



Transportation Synthesis Report

Research and Communication Services
Wisconsin Department of Transportation
608-261-8198
wisdotresearch@dot.state.wi.us

Comparing Frozen Four Rigid Pavement Research Activities to the Concrete Pavement Road Map

Prepared for
North Central Pavement Research Coordination Partnership

Prepared by
CTC & Associates LLC
WisDOT Research & Communication Services
March 23, 2007

Transportation Synthesis Reports are brief summaries of currently available information on topics of interest to WisDOT technical staff. Online and print sources for TSRs include NCHRP and other TRB programs, AASHTO, the research and practices of other transportation agencies, and related academic and industry research. Internet hyperlinks in TSRs are active at the time of publication, but changes on the host server can make them obsolete.

Request for Report

At the Dec. 5, 2006, meeting of the North Central Pavement Research Coordination Partnership (the Frozen Four), CTC & Associates LLC presented a report, *Comparing the Concrete Pavement Road Map to Research Priorities of WisDOT and Neighboring State Transportation Agencies*. After discussion and review, partner agencies requested that we update the report for the Frozen Four to include recommendations from the agencies' technical staffs on how to best align the states' research projects with the Concrete Pavement Road Map research tracks.

Summary

Published in 2005, the Concrete Pavement Road Map (<http://www.cptechcenter.org/publications/task15/task15.cfm>) presents guidance on research needs for the next 10 years to optimize concrete pavement construction, rehabilitation and repair through the best techniques, technology and materials. The Road Map identifies 12 research tracks for the field to follow.

We reviewed the table of completed and in-progress Rigid Pavement Research Activities undertaken by the Frozen Four states (Illinois, Michigan, Minnesota and Wisconsin) in the last decade, and compared the project topics with the CP Road Map research tracks. We also reviewed the research activities in other subject areas for relevant projects; see spreadsheets of all projects at the following links:

- Rigid Pavement: <http://www.frozenfour.us/docs/Rigid%209-22-06.xls>
- Flexible Pavement: <http://www.frozenfour.us/docs/Flexible%209-22-06.xls>
- Soils, Geology and Foundations: <http://www.frozenfour.us/docs/Soils%209-22-06.xls>
- Pavement Design, Management and Maintenance: <http://www.frozenfour.us/docs/Design%209-22-06.xls>

Comments from partner state representatives, including the addition of several recent studies not yet part of the Frozen Four databases, helped categorize the states' research activities into the 12 CP Road Map research tracks.

The summary table on the next page shows the distribution of the states' concrete pavement research projects into the 12 CP Road Map research tracks. Frozen Four states have sponsored the most research in the Design Guide and Mix Design tracks, and have also conducted several projects related to Nondestructive Testing, Pavement Performance, Surface Characteristics and other Road Map topics. This report concludes with a listing of the 69 research projects, by state, within each Road Map track.

Frozen Four Research Distribution by CP Road Map Research Tracks

The table below shows how 69 research projects performed by the Frozen Four states align with the CP Road Map tracks.

Concrete Pavement Road Map Research Track	Illinois	Michigan	Minnesota	Wisconsin	Total Studies
Track 1 – Mix Design		2	3	6	11
Track 2 – Design Guide	6	6	10	3	25
Track 3 – Nondestructive Testing		3	1	3	7
Track 4 – Surface Characteristics		1	3	1	5
Track 5 – Equipment Advancements					0
Track 6 – Innovative Joints			2	1	3
Track 7 – Rehabilitation and Construction	1		1	1	3
Track 8 – Long Life Concrete			1		1
Track 9 – Data Collection	1		1		2
Track 10 – Pavement Performance		4	2	1	7
Track 11 – Business and Economics	1	1			2
Track 12 – Advanced Materials	2		1		3
Totals	11	17	25	16	69

Of the 12 research tracks, Frozen Four agencies have conducted the most research in the Design Guide and Mix Design tracks. The Design Guide track (25 projects, led by 10 from Minnesota) looks at issues relevant to AASHTO’s Mechanistic-Empirical Design Guide, while the Mix Design track (11 projects, led by Wisconsin’s 6) addresses concrete mix properties and designs. Of the 36 studies in these two tracks, up to nine may directly pertain to M-E Guide implementation, and several more may have implications for adoption of M-E design.

