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Current Application and Successful Implementation of Local Agency Pavement Management in the United States



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Innovation Through Partnerships

Current Application and Successful Implementation of Local Agency Pavement Management in the United States

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Prepared for

Federal Highway Administration

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Executive Summary

This report documents the activities of a one-year Intergovernmental Personnel Act (IPA) assignment of Mr. Paul Sachs, a transportation specialist from the State of Washington Department of Transportation. The purpose of the assignment was to enhance the Federal Highway Administration's (FHWA's) ability to transfer pavement-management technology to local agencies. The report highlights the important activities that local agencies, Technology Transfer Centers (T² Centers), and Metropolitan Planning Organizations (MPOs) are engaged in to implement pavement-management systems (PMSs) at the local agency level, and the issues that arise from implementing such systems around the United States. It also focuses on how communities around the country are benefitting from implementing local agency pavement-management programs. In addition, the report provides recommendations from the local agencies and MPOs on what efforts the FHWA could initiate to assist them in implementing, enhancing, and advancing pavement-management systems at the local level.

Data for this report was collected from State DOTs, the T² Centers, MPOs, universities, and local agencies from 21 States in eight of the nine FHWA regions. The 21 States were selected through the advice of FHWA's regional pavement engineers and division pavement engineers. Technical assistance, technology transfer, and mini-training sessions on pavement-management systems were provided to local agencies and MPOs through the project. The T² Centers were provided with technical assistance in presenting the FHWA course on "Pavement and Road Surface Management for Local Agencies." The MPOs were assisted in their efforts to define their role in assisting local agencies in their regions with the implementation of pavement-management systems. In addition, information was collected on how FHWA could help the T² Centers, local agencies, and MPOs advance pavement-management technology. Trips to each State were individualized to accommodate the needs of the State, the local agency, and MPO visited. Trips to universities in some States allowed the opportunity to visit with professors and researchers involved in local agency pavement-management activities.

The report is divided into sections addressing the following:

- Success stories of how local agencies are working with State DOTs, MPOs, or T² Centers to implement pavement-management systems.
- Technical assistance to T² Centers, as well as the Centers' efforts to assist local agencies in implementing pavement-management systems. How Centers are using the FHWA Train-the-Trainer course, "Pavement and Road Surface Management for Local Agencies."
- Technical assistance and issues related to defining the role of MPOs in pavement-management implementation.
- Recommendations on how the FHWA could help local agencies, T² Centers, and MPOs advance pavement-management technology.

Some conclusions of the assignment set forth in the report are as follows:

- Local agencies and MPOs that were visited in the eight regions are successfully implementing and benefiting from the use of a pavement-management systems. Their successful efforts are described in the report.
- The Federal regulation that required States and local agencies to have a pavement-management system for federally funded roads encouraged many local agencies to adopt pavement-management systems.
- MPOs have been playing an increasingly important role in the implementation of pavement-management systems in their regions. The support MPOs offer to their local agencies varies by region. However, the suspension of the Intermodal Surface Transportation Efficiency Act (ISTEA) pavement-management requirement came too soon for many MPOs. The requirement was suspended just as they were making inroads with local agencies in their regions and developing a technical communication link. When the management systems requirement was rescinded, many MPOs deferred deciding whether to assist local agencies until a later time.
- T² Centers are providing exceptional pavement-management training and service to local agencies and MPOs in all of the States visited. The FHWA course “Pavement and Road Surface Management for Local Agencies,” offered to the Centers in each of the nine FHWA regions in Fall 1994, has been widely used by the Centers that were visited. Several of the Centers have developed pavement-management-system computer programs, and improve and update the programs each year. The computer programs are made available to local agencies and MPOs for the cost to reproduce them. The computer programs are also shared with other T² Centers.
- The university system in the United States has also been a factor in many of the pavement-management successes. Related work being accomplished at universities ranges from classes in pavement management to the involvement of professors and researchers transferring pavement-management technology to States and local agencies.
- The information gathered during this IPA assignment demonstrates that many local agencies and MPOs throughout the United States have implemented pavement-management systems that benefit their communities through the cost-efficient use of taxpayers’ dollars. This report, highlighting the PMSs of the 21 agencies visited, was written as a resource for local agencies that may be considering implementation of a pavement-management system.

Local Agency Pavement-Management Success Stories

Introduction

One of the key components of the IPA assignment was to visit local agencies in all FHWA regions of the country that have successfully implemented pavement-management systems. This part of the assignment is intended to provide local agencies in each region and State with contacts in local agencies that have successfully implemented pavement-management systems. It also is meant to be a learning guide for other local agencies in the country. This examination of various local agency pavement-management success stories is intended to provide ideas for other local agencies that have just started or are considering using a pavement-management system. In addition, this section of the report may provide details on successful projects or methods that agencies that have already implemented pavement-management systems may want to try. The key individuals associated with each success story are listed at the end of each State discussion.

In total, 21 states were visited during the past year. In order to get a total picture of how pavement-management systems are being implemented in the United States, eight of the nine FHWA regions were visited. A successful agency in each State was selected on the basis of its use and promotion of pavement-management systems in its community. For instance, in regions where pavement-management systems have been used for many years, local agencies have been very successful in using the budget results from the program or procedures to acquire additional revenues for pavement repair and maintenance activities. By contrast, success stories in regions that had very few, if any, local agencies using pavement-management systems prior to the ISTEA requirement focus on how the State, MPOs or equivalents, T² Centers, and local agencies have worked cooperatively to implement pavement-management systems.

Successful implementation also varies between local agencies. Though using a pavement-management system to acquire additional revenue for pavement repair is the goal of many local agencies, successful implementation may also include using the program to more cost-effectively prioritize projects with existing revenues. Many local agencies around the country are successfully implementing their pavement-management systems in this manner.

It is also important to note that the local agencies visited during this assignment represent only the “tip of the iceberg” of those that have successfully implemented pavement-management systems around the country. The local agencies were selected by the FHWA regional and divisional pavement engineers with the assistance of other individuals from each State. In almost every State, there were many additional local agencies using pavement-management systems to better prioritize the use of limited resources, but time and budget constraints precluded visiting all of these local agencies.

Massachusetts

The Commonwealth of Massachusetts has achieved a unique pavement-management success. Through the hard work of the Massachusetts Highway Department (MHD), Baystate Roads Program, and private consultants, all 13 of the Regional Planning Agencies (RPAs) in the Commonwealth are assisting local agencies in their regions in implementing pavement-management systems. The pavement-management-system program at the local and RPA level began in the early 1980s and made significant progress throughout that decade. In 1989, pavement management began to make further advances in Massachusetts at the local agency level. The advances were the result of an MHD policy directive that allowed local agencies to use State-aid dollars for the acquisition of pavement-management software and services. A key to the policy was that RPAs could also assist in the development and implementation of pavement-management systems in their region using Federal funds. With the cooperation of MHD and the private sector, this enabled the RPAs to assist in training local agency personnel, writing pavement-maintenance budget reports for local agencies, and helping local agencies to answer their pavement-management-related questions.

MHD authorities recognized that they had a statewide system that included roads they were not directly responsible for repairing. They also recognized that they did not have enough internal resources to manage the entire statewide system, including local agency federally funded roads. In developing the policy directive, the MHD established a partnership with RPAs, local agencies, and private consultants that continues today.

The private sector played a major role in achieving the successful results in Massachusetts. Robert Christman of Vanasse Hangen Brustlin, Inc. (VHB, Inc.) has been involved with local agency pavement management in Massachusetts since 1979. He has led training sessions on the benefits of pavement management, encouraged the use of the system at the RPA level, and through VHB has provided related pavement-management software and services to many Massachusetts communities. He continues to assist both local agencies and RPAs in the implementation of pavement management.

Before the policy directive, local agencies had been having a difficult time persuading finance committees in their communities of the need for pavement maintenance. Local finance committees were not allocating money for street and road repair. Municipal public works' staff did not have the information to demonstrate the great need for pavement maintenance to decision makers. The State got involved by helping municipalities pay for a tool to document the dire condition of many local agencies' street networks. Working with the RPAs, a couple of local consultants, local agencies, and the Massachusetts Technology Transfer Center (Baystate Roads Program), the State conducted an extensive evaluation of available pavement-management software systems in 1991. From this evaluation, three software systems were selected as acceptable for use in Massachusetts. The systems included a private-sector, a public-domain, and a university-developed system.

Many communities that had not implemented a pavement-management system before 1991 began to look to the RPAs for assistance and guidance in pavement-management implementation. In

Massachusetts, the 13 RPAs cover every city and town in the Commonwealth. Each RPA selected one of the three systems that they then supported and trained their regional local agencies to use. The RPAs also established a Pavement-Management User Group (PMUG), which met bimonthly. PMUG offered support to RPAs that were just getting started in pavement-management implementation, holding meetings statewide to accommodate all 13 RPAs. PMUG meetings focused on the use of the three pavement-management systems; integrating mapping components into a pavement-management system; and support for pavement-management users. With the passage of the ISTEA requirement in 1991, the Commonwealth was already working with RPAs to implement pavement-management systems. All 13 RPAs were at some stage of implementing pavement-management systems in their regions in 1991.

The policy directive enabled the RPAs to develop a better rapport with the Commonwealth and develop a much better working relationship with their local agencies. The RPAs helped the smaller local agencies in implementing pavement-management systems, especially when smaller local agencies lacked the necessary resources to do the task on their own.

Since 1991, the RPAs, local agencies, private sector, and the Commonwealth have been working on several important pavement-management projects. In 1995 they established the statewide Pavement-Management Program (PMP). The PMP program collects, evaluates, and reports on pavement condition for Surface Transportation Program (STP) roadways eligible for Federal aid. The entire STP Federal-aid network will be surveyed by 1997, when the statewide PMP will provide information on the road condition, recommend rehabilitation strategies, estimate the cost of maintenance, and forecast future condition of the STP Federal-aid network.

The MHD recently evaluated the various pavement-management-system software packages used at the local agency level. Most RPAs use the Road Manager™ software developed by Vanasse Hangen Brustlin, Inc. Another system used by a few of Massachusetts' smaller communities is the Road Surface Management System (RSMS), developed by the New Hampshire Technology Transfer Center. The third system that some RPAs used initially no longer has widespread use.

In order for the Commonwealth to successfully implement a statewide program that analyzes all pavement needs, it must encourage compatibility among the various software systems being used by the Commonwealth, RPAs and local agencies. Consistency is required to determine overall network condition and to assess the priorities of projects from the various regions around Massachusetts. MHD and its pavement-management staff did not want to achieve this consistency at the cost of compromising the individuality of existing pavement-management systems. Massachusetts has chosen to harmonize the different pavement-management systems, allowing them to work together rather than mandating a standardized system.

In harmonizing the systems, the MHD and the RPAs addressed two problems: different referencing systems being used by the Commonwealth and local agencies, and different condition-rating scales used by the various systems. Through good working relationships, the MHD, RPAs, PMUG, and the private sector have developed innovative solutions to overcome these potential threats to implementing a statewide program.

In Massachusetts, the Commonwealth has worked closely with RPAs and private consultants for more than a decade to promote the benefits of local agency pavement management. Without the cooperation of all three, the successes at the local agency level in Massachusetts could not have occurred. With the 1989 issue of the policy directive, all 13 RPAs became involved in implementing, supporting, and training local agency personnel in pavement management, with the cooperation of the private sector and the MHD. During the past five years, local agencies, RPAs, private consultants, and the Commonwealth have worked to successfully integrate the existing pavement-management systems into a statewide pavement-management program.

Contacts in Massachusetts

SRPEDD-(RPA Contact) Paul Mission, (508) 824-1367

MHD-Mike Ecmecian, (508) 287-6115

VHB-Robert Christman, (617) 825-7650

Baystate Roads Program-Matt Turo, Massachusetts Highway Department, (617) 973-7266

Florida

Pavement management has been used at the local agency level in Florida since the early 1980s. The city of Tampa was one of the first users of the Micro Paver system and continues to be a leader in its use. Not only does Tampa use Micro Paver to guide its street and road repair program on 520 miles of arterials and collectors, but it hosts a nationwide Spring User Group meeting for the Micro Paver system. The city uses the Pavement Condition Index (PCI) as a guide in selecting street repair. The PCI is an index that ranks streets from 0 to 100, with 0 being failed and 100 being excellent. The city reviews the list of streets selected for repair from the pavement-management system and refines it based upon additional project-level work. After the work on the street is complete, the maintenance record is added to the Micro Paver database. Eventually the city hopes to track the performance of each treatment it places on Tampa's streets.

Seminole County began using a pavement-management system in the late 1980s in order to maximize tax dollars. After soliciting proposals, the county selected Infrastructure Management Systems, Inc. to implement a pavement-management system. To encourage the county to adopt a pavement-management system, the staff developed an educational tour for the county's commissioners. Prior to adoption of the pavement-management system, the selection of street maintenance projects was a subjective process. The county staff would drive streets to select projects for their yearly program. The county's Average Condition prior to pavement-management adoption was 70. The county proposed, with the implementation of a pavement-management system, to maintain its roads at an Average Condition of 80. After the implementation, the pavement-management system identified a \$7- to \$8-million need over five years. However, the county was appropriating only \$450,000 a year to its street repair program. After learning more about the pavement-management need and with the background provided by the educational tour, the commissioners increased funding for street repair in 1987. Today, the Average Condition of Seminole County roads is 80.

