RESEARCH

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Implementation of Pavement Management in Minnesota

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16. Abstract (Limit: 200 words)

Pavement Management Systems (PMSs) are cost effective tools for helping local agency engineers manage the significant investment that has been made in their pavements. PMSs can also estimate future pavement conditions. This capability supports local engineers in making critical funding decisions about valuable pavement assets. Like any computerized system, PMSs are only as good as the data that is put into them and the analysis algorithms that drive them. Data collection, validation, and updating can be expensive. Accurate life cycle analysis is critical for making a PMS effective. However, automation and other new tools offer opportunities for reducing costs and improving the results coming out of PMSs. This report was developed as a resource for Minnesota local agencies, focusing on the capabilities, applications, and benefits of current pavement management systems used on local road systems in Minnesota. This resource will provide information to help local agencies without a PMS to evaluate, select, and justify the purchase and operational costs of a PMS; additionally, it will help local agencies who have a PMS to better use and enhance their capabilities. This report has a related PowerPoint and Brochure.

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Implementation of Pavement Management in Minnesota

DRAFT REPORT

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INTRODUCTION

Pavement Management Systems software is designed to make the job of pavement management easier and more efficient, providing applications to track pavement data and to aid in planning and identifying project needs. As more and more public works departments face the realities of increasing workloads and shrinking resources, finding technology applications that allow productivity gains becomes ever more important. The use of Pavement Management System software as a tool for pavement management has grown and continues to grow at a rapid pace. This report reviews the various Pavement Management System software programs available, provides a matrix indicating features of each program and highlights the findings from case studies within the state of Minnesota. This report will provide information to help local agencies without a Pavement Management System to evaluate, select, and justify the purchase and operational costs of a Pavement Management System software program and help local agencies who have a Pavement Management System software program to better use and enhance their capabilities.

TASK BACKGROUND AND PURPOSE

The Local Road Research Board (LRRB) undertook this research implementation study to develop an understanding of how Pavement Management System software programs were (or were not) currently being used by county and city engineers in Minnesota and to provide a tool summarizing systems currently used in Minnesota.

The resulting documentation should be understood as a review of Pavement Management System software programs; **not a recommendation for any one product**. The decision to purchase and use one product over another must be made based on the individual users' or agencies' requirements.

SOFTWARE DATA COLLECTION PROCESS

In order to determine current usage and desired functionality of Pavement Management System software programs in Minnesota, a survey was developed and administered to city and county engineers. Results from this survey were used to determine what Pavement Management Systems software is currently in use by Minnesota local governments. A list of evaluation criteria was developed by the TAP and a secondary survey was conducted to determine from a "users" perspective, the capabilities, applications, and benefits of the various pavement management systems. Results of the survey were then compiled in a matrix format, for ease of comparison. After the "user" information was compiled for each commercial system, a third survey was sent to the actual pavement management system software vendors. This data was compared with the user results, and through a series of emails and phone calls, discrepancies were resolved. A final copy of the matrix was sent to each of the vendors to review the results.

INITIAL SURVEY – CITY AND COUNTY ENGINEERS

The first step was to survey Minnesota city and county engineers, querying them regarding their use of Pavement Management System software programs, how long they have used the software and any case studies they have that demonstrate the use of their Pavement Management System software.

The survey was administered via e-mail in the summer of 2008, with a total of 64 responses received (27 cities and 37 counties). Results of the survey are listed below each question. Significant findings are summarized below, with the full survey summary included in Appendix A of this report.

Table 1: Initial Survey Results – Identifying Minnesota Pavement Management Systems

1. *Does your agency currently use a Pavement Management System software program? If so, which one?*
   Results: Of the 64 respondents, 40 agencies (63 percent) currently use a commercial Pavement Management System software program and 13 agencies (20 percent) use an in-house developed Pavement Management System.

Pavement Management System	**Number of Responses**
GoodPointe Technology (Icon)	30
Cartegraph (Roadpro)	3
Hansen	0
Micropaver (Corps of Engineers)	3
Infrastructure Management Services (IMS)	2
Roadware Group Inc.	0
Stantec	0
Deighton Associates	0
Applied Research Associates	0
PASERWARE (WisDOT)	1
In-House Pavement Management System	13
Other - iWorqs	1
None	11
TOTAL	64

2. *How many years have you used your current system?*
   Results: Experience ranges from 1-20 years (see Appendix A for detailed responses)

3. *Have you ever used a different Pavement Management System? If so, why did you change?*
   Results: Of the 64 respondents, 18 agencies (28 percent) had used a different Pavement Management System in the past. The following is a summary of reasons why they switched:
   - Need more detailed system (previously used a spreadsheet): 3
   - Wanted GIS integration: 1
   - Wanted same system as neighboring cities: 1
   - Old program became obsolete: 1
   - Wanted a program that did sign management as well: 1
   - Too expensive: 2
   - Too difficult to use: 5
   - Wanted better reports: 2
   - Wanted standard PCI rating system: 1
   - System crash – lost data: 1

4. *Do you have any case studies that demonstrate the use of your Pavement Management System? (e.g. actual experiences where the use of a Pavement Management System increased efficiency, roadway quality, reduced city/county board meetings, etc. due to the results)*
   Results: Of the 64 respondents, 15 agencies (23 percent) had case studies that demonstrated the use of their Pavement Management System. Of the case studies, ten focused on commercial Pavement Management System software programs and five on in-house systems. Phone interviews were conducted with these agencies and a one page case study summary was developed for each. These summaries are included in Appendix B of this report.

5. *Do you have any case studies that demonstrate the use of your Pavement Management System? (e.g. actual experiences where the use of a Pavement Management System increased efficiency, roadway quality, reduced city/county board meetings, etc. due to the results)*
   Results: Of the 64 respondents, 15 agencies (23 percent) had case studies that demonstrated the use of their Pavement Management System. Of the case studies, ten focused on commercial Pavement Management System software programs and five on in-house systems. Phone interviews were conducted with these agencies and a one page case study summary was developed for each. These summaries are included in Appendix B of this report.

DATA COLLECTION OF SELECTED SOFTWARE PROGRAMS

In order to provide a comprehensive review of the Pavement Management System software programs identified as used in Minnesota, the Technical Advisory Panel developed an extensive list of attributes to review each of the Pavement Management System software program on. Eight major categories were developed, with multiple subcategories within each (see Table 2: Pavement Management System - Software Program Data Collection Results). The major categories included in the review criteria are:

1. Cost
2. Date Inputs
3. Budget Analysis Provided
4. GIS Capabilities (Mapping Tool)
5. Access to Data
6. Support
7. Ease of Data Input/Output
8. Software Operates on a "typical" Office Computer

Once the review criteria was finalized by the TAP, an online survey was developed and sent to each software program vendor to fill out for their Pavement Management System. Responses from the surveys were reviewed and synthesized into a tabular format. The final table for each Pavement Management System software program was then sent to each vendor for review and final approval was received from each. The tables were then combined to form a matrix to be used by local agencies for ease of comparing the various software programs and their attributes (see Table 1: Pavement Management System - Software Program Data Collection Results).

DATA COLLECTION RESULTS

An important caveat for the reader to make note of when viewing the results of the survey is this; each software program is designed to meet a certain niche and simply because an application may not, for example, have a data input field for ESALs, does not mean that the software does not have other useful capabilities. In this regard, the information that follows is not meant to be viewed as a recommendation for any one program over another, but simply to provide information regarding capabilities of each.

Responses are summarized and indicated in the following format:

● Standard – Included in Standard Software Cost

◐ Optional – Available for an Additional Cost

○ Not Available

Table 2: Pavement Management Systems – Software Program Data Collection Results

	Software (Provider)					
	Micropaver (APWA / Corps of Engineers)	**PAVEMENTview Plus (Cartêgraph)**	**ICON (Goodpointe Technology)**	**PavePRO Manager (IMS)**	**RoadMatrix (Stantec)**	**PASERWARE (WI TIC LTAP)**
1.0 COST						
1.1 Initial Cost of Software	$995 for APWA members $1095 for non-APWA members	$1,000 - $5,000	$1,000 - $10,000+	$10,000+	$5,000-$8,000	Free for WI agencies $100 for non-WI agencies
1.2 Annual Technical Support Costs	● First year ◐ Renewable annually for $500 for APWA members $650 for non-APWA members	●	● for one authorized user ◐ $250 for each additional user ◐ Value-added infrastructure management consulting services, cost varies with number of hours ($1,000 - $4,000)	●	◐ $2,500-$5,000	○
1.3 Vendor Data Collection Costs						
1.3.1. Automated	○	○	$25 - $215/mile	$300+/mile[1]	$50 - $200/mile	○
1.3.2. Manual	○	○	$25 - $250/mile	Included in cost for Automated	$100 - $200/mile	○
1.3.3. Hand-held/PDA/Tablet PC	○	$20 - $50/mile	$100 - $250/mile	Included in cost for Automated	○	○
2.0 DATA INPUTS						
2.1 Segment, Begin and End Points	●	●	●	●	●	●
2.2 Spatial location (GPS Location)	●	●	●	●	●	○
2.3 Segment Width and/or Area	●	●	●	●	●	●
2.4 Pavement (Layer) Data	●	●	●	●	●	●
2.5 Age	●	●	●	●	●	●
2.6 AADT	○	●	●	●	●	●
2.7 ESAL's	○	●	●	●	●	○

● Standard – Included in Standard Software Cost

◐ Optional – Available for an Additional Cost

○ Not Available

[1] Data collection includes surface data, deflection testing, digital images, and GIS linkage.

	Software (Provider)					
	Micropaver (APWA / Corps of Engineers)	PAVEMENTview Plus (Cartêgraph)	ICON (Goodpointe Technology)	PavePRO Manager (IMS)	RoadMatrix (Stantec)	PASERWARE (WI TIC LTAP)
2.8 Surface Condition (Pavement Distress)	●	●	●	●	●	●
2.9 Strength Inventory	○	●	●	●	●	○
2.10 Ride Quality	●	●	●	●	●	○
2.11 Geotechnical Evaluation	○	●	●	●	●	○
2.12 Pavement Performance Curve	●	●	●	●	●	●
2.13 Drainage Features	○	●	●	●	●	●
2.14 Right of way asset capabilities Integrated into pavement software (Integrated) Stand-alone (Stand Alone)						
2.14.1. Curb & Gutter	○	● Integrated	● Integrated	● Integrated	● Integrated	● Integrated
2.14.2. Shoulders	○	● Integrated	● Integrated	● Integrated	● Integrated	● Integrated
2.14.3. Slopes	○	● Integrated	● Integrated	● Integrated	● Integrated	○
2.14.4. Signs	○	● Integrated	● Integrated	○[2]	● Integrated	○
2.14.5. Striping	○	● Integrated	● Integrated	○[2]	● Integrated	○
2.15 Agency's Maintenance Strategies	●	●	●	◐	●	●

● Standard – Included in Standard Software Cost

◐ Optional – Available for an Additional Cost

○ Not Available

[2] Data is collected as part of vendor data collection costs and can be input into third-party software applications.

