9.7.3 Selection of suitable vibrators for different situations

Table 9.4 : Selection of vibrators

S.No.	Type of Vibration	Places where used
1.	Internal	For structures of large sections of mass concrete with sufficient thickness,for concrete of foundations, columns, beams.
2.	Screed	For plain concrete road surface etc.
3.	Form	For thin arcres,tunnel lining, for production of precast reinforced concrete.

9.9 CURING OF CONCRETE

Everybody knows that:

The process of keeping the surface moist for hardening after compactoin is called curing. Some people believe that "Concrete gains strength by drying".Quite the opposite is true. "It gains strength by remaining moist".

It is one of the important factor for obtaining better strength. The concrete hardens becauseof hydration. i.e. the chemical reaction between water and cement.

In the absence of proper curing. Concrete will be weak and may rust and cause less of strength and durability problems. Curing should continue as long as practical as all the desired properties of concrete are improved by curing. Concrete should attain atleast 70% strength at the end of curing.

9.9.1 Objects of Curing

(i) It prevents loss of water by evaporation thus maintaining the process of hydration.
(ii) It improves wear resistance, strength volume stability etc.
(iii) It increases impermeability and durability of concrete.
(iv) It reduces shrinkage of concrete.

Methods of Curing:

(i) Shading concrete works.
(ii) Covering surfaces with gunny bags.
(iii) Sprinkling water
(iv) Ponding method
(v) Membrane curing
(vi) Steam curing.

(i) Shading of concrete work : In hot and dry climates it is necessary to prevent the evaporation of water. In cold climates it is necessary to preserve heat of hydration. The main object is to avoid the evaporation of water from the surface of concrete.

(ii) **Moisture retention :** Use polythene sheets of 0.1mm minimum thickness. Sometimes surface is covered with gunny bags, to prevent from drying out. This method can also be used for horizontal and vertical members.

(iii) **Spinkling :** Using equipment like soaker hoses,lawn sprinklers etc. water should be directed on vertical concrete surfaces for keeping concrete continously wet.

(iv) **Ponding :** Build a ridge with earth, sand or lean mortar to form shallow ponds and flood with water without spoiling the surface. Replace water lost due to evaporation and keep concrete surfaces continously wet.

(v) **Membrance curing :** In this method a newly laid concrete surface is covered for 7 days by using a solid or liquid membranes. These membranes are also known as sealing compounds liquid membranes are used to retard the loss of water from concrete during the early period of setting and hardening. These are used not only for curing fresh concrete, but also for further curing of concrete after removal of form work. Curing compounds like synthetic resin, wax, acrylic, chlorinated rubber, etc. are common types of membrane used.

(vi) **Steam curing :** This method is used in pre-cast concrete industry. In this type of curing temperature and humidity can be effectively controlled with steam curing the strength development of concrete is very rapid.

Precautions during curing :

(i) The temperature of curing water shall not be more than 10 centigrade degress cooler than the surface temperature of concrete.

(ii) Do not allow concrete surfaces to dry or alternate with drying and wetting cycles.

(iii) Use while or reflective sheeting when ambient temperature exceeds 30°C use black or dark colour sheets when maximum ambient temperature is below 15°C.

9.9.2 Duration of curing

The duration of curing period varies according to the type of cement and temperature.As per Indian standards the curing must be carried out at least for 7 days. Curing should continue as long as practical as all the desired properties of concrete are improved by curing concrete should attain at least 70% strength at the end of curing.

9.10 JOINTS IN CONCRTE

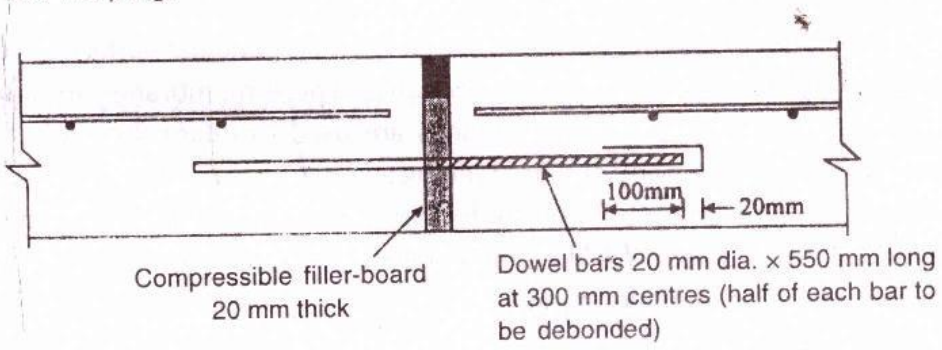
Temperature and moisture changes in concrete slabs induce expansion, contraction and warping, and thus necessitate the provition of joints. Joints are also required to be provision for facilitating a break in construction at the end of the day's work or for any interruptions to work progress.

