NEBRASKA

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DEPARTMENT OF TRANSPORTATION

Effect of Penetrating Concrete Sealers on Pavement Marking

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M&R MATERIALS & RESEARCH

Background

Recently, several questions were raised concerning the influence of penetrating concrete sealers on pavement markings. There was discussion about whether applying penetrating concrete sealer before the pavement markings is more effective than applying the penetrating concrete sealer afterwards. For the former, there was worry that the pavement markings would not properly adhere to a surface covered with penetrating concrete sealer. Furthermore, the surface preparation during the pavement marking application could damage the sealer. Conversely, there were worries about the reflectivity of the pavement markings if penetrating concrete sealers were applied over it. The Department launched this internal investigation with the hope to answer these concerns.

Purpose of the Investigation

This internal research investigates the interaction of penetrating concrete sealers on pavement marking, with the following objectives:

1. Determine if pavement marking reflectivity is affected by the application of a penetrating concrete sealer.
2. Ensure pavement markings (polyurea) adhere properly to a surface treated with a penetrating concrete sealer.

Laboratory Investigation (Test Methodology)

With assistance from the Portland Cement Concrete (PCC) and Chemistry Lab, five identical concrete beams were prepared with pavement markings consisting of paint and reflective glass beads, along with a penetrating concrete sealer. The control sample included only the paint with reflective beads without any penetrating concrete sealer. The remaining samples were divided into two groups, each treated with a different penetrating concrete sealer: BHN and TK590 Both of these penetrating concrete sealers are 100% tri-silane and are on the Nebraska Qualified Products List. These two sealers were selected to determine if different sealers interact differently with the pavement marking materials being used. In each group, one sample received the paint first followed by the sealer, while the other received the sealer first, then the paint. Details of each sample's preparation is provided in Table 1.

Figure 1: This image shows the two different sealers used, with TK-590 in the black and BHN in the blue. The white container is a standard sprayer used to spray sealer onto concrete beams in the lab.

Table 1: Sample Descriptions

Label	Description
Control	Paint and beads were applied on Day 1. No sealer was applied.
BHN-P	Paint and beads were applied on Day 1. BHN sealer was applied an hour after the application of the paint.
BHN-S	BHN sealer was applied on Day 1. Paint and beads were applied 24 hours after the sealer on Day 2.
TK-P	Paint and beads were applied on Day 1. TK590 sealer was applied an hour after the application of the paint.
TK-S	TK590 sealer was applied on Day 1. Paint and beads were applied 24 hours after the sealer, on Day 2.

The application schedule was arranged so that the sealer was applied to all beams at the same time. Nebraska standard construction paint was applied, followed by the application of standard construction grade glass beads. After application, the paint drying time was recorded. The procedure for applying the paint and beads is illustrated in Figure 2 and Figure 3. One week after the sealer application, the paint's reflectivity was measured using a Mirolux 30 retroreflectometer (manufactured by Advanced Retro Technology), along with a qualitative assessment to determine if the sequence of paint and sealer application had any effect. Finally, each section of paint was scraped to assess the paint adhesion to the concrete beams.

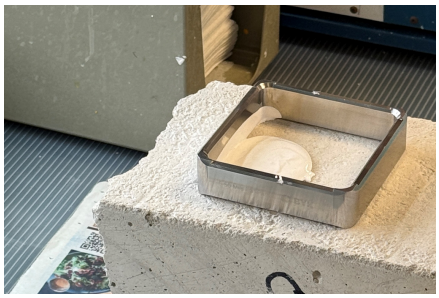

Figure 2: This image illustrates the application of paint to the concrete slabs. Paint was dispensed into the rounded square molds and drag across to create the paint stripe.

Figure 3: This image illustrates the application of sealer onto the slabs.

Observations

The concrete beams are shown in Figure 4 and Figure 5 after the paint had dried. Overall, the paint was applied uniformly across the concrete beams; however, the Control and BHN-S samples had uneven coverage in the upper right-hand corners. This resulted in exposed areas of concrete, which is important consideration when evaluating paint adhesion.

All five samples showed similar results, as summarized in Table 2. Paint drying times were consistent across all configurations, ranging from 5 to 7 minutes. For samples where the paint was applied first or without sealer (Control, BHN-P, and TK-P), drying times were not measured directly; instead, a standard range was used based on prior experience with the paint. The PCC Engineer concluded that the presence of sealer did not negatively impact the drying time of the paint. Reflectivity measurements, taken with a reflectometer, indicated that all samples had comparable and acceptable levels of reflectivity. The PCC engineer also noted that variations in reflectivity were more strongly influenced by inconsistencies in the application of glass beads than by the sequence of paint and sealer application.

Figure 4: Concrete beams BHN-P, BHN-S, and Control are shown (from left to right) once all paint and sealer was applied.

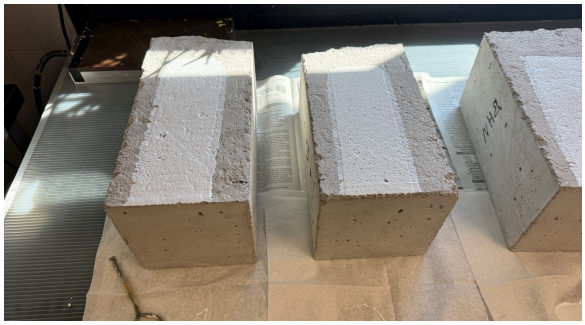

Figure 5: Concrete beams TK-P and TK-S are shown (from right to left) one all paint and sealer was applied.

Table 2: Sample Observations

Label	Paint Drying Time (min)	Paint Reflectivity (Visual)	Paint Adherence (Visual)
Control	5 to 7	Passed	Passed
BHN-P	5 to 7	Passed	Passed
BHN-S	6	Passed	Passed
TK-P	5 to 7	Passed	Passed
TK-S	6	Passed	Passed

The painted section on each beam was scraped, shown below in Figure 6. Based on this testing, the PCC Engineer determined that the paint adhered to the surface in all configurations. This conclusion was drawn through a qualitative assessment by comparing each sealer-paint sample to the control.

Figure 6: This image shows the 5 different concrete beams post scrapping. While both Control and BHN-S had areas without paint, this was a paint application issue, not a paint adhesion issue. The paint was not applied at those locations.

Recommendations on Based Lab Observations

Based on the drying times, reflectivity assessment, and paint adhesion, penetrating concrete sealers can be applied either before or after the pavement markings. The paint drying times were similar across all configurations, indicating that the order of application (paint to sealer, or sealer to paint) had a negligible effect. Additionally, differences in reflectivity were minimal concerning the sequence of application, with the quantity of glass beads applied being the more significant factor. Moving forward, the Department plans to include the removal of existing pavement markings and installation of ungrooved polyurea. This work can be completed prior to the installation of the penetrating concrete sealer. The penetrating concrete sealer will not affect the pavement markings applied prior to its application, and the removal of existing pavement markings will not compromise the sealer's performance. Alternatively, the penetrating concrete sealer may be applied after the pavement markings are removed, with new pavement markings reapplied once the sealer has dried, prior to reopening the pavement to traffic.