	Software (Provider)					
	Micropaver (APWA / Corps of Engineers)	PAVEMENTview Plus (Cartêgraph)	ICON (Goodpointe Technology)	PavePRO Manager (IMS)	RoadMatrix (Stantec)	PASERWARE (WI TIC LTAP)
3.0 BUDGET ANALYSIS PROVIDED						
3.1 Based on performance measures and performance forecasts	●	●	●	●	●	●
3.1.1. Adjust based on maintenance strategies	●	●	●	●	●	●
3.2 Output - Does it provide:						
3.2.1. Estimates for infrastructure investments?	●	●	●	●	●	●
3.2.2. Cost for "do nothing" approach?	●	●	●	●	●	●
3.3 Does it use lifecycle cost?	●	●	●	●	●	○
4.0 GIS CAPABILITIES (MAPPING TOOL)						
4.1 GIS Compatibility (Seamless Linkability)	●	●	●	●	●	○
5.0 ACCESS TO DATA						
5.1 What database platform is used?						
5.1.1. Access	●	●	●	○	○	●
5.1.2. Oracle	○	●	●	○	●	○
5.1.3. SQL Server	○	●	●	○	●	○
5.1.4. FoxPro	○	○	○	●	○	○

● Standard – Included in Standard Software Cost

◐ Optional – Available for an Additional Cost

○ Not Available

	Software (Provider)					
	Micropaver (APWA / Corps of Engineers)	PAVEMENTview Plus (Cartêgraph)	ICON (Goodpointe Technology)	PavePRO Manager (IMS)	RoadMatrix (Stantec)	PASERWARE (WI TIC LTAP)
5.2 Can data be written to other programs?						
5.2.1. Access	●	●	●	●	●	●
5.2.2. Excel	●	●	●	●	●	●
5.2.3. Arcview	●	●	●	●	○	○
5.2.4. Crystal Reports	○	●	●	○	●	○
5.2.5. SQL	○	●	●	○	●	○
5.2.6. Oracle	○	●	●	○	●	○
5.2.7. Shape Files	●	●	●	●	●	○
5.2.8. Geo Database	○	●	●	○	●	○
5.3 Data Accessibility						
5.3.1. Can multiple users access data simultaneously?	○	◐[3]	●	●	●	●
5.3.2. Can data be accessed wirelessly?	●	●	●	○	○	○
5.3.3. Is data web-based/browser-based?	○	○[5]	●[4]	○	○	○

● Standard – Included in Standard Software Cost

◐ Optional – Available for an Additional Cost

○ Not Available

[3] With SQL server integration

[4] Option: hosted on user's site or provider's site

[5] Web-solution to be deployed in Version 8.3 (anticipated release summer of 2009)

	Software (Provider)					
	Micropaver (APWA / Corps of Engineers)	**PAVEMENTview Plus (Cartêgraph)**	**ICON (Goodpointe Technology)**	**PavePRO Manager (IMS)**	**RoadMatrix (Stantec)**	**PASERWARE (WI TIC LTAP)**
6.0 SUPPORT						
6.1 Is technical support available?	● for first year ◐ thereafter	●	● for one authorized user ◐ additional users ◐ Value-added infrastructure management consulting services	●	● for first year ◐ thereafter	○
6.2 Does vendor offer continuing education/training?	◐	●[6]	●[7] ◐[8]	◐	◐	○
6.3 Quality of Support	Large Majority Satisfied	Large Majority Satisfied	Large Majority Satisfied	Large Majority Satisfied	Large Majority Satisfied	○
7.0 EASE OF DATA INPUT/OUTPUT						
7.1 Is there a map input interface?	●	●	●	●	●	○
7.2 Can reporting be customized?	●	●	●	●	●	●
8.0 Software Operates on "Typical" Office Computer	√	√	√	√	√	√

● Standard – Included in Standard Software Cost

◐ Optional – Available for an Additional Cost

○ Not Available

[6] Web based

[7] New features are part of regular User Group Meetings which are usually held in the Twin Cities Metro Area.

[8] Hands-on training opportunities are provided at their headquarters. Customized, hands-on onsite training programs are provided as-needed.

IN-HOUSE PAVEMENT MANAGEMENT SYSTEMS

Not all local agencies choose to purchase commercially available Pavement Management System software programs. Of the 64 local agencies that responded to the survey, 13 agencies (20 percent) have developed an in-house Pavement Management System, which in most cases was created using Microsoft Excel. The detail and use of these systems vary greatly between agencies. For further information about the development and use of in-house systems, contact one of the following agencies:

- Becker County
- City of Blaine
- City of Brooklyn Park
- Clearwater County *
- Faribault County *
- Kandiyohi County
- Lake of the Woods County
- Pipestone County
- Ramsey County *
- Stearns County
- St. Louis County *
- Three Rivers Park District *
- Todd County
- City of Willmar

* Case studies were created for five of the agencies that responded, highlighting the background, tips for implementing pavement management and realized benefits. A one-page summary for each is provided in Appendix B of this report.

SUMMARY OF CASE STUDIES

Some Minnesota local agencies have been using pavement management systems since the early 80's, while others do not have a system at all. In effort to share past experience, case study summaries were developed for those that have demonstrated the use of their Pavement Management System. Information obtained from the city and county survey indicated that 15 agencies had case studies, ten focused on commercial Pavement Management System software programs and five on in-house systems. Phone interviews were conducted with these agencies and a one page case study summary was developed for each, highlighting the background, tips for implementing pavement management and realized benefits. These summaries are included in Appendix B of this report.

The following is a summary of common tips and benefits indicated amongst the 15 case studies, with the number of agencies noted in parenthesis:

TIPS FOR IMPLEMENTING PAVEMENT MANAGEMENT:

- Periodically rate your network (6)
- Keep data up to date to increase usefulness of the tool:
    - Use to identify project needs (8)
    - Use to identify appropriate maintenance treatment (2)
    - Include information such as treatment used, cost, construction history (2)

- Use Pavement Management System to gain council support on project needs and funding (5)
- Develop a system-wide map and list of priorities (4)
- Use to inform public of projects early in the process, to avoid project delay (1)
- Contact other agencies that use Pavement Management Systems to learn about experiences, lessons learned, etc. (1)

REALIZED BENEFITS:

- Used data to determine project needs (8)
- Used data to strengthen presentation to council/public and obtain funding (7)
- Able to track system performance over time (5)
- Able to maintain or increase PCI rating (4)
- Able to show project needs in graphical form, to present to council/public (2)
- Used to predict future pavement status (1)
- Easier to efficiently schedule maintenance and reconstruction projects (1)

PAVEMENT MANAGEMENT SYSTEMS SELECTION WORKSHOP

In addition to this report, curriculum and material for a four-hour pavement management systems selection workshop was developed for staff of agencies considering the acquisition of a Pavement Management System. Three training workshops will be conducted around the state in 2009. This workshop highlights the benefits of Pavement Management System, elements of Pavement Management System, case studies and resources. A copy of the PowerPoint slide handouts from this workshop are available in Appendix D of this report.

PAVEMENT MANAGEMENT SYSTEMS BROCHURE

For those that are not familiar with Pavement Management Systems and want to learn more about them, a brochure was developed to describe the concept, use, and benefits of Pavement Management Systems. This brochure is ideal for educating county commissioners, city council members, and the public on the use and benefits of Pavement Management Systems. This brochure is available for your use in Appendix E of this report.

Appendix A

City and County Engineer Survey Results Table

	Responses Received: **Cities: 27** **Counties: 36** **Other: 1** **Total: 64** PINK BOX: Possible Case Studies to followup on		Does your agency currently use a PMS? If so, which one? • GoodPointe Technology (Icon) **[30]** • Cartegraph (Roadpro) **[3]** • Hansen **[0]** • Micropaver (Corps of Engineers) **[3]** • Infrastructure Management Services (IMS) **[2]** • Roadware Group Inc. **[0]** • Stantec **[0]** • Deighton Associates **[0]** • Applied Research Associates **[0]** • PASERWARE (WisDOT) **[1]** • In-House PMS **[13]** • Other **[None 11] [iWorqs 1]**	How many years have you used your current system?	Have you ever used a different PMS? If so, why did you change? Need more detailed system (used spreadsheet): 3 Wanted GIS intergration: 1 Wanted same system as neighboring cities: 1 Old program became obsolete: 1 Wanted a program that did sign management as well: 1 Too expensive: 2 Too diffucult to use: 5 Wanted better reports: 2 Wanted standard PCI rating system: 1 System crash - lost data: 1	Do you have any case studies that demonstrate the use of your PMS? (e.g. actual experiences where the use of a PMS increased efficiency, roadway quality, reduced city/county board meetings, etc. due to the results)	Who can we contact at your agency to get more information on your experience with your PMS? (brief phone interview to gather more specific data)
1	Jason Law Andover Assistant City Engineer 763-767-5130	JLaw@ci.andover.mn.us	Cartegraph	5 years	No	We use the output data (OCI's) to set our schedule in our Capital Improvement Plan to schedule mill and overlay work. Also use as a database tool for lengths, areas, curb type, widths, etc. Also use as a historical record of years improvements and maintenance was completed on a given roadway segment.	Myself
2	Daniel Schluender City of Blaine Sr. Civil Engineer 763-785-6158	DSchluender@ci.blaine.mn.us	In-House PMS	0 years	Changed when old system crashed and data was lost.	No	Myself
3	Gary Brown City of Brooklyn Park	Gary.Brown@brooklynpark.org	In-House PMS	17 years	No	We used our system to demonstrate the need for reconstruction and overlays. 17 years & 45 million dollars later we have now completely reconstructed all streets (repaired utilitiesand installed storm sewer) and reduced the percentage of poor condition streets to less than 8%	Steve Nauer 763-493-8009
4	Jeffrey Radick City of Burnsville 952-895-4418	jeffrey.radick@ci.burnsville.mn.us	ICON	14 years	Yes, past program no longer supported by software company.	Nothing easily documented	Myself
5	Todd M. Blank Cambridge City Engineer 651-490-2017	tblank@sehinc.com	Micropaver	8 years	No	No	Myself
6	Sue Knight City of Champlin Engineer 763-923-7130	sknight@ci.champlin.mn.us	ICON	15 years	No	No	Myself
7	Tom Colbert City of Eagan Public Works Director	TColbert@cityofeagan.com	ICON	19 years	No	Yes!	Tom Struve 651-675-5300
8	Mary Krause City of Eden Prairie Project Engineer 952-949-8315	MKrause@edenprairie.org	ICON	13 years	No	Nothing as specific as the examples given; however, we have been able to maintain our pavement system at the PCI rating goal we had originally set.	Myself
9	Wayne Houle Edina City Engineer 952-826-0443	WHoule@ci.edina.mn.us	ICON	2-3 years	Yes, Stantec. Became too (ooooo) expensive for updates.	No, to soon.	Jeff Frahm or Rebecca Foster
10	Nick Egger Hastings City Engineer 651-480-2370	NickEgger@ci.hastings.mn.us	ICON	2 years	No	We are still in the process of completing data acquisition (i.e. road ratings) to fully implement the PMS software.	John Caven Assistant City Engineer 651-480-2369
11	John Caven Hastings Assistant City Engineer 651-480-2369	JCaven@ci.hastings.mn.us	ICON	1 year	THE CITY USED A PAVEMENT RATING SYSTEM FROM "PAVEPRO IMS." THE CITY CHOSE TO GO WITH THE LOCAL AGENCY, GOODPOINTE, IN 2007 TO RATE THE STREETS AND BE PROVIDED WITH THE SOFTWARE. IT APPEARED THAT MANY NEIGHBORING CITIES FAVORABLY USED THIS PROGRAM.	N/A	Myself
12	Kent Exner Hutchinson City Engineer 320-234-4212	kexner@ci.hutchinson.mn.us	ICON	10 years	No	WE USE OUR PMS TO ESTABLISH OUR PAVEMENT 5-YR CIP ANNUALLY AND TO JUSTIFY PROJECT TIMING/METHOD	Myelf
13	Scott Thureen Inver Grove Heights City Engineer	sthureen@ci.inver-grove-heights.mn.us	ICON	10 years	No	No	Steve Dodge Assistant City Engineer 651-450-2541
14	Marcus Culver Maple Grove Traffic Engineer 763-494-6364	mculver@ci.maple-grove.mn.us	ICON	Just transitioning to it now.	Had been using iworqs (iworq.com) for about 2-3 years previously. We changed due to wanting better integration with our GIS system. Also liked the local support and regular user group meetings for ICON.	We really only use our PMS to manage history of applications/maintenance as well as keeping consistent measurements for pavement area calculations (radius, width, extra area for cul-de-sac, etc.). We will be looking at using the PMS ratings and projected life cycles for our major collector/minor arterial roadways.	Myself
15	Glenn J. Olson Marshall City Engineer 507-537-6773	Glenn.Olson@marshallmn.com	None	N/A	N/A	N/A	N/A