A subtrack of the Design Guide track, “Special Design and Rehabilitation Issues,” had 13 relevant projects, driven largely by several Minnesota and Illinois studies of whitetopping performance. However, this research may not all pertain directly to the new AASHTO M-E design standards, especially since Illinois DOT uses its own M-E Design Guide and does not plan to adopt the AASHTO guide.

On the other end of the spectrum, no partner agency had research pertinent to Track 5, Equipment Advancements, and little research seems to have been devoted to several other tracks, including Advanced Materials, Long Life Concrete, Data Collection, and Business and Economics. However, research activities in areas such as data collection and business practices do not typically fall under state DOT concrete pavement research functions, and may not have been included in the spreadsheet of Frozen Four rigid pavement projects

Observations

During our analysis, we observed that not all of the Frozen Four states’ concrete pavement research fits neatly into CP Road Map categories. For example, we grouped projects on whitetopping performance into the subtrack of Track 2 that deals with overlay design, which was the closest match in terms of subject area, although Track 2’s focus is on M-E Design Guide issues.

Similarly, some concrete pavement research topics addressed by partner states are not covered by the CP Road Map, so projects in those areas are not included in this analysis. For example, research related to concrete cracking doesn’t fit well into the Road Map as a maintenance or repair issue, and Track 7’s focus on fast-track approaches to construction and rehabilitation does not encompass more conventional efforts in these areas.

Regional Research Track Distribution

This section divides the relevant research projects in each Frozen Four partner state into the 12 CP Road Map research tracks (and subtracks as appropriate). When available, we have included investigator names and institutions, transportation agency contact information, and hyperlinks to research reports.

Track 1 – Mix Design

Performance-Based Concrete Pavement Mix Design System. This track focuses on concrete mix design procedures and active concrete industry involvement in design that integrates new equipment, consensus design values, standard lab procedures, and design and quality control. For a full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track1.cfm>.

Michigan

- 2002-0532, auth. 18, Quantifying Coefficient of Thermal Expansion Values of Typical Hydraulic Cement Concrete Paving Mixtures. Neeraj Buch, Michigan State University (PI). Michael Eacker, eackerm@michigan.gov.
- Quantifying Expansion Rates and Possible Crack Initiation During Freeze-Thaw Testing. PI and agency contact to be determined. Michael Eacker, eackerm@michigan.gov. (Subtrack MD2.)

Minnesota

- Cell 64 MnROAD Pervious Concrete Construction Report. B.I. Izevbekhai et al. http://www.mrr.dot.state.mn.us/research/MnROAD_Project/MnROADReports/MnRoadOnlineReports/Cell64ConstructionReportforPerviousConcrete.pdf. Bernard Izevbekhai, Bernard.Izevbekhai@dot.state.mn.us, 651.366.5454.
- Cell 64 MnROAD Pervious Concrete 1st Year Performance Report. A.J. Eller and B.I. Izevbekhai. http://www.mrr.dot.state.mn.us/research/MnROAD_Project/MnROADReports/MnRoadOnlineReports/Cell64ConstructionReportforPerviousConcrete.pdf. Bernard Izevbekhai, Bernard.Izevbekhai@dot.state.mn.us, 651.366.5454.
- Implementation of the Hydraulic Fracture Process for Concrete Aggregates. Nancy Whiting, nancy.whiting@dot.state.mn.us.

