

Wisconsin Highway Research Program
Request for Proposals – FFY 2009
From the Rigid Pavement Technical Oversight Committee

Problem Title:

Performance Evaluation of Open Graded Base Course with Doweled and Nondoweled Transverse Joints on USH 18/151

Background:

Until the late 1980s, Portland cement concrete (PCC) pavement in Wisconsin was constructed as either jointed plain concrete pavement (JPCP) or continuously reinforced concrete pavement (CRCP). Use of CRCP was discontinued because of its high initial cost. Use of JPCP was questioned because of severe transverse joint faulting that occurred at many locations. It was proposed that using dowel bars to provide load transfer at joints and/or eliminating free water and erodable material beneath the slabs would alleviate the faulting problem. All PCC pavements since 1987 have been constructed as JPCP with doweled joints, and many utilize open graded base course (OGBC) to provide a drained pavement structure. However, it has not been proven whether dowels, OGBC, or a combination of both provide the best protection against joint faulting and other pavement distress.

In 1988, 17 test sections were constructed on USH 18/151 to study the effects of dense and open graded base courses (stabilized and non-stabilized), several drain systems, and doweled and nondoweled transverse joints. A performance report was written in 1998,¹ when the pavement had been in service for 10 years. The major conclusions of this report were that dowels and asphalt-stabilized OGBC provided the greatest protection against joint faulting, but use of dowels and asphalt-stabilized OGBC in combination did not provide significantly better performance than using either of these measures separately.

These conclusions might be premature, however, as very little distress was observed in any of the test sections at the time of the 10-year study. In addition, falling weight deflectometer (FWD) testing indicated no evidence of poor support in most test sections.² Therefore, a second review of these test sections is warranted as the pavement approaches 20 years in service. Differences among test sections may now be apparent and will allow for more definite conclusions to be drawn.

Problem Statement:

This study will evaluate the 20-year performance characteristics of 17 test sections constructed on USH 18/151. Emphasis will be placed on the performance results of test sections constructed with doweled and nondoweled joints, OGBC, and a combination of both.

Scope:

The researcher will investigate the performance of 17 test sections along USH 18/151 in Iowa and Dane counties. Details of the test sections are provided in Table 1 at the end of this document. Specific locations of the test sections will be made available upon request.

The researcher will evaluate pavement performance using the following analysis tools:

- The WisDOT Pavement Surface Distress Survey Manual and the pavement distress index (PDI),
- International ride index (IRI),
- Falling weight deflectometer (FWD) testing to evaluate support conditions, and
- Any additional analysis tool the researcher feels is appropriate.

Specific Results, Findings, Tools, etc. (Deliverables):

1. Evaluate the performance of 17 test sections using the analysis tools listed above.
2. Provide a performance comparison of all test sections using an appropriate statistical analysis method.
3. Provide a cost analysis to demonstrate the economic and performance trade-offs of the best-performing test sections.
4. Estimate the remaining service life and future rehabilitation needs for all test sections.
5. Provide a recommendation on the combination of base course, drainage system, and/or dowel bars that leads to the most economical pavement with the longest service life.
6. Provide 40 printed copies of the final Analysis report to be distributed to WisDOT (34) and WHRP (6), as well as one electronic copy of the final version of the report.

Length of Research Project and Approximate Cost to Complete:

Proposals for up to 18 months of research and a total project cost of \$50,000 will be considered. Note that the cost of any traffic control needed for field testing should be included in the budget for this research project. Separate funding for traffic control will

not be available through WisDOT. The project schedule should include a three month period for TOC review.

Urgency and Potential Benefits:

Findings will enhance WisDOT PCC pavement design and result in pavements that provide a high level of performance at the lowest cost. In addition, this research will augment results from previous studies of dowel bars and drained pavement structures.

Additional Requirements for Implementation:

Upon acceptance of the researcher's recommendation(s), the results can be directly implemented in WisDOT PCC pavement design and construction.

Implementation may be in the form of changes to the WisDOT Standard Specifications, changes to the Facilities Development Manual (FDM), or a combination of both.

References:

1. Rutkowski, T. S., Shober, S. F., and Schmeidlin, R. B., "Performance Evaluation of Drained Pavement Structures," Wisconsin Department of Transportation Report No. WI/SPR-04-98, Dec. 1998, 41 pp.
2. Crovetti, J. A., "Analysis of Support Conditions Under Jointed Concrete Slabs Along USH 18/151," Wisconsin Department of Transportation Report No. WI/SPR-04-95, Mar. 1995.

Table 1. Test Section Details*

Test Section	Base Type	Subbase Type	Drain Design	Doweled Transverse Joints	Sealed Transverse Joints
1	4" NSOG	4" DGBC	PAD	No	Yes
2	4" NSOG	4" DGBC	PAD	No	No
3	4" CSOG	4" DGBC	PAD	No	Yes
4	4" CSOG	4" DGBC	PAD	No	No
5	4" ASOG	4" DGBC	PAD	No	Yes
6	4" ASOG	4" DGBC	PAD	No	No
7	---	6" DGBC	TIC	No	No
7a	---	6" DGBC	TIC	No	No
8	---	6" DGBC	None	No	Yes
9	---	6" DGBC	None	No	No
10	---	6" DGBC	TIC	Yes	No
11	4" CSOG	4" DGBC	PED	Yes	No
12	4" ASOG	4" DGBC	PED	Yes	No
13	4" NSOG	4" DGBC	PED	Yes	No
14	---	6" DGBC	None	Yes	No
15	---	6" DGBC	None	Yes	Yes
16	6" LCBC	---	None	Yes	No

Abbreviations:

NSOG Non-Stabilized Open Graded base course
 CSOG Cement-Stabilized Open Graded base course
 ASOG Asphalt-Stabilized Open Graded base course
 LCBC Lean Concrete Base Course
 DGBC Dense Graded subBase Course
 PAD Pipe/Aggregate longitudinal Drains
 TIC Transverse InterChannel transverse joint drains
 PED wrapped trench with 4" Pipe longitudinal Edge Drain
 None no edge drains

*Adapted from Croveti²