Responses Received:
Cities: 27
Counties: 36
Other: 1
Total: 64

PINK BOX: Possible Case Studies to followup on

			Does your agency currently use a PMS? If so, which one? • GoodPointe Technology (Icon) **[30]** • Cartegraph (Roadpro) **[3]** • Hansen **[0]** • Micropaver (Corps of Engineers) **[3]** • Infrastructure Management Services (IMS) **[2]** • Roadware Group Inc. **[0]** • Stantec **[0]** • Deighton Associates **[0]** • Applied Research Associates **[0]** • PASERWARE (WisDOT) **[1]** • In-House PMS **[13]** • Other **[None 11] [iWorqs 1]**	How many years have you used your current system?	Have you ever used a different PMS? If so, why did you change? Need more detailed system (used spreadsheet): 3 Wanted GIS intergration: 1 Wanted same system as neighboring cities: 1 Old program became obsolete: 1 Wanted a program that did sign management as well: 1 Too expensive: 2 Too diffucult to use: 5 Wanted better reports: 2 Wanted standard PCI rating system: 1 System crash - lost data: 1	Do you have any case studies that demonstrate the use of your PMS? (e.g. actual experiences where the use of a PMS increased efficiency, roadway quality, reduced city/county board meetings, etc. due to the results)	Who can we contact at your agency to get more information on your experience with your PMS? (brief phone interview to gather more specific data)
16	Sue McDermott Mendota Heights City Engineer 651-255-1123	SueM@Mendota-Heights.com	iWorqs	3 years	No	Use it to develop 5-year CIP and maintenance schedule	Sam Kuchinka 651-452-1850
17	Mike Kennedy City of Minneapolis Public Works Director 612-673-3759	Mike.Kennedy@ci.minneapolis.mn.us	Micropaver	20 years	No	Depends upon what you are looking for.	Myself
18	Steve Lillehaug Minnetonka Assistant City Engineer 952-939-8234	slillehaug@eminnetonka.com	IMS	15 years	No	No	Myself
19	Thomas E. Trowbridge Moorhead Assistant City Engineer 218-299-5395	tom.trowbridge@ci.moorhead.mn.us	IMS	We have used IMS for 2 years now. IMS surveys the City streets on a 3-year cycle, completing 1/3 of the City's streets every year. Therefore, 2/3 of the City's streets have been rated. Later this year, IMS will do the last 1/3.	The City began with a different PMS in the late 1990's. It was labor intensive, and the City did not have enough staff to keep the evaluations current. The contract with IMS was deemed a more efficient use of City resources.	We have not been using the system long enough to demonstrate its effectiveness. Given the 3-year cycle needed to evaluate all of the City's streets, we would expect that it will take at least 3 more years before we can start evaluating whether the City's current pavement management plan is maintaining the City's streets to the desired level.	Jody Bertrand (218-299-5388) is the best contact for information on the City's PMS. You may also contact Tom Trowbridge (218-299-5395) if he is unavailable.
20	Dave Kotilinek North St. Paul City Engineer 651-747-2437	dave.kotilinek@ci.north-saint-paul.mn.us	ICON	13 years	No	No	Myself
21	Derick Anderson City of Richfield	DAnderson@cityofrichfield.org	ICON	12 years	Yes, Carter. We switched to move to a more standard PCI rating system	Yes, we watched one area over the years to see how maintenance affects the PCI rating	Myself
22	Kristin Asher Richfield Assistant City Engineer 612-861-9795	KAsher@cityofrichfield.org	N/A	N/A	N/A	N/A	Derick Anderson 612-861-9798
23	Richard McCoy Robbinsdale City Engineer 763-531-1260	rmccoy@CI.ROBBINSDALE.MN.US	ICON	We first introduced ICON in 2002.	In Robbinsdale, there was a very basic spreadsheet system, which was more of an inspection record than any formalized system. The need for change was pretty obvious.	We use data from our PMS in conjunction with our other asset data to help drive our Capital Works Program.	Myself
24	James Landini Shorewood City Engineer	jlandini@ci.shorewood.mn.us	Paser on Paper	N/A	No	No	Myself
25	Matt Saam West St. Paul City Engineer 507-537-6803	matt.saam@ci.west-saint-paul.mn.us	ICON	2 years	Yes, at a former employer we used Micropaver for a while. We went away from Micropaver (to Goodpointe) because it was so difficult/archaic to use.	No	Not available due to work load.
26	Mel Odens Willmar Director of Public Works 320-214-5169	modens@ci.willmar.mn.us	In-House PMS	10 years	No	No	Myself
27	Aaron Nelson City of Woodbury Engineer II 651-714-3593	anelson@ci.woodbury.mn.us	ICON	8-10 years	No	NO, BUT IT IS A GOOD TOOL FOR PRINTING MAPS OR VARIOUS PCI'S THROUGHOUT THE CITY AND PICKING WHICH NEIGHBORHOODS WE'RE GOING TO WORK IN.	Myself
28	Andrew J. Witter Anoka County Assistant Engineer 763-862-4249	Andrew.Witter@co.anoka.mn.us	ICON	3 years	Cartegraph, high cost, not user-friendly, paying for more modules and technology than were actually using.	We currently use it to assist in selection of overlay projects.	Myself
29	William Malin Chisago County	WGmalin@co.chisago.mn.us	ICON	we do not have much experience with it. We are in the process of training one of our techs but he is out on inspection until fall.	No	No	Myself
30	David Overbo Clay County Engineer	David.Overbo@co.clay.mn.us	ICON	Starting in 2008	No	N/A	Nathan Gannon 218-299-5099
31	Dan Sauve County Engineer Clearwater County 218-694-6132	dan.sauve@co.clearwater.mn.us	No, However, we do use an Excel spreadsheet. Poor mans PMS.	10 years	No	It has shown the road quality actually improved in the last 10 years. It has helped to identify and track where the work is needed on a road.	Myself
32	Shae Kosmalski Cook County Highway Engineer 218-387-3695	shae.kosmalski@co.cook.mn.us	None, but poised to do so in the very near future. When is the estimated completion date of this LRRB?	N/A	N/A	N/A	N/A
33	Ron Gregg County Engineer Cottonwood County 507-831-1389	ron.gregg@co.cottonwood.mn.us	None	N/A	N/A	N/A	Myself
34	Lyndon Robjent Crow Wing County 218-824-1110	lyndon.robjent@co.crow-wing.mn.us	ICON	1 year	Yes, spreadsheet. Wanted to use something that had budget forecasting.	No	Myself

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Other: 1
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PINK BOX: Possible Case Studies to followup on

			Does your agency currently use a PMS? If so, which one? • GoodPointe Technology (Icon) **[30]** • Cartegraph (Roadpro) **[3]** • Hansen **[0]** • Micropaver (Corps of Engineers) **[3]** • Infrastructure Management Services (IMS) **[2]** • Roadware Group Inc. **[0]** • Stantec **[0]** • Deighton Associates **[0]** • Applied Research Associates **[0]** • PASERWARE (WisDOT) **[1]** • In-House PMS **[13]** • Other **[None 11] [iWorqs 1]**	How many years have you used your current system?	Have you ever used a different PMS? If so, why did you change? Need more detailed system (used spreadsheet): 3 Wanted GIS intergration: 1 Wanted same system as neighboring cities: 1 Old program became obsolete: 1 Wanted a program that did sign management as well: 1 Too expensive: 2 Too diffucult to use: 5 Wanted better reports: 2 Wanted standard PCI rating system: 1 System crash - lost data: 1	Do you have any case studies that demonstrate the use of your PMS? (e.g. actual experiences where the use of a PMS increased efficiency, roadway quality, reduced city/county board meetings, etc. due to the results)	Who can we contact at your agency to get more information on your experience with your PMS? (brief phone interview to gather more specific data)
35	Ross Beckwith Dakota County Construction Engineer 952-891-7926	Ross.Beckwith@CO.DAKOTA.MN.US	ICON	8 years	No	No	Lenny Weiss 952-891-7100
36	Guy Kohlnhofer Dodge County Engineer 507-374-6694	guy.kohlnhofer@co.dodge.mn.us	ICON	3 years	We had Paver but didn't like the lack of usable reports.	No	We'll talk at meetings
37	John McDonald Faribault County Director/Engineer 507-526-3291	John.McDonald@co.faribault.mn.us	Faribault County does not have a pavement management program. I developed a map showing the construction history that I rely on in coming up with projects.	N/A	N/A	The recent road rating that was done also helped in convincing the Board which projects to do.	Myself
38	Greg Isakson Goodhue County Public Works Director 651-385-3025	greg.isakson@co.goodhue.mn.us	ICON	We bought it two years ago, recently populated it with information from MnDoTs VAN and are just starting to use it.	No	No	N/A
39	James Grube Hennepin County Director of Transportation	James.Grube@co.hennepin.mn.us	ICON	10 years	No	Retrieving network data (ride ratings, condition surveys, or quantity estimates) is more efficient than manual spreadsheets. Reports help management prioritize selection of roads to overlay, reconstruct and crackseal.	Steve Peterson 612-596-0334
40	Marcus Evans Houston County Engineer 507-725-3925	Marcus.Evans@co.houston.mn.us	None	N/A	N/A	N/A	N/A
41	Gary Danielson Kandiyohi County Public Works Director 320-235-3266	gary_d@co.kandiyohi.mn.us	In-House PMS: We have an informal process of condition ratings, age (year of last surfacing), rut depth, traffic, risk of delays, road function and then our staff gets in a van together doing visual inspection for final selection. In case of a tie, the roads I drive on get extra points. Great system as long as one's memory is still good.	N/A	N/A	N/A	N/A
42	Bruce Hasbargen Lake of the Woods County Public Works Director 218-634-1767	bruce_h@co.lake-of-the-woods.mn.us	No, only a spreadsheet.	15 years	No	No	Myself
43	Lee Amuson Lincoln County 507-694-1464	left voicemail	None. Hope to use data from MnDOT Road Photolog data collection	N/A	No	No	Lee Amuson
44	Lon Aune Marshall County Engineer	lon.aune@co.marshall.mn.us	None	N/A	N/A	N/A	N/A
45	John T. Brunkhorst McLeod County Engineer	john.brunkhorst@co.mcleod.mn.us	ICON	3-4 years but have not used it much at all unfortunately.	We did have Micropaver but switched because I wanted flexibility for sign mgmt as well.	No	Myself
46	Mike Wagner Nicollet County Engineer	mwagner@co.nicollet.mn.us	Nicollet County is not subscribing to any organized pavement management system at this time. We resurface or reconstruct the pavements as soon as it becomes necessary.	N/A	N/A	N/A	N/A
47	Jay Munson Mille Lacs County Assistant Engineer 320-983-8327	jay.munson@co.mille-lacs.mn.us	None. Formarlly used ICON	No longer use the system	No	No	Alan Hancock 320-983-8347 Warren Delles 320-983-8395
48	Stephen Schnieder Nobles County Public Works Director 507-295-5334	sschnieder@co.nobles.mn.us	None, I do in field inspections and reviews of the pavement conditions a minimum of annually	N/A	N/A	N/A	Myself
49	David Halbersma Pipestone County Highway Engineer	David.Halbersma@co.pipestone.mn.us	In-House PMS	10 years	No	N/A	Myself
50	Richard C. Sanders Polk County Engineer 218-470-8253	sanders.rich@co.polk.mn.us	ICON	1 year	Cartegraph, to complicated	No	Myself
51	Ken Haider Ramsey County Engineer	Ken.Haider@CO.RAMSEY.MN.US	We use an in-house PMS	I believe we have over 20 years of records.	This is the only system we have used but are looking forward to the data this year from the State Aid van evaluation.	Contact Kathy about this one.	Kathy Jaschke 651-266-7192 Nick Fischer 651-266-7191
52	~~Stefan Gantert~~ Dennis Luebbe Rice County Assistant Engineer	~~sgantert@co.rice.mn.us~~ dluebbe@co.rice.mn.us	ICON	Less than 2 years	No	Not yet. We have not been able to dedicate enough time to generating any type of report yet.	Myself
53	Jess Greenwood Rock County	jess.greenwood@co.rock.mn.us	Micropaver	2.5 Years	No	No	Jess Greenwood