During the last 10 years, Orange County has used a pavement-management system to develop a cyclical pavement-maintenance schedule. Prior to implementing a pavement-management system, the county's pavement repair selection was by worst-first priority. With a pavement-management system, the county has been able to develop a 12-year resurfacing cycle. Sold to the council as a tool that would improve the county's streets, the pavement-management system has been used to increase the amount of revenues spent on its street system. Prior to implementation, the county might have received an increase of 3 percent a year. After the pavement-management system was adopted and fully functional, the county was able to document its budget needs and request funding levels to decrease the backlog of county street and road projects. With a pavement-management system, the county was able to show that an average annual increase of 3 percent was not enough to keep the backlog from growing.

The city of Orlando adopted a pavement-management system in the late 1980s and has used the program to assist in improving the overall condition of its roadways ever since. The system Orlando staff developed in-house is based on the principles of the Micro Paver system. In 1988, the city had an average pavement condition index of 69. By effectively using the pavement-management system, the city has been able to argue for an increase in funding of its street maintenance program and increase the PCI to the upper 70s. The number of complaints from citizens has decreased as the condition of the streets has improved. The city has worked with utility companies to schedule major utility work prior to resurfacing projects by using the results from the pavement-management system. They have also held public education seminars so their clients, the public, understand how a pavement-management system can help city officials use their tax dollars more effectively.

In 1995, The Center of Urban Transportation Research (CUTR) at the University of South Florida in Tampa developed a guide for local agencies on pavement-management activities in Florida. The guide presents the benefits of implementing a pavement-management system and offers a number of local agency contacts in Florida who have implemented such a system. The manual provides a detailed look at a system CUTR developed for a small city in Florida and how the city has used the system to its benefit. The manual provides a list of contacts to answer pavement-management-related questions. It is a good resource for any local agency in Florida that has yet to implement a pavement-management system.

Contacts in Florida:

City of Tampa-Sabine Stokes, (813) 274-7519

Seminole County-Tom George, (407) 323-2500

Orange County-Bill Baxter, (407) 836-7972

City of Orlando-Rick Howard, (407) 246-3222

University of South Florida, Center of Urban Transportation Research-Mike Pietrzyk, (813) 974-5818

Georgia

In Georgia, there has been local agency involvement in pavement management since the mid-1980s. Gwinnett County had no formal pavement-management system until 1985. Previously in Gwinnett County, a suburban Atlanta county, street selection for pavement repair was subjective. A crew of inspectors would ride the streets and give the road an initial score, which translated into a simple prioritization scheme. In 1986, Gwinnett County wanted to improve its pavement repair and management procedures. The county developed a Request for Proposals (RFP) and hired Carter and Associates to provide the tools to develop a more systematic approach to pavement management. When the consultant was hired in 1987, the county had 1,500 miles of roads, each of which it planned to survey annually. However, the county now surveys every other year.

One of the original keys to the success of Gwinnett County's pavement-management system was obtaining commissioners' support for the goal of managing the county's pavement-repair dollars more cost-effectively. Prior to developing the RFP, the staff gave the county commission a briefing on the benefits of pavement management. The commission fully backed the staff's desire to implement a pavement-management system and has continued to support the system. Due to the turnover of commissioners, Gwinnett County briefs the commissioners annually to maintain support for the program. The annual sessions present progress the county has made with the program, but also spends the first few minutes discussing basic pavement-management concepts.

Implementation of the program in 1987 was instrumental in helping to pass a sales tax measure in the fall of that year. The measure, which now pays for all resurfacing in the county, expires every four years. The residents appear to be happy with the improvements to their streets, as they have reinstated the sales tax twice.

Commitment to the pavement-management program in Gwinnett County has led to its successful implementation. In addition, the lack of turnover in the day-to-day program staff has contributed to the success of the pavement-management system in the county. Though a consultant was hired to implement the pavement-management system, the staff is responsible for annually updating the program. The individual originally trained by the consultants in the distress identification continues to be involved in the surveys. This continuity has led to stability within the staff and much success in the daily operation of the program.

Contact in Georgia:

Gwinnett County-Martin K. Conroy, (404) 822-7414

Mississippi

Prior to 1991, few local agencies in Mississippi were involved in implementing formal pavement-management systems. Since the passage of ISTEA in 1991, local agencies in Mississippi have worked very closely with MPOs and the T² Center in implementing pavement-management systems. Beginning in 1993, the T² Center conducted introductory pavement-management classes that were co-hosted by the MPOs. There are four MPOs in Mississippi. These MPOs have devoted Federal STP funds to assist local agencies in their regions with implementing pavement-management systems. Since the State does not get a huge slice of Federal funds, the MPOs focused on managing the current system rather than banking their funds for big-ticket items. For instance, in the Jackson area, the Central Mississippi Planning and Development District (CMPDD) decided to use part of its STP funds for local agency pavement-management support, rather than saving all of the STP funds to build a new road to the Jackson Airport. Even though the Federal mandate was suspended in 1995, the CMPDD plans to continue to assist local agencies in pavement-management efforts. CMPDD staff plans to survey the arterials and collectors in the region and use the information in developing a Transportation Improvement Program. This information would also be shared with local agencies in the region for use in day-to-day street management.

The Gulf Regional Planning Commission (GRPC) plans to work with cities in the Gulfport MPO region in implementing a pavement-management system. The GRPC plans to either survey the streets for the local agencies or undertake the entire implementation. After the Federal pavement-management requirement was suspended, the GRPC held a meeting with local agencies to see if there was still interest in implementing a pavement-management system. All of the communities attending the session felt it was important to continue to implement pavement-management systems because it would improve their current practices. GRPC is hiring an additional staff person to assist the local agencies in pavement-management training and assistance. Like the CMPDD, GRPC will be using Federal STP funds to assist in implementing local pavement-management systems.

Contacts in Mississippi:

Mississippi Center for T²-Otha Burton, Jr., (601) 968-2339

Gulf Regional Planning Commission-David Taylor, (601) 864-1167

Central Mississippi Planning and Development District-Kim Compton, (601) 981-1511

Alabama

The T² Center at Auburn University has played an integral role in encouraging the use of pavement-management systems by local agencies in Alabama. The T² Center has been committed to cyclical seminars providing local agencies with an overview of local road and street maintenance. The seminars, held in four locations in the State, are well attended. As an outgrowth of these seminars,

it became apparent that local agencies need support in the implementation of pavement-management systems. The T² Center has determined that it can provide a role in the implementation of local agency pavement management in Alabama.

Although the Federal requirement has been suspended, the T² Center plans to adopt a single pavement-management system to offer to local agencies. The T² Center will provide pavement-management system training and will work to assist local consultants. Since the T² Center is associated with a university, graduate civil engineering students will also assist. Prior to 1995, few local agencies had adopted a pavement-management system in Alabama. Because of the lead role the T² Center is providing and its developing partnership with the local consultant community, it is likely that a high percentage of both small and large communities will take advantage of the technical assistance offered.

Contact in Alabama:

Technology Transfer Center, Auburn University-Robert Vecellio, (334) 844-6286

New Hampshire

In 1986, the New Hampshire Technology T² Center, located on the University of New Hampshire campus, identified a need for assisting local agencies in pavement management. Working with a number of local agencies, it developed the Road Surface Management System. RSMS is a network-level pavement-management system developed for small- to middle-sized local agencies. Since 1986, the T² Center has trained 140 municipalities in the operations of RSMS. The municipalities include Regional Planning Commissions (RPCs), townships, cities, and counties. The T² Center presents two-day training sessions on how to use the RSMS. The first day is devoted to condition assessment, while the second day is devoted to computer training. The T² Center hired a local consultant to staff a hotline or help desk to assist local agencies in working out problems they encounter while operating the program. This "help desk" is essential to supporting the computer component of the system. The T² Center has found that most town-level agencies have little computer experience. A variety of computer classes has been developed, including an Introduction to Computers. This class has become one of the most popular workshops offered by the T² Center.

Many small- to mid-size communities lack the staff to fully implement and support a pavement-management system. To resolve this problem, the T² center hired civil engineering students from the University of New Hampshire in 1994 to assist a number of smaller agencies. The smaller agencies reimbursed the T² center for the work performed by the civil engineering students. The program was so successful that it was repeated in the summer of 1995. In total, 27 towns in New Hampshire have opted for this method of implementing RSMS.

Since passage of ISTEA in 1991, RPCs have played increasing roles in implementing pavement-

management. In the Lebanon area, all 12 communities have been helped by the local RPC in implementing pavement management. The RPC has assisted in conducting training sessions on different pavement-management steps. It has assisted in condition assessment and computer training, and when the communities have needed assistance in interpreting the pavement-management budget results from RSMS. This trend towards RPC involvement in New Hampshire encouraged by the T² Center.

The town of Salem was able to use the RSMS program to document its total need and educate the town's board on the benefits of pavement management. It was able to successfully pass a \$1.4 million bond issue with the results of RSMS.

Overall, the T² Center has developed a comprehensive training and support network for the implementation of pavement management in New Hampshire. Its staff works in partnership with local consultants to assist local agencies and develop new training sessions as needed by their users. They currently are working with T² Centers from around the country to modify RSMS. If RSMS proves not to be the best pavement-management system for a local agency in New Hampshire, the T² Center will assist in finding either another public domain system or a private package.

Contact in New Hampshire:

New Hampshire Technology Transfer Center-David Fluharty, (603) 862-2826

New York

Local agencies in New York have extensive resources for implementing pavement-management systems. Throughout the State, cities, villages, counties, and townships work with private consultants, the New York State Department of Transportation (NYSDOT), MPOs, and the Cornell Local Roads Program (T² Center) in implementing pavement-management systems. Several examples of pavement-management-system implementations are described below.

Since 1983, the Capital District Transportation Committee (CDTC), the MPO for the Albany Capital District, has used an adaptation of the NYSDOT condition survey to analyze pavement conditions in the region. Specifically, the CDTC has assisted local agencies in collecting distress information on local roads to project the total cost and condition of the entire road system in the Albany region over a 30-year horizon. This condition assessment includes both federally funded and non-federally funded roads. CDTC surveys the roads every two years and uses the information to develop its Transportation Improvement Program. Using information derived from its condition surveys, the CDTC has developed a method to compare infrastructure renewal projects, such as street reconstruction, with mobility improvement projects, such as signal system improvements or any other project that adds capacity. It is important to make this type of comparison at the MPO

level in evaluating federally funded projects. It allows for comparison of mobility improvement and infrastructure repair projects in the Transportation Improvement Program. CDTC was one of the first MPOs in the country to develop this type of scoring procedure.

Prior to 1991, the assistance provided by the Cornell Local Roads Program (T² Center) to local agencies interested in implementing a pavement-management system consisted of providing a list of available software systems. After the passage of the ISTEA, the T² Center sought a more proactive approach. After working with a number of local agencies, the T² Center adopted a computerized pavement-management system and developed a three-day training class for local agencies. Until the T² Center recognized that its clients were small- to medium sized communities with limited public works staff, it had marginal success in assisting these agencies in implementing pavement-management systems. Beginning in the summer of 1994, the T² Center matched Cornell engineering students with local highway agencies to assist the agencies with implementing pavement-management systems. The students were paid by the T² Center, which was reimbursed by the five participating municipalities. The program was a success. During the summer of 1995, the T² Center increased the number of municipalities to 15. The goal of the summer program is to assist each municipality in implementing a pavement-management system. This includes the following components: 1) Creating a road inventory; 2) Performing road condition ratings; 3) Determining a set of repair alternatives and unit costs for the alternatives; 4) Entering the data into the pavement-management data base; 5) Generating pavement-management-system reports. By the end of the summer, the students enable the municipality to use the pavement-management system to develop a budget report, which the municipality can present to its council or board. If a municipality needs assistance in developing a budget report, the T² Center has written a fictional case study to be used as an example. The T² Center planned to continue the summer program in 1996.

The town of Covert implemented a pavement-management system in 1991 for its 45 miles of roadways. The highway superintendent was frustrated that his capital-improvement budget was not sufficient to fix all of the roads. He felt the only way to bring attention to his plight was to develop a systematic approach to pavement repair and implement a pavement-management system. Through use of the pavement-management system, he was able to show that while the town was spending \$60,000 a year on pavement repair with only \$12,000 from local taxes, it needed closer to \$120,000 a year. After the board was presented with a formal report of the results, it deferred action until it could gauge how much of an increase the public would support. A formal presentation was made to a packed public audience, which fully supported an increase in property taxes of \$1.00 per thousand assessed. After the board reviewed the pavement-management study again, it approved an increase from \$12,000 a year to \$68,000 a year in local taxes. With the continuation of the other revenues, the town came close to achieving the budget needs of \$120,000 a year.

Contacts in New York:

Cornell Local Roads Program-Lynn Irwin, (607) 255-8033

Capital District Transportation Committee-Glenn Posca, (518) 458-2161

Rhode Island

In 1986, the Rhode Island League of Cities and towns published a report indicating that Rhode Island ranked at the bottom of all States in State highway aid to cities and towns. In September 1987, the governor of Rhode Island, recognizing that a problem existed in the area of pavement maintenance, proposed a three-year \$8-million pavement-management program. The money was earmarked for repairing the main streets and roads in cities and towns throughout the State, with funding from the State's general fund.