9.10.1 Types of joints

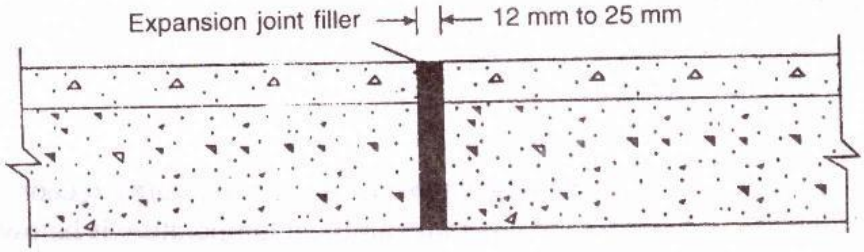
Following ar the types of joints that are present in concrete structures :

1. Transverse joints : Transverse joints consists of expansion, contraction and contruction joints.

(a) Expansion joints : These provide spaces in concrete to allow for expansion of slabs, caused by the increase in mean temperature as compared to the temperature at the time of laying the concrete slab. They relieve compressive stress due to expansion, as also those due to contraction and warping.



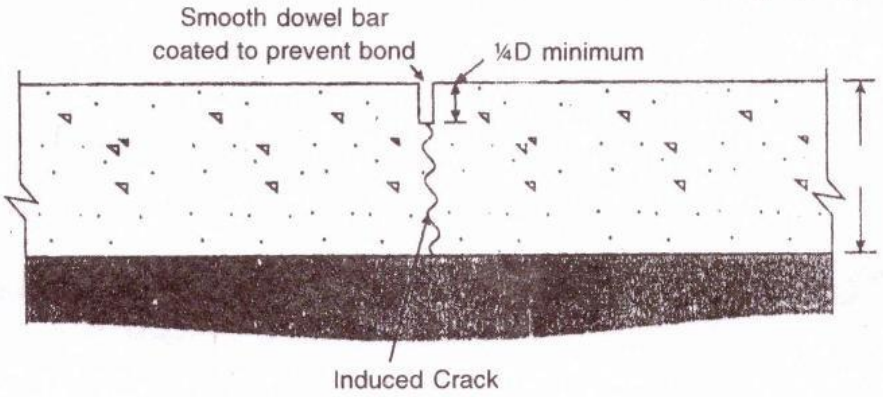
Expansion Joint with Load-Transfer Device



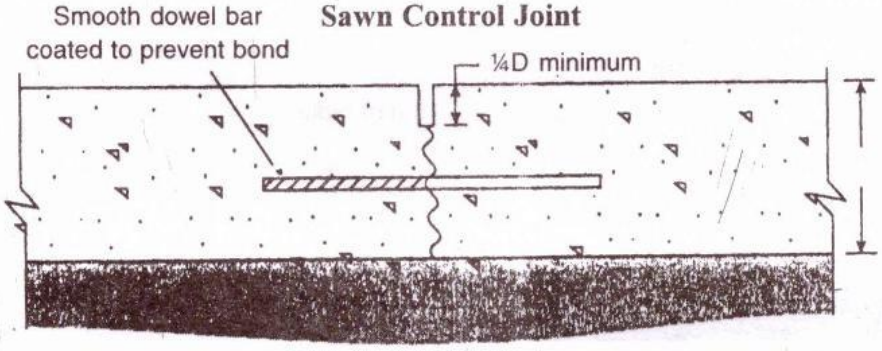
Expansion Joint without Load-Transfer Device

