SUMMARY of PAVEMENT TECHNOLOGY NEEDS in the NORTHEASTERN UNITED STATES

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Summary of Pavement Technology Needs in the Northeastern United States

BACKGROUND – In July 2003, the Connecticut Transportation Institute (CTI) entered into an Agreement governing a pooled funds project to coordinate pavement activities in the northeastern United States. The purpose of the project was to establish a management structure and direction for paving activities and technology, to communicate findings to transportation agencies in the northeast and to establish a consensus of research and technology transfer needs for the northeast. This report summarizes the pavement technology needs obtained by interviewing key staff of northeastern transportation agencies and integrates the findings into a cohesive program that can be pursued by the agencies. Recommendations for further action are presented.

METHODOLOGY – Transportation agencies were visited by the author. The visits were structured to obtain the pavement needs perceived by each agency. Meetings were arranged by individual contacts in the agency and were attended by agency staff working in the pavement, materials, and construction areas.

The needs were broken into four categories or areas: Paving, Design, Management, and Other.

1. Paving - contains any problems or issues related to the materials, construction, maintenance, and performance pavements.
2. Design - addresses issues with design of pavement systems, sub-systems and specification requirements.
3. Management – focuses on management systems and concepts to provide data and systems to estimate long term pavement performance and its benefit/cost.
4. Other - is a melting pot for such complex issues as personnel retention, data, and information dissemination. Each of the needs was ranked High, Medium, Low, or No values (Scale 3, 2, 1, 0; High to No) by the agency staff interviewed. The rank scores were used to establish consensus.

Table 1 presents the overall results of the survey conducted. By roughly a 2 to 1 margin the greatest number of needs cited by transportation staff was in the paving area. Appendix 1 shows a complete list of needs. It also shows the ranking of each need. This is the total of the average ranking by each agency (the sum of the average rating per agency).

Table 1: Summary of Needs Statements

* 10 Transportation Agencies Visited
* 42 Transportation Professionals Interviewed

Category	Number of Need Statements
Paving	42
Design	30
Management	20
Other	13

DATA ANALYSIS – The first step was to analyze the ranking of each need by category. The four highest ranked needs by category are presented in Table 2, as well as the number of agencies stating the need. For Paving, the highest need cited is guidance on quality assurance (QC) for acceptance of binder and pavement. This is followed closely by Long Term Performance of Pavements and the system modifications put in place by states during the implementation of the SuperPave process. In Design, training in the 2002 Pavement Design Guide is, by far, the greatest perceived need. The Management category provided the highest ranked need, the integration of existing databases for pavement management and pavement performance assessments. This was followed by the need to use pavement management databases to determine long term pavement performance. In Other, staffing, the loss of and lack of qualified personnel are two very pressing issues. The staff interviewed expressed extreme concern about these issues and simultaneously recognized their limited span of control over these personnel issues. The data were then sorted in rank order regardless of category. Appendix 2 shows their tabulation. The data were then truncated at the top twenty needs, (see Table 3), and the remaining needs were then reviewed to determine if some lower ranked needs could be added to the top 20 needs. This resulted in several needs, not ranked in the top 20, directly affecting the top 20.

Each need was then reviewed, a survey of on-going work conducted, and a recommendation for action developed. A program of action items was then prepared. This program is shown as Table 4. Due to current financial constraints only recommendations on the ten highest rated needs are presented. The following section outlines suggested follow-up activities for the ten top rated pavement needs, articulated by the northeastern transportation agencies.

RECOMMENDATIONS – The following recommendations refer to the needs outlined in Table 4.

#1 – No action by northeastern states. Carefully and thoughtfully follow the on-going work by FHWA. Maryland DOT staff have participated with FHWA in this on-going project.

#2 – Initiate a project to develop a training course for the 2002 Guide. The course should take into account the implementation efforts in the project and by AASHTO's Joint Task Force on Pavements. The course should be directed at pavement professionals in State Transportation agencies as well as consultants engaged by the agencies. NETC should be contacted as a possible source to accomplish this task.

#3, 5, 6, 7, 8, 9, and 10 – Develop appropriate contracts to secure via survey or other methods, etc., the data and information to address these needs. The interviews conducted and subsequent follow-up., indicated that varying levels of activity have been and are being conducted on these needs. It appears prudent to determine the state of practice on these issues and from there focus on actions addressing these issues in the northeast.

#4 – Develop a detailed problem statement and submit to NCHRP. This issue has national significance and nationwide application.

