

Technical Note No: 5

Sub: APRRP-CC Pavements – Sealing of Joints in Cement Concrete Pavements- Guidelines - Communicating - Reg.

Ref: 1) Inspection of works in Prakasam, Guntur and Nellore Districts by PMC Team.
2) IRC:57-2018: Recommended Practice for Sealing of Joints in Concrete Pavements (Second Revision)

Background: During inspection of APRRP works by PMC Team it was observed that the Joints in CC roads are not sealed properly as per specifications. Due to that spilling of sealing compound observed on the CC road results into shabby appearance of road and the purpose of sealing is also not served.

The defective process of sealing of joints observed on CC roads of APRR Project in three districts are as shown below.





Purpose of Sealing Joints:

The **purpose** of **joint sealant** is to minimize infiltration of surface water and incompressible material into the **joint** system. **Sealants** also reduce dowel bar corrosion potential by reducing entrance of de-icing chemicals.

Type of Joints:

In Cement concrete pavements, the following types of joints are commonly provided:

- a) Contraction Joints
- b) Expansion Joints
- c) Construction Joints
- d) Longitudinal Joints

Contraction Joints:

They are formed initially by sawing a groove of 3-5 mm width up to about one-fourth to one-third the slab thickness as shown in Fig1. In order to seal the joint, the top 10-20 mm of this groove is widened to 8-10 mm as shown in Fig 3,4 &5. Typical cross section of a contraction joint is given in Fig 6.

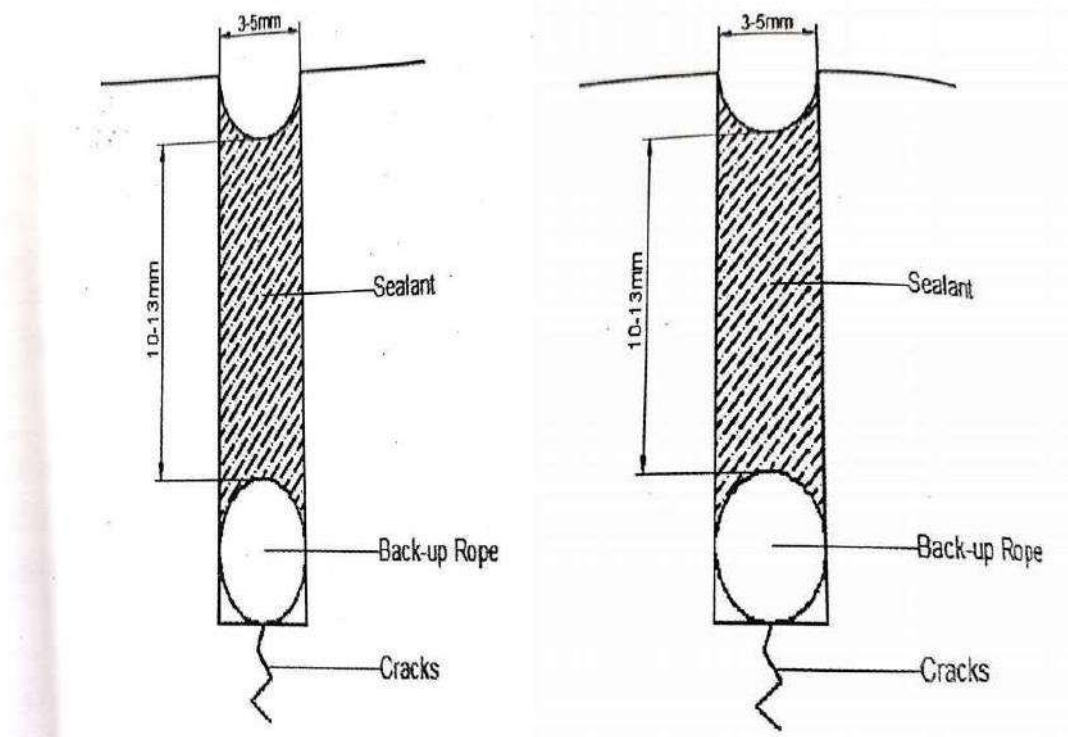


Fig 1. Contraction Joint/Construction Joint.