At the same time, State officials noticed the absence of a systematic approach to managing local-agency-maintained pavements. In response to this finding, the governor's program in 1988 supported a research team from the University of Rhode Island (URI) to identify an appropriate pavement-management system for implementation at the local agency level. After surveying all 39 municipalities to see if there was an interest in a computerized pavement-management system, the survey determined that 35 municipalities had some level of interest. After an extensive survey of available software for municipalities, the Micro Paver system was selected. Pilot implementations of the Micro Paver system were developed in the town of South Kingston and the URI Kingston campus. From these two pilot studies, a set of municipal implementation guidelines was developed for other municipalities in Rhode Island. From the set of implementation guidelines, a statewide plan was developed that called for a series of training sessions and workshops. This was accomplished through three workshops. Of 39 municipalities, 26 attended the workshops. Of the 26, 16 municipalities decided to fully implement Micro Paver. By the fall of 1995, 12 of these were continually updating the system. Municipalities implemented the system by one of the following methods: 1) Hired URI civil engineering students; 2) Hired consultants; or 3) Did the work with in-house staff.

In Rhode Island, partnerships between the university, consultants, and municipalities have led to a successful, cooperative arrangement to implement local agency pavement-management systems.

Contact in Rhode Island:

University of Rhode Island-K. Wayne Lee, (401) 792-2695

California

Since the mid-1980s, local agencies in both northern and southern California have used pavement-management systems. For example, in 1985 the City of Los Angeles developed a pavement-management system for its 6,500 centerline miles of streets. Los Angeles wanted to develop a

program that systematically assisted in selecting street projects for maintenance. Prior to implementing a pavement-management system, Los Angeles applied the worst-first strategy to pavement repair selection. The city is divided into four areas and within each area there are six districts. The goal of the program is to survey each street in the system every other year. With the results of the pavement-management system, the city has been able to secure additional funds to resurface streets with bus routes. These funds are derived from a transportation sales tax initiative that was originally devoted to public transportation projects. With the use of these funds, Los Angeles has increased its budget enough to resurface 200 centerline miles a year and slurry seal 400 centerline miles of streets.

The streets in the city of Berkeley were in a state of disrepair when the city adopted a pavement-management system in 1984. The initial results of the program indicated that the city had a \$60 million dollar need over a five-year horizon for its 225 centerline miles. The results also showed that the average Pavement Condition Index was 49 on a scale of 0 to 100. At the time, the city was funding its street repair program on an annual budget of \$500,000. Realizing that they were not going to receive all of the funds necessary to repair their streets, Berkeley developed the following strategy: 1) The Public Works staff began working with the city council and a citizen public works committee to develop alternative funding options to fix streets; and 2) The Public Works staff worked with the council and public works committee to prioritize spending of pavement repair dollars. With results from the pavement-management system, a priority system was developed. With such a huge shortfall of pavement needs compared to pavement revenues, the Berkeley Public Works Department needed to commit itself to a long-range plan.

In the 10 years since Berkeley fully implemented the pavement-management system, the city has been able to secure additional revenues by using the results of the program. Sources of revenues include: 1) Additional general fund monies; 2) County transportation sales tax monies devoted to street repair; 3) Additional State gas tax monies; and 4) Federal Surface Transportation Program funds. The city remained committed to its program and slowly increased the pavement repair dollars from \$500,000 a year to \$3 million a year. It has stayed at that level for the past four years. The city's average PCI has increased to the mid 60s, while its total budget need for the next five years has decreased to \$40 million. Recently, Berkeley started another educational program for its residents. Through a World Wide Web site on the Internet, any resident of Berkeley can see if their street has been selected for repair over the next five years.

The city of Los Gatos has used a pavement-management system since 1990 to develop its street maintenance program. However, it wasn't until the recession in California in the early to mid 1990s that Los Gatos began to see the full benefit of having a pavement-management system. Because of dwindling State funding sources and a sagging economy, the city either had to raise revenues or cut services to its citizens. Los Gatos opted for raising revenues in an innovative way. Its staff implemented a 2-percent utility users tax with a large portion of the tax devoted to repairing streets and roads. The utility tax is a 2-percent tax on the charges incurred for gas, electricity, cable television, water, and telephone service in the city. For the five-year period beginning in fiscal year 1996, Los Gatos had budgeted \$3.68 million for street maintenance and resurfacing. However, the

city's pavement-management system results indicate that \$5.66 million is needed in order to simply keep the streets in approximately the same condition as they are in today. Because the pavement-management system was able to quantify the state of the street network, the community was able to invest in its system through the utility users tax, which is expected to generate \$800,000 a year. Of that amount, \$450,000 to \$600,000 is designated for repairing streets and roads.

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Nebraska

Prior to the 1991 implementation of the ISTEA regulation for pavement management, few local agencies in the State of Nebraska had adopted formal pavement-management systems. One of these local agencies was the city of Omaha. The city adopted an in-house system in the late 1980s and has used the system to prioritize maintenance and rehabilitation treatments for major streets the system ever since. It has also been used to acquire additional revenue for the city's overlay program. The Public Works Department showed the city council that if the city's streets could be fixed at a certain point on a normal pavement-deterioration curve, it would be more cost-effective than waiting until the street was in poor condition. The Public Works Department was able to secure an increase in a wheel tax, with all proceeds devoted to the overlay program. The wheel tax is charged when the vehicle registration is paid yearly in the city of Omaha. This additional revenue could not have been generated without the pavement-management system.

Since few other local agencies Nebraska were implementing formal pavement-management systems, the State Department of Transportation (DOT), working with MPOs and the T² Center at the University of Nebraska, developed and sponsored a one-day training class on pavement-management to educate local agencies on the benefits. The class was taught in the State's eight DOT districts and was based on a course sponsored by the FHWA and Local Technical Assistance Program, "Pavement and Road Surface Management for Local Agencies." In the course of the statewide one-day classes, local agencies asked the T² Center for assistance in implementing pavement-management systems. The T² Center evaluated different software options in late 1995 and in 1996, the T² Center adopted Road Surface Management System. The T² Center plans to train local agencies from around the State on how to use the RSMS software. Although the ISTEA pavement-management requirement has been rescinded, the Nebraska T² Center is committed to assisting local agencies.

Contact in Nebraska:

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Iowa

The State of Iowa took a cooperative approach in attempting to implement the ISTEA local agency pavement-management regulation prior to the suspension of the rule in November 1995. The Iowa Department of Transportation (IDOT) developed a project to plan, implement, and operate a statewide pavement-management system. The project is being conducted by the Center for Transportation Research and Education (T² Center) at Iowa State University. In response to ISTEA, IDOT, together with a steering committee composed of representatives from cities, counties, regional governments, the T² Center, and the FHWA, felt that a statewide approach was key to the successful implementation of pavement-management at the local agency level. A survey of local agencies showed that few local agencies had a formal pavement-management system in place. Thereafter, the scope of the project focused on Iowa's Federal-aid eligible highways that are not part of the National Highway System. These highways comprise approximately 24,000 centerline miles. One of the first tasks of the steering committee was a work plan of activities for the development of the statewide pavement-management system. Not only was the pavement-management work plan submitted to the FHWA in September 1994 as mandated by the ISTEA requirement, but it has been used as a guideline for key milestones and dates when certain tasks are expected to be accomplished. An initial task identified in the work plan was development of the system design of the pavement-management system. Much discussion by the steering committee centered around the data needs of the eventual system. The steering committee felt that if the pavement-management system was too data intensive, it would not be useful or used. Therefore, the steering committee suggested that the design of the statewide system emphasize the use of the pavement-management system as a network planning tool, with actual project-level decisions made by the individual highway personnel in the local agencies. In this way, a minimal amount of data would need to be collected at the network level, and local agencies could quickly have a pavement-management system in place.

The T² Center has worked closely with all of the agencies in developing the work plan. The work plan includes not only the development of the system by the T² Center, but ongoing training after the system is developed. The T² Center training will be available to all cities, counties, and regional planning agencies in Iowa.

Although the ISTEA requirement has been suspended, the work plan developed for the project is still being used to direct the statewide pavement-management development. The time line for the project has slipped, but the State, cities, counties, and regional agencies committed to implementing the statewide pavement-management system.

Contact in Iowa:

Center for Transportation Research and Education-Omar Smadi, (515) 294-8103

Maryland

The T² Center in Maryland has been active in assisting local agencies in implementing pavement-management systems. It adopted the Road Surface Management System in 1993 and has conducted numerous training sessions around the State on the operations of the system and the general benefits of pavement-management systems. The T² Center is committed to ongoing training in the operation and continued use of the RSMS program.

One of the cities that has successfully implemented a pavement-management system with the assistance of the Maryland T² Center is Gaithersburg. Prior to implementing a pavement-management system, the city of Gaithersburg had no formal method of identifying streets for repairs. The city employed a subjective method, focused on fixing streets that were not necessarily cost-effective to repair.

In the adoption of a pavement-management system, the city staff made a presentation to its elected board, a key step in obtaining the support of the entire community. When the board approved the pavement-management system, they did so with the assumption that the city would be able to make more cost-effective pavement repair decisions. The board's assumption has proven true—the city has, in fact, been able to make more cost-effective pavement repair decisions. Gaithersburg has 68 miles of roads in its network, all of which have been entered into the RSMS database. The city uses the pavement-management system to identify streets that need reconstruction, overlays, and even those that need to be crack sealed.

The city has adapted RSMS to meet its needs. The city is divided into separate maintenance divisions. With the pavement-management system, the city can determine the mileage in each division; the type of treatments needed in each division; and the amount of money necessary to fix all of the streets in each division. The city has also used the pavement-management system to test different strategies for its overlay program. The RSMS software came with a set of default treatments and costs for the decision tree procedure. The city modified these to reflect the actual treatments and costs for its agency. The city has also used the system in areas other than those originally anticipated. Its snow routes and recycling programs are identified in the pavement-management-system database and this information is used by other public works staff.

The city has changed its entire street and road operations through the use of the pavement-management system. Prior to implementing the system, the city employed a worst-first method of prioritization. The pavement-management system allows the city a method of prioritization that also takes into account average daily traffic, the age of the pavement, and the actual pavement condition, which is generated from the pavement-condition survey required by RSMS.

Gaithersburg is one of a growing number of local agencies in Maryland that has successfully implemented a pavement-management system through the assistance of the T² Center. Despite the suspension of the ISTEA requirement, the city of Gaithersburg and the T² Center in Maryland are committed to promoting the use of pavement management.

Contacts in Maryland:

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West Virginia

Prior to ISTEA, few local agencies in West Virginia had implemented a pavement-management system. The West Virginia Transportation Technology Transfer Center saw there was a need for assistance and adopted the Road Surface Management System developed by the New Hampshire Technology Transfer Center. The West Virginia T² Center worked with other T² Centers in the region, notably Maryland and Delaware, to develop a number of training classes on the use of the RSMS program for local agencies in West Virginia. Cooperation between the T² Centers in this region was very important in implementing RSMS, as it allowed one State to gain experience and knowledge from T² Centers in other States. Training and ongoing support is a key element in the successful implementation of any pavement-management system. Having other T² Centers nearby to assist in teaching classes and answering questions about the software and other pavement-management activities made it easier for the West Virginia T² Center to successfully implement RSMS.

The city of Weirton is one of the local agencies in West Virginia that has implemented RSMS. The city has a population of 22,000 and is responsible for maintaining 90 centerline miles of roads. Prior to implementing RSMS in 1995, the city used a subjective method of selecting streets for repair. City staff would drive the streets every year to identify the streets that needed repair and those that could wait for future repair. The city was assigned a set budget by the board each year and streets were selected for repair based on the city staff's windshield. As soon as the city reached the budget apportioned by the board, no additional streets were placed on the maintenance list. The city repaired streets that were in poor condition and allowed streets that were in good condition to deteriorate to the point where only a major rehabilitation, or total reconstruction, were viable fixes. With a budget that never exceeded \$50,000 a year, it was hard to keep up with the repair of streets in poor condition let alone develop a more cost-effective approach to street repair.

In 1995, the city implemented the RSMS program with the assistance of the T² Center. For the first time, the city had a condition rating for every street in its network and the ability to develop a budget for how much it would cost to fix every street in its network. This was achieved through use of the budget and strategies section of the RSMS program. The city developed its own strategies and costs and realized that in order to maintain the street and road network in Weirton, a larger investment of money was needed. City staff made a presentation to the city in January 1996. The presentation included the key concepts of pavement management, as well as how the city was trying to employ a more cost-effective method of pavement repair selection, allowing them to spend taxpayers' dollars more effectively. As a request of the presentation, the board increased funding

for the road program to \$210,000. The city is currently using the RSMS program to determine where it can best spend the additional dollars to maintain its road network.

Although the city of Weirton is in the early stages of implementing a pavement-management system, it is off to a successful start. Even with the suspension of the ISTEA requirement, the city is committed to the continued use of its pavement-management system.

Contact for West Virginia:

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City of Weirton-Terry R. Weigel, (304) 797-8543

Virginia

A unique situation exists in the State of Virginia with regard to the maintenance of roadways in cities and counties. Each of the nine Virginia Department of Transportation (VDOT) districts is responsible for maintaining roadways on the Federal-aid network that runs through most cities and counties in the State. Even with this arrangement, cities and counties have found it necessary to implement pavement-management systems for the roads that are not maintained by the State. For example, Virginia Beach and other local agencies have been operating formal pavement-management systems for close to a decade. With the passage of the ISTEA requirements in 1991, the State and the Virginia Transportation Research Council (T² Center) began to work closely with local agencies. They first taught a pavement-management class to local agencies in 1992. After the class was completed, they surveyed the local agencies in the State to assess which agencies had pavement-management systems in place. At the time of the survey, nearly half of all local agencies had some type of pavement-management system. (Many of the local agencies were using VDOT's pavement-management system with the assistance of the State, which performed the data collection and reported the information back to the local agency. The local agency would then reimburse the State for the services provided).