Wisconsin

- 0092-04-11, Research and Development of the Application of FHWA's HIPERPAV Model to Wisconsin, http://www.whrp.org/Research/Rigid/rigid_0092-04-11/index.htm. Mauricio Ruiz and Rob Rasmussen, The Transtec Group (PIs). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack MD3.)
- 0092-02-14a, Effects of Ground Granulated Blast Furnace Slag in Portland Cement Concrete, http://www.whrp.org/Research/Rigid/rigid_0092-02-14a/index.htm. Steve Cramer, UW-Madison (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack MD1.)
- 0092-05-01, Effects of Ground Granulated Blast Furnace Slag in Portland Cement Concrete – Expanded Study, http://www.whrp.org/Research/Rigid/rigid_0092-05-01/index.htm. Steve Cramer, UW-Madison (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack MD1.)
- 0092-00-07, Effects of Aggregate Coatings and Films on Concrete Performance, http://www.whrp.org/Research/Rigid/rigid_0092-00-07/index.htm. Steve Cramer, UW-Madison (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939.
- 0092-04-12, Expanded Study on the Effects of Aggregate Coating and Films on Concrete Performance, http://www.whrp.org/Research/Rigid/rigid_0092-04-12/index.htm. Steve Cramer, UW-Madison (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939.
- 0092-06-08, Implementation of 0092-04-11 (see above). Tom Lorfeld, thomas.lorfeld@dot.state.wi.us, 608.246.7950.

Track 1 Total Studies – 11. Leading State – Wisconsin, 6.

Track 2 – Design Guide

Performance-Based Design Guide for New and Rehabilitated Concrete Pavements. In this track the concrete industry builds upon and develops models from the AASHTO Mechanistic-Empirical Design Guide and extends it to pavement preservation and restoration. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track2.cfm>.

Illinois

- IHR No. 57, Implementation/Calibration of CRC and JRC Design, <http://www.ict.uiuc.edu/displaysingle.asp?ID=30>. Jeff Roesler, University of Illinois, Urbana-Champaign (PI). Amy Schutzbach, Amy.Schutzbach@illinois.gov, 217.785.4888.
- PRR No. 148, Final Report: Whitetopping Performance in Illinois. <http://www.dot.il.gov/materials/research/pdf/148.pdf>. Tom Winkelman, Thomas.Winkelman@illinois.gov, 217.782.2940. (Subtrack DG3.)
- PRR No. 147, Open Graded Drainage Layer Performance in Illinois. <http://www.dot.il.gov/materials/research/pdf/147.pdf>. Tom Winkelman, Thomas.Winkelman@illinois.gov, 217.782.2940. (Subtrack DG2.)
- PRR No. 143, Bonded Concrete Overlay Performance in Illinois. <http://www.dot.il.gov/materials/research/pdf/143.pdf>. Tom Winkelman, Thomas.Winkelman@illinois.gov, 217.782.2940. (Subtrack DG3.)
- PRR No. 140, Performance of an Unbonded Concrete Overlay on I-74, <http://www.dot.il.gov/materials/research/pdf/140.pdf>. Laura Heckel, IDOT (PI). LaDonna Rowden, LaDonna.Rowden@illinois.gov, 217.782.8582. (Subtrack DG3.)
- IHR-27-3, Evaluation of UTW and Whitetopping Procedure, <http://www.ict.uiuc.edu/displaysingle.asp?ID=39>. Jeff Roesler, University of Illinois, Urbana-Champaign, Anastasios Ioannides, University of Cincinnati (PIs). Tom Winkelman, Thomas.Winkelman@illinois.gov, 217.782.2940. (Subtrack DG3.)

