

Evaluation of WisDOT Quality Management Program Activities and Impacts on Pavement Performance

Research Objectives

- Evaluate the effectiveness of WisDOT's construction quality control program
- Create a relational geo-referenced database connecting production, placement, and in-service performance data for select WisDOT projects
- Understand the relationship between quality control and in-service performance

Research Benefits

- Provided feedback regarding reliability of current quality control program for HMA pavements
- Recommended implementation of mechanical performance tests to mixture design process
- Established a framework for WisDOT to create a complete relational database for its pavement network

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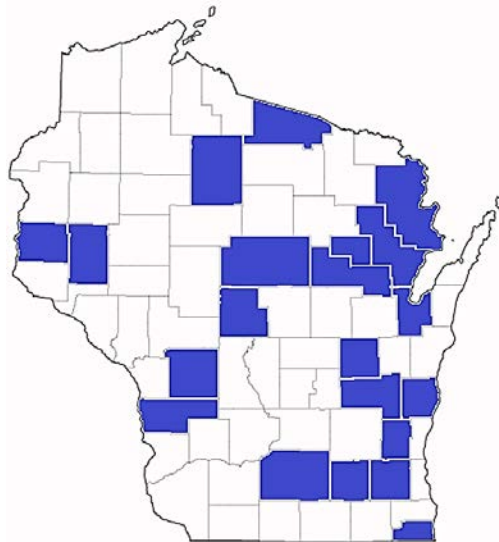
Background

The Wisconsin Department of Transportation's (WisDOT) Quality Management Program (QMP) accepts Hot Mix Asphalt (HMA) materials based on quality control testing during construction. There is a need to expand the use of this data to directly relate construction practices to measurable indicators of pavement performance, such as distress surveys. This research investigated the relationship between historical QMP test data and in-service pavement performance. If current quality control testing methods are reliable, construction data is expected to correlate with pavement performance.

Methodology

The research team created a relational database in which project quality data records and in-service performance are linked through geo-referencing. Indicators include compaction density of the pavement during placement and mixture volumetrics.

Researchers identified 200 miles of pavement constructed between five and ten years ago. Seven projects were selected for visual field distress surveying and Falling Weight Deflectometer testing to determine if observed distress was caused by structural deficiencies or material quality.



Analysis focused on four main pavement performance distresses: rutting, alligator cracking, transverse cracking and longitudinal cracking. Categorical survey data was converted into an index value(s) corresponding to each distresses' impact on serviceability and general condition of the roadways.

“Findings support WisDOT’s initiative to implement an improved Percent Within Limits (PWL) quality control program.”
– Erik Lyngdal,
WisDOT

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Final report is available at:
[WisDOT Research website](#)

Results

Current specification quality limits correlate with field performance; deviation from these limits negatively impacts performance. All four types of distresses can be caused by field over-compaction of thin pavement layers. Rutting correlates to mix production air content at the design number of gyrations. Alligator, longitudinal and transverse cracking showed sensitivity to HMA volumetrics.

Pavements aged seven to eight years old were found to have the following percent distribution of distresses:

Distribution of Distresses in Pavement Inventory Files (PIF) Network at Age 7-8 Years (2016)

	66.2%	82.3%	29.9%	26.6%
	28.2%	15.6%	62.1%	71.0%
	5.4%	1.9%	7.5%	2.1%
	0.2%	0.3%	0.6%	0.3%

Recommendations for implementation

WisDOT standard specifications were revised multiple times after construction of the pavements studied in this research. In 2017, minimum pavement density and asphalt content requirements were increased; both specification revisions are supported by the research conclusions. In addition to past specification changes, the research team recommends:

1. Limiting compaction of thin lifts under two inches thick, especially if over a stiff base.
2. Adopting mechanical performance test methods in the HMA design process.
3. Investigating the influence of effective asphalt cement content on volumetric properties to improve the reliability of quality control data.
4. Reviewing specified frequencies of testing to ensure representative sampling and adjusting quality limits to maximize performance. The current volumetric properties measured are adequate; however, quality thresholds should be revised.
5. Tracking asphalt binder content during production.

This brief summarizes Project 0092-15-05,
 “Evaluation of WisDOT Quality Management Program (QMP)
 Activities and Impacts on Pavement Performance”
 Wisconsin Highway Research Program