult to hold the filler in position. One method is to fix the joint in position beforehand, holding it in place in a beam of concrete placed and compacted by vibration 30 minutes before the machine reaches it. The thin layer of concrete placed by the machine above the filler will crack and spall and it is then cleaned out and replaced by sealing compound.

2327. Sealing the Joint.

a. The slot to accommodate the seal may be formed by:-

(1) Attaching a wooden lath to the top of the filler when this removed, the slot is cleaned out and its edges are rounded to a ½ -in radius.

(2) Using a special metal assembly which locks into the steel side forms used for machine laying.

(3) Driving a wood or metal former into the unset concrete to forms dummy joints. This necessitates leveling off the adjoining surfaces.

b. The primer (see para 559 (b)) is best applied by brush, using the thinnest possible coating. It should be allowed to dry before pouring the sealing compound.

c. Sealing compound is usually poured from a can with a long nozzle. In cold weather, leave the surface slightly low. In warm weather, fill the joint level. Excess material can be cut off with a sharp spade.

Figure 23-18: Sealing Concrete Joint

2328. Maintenance. Periodic maintenance of the joint seal is necessary to prevent the entry of water and grit. All joints must be properly inspected at least once a year. Joints requiring renewal, and newly formed cracks, should be cleared of old sealing material, dirt, and grit. If the filler has deteriorated the joint should be repacked with fresh compressible material. Sealing is done in the normal way.