	Responses Received: **Cities: 27** **Counties: 36** **Other: 1** **Total: 64** **PINK BOX: Possible Case Studies to followup on**		Does your agency currently use a PMS? If so, which one? • GoodPointe Technology (Icon) **[30]** • Cartegraph (Roadpro) **[3]** • Hansen **[0]** • Micropaver (Corps of Engineers) **[3]** • Infrastructure Management Services (IMS) **[2]** • Roadware Group Inc. **[0]** • Stantec **[0]** • Deighton Associates **[0]** • Applied Research Associates **[0]** • PASERWARE (WisDOT) **[1]** • In-House PMS **[13]** • Other **[None 11] [iWorqs 1]**	How many years have you used your current system?	Have you ever used a different PMS? If so, why did you change? Need more detailed system (used spreadsheet): 3 Wanted GIS intergration: 1 Wanted same system as neighboring cities: 1 Old program became obsolete: 1 Wanted a program that did sign management as well: 1 Too expensive: 2 Too diffucult to use: 5 Wanted better reports: 2 Wanted standard PCI rating system: 1 System crash - lost data: 1	Do you have any case studies that demonstrate the use of your PMS? (e.g. actual experiences where the use of a PMS increased efficiency, roadway quality, reduced city/county board meetings, etc. due to the results)	Who can we contact at your agency to get more information on your experience with your PMS? (brief phone interview to gather more specific data)
54	Dan Knapek Sherburne County Assistant Engineer 763-241-7031	Dan.Knapek@co.sherburne.mn.us	Cartegraph	1 year	Yes, Paserware. Wanted software to have the ability to monitor more defined pavement deficiencies and better reporting.	No	Myself
55	Darin Mielke Sibley County Public Works Director 507-237-4093	DarinM@co.sibley.mn.us	Cartegraph	Just Starting	No	No	Myself
56	Jim Foldesi St. Louis County Assistant Engineer 507-537-6792	foldesij@co.st-louis.mn.us	In-House PMS	8 years	Yes, we used RoadPro. It was too data and time intensive and they were bought out by Cartegraph, who them raised the price of upgrades and maintenance.	N/A	Myself, I am on the PMS committee
57	Jeff Miller Stearns County Assistant Highway Engineer 320-255-6180	jeffrey.miller@co.stearns.mn.us	Stearns County Highway is currently using an In-House system utilizing Excel spreadsheet/GIS(ESRI)/ and the MnDOT rating information.	2 years	No	We were able to generate rather quickly (once the ratings were input into our spreadsheet) a map that showed our road system's PQI ratings graphically and were able to justify the roads in our Five Year Program (ie. the roads in the program had lower PQI ratings).	Myself
58	Brian Giese Stevens County Engineer	briangiese@co.stevens.mn.us	None	N/A	N/A	N/A	N/A
59	Loren Fellbaum Todd County Engineer 320-732-2721	loren.fellbaum@co.todd.mn.us	In-House PMS	3 years	No	No	Myself
60	Jeff Adolphson Wadena County	jeff.adolphson@co.wadena.mn.us	ICON	< 1 year	Yes, an In-House Pencil & Paper system (in another county). Limited ability to evaluate the road system effectively.	No case studies outside of drawing attention to the need for pavement preservation and resurfacing based on ADT, Age and Cross Section of pavement surface.	Joel Ulring or myself
61	Wayne Sandberg Washington County Deputy Director	Wayne.Sandberg@co.washington.mn.us	ICON	10+ years	No	Yes - During budget time with county board. Information for County Commissioners.	Cory Slagle 651-430-4337 Jacob Gave - 651-430-4316
62	David Kramer Winona County Engineer	DKramer@Co.Winona.MN.US	ICON, Not currently using	4-5 years	No	N/A	N/A
63	Virgil G.Hawkins Wright County Assistant Engineer 763-682-7387	Virgil.Hawkins@co.wright.mn.us	ICON	15 years	No	No	Kevin Johnson 763-682-7707
64	Tim Gross Three Rivers Park District 763-694-2060	tgross@threeriversparkdistrict.org	In-House PMS	2 years	Micropaver - too expensive and ratings were too subjective depending on person rating	Yes	Brent Christensen, Graduate Engineer 612-490-5275

Appendix B:

- **Case Studies – Commercial**
- **Case Studies – In-House**

Case Studies

Commercial Pavement Management Systems

City of Bloomington

Pavement Management Case Study

Agency Information:

Population	85,000 people
Number of Roadway Centerline Miles	350 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Pavement Management System Implementation	Used since 1989 Adopted by the City Council in 1992

Pavement Management Background

The City of Bloomington began using pavement management in 1989. Using the data gathered between 1989 and 1992, City staff was able to show the Council different scenarios, including what the system would look like in the future, if current strategies continued. Staff also discussed how investing money in the roadway system, while it was still in good condition, would save money over the long term and extend pavement life. The data and ideas presented convinced the City Council to formally adopt pavement management in 1992.

Since pavement management was adopted in 1992, Bloomington's average PCI has remained around 78. The City has maintained this roadway condition by focusing on performing the right action at the right time and using the proper techniques. The pavement management preservation techniques used are:

- Seal coats
- Overlays
- Reconstruction

Tips for Implementing Pavement Management

- Focus non-assessment funding on roadways that are in good condition.
- Use appropriate techniques rather than "quick fixes" that require repeated attention.
- Use the principles behind pavement management along with data to gain council/board support for pavement management.

Realized Benefits

- Increased funding for sealcoats and overlays
- Established assessment policy for street reconstruction
- Relatively steady "average" PCI
- Extended pavement life at a lower cost
- Higher financial ratings for the City due to the comprehensive plan (the City is seen as forward thinking and responsible with regard to planning for infrastructure needs)

Clay County

Pavement Management Systems Case Study

Agency Information:

Population	56,000 people
Number of Roadway Centerline Miles	743 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Current Pavement Management System Implementation	Used since 2008

Pavement Management Background

Prior to purchasing a Pavement Management System in 2008, Clay County staff researched several options. They also spoke with multiple Minnesota agencies already using a Pavement Management System for insights into the different options available. Using the gathered information, staff was able to determine which system would work best for the County.

Soon after purchase, staff prepared the system for use. They input all roadway network data received from Mn/DOT's Pavement Management Unit. (The data was collected under an agreement between Mn/DOT's Office of Materials and Division of State Aid.) They determined which decision tree to use after gathering information on what other similar agencies use. They, along with vendor staff, also worked to get the system's GIS base map ready. The goal of the base map work was to display network information at the same quality level as the County's own GIS system, while maintaining the necessary roadway labels for location identification.

Now that the system is up and running, staff will begin using it in the spring of 2009. They will mainly use the reports and maps generated by the system to aid in justification of project selections for the County's State Aid allotments.

Tips for Implementing Pavement Management

- Contact other agencies that to learn about their experiences, lessons learned, etc.
- Maintain the integrity of the system's GIS base map by keeping pertinent information and labels.

Realized Benefits

- Gain insight into what may or may not work for your agency through the successes and failures of other agencies.
- Easily identify roadway locations, project locations, etc. for presentation to decision-makers and the public

Dodge County

Pavement Management Case Study

Agency Information:

Population	19,000 people
Number of Roadway Centerline Miles	332 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Current Pavement Management System Implementation	Used since 2003
Initial Year of Pavement Management System Implementation	2000

Pavement Management Background

Dodge County began using their initial Pavement Management System in 2000, but found that the system did not have the capabilities they were looking for. So in 2003, County staff switched pavement management systems. Using their current system, staff track:

- Roadway structure information
- Project information
- Pavement condition information
- Sign information

Tips for Implementing Pavement Management

- Use Pavement Management System to track network information.

Realized Benefits

- Easily obtain pertinent network information

City of Eagan

Pavement Management Case Study

Agency Information:

Population	68,000 people
Number of Roadway Centerline Miles	236 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Pavement Management System Implementation	1989

Pavement Management Background

The City of Eagan has been using pavement management since 1989, just after the majority of Eagan's pavements were constructed. At that time, the City Council set a goal of maintaining a system PCI at or above 75. The City has been able to meet this goal consistently (the 2007 average PCI is 78).

To adequately track the roadway system, Eagan rates one-third of the roadway system per year. In addition, every roadway segment within the City's CIP is rated every year to determine appropriate maintenance and construction activities.

Eagan is also very active in communicating with residents who will be affected by upcoming maintenance and construction activities. The process begins two years prior to maintenance or construction when residents are notified with a letter. Then neighborhood meetings are held the year before any work. These meetings typically include 10 to 14 residents and allow them to discuss their concerns. City staff also present data and statistics on the segments of roadways that will be worked on, including maintenance history. Finally, there is a notice for the public hearing. Typically, most resident issues and concerns have been addressed and residents do not attend the public hearing.

Tips for Implementing Pavement Management

- Have roadway system periodically rated.
- Utilize numerous proactive communication initiatives (information letters, announcements, neighborhood meetings) to provide education about the process.

Realized Benefits

- Track the system and individual pavements to ensure the appropriate maintenance and construction activities are implemented
- Identify and address residents' concerns and create project "buy-in" or ownership, preempting the possibility of project denial resulting from negative feedback at the time of public hearings

City of Eden Prairie

Pavement Management Case Study

Agency Information:

Population	65,000 people
Number of Roadway Centerline Miles	220 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Pavement Management System Implementation	Used since 1995

Pavement Management Background

The City of Eden Prairie began using pavement management in 1995, when the system's average PCI was 88. By 2008, the system's average PCI had dropped slightly to 81. City staff met with the Council to discuss future funding for the system. The current condition of the system was presented along with the system's predicted condition using the following scenarios:

- No additional funding moving forward
- Current funding levels maintained moving forward
- Increased funding levels moving forward

The Council was receptive to the information provided and set an agency goal to maintain the system's average PCI at or above 80.

Tips for Implementing Pavement Management

- Use pavement management systems data to gain council/board support for pavement management.
- Use multiple budgeting scenarios and predicted system conditions to gain council/board approval of future pavement management funding.

