

Construction Quality Technical Direction

Quality Alert 34 – Concrete Pavement Joint Sealing

CQTD
2012/003
October 2012

This alert has been issued to minimise the risk from incorrectly installed concrete pavement joint sealants.

Background

There have been a number of reports of pavement joint sealants losing adhesion within the first 5 years of service and eventually coming away from the joints. This is preceded by the sealant 'dropping down' in the joint at the wheel paths as shown in Figure 1 and progressively deteriorating to the point of being removed from the joint.

Joints are required to be sealed to prevent the ingress of debris and water. The early distress of the sealants is of serious concern as the repair task requires lane closures and associated serious disruption to traffic, along with significant costs.

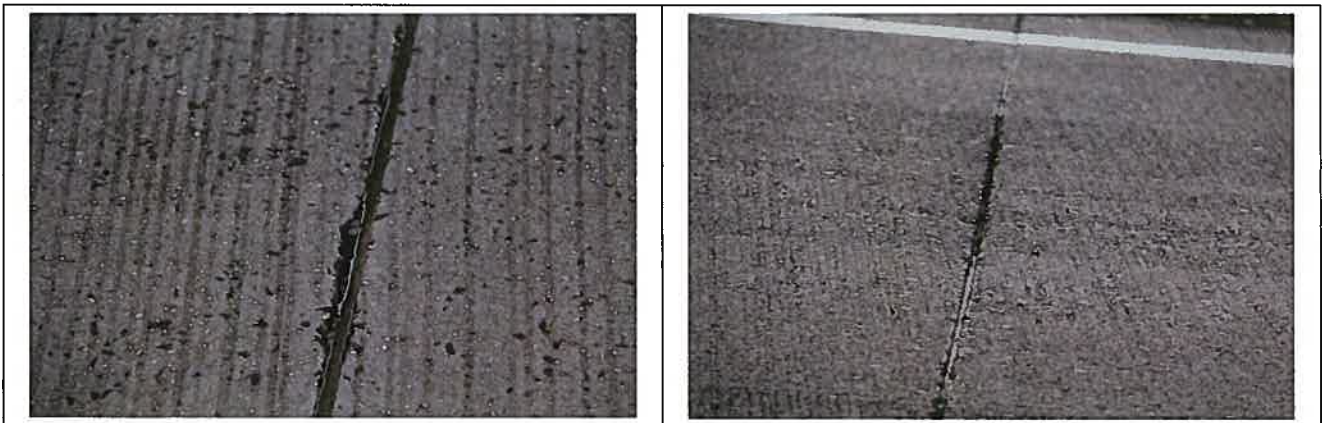


Figure 1 View of silicone sealant adhesion failure (left) and sealant 'dropping down' in the transverse contraction joint (right).

An investigation into the possible causes of the early sealant distress by RMS and the Australian Society of Concrete Pavements (ASCP) has indicated that the most likely cause is in the preparation of the joint prior to application of the sealant.

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In addition, the increase in this distress mechanism in recent years may also be related to the wider use of early-entry sawing.

Comment

1. Specification R83

The cleanliness of joints after sawing and prior to sealing is a two stage process, with a preliminary seal¹ installed between the two stages.

In Clause A4.5.3.2, the joint cleaning requirements are as follows:

“The sawcut must be cleaned of all debris soon after sawing and before the residue dries. The cleaning method used must not damage the sawcut or arrises nor leave any substance deleterious to the concrete or to the adhesion of the joint sealants to be used.

The method must incorporate a liquid or liquid/air oil-free jet at a sufficiently high pressure to ensure that the faces are dust-free upon drying. Gravity fed liquid from tanks will not be acceptable. Grit blasting must not be used.”

The residue powder from early-entry sawing is commonly broomed to temporary piles and removed. Shovels or other metallic devices should be used with caution as they may damage the surface tining and joint arrises. The final residue from early-entry or conventional sawing may be removed by air or liquid (ie water) with sufficiently high pressure.

Clause A4.5.3.5 of R83 states that the permanent sealing is applied within 14 days of initial sawing and within 2 hours of removing or depressing the existing preliminary seal, and the joint cleaning requirements are as follows:

“Immediately prior to introducing the silicone sealant into the groove, any foreign or disturbed material such as dust must be cleaned from the joint and from the top of the backer rod by a dry, oil-free air jet. Grit blasting must not be used. The joint faces must be fully surface dry at the time of installation and the joint must then be primed in accordance with the recommendations of the sealant manufacturer.”