In 1995, VDOT sent a letter to all local agencies in the State soliciting their interest in a VDOT-supplied pavement-management-system software package. VDOT is implementing the Pavement-management Systems, Inc. Super PMS 2.0 for Windows in the State, and had been working with Pavement Management Systems, Inc. to determine if a slightly modified pavement-management system could be a viable alternative for local agencies. More than a third of the local agencies in Virginia responded to the solicitation. Roughly two-thirds of those that responded indicated their interest in tying in to the VDOT pavement-management system. The remaining third were conditionally interested and needed more information. VDOT continues to work with the local agencies even though the ISTEA requirement was suspended.

Although VDOT is continuing to work with local agencies, the agency will not cover the costs for the local agencies if they decide to adopt the modified VDOT pavement-management system. The local agencies will have to supply their own hardware. Training for the specific pavement-

management-system software will be provided as needed. The T² Center for Virginia will also provide pavement-management training for local agencies as soon as the details are worked out.

Despite suspension of the ISTEA requirements, Virginia DOT continues to work with a group of local agencies to either convert an existing pavement-management system or begin to implement a modified VDOT pavement-management system. This type of cooperation will enable the local agencies, many of which had never implemented a pavement-management system, to cost-effectively prioritize future street and road projects.

Contact in Virginia:

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Wisconsin

Many local agencies in the State of Wisconsin have been using pavement-management systems since the late 1980s, primarily as a result of work conducted by the Wisconsin Transportation Information Center (T² Center). In 1987, the T² Center developed a pavement-rating procedure called PASER with the assistance of the Northwest Regional Planning Commission. (The entire pavement-management system now used in Wisconsin is called Roadware. The PASER rating system continues to be used in combination with Roadware.) Local agencies in Wisconsin have used this rating procedure ever since.

The T² Center conducts training sessions throughout the State, working with Regional Planning Agencies, local agencies, and even an asphalt contractor that uses the program. The asphalt contractor has implemented the PASER program for many of the local agencies with which it does business in Wisconsin. This is a great example of a cooperative effort between public agencies and private enterprise.

Another example of cooperative effort is the T² Center's ongoing effort to rewrite the entire PASER pavement-management program. This rewrite is being done with the cooperation of the Wisconsin Department of Transportation and the Federal Highway Administration. It was brought in response to the ISTEA regulation. Many of the users of the original PASER program are also assisting in the rewrite of the program. Even though the ISTEA regulation has been suspended, the rewrite of the program continues. Many of the users of the PASER program recognize the benefits they have already derived from its use and believe the rewrite will only improve the system.

Jackson County first implemented the PASER program in 1992. The county's interest in implementing a pavement-management system was motivated by the need for an assessment of the condition of its entire roadway system. The county also needed a less subjective method of selecting streets for repair. Prior to implementing PASER, the county prioritized streets through a

windshield survey conducted by county employees. The county highway department made a formal presentation of the PASER program to the county board, highlighting the benefits of a roadway-management system. The presentation was intended to alert the board of the county's decision to adopt a more cost-effective approach to street and road repair selection, as well as to educate the board on pavement-management-system concepts. This was a very important step because when it came time to present the budget results from the PASER program, the board was able to focus on the cost to repair the streets.

In 1992, Jackson County surveyed its entire street and road system and presented an "Asphalt Surface Evaluation and Rating Report" in November. The report focused on the condition of the roadway network and evaluated potential cost estimates for each anticipated treatment on segments of roadway. The county used this information to help develop a Six-Year Highway Improvement Plan, which the board adopted in December 1993. The plan called for an increase in the number of roads to be repaired, from 7.0 miles a year in 1994 to 12.0 miles a year in 2000. The increase in the number of miles projected to be fixed is possible through an increase in revenues devoted to roadway improvements. In 1991, the county received \$250,000 for pavement repair. In 1994, the county received \$775,000. The initial condition report for the county developed in 1992 documented the status quo for the county supervisors and enabled them to understand the consequences of not funding their roadway system. Without PASER, the county could not have achieved these results.

The East Central Wisconsin Regional Planning Commission, the MPO for the Fox Cities and Oshkosh Urbanized Area, implemented the PASER and Roadware programs in 1995 on all functionally classified roads in its region. A staff member completed the condition evaluation, which included 293 centerline miles of roads eligible for Federal funding under the original ISTEA regulation. The MPO intends to assist local agencies in its region with implementation of the PASER/Roadware system on all other local roads in the region. The MPO also plans to provide on-site technical support and limited training to the local agencies as needed. Despite the suspension of the ISTEA regulation, the MPO remains committed to assisting local agencies in its region.

With the development of the PASER/Roadware program, the Wisconsin T² Center has provided numerous local agencies with the tools to help them spend their pavement repair dollars more cost-effectively. Even with the suspension of the pavement-management requirement, the T² Center is committed to assisting MPOs, local agencies, and private consulting firms in implementing pavement-management systems.

Contacts in Wisconsin:

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Jackson County-Michael Hemp, (715) 284-0233
East Central Planning-Walt Raith, (414) 751-4770

Minnesota

Local agencies in the State of Minnesota have been using pavement-management systems successfully since the early 1980s. Ramsey County developed its own system in 1981 and has been using it ever since. The county developed the original program on a Lotus spreadsheet, which it still uses today. The spreadsheet can easily be updated and modified to include new developments in pavement management. The county initially developed the system to track the performance of individual segments over time and devise a less subjective method of pavement repair selection. The county public works department has used the pavement-management system to develop its yearly street and road repair program since 1982.

Through the use of the pavement-management system, the county public works department has developed a good rapport with the county board. During the last 15 years, the county has made a number of presentations to the board. Frequent presentations are necessary, as the make up of the board changes each time new elected officials are voted in. In the most recent major board presentation, in 1993, the county was able to present significant findings of the pavement-management system. The overall condition of the county's roadway system has improved from an average of 68.5 in 1984 to 88.2 in 1993. (Ramsey County uses a condition index from 100 to 0, where 100 is excellent and 0 is poor.) The total backlog of pavement needs dropped from \$23 million in 1987 to \$8.7 million in 1993. In 1987, annual springtime axle load limitations were necessary on nearly 40 percent of county roads. By 1993, such limitations had declined to roughly 21 percent. The aged condition of roads in Ramsey County stood at 39 years in 1987. By 1993 that had dropped to 31 years. Lastly, the ride quality of 43 percent of the county roads had been rated as fair to poor. In 1993, this number had been reduced to 21 percent.

These achievements can be attributed to the county's pavement-management system. The county quantified certain pavement-related information at first to establish a baseline. Over the course of 15 years, the county was able to show that a combination of fixing the worst streets while maintaining some of the better streets contributed to a more cost-effective expenditure of pavement repair revenue.

The city of Golden Valley first implemented a pavement-management system in the early 1980s. In 1993, the city converted its existing program into Pavement Management Systems, Inc., a program for local agencies. Golden Valley has a population of roughly 21,000 and is responsible for 120 centerline miles of roads.

A Minnesota State statute enables municipalities to make public improvements such as street improvements, including resurfacing, grading, etc. The statute allows municipalities to assess all or portions of the costs of any improvements to property owners based on the benefits received from the project. This type of statute is common in other areas of the United States and is more commonly known as a Special or Benefit Assessment District. After receiving the results from the pavement-management program in 1993, the city's public works staff realized they had a large

number of roads that were in good condition, but many roads in need of reconstruction. With no means of financing the repair of the roads in need of reconstruction, the city considered using a special assessment district to pay for all reconstruction projects identified in the pavement-management program.

Realizing it would not be easy to persuade the residents of the community that a special assessment district was necessary, the city developed a comprehensive public information campaign including newsletters, a formal policy statement on the pavement-management program in Golden Valley, and a policy statement on the formation of a special assessment district. In the special assessment policy statement, the city explained what streets it proposed to fix and what it did not plan to fix. For instance, the special assessment district was to include all reconstruction for streets, but all seal-coating repairs were to be accomplished with available general fund revenues.

The city council approved the special assessment district in 1995. The pavement-management program was a key element in documenting the need for the additional dollars the city required for its street and road program. The special assessment district is for ten years. During that time, the city intends to reconstruct the streets identified by the pavement-management system as needing work. Funding for the special assessment district will enable the city to bring all of its streets up to an excellent standard and allow them to apply an aggressive preventative maintenance program on the streets that have been reconstructed.

Ramsey County and the city of Golden Valley are only a couple of the local agencies in Minnesota that have successfully implemented pavement-management systems. These agencies are committed to the use of the pavement-management system even though the ISTEA requirement has been suspended. They are reaping great benefits as a result.

Contacts for Minnesota:

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Illinois

Local agencies in the State of Illinois have been using pavement-management systems ever since the PAVER system was made available for local agency use in the early 1980s. The city of Champaign was one of the first users of the PAVER system, and was assisted in implementation by ERES, Inc. Since that time, other agencies have implemented other pavement-management systems as well. For example, the city of Crystal Lake, a growing suburb west of Chicago, hired ERES Inc. to assist it in developing a pavement-management program in 1993. The city wanted a more formal pavement-management system to help in spending taxpayers' dollars more cost-effectively. Prior to implementing the Decision Support System (DSS), the pavement-management system developed by ERES, Inc., the city selected streets for repair through a committee of individuals from its

maintenance and engineering departments. The condition of underground utilities drove most of the city's pavement repair decisions.

The city implemented the pavement-management program as part of a larger Master Transportation Plan. In addition to needing a pavement-management system to assist in making more cost-effective pavement repair decisions, the city wanted to be able to track the performance of both the existing roads as well as new roads in the city's ever-expanding roadway network. The city has a population of 35,000 and is responsible for 150 centerline miles of roads.

When the city first implemented the pavement-management system, the pavement distress evaluation was conducted by Pavetech using automated equipment. The city has used this information to develop its pavement repair list for the past three years. In addition, the city produces a list of candidate projects every year using the pavement-management system. The list is then reviewed by city staff and changes are made to package sections that are close together geographically. Individual sections might also be removed due to utility work and rescheduled for the following year. On average, 90 percent of the list generated from the pavement-management system is actually repaired.

Early on in the process the council determined that all decision making on street and road repairs would be made by the city's technical staff. Because the pavement-management system was implemented as part of a larger Master Transportation Plan, the city had already accepted the concept of pavement-management as beneficial. Champaign has found the pavement-management program easy to adapt to its own specifications. The city has modified decision trees to reflect current treatments and costs; the deterioration curves were based on its specific soils and traffic counts, and the city had ERES, Inc. integrate a mapping feature to include all of its roads in the network. Overall, the program has improved the city's maintenance practices, and the city plans to explore other ways in which the pavement-management program can assist in spending taxpayer dollars more cost effectively.

The city of Evanston implemented a pavement-management system in 1988, with Infracon hired to implement the PAVER system. The city has 137 centerline miles of roads and a population of 73,000. During the original implementation, the city was interested not only in having a visual/walking survey done on the road segments, but also in conducting Non-Destructive Testing (NDT). The city was interested in defining structural curves from the NDT information, which would be used as part of the development of a pavement maintenance list for each year.

Since the initial implementation, the city has conducted a number of additional visual/walking surveys on its road network. On average the city performs a complete resurvey every three years. Along with the resurvey, any treatment placed on a city street is added to the database.

Evanston uses the pavement-management program as a network planning tool. It uses the pavement condition index generated by the pavement-management program to place streets in a certain treatment or condition category range. For instance, any street with a PCI of less than 50 would

qualify for resurfacing. Any street with a PCI greater than 70 would be assigned to the maintenance department for possible crack sealing or a skin patch. After a street is placed in a certain condition category, additional criteria are evaluated to determine if the street should be placed on a pavement repair list. These additional criteria can include movement of utility structures underneath a roadway, and routine utility maintenance on telephone and cable lines, waterlines or sewers, etc.

Adopting the pavement-management program has enabled the city to develop a long-range pavement repair plan to be used well into the future. It has not been able to provide the city with an overall infrastructure management system—one of Evanston’s original goals in 1988—but the pavement-management program has improved the city’s project selection for pavement repair and allowed the city to develop a pavement repair planning horizon much longer than one year.

Contacts in Illinois:

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City of Evanston-Jim Tonkinson, (847) 866-2956

Ohio

Local agencies in Ohio have been using pavement-management systems since the early 1980s. The experience of the city of Columbus and the township of Delphi provide examples of how local agencies have benefited from the use of pavement-management systems in Ohio.

Columbus implemented the Infrastructure Management System (IMS) pavement-management system in 1992. The city was interested in selecting streets for repair based on a more systematic approach than the two methods it had been using. The first method was to respond to citizen complaints. The second method was identification of streets for repair using a windshield survey by city maintenance workers.

The Columbus public works department (DPW) is responsible for roughly 2,000 centerline miles of roads used by a population of 685,000. By the summer of 1994, all 2,000 centerline miles of roads had been entered in the program. The city has changed its pavement repair prioritization scheme since the pavement-management system has been in place. The initial list is produced using the IMS pavement-management system. The list is then passed on to different affected departments within the city. Agreement is reached on which streets to repair and which to defer from the original list. At present, 50 to 60 percent of the projects on the original prioritized list are selected for repair.

