Joint Sealant Life Confirmed

New studies verify that silicone and hot-pour sealants can indeed last more than 20 years.

By Larry Scofield

Selecting how long a given joint sealant will last before replacement — and what to include for the performance period in life-cycle costing — is not as easy as it may seem. Historically, the best reference has been the federal Strategic Highway Research Program's (SHRP) H-106 work conducted in 1999 (see Web extra on page CS-52). The report documents the results of the research effort, which installed sealants at five locations and evaluated them for a mere seven years. Another limitation: This report only studied the reseal condition.

The Seal/No Seal Group recently reported on two unique studies at sites that allowed evaluations of sealants up to 21 years. One study was coordinated by pavement preservation product manufacturer Crafco, and took place at Fairchild Air Force Base in Spokane, Wash. The other study was at the Federal Highway Administration's Long-Term Pavement Performance (LTPP) SPS-2 Experiment in Phoenix.

Crews perform a hot-pour sealant installation into ½-inch-wide longitudinal concrete pavement joints in a brand-new intermodal facility in Joliet, Ill. (see sidebar).

PHOTOS: CRAFCO

Fairchild Air Force Base

In 1989, the U.S. Army Corp of Engineers Construction Productivity Advanced Research (CPAR) conducted a sealant performance study consisting of both laboratory and field evaluations. The study evaluated both hot-pour and silicone sealants over a 10-year period (see Web extra). CPAR selected the Fairchild site because it had reported extreme temperatures ranging from -30 degrees F and 108

This low-modulus hot-pour sealant, located on a runway at Fairchild Air Force Base in Washington State, is approximately 21 years old.

degrees F, which would sufficiently test the efficacy of the sealant products.

As part of the field evaluation, crews replaced existing sealants with new ones on the then 35-year-old runway. CPAR researchers then conducted seven different evaluations, with the final evaluation taking place after 117 months (10 years) in service.

In 2012, Crafco realized that many of the sealant test sections were still in service and performing well. As a result, a second "final" evaluation was conducted by the same personnel who conducted the earlier evaluations. They used the same techniques used previously, which were consistent with SHRP H-106 and National Transportation Product Evaluation Program (NTPEP) procedures still used today. This evaluation took place 21 years (250 months) after the original installations. Findings include:

- A silicone sealant installed in a conventional manner and a low-modulus, hot-applied asphalt sealant installed using flush-fill geometry exhibited a performance period of more than 21 years.
- With the hot-applied asphalt sealants, the flush-fill installation geometry produced more than a 50% increase in sealant life as compared to the standard recess fill.
- Silicone sealants produced six times more joint spalling than hot-applied asphalt sealants.
- There doesn't appear to be a correlation between silicone sealant extension ranging from 450% to 1000% and silicone sealant life.

These findings are not necessarily new, but they provide more conclusive evidence due to the longer evaluation period.

Stay Tuned . . .

Other joint sealant studies in progress.

➔ Water migration into a pavement structure can considerably reduce pavement service life. However, most criteria for joint seal evaluation do not directly measure the amount of water entering the joint, but instead rely on surrogate measures such as percent of joint with adhesive or cohesive failure.

Dan Zollinger, PhD, Professor of Civil Engineering of the Texas Transportation Institute, is evaluating field methods to assess water infiltration into joints. As part of the study, Zollinger, who is under contract with the Seal/No Seal Group, is modeling the effects of the water intrusion on base erosion.

The institute developed expendable slabs that allow a joint to be pulled apart under controlled conditions to simulate actual joint movement. This technique helps establish the quantity of water that could enter the joint for a given rainfall intensity. The slabs will also be used to further gauge the impact of moisture and cleanliness on sealant bond.

The Texas Transportation Institute is also evaluating the use of ground-penetrating radar for determining the presence of moisture in the joint and pavement structure, and whether this technique can be used to determine when to reseal a pavement.

The last phase of the study will consist of field validation of the techniques and base erosion model validation. If successful, the base erosion model will allow users to determine when and where sealant is cost effective.

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Joint sealants are installed to prevent water and incompressibles from entering into a pavement structure.

Properly installed silicone sealants can provide at least a 20-year service life.

Arizona LTPP SPS-2

The SHRP LTPP SPS-2 experiment is the largest ongoing concrete research project. Fourteen states originally constructed new concrete pavement test sections as part of this effort. Arizona's SPS-2, constructed in 1993, is now 20 years old.

In March 2013, a field review of the silicone sealant performance was conducted by Applied Research Associates engineer Lynn Evans, under contract with the Seal/No Seal Group. Evans also conducted the SHRP H-106 and earlier SPS-4 Arizona evaluations, so a consistent evaluation method and team were used. His team found that properly installed silicone sealants can provide at least a 20-year service life. These findings confirm and document that sealants can last a long time. Previously, there has not been any factual evidence to prove the long-term effectiveness of sealants.

The findings from these two efforts also reinforce that properly installed sealants can achieve a service period of 20 years and more for both airfield and highway applications. In addition, the Fairchild installations suggest that a re-evaluation is needed of the geometry for hot-pour installation. **CS**

Larry Scofield is director of engineering and research of the International Grooving and Grinding Association and consultant to the Seal/No Seal Group. E-mail lscofield@pavement.com.

- Long-term sealant performance is contingent upon proper joint preparation and sealant installation. Although most believe and understand this, the inspection tools to ensure this are often unavailable to public agencies.

  The Seal/No Seal Group has contracted structural engineering firm Wiss, Janney, Elstner, and Associates to examine potential test methods for evaluating how clean and dry a joint face is prior to sealing, as well as a method for quantifying the bonding of the sealant.

  Phase 1 of the work included screening different test methods and identifying the most promising test procedures. Phase 2 will assess the final candidate tests and develop test protocols for them.

- Many sealing studies are conducted on test sections that are currently available, as opposed to constructing designed experiments, and oftentimes the existing pavements are early in their performance period. This makes determining long-term effectiveness problematic.

  In November 2009, the Seal/No Seal Group constructed 10 test sections on state Route 59 near Joliet, Ill. These sections will serve as long-term evaluation sections to establish sealant effectiveness. This will also be one of the field validation sites for the Texas Transportation Institute's work.

- One issue that has surfaced in recent times is premature deterioration at joints. Although a number of different mechanisms appear to be contributing factors, water is always one of the factors.

  To mitigate the impact of this phenomenon, penetrating sealers have been used to seal a joint face from moisture intrusion. This is a new approach and the efficacy of this approach is still unproven.

  As such, the Seal/No Seal Group is promoting the development of test sections that include penetrating sealers, as well as use of conventional sealants, and a "belt and suspenders" approach using both penetrating sealers and conventional sealants. Unsealed sections will also be included.

The Seal/No Seal Group was formed in 2009 to respond to the age-old industry question about the value of sealing concrete pavement joints. Its mission is to determine the long-term effectiveness of sealants in concrete pavements. To join and participate in the research, call Scott Eilken at 708-728-1895, Charley Grady at 602-524-1334, e-mail info@sealnoseal.org, *or visit* www.sealnoseal.org.

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