Realized Benefits

- Obtain funding approvals to maintain system PCI goal

City of Mankato

Pavement Management Systems Case Study

Agency Information:

Population	35,000 people
Number of Roadway Centerline Miles	153 miles
Current Pavement Management System Used	Simplified COE Paver
Year of Current Pavement Management System Implementation	Used since 2007
Initial Year of Pavement Management System Implementation	1979

Pavement Management Background

The City of Mankato began using pavement management in 1979, with the goal of rating arterial pavements once every two years and local streets once every three years. The City has generally used the pavement ratings to identify seal coat, overlay and reconstruction project needs. Although identified projects may not be completed when scheduled due to budget constraints, redevelopment pressures or politically identified issues, all projects that have been identified remain on a priority list until completed.

Budget restrictions between 2002 and 2004 resulted in a loss of manpower to perform pavement ratings, which generally required 120 to 160 hours per year for updating. The lack of manpower prevented staff from accomplishing the updates necessary to utilize the pavement condition ratings. Then in 2007, the City worked to streamline the pavement rating process by minimizing the number of samples taken. At the same time, they were able to add ranking for curb and gutter and drainage condition, also factoring those conditions into the pavement ratings.

In the early 1980's, the average condition of pavements in place longer than five years was 55. Currently, the average condition rating of pavements in place longer than five years is 75. Mankato's use of pavement management over the years has provided significant improvement to the network system through identification and annual reconstruction efforts for streets falling into disrepair.

Tips for Implementing Pavement Management

- Periodically rate roadway network.
- Keep deferred projects on priority list until work is completed.
- Streamline pavement rating system if faced with budget cuts.

Realized Benefits

- Identify and complete project needs
- Keep pavement management data up to date for project identification

Olmsted County

Pavement Management Systems Case Study

Agency Information:

Population	140,000 people
Number of Roadway Centerline Miles	522 miles, 374 are Hard Surface
Current Pavement Management System Used	ICON (Goodpointe)
Year of Current Pavement Management System Implementation	Used since 2001
Initial Year of Pavement Management System Implementation	2000

Pavement Management Background

Olmsted County began using their current pavement management system in 2001. Each spring, engineering and construction staff rate all hard surfaced roadways within the network and create a tabular report with the following information for each road segment:

- Length
- Width
- Pavement rating
- Comments/recommendations

A color coded map displaying segment pavement ratings is also created from the rating data collected each year. The map is used to identify future road projects that include:

- Seal coating
- Reclaiming/overlaying
- Reconstruction

Using the reports and mapping created each year, Olmsted County staff has been able to identify needs and request funding from the County Board for bituminous overlay projects with successful results.

Tips for Implementing Pavement Management

- Periodically rate roadway network.
- Create reports and maps with newly gathered network ratings.

Realized Benefits

- Identify needs and determine recommended actions
- Routinely update council/board on the network and request funding when needed

City of Roseville

Pavement Management Case Study

Agency Information:

Population	35,000 people
Number of Roadway Centerline Miles	126 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Pavement Management System Implementation	1985

Pavement Management Background

The City of Roseville has been using pavement management since 1985.

The majority of Roseville's pavements were constructed in the 50's and 60's as temporary pavement without curb and gutter. In 1985 over 50% of pavements were failing and in the problem category. Bonds were used to fund reconstruction of 4-6 miles per year to reduce the problem streets inventory. A Levy for future major maintenance began in 1985 and was continued for 15 years until an adequate sustainable fund balance was accrued.

To adequately fund the maintenance activities required to maintain the desired system pavement ratings, the City has dedicated funds that are not from bond interest rather interest earnings from a dedicated infrastructure fund. This has allowed the City to use dedicated funding without the need to regain approval from the City Council each year.

By starting the program early on in the life of the roadway system the City has been able to maintain a steady PCI rating throughout the years (the 2008 average PCI is between 83 and 85).

Typical yearly pavement management treatments include:

- Patching pavement that will be seal coated the next year
- Crack Seal and Seal Coating annually between 13 to 15 miles
- Major Maintenance and Reconstruct of three miles per year as necessary

Tips for Implementing Pavement Management

- Begin using pavement management preservation techniques as early as possible in the life of the roadway system and newly constructed or reconstructed pavements.
- Use dedicated funds (such as infrastructure fund interest) to maintain consistent funding.
- Keep data up to date, including treatment and construction costs.
- Participate in user group meetings to learn what other agencies are doing.

Realized Benefits

- Maintain a relatively high "average" PCI
- Predict what will happen with the system given different scenarios that are based on real world costs, leads to better decisions

Washington County

Pavement Management Systems Case Study

Agency Information:

Population	235,000 people
Number of Roadway Centerline Miles	285 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Pavement Management System Implementation	1994

Pavement Management Background

Washington County has been using pavement management since 1994. In order to gain program buy-in and financial approval, County staff presented several pieces of information to the Board including:

- The system's current pavement condition
- The system's projected pavement condition under different budget scenarios
- Photos of pavements with varying PCI's

After reviewing this information, the Board decided to set a goal to maintain the system PCI at or above 72.

Since setting the PCI goal, the County has found that it has been the "one performance goal that elected officials and staff have bought into and rallied around." Staff has seen that by using Pavement Management System, roadway costs have been less expensive in the long run. Pavement Management System has also been a long-term way to keep track of the roadway system.

Tips for Implementing Pavement Management

- Use the ideas behind pavement management along with data to gain council/board and staff support for pavement management.
- Set a tangible, metric agency goal.

Realized Benefits

- Obtain funding approvals to maintain system PCI goal
- Track long-term costs and performance

City of Woodbury

Pavement Management Systems Case Study

Agency Information:

Population	58,000 people
Number of Roadway Centerline Miles	220 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Pavement Management System Implementation	Unknown

Pavement Management Background

The City of Woodbury uses pavement condition ratings from their pavement management system, as one of many tools to aid in defining which projects move forward. Other factors considered when determining project needs include:

- Input from the Street Department
- Age of the roadways being considered
- Complaints from residents
- Curb and utility condition along the roadways being considered

The City also uses their pavement management system as one of the tools to gain staff, Council and resident buy-in. For instance, a City-wide pavement condition map is updated yearly and indicates current areas that need to be focused on.

Tips for Implementing Pavement Management

- Use pavement condition as one of many tools for identifying future projects.
- Create maps with newly gathered pavement condition ratings.

Realized Benefits

- Present additional information to support project recommendations and funding requests
- Show pavement condition ratings and area of need to staff, council/board and residents in a pictorial format to gain buy-in

Case Studies

In-House Pavement Management Systems

Clearwater County

Pavement Management Systems Case Study

Agency Information:

Population	8,500 people
Number of Roadway Centerline Miles	281 miles
Current Database(s) Used	Microsoft Excel
Year of Pavement Management System Implementation	1996

Pavement Management Background

In 1996, Clearwater County had their pavement system rated. The system was rated again in 2007 by the Mn/DOT Pavement Management Unit under an agreement between Mn/DOT's Office of Materials and Division of State Aid.

Rating data from both 1996 & 2007, along with construction and maintenance history, are contained within a spreadsheet. This spreadsheet is used to help determine and schedule overlay and reconstruction needs. Clearwater County staff also maintains a PDF map of the County with each roadway's age and structural information as well as links to past construction plans for each segment. Staff spends approximately eight to sixteen hours per year updating system information.

Tips for Implementing Pavement Management

- Have roadway system periodically rated.

Realized Benefits

- Gather important information while making a low-cost investment
- Track system performance over time
- Identify roadway segments that require minimal repairs before condition deteriorates and requires more costly repairs
- Schedule maintenance and reconstruction activities more effectively

Faribault County

Pavement Management Systems Case Study

Agency Information:

Population	16,181 people
Number of Roadway Centerline Miles	450 miles (347 miles of CSAH, 103 miles of CR)
Current Database(s) Used	Microsoft Excel
Year of Pavement Management System Implementation	2007

Pavement Management Background

Mn/DOT's Pavement Management Unit rated the Faribault County roadway system in 2007, under an agreement between Mn/DOT's Office of Materials and Division of State Aid.

With the information provided by Mn/DOT, County staff created a list of potential project needs by sorting the roadway segments based on each segment's Pavement Quality Index (PQI). The list of potential projects is used to make objective recommendations for overlay and reconstruction projects to the County Board.

Tips for Implementing Pavement Management

- Use system data received from Mn/DOT's Pavement Management Unit.

Realized Benefits

- Make objective recommendations to decision makers for required funding at a low cost

Ramsey County

Pavement Management Case Study

Agency Information:

Population	511,000 people
Total Number of Miles in Roadway System	295 miles
Current Database(s) Used	Microsoft Excel
Year of Pavement Management System Implementation	1984

Pavement Management Background

In 1984, Ramsey County began using a spreadsheet-based pavement management system. The system looks at a variety of factors including smoothness, structural capacity, structural condition, wear, weathering, skid resistance, uniformity, alligatoring, patching, and cracking. Data is collected via visual inspection once every two years.

Once data has been collected, numerical ratings are assigned for each factor and the system calculates an overall pavement condition score for each segment of roadway. The system also recommends maintenance treatments and prioritizes major maintenance projects based on the pavement condition and traffic volumes.

Tips for Implementing Pavement Management

- Have roadway system periodically rated.
- Maintain system maintenance and construction history.

Realized Benefits

- Improve average pavement condition rating (risen from 69 in 1984 to 89 in 2008)
- Develop projections for funding needs
- Determine appropriate maintenance treatments
- Track progress of the system and individual components
    - Identify issues with specific construction materials and obtain funding for corrective actions
    - Analyze various pavement treatments, such as cold-in-place recycling and seal coating, to determine benefit over time

St. Louis County

Pavement Management Case Study

Agency Information:

Population	200,000 people
Total Number of Miles in Roadway System	3000 miles
Current Database Used	Microsoft Excel
Year of Pavement Management System Implementation	Work-in-progress

Pavement Management Background

St. Louis County has developed a system that uses PQI, AADT, and the accident rate to produce a prioritized list of segments. The PQI, AADT, and the accident rates are weighted based on factors determined by the County.

Once the prioritized list of segments has been created, it is used as added input during the project selection process.

Tips for Implementing Pavement Management

- Develop a system of prioritizing roadway segments.

Realized Benefits

- Include additional objective information to the project selection process

Three Rivers Park District

Pavement Management Systems Case Study

Agency Information:

Number of Annual Visits	4 million visits
Total Amount of Pavement in System	28 lane-miles of very low volume roadway 123 miles of paved trails 56 acres of parking lots
Current Database Used	Microsoft Excel
Year of Pavement Management System Implementation	Used since 2001

Pavement Management Background

Three Rivers Park District's network consists of roadways, parking lots and trails. In 2001, staff developed a series of pavement management spreadsheets to house network information, filter data, develop formulas for life cycling and cost forecasting, and to create charts and reports as needed.

Park District staff has been able to demonstrate the ability to understand what they have and how best to maintain it through the use of customized reports and charts to:

- Justify future rehabilitation and reconstruction work
- Justify proposed expenses
- Secure capital funding through the Board's budget approval process

The success of Pavement Management System at the Board level has resulted in aggressive pavement projects, allowing the Park District to maintain or improve existing pavements.

Tips for Implementing Pavement Management

- Develop a system of spreadsheets built from simple, easy to understand concepts.
- Create customized charts and graphs to visually aid in justifying projects and securing funding.

Realized Benefits

- Network data is accessible and easily understood: viewing, maintaining, editing and analyzing network data can be performed by anyone with a working knowledge of common desktop office software.