Table 2: Top Ranked Needs by Category

Category	Need	Total Ranking*	Number of Agencies**
Paving	QA for Binder Acceptance and Pavement (Construction; Smoothness)	14.58	6
	Long Term Performance of Pavements	11.58	5
	SuperPave – Design of System Modifications	11.38	5
	Assessment of Long Joint Density, etc.	10.10	4
Design	Training in the 2002 Pavement Design Guide	17.05	7
	HMA Permeability	6.31	3
	Applicability of 2002 Pavement Design Guide Results in N.E.	5.60	2
	Long Term Effect of Fibers in HMA (Modifiers)	4.71	2
Management	Integration of Existing Database	17.25	7
	Use of Pavement Management Databases to Determine Long Term Pavement Performance	8.93	4
	Integrity of Contractor Supplied Data	7.38	3
	Training at All Levels	5.93	3
Other	Loss of Qualified Personnel	8.50	4
	Lack of Qualified Personnel	8.07	4
	Clearinghouse for State DOT Pavement Activities	5.67	2
	Survey of Acceptance and Payment Specifications	4.92	2

* Total Ranking = Sum of the Average Ranking/Agency
** Number of Agencies Stating the Need

Table 3: Top Twenty Needs

Category	Need	Total Ranking*	Number of Agencies**
M	Integration of Existing Database	17.25	7
D	2002 Pavement Design Guide Training	17.05	7
P	QA for Binder Acceptance and Pavement (Construction; Smoothness)	14.58	6
P	Long Term Performance of Pavements	11.58	5
P	SuperPave – Design of System Modifications	11.38	5
P	Assessment of Long Joint Density	10.10	4
M	Pavement Management Database to Determine Long Term Pavement Performance	8.93	4
O	Loss of Qualified Personnel	8.50	4
O	Lack of Qualified Personnel	8.07	4
P	Placement Temperature Issues	7.58	3
M	Integrity of Contractor Supplied Data	7.38	3
M	Long Term Performance of Modified Binders	6.75	3
D	HMA Permeability	6.31	3
D	Design of Thin-Lift Sections	6.17	3
M	Training at All Levels	5.93	3
P	SuperPave for Low Volume Roads	5.85	3
O	Clearinghouse for State DOT Pavement Activities	5.67	2
O	Synopses of Completed Research and Implementation Potential	5.67	2
D	Applicability of 2002 Pavement Design Guide Results in NE	5.60	2
D	Tests of Aggregate Durability	5.25	2

* Total Ranking = Sum of the Average Ranking/Agency
** Number of Agencies Stating the Need
P - Paving
D - Design
M - Management
O - Other

Table 4: Program of Action on the Top Rated Pavement Needs

1. Integration of Existing Databases	- On-going: Work being performed by FHWA and several state DOTs. - Action: Await results of FHWA work. Follow-up with state DOTs involved with the FHWA effort.
2. 2002 Pavement Design Guide Training	- On-going: Final review of the draft Pavement Design Guide is being accomplished. It should be available in the Fall 2004. - Action: Develop a training course for the 2002 Guide.
3. QA for Binder & Pavement Acceptance	- On-going: Several states are working on various elements of this issue, ie., definition of the acceptance criteria and any limits of application, smoothness measures, measurement of pavement parameters etc. - Action: Review the state of the QA practice in the northeast. Use this work to focus attention and effort on the most meaningful elements of this problem.
4. Long Term Performance of Pavement	- On-going: State DOTs and FHWA are addressing this issue. For example LTPP is obtaining data to assess various pavement designs nationwide. This effort will be closing in the near future, but the states need criteria and equipment to determine pavement performance regionally. -Action: Define general modes of pavement failures in the northeast. Survey state agencies to : (1) assess methods of measuring the failures, their Benefit/Cost; and, (2) define the limits of failure tolerated by state transportation agencies before corrective actions are taken, ie., the depth of rut or the extent and severity of cracking.
5. SuperPave – Design of System Modifications	- On-going: Several agencies interviewed cited variations in the SuperPave process, which have proven effective. - Action: Survey the state transportation agencies in the northeast. Define SuperPave modifications used and document the Benefit/Cost of these modifications.
6. Assessment of Longitudinal Joint	- On-going: Several agencies have conducted field trials of various HMA longitudinal joint designs, construction systems and methods to evaluate the construction of longitudinal joints. NCAT has also looked at the problem. - Action: Survey the state transportation agencies in the northeast. Document the systems and joint formation concepts employed and assess the Benefit/Cost of the systems.