Fig. 9.20 Expansion joints

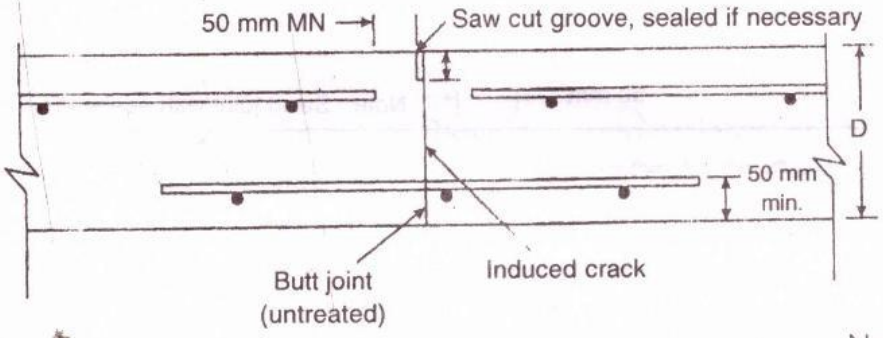
(b) Contraction Joints : These permit the slabs to contract and are breaks in the continuity of the slabs to prevent irregular cracking, which would otherwise result when the ambient temperature falls below the laying temperature. These joints also relieve warping stresses, allowing some angular movement between the slabs caused by temperature gradients. The joints are of dummy - goove type, about 1/3rd to 1/4th the depth of the slab. The cracks from below the grove, at the sametime, they provide aggregate interlock across the joint,to allow some load transfer across the crack.



Sawn Control Joint



Sawn Control Joint with Dowels

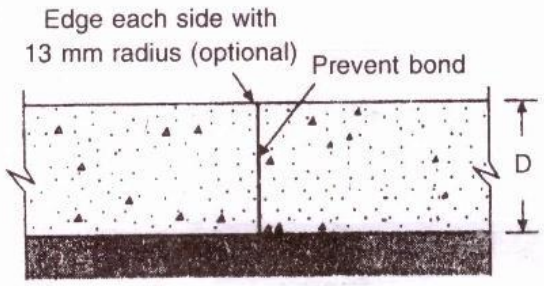


Note : d > D/4

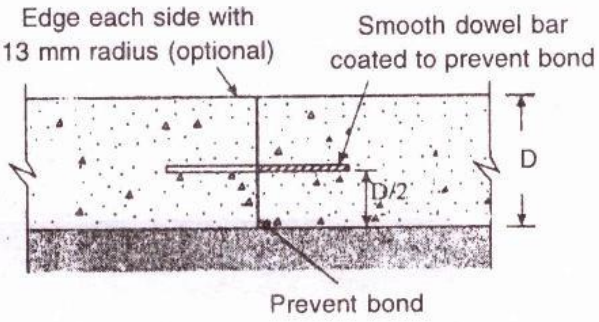
Control Joints (Alternate Detail)

Fig. 9.21 Constraction Joints

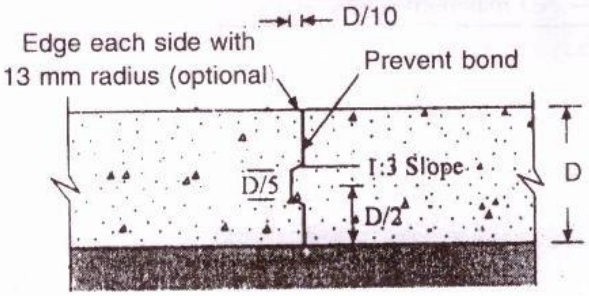
(c) Construction joints : These are provided at the end of the day's work or when work is stopped due to any reason. These are provided at a point, where otherwise no joint will be required in certain cases, opening at construction joint is prevented by providing tie bars or reinforcement.



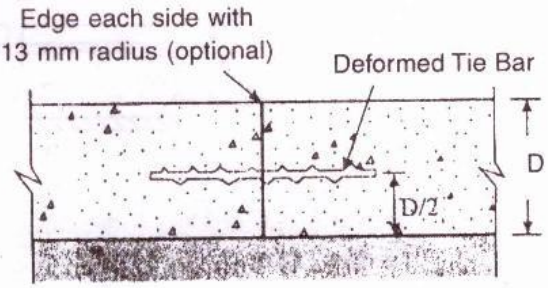
Butt-Type Construction Joint



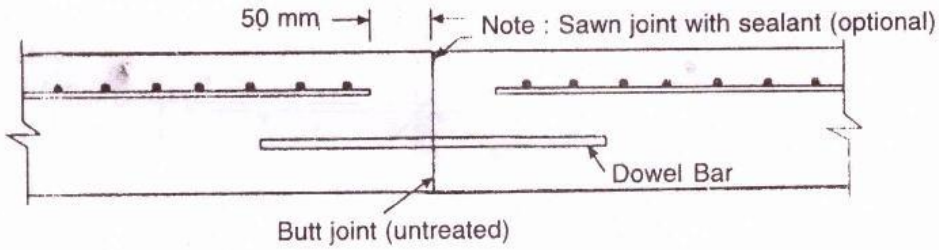
Butt-Type Construction Joint with Dowels



