Research Brief

Wisconsin Highway Research Program
Project 0092-21-05
April 2022

Material Specifications for Longitudinal Joint Construction, Remediation and Maintenance

Research Objectives

- Identify and compare materials, processes, and experiences to improve longitudinal joint performance during and after construction
- Recommend best practices for selected materials and processes relative to Wisconsin standard practice
- Summarize quality assurance requirements for each selected alternative

Research Benefits

- Recommends WisDOT continue current standard practice regarding joint geometry and testing of joint density
- Recommends implementing Void Reducing Asphalt Membrane (VRAM) during construction on a trial basis
- Recommends using penetrating asphalt emulsions as a preventative and remedial treatment for longitudinal joints

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Background

Asphalt pavement density at and near longitudinal construction joints is often significantly lower than density in the mainline areas of the pavement: this can manifest in premature deterioration of the joint area relative to the mainline. This project's objective is to synthesize the most probable solutions to deliver better longitudinal joints in Wisconsin. Distress associated with longitudinal joints is not confined to a single mix type or geographical area.

The research team identified causal mechanisms of premature longitudinal joint failure, ranging from inability to achieve sufficient density at the joint location, infiltration and subsequent damage from water at the joint, mixture segregation, aggregate bridging, and others.

Many states have enhanced or created joint performance specifications over the last decade. WisDOT's WHRP Project 0092-15-09 investigated the influence of construction practice, mix design type, and joint type on the density achieved at the joint location. Since the time of that report, WisDOT has further modified its mixture design and production specification, harmonized joint construction technique among regions, refined the longitudinal joint density specification, and built a more robust data set of paving jobs on which longitudinal joint density was a pay item for contractors. Joint improvement should focus on reducing permeability of water and air both at and near the joint directly or indirectly.

Methodology

The research team used information and data extracted from a literature review, a review of state agencies' standard practices, a review of WisDOT pavement annual distress survey data, and interviews of several pavement experts to define the most probable practices to further improve joint performance based on understanding the causes of distress. In addition to reviewing state DOT standard practices in the U.S., the research team conducted a limited review of practices in Germany, United Kingdom, Sweden, and China. Methods like cutting or milling back of joints is more popular internationally than in the U.S., but much of the same methodology practiced in the U.S. is used overseas, like overlap and pinching of the joint, and use of tack or paving asphalt to coat the joint face. From this review of methods and materials, the research team developed a framework for identifying and comparing the effectiveness of various joint materials, methods and experiences that have shown good results.

"This research helps to confirm the direction the department has taken with recent changes to longitudinal joint specifications."
– Project Manager Dan Kopacz, WisDOT

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WisDOT Research website

Results

Reducing mixture permeability at and near the joint is identified as the most promising method to improve joint performance. Based on findings, the research team proposes an organizational structure comprised of three categories for joint improvement materials and methods: Construction and Design (CD) are considerations that include specifying joint geometry, paving methods, and plans for testing of joint density that can be specified before construction; Methods and Materials During Construction (MDC) includes supplementary processes and materials during construction, such as using joint adhesive on the cold face of the joint, or applying a strip of special membrane; Methods and Materials Post-Construction (MPC) includes processes and materials used immediately following construction, before joint deterioration requires extensive structural repair or replacement, such as fog sealing and spraying penetrating asphalt emulsions on the joint following construction.

Recommendations for implementation

The research team recommends that WisDOT continue its current standard practice regarding joint geometry and testing of joint density, but also consider evaluation of other alternatives that show significant promise in reducing risk of premature joint failures and minimizing the risk of accepting lower density at the joints relative to mainline of pavements. Based on published data and review of case studies, implementing and evaluating Void Reducing Asphalt Membrane (VRAM) during the construction process on a trial basis is recommended. Post-construction, it is recommended to use penetrating asphalt emulsions as a preventative and remedial treatment for longitudinal joints. In addition, the team recommends a more focused look at collecting and analyzing the Pavement Condition Index (PCI) database, which is an invaluable tool for understanding costs associated with joint performance. The team recommends refining this project-specific database and more accurately developing the longitudinal joint distress collection procedure to help justify the use of more costly processes or materials shown to improve joint performance.

This brief summarizes Project 0092-21-05,
"Material Specifications for Longitudinal Joint Construction, Remediation and Maintenance"
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