One of the key attributes for the sealant to perform to its design life is that the vertical surfaces of the joint must be clean and dry to ensure adhesion between the sealant and concrete. Sealing the joint when the concrete has not had sufficient time to cure and dry may contribute to poor adhesion.

2. Interim approach to sealant application

The following steps are considered to be a minimum approach to sealant application for all sawn joints in RMS concrete pavements and are in keeping with the current requirements of RMS R83:

1. Remove the residue powder when using early-entry saws but ensure the powder does not enter the joint.
2. Where early-entry saws are being used the Contractor must inspect the skid plates and saw blades at regular intervals and ensure they are cleaned as required and, as a minimum, at the end of every shift.
3. High pressure water, or high pressure water and air be used to clean all joints. The timing of this cleaning will need to be adjusted to suit individual mixes and setting times during different periods of the year to minimise damage to joint arrises. The use of industrial or domestic leaf blowers and very high pressure water devices is not permitted.
4. Install preliminary seal.

¹ Consisting of a continuous closed-cell polyethylene backer rod.

5. Conduct second sawcut if required to meet the reservoir dimensions as detailed in the project drawings.
6. Clean and dry the joint using high pressure air.
7. Before commencing sealing operations, assess the cleanliness of the sawcut using a piece of 100% cotton black cloth inserted into the cut using a tongue depressor (or similar). An acceptable result is achieved when no residue appears on the cloth when rubbed at a minimum width of 25 mm from the top of the arris.
8. The vertical faces of the joint must also be surface dry. This inspection is to be administered as a Hold Point as part of a trial to be released either by the Contractor's representative, Project Verifier or RMS representative following a joint inspection.
9. Surveillance Officers are to inspect on a regular basis the application of the approved contractor's method statement and that the verification checklists (referred to below) are correctly applied on the project.

Testing of the joint for cleanliness and dryness is to be carried out at 2 locations per transverse joint and 1 location on a longitudinal joint per subplot. If these are all acceptable over 3 consecutive sublots then the frequency may revert to 1 set of tests over 2 sublots. If any joint fails then all joints within the subplot must be re-cleaned and re-inspected, with test frequency reverting back to the start.

Ensuring that the concrete has cured sufficiently and dried adequately after rainfall is essential to achieving the sealant design life. While no testing regime currently exists, a process is being developed to assess moisture conformity.

Consideration is to be given to the application of a primer in accordance with the sealant manufacturer's recommendations in areas that are considered high risk. Examples where high risk areas may occur are:

- sag curves
- areas protected from direct sunlight for long periods of the day
- areas under bridge overpasses, especially in high rainfall areas (where rainfall exceeds 1500 mm per annum).

Notwithstanding the use of a primer, the preparation and assessment of the sawcut joint is to be conducted in accordance with this Quality Alert.

Conduct a standard field adhesion hand pull test at 3 tests per Lot². Cut the silicone sealant at each arris in one location and lift the tail, stretching the sealant. For an acceptable test result to be achieved, the sealant should stretch to four times its length before breaking the bond. The Contractor must assess the performance of the adhesion test in liaison with the Project Verifier and RMS representative. The adhesion test must be administered as a Witness Point.

3. Checklist

A verification checklist for joint preparation and sealing must, as a minimum, include the following details³:

- date and time the concrete was placed.
- date and time the joint was sawn and sawcut method.

² Lot being one day's production.

³ This is not a comprehensive list and consideration should be given to other details, such as recording the sealant batch number.

- date and time the joint was widened and the sawcut method (if applicable).
- that the joint has been cleaned and the joint's cleanliness has been assessed.
- remedial action taken in the event that the cleanliness of the joint is unsatisfactory (if applicable).
- air temperature and the Dew Point at time of sealing.
- the sealant product name and supplier.
- the primer product name and supplier (if applicable).
- date and time the joint was sealed.
- a standard field adhesion hand pull test has been performed successfully at the specified intervals.

Action

It is recommended that:

1. A review of PQP documentation commences for all current projects covering sawing and sealant application operations. In this review the contractor's ITP must address the matters described in this Quality Alert.
2. Specific actions are:
 - the joint be cleaned after every sawing operation as required in the Specification and described in this Quality Alert;
 - the joint be cleaned and tested before the application of the sealant;
 - a suitable primer be used in accordance with the manufacturer's guidelines in high risk areas.
 - standard field adhesion hand pull tests be conducted
 - a verification checklist (or ITP) be used that covers the preparation of the joint, sealing, and assessment of seal.

A new RMS Test Method is being developed that addresses additional site testing requirements and will be circulated when completed.