Michigan

- No. 25, Preliminary Mechanistic Evaluation of PCC Cross-Sections Using ISLA2000—A Parametric Study, http://www.michigan.gov/mdot/0,1607,7-151-9622_11045_24249-100755--,00.html. Neeraj Buch, Michigan State University (PI). Curtis Bleech, bleechc@michigan.gov. (Subtrack DG1.)
- R-1417, Three-Year Evaluation of Whitetopping Project on M-46, http://www.michigan.gov/documents/mdot_R-1417_92277_7.pdf. Michael Eacker, MDOT (PI). Michael Eacker, EackerM@michigan.gov. (Subtrack DG3.)
- 2002-0532, auth. 17, Evaluation of the I-37A Design Process for New and Rehabilitated Jointed Concrete Pavements. Neeraj Buch, Michigan State University (PI). Michael Eacker, eackerm@michigan.gov. (Subtrack DG2.)
- 98-MTU-1, Modernization of the Illi-Slab Finite Element Analysis Program for Concrete Pavements. Lev Khazanovich, ERES Consultants (PI). Dave Smiley, smileyd@michigan.gov. (Subtrack DG1.)
- MSU 00-2-1, Evaluation of Alignment Tolerances for Dowel Bars and Their Effects on Joint Performance. Neeraj Buch, Michigan State University (PI). Michael Eacker, eackerm@michigan.gov. (Subtrack DG3.)
- A Laboratory Evaluation of Alignment Tolerances for Dowel Bars and Their Effects on Joint Performance. Neeraj Buch, Michigan State University (PI). Michael Eacker, eackerm@michigan.gov. (Subtrack DG3.)

Minnesota

- 2004-19, The Construction and Performance of Ultra-Thin Whitetopping Intersections on US-169. <http://www.lrrb.gen.mn.us/PDF/200419.pdf>. (Final report, http://mnroad.dot.state.mn.us/research/mnroad_project/mnroadreports/mnroadonlinereports/the_construction_and_performance_of_ultra-thin_whitetopping_intersections_on_us-169_final_report_state_project_report_7106-60.pdf.) Julie Vandenbossche (PI). Bernard Izevbekhai, Bernard.Izevbekhai@dot.state.mn.us, 651.366.5454. (Subtrack DG3.)
- The Measured Response of Ultra-Thin and Thin Whitetopping to Environmental Loads, http://mnroad.dot.state.mn.us/research/MnROAD_Project/MnRoadReports/MnRoadOnlineReports/The_Measured_Response_of_Ultra-Thin_and_Thin_Whitetopping_to_Environmental_Loads.pdf. No contact information. (Subtrack DG3.)
- Whitetopping Construction and Instrumentation at Mn/ROAD aka Forensic Investigation Report For MnROAD Ultrathin Whitetopping Test Cells 93, 94 and 95, http://www.mrr.dot.state.mn.us/research/MnROAD_Project/MnROADReports/MnRoadOnlineReports/2005-45.pdf. Thomas Burnham, 651.366.5452. (Subtrack DG3.)

- Performance, Analysis and Repair of Ultra-Thin and Thin Whitetopping at MnROAD, http://mnroad.dot.state.mn.us/research/MnROAD_Project/MnRoadReports/MnRoadOnlineReports/Performance_Analysis_and_Repair_of_Ultra_Thin_and_Thin_Whitetopping_at_MnROAD.pdf. Julie Vandebossche, Aaron Fagerness (PIs). Thomas Burnham, 651.366.5452. (Subtrack DG3.)
- One Year Performance Summary of Whitetopping Test Sections at the MnROAD Test Facility, http://mnroad.dot.state.mn.us/research/MnROAD_Project/MnRoadReports/MnRoadOnlineReports/One_Year_Performance_Summary_of_Whitetopping_Test_Sections_at_the_MnROAD_Test_Facility.pdf. Julie Vandebossche, David Rettner (PIs). Thomas Burnham, 651.366.5452. (Subtrack DG3.)
- 2001-07, The Construction of US-169 and I-94 Experimental Thin and Ultra-Thin Whitetopping Sections in Minnesota, <http://www.lrrb.gen.mn.us/PDF/200107.pdf>. Julie Vandebossche, David Rettner (PIs). Bernard Izevbekhai, Bernard.Izevbekhai@dot.state.mn.us, 651.366.5454. (Subtrack DG3.)
- INV 815, Calibration of the 2002 AASHTO Pavement Design Guide for MN PCC/HMA Pavements. Maureen Jensen, 651.779.5507. (Subtrack DG2.)
- Resilient Modulus Development for Materials Containing Bituminous and Concrete for 2002 Design Guide and MnPAVE Pavement Design. Shongtao Dai, 651.779.5218.
- Adaptation of the Design Guide to LV Concrete Roads. Thomas Burnham, 651.366.5452.
- Multi-State Pooled Fund Analysis of Performance Data from Whitetopping Test Cells for Inclusion in the Design Guide. Thomas Burnham, 651.366.5452.