Longitudinal Joint

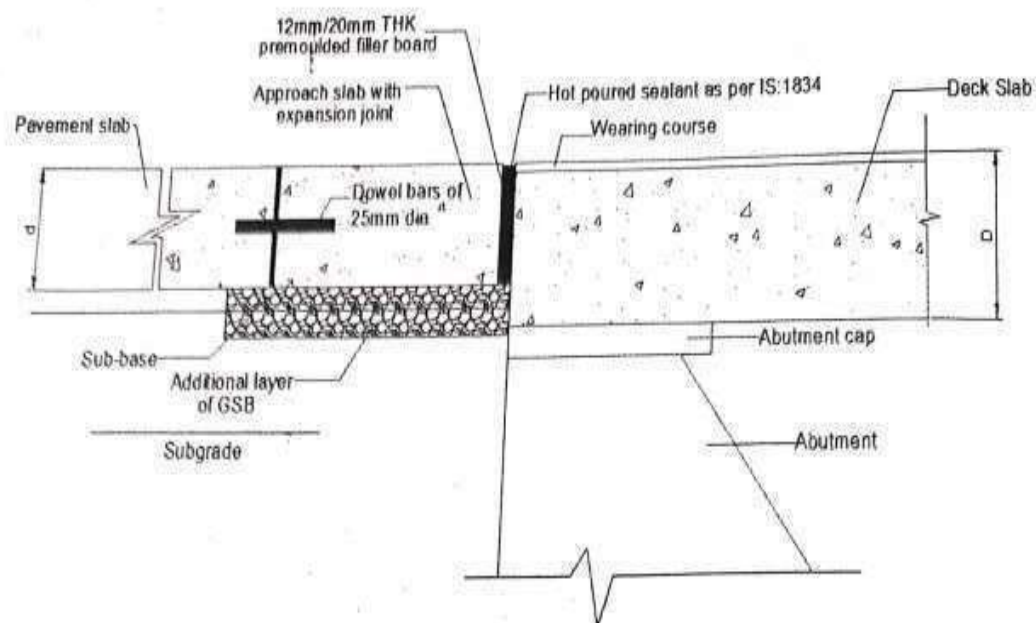
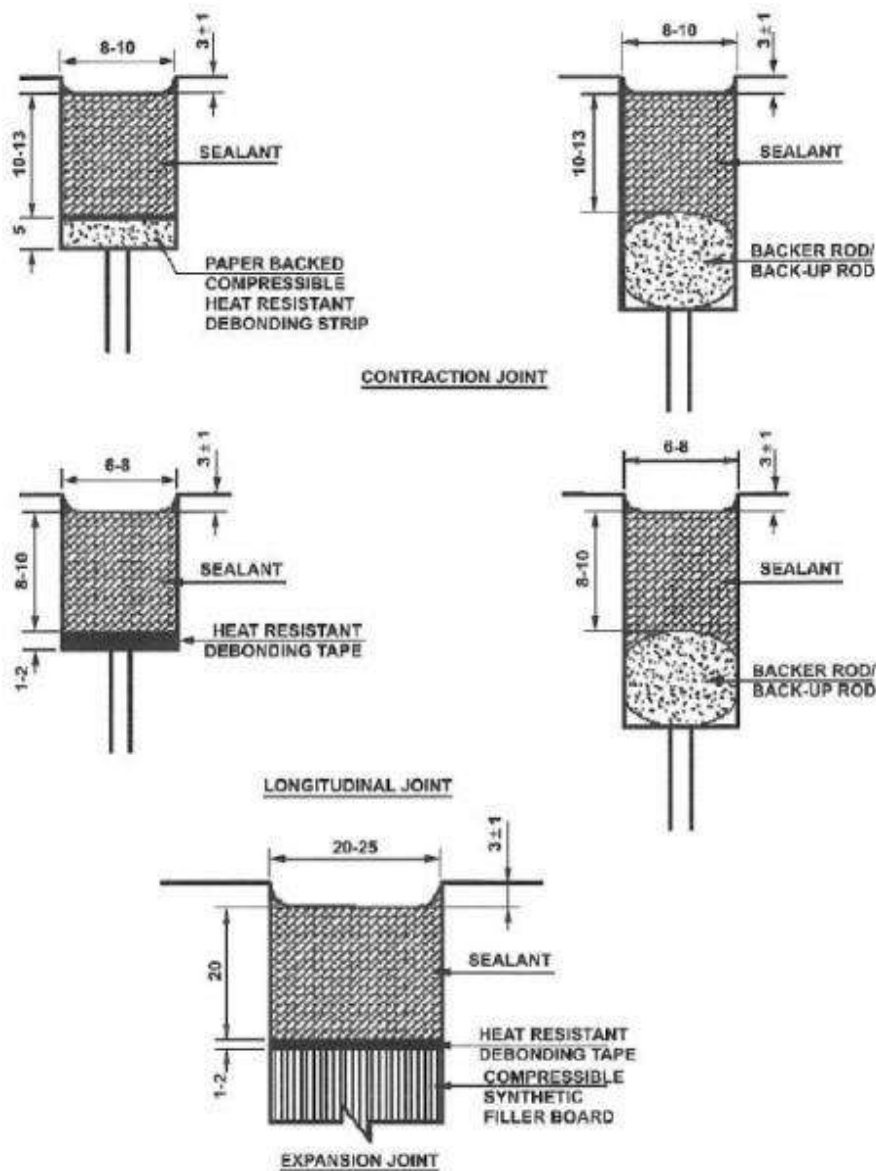