Appendix C:

Pavement Management Systems Selection Workshop

Powerpoint Slides Handout

Pavement Management Systems

Sponsored by: Local Road Research Board
Minnesota LTAP Center

Presentation Outline

1. Overview
2. Benefits
3. Elements
4. Case Studies
5. Resources

Presentation Outline

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Pavement Management Old School Methods

- **Last Year's Budget**
  - The budget is based on last year's funding, possibly with an arbitrary increase or decrease (usually to fix the worst streets)
- **Standard Program**
  - A program based on a periodic maintenance schedule, such as a seal coat every seven years and an overlay every 15 years, whether or not the street really needs it.
- **"Fighting Fires" Approach**
  - Fix the ones citizens constantly complain about.

Pavement Management Old School Methods

- **Worst-First**
  - The streets in the worst shape are fixed first. This approach has a certain logical appeal that satisfies the public and some council members.
- **Political Pressure**
  - Use political considerations to establish priorities and budgets.
- **Gut Feel**
  - Rely on the experience, knowledge and "gut feel" of managers and experienced employees.

A Pavement Management System Is…

- …a **set of tools or methods** that **assist decision-makers** in **finding optimum strategies** for providing, evaluating, and maintaining pavements in a serviceable condition over a period of time.

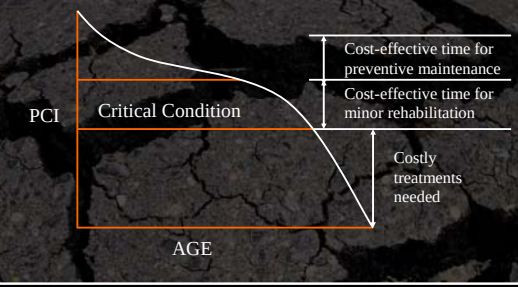
AASHTO *Guide for Design of Pavement Structures (1993)*

There are Many Methods for Measuring Pavement Serviceability

- PCI = Pavement Condition Index
  - Rating of 0 to 100
  - Developed by US Army Corps of Engineers
- PQI = Pavement Quality Index
  - Rating of 0.0 to 4.5
  - Developed by Mn/DOT
  - Combines condition and ride
- Others

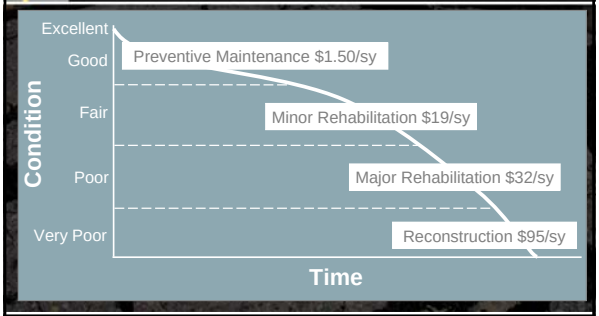
Managing Pavement Deterioration

Pavement Management Primer



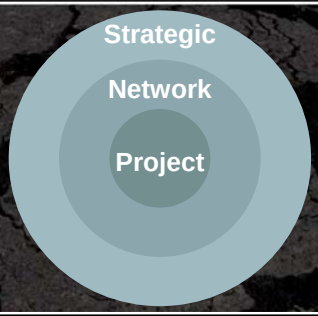
Pay Now or Pay More Later

NHI Course No. 131116



Three Levels of Management

NHI Course No. 131116

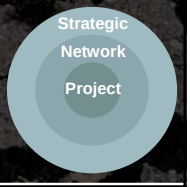


Three Levels of Management

- Strategic Level
  - Make policy decision
  - Set funding allocations
  - Establish preservation strategies
  - The "Philosophy"

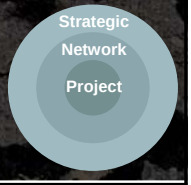
Three Levels of Management

- Network Level
  - Collect condition information on the network
  - Analyze condition information
  - Provide information to upper management to assist in making strategic decision
  - Provide information to other users to support project selection, design and other types of analyses
  - Identify corridor project
  - The "Data"



Three Levels of Management

- Project Level
  - Determine final project recommendations
  - Design rehabilitation strategies
  - Conduct special studies
  - The "Plan"



Uses of Pavement Management

- Identify and prioritize maintenance and rehabilitation needs
- Determine cost-effective treatment strategies
- Provide information to the public and agency council/board
- Influence agency bond rating
- Comply with GASB 34

Pavement Management Systems

- A Pavement Management System is ***NOT*** simply a computer program
- A Pavement Management System ***IS*** a formalized process providing necessary information to decision makers
- A Pavement Management System helps lead to good investments

Pavement Management System ≠

Pavement Management Systems

- A Pavement Management System should:
  - Provide a systematic, consistent approach to evaluate the present condition of each pavement surface
  - Provide guidance for the proper type of maintenance to keep the pavement at an acceptable level of service
  - Prioritize necessary repairs
  - Generate useful reports

Presentation Outline

1. Overview
2. Benefits
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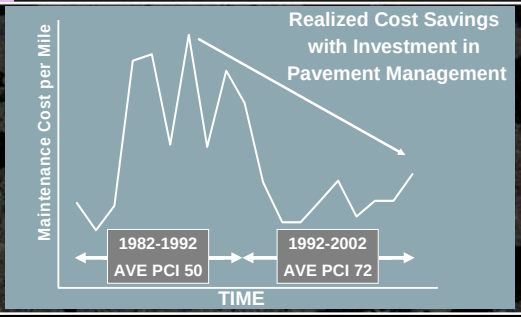
Benefits of Pavement Management

- More efficient use of available resources
- Ability to justify funding needs
- More accurate and accessible information on the pavement network
- Ability to track pavement performance
- Ability to show impacts on condition
- Improved communication

AASHTO Pavement Management Guide (2001)

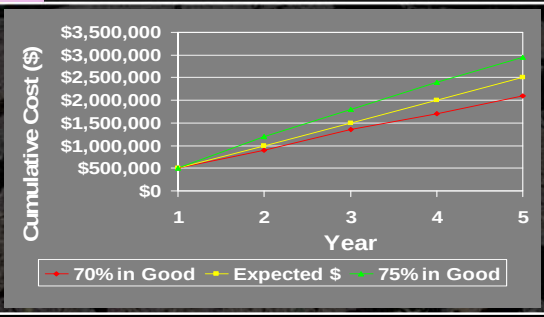
More Efficient Use of Available Resources
Example From Orange County, CA

Orange Whip, NHI Course No. 131116

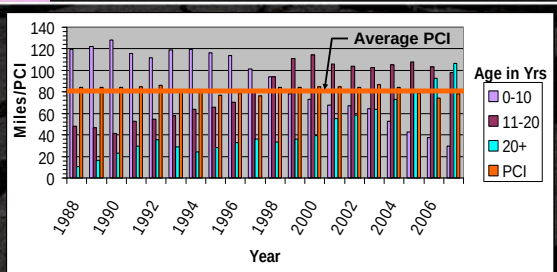


Ability To Justify Funding Needs
Example of Meeting Agency Goals

NHI Course No. 131116

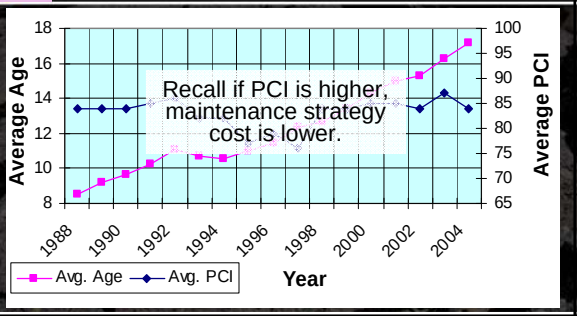


More Accurate & Accessible Information on the Pavement Network
Example from the City of Eagan

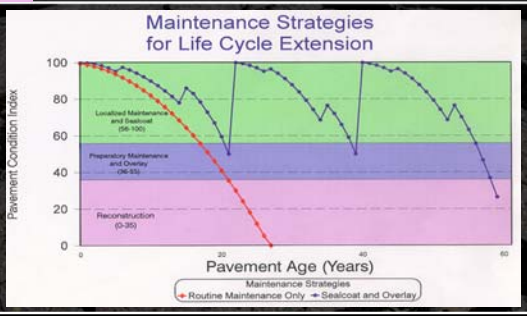


PCI stayed the same as pavement age increased.

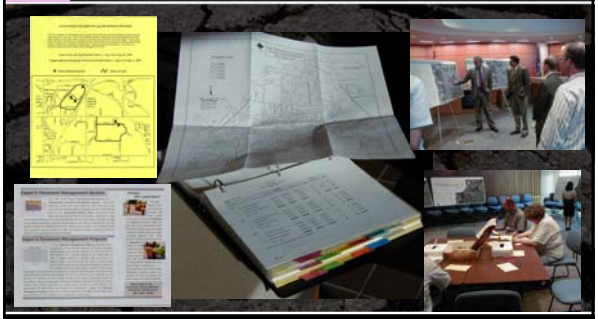
Ability to Track Pavement Performance
Example from the City of Eagan



Ability to Show Impacts on Condition
Example from the City of Eagan



Improved Communication
Stakeholder Involvement in the City of Eagan



Presentation Outline

1. Overview
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Elements of Pavement Management

- Pavement/Asset Inventory
- Database/Software
- Analysis
- Reports and Mapping
- Implementation Strategies

Elements of Pavement Management

- Pavement/Asset Inventory
- Database/Software
- Analysis
- Reports and Mapping
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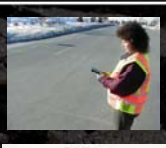
Pavement/Asset Inventory

- Criteria for Data Collection:
  - Data must be relevant, accurate & reliable
  - Data must be collected on a regular basis to keep it relevant, as your budget allows
    - i.e., collect data on 25% of your network each year



Pavement/Asset Inventory

- Types of Data:
  - Section Identification
  - Construction, Maintenance and Rehabilitation History
  - Pavement Characteristics
  - Pavement Condition Data
  - Others

Pavement/Asset Inventory

- Types of Data:
  - Section Identification
  - Construction, Maintenance and Rehabilitation History
  - Pavement Characteristics
  - Pavement Condition Data
  - Others

Pavement/Asset Inventory
Types of Data

- Section Identification:
  - Must be consistent throughout the network
    - User determined
    - Examples of segmentation include by roadway, by roadway cross-section, intersection to intersection, breaks at municipal lines
  - Information can include:
    - Segment begin/end points
    - Spatial location (GPS location)
    - Segment width and/or area

Pavement/Asset Inventory

- Types of Data:
  - Section Identification
  - Construction, Maintenance and Rehabilitation History
  - Pavement Characteristics
  - Pavement Condition Data
  - Others

Pavement/Asset Inventory
Types of Data

- Construction, Maintenance and Rehabilitation History
  - Information can include:
    - Construction dates
    - Maintenance, rehabilitation & reconstruction activities
      - Dates
      - Types of treatment
    - Any other pertinent information
  - Important for analytical process

Pavement/Asset Inventory

- Types of Data:
  - Section Identification
  - Construction, Maintenance and Rehabilitation History
  - Pavement Characteristics
  - Pavement Condition Data
  - Others

Pavement/Asset Inventory
Types of Data

- Pavement Characteristics:
  - Information can include:
    - Pavement structure (layer) data
    - Age
    - Traffic
      - AADT
      - ESAL's
    - Geometric features
    - Any other pertinent information

Pavement/Asset Inventory

- Types of Data:
  - Section Identification
  - Construction, Maintenance and Rehabilitation History
  - Pavement Characteristics
  - Pavement Condition Data
  - Others

Pavement/Asset Inventory
Types of Data

- Pavement Condition Data:
  - Surface Condition
  - Ride Quality or Smoothness
  - Structural Capacity

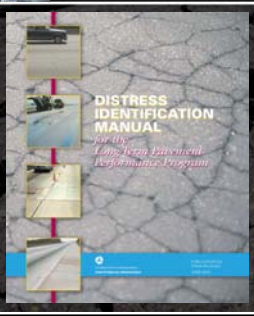
Pavement/Asset Inventory
Types of Data

- Pavement Condition Data:
  - Surface Condition
  - Ride Quality or Smoothness
  - Structural Capacity

Pavement Condition Data
Surface Condition

- Pavement Distress
  - Type – what kind?
  - Severity – how bad?
  - Quantity – how much?