Wisconsin

- 0092-06-03, Investigation of Concrete Properties to Support Implementation of the New AASHTO Pavement Design Guide, http://www.whrp.org/Research/Rigid/rigid_0092-06-03/index.htm. Tarun Naik, UW-Milwaukee (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack DG2.)
- 0092-00-11, Portland Cement Concrete (PCC) Pavement Over Rubblized PCC, http://www.whrp.org/Research/Rigid/rigid_0092-00-11/index.htm. Jim Crovetti, Marquette University (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack DG3.)
- 0092-07-03, Improving Full Depth Concrete Pavement Repair. Michael Darter, ARA Inc. Jim Parry, james.parry@dot.state.wi.us, 608.246.7939.

Track 2 Total Studies – 25. Leading State – Minnesota, 10.

Track 3 – Nondestructive Testing

High-Speed Nondestructive Testing and Intelligent Construction Systems. This track investigates the use of high-speed, nondestructive quality control systems during construction of pavements to evaluate properties and allow for adjustment of construction practice to meet desired standards. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track3.cfm>.

Michigan

- Investigating New Technologies to Detect Dowel Alignment Errors in Jointed Concrete. No contact information. (Subtrack ND2.)
- Evaluation of the Air-Void Analyzer for Use in Pavement and Bridge. No contact information. (Subtrack ND2.)
- Assessment of Pavement Acceptance Criteria and Quantifying its As-Constructed Material and Structural Properties. David Smiley, smileyd@michigan.gov. (Subtrack ND1.)

Minnesota

- Testing of PCC Pavement Design and Rehabilitation Features aka Load Testing of Instrumented Pavement Sections: Improved Techniques for Applying the Finite Element Method to Strain Prediction in PCC Pavement Structures, http://mnroad.dot.state.mn.us/research/MnROAD_Project/MnRoadReports/MnRoadOnlineReports/Load_Testing_of_Instrumented_Pavement_Sections_Improved_Techniques_for_Applying_the_Finite_Element_Method_to_Strain_Prediction_in_PCC_Pavement_Structures.pdf. Thomas Burnham, 651.366.5452.

Wisconsin

- 0092-03-16, Evaluation of Methods for Characterizing Air Void Systems in Wisconsin Paving Concrete, http://www.whrp.org/Research/Rigid/rigid_0092-03-16/index.htm. Larry Sutter, Michigan Technological University (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack ND2.)

- 0092-45-16, Field Measurement of Water Cement Ratio for PCC – Phase 2. http://www.whrp.org/Research/Rigid/rigid_0092-45-16/index.htm. Steve Cramer, UW-Madison (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack LL2.)
- 0092-07-02, Detecting Deleterious Fine Particles in Concrete Pavements. Steve Cramer, UW-Madison (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack ND3.)

Track 3 Total Studies – 7. Leading States – Michigan and Wisconsin, 3 each.

Track 4 – Surface Characteristics

Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements. This track focuses on pavement surface designs to meet or exceed friction and safety requirements, noise reduction, reduced spray and hydroplaning, light reflection, and durability. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track4.cfm>.

Michigan

- Noise Generated by Vehicle/Road Surface. Jason Blough, Michigan State University (PI). Frank Spica, spicaf@michigan.gov. (Subtrack SC3.)

Minnesota

- INV 857, A Report and Analysis of Effects of Seasonal and Climatic Changes on Ride Quality Observed in MnROAD Low- and High-Volume Roads. Ben Worel, ben.worel@dot.state.mn.us.
- Minnesota Pavement Noise Study, NCAT Report 2005. D.I. Hanson and B. Waller. Curtis Turgeon, curtis.turgeon@dot.state.mn.us.
- Evaluation of Current Texturing Practices Using Wet Weather Accident Data. Bernard Izevbehai, Bernard.Izevbehai@dot.state.mn.us, 651.366.5454.