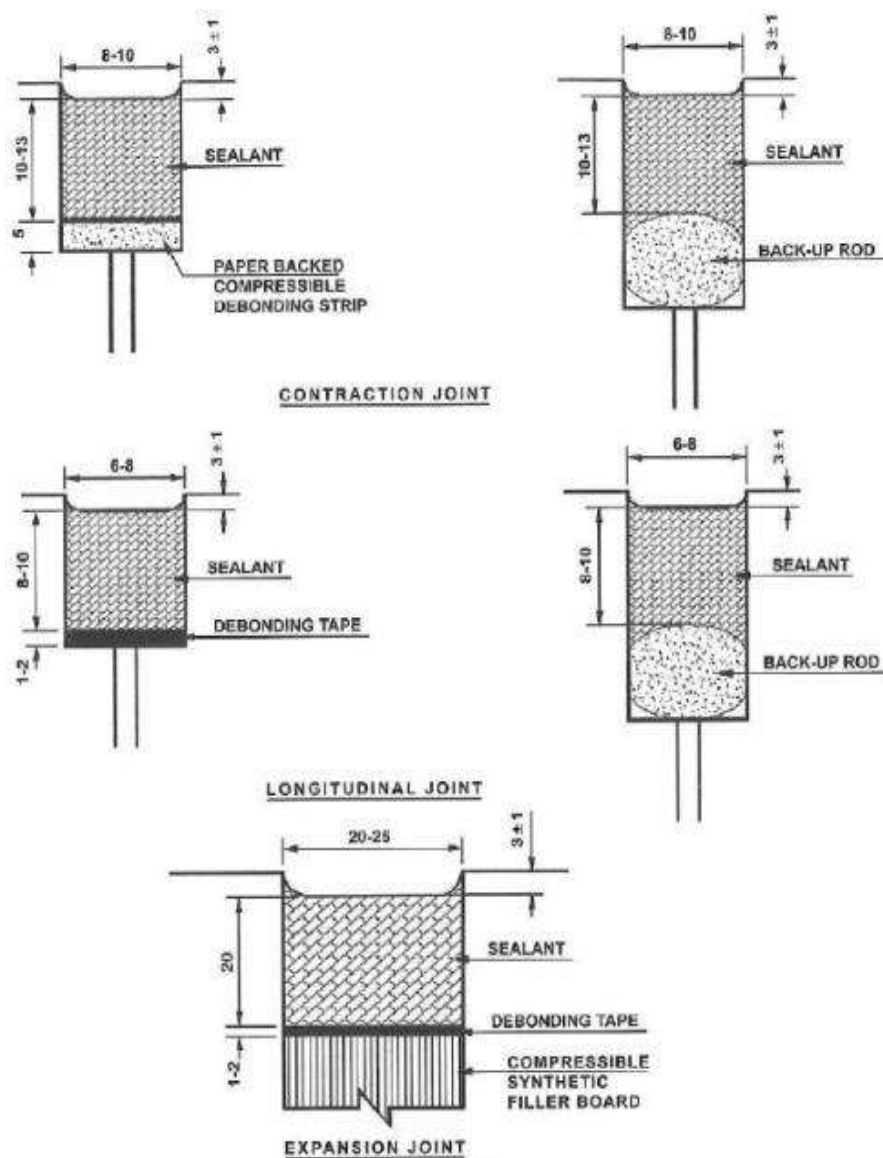
Fig 2. Deck Slab and Expansion Joint in Concrete Pavement