Table 4: Program of Action on the Top Rated Pavement Needs (Continued)

7. PM Database to Determine Long Term Pavement Performance	- On-going: Work in item 1 above, addresses this problem. Transportation agencies collect and store data needed to define pavement performance. By integrating the design, construction, materials, and maintenance data with performance histories, long term trends can be quantified and thus performance defined. - Action: Determine, via survey, the data in various state Pavement Management databases and its applicability to determine the long term performance of pavement systems.
8. Loss of Qualified Personnel, and 9. Lack of Qualified Personnel	- On-going: These needs are treated in a like manner as a unit. Currently AASHTO has recognized both the loss of staff and lack of qualified replacements. Transportation agencies have little control over these issues, however, some states have partnered with the construction industry and other affected groups to focus attention on these issues. Construction Career Days and other concepts are proving their worth. - Action: Here again a survey of regional concepts and an assessment of their Benefit/Cost is suggested. Documentation of successes and failures will provide valuable guidance in addressing these problems.
10. HMA Placement Temperatures	- On-going: Several noteworthy studies have been conducted on the national and state levels. The need has also been addressed by NCAT and the Asphalt Institute. - Action: Develop from existing data and information, a recommended practice for HMA Placement temperatures in the Northeast.

Appendix 1: Tabulation of Pavement Needs by Category

Rank	Paving	Total Ranking
1	QA for Binder Acceptance and Pavement (Construction; Smoothness)	14.58
2	Long Term Performance of Pavements	11.58
3	SuperPave – Design of System Modifications	11.38
4	Assessment of Long Joint Density	10.10
5	Placement Temperature Issues	7.58
6	SuperPave for Low Volume Roads	5.85
7	Use of Pavement Performance for QA (and SuperPave)	4.50
8	Comparison of SuperPave Failures to Failures in Other Mixes	3.73
9	SuperPave - Rut Based vs Cracking	3.00
10	Construction Benefits of Modified Binders	3.00
11	Durability of Pavement	3.00
12	Tests for Segregation in HMA Pavement	3.00
13	In-Line Blending Guidelines	2.67
14	High Early Strength Concrete Patches	2.67
15	Relation of Aggregate Qualities to Friction	2.67
16	Equipment to Place Coarse Mixes	2.60
17	Long Term Performance of Recycling Concepts	2.50
18	Balling Problem in OGFC with Latex	2.50
19	Paving at Obstructions	2.50
20	Cracking in Latex-Modified Bridge Overlays	2.43
21	Survey of PG Graded Binder Performance	2.33
22	Placement Guidelines and Performance Measures for Tack Coats	2.33
23	Application of QA to Pavement Construction	2.33
24	Density of HMA Cores vs. Nuclear Data	2.33
25	Use of Maturity Meters to Open Concrete Patches	2.33
26	Effect of Mix Type on Pavement Performance	2.33
27	Maintenance of OGFC (Snow Removal)	2.25
28	Top-Down Cracking in HMA Pavements	2.20
29	Smoothness of Concrete Bases	2.00
30	Composition of HMA Modifiers (VOC)	2.00
31	Measurement of Noise Levels Generated by Various Pavement Surfaces	2.00
32	Early Cracking in HMA Overlays on Bridge Decks	1.86
33	Guidelines for Use of Material Transfer Devices	1.75
34	SuperPave Blind to Modifiers	1.75
35	Lateral Placement of Pavement Markings	1.71
36	Relation of PG-Grade to Performance	1.57

Appendix 1: Tabulation of Pavement Needs by Category (Continued)

37	Effect of Color on Pavement Performance	1.43
38	Define High Performance Concrete	1.43
39	Pre-Emptive Measures for VOC and HMA Odor Suppression	1.33
40	Evaluation and Correction of Rutting	1.29
41	Raveling in Bridge Shadow Areas	1.29
42	Use of Foam-Asphalt For In-Place Recycling	1.00
Rank	**Design**	**Total Ranking**
1	2002 Pavement Design Guide Training	17.05
2	HMA Permeability	6.31
3	Design of Thin-Lift Sections	6.17
4	Applicability of 2002 Pavement Design Guide Results in NE	5.60
5	Tests of Aggregate Durability	5.25
6	Long Term Effect of fibers in HMA	4.71
7	Effect of RAP on PG-Graded Binders	4.61
8	Warrants for the Use of Open-Graded Friction Courses	4.36
9	Tests to Identify Modified Binders	3.71
10	Warrants for Modified Binders	3.51
11	Changes in the MP2 Specification	2.75
12	Smoothness Specifications for Pavement Surfaces	2.75
13	Control of Reflective Cracking in HMA	2.67
14	Natural vs. Manufactured Sand in SuperPave mixes	2.50
15	Benefit/Cost of Using the 2002 Pavement Design Guide	2.50
16	Assessing In-Situ Pavement Structures	2.33
17	Sensitivity of Inputs for the 2002 Pavement Design Guide	2.29
18	Correlation of WIM Data to Pavement Response	2.25
19	Use of SHRP LTPP Data in N.E. for Design	2.25
20	Typical Design Parameter for 2002 Pavement Design Guide (E*, Mr)	2.14
21	Bridge Pavement Density	2.14
22	Implementation of Smoothness Spec.	2.14
23	Performance of Porous Pavement-Vertical Drainage	2.00
24	Use of E* in Design	1.75
25	Establishing Materials Tolerances	1.75
26	Accelerated Load Tests for Design	1.75
27	Performance Estimates via Rut Testers	1.71
28	Selection of SuperPave Mix for Surface and Base Course	1.67
29	Assessment of Direct Tension Equipment	1.40
30	Quantification of Aggregate Quality on Mix Performance	1.25

