Seal No Seal GROUP

Tech Brief

Filling Narrow Joints in Concrete Pavements

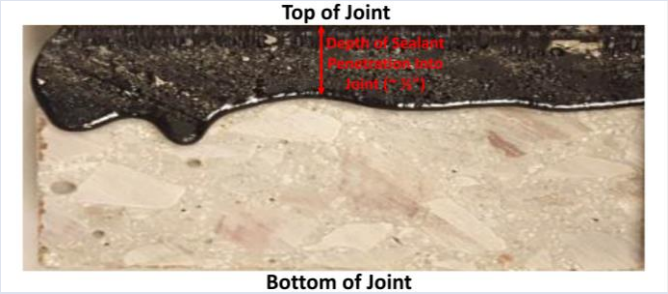

Figure 1 Hot Pour Penetration Depth

Introduction

Traditionally, sealing joints requires a specific sealant shape factor, backer rod, and reservoir cut. The reservoir cut is typically ¼" to 3/8" wide for highway applications. Sealant materials include hot pour, silicone, or compression seal (which does not use a backer rod).

In recent times, filling of narrow joints in concrete pavements has become more common. With this increased interest, it is important to understand the procedures and materials necessary to provide quality installations and acceptable performance.

Width of Initial Saw Cut

It is not possible to successfully install hot pour sealant in a 1/8" sawn joint. The product does not penetrate sufficiently into the joint as indicated in Figure 1. The volume of hot pour being placed is small, so it is difficult to control and often results in excess material on the surface.

Figure 1 represents the sealant penetration into a 1/8" inch wide laboratory prepared joint sealant installation with a resulting penetration of approximately 1/2". Penetration into a 3/16" wide joint opening was at least two inches. The laboratory penetration results for both joint widths were based on an ASTM D6690 Type II sealant applied at the high end of the recommended application temperature.

Figure 2 indicates a core retrieved from a project which specified a 1/8-inch-wide joint width. Penetration was limited to ½ inch with a large deposit on the surface. This field result supports the lab results.

It is recommended that for new construction, a minimum blade width of 5/32" be used for contraction joints unless a second widening cut is to be performed. This also assumes that with shrinkage, the final joint opening width will be at least 3/16 inch before sealant installation.

Figure 2 Field Core Retrieved from 1/8" Joint

Estimates of the joint opening widths can easily be determined using the ACPA "Joint and Sealant Movement Estimator". The ACPA also has a Joint Noise Estimator app. Both apps are available at the App Library at www.acpa.org .

When constructing narrow joints, one of the trade-offs is selection of the green saw blade width. The initial cut must be wide enough to provide the minimum width necessary for joint filler installation and narrow enough to allow timely sawing to prevent random cracking or raveling of the joint. The wider the blade used, the greater risk of random cracking and/or joint raveling.

This statement also assumes a typical 15 ft joint spacing. Joint spacings greater than 20 ft may require further analysis based on the environment. It further assumes that initial saw cut depths are sufficient to activate all joints prior to joint filling.

Joint Sawing

When narrow joints are used, only the initial saw cut in the green concrete is typically done. As mentioned before, the blade width and subsequent concrete shrinkage should produce a minimum joint opening width of 3/16 inch. After green sawing, slurry residue can be removed through water blasting, or allowed to remain in the joint until shortly before sealing. Allowing slurry to remain, provides protection from incompressibles entering during other construction activities.

When slurry can remain, a second sawing operation is typically conducted to remove it. The same blade width as before is used. Once the joint has been sawn to remove slurry, it is imperative to water blast the joints to remove the remaining slurry and debris. Figure 2 indicates debris that was trapped beneath the filled joint because of improper cleaning.

Joint Cleaning

With the minimal cost associated with joint cleaning and its significant impact on overall sealant performance, there is no reason to not ensure proper procedures are followed; both from a contractor and agency perspective.

Cleaning and inspection of joints is hindered due to the narrow joint configuration. However, clean and dry are still critical components of successful formed-in-place joint sealant installations and are always recommended.

Just prior to filling the joint, media blasting should be conducted to provide a good bonding surface followed by air blasting. If significant time elapses between the air blasting and joint filling, a second air blasting may be necessary.

Most media blast procedures recommend that two passes be made (one for each side). However, a more typical approach for narrow joints is a single pass with an alignment fixture (See Figure 3). It should be remembered that the goal is to media blast the top two inches of the joint walls to provide good bond throughout the filled area.

Figure 3 Media Blast Alignment Fixture

Inspection of the cleanliness of the narrow joint is difficult and it is recommended that the ACPA Joint Reservoir Quality Control Wipe test be used. It is available at www.sealnoseal.org.

It should be noted that only the top two inches of the joint wall are important for bonding. This is a result of the inability of the sealant to penetrate the entire depth unless a ¼ inch or wider joint is used. If a reservoir cut is used, this problem is eliminated.

Figure 4 is a joint ready for material installation.

Figure 4 Photo of Media Blasted Joint

Material Selection

Although other products may work, it is recommended that an ASTM D6690 Type IV sealant be used for narrow joints. This material type will allow better penetration into the joint without having to approach or exceed maximum recommended installation temperatures.

Its lower modulus also allows better surface conformance if the sealant is extruded upward during summer months. That is, if the sealant is pushed above the surface due to slab expansion, the lower modulus sealant is more conducive to allowing traffic action to roll the sealant into the pavement texture providing an even better seal. This also prevents joint induced roughness and noise.

Material Installation

It is recommended that the sealant be flush filled with the surface as indicated in Figure 5 which indicates a properly filled joint. It has been demonstrated that a flush filled hot pour installation can last twice as long as a recessed installation (1).

Figure 5 Properly Filled Narrow Joint

The minimum depth of penetration should be two inches. Greater depths of penetration are possible with wider joints. If a reservoir is constructed, this is not a concern.

Special wand tips are required to provide sealant installation. Figures 6 and 7 indicate an example of such a tip. The tip needs to extend into the joint to fill at least the top two inches. Note that two passes may be required to accomplish this. If only a single pass is used, it may result in an unsatisfactory joint fill as indicated in Figure 8.

It should also be noted that the small volume of material that is necessary requires better equipment and personnel control to ensure that excessive material is not left on the surface of the roadway. Installation is generally accomplished at a brisk walking speed.

One advantage of Type IV sealant is if the sealant is extruded during hotter times, it has greater capacity to roll into the texture improving the seal and preventing roughness.

Although manufacturer dependent, tracking should not occur until pavement temperatures exceed 150° F. Concrete pavements rarely exceed 135° F.

Figure 6 Special Installation Tip -Side View

Figure 7 End View of Special Tip

Figure 8 Unsatisfactory Filled Joint

References

1. L. Lynch, et. al, "Twenty-One Year Field Performance of Joint Resealing Project at Fairchild AFB", TRB Annual Meeting, 2013