Pavement Condition Data
Surface Condition



- LTPP Distress Identification Manual
  - Pavement distress ***definitions*** should be applied consistently
  - Photos and drawings
  - Can be downloaded at http://www.tfhrc.gov/pavement/ltpp/reports/03031/03031.pdf

Pavement Condition Data
Surface Condition

- Approaches to Collecting Data:
  - Manual
  - Semi-automated
  - Automated

Pavement/Asset Inventory
Types of Data

- Pavement Condition Data:
  - Surface Condition
  - Ride Quality or Smoothness
  - Structural Capacity

Pavement Condition Data
Ride Quality or Smoothness

- Ride quality or smoothness data can be collected using automated or manual equipment.
  - Represents functional condition
  - Direct measure of public's perceived riding comfort
  - Profile data often converted to IRI

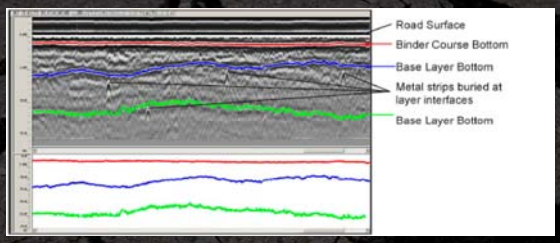
Pavement/Asset Inventory
Types of Data

- Pavement Condition Data:
  - Surface Condition
  - Ride Quality or Smoothness
  - Structural Capacity

Pavement Condition Data
Structural Capacity

- Pavement layer data can be collected with Ground Penetrating Radar (GPR)
  - Provides a "picture" of pavement structure
  - Used for FWD Analysis

Pavement Condition Data
Structural Capacity



Pavement Condition Data
Structural Capacity

- FWD Testing
  - Data used to calculate pavement strength, capacity, remaining life, and help determine rehabilitation strategies

Pavement Condition Data
Structural Capacity

- Used for identifying pavement structural strength and establishing tonnage "postings"
- Typically collected for project level analysis

Elements of Pavement Management

- Pavement/Asset Inventory
- Database/Software
- Analysis
- Reports and Mapping
- Implementation Strategies

Database/Software

Complexity of Pavement Management Systems Can Vary Greatly

Spreadsheet

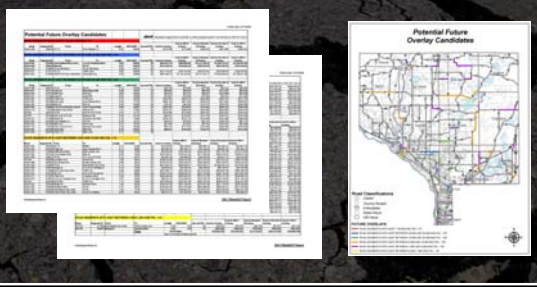
Software

Database/Software

- Internal / “Home-grown”
  - Can be as simple as a manual method using paper and pencil
  - Can be a spreadsheet application created by the agency and can be fairly sophisticated
  - Built to user’s needs

Database/Software
Internal

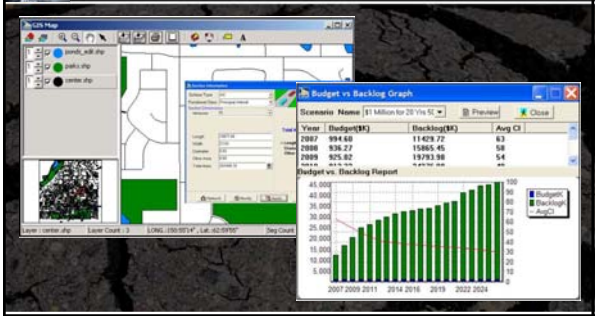
Courtesy of Anoka County



Database/Software

- External / Commercially Developed:
  - Optimization-type Pavement Management System that will be able to determine the best investment strategy (as defined by the agency) every year for an extended number of years
  - “What-if” scenarios
  - Requires large amounts of data

Database/Software
External



Capabilities of the Database

- Condition Ratings
  - By functional classification
  - By surface type
  - Overall condition
  - Rate of deterioration
- Analysis
- Reports and Mapping
  - Integrates data with visual mapping (GIS)
  - Provides prediction modeling with worst first or weighted rankings

Software Options

- A survey was competed in 2008 to determine which Pavement Management Systems were being used by MN agencies
- The following six systems were used in MN

Vendor	Pavement Management System
APWA/Corps of Engineers	Micropaver
Cartêgraph	PAVEMENTview Plus
Goodpointe Technology	ICON
Infrastructure Management Services	PavePRO Manager
Stantec	Roadmatrix
WI TIC LTAP	PASERWARE

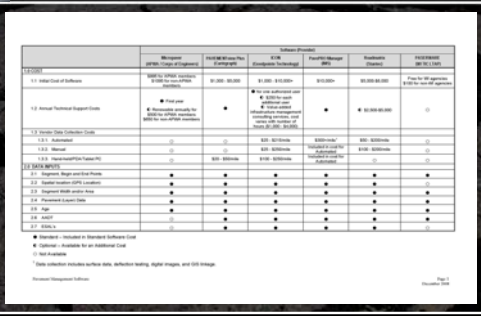
Software Options

- A secondary survey was conducted in 2008 to:
  - Determine the capabilities of each Pavement Management System
  - Determine additional services provided by each Pavement Management System company

Software Options

- The results of the survey have been compiled into a matrix format.
  - Located in the LRRB report titled "Implementation of Pavement Management in Minnesota"
  - Can be used as a resource to review Pavement Management Systems' capabilities
  - Does not recommend a specific Pavement Management System software

Software Matrix
Page 1 of 5



Elements of Pavement Management

- Pavement/Asset Inventory
  - Data Collection
- Database/Software
- Analysis
- Reports and Mapping
- Implementation Strategies

Analysis
Prediction Modeling

- Typical uses of a pavement management system database:
  - Develop multi-year programs
  - Compare different options
  - Predict future conditions
- This can be done with a pavement management system that includes analysis models and multi-year programming capabilities or with "home-grown" applications

There are Many Analysis Methods

- Pavement condition
- Treatment rules
  - When should a treatment be considered feasible?
  - What happens after the treatment is applied?
- Performance modeling
- Needs assessment
- Optimization

Use of Analysis Results

- Identify and prioritize maintenance and rehabilitation needs
- Evaluate the impact of various scenarios through a comparison of conditions, backlog or remaining service life
- Establish pavement condition targets
- Set budget needs
- Support asset management activities

Elements of Pavement Management

- Pavement/Asset Inventory
  - Data Collection
- Database/Software
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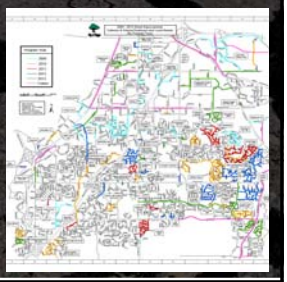
- Implementation Strategies

Reports and Mapping

Courtesy of the City of Eagan



Reports and Mapping: Presenting Results to Stakeholders

Know the Audience's Needs:

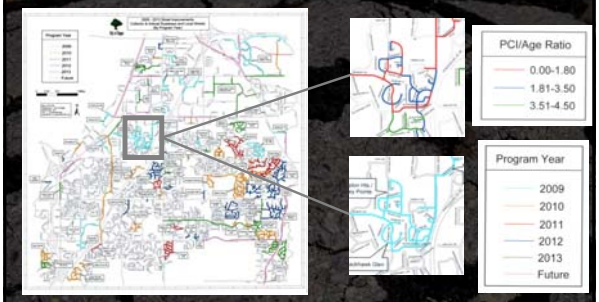
- Network Level
  - Legislature/Highway Commission
  - Senior agency management
  - Public
- Project Level
  - Design engineers
  - Mid-level management

Reports and Mapping: Presenting Results to Stakeholders

- Using graphical data and maps helps illustrate "the plan" to elected officials and the public

Reports and Mapping: Presenting Results to Stakeholders

Reports and Mapping: Presenting Results to Stakeholders



Elements of Pavement Management

- Pavement/Asset Inventory
  - Data Collection
- Database/Software
- Analysis
- Reports and Mapping
- Implementation Strategies

Implementation Strategies: Effective Uses of Pavement Management

- Support pavement preservation programs
- Establish investment levels and goals
- Strengthen links to maintenance
- Support engineering and economic analysis
- Support other uses
  - GASB 34
  - Bond Ratings

GASB 34: Modified Approach

- Pavement Management Systems supports the Modified Approach of GASB 34 by:
  - Maintaining an inventory of the system
  - Providing the system's condition, reproducible
  - Aiding in setting minimum condition targets
  - Providing the estimated system condition given alternate investment levels
  - Determining the level of funding associated with a particular network or subsystem

Presentation Outline

1. Overview
2. Benefits
3. Elements
4. Case Studies
5. Resources

Case Studies from Minnesota Agencies

- Using Commercially Available Software
  - City of Roseville
  - Washington County

City of Roseville Commercially Developed Software

Agency Information

Population	35,000 people
Number of Roadway Centerline Miles	126 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Pavement Management System Implementation	Used since 1980's

City of Roseville Commercially Developed Software

- Pavement Management Background
  - Majority of pavements built in the 1950's and 1960's
  - 50% of pavements were failing (in the problem category) by 1985
  - The City began a levy for future major maintenance

City of Roseville Commercially Developed Software

- Pavement Management Background (Cont.)
  - Typical annual activities funded by the levy include:
    - Patching pavement for seal coating (prior year)
    - Crack sealing and seal coating of 13-15 miles/year
    - Major maintenance and reconstruction of ≈ 3 miles/year
  - Since implementation, the network's PCI has remained steady (≈ 85 in 2008)

City of Roseville Commercially Developed Software

- Tips for Implementation
  - Begin using pavement management preservation techniques as early as possible
  - Use dedicated funds, such as infrastructure fund interest
  - Keep treatment costs up to date
  - Participate in user group meetings

City of Roseville Commercially Developed Software

- Realized Benefits
  - Roadway network that is in "good" condition
  - Able to more accurately predict what will happen with the network given different scenarios
  - Learn about what other agencies are doing

Washington County Commercially Developed Software

Agency Information

Population	235,000 people
Number of Roadway Centerline Miles	285 miles
Current Pavement Management System Used	ICON (Goodpointe)
Year of Pavement Management System Implementation	1994

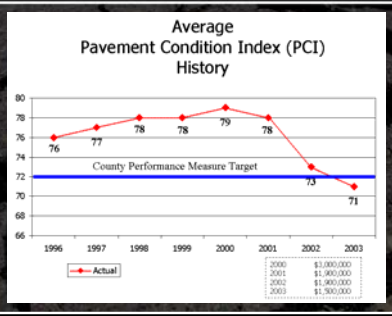
Washington County Commercially Developed Software