Columbus has also used the program to secure additional revenue for the street maintenance program. By using the pavement-management system, the DPW has been able to secure an additional \$2 million a year for street resurfacing for 9 years. The city DPW was also able to secure a large percentage of bond measure recently passed in the city. The measure was for a total of \$225

million. Of that amount, the DPW engineering section was able to secure \$98 million. Much of this additional revenue is earmarked for resurfacing and reconstruction projects. Without the pavement-management system, the DPW would not have been in a position to compete for the additional revenue that was available.

The city DPW made a number of presentations to the city council to alert them of the state of the road system in Columbus, and to educate them on the use of pavement-management principles. It was through these presentations that the board was able to understand the city's needs and realize that implementing a pavement-management system was a more cost effective method of spending taxpayers' dollars.

At present, the city is able to fund a large group of deferred maintenance projects through the passage of the bond and the additional revenue garnered for resurfacing. However, the city has also implemented an aggressive crack seal and slurry seal program to maintain the condition of roads that have recently been resurfaced or reconstructed. Though its pavement-management program is in the early stages, Columbus has successfully used the program to alter its pavement repair prioritization selection, secure additional revenue for the city's resurfacing and reconstruction program, and implement a cost-effective preventative maintenance program to maintain the condition of streets that were recently resurfaced or reconstructed.

The township of Delphi developed its own pavement-management system in 1983. The township has 53.4 centerline miles of roads and a population of 31,000. The program was implemented because although the township staff believed its roads were in poor condition, they had no way to quantify this subjective opinion to the council and the township's residents. Through the implementation of the pavement-management system, the township staff were able to show the council that the roads were in poor condition. This information was used to secure a \$400,000 a year road levy in November 1984. The levy passed through a combination of public information literature sent to citizens and support by the township council. The road levy has been well received since it was first passed. It was set up such that voters must continually pass the road levy. It has never failed, with the last passage of the levy being in 1994. The revenue has been used to begin to fix the township's roads. After using the program for several of years, the township felt it needed a more sophisticated program than the one that it had developed, so the consulting firm, CTL, was hired in 1988 to implement a program. The township uses CTL's pavement-management system to identify streets to repair in their network on a yearly basis. Of the streets identified in the pavement-management system prioritized listing, roughly 95 percent are repaired.

The township also uses the program to secure additional revenue through an Ohio State grant program, which became available when an initiative known as Issue 2 passed in the State. Issue 2 funds are to be used for infrastructure improvements. The State divides the funds and distributes them among 19 districts. Each district determines the funding priorities in its region by scoring every project submitted. Over the eight-year span of the grant program, the township has received \$6 million to use on 38 separate street reconstruction projects. Without the pavement-management system, the township would not have been able to compete for the additional funds.

Comparing the percentage of poor to failed roads from 1984 to 1996 provides a measure of how successful the township has been in implementing a pavement-management system. In the 1984 survey of the townships roads, 56 percent were in poor to failed condition. In 1996, less than 8-percent of the townships roads were in poor to failed condition. After improving the network from more than 50 percent of the roads in poor to failed condition to less than 10 percent, the township is now aggressively implementing a preventative maintenance program to make sure its estimated \$43 million investment to replace all the streets in the township does not go to waste.

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Texas

Local agencies in Texas have been using formal pavement-management systems in their day-to-day operations since the mid-1980s. The experiences of the San Antonio metropolitan area, the Dallas/Fort Worth metropolitan area, the city of Austin, and Montgomery County with pavement-management systems show how such systems can benefit local agencies.

The metropolitan area of San Antonio has been involved in pavement management since the late 1980s when Bexar County hired the consulting firm of Carter and Associates to implement a pavement-management system. The county has a total of 1,200 centerline miles of roads. By September 1989, Carter had completed surveying 750 miles of roads and had trained the county personnel in surveying and using the system.

Prior to implementing a pavement-management system, the county had no systematic method of identifying projects for pavement repair. The county would have individuals survey the roads using a subjective windshield method. Since 1989, the county has used the pavement-management system to identify projects for pavement repair. After Carter completed its contract with the county in 1989, the county surveyed its area's remaining 450 centerline miles of roads by the summer of 1990.

The pavement-management system not only assists in determining which streets to reconstruct and overlay in Bexar County, but since the inception of the program in 1990, an aggressive preventative maintenance program has been established to ensure that repaired streets are maintained at a lower cost. On average, 100 miles of streets have been seal coated in the last five years.

With the passage of ISTEA in 1991, the region, through the coordination of the San Antonio MPO, began to evaluate the ability to establish a region-wide pavement-management system to include all streets and roads on the federally aided system. A pavement-management committee was established, including representatives from Bexar County, the city of San Antonio, and several of

the smaller cities in the region. Acting as the lead agency for the region, the city of San Antonio applied for and secured a grant from the MPO in 1995 for the development of a pavement-management program. The city developed an RFP and after evaluating all of the proposals, hired the consulting firm of Braun Intertec in 1995 to develop the pavement-management system. When completed, the system will be used not only by San Antonio, but by many of the other 24 incorporated cities in the metropolitan San Antonio region. Bexar County also plans to integrate its pavement-management system into the new program.

One of the important features of the San Antonio pavement-management system is the ability to use the Texas Department of Transportation (TexDOT) method of distress collection to determine the overall condition. This feature was added after the contract had been signed with Braun Intertec. The program will enable San Antonio and the other communities in the region to use the surveying method used in the original Braun program, but will also provide a TexDOT condition score from the same distress evaluation. This feature of the regional pavement-management system will allow for a direct correlation of projects being evaluated for funding in the regional and State Transportation Improvement Programs.

When ISTEA passed in 1991, the North Central Texas Council of Governments (NCTCOG), the MPO for the Dallas/Fort Worth Metropolitan area, was not actively involved in assisting local agencies with pavement management. Responding to the ISTEA mandate, the NCTCOG formed a pavement-management task force in 1993. The task force was composed of representatives from local agencies in the Dallas/Fort Worth area, as well as staff from the NCTCOG. The NCTCOG wanted to explore what role its members could play in the implementation of pavement management.

Through the task force, a pavement-management system survey was sent to all of the local agencies in the region. The intent of the survey was to gauge the general experience of local agencies with pavement management and to document existing systems. Of the more than 100 agencies in the region, 70 returned surveys. Results indicated that 31 different types of pavement-management systems were in use in the region. In general, the systems were developed in-house with a variety of levels of sophistication. Using the data from the survey, the NCTCOG task force was able to develop an outline of the region's typical pavement-management system. In addition, NCTCOG evaluated other pavement-management systems in the United States and identified the existing or planned pavement-management methodology used by other MPOs in the United States.

The review of other pavement-management systems nationwide provided a good perspective on the types of data considered important to collect for pavement management. Using the information from this analysis as well as data from the local survey, the task force recommended the minimum data collection requirements considered basic to making a pavement-management system functional and beneficial. The analysis also identified the essential components of a network-level pavement-management system. Using this information, the task force recommended five principal components for any pavement-management system. To allow the agencies flexibility and to recognize that many local agencies had individual needs beyond the five components, the task force

allowed that other features could be included.

In March 1995, the NCTCOG published its findings in a report entitled *Pavement-Management Systems Evaluation Report*. The NCTCOG report identified four distinct regional pavement-management alternatives. The alternatives ranged from the State collecting all street and road data, to the MPO developing and supporting a pavement-management system, to all local agencies selecting a system that met the minimum requirements established by the task force and providing the data to the MPO, who in turn would develop the Transportation Improvement Program. With suspension of the ISTEA management system component, the NCTCOG plans to provide a list of available pavement-management software to those cities evaluating implementation of a pavement-management system. NCTCOG has deferred a decision concerning the provision of additional pavement-management support and training for the region's local agencies.

The city of Austin has used a formal pavement-management system since 1991. In that year, the city hired Pavement Management Systems, Inc. to develop a program that would allow the city to select streets for repair through a more cost-effective method. Prior to implementing the pavement-management system, Austin used a subjective method of selecting streets for repair. City staff would perform a windshield survey every year and select streets for different maintenance options. A complete survey of Austin's 1,965 centerline miles of roads was completed in 1993 by PMS, Inc. Since that time, the city has used the pavement-management system to determine which streets to repair. A prioritized pavement repair list is generated from the pavement-management system. This list is reviewed by city staff and refined by engineering and maintenance staff.

In 1993, the pavement-management system's budget estimates indicated that in order to maintain the current condition, the city would have to spend \$14 million a year. At that time, the city was spending \$10 million a year. The report also identified a \$50 million backlog of reconstruction projects. With this information, the city began to build upon the revenues it already had in place for street and road repair. In 1992, Austin passed a 1-cent transportation tax for public transit. The Austin Department of Public Works was able to show that buses damage local roads at a higher rate than automobiles, and was able to secure a commitment of \$40.1 million over a 10-year period from the transportation tax. The city is also evaluating other pavement financing options. With the budget results from the pavement-management system, the city is able to better compete for available revenues.

Montgomery County implemented a computerized pavement-management system in 1992. After evaluating a number of different packages, the county selected the Metropolitan Transportation Commission's (MTC) program. The county has 2,242 centerline miles of roads and is divided into four precincts. The county decided to implement a pavement-management system to select streets for repair through a more systematic approach than the windshield survey method it had been using.

The county implemented the entire system on its own. Its staff hired a retired TexDOT employee to inventory the system and to perform the condition survey. Since 1994 when the survey was

completed on the entire network, a prioritized list of candidate sections for repair has been generated by the pavement-management system. The prioritized list is divided by the four precincts. Like most counties in Texas, revenues for street and road repair are derived from a road and bridge tax collected through vehicle registration. Each of the four precincts receives roughly a quarter of the road and bridge funds annually. The county reviews the prioritized list and makes modifications when appropriate. The county's staff has yet to use the program to request additional revenue, but believe they are in a good position to request funds if the need arises. Currently, the county is using the pavement-management program to spend available pavement repair revenues in a more cost-effective method.

Even with the suspension of the ISTEA pavement-management requirements, local agencies and MPOs are continuing to use the programs to their benefit. As each local agency uses and adapts its pavement-management system to local conditions in Texas, they provide a more cost-effective method of selecting street projects than in the past.

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City of Austin-Edward Poppitt, (512) 440-8444

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Oregon

Local agencies in the State of Oregon have been successfully implementing pavement-management systems since the early 1980s. One of these local agencies is Marion County, which began to evaluate computerized pavement-management systems in 1985. In 1986, the county selected the Metropolitan Transportation Commission's pavement-management system. At that time, the county hired the consulting firm of Austin Research Engineers (ARE, Inc.) to assist with its initial survey and bring the county to a point where it could use the information on a daily basis.

Since the initial survey was conducted, Marion County has been responsible for maintaining the entire program. Marion County has used the system in many ways to improve its pavement maintenance practices. The county has improved communications between different departments within the county and its customers. The engineering department staff has worked closely with the maintenance department on a yearly basis to prioritize pavement projects within known fiscal constraints. The pavement-management system produces an initial listing, which is then discussed in a group with all interested parties present. The county produces a five-year list of projects it will perform if it receives all available pavement revenue. When a citizen calls to ask the county when

their street is to be repaired, the county refers to the five-year list. This list has proved an invaluable tool to improving communication with the customer.

Six years ago, Marion County believed there was a better method of collecting distress data than using a pencil and paper to record each distress. Consequently, the county developed an interface with a Grid Pad to enter all distress data on a pen-based, handheld computer. County staff would collect the distress information on the handheld computer and transfer the data to a personal computer back at the office for further processing. The county calculates that it has saved hundreds of person-hours annually with this pavement-management innovation.

Since the Marion County has almost ten years' experience with the system, it has assisted other cities and counties in the State of Oregon upon request. Small cities in the county have obtained assistance, as has Multnomah County, the county surrounding the Portland metropolitan area. Marion County is a strong promoter of pavement-management systems throughout the entire State of Oregon.

Marion County has also been a leader in trying to establish a statewide pavement-management user group. The idea for a user group was first discussed in 1993. The group recently met for the first time through the coordination of the Association of Oregon Counties (AOC). The AOC represents the interests of all counties in the State, and provides technical support to the counties. The user group has invited all agencies that use a pavement-management system in Oregon to attend the bimonthly meetings. The meetings are held all over the State to accommodate the geographical barrier of the Cascade range. Oregon has been working closely with local agencies in the State of Washington, who have had different types of pavement-management user groups for nearly a decade.

To encourage counties in Oregon to use pavement-management systems, the AOC adopted a policy in 1994 to support the MTC pavement-management system for its clients. The AOC provides an entire Road Information System (IRIS) to the counties, and the MTC pavement-management system has been integrated into IRIS. The AOC has modified the MTC system and is now working on a Windows-based system for its clients. The AOC has been working with MTC to ensure that the new Windows program is consistent with the original program. The MTC will benefit from AOC's modifications to a Windows-based pavement-management system since MTC has yet to develop a Windows-based program. To date, 25 of Oregon's 38 counties have adopted the AOC-supported pavement-management system.

The AOC has provided training similar to that which MTC provides in the San Francisco Bay Area. The AOC has its own pavement-management technical committee made up of representatives from counties throughout the state. The committee assists the AOC in developing the new Windows-based pavement-management system. The committee has suggested additions to the program that improve upon the original DOS-based MTC system. The AOC Windows-based program is presently in a beta testing phase.