NOTES:

1. PAPER BACKING OF COMPRESSIBLE DEBONDING STRIP IS NOT NECESSARY IF THE STRIP IS NON-ABSORBENT TYPE.
2. JOINTS CAN BE SEALED BY ADOPTING ONE OF THE TWO OPTION OF DEBONDING STRIP/BACKER-ROD AS SHOWN.
3. DEPENDING UPON THE SEALANT MANUFACTURER'S RECOMMENDATION, THE SIDES OF THE GROOVE MAY HAVE TO BE SAND BLASTED/SAND PAPERED AND PRIMED.
4. THE GROOVE AND SEALANT DIMENSIONS SHOWN ARE ONLY FOR GUIDANCE.
5. BACKER ROD/BACK-UP ROD SHALL BE EXPANDED CLOSED-CELL POLYETHYLENE FORM.
6. ENDS OF THE SEALANT GROOVE SHALL BE PLUGGED BEFORE POURING SEALANT TO AVOID SPILLAGE Laterally.
7. ALL DIMENSIONS ARE IN mm.

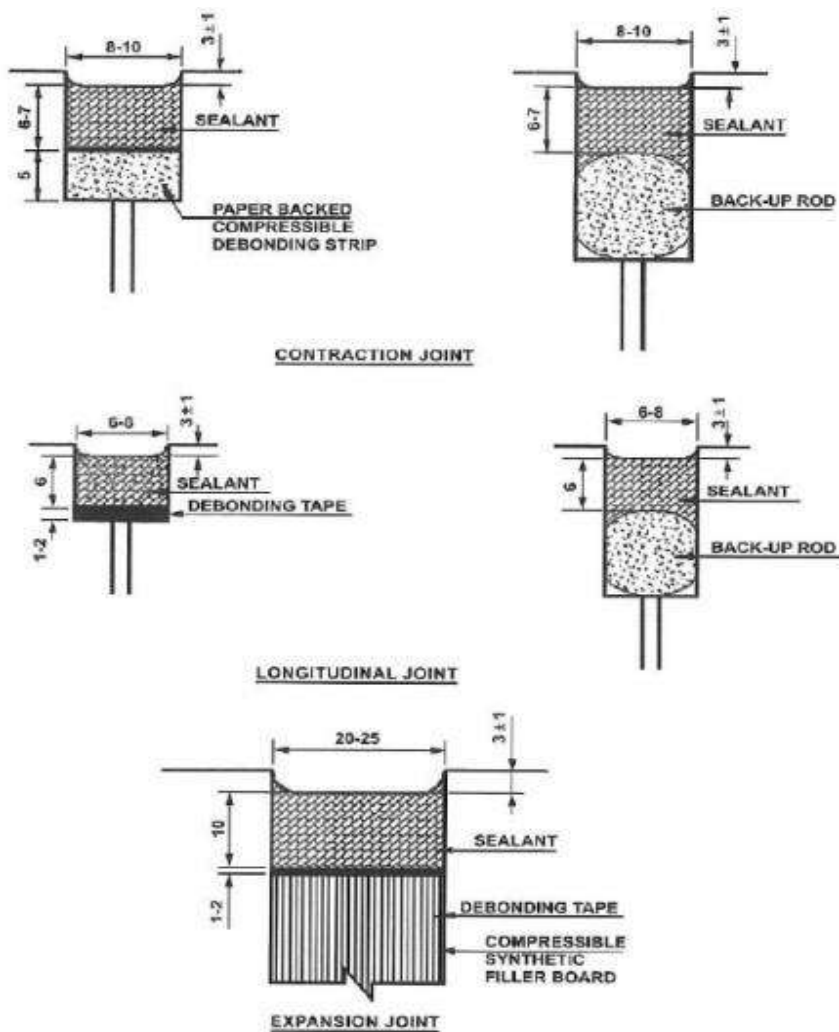
Fig. 3 Sealing Details of Joints
(Grooves Suitable for Hot Poured Rubberised Bitumen Sealant)



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6. ENDS OF THE SEALANT GROOVE SHALL BE PLUGGED BEFORE POURING SEALANT TO AVOID SPILLAGE LATERALLY.
7. ALL DIMENSIONS ARE IN mm.