Wisconsin

- 0092-00-08, Wet Pavements Crash Study of Longitudinal and Transverse Tined PCC, http://www.whrp.org/Research/Rigid/rigid_0092-00-08/index.htm. Alex Drakopoulos, Marquette University (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtracks SC3 and SC4.)

Track 4 Total Studies – 5. Leading State – Minnesota, 3.

Track 5 – Equipment Advancements

Equipment Automation and Advancements. This track addresses improvements in concrete paving processes and equipment with high-speed, high-quality technology for curing, surface treatment, jointing, and drain placement, as well as repair process improvements. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track5.cfm>.

No projects applicable.

Track 5 Total Studies – 0.

Track 6 – Innovative Joints

Innovative Concrete Pavement Joint Design, Materials, and Construction. This track focuses on design, equipment, and methods for installing, repairing, and monitoring joints and their performance. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track6.cfm>.

Minnesota

- 2006-01, Investigation of Deterioration of Stainless Steel Dowel Tubes Under Repeated Loading, <http://www.lrb.org/pdf/200601.pdf>. Bernard Izevbehai, Bernard.Izevbehai@dot.state.mn.us, 651.366.5454. (Subtrack IJ1.)
- Study of Innovative Retrofit H Ties at MnROAD. Thomas Burnham, 651.366.5452.

Wisconsin

- 0092-05-05, Analysis of Concrete Pavement Joints to Predict the Onset of Distress, http://www.whrp.org/Research/Rigid/rigid_0092-05-05/index.htm. Rob Rasmussen, The Transtec Group (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack IJ2.)

Track 6 Total Studies – 3. Leading State – Minnesota, 2.

Track 7 – Rehabilitation and Construction

High-Speed Concrete Pavement Rehabilitation and Construction. The focus of this track is high-speed construction and rehabilitation through planning and simulation, precast modules, fast track field work, evaluation and technology transfer of high-speed equipment and processes. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track7.cfm>.

Illinois

- IHR-32, Construction and Accelerated Pavement Testing of Extended Life CRCP. Jeff Roesler, University of Illinois, Urbana-Champaign (PI). Amy Schutzbach, amy.schutzbach@illinois.gov, 217.785.4888.

Minnesota

- 2005-33, INV 645, 2005/2006 Task 9, State Aid Concrete Pavement Rehabilitation (CPR) Best Practices Manual. <http://www.lrrb.org/pdf/200533.pdf>. Michael Sheehan, 507.285.8231.

Wisconsin

- 0092-01-04, Early Opening of Portland Cement Concrete Pavements to Traffic, http://www.whrp.org/Research/Rigid/rigid_0092-01-04/index.htm. Jim Crovetti, Marquette University (PI). Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack RC3.)

Track 7 Total Studies – 3, Illinois, Minnesota and Wisconsin, 1 each.

Track 8 – Long Life Concrete

Long Life Concrete Pavements. While the entire Road Map looks to expand periods between maintenance, restoration and rehabilitation of concrete pavement, this track focuses on research directed toward service lives of 60 years or more. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track8.cfm>.

Minnesota

- Minnesota Monitoring of 60-Year Concrete Design on I-35. B.I. Izevbekhai and T. Burnham (Paper presented at the Long Life Concrete Pavements Conference, Chicago, Illinois, 2006). Bernard Izevbekhai, Bernard.Izevbekhai@dot.state.mn.us, 651.366.5454.

Track 8 Total Studies – 1, Minnesota.

Track 9 – Data Collection

Concrete Pavement Accelerated Loading and Long-Term Data Collection. Anticipating future programming on accelerated loading and long-term data use, this track provides testing methods, data collection and reporting tools, constructs test sections, and shares data. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track9.cfm>.

Illinois

- Construction and Accelerated Pavement Testing of Extended Life CRCP. Jeff Roesler, University of Illinois, Urbana-Champaign (PI). Amy Schutzbach, Amy.Schutzbach@illinois.gov, 217.785.4888.