Local agencies are continuing to use pavement-management systems in the State of Oregon even though the ISTEA requirement has been suspended. This is due to the fact that a number of local agencies in Oregon have been using pavement-management systems for almost a decade and have been influential in documenting the benefits of its use and promoting it throughout the State. In addition, the use of pavement-management systems has promoted coordination between local agencies in the state: Counties are assisting cities, and the statewide AOC is coordinating a pavement-management user group with the assistance of many representatives of local agencies throughout the State.

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Washington

Local agencies have been successfully implementing pavement-management systems in the State of Washington since the mid-1980s. But it is not an individual agency that is the success story in Washington. The many local agencies working together have formed the successes. Since the late-1980s, a group of local agencies has met on a statewide basis to improve pavement-management methods.

A study was performed for the State in the mid-1980s that showed that the Washington State Pavement Management System (WSPMS), used by the Washington State Department of Transportation (WSDOT) since the mid-1970s, could be modified to a local agency version. The University of Washington began this project in 1987. A local agency committee made up of representatives from cities, counties, and the State, assisted in the direction of the project. By 1988, the first version of the modified pavement-management system for cities and counties was in operation.

The first statewide pavement-management user group was established through the initial committee. The first group called itself the North West Pavement-Management Users Group. (NWPMUG) The group met to develop and continue to refine the original software system produced by the University of Washington. When the project ended and the software was taken over by Measurement Research Corporation (MRC), a consulting firm, the NWPMUG continued to meet bimonthly. The meetings centered around the use of the software, but individuals from other consulting firms and public agencies were invited to speak on subjects ranging from automated distress collection to appropriate maintenance treatments and when to apply them. The group also worked with the State to standardize the condition rating procedures being employed. The result of this work was a *Pavement Condition Rater's Manual*, still used by local agencies in the State today.

The NWPMUG tried to meet on the east side of the Cascade Mountains at least annually to allow local agencies on the east side of the State to participate in the group. Pavement-management systems proliferated in the State, due in part to a State regulation that made it mandatory for all counties to implement a pavement-management system in order to secure certain revenues. Though interest levels were high, it became more and more difficult for agencies on the east side of the Cascades to attend NWPMUG meetings five times a year on the west side. Therefore in 1994, the NWPMUG voted to disband and create a new users group that divided the State into five regions. Three of the regions were on the west side of the State and two were on the east side. Each of the regions formed an important component of the new group that was named the Northwest Pavement Managers Association (NWPMA). The NWPMA also recognized the importance of technical subcommittees. Five subcommittees were established, with membership determined by the interest of individuals from around the State. The subcommittees include one devoted to automated data collection. This subcommittee and local agencies from the State of Oregon worked together to evaluate current methods of automated data collection as it relates to pavement distress.

Each region of the NWPMA has elected a chairperson responsible for setting up the bimonthly meetings in the region. Each chairperson is elected from their region and sits on an Executive Board for the NWPMA. Each of the subcommittees has an elected chairperson who also sits on the Executive Board. The Executive Board develops the agenda for two annual statewide meetings. An annual conference in the fall, alternating between the east and west sides of the Cascades, is one of these conferences. Sessions at the conference concern how agencies implement their pavement-management systems, and include topical sessions related to pavement management. There usually are sessions for individuals who have just begun to work in pavement management, as it is common to have a number of new attendees at the statewide conference.

One of the key benefits arising from the statewide user group is the information sharing that occurs between the representative local agencies. If an agency has been successful in trying a new maintenance treatment, this information is shared at the statewide user group. If an NWPMA member agency finds a cost-effective solution to a pavement-management issue, it will want to share it with the others.

The NWPMA continues to impact local agency pavement-management issues in Washington. At present, the NWPMA is assisting the development of a new pavement-management manual requested by the user group to focus on how to use pavement-management results in day-to-day public works activities. The group is also assisting in a rewrite of the original *Pavement Condition Raters Manual*.

The NWPMA has been working very closely with both State and private vendors to achieve its successes. At the State level, the WSDOT TransAid Service Center has sponsored a number of the projects undertaken by the NWPMA user group. Also, the County Road Administration Board (CRAB) has offered its support to the group, including publishing a monthly newsletter and posting the newsletter on its Internet Homepage. MRC has also played a vital role in increasing the level of expertise in local agency pavement management by conducting pavement-management training

sessions and providing extensive assistance to the many local agencies in the State that use the Centerline pavement-management system.

Although the ISTEA pavement-management system requirement has been suspended, the NWPMA continues to thrive. The bimonthly meetings have increased in size since the beginning of 1996, and attendance at the annual fall conference is expected to be greater than in previous years. The NWPMA is also working closely with local agencies in the State of Oregon to establish a true Northwest Pavement Manager's Association.

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Summary

Throughout the United States, local agencies have been successfully implementing pavement-management systems to improve pavement repair practices since the mid-1970s. They have been able to use the information generated from pavement-management systems to:

- Acquire additional revenues for pavement repair activities;
- Spend existing pavement repair monies more cost-effectively;
- Develop regional and statewide pavement-management user groups to share information; and
- Improve communication between the traveling public, the elected board/council, and the different departments within the local agency.

The purpose of this section of the IPA assignment was to examine local agency success stories of both large and small agencies in the United States. This section of the IPA assignment is also intended to examine how MPOs and States were involved with local agency pavement management where they were active in the successes. The common thread between all local agency success stories is the desire to improve upon current pavement-maintenance practices. For this to occur, the successes happened over a period of time, not overnight. To achieve success in implementing pavement management, most of the individual local agencies interviewed believed that two qualities were necessary to achieve success: patience and the ability to continually communicate the pavement-management objectives. These qualities do not ensure success, but they make success easier to achieve.

The successes described in this section of the report are meant to showcase local agencies that have worked to promote the use of pavement management to improve their pavement maintenance practices. By documenting these local agency success stories, the FHWA hopes that further networking and cooperation can be stimulated between different local agencies in the country.

Train-the-Trainer Pavement Management Follow-Up

In the fall of 1994, the FHWA offered a two-day train-the-trainer course entitled “Pavement and Road Surface Management for Local Agencies” to the Local Technical Assistance (LTAP) Centers so that the Centers could teach the course as needed to locals. The course was developed for FHWA through a contract with Texas A & M University’s Texas Transportation Institute to assist local agencies in complying with ISTEA. The ISTEA required all Federal-aid roads to have a pavement-management system, with approximately one-third of all Federal-aid roads owned and maintained by local agencies. The class was taught in each of the nine regions nationwide and representatives from the local LTAP Centers and State DOTs attended, as well as the FHWA division and regional pavement personnel. Each of the participants received course materials and slides to take back with them to their States and teach the pavement-management class locally.

As part of the IPA assignment, assistance was provided to LTAP Centers that had specific questions about the class direction provided to those LTAP Centers that needed additional advice. During the discussions with the LTAP Centers, it became apparent that in the one- to two-year period since the “train-the-trainer” class was taught, the majority of Centers had integrated the original course into their normal course offerings. Of the 27 LTAP Centers that were visited during the IPA assignment or interviewed during a Road Surface Management Conference in Cincinnati in March 1996, 21 had used the course material to some degree in teaching pavement management to local agencies. Two of the other six centers are planning to use the material in upcoming courses.

Prior to attending the “train-the-trainer” course, some LTAP Centers had existing pavement-management system classes they offered to local agencies. In these states, the LTAP Centers used the “train-the-trainer” course materials to supplement and update their original courses. States such as New York and New Hampshire fell into this category. Other states such as California adapted existing pavement-management courses to use the course materials. In California, the LTAP Center developed a satellite setup in cooperation with CalTrans, to allow the class to be taught in every district in California. This proved very successful, as local agencies from around the State were able to attend a one-day class on pavement-management systems without traveling great distances.

Other states such as Oregon and Washington used the material to develop two-day classes that they offered to local agencies in their States. The two-day format allowed adequate time to answer course participants’ questions. These classes were targeted to first-time pavement-management system users, and were structured such that participants would work through a series of workshops. Participants designed their own pavement network by dividing a small map from the LTAP course materials into manageable pavement segments. Other State LTAP Centers condensed the two-day course into a one-day class taught throughout their States. In Nebraska, the LTAP Center, working with the State DOT and the division FHWA pavement engineer, taught a one-day class eight times in different areas of the State.

The course materials are also being used by other agencies and are being referenced in articles and research on local agency pavement management. In the fall of 1995, the Center for Urban Transportation Research part of the College of Engineering at the University of South Florida, published a manual entitled *Pavement-management Systems for Local Governments*. The CUTR used the course material from the LTAP class to assist in the development of the guide. The guide was developed to introduce pavement-management systems to those local agencies in Florida that needed assistance. The guide also provides additional resources on pavement management for local agencies, such as phone numbers of the State pavement-management engineer, the chairperson of the Transportation Research Board's subcommittee on local agency pavement management, FHWA contacts at the State and national levels, and a contact at the American Public Works Association (APWA). The publication provides excellent assistance to those local agencies in Florida that need information.

The FHWA course "Pavement and Road Surface Management for Local Agencies" has been widely used throughout the country. It is used quite frequently in LTAP classes and is referenced in local agency publications around the country.

LTAP Application in Pavement Management

The LTAP Centers and T² Centers that exist in each of the 50 states are in a unique position to offer pavement-management assistance to local agencies. When the ISTEA passed in 1991 and required that local agencies have a pavement-management system for all Federal-aid roads, including those under the jurisdiction of local agencies, the LTAP Centers were the logical entity to assist in training public works officials throughout the country.

Prior to ISTEA, a number of LTAP Centers, most notably in New Hampshire and in Wisconsin, had developed pavement-management systems for small local agencies. These LTAP Centers provided training to the local agencies. Other LTAP Centers had offered basic pavement-management system classes, as well as classes on effective implementation and continued use of pavement management. While there was no consistent pavement-management course offered, LTAP Centers that offered pavement-management courses were able to adapt the curriculum to the local environment.

The LTAP Centers share information and software with each other. The best example of this is the New Hampshire LTAP Center located on the University of New Hampshire, Durham campus. The New Hampshire Center developed the Road Surface Management System for local agencies in New Hampshire. The New Hampshire Center let other Centers in the country know that they had an easy-to-use software package that local agencies were successfully using. Prior to ISTEA, a small number of local agencies in Massachusetts were using RSMS with the assistance of the Massachusetts LTAP Center. Through an annual regional pavement-management conference in Region 1, and through various discussions between the LTAP Centers in each region, the success of the RSMS system became evident. Within Region 1, Maine, Vermont, New York, and Connecticut, LTAP Centers have provided different levels of support to the RSMS program since ISTEA passed in December 1991. LTAP Centers around the country have now adopted the RSMS program. At a user group meeting for RSMS in Cincinnati in March 1996, 17 State LTAP Centers sent representatives.

This type of cooperation continues between LTAP Centers within regions. For example, when the West Virginia LTAP Center decided to implement RSMS, they asked the Maryland Center to assist them in establishing a set of training classes and in assisting in teaching the courses. The Delaware LTAP Center has also played a role in cross training other Centers in the region.

Without the assistance of LTAP Centers, many local agencies using the RSMS program would not be able to afford to implement a pavement-management system. With the creation of LTAP Center pavement-management systems, LTAP Centers have been able to offer a low-cost pavement-management solution to many local agencies. Through software training and basic pavement-management courses, the LTAP Centers have been able to demonstrate the benefits of implementing RSMS. As a result, local agencies achieve a very high degree of success from its use.

Another LTAP Center that has developed a pavement-management system for local agencies is located in Wisconsin. The Wisconsin Center developed a road condition assessment program for local agencies called PASER in the State in 1987. As more and more local agencies began to use the program, the LTAP Center realized the need to develop a full pavement-management system to accompany the condition assessment tool it had developed. With the assistance of the State DOT and the FHWA, the Wisconsin LTAP Center has modified the PASER program to incorporate a computerized pavement-management system. The LTAP Center provides training to local agencies throughout the State on the use of the program. In addition, the Wisconsin Center assisted the Michigan LTAP Center when it expressed interest in adopting the program and using it for local agencies in Michigan.

The PASER/Roadware program is used extensively in Wisconsin. Many MPOs have adopted it to assess the condition of roadways in their regions. These MPOs have assisted smaller cities and townships with implementation. Counties in Wisconsin have also adopted the program. Many of the counties assist smaller cities and townships within their boundaries. One in particular allows the smaller local agencies to use its computers, since these agencies do not have computers of their own. Of special interest is the use of PASER/Roadware by an asphalt contractor. The contractor has provided some local agencies with information on the overall condition of their roads and how much it will cost to fix every street in their systems. The contractor also provides a prioritized listing of projects.

The PASER/Roadware system developed for local agency use by the Wisconsin LTAP Center is another great example of an LTAP Center providing a tool to assist in improving local agency efforts. The system is relatively easy to use and has widespread use throughout Wisconsin. Like the RSMS program, when the ISTEA pavement-management system requirement was suspended, the developers of the PASER/Roadware program continued to refine and promote the use of it in day-to-day public works activity.

In addition to providing inexpensive pavement-management software, the LTAP Centers provide training. Many LTAP Centers offer basic pavement-management courses as well as more advanced classes on the subject. The basic classes are designed for individuals who are new to pavement management or people needing a refresher class. The advanced classes focus on potential problem areas within a local agency as the agency implements a pavement-management system, as well providing refresher material on basic pavement management. The advanced class will also include subject areas that pertain to institutional barriers in implementing a pavement-management system. The courses evaluate how to make pavement-management budget presentations to elected boards or councils.