Fig. 4 Sealing Details of Joints
(Grooves Suitable for Cold Polysulphide Sealant)

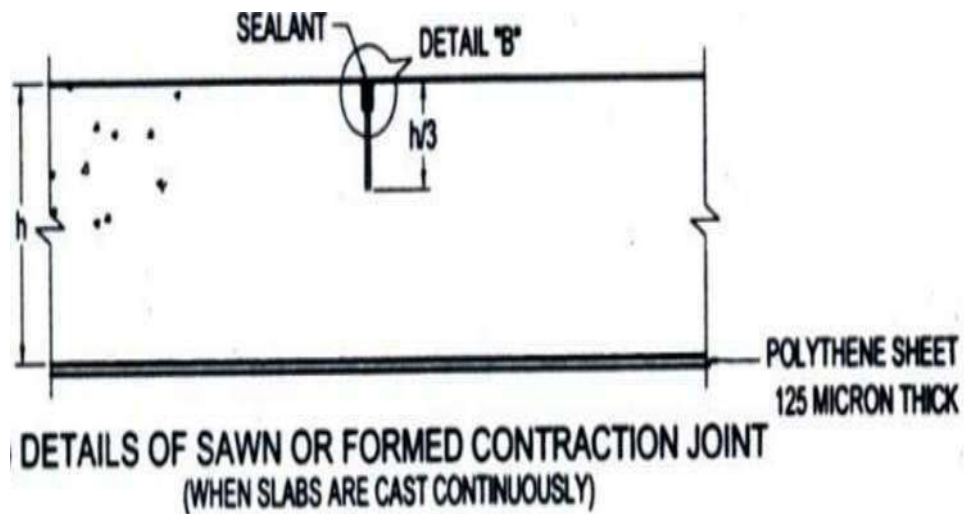


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Fig. 5 Sealing Details of Joints
(Grooves Suitable for Cold Silicone Sealant)

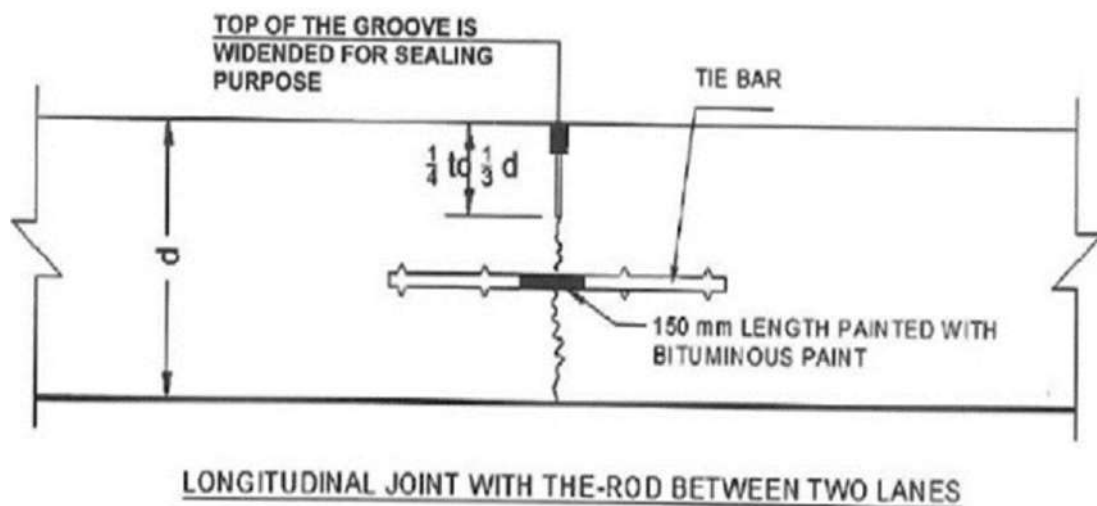
Fig 6:



Longitudinal Joint:

Longitudinal joints are provided in multi-lane pavements and also when the pavement is more than 4.0 m wide (As per IRC:15) and 4.50 m (as per IRC: SP:62-2014). Initial Joint is cut to depth of $\frac{1}{4}$ to $\frac{1}{3}$ of the slab. Tie bars are provided at the joints. The top 10-20 mm depth of the joint is sawn to width of 6-8 mm for sealing. Typical cross section of a joint is given in Fig 7.

