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Evaluation Of Silicone Joint Seal Versus Preformed Compression Joint Seal

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14. Supplementary Notes

15. Abstract

Purpose and Need

The joints of concrete pavement experience very large thermal contractions and expansions. These thermal stresses cause the sealant in the joint to fail. The different performance between silicone and preformed compression sealant needs to be evaluated to determine which sealant to use.

Objective

The objective of this report was to determine which joint sealant, silicone or preformed compression, has the best performance judged by durability and cost. This evaluation was also designed to determine which sealer would perform more effectively with the climatic changes North Dakota experiences.

Scope

This research project is located on Interstate 94 between reference points 331.4 and 338.6. This scope of this evaluation was to visually and mechanically inspect the condition of the silicone and preformed compression joint sealants for leaks caused by; adhesion failure (loss of bond), cohesion (loss of the joint materials ability to bond to itself), or spall related failures (edges of concrete saw joint deteriorating). In an effort to rate the severity levels of joint and joint sealant damage, the "Strategic Highway Research Program (SHRP) manual on Distress Identification for Long-Term Pavement Performance" was used as a reference. The joints were evaluated annually for four years.

Summary

The comparison of leaks relative to each of the two different sealants is obvious. In the 336 linear feet of joint sealant tested, the preformed compression sealant had an increase from a total of 485 leaks to 533 leaks during the period between the 1994 post construction evaluation and the 1995 evaluation but decreased to 227 in the 1996 evaluation and remained approximately the same in the 1997 and the 1998 evaluation. The decrease from previous levels was probably attributable to the smaller leaks developing into larger leaks, making the count less but the effective leaking area remained the same or is increasing. During the evaluation there appeared to be as many leaks in the passing lane as in the driving lane. A comparison of the leaks, as shown in tables 1 and 2 include where joints had a greater number of leaks in the 1994 post construction evaluation than what was tabulated for that same joint in the 1997 and 1998 evaluations. In most of these cases the leaks were so numerous that only an estimate could be made.

The results of the evaluation of the contraction joint silicone sealant show an increase in total leaks. Of the 336 linear feet evaluated, the total leaks have increased from 19 to 107 to 222 to very severe failure in 1997 and even more so in 1998. In 1996 this seemed attributable to many spall and puncture failures but inspection of the joints in 1997 and 1998 show a dramatic increase in the amount of spalling failures, so much so that the joints are considered to have failed. The joint details in the construction plans show the silicone sealant to be installed in these joints at a thickness of 1/4" and a width of 3/8", which results in an acceptable shape factor of 0.67. The typical newer low modulus silicone material used on this project can stretch up to 100% of its applied width or be compressed to about 50% of the applied width. In theory it can stretch to approximately 3/4 of an inch, making the widest joints is at the limit of the sealants capabilities. It is possible that the silicone is pulling apart the concrete.

The degree of damage to the sections utilizing the preformed compression joint sealant was assessed to be moderate to high severity. The degree of damage to the sections utilizing the silicone joint sealant was assessed to be of high severity to total failure.

At this time the preformed compression joint seals are out-performing the contraction joint silicone seals by a wide margin. During the 1997 evaluation it appeared that both types of joints were failing at an accelerated rate, however, since the evaluation of 1997 the silicone joint seal has continued to fail at even more accelerated rate and has essentially failed. On the other hand, the preformed compression joint seals have remained relatively the same as in 1997.

An observation made while testing the joints is that the silicone joints have a preponderance of the spall failures. This could be due to improper construction techniques, improper sawing (sawing too green) or the properties of the silicone may be such that when the joints expand the adhesive strength of the silicone is enough to pull the concrete apart at the edges of the joints. The number of punctures developing in the silicone appears to remain constant with the 1997 findings but the spalling failures have essentially caused total failure of the joints. The preformed compression joint seals appear to be failing due to loss of adhesion of the material to the sidewalls of the joint either from poor application of adhesive or failure of the adhesive. It is rather obvious from the 1998 evaluation that the silicone joint seals have failed, there is a preponderance of spalls and the joints leaked over approximately 75% of their lengths.

Recommendations

In this study neither the silicone nor the preformed joint sealer achieved the results desired, neither worked as a joint sealant. Both keep the incompressible material out of the joint but neither keeps moisture out of the joint. The preformed because of loss of adhesion and the silicone because of spalling. NDDOT is continuing to evaluate different types of joints and also is evaluating sections with unsealed joints.

16. Key Words

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