In addition to providing classes specifically dealing with pavement-management, many LTAP Centers provide other training. For instance, LTAP Centers have provided training to local agencies addressing when to apply pavement treatments and the best time to place them. Each LTAP Center also offers a large library of books and videos on pavement-related activities that local agencies may use as a resource. If one of the LTAP Centers produces a book or a video, it is not uncommon for

another LTAP Center to use it in a training class or make it available on loan to a local agency in its State. For instance, the Washington LTAP Center published *A Guide for Local Agency Pavement Managers* in December 1994. The book was written by a team composed of local agencies from the State of Washington, WSDOT staff, the LTAP Center, and a technical writer from WSDOT. The manual is a basic guide for individuals just starting out in pavement management. It was written for local agencies in Washington, but was sent to all LTAP Centers in the country as well as the American Public Works Association clearinghouse, which is associated with the LTAP Centers. Parts of the guide have even been used in pavement-management training in other States. LTAP Centers make the guide available to local agencies in their States through their libraries. Such information sharing between LTAP Centers benefits local agencies across the country and works to prevent the unnecessary duplication of effort and materials if something similar has already been published elsewhere in the country.

Although there is much information sharing between LTAP Centers in pavement management, not all of the Centers have the same level of expertise in the area. The level of expertise varies by State, with greater expertise usually occurring when someone on the LTAP Center staff has an interest in pavement management. LTAP Centers have been able to work with each other to bring in expertise from the private sector and from other LTAP Centers.

Throughout the United States, LTAP Centers have been assisting local agencies in implementing pavement-management systems. The Centers have developed pavement-management systems that are widely used around the country. The LTAP Centers offer a variety of pavement-related courses that are tailored to each of the States needs. The Centers share information with each other and have proven to be an invaluable group in assisting local agencies in implementing pavement-management systems.

Technical Assistance in Pavement Management to Local Agencies

Introduction

Another focus of the IPA assignment was to provide the local agencies visited with technical assistance. Most local agencies lack resources to assign one individual to be responsible for pavement management on a full-time basis. Many agencies assign more than one person to work on pavement management, but the number of person hours usually adds up to less than one full-time employee. Because of this lack of available personnel and resources, local agencies are continually looking for ways to improve their effectiveness. During visits to a handful of local agencies, technical assistance was provided to those that had specific requests. A number of additional types of technical assistance were also discussed that are currently unavailable to local agencies, but which might be useful in future pavement-management work. Some of the ideas suggested during the visits and important pavement-management issues for additional technical assistance are mentioned. The list below is not all-inclusive. Many of the ideas were grouped together. It should be noted that as agencies continue to use pavement-management systems their needs for technical assistance will change.

Available Pavement-Management Software

Each visit to a local agency focused on how the agency successfully used a pavement-management system in its day-to-day activities. Though it was important to visit as many agencies implementing different pavement-management systems as possible, the key to the visit was how the agency had successfully implemented the program. Even though many of the agencies had implemented a pavement-management systems, they were interested in seeing a list of other available software currently in use by public agencies from around the United States. Most of the local agencies requested the list with the intention of comparing the features of their current pavement-management system with those of other programs. Many local agencies whose software did not include a mapping system such as a link to a Geographical Information System (GIS) were especially interested in seeing what other systems were available with a mapping system. Most of these agencies had implemented modular pavement-management systems and would therefore be able to add a mapping or a GIS system. The information these local agencies requested was available, as a list of available software had been compiled for the FHWA "Train-the-Trainer" Course for LTAP Centers, held in Fall 1994.

Many local agencies were also interested in integrating their pavement-management systems into an infrastructure-management systems, which would include inventory and assessment applications for sidewalks, sewer systems, and other public facilities. In the past couple of years many local agencies have begun to implement such programs. In fact, there is now a tendency for local agencies to purchase an entire infrastructure-management system, which includes a pavement-management system component. Those agencies that had implemented only a pavement-management system felt that they were lacking a decision making tool that could provide them with better information concerning the expenditure of public works dollars. While this is not necessarily a pavement-management issue, it is an outgrowth of the benefits local agencies have derived from using

management systems. Local agency staff therefore assume that they should be able to achieve the same level of success with an infrastructure-management system as they accomplished with a pavement-management system if they can generate the same type of information. Unlike the list of available pavement-management system software packages, there is no such list comparing infrastructure-management systems. A couple of local agencies had already contacted their T² Centers for assistance in evaluating infrastructure-management systems, and other agencies were considering this option as well. At present, many local agencies rely on word of mouth from other agencies using infrastructure management systems to evaluate such systems.

Utility Cuts and Patching—Utility Coordination Councils

Throughout the United States, local agencies are greatly concerned about the damage caused by utility cuts in the driving roadway. There is, however, no sure-fire method that local agencies can employ to contend with utility cuts. Many local agencies have established Utility Coordinating Councils to better coordinate pavement-maintenance projects with work requiring utility cuts. The Coordinating Councils are usually made up of all agencies and companies that may dig in the public right of way. They meet on a monthly or quarterly basis to discuss what streets are going to be repaired and the frames. Local agencies bring their list of candidate projects for pavement-maintenance repair for a given year generated from the pavement-management system to the meetings. If, for instance, the local agency's water department was planning on replacing a mainline pipes under a street that the road maintenance department planned to overlay, the road department would delay its work until all other departments and companies had completed their work. This type of coordination has cut down on the number of newly paved roadways that have been cut into for another planned activity.

Utility Coordination Councils have cut down on the number of ill-advised utility cuts, but it does not address the problem that occurs if an agency or company does cut into a roadway after a new overlay or reconstruction is in place. A number of local agencies have developed street moratoriums prohibiting any agency or company from cutting into a street from anywhere between one and five years after the overlay or reconstruction. The moratorium usually includes a clause that allows a company to cut into a street in an emergency situation. In addition to the use of moratoriums, a number of local agencies have effectively implemented a sliding-cost-scale permitting process. For instance, if a company wanted to cut into a street paved six months previously, it would cost more than if the same street had been paved five years earlier.

Local agencies have been using moratoriums and Utility Coordinating Councils for more than a decade. They are not new ideas. However, their effectiveness increases with the use of pavement-management systems. Local agencies have been able to track the condition of utility cuts with their pavement-management systems. One agency became so frustrated with failure of repaired utility cuts that they circled each one in the city, using the pavement-management system as a guide. After circling the cut, the public works department placed the responsible agency's name next to it. The city claims that utility failures dropped dramatically from that point forward.

Regional agencies have also assisted local agencies in their areas to cut down on the number of utility

cut failures. A common complaint that inspired a couple of regional agencies to act was the fact that utility cut standards for compaction and utility back filling were different from one city to the next in the region. In an effort to combat this problem, a number of regional agencies have developed standards for utility cuts. While these standards are not mandatory, local agencies in each region are encouraged to adopt them.

Even though agencies and regional agencies around the United States have employed and adopted Utility Coordination Councils, moratoriums, and Standard Specifications for Utility Cuts and back filling, many have not. Utility cuts and their subsequent failures will only become a much larger issue in the next few years. The new telecommunications bill passed by Congress earlier this year allows all companies equal access to compete against one another. Thus, any telecommunications company may come into an area and install lines, cables, and wires. If a local agency has a moratorium in place or has a Utility Coordinating Council, it will be in a better position to negotiate with the new telecommunications company. If the company believes it is not being given equal access to compete, it can file a complaint with the Federal Communications Commission (FCC).

For those local agencies visited that did not have any utility policies in place, the *Highway/Utility Guide* published by the Office of Technology Application of the FHWA was suggested. It was readily available from their States' Technology Transfer Centers. Those local agencies that were not aware of the new telecommunications bill were given a copy for review. Discussions with regional agencies focused on the use of a regional utility standard and other roles the regional agency could play in utility policy.

Pavement Treatments and the Use of Preventive Maintenance

Another area of concern for local agencies is their need to assure they are aware of the most recent technology for improving their street and road maintenance practices. Many agencies that were visited were interested in how research performed by the Strategic Highway Research Program (SHRP) could impact their day-to-day activities. The agencies were mainly focused on the performance of different treatments, although many agencies had questions about the SHRP program products that are not pavement related. Literature was provided to the local agencies on the SHRP program and the specific products they were interested in. In addition, the regional nature of certain treatments was discussed.

Information and phone numbers were provided to local agencies that had specific questions about the performance of treatments not covered by SHRP. For example, one agency had a question about the correct application of fog seals. An agency visited the day before in the same region had successfully used fog seals the year before and was planning to establish a larger program based on that experience. The phone number of an individual in the agency as well as the phone number of a couple of other individuals who had recently tried fog seals were provided to the interested agency. This type of technology transfer is important both at the local and regional levels and shows the important impacts that a neighboring local agency can have if it experiences a successful pavement-treatment application. Such technology transfer can occur either through a regional or statewide forum and should be strongly encouraged at all levels.

When to use preventive maintenance as an effective treatment was a topic discussed with many local agencies. Many local agencies are applying sealcoats and have aggressive crack-sealing programs, but may be placing these treatments on pavements whose condition is well beyond the point on the deterioration curve where it would provide the maximum benefit. There have been many studies done on the effectiveness of preventive maintenance, some which discuss the most opportune point on the deterioration curve to apply preventive maintenance. These studies were offered to local agencies for review and discussion. Many of the local agencies understand when it was best to apply preventive maintenance, but have not been able to convince their boards that applying a treatment to a street in excellent condition is more cost-effective than repairing a street that is in worse condition. Local agencies have been effective at using a percentage of the total pavement repair budget for preventive maintenance, but the percentage is not as high as they would like. There is no literature addressing how to persuade a board or council of the need for preventive maintenance. This type of material would be of great use to local agencies throughout the United States.

Benefits of Curbs and Gutters

An issue that did not arise until a trip in May to Region 5 concerns the economic benefits of curbs and gutters from an engineering point of view. The staff of one city was having a very difficult time convincing its council of the long-term engineering economic benefits of curbs and gutters. It seems that the council had heard from residents in some sections of the city that they wanted to maintain the rural nature of their community and were opposed to curbs and gutters in certain areas. A couple of years ago, the American Public Works Association produced a pamphlet on the benefits of curbs and gutters. The city staff were aware of this pamphlet but had not been able to use it successfully. The city staff were more interested in a good engineering study that could be employed in discussion with the council.

Despite a thorough search of the Transportation Research Information System (TRIS), no thorough engineering study on the benefits of curbs and gutters was discovered. Phone calls were made to local agencies that had been visited previously to determine if they had ever encountered the problem that this agency was having. A couple of the local agencies had encountered some resistance from their councils regarding the placement of curbs and gutters. Although there was no consensus on how they convinced their councils to adopt curbs and gutters, each was asked if they could share their experiences with the local agency encountering difficulties. The two agencies were happy to share their methods.

This type of information sharing at the local agency level is important to the continued successful implementation of pavement-management systems. In the case above, a local agency was using information generated from a pavement-management system to make a case to construct curbs and gutters on city streets. The local agency was able to show that curbs and gutters were more cost effective than leaving the street without them. Other local agencies had experienced a similar issue and were willing to share their experiences. In an era fraught with dwindling training resources at the local agency level, this type of directed problem solving is a fast and inexpensive solution.

Deighton Tapes

From the start of the assignment, local agencies, State agencies, and T² Centers were offered pavement-management-system training tapes on a loaner basis. Two copies were continuously sent around the country and viewed. The reviews of the tapes were very good. However, many of the local agencies felt that the price to purchase the set, \$2000, was more than they had available in their training budget. The staff of many local agencies said that if the Federal requirement were still in place they would have more justification to convince their superiors of the need to purchase the tapes.

Joint Procurement of Pavement Materials

One question always asked in discussions with the local agencies was whether the agency bought materials for pavement repairs with adjoining agencies. This idea is not a new one. In simple economics, the more one buys of any one item, the lower the cost of that item. In order for joint procurement to work, local agencies must be able to plan their pavement-material purchasing in advance. This is achievable with a pavement-management system.

Many of the local agencies visited were aware of procedures through the State enabling them to purchase materials for a specific treatment at the same cost offered to the State. Also, many larger counties have procedures in place that enable smaller cities in their county to purchase materials through the county contract. These two sets of procedures are encouraging as local agencies have the ability to save pavement-maintenance-related dollars in purchasing materials. However, this type of activity is not as widespread as it could be.

Local agencies have not packaged or grouped similar pavement treatments, such as overlays, in their regions to establish a price for the treatment. There is a difference between being able to join a contract at a set price, which as noted above, many agencies have the ability to do, and having asphalt firms bid on an entire estimate of pavement materials. In areas of the country where this type of procedure was tried, the problems seem to be contractual. Each local agency has its own specifications for contracting for pavement materials. The money saved by joint procurement was less than the amount of time it took to develop the contract between the local agencies.

Local agencies interested in pursuing joint procurement contracts were given phone numbers of individuals that had tried to implement a regional effort. Little research has been done on local agency efforts at joint procurement or even steps to achieve successful implementation. With a pavement-management system, local agencies are able to plan the purchasing of materials for pavement repairs. From a regional perspective, joint procurement of pavement materials could offer local agencies another cost-effective solution in their use of a pavement-management system.

Pavement-Management on the Internet

As more and more people and organizations use the Internet, more information is available to view or "surf." Many local agencies have established "home pages" providing additional information for their residents and other interested persons. Many of the local agencies that were visited had established Internet "home pages" that included information on their pavement-management system.