Minnesota

- Peak Pick Process for Data From Concrete Test Cells. Thomas Burnham, 651.366.5452.

Track 9 Total Studies – 2, Illinois and Minnesota, 1 each.

Track 10 – Pavement Performance

Concrete Pavement Performance. In consideration of asset management concerns for if and how pavements meet performance standards, this track looks at functional pavement performance, scheduling surface improvements, and providing rapid performance feedback. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track10.cfm>.

Michigan

- Development of Alternative Pavement Distress Index Models, Final Report, http://www.michigan.gov/documents/mdot_rc-1436_80484_7.pdf. Gilbert Baladi, Michigan State University (PI). Kevin Kennedy, kennedyk@michigan.gov. (Subtrack PP2.)

- MSU 99-2-1, Development of a Roughness Threshold for the Preventive Maintenance of Pavements Based on Dynamic Loading Considerations and Damage Analysis. Karim Chatti, Michigan State University (PI). Dave Smiley, smileyd@michigan.gov. (Subtrack PP2.)
- 2004-0283, auth. 1, Performance of Michigan's Jointed Portland Cement Concrete (PCC) Pavements – Phase I. Alan Robords, robordsa@michigan.gov.
- 2003-0026, auth. 6, Performance Evaluation of JRCP with Stabilized Open-Graded Drainage Course. Will Hansen, University of Michigan (PI). Dave Smiley, smileyd@michigan.gov.

Minnesota

- INV 808, Pavement Rehabilitation Selection. Brad Wentz, 218.847.4463.
- Dynamic Response of Flexible and Rigid Pavements Built Over Geofam. Bernard Izevbekhai, Bernard.Izevbekhai@dot.state.mn.us, 651.366.5454.

Wisconsin

- 0092-05-06, Effects of Heavy Loading on Wisconsin's Concrete Pavements, http://www.whrp.org/Research/Rigid/rigid_0092-05-06/index.htm. Jim Parry, james.parry@dot.state.wi.us, 608.246.7939. (Subtrack PP2.)

Track 10 Total Studies – 7. Leading State – Michigan, 4.

Track 11 – Business and Economics

Concrete Pavement Business Systems and Economics. To address expansion of contractor responsibilities into operations and quality control, this track looks at contracting options and practices, technology transfer systems, public-private cooperation, and economic models. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track11.cfm>.

Illinois

- Demonstrating the Use of Performance Based Warranties on Highway Construction Projects in Illinois, <http://www.dot.il.gov/materials/research/pdf/146.pdf>. Charles Wienrank, Charles.Wienrank@illinois.gov, 217.782.0570. (Subtrack BE3.)

Michigan

- Value Effect of Construction Incentive Payments on Pavement Performance. No contact information. (Subtrack BE3.)

Track 11 Total Studies – 2, Illinois and Michigan, 1 each.

Track 12 – Advanced Materials

Advanced Concrete Pavement Materials. This track looks to develop or refine new pavement materials, reintroduce existing advanced materials, improve construction, and reduce waste by studying advanced materials that are prospective, used in other countries, or currently studied on only a small scale. For full description and problem statements, see <http://www.fhwa.dot.gov/pavement/pccp/pubs/05053/track12.cfm>.

Illinois

- IHR-44, Self-Consolidating Concrete. <http://www.ict.uiuc.edu/displaysingle.asp?ID=26>. David Lange, University of Illinois, Urbana-Champaign (PI). Brian Pfeifer, Brian.Pfeifer@illinois.gov, 217.782.2912. (Subtrack AM2.)
- Utilization of Recycled Materials in Illinois Highway Construction, <http://www.dot.il.gov/materials/research/pdf/142.pdf>, Carolyn Griffiths, James Krstulovich, Jr. (PIs). James Krstulovich, Jr., James.Krstulovich@illinois.gov, 217.557.6038. (Subtrack AM3).

Minnesota

- Physical and Mechanical Properties of Innovative Concrete Mixtures. Curt Turgeon, 651.779.5535.

Track 12 Total Studies – 3. Leading State – Illinois, 2.