Appendix 1: Tabulation of Pavement Needs by Category (Continued)

Rank	Management	Total Ranking
1	Integration of Existing Database	17.25
2	PM Database to Determine Long Term Pavement Performance	8.93
3	Integrity of Contractor Supplied Data	7.38
4	Long Term Performance of Modified Binders	6.75
5	Training at All Levels	5.93
6	Guidelines for Contracting QA	4.67
7	Use of Warranty Specifications	4.33
8	Benefit/Cost of Short-term Treatments	4.25
9	Benefit/Cost of Pavement Treatments	3.68
10	Quality and Quantity of Pavement Data	3.00
11	Pavement Preservation	3.00
12	Required Resources (Funding and Personnel)	2.50
13	Methods to Address Problem Areas Rapidly	2.00
14	Management of SP Process	2.00
15	Calibration of FWD and Profiler Equipment	2.00
16	Application of Different HMA Mixes to Roadway Environment	1.75
17	PWL for HMA Binder Acceptance	1.50
18	Management Controls	1.50
19	Management of QA Process	1.50
20	Integration of All Factors for Incentive Payments	1.33
Rank	**Other**	**Total Ranking**
1	Loss of Qualified Personnel	8.50
2	Lack of Qualified Personnel	8.07
3	Clearinghouse for State DOT Pavement Activities	5.67
4	Synopses of Completed Research and Implementation Potential	5.67
5	Survey of Acceptance and Payment Specifications	4.92
6	Peer Exchange Re/ All Pavement Issues	3.00
7	Test and Evaluation of Products and Concepts	2.25
8	Updating Binder Technician Certification	2.00
9	QA of Outsourced Work (Audit Procedures)	2.00
10	Extension of Pavement Acceptance via Defect Warranties	1.67
11	Maintenance of Binder Database	1.50
12	Staffing Requirements to Implement the 2002 Pavement Design Guide	1.29
13	Marketing Pavement Concepts	1.00

Appendix 2: Tabulation by Rank Order
High => Low for All Categories

Category	Need	Total Ranking
M	Integration of Existing Database	17.25
D	2002 Pavement Design Design Guide Training	17.05
P	QA for Binder Acceptance & Pavement (Construction; Smoothness)	14.58
P	Long Term Performance of Pavements	11.58
P	SuperPave – Design of System Modifications	11.38
P	Assessment of Long Joint Density	10.10
M	PM Database to Determine Long Term Pavement Performance	8.93
O	Loss of Qualified Personnel	8.50
O	Lack of Qualified Personnel	8.07
P	Placement Temperature Issues	7.58
M	Integrity of Contractor Supplied Data	7.38
M	Long Term Performance of Modified Binders	6.75
D	HMA Permeability	6.31
D	Design of Thin-Lift Sections	6.17
M	Training at All Levels	5.93
P	SuperPave for Low Volume Roads	5.85
O	Clearinghouse for State DOT Pavement Activities	5.67
O	Synopses of Completed Research and Implementation Potential	5.67
D	Applicability of 2002 Pavement Design Guide Results in NE	5.60
D	Tests of Aggregate Durability	5.25
O	Survey of Acceptance and Payment Specifications	4.92
D	Long Term Effect of fibers in HMA	4.71
M	Guidelines for Contracting QA	4.67
D	Effect of RAP on PG-Graded Binders	4.61
P	Use of Pavement Performance for QA (and SuperPave)	4.50
D	Warrants for the Use of Open-Graded Friction Courses	4.36
M	Use of Warranty Specifications	4.33
M	Benefit/Cost of Short-term Treatments	4.25
P	Comparison of SuperPave Failures to Failures in Other Mixes	3.73
D	Tests to Identify Modified Binders	3.71
M	Benefit/Cost of Pavement Treatments	3.68
D	Warrants for Modified Binders	3.51
P	SuperPave - Rut Based vs. Cracking	3.00
P	Construction Benefits of Modified Binders	3.00
P	Durability of Pavement	3.00