Fig 7 :



The details of Tie-bars for longitudinal joints are shown in Table 8 of IRC:15 as below

Table 8 Details of Tie Bars for Longitudinal Joints of Two-Lane Rigid Pavements (Same as IRC:58)

Slab Thickness (mm)	Tie Bar Details				
	Diameter (d) (mm)	Max. Spacing (mm)		Minimum Length (mm)	
		Plain Bars	Deformed Bars	Plain Bars	Deformed Bars
150	8	330	530	440	480
	10	520	830	510	560
200	10	390	620	510	560
	12	560	900	580	640
250	12	450	720	580	640
300	12	370	600	580	640
	16	660	1060	720	800
350	12	320	510	580	640
	16	570	910	720	800

Note:

- 1) S = 125 MPa for plain bars, 200 MPa for deformed bars, Bond stress for plain bars = 1.75 MPa, for deformed bars = 2.46 MPa, W = 24 kg/sqm/cm of slab.
Where, S is minimum tensile strength of steel, B is minimum bond strength of concrete with steel bar, W is the weight of concrete/sq cm/cm.

Expansion Joints:

The current Practice is to provide these joints only when concrete slab abuts with bridge or culvert. They are about 20-25 mm in width. The joint groove is filled by a sealant as shown in Fig 3,4 and 5. Two expansion joints may be provided near a culvert or a minor bridge to take care of expansion of the concrete slab as shown in Fig. 2. The details of Joint are shown in Fig .8.

Table 5 of IRC:58-2015 Recommended Dimensions of Dowel bars

Slab thickness mm	Dowel bar details		
	Diameter mm	Length mm	Spacing mm
200	25	360	300
230	30	400	300
250	32	450	300
280	36	450	300
300	38	500	300
350	38	500	300

Note: Dowel bars shall not be provided for slabs of less than 200mm thick. For heavy traffic, more than 450 CVPD, dowel bars shall be provided at contraction joints also,

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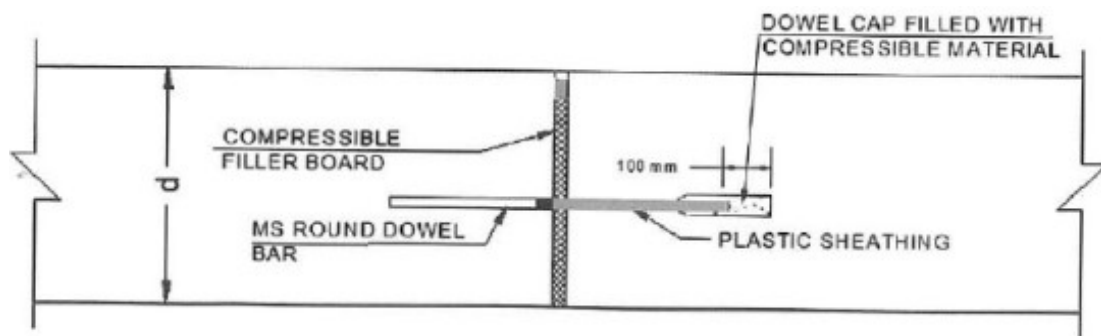


Fig. 8. EXPANSION JOINT WITH DOWEL

Construction Joints:

Transverse Construction joints shall be provided wherever concreting is completed after a day's work or is suspended for more than 90 minutes. The sealing of such joints shall be done in the same manner as for contraction joints, by cutting a groove 10-12 mm wide and 20-25 mm deep. The work should be normally stopped at the regular location of contraction or expansion joint.

Steps Involved in Sealing Operations:

- **After minimum 28 days of casting, widening of the first saw cut of 3-4 mm to the required dimensions as shown in Figs. 3,4 and 5.**

Groove before sealant fill.



- Sand blasting the groove face if the sealant manufacturer recommends it since the surface of sides becomes smoother during grooving/widening.
- **Cleaning the groove with air compressor**



- **Cleaning the groove with water**



- **Insertion of debonding strip**



- **Priming the sides of the joint to improve the adhesive bond between sealing compound and concrete, if the sealant manufacturer recommends it.**
- **To prevent spillage of sealant on the concrete surface card-board or tape should be stuck on both edges before pouring sealant as shown below.**



- **Pouring of Sealant**

Sealing of Joints : Adhesive Tape is fixed on both sides of Joint to maintain neat finishing of joint