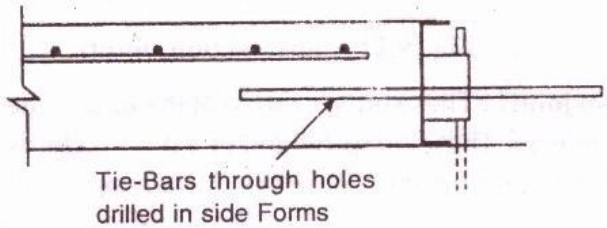
Tongue and Groove Construction Joint



Butt-Type Construction Joint with Tie Bars



Dowelled Construction Joint



Longitudinal Construction Joint

Fig. 9.22 Construction joints

(d) Longitudinal Joints : Longitudinal joints in concrete pavements or floors are required when more than 4 mm wide longitudinal joints are mainly provided to allow for transverse warping and for uneven settlement of the sub grade. These joints are required to act as a hinge, and to allow construction in convenient widths. Generally these are of butt type, but dummy type joints are also used.

9.10.2 Location of construction joint

The joints must be made at such places that the concrete is leas vulnerable to maximum bending moment and maximum shear force, in walls and columns construction joints should be horizontal and arranged at such a level to coincide with the general architectural features. Joints in beams and slabs should be formed at the point of minimum shear.

It is also not deisrale to have the construction joints at the point of maximum bending moment, therefore the joints may be made at the extreme position of the middle third.

Treatment of construction joint :

(1) Construction joint should be properly marked when finishing the structure. Wire brush can be used for making the surface rough.
(2) If old concrete has hardened, then chiselling is done for making the concrete surface rough.
(3) Then it is washed with a water jet under pressure.
(4) The wetted surface of old concrete is then covered with 13mm layer of concrete.
(5) The groove may be incorporated at the joint to make a feature and to hide the joint.

9.10.3 Location of expansion joint

In the part expansion joints were provided at closer intervals in the floars and pavements.These days from experience, it is seen that concrete does not actually expand to the extent indicated by the simple analytical calculations.

In view of the large number of factors involved in deciding the location, spacing and nature of expansion joints. It is recommended that structure exceeding 45m in length shall be divided by one or more expansion joints.

9.10.4 Importance of joints

Industrial floors and concrete pavements are constructured generally in alternate bays to allow for the incidental shrinkage of concrete. A time interval as much as practicable is given between the adjacent bays to provide scope for the maximum possible shrinkage. In pavements proper joints are provided to direct the possible cracks arising out of expansion and out of thermal expansion and contraction due to variation in temperature and also due to long term drying shrinkage.

9.11 REPAIR AND MAINTENANCE OF CONCRETE

Even if good materials strict quality control and excellent workmanship is employed in

Chapter-10

Non-Destructive Tests

These tests are conducted to know the quality of concrete work, its strength and durability, thickness of the concrete member etc. These tests are done without damaging the concrete.

Types of Tests on hardened concrete

1. Destructive tests
2. Non-destructive tests

1. Destructive tests → These tests are conducted by either casting cubes from the concrete samples from the actual concrete and ~~they~~ then loading these cubes till they break.

Mostly compressive strength test is performed to get an idea about the strength of concrete in compression.

2. Non-destructive tests → These tests are used to examine the properties of concrete used in existing structure without damaging the composition or stability of the structure.

Importance of Non-destructive Testing →

1. Non-destructive testing can be applied to both old and new structures.
2. For new structures, these tests are conducted for quality control
3. for detecting voids, cracking etc in the concrete.
4. The range of properties that can be assessed is quite large.
5. It also assessed fundamental parameters such as density, elastic modulus, strength as well as surface hardness, surface absorption, size and distance from the surface.

~~Rebo~~ Types of Non-destruction tests —

1. Rebound hammer test
2. Pulse velocity test