- Pavement Management Background
  - Gained Board buy-in and financial approval by:
    - Showing current network pavement condition
    - Showing network pavement condition under different budget scenarios
    - Showing photos of pavement with varying PCI's
  - Board set goal of system PCI ≥ 72

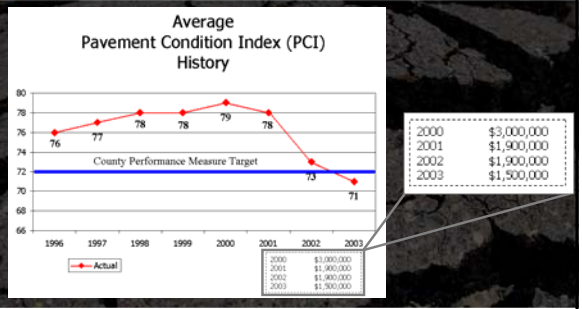
Washington County Commercially Developed Software

- Tips for Implementation
  - Use the principles behind pavement management strategies along with data to gain council/board and staff support for pavement management

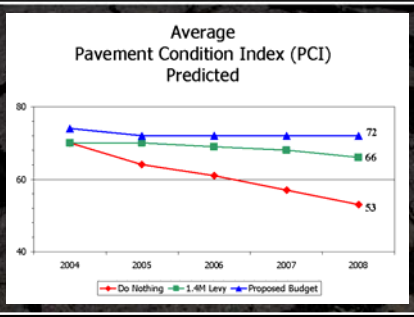
Washington County Commercially Developed Software



Washington County Commercially Developed Software



Washington County Commercially Developed Software

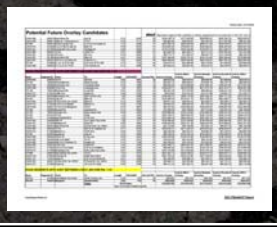


Washington County Commercially Developed Software

- Realized Benefits
  - Able to obtain funding approvals to maintain system PCI goal

Case Studies from Minnesota Agencies

- Using Internally Developed Software
  - Clearwater County



Clearwater County Internally Developed Software

Agency Information

Population	~ 8,500 people
Number of Roadway Centerline Miles	281 miles
Current Pavement Management System Used	Microsoft Excel
Year of Pavement Management System Implementation	1996

Clearwater County Internally Developed Software

- Pavement Management Background
  - Spreadsheet keeps track of:
    - Pavement condition ratings
    - Construction and maintenance history
  - PDF map:
    - Shows each roadway's age and structural information
    - Links to past construction plans for each segment
  - System used to help determine and schedule overlay and reconstruction needs

Clearwater County Internally Developed Software

- Tips for Implementation
  - Maintain network information in easy to understand format

Clearwater County Internally Developed Software

- Realized Benefits
  - Able to identify roadway segments that require minimal repairs before condition deteriorates and requires more costly repairs

Additional Case Studies Available

Additional case studies for both commercially available software and internally developed software are located in the LRRB report titled **"Implementation of Pavement Management in Minnesota"**

Presentation Outline

1. Overview
2. Benefits
3. Elements
4. Case Studies
5. Resources

Workshop Resources

AASHTO Pavement Management Guide:
https://bookstore.transportation.org/item_details.aspx?ID=352

NHI Course No. 131116:
http://nhi.fhwa.dot.gov/training/train.aspx

International Conference on Managing Pavement Assets:
http://www.icmpa2008.com/ & http://www.icmpa2011.cl/

MnROAD:
http://www.dot.state.mn.us/mnroad/

FHWA Pavement Management Website:
http://www.fhwa.dot.gov/pavement/mana.cfm

Other Helpful Resources

Local Road Research Board (LRRB):
www.lrrb.org

Minnesota Department of Transportation (Mn/DOT) Pavement Management:
http://www.dot.state.mn.us/materials/pvmtmgmt.html

Federal Highway Administration (FHWA) Asset Management:
www.fhwa.dot.gov/infrastructure/asstmgmt

National Center for Pavement Preservation (NCPP):
http://www.pavementpreservation.org

Minnesota Local Technical Assistance Program (MN LTAP):
www.mnltap.umn.edu

Pavement Interactive Website:
www.pavementinteractive.org

Appendix D:

Workshop Resources

Pavement Management Systems Workshop Resources

WORKSHOP RESOURCE MANUALS/INFORMATION

AASHTO Pavement Management Guide:
https://bookstore.transportation.org/item_details.aspx?ID=352

NHI Course No. 131116:
http://nhi.fhwa.dot.gov/training/train.aspx

WORKSHOP RESOURCE WEBSITES

International Conference on Managing Pavement Assets (ICMPA):
Calgary, Canada 2008: http://www.icmpa2008.com/
Santiago, Chile 2011: http://www.icmpa2011.cl/

MnROAD:
http://www.dot.state.mn.us/mnroad/

Federal Highway Administration (FHWA) Pavement Management:
http://www.fhwa.dot.gov/pavement/mana.cfm

ADDITIONAL WEBSITES

Local Road Research Board (LRRB):
www.lrrb.org

MN Department of Transportation (Mn/DOT) Pavement Management:
http://www.dot.state.mn.us/materials/pvmtmgmt.html

Federal Highway Administration (FHWA) Asset Management:
www.fhwa.dot.gov/infrastructure/asstmgmt

National Center for Pavement Preservation (NCPP):
http://www.pavementpreservation.org

MN Local Technical Assistance Program (LTAP):
www.mnltap.umn.edu

Pavement Interactive Website:
www.pavementinteractive.org

Appendix E:

Pavement Management System Brochure

Case Studies

Are you curious to know how other agencies have benefited from the use of Pavement management systems? Results from of a survey of 64 cities and counties were used to develop case studies for 15 agencies, demonstrating the use of their pavement management system and highlighting the history of their use, tips for implementing pavement management and realized benefits. The following are some quotes from these case studies:

"We used the principles behind pavement management along with the data collected to gain council/board support for pavement management." - Washington County

"The use of a pavement management system allowed us to rate our agency's pavement condition, which we use as one of many tools to identify future projects needs." - City of Woodbury

"We use our pavement management system to analyze various pavement treatments, such as cold-in-place recycling and seal coating, to determine the benefits and cost savings over time." - Ramsey County

"Before selecting a pavement management system for our agency, we were able to gain insight into what may or may not work for our agency, through investigating the successes and failures of other agencies" - Clay County

"We use our pavement management system to routinely update our board on the status of our pavement network, which helps with requesting and obtaining funding when needed." - Olmsted County

Resources

This brochure is a supplement to LRRB report #2009RIC11 entitled "Implementation of Pavement Management in Minnesota" which is available at:

http://www.lrrb.org/PDF/2009RIC11.pdf

AASHTO Pavement Management Guide:

https://bookstore.transportation.org/item_details.aspx?ID=352

National Highway Institute Course No. 131116:

http://nhi.fhwa.dot.gov/training/train.aspx

International Conference on Managing Pavement Assets (ICMPA):

Calgary, Canada 2008: http://www.icmpa2008.com/

MnROAD:

http://www.dot.state.mn.us/mnroad/

Federal Highway Administration (FHWA) Pavement Management:

http://www.fhwa.dot.gov/pavement/mana.cfm

MN Department of Transportation (Mn/DOT) Pavement Management:

http://www.dot.state.mn.us/materials/pvmtmgmt.html

LRRB LOCAL ROAD RESEARCH BOARD

May 2009

MINNESOTA DEPARTMENT OF TRANSPORTATION

Pavement Management Systems

How do you manage your pavement?

LRRB LOCAL ROAD RESEARCH BOARD

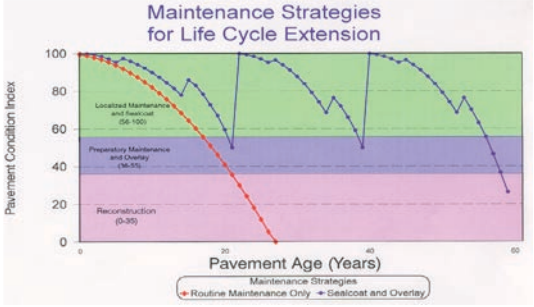
MINNESOTA DEPARTMENT OF TRANSPORTATION

What is a Pavement Management System?

A pavement management system is a set of tools used to assist with maintaining a network of roadways. Pavement management systems are a critical component of managing and maintaining transportation infrastructure. Agencies must address transportation needs with limited resources, while legislative bodies are requiring more efficiency in highway agencies and more accountability for the expenditure of taxpayers' money. As a result, the importance of a management system to help with the allocation of these resources, to manage the infrastructure, becomes more critical than ever.

Why use a Pavement Management System?

- In a time of decreasing budgets and increasing demands, a pavement management system can be a strategic tool to make cost effective decisions on your pavement.
- Pavement management systems can help identify and prioritize maintenance and rehabilitation needs.
- Pavement management systems can be used to analyze different pavement treatments to determine their cost savings over time.
- Agencies can use pavement management systems to provide information to the public and agency council/board to gain support and secure project funding.



Summary of Research Implementation Project

Workshop

Curriculum and material was developed for a 2-4 hour workshop for staff of agencies considering the acquisition of a pavement management system. Several training workshops will be conducted around the state in 2009.

Matrix

A matrix was developed to provide an objective review of the pavement management system software programs currently used by agencies in Minnesota. This matrix does not favor or recommend one pavement management system product over another, but rather serves as a neutral source of information and comparison of software programs.

Report

http://www.lrrb.org/PDF/2009RIC11.pdf

A resource guide was developed that describes, in detail, the various pavement management system software programs available and innovative and high-impact examples of the use of pavement management systems in Minnesota. This guide is targeted towards engineering staff of agencies currently using pavement management systems.

	Software (Provider)					
	Micropaver (APWA / Corps of Engineers)	PAVEMENTview Plus (Cartégraph)	ICON (Goodpointe Technology)	PavePRO Manager (IMS)	Roadmatrix (Stantec)	PASERWARE (WI TIC LTAP)
1.0 COST						
1.1 Initial Cost of Software	$995 for APWA members $1095 for non-APWA members	$1,000 - $5,000	$1,000 - $10,000+	$10,000+	$5,000-$8,000	Free for WI agencies $100 for non-WI agencies
1.2 Annual Technical Support Costs	● First year ◐ Renewable annually for $500 for APWA members $650 for non-APWA members	●	● for one authorized user ◐ $250 for each additional user ◐ Value-added infrastructure management consulting services, cost varies with number of hours ($1,000 - $4,000)	●	◐ $2,500-$5,000	○
1.3 Vendor Data Collection Costs						
1.3.1. Automated	○	○	$25 - $215/mile	$300+/mile[1]	$50 - $200/mile	○
1.3.2. Manual	○	○	$25 - $250/mile	Included in cost for Automated	$100 - $200/mile	○
1.3.3. Hand-held/PDA/Tablet PC	○	$20 - $50/mile	$100 - $250/mile	Included in cost for Automated	○	○
2.0 DATA INPUTS						
2.1 Segment, Begin and End Points	●	●	●	●	●	●
2.2 Spatial location (GPS Location)	●	●	●	●	●	○
2.3 Segment Width and/or Area	●	●	●	●	●	●
2.4 Pavement (Layer) Data	●	●	●	●	●	●
2.5 Age	●	●	●	●	●	●
2.6 AADT	○	●	●	●	●	●
2.7 ESAL's	○	●	●	●	●	○

● Standard – Included in Standard Software Cost
◐ Optional – Available for an Additional Cost
○ Not Available

[1] Data collection includes surface data, deflection testing, digital images, and GIS linkage.