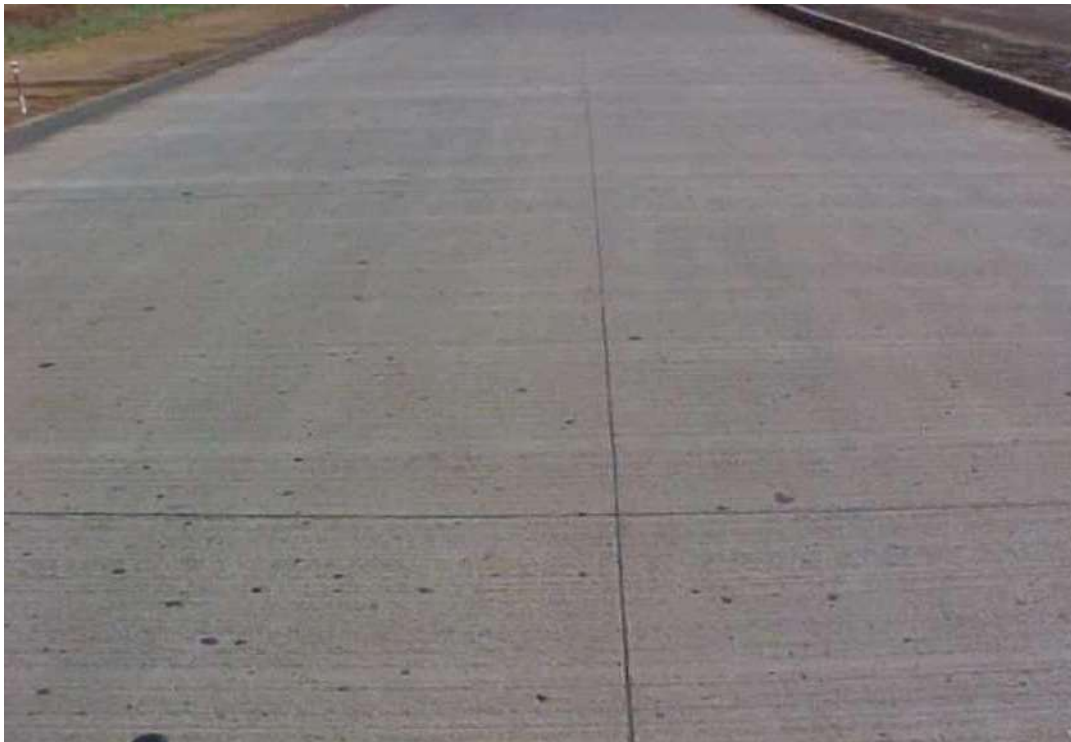
- **Removal of Masking Tape after pouring the sealant**



- **Correct way of sealing joints**



- **Finished PQC surface with Sealed Joints**



Types of Sealants:

There are two main categories of materials for sealing of joints in cement concrete pavements, viz:

- Hot-poured sealants
- Cold poured sealants

Table 1 gives the brief details of various joint sealants in use.

Table 1 Common Joint Sealants

Sealant Type	Specification	Properties
Hot Poured Joint Sealants		
Rubberized Bitumen Sealant	IS 1834	Self leveling
Polymeric Asphalt Based	AASHTO M0173	Self leveling
	ASTM D 34005	Self leveling
	US Federal Highways Administration Specification	Self leveling
	SS-S-1401 C	Self leveling
	ASTM D 1190	Self leveling
Polymeric Sealant	ASTM D 3405	Self leveling
Low Modulus	Modified	Self leveling
Elastomeric Sealant	US Federal Highways Administration Specification	
	SS-S-1614, ASTM D 3406	
Coal Tar, PVC	ASTM D 3406	Self leveling
Cold Poured Sealants/Single Components		
Silicone Sealant	ASTM 5893-96	Non sag, Toolable Low modulus
Silicon Sealant	ASTM 5893-96	Self-leveling (no tooling) low modulus
Sealant Type		
Polysulphide Sealant	BS 5212-1990 IS 11433-1986 (Reaffirmed in 1995)	Self-leveling (no tooling) low modulus
Polyurethane Sealant	BS 5212	
Polyurethane Sealant	Polymer US Federal Specification item 4.4.7	<ul style="list-style-type: none"> • High chemical resistance (as per US federal specification item 4.4.7) • High mechanical resistance (as per US federal specification item 4.4.9) • Density is 1.6 kg/l • Curing time is approx 24 hrs. • MAF is 25% • Non sag properties are self leveling, can be used with a slope of 3% (depending on the temperature) • Service temperature is minus 40°C up to 80°C

10/10/19
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