



Field testing in Ankeny, Iowa, allowed project engineers to monitor sealer performance on concrete joints in a real-world setting.

# RESEARCH SOLUTIONS

## Choosing a penetrating sealer to enhance concrete durability

Penetrating sealers show great promise for protecting concrete roads from the negative impacts of deicing salts. However, there are many different sealers on the market that work using disparate principles and chemical compositions. Iowa DOT funded laboratory and field testing to better understand how to select the right sealer for a specific application and to determine the best way to evaluate a sealer's effectiveness. The result was a set of testing methods that will support county and municipal engineers as they identify which sealers can cost-effectively improve the longevity of concrete surfaces by helping compensate for mixtures at risk for early deterioration.

### THE NEED

Joints between pavement sections on concrete roads are especially vulnerable to the damaging effects of winter maintenance chemicals due to the concentration of salts, high moisture content, and exposed aggregate. Even a pavement built with a very durable concrete mix

may have joint distress that requires a sealant to protect against deicers. County and municipal engineers in Iowa were inundated by the number of new sealers on the market, which have different chemical profiles and modes of action, and the performance claims of these sealers by manufacturers.

Many of these sealers operated on different principles, such as filling microscopic pores in the concrete versus coating pores with water-repellent material, making them difficult to compare. Engineers lacked guidance on how to evaluate and assess these products and their suitability to different applications.

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**“The results from this research have provided state, city, and county engineers with a better understanding of the mechanisms that enhance sealer performance in unique applications”**

**— TODD HANSON,**  
Iowa DOT PCC Engineer

Agencies needed a protocol to help guide the assessment and selection of sealers that would have the most cost-effective impact on maintaining roads.

Iowa DOT undertook this research project to develop a test protocol to support evaluation of both the short- and long-term performance and stability of sealers, their effectiveness in reducing moisture infiltration in a severe freeze-thaw environment, and their ability to resist the corrosive impacts of deicing salts on joint durability.

## RESEARCH APPROACH

The research began with an extensive literature review to identify laboratory testing specifications and selection criteria. Results of this effort were used to develop a testing plan. Two phases of laboratory testing were then conducted followed by a field test to assess how the materials performed long term.

The first phase of laboratory testing focused on the impact of different types of sealers on concrete durability. A single concrete mixture was treated with many different sealers applied to the vertically sawn faces of highway concrete specimens to mimic real practices in the field. A suite of tests assessed the performance and durability of the sealers.

Next, the effect of different families of sealers on three concrete mixes with specific durability issues was assessed. Researchers in the lab examined susceptibility to marginal air content, oxychloride susceptibility and poor-quality aggregate (prone to cracking).

To build on the laboratory findings, researchers field-tested specific categories of sealers at three sites. Two categories of sealers were tested in urban and rural locations.

## WHAT IOWA LEARNED

The research showed that sealers can help improve the longevity of concrete and that certain types of sealants are very effective at addressing specific pavement deficiencies that may lead to early deterioration. The findings of the laboratory testing yielded a clearer understanding about the effectiveness of tests, such as absorption capacity, wettability, and desorption, at measuring the impact of water repellants, pore blockers, and other sealers on concrete with different types of durability issues.

Each category of sealers acts differently on concrete mixtures. As a result of this research, engineers have a better understanding of which categories of sealers are formulated to effectively address the problems they need to solve. They also have a set of recommendations on the best tests for assessing products within each category of sealers.

## PUTTING IT TO WORK

Sealers can be an important tool for extending pavement service life. Investigators are collaborating with local agencies to set up field testing that will allow them to assess the long-term impacts of sealers. Iowa DOT plans ongoing monitoring

of the field testing and potentially more structured follow-up research in the future.

The final report includes clear guidance on the best test for each category of product and the best family of products to compensate for specific concrete deficiencies. This guidance can be enhanced as agencies continue to monitor the field-testing sites.

## ABOUT THIS PROJECT

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