Appendix 2: Tabulation by Rank Order (Continued)

P	Tests for Segregation in HMA Pavement	3.00
M	Quality and Quantity of Pavement Data	3.00
M	Pavement Preservation	3.00
O	Peer Exchange Re/ All Pavement Issues	3.00
D	Changes in the MP2 Specification	2.75
D	Smoothness Specifications for Pavement Surfaces	2.75
P	In-Line Blending Guidelines	2.67
P	High Early Strength Concrete Patches	2.67
P	Relation of Aggregate Qualities to Friction	2.67
D	Control of Reflective Cracking in HMA	2.67
P	Equipment to Place Coarse Mixes	2.60
P	Long Term Performance of Recycling Concepts	2.50
P	Balling Problem in OGFC with Latex	2.50
P	Paving at Obstructions	2.50
D	Natural vs. Manufactured Sand in SuperPave mixes	2.50
D	Benefit/Cost of Using the 2002 Pavement Design Guide	2.50
M	Required Resources (Funding and Personnel)	2.50
P	Cracking in Latex-Modified Bridge Overlays	2.43
P	Survey of PG Graded Binder Performance	2.33
P	Placement Guidelines and Performance Measures for Tack Coats	2.33
P	Application of QA to Pavement Construction	2.33
P	Density of HMA Cores vs. Nuclear Data	2.33
P	Use of Maturity Meters to Open Concrete Patches	2.33
P	Effect of Mix Type on Pavement Performance	2.33
D	Assessing In-Situ Pavement Structures	2.33
D	Sensitivity of Inputs for the 2002 Pavement Design Guide	2.29
P	Maintenance of OGFC (Snow Removal)	2.25
D	Correlation of WIM Data to Pavement Response	2.25
D	Use of SHRP LTPP Data in N.E. for Design	2.25
O	Test and Evaluation of Products and Concepts	2.25
P	Top-Down Cracking in HMA Pavements	2.20
D	Typical Design Parameter for 2002Pavement Design Guide (E*, MR)	2.14
D	Bridge Pavement Density	2.14
D	Implementation of Smoothness Spec.	2.14
P	Smoothness of Concrete Bases	2.00
P	Composition of HMA Modifiers (VOC)	2.00
P	Measurement of Noise Levels Generated by Various Pavement Surfaces	2.00

Appendix 2: Tabulation by Rank Order (Continued)

D	Performance of Porous Pavement-Vertical Drainage	2.00
M	Methods to Address Problem Areas Rapidly	2.00
M	Management of SuperPave Process	2.00
M	Calibration of FWD and Profiler Equipment	2.00
O	Updating Binder Technician Certification	2.00
O	QA of Outsourced Work (Audit Procedures)	2.00
P	Early Cracking in HMA Overlays on Bridge Decks	1.86
P	Guidelines for Use of Material Transfer Devices	1.75
P	SuperPave Blind to Modifiers	1.75
D	Use of E* in Design	1.75
D	Establishing Materials Tolerances	1.75
D	Accelerated Load Tests for Design	1.75
M	Application of Different HMA Mixes to Roadway Environment	1.75
P	Lateral Placement of Pavement Markings	1.71
D	Performance Estimates via Rut Testers	1.71
D	Selection of SuperPave Mix for Surface and Base Course	1.67
O	Extension of Pavement Acceptance via Defect Warranties	1.67
P	Relation of PG-Grade to Performance	1.57
M	PWL for HMA Binder Acceptance	1.50
M	Management Controls	1.50
M	Management of QA Process	1.50
O	Maintenance of Binder Database	1.50
P	Effect of Color on Pavement Performance	1.43
P	Define High Performance Concrete	1.43
D	Assessment of Direct Tension Equipment	1.40
P	Pre-Emptive Measures for VOC and HMA Odor Suppression	1.33
M	Integration of All Factors for Incentive Payments	1.33
P	Evaluation and Correction of Rutting	1.29
P	Raveling in Bridge Shadow Areas	1.29
O	Staffing Requirements to Implement the 2002 Pavement Design Guide	1.29
D	Quantification of Aggregate Quality on Mix Performance	1.25
P	Use of Foam-Asphalt For In-Place Recycling	1.00
O	Marketing Pavement Concepts	1.00