Some local agencies had placed their five-year overlay and resurfacing plan on their “home pages.” If a resident wants to see when their street will be fixed, they may access their city’s “home page,” find the pavement maintenance five-year plan and locate their street. Local agencies have notified their residents that a “home page” has been established by mailing newsletters and other materials to their residents. Local agencies that did not have “home pages” and were interested in establishing them one were given information listing the available resource material on how to get started. The phone numbers of individuals that had established “home pages” at other local agencies were also provided.

The Internet has also become a valuable resource for researching pavement management. Numerous State Technology Transfer Centers have “home pages.” The Transportation Research Board (TRB) has a “home page” that allows for searches of the Transportation Research Information System. Many private consulting firms have “home pages” that provide information related to pavement-management systems. Those local agencies that have access to the Internet have found many of the Technology Transfer Centers “home pages,” and are using these resources for pavement-management-related information as well as other services provided by the T² Centers.

Local agencies find new pavement-management information daily through the many Internet search functions. Those that do not have access yet plan to obtain access in the near future. The Internet can provide a plethora of information for local agency pavement-management users. At the time there is no central group responsible for pulling together all of the available pavement-management resources to local agencies on the Internet. This issue may become moot in the next year, as the TRB subcommittee for local agency pavement-management may undertake this task. The issue was discussed at the 1996 annual meeting, though it must be noted that very few members of the subcommittee attended due to the winter storm that preceded the TRB meeting. The issue will be raised again at the 1997 meeting and the subcommittee may commit to pulling together all available resources for local agencies. This “Local Agency Pavement-Management Home Page” would offer centralized pavement-management resources.

One drawback of the Internet is access. The Internet benefits only those that have access to it. First, not every local agency has a computer. To overcome this problem, some State DOTs have offered to purchase computers and modems for every local agency in the State that does not already have one. Second, once a local agency establishes a home page, all residents in the community are not likely to have a computer at home to access the information. Another problem is that some smaller local agencies have computers that are not fast enough to access the Internet effectively. As the cost of high-speed computers drops, these local agencies should be able to purchase quicker machines. Despite these problems, the Internet is a powerful tool for local agencies that continues to become more useful daily.

Automated Data Collection to Collect Pavement-Distress Information

Many local agencies that have implemented pavement-management systems are very interested in trying to reduce the cost of collecting pavement distress information. These agencies realize that performing condition assessments is the most costly part of implementing and using a pavement-management system. Many local agencies have been approached by private consultants offering to

perform a condition assessment with automated or semi-automated equipment. There are few local agency studies that have evaluated automated equipment and automated data collection. However, the studies that exist were offered to those local agencies that asked for them. The studies that were done for State DOTs were also offered to the local agencies for review.

Initiation of Pavement-Management User Groups

Throughout the country, there are a number of regional and national pavement-management user groups. In discussions with local agencies, questions arose on how to get more information about the existing user groups and how to start one. The two most common types of pavement-management user groups in the country are those that are software specific and those that are not. The Micro Paver Group, a software-specific user group, meets at annual APWA meetings and one other time each year in Florida. The Northwest Pavement Manager's Association, a pavement-management user group in the State of Washington, is not software specific. Representatives from local agencies meet for regional bimonthly meetings around the State and meet all together every six months.

There are many benefits of establishing a user group. These benefits include: information sharing by local agencies; better methods of implementing pavement-management systems since users are at different stages of implementation; and support for other pavement-management users regardless of the software or procedures a local agency employs. Phone numbers were given to local agencies interested in obtaining information on establishing a pavement-management-system user group. Also, several papers were written for TRB and other conferences in the past discussing the benefits of user groups. These were provided to local agencies.

Summary

This section of the IPA report focuses on the technical support provided to local agencies during the assignment. It also discusses important issues and concerns faced by local agencies in implementing pavement-management systems today in the United States.

MPO Issues and Applications in Pavement Management

Introduction

Another main focus area of the IPA assignment was to visit metropolitan planning organizations around the country to provide assistance in implementing pavement-management systems in their regions. The visits also provided an opportunity to determine the extent of MPO involvement in pavement-management since the 1991 ISTEA management-system requirement. Prior to 1991, few MPOs were involved in pavement-management activities. However, under ISTEA, MPOs were charged with assuring States in implementing the management systems component of the law. MPOs were a most logical selection for the role, as ISTEA required that the regional planning organizations use the output of the management systems to help develop the Regional Transportation Improvement Programs (RTIP) or their regional equivalent.

With a much larger role, MPOs throughout the country have worked closely with State and local agencies to better define their role in assisting local agencies in their regions to implement pavement-management systems. One of the major benefits of the ISTEA provisions was that each regional MPO, working in cooperation with its State DOT and local agencies in its region, would be able to determine its role: ISTEA did not set guidelines for each region to follow the management-system component. Therefore, the type of assistance MPOs provided in the same State could vary from asking local agencies for output from their pavement-management systems to incorporate into their Transportation Improvement Program to providing pavement-management software and complete training. In some States, MPOs worked very closely with the private sector to develop pavement-management procedures for their regional local agencies.

Roles the MPO Can Play in Pavement-Management Implementation

Initially, many local agencies were resistant to the idea that the MPOs should be involved in pavement-management system activities. MPOs were normally seen as planning organizations that could offer very little technical assistance to local agency public works departments. In interviews with a couple of local agencies from around the country, this view is still held by a number of them. MPOs in these regions have a less-defined role than in other areas of the country.

MPOs have been successful in assisting in pavement-management during the past five years in areas of the country where they have worked closely with local agencies, with a mutual trust developing from of this continued dialog. This mutual trust is key to developing a rapport between the MPO and local agency. For example, the Metropolitan Transportation Commission (MTC), the MPO for the San Francisco Bay Area, encountered much resistance when it initially tried to assist local agencies in pavement-management implementation in the early 1980s. After a couple of years when it became clear to the local agencies that the MPO was assisting them in documenting their pavement repair shortfalls and using the pavement-management budget information to develop a regional pavement repair need, the local agencies began to trust MTC. MTC used the pavement-management budget information in its Regional Transportation Plan, as well as to help to secure additional State gas tax

dollars for local agencies on two different occasions.

The four MPOs in the State of Mississippi envision a role similar to the one MTC plays in the San Francisco Bay Area. As part of the IPA assignment, a one-day training session sponsored by the Mississippi Department of Transportation (MDOT) and the FHWA was conducted in Jackson, Mississippi. The training session focused on the role the four MPOs could play in assisting local agencies in implementing pavement-management systems. Each of the four MPOs had adopted the Road Surface Management System software was initially developed by the New Hampshire Technology Transfer Center. The T² Center in Mississippi will assist the MPOs in training the local agencies in the State to implement the RSMS program.

The MPOs in Mississippi were interested in how other MPOs were establishing criteria for distributing Surface Transportation Program funds to local agencies using pavement-management systems. They had established some liaisons with MPOs in neighboring States, but were interested in learning what MPOs in other areas of the country were doing. Other MPOs visited also showed interest in learning of their counterparts nationwide. The National Association of Regional Councils (NARC) has provided assistance to MPOs and their equivalents on this subject by compiling the methods employed in distributing STP funds around the country. While this work has not been specific to pavement management, an individual can evaluate the methods employed elsewhere in the United States by requesting a list of the different criteria developed by MPOs for the STP funding cycle.

Other MPOs conducted thorough studies to determine their role in assisting local agencies in implementing pavement-management systems. The North Central Texas Council of Governments, the acting MPO for the Dallas/Ft. Worth Metropolitan area, worked extensively with local agencies in the region to determine its role. As a component of their study, they surveyed a sample of other MPOs in the country to find out how ISTEA was being implemented elsewhere. The NCTCOG developed four possible scenarios for their involvement in implementing pavement management:

- 1) State-only pavement-management-system method - All local agencies in their region would adopt the State-operated pavement-management system. The State would collect all data and provide results to the local agencies;
- 2) MPO-only pavement-management-system method - All local agencies in the region would adopt an MPO-operated pavement-management system. The MPO would contract to collect all data and would provide results to the local agencies;
- 3) Local government based pavement-management-system method - Local agencies would choose between the MPO-supported pavement-management system or a certifiable pavement-management system to perform their own data collection and analysis;
- 4) MPO centralized pavement-management-system method - Local agencies would provide pavement-management-system data to the MPO central data base by collecting the required

data for the MPO pavement-management system or using a certifiable pavement-management system to provide the same information.

The NCTCOG study allowed the MPO to work more effectively with the State and local agencies in the region to identify the most appropriate role for the MPO to take. This type of study shows that cooperation can occur between the State, local agencies, and MPOs.

This type of cooperation occurred in other areas of the country as well. Many Regional Planning Agencies, the equivalent of MPOs in the Northeast, have been active in pavement-management implementation. As documented in the success stories of this report, prior to the ISTEA requirement, all of Massachusetts' RPAs had been involved in assisting local agencies in pavement-management implementation. The RPAs in New Hampshire have done extensive work in the area of pavement-management since the ISTEA requirement was first passed in 1991. The RPAs have adopted the New Hampshire Technology Transfer Center RSMS software. They have been trained by the T² Center and have assisted local agencies in the regions with pavement-management implementation.

The NCTCOG study is also significant in that it accomplished what other MPOs in the United States were trying to do: Define the possible roles that MPOs could play. An additional role is the one MTC provides to local agencies in the San Francisco Bay Area; MTC developed a pavement-management system for the region and supports it with in-house staff.

In visits to MPOs across the country, these five alternatives were discussed at great length. The key determination an MPO must make before selecting any of the five alternatives is what resources are required to adopt its selected strategy. Many MPOs are small entities with two to five staff people. It is unrealistic to assume that these MPOs would be able to support the development of a pavement-management system and fully support it as in the MTC model. It is important to note that many of the smaller MPOs in the country were also actively pursuing the options of hiring consultants to implement pavement-management systems in their regions. Larger MPOs were able to work with local agencies in their regions to establish a possible greater role, as in the NCTCOG model. These MPOs determined that they had the resources to support a pavement-management system on their own, if that alternative was selected by the region.

Unfortunately, the National Highway System bill passed in November 1995 suspended the management-system requirements. Since the bill passed, MPOs such as the NCTCOG and others, have pulled back from their original plans of supporting a pavement-management system for the local agencies in their regions. In the case of the NCTCOG, while it is not recommending any one individual system for use by agencies in its region, the MPO has published a report showcasing a number of software systems it had researched extensively.

Funding for Local Agency Pavement Management at the MPO Level

With funding available through the Federal Surface Transportation Program for regional local agency priorities, many MPOs have set aside money for the development of pavement management at both

the local agency and regional levels. In Mississippi, the MPO that supports the Jackson area plans to use a portion of its STP funds to reduce the cost of implementing a pavement-management system for every local agency in its region. The money will be used to reimburse the cities for costs incurred in implementing a pavement-management system. Elsewhere in the country, individual local agencies have been successful in acquiring STP funds through a competitive process. The city of Tacoma, Washington, received an STP grant in this manner through its MPO. The San Antonio MPO took another option in funding pavement management in its region by setting aside money for the city of San Antonio to develop a pavement-management system. Once developed, the pavement-management system will be used by other local agencies in the region.

When MPOs began working with local agencies in each of their regions, they discovered that many of the local agencies had some type of pavement-management system already in place. This was especially true in large metropolitan areas. However, this issue should not be considered a problem, since local agencies were using pavement-management system results to determine future expenditures of pavement maintenance revenues. This has, however, created a dilemma when trying to compare the results of one pavement-management system to another, as the data requirements for each pavement-management system are usually different. Different pavement-management-system software packages require different distress information and the resultant pavement condition ratings or indexes are not standardized. For an MPO, the ideal is to have a standardized rating system in order to be able to compare projects submitted for funding under the TIP or STP. However, in regions where local agencies had already developed different pavement-management systems, this ideal could not occur. Working with local agencies in their regions, many of the MPOs have developed routines to compare the results of one system with another. In Massachusetts, where MPOs mainly use two systems, an equation is being developed to calculate an equivalent rating between the two systems and the State system. In this manner, the State, MPOs, and local agencies will be able to compare the results of the three systems when developing the entire State Transportation Improvement Program.

Conclusions

Since the 1991 ISTEA requirement passed, those MPOs most successful in working with local agencies are ones that have established a mutual trust with the agencies. The ISTEA guidelines prompted local agencies to work more with MPOs to establish the role the MPO would play in the region. Many MPOs in the country were well on their way to establishing pavement-management roles when the National Highway System bill passed in November 1995. While many MPOs have continued the efforts they began prior to passage of the NHS bill to assist in implementing pavement-management systems in their regions, other MPOs have chosen to discontinue or limit their original plans to fully support pavement-management systems. Had the NHS bill passed one year later, many of the MPOs that have decided to pull back would be much further along in implementing pavement-management than they are now.

Opportunities for the FHWA to Assist Locals in Pavement Management

Introduction

Another component of the IPA assignment was to compile a list from local agencies, metropolitan planning organizations, and technology transfer centers of areas in which the FHWA could further assist them in implementing pavement-management systems. While visiting the agencies during the past year, many ideas and topics were suggested. These suggestions are grouped together into the general topics listed below. The following is a discussion of suggested areas in which the FHWA should initiate efforts to help technology transfer centers, locals agencies, and MPOs implement, enhance, and advance the use of pavement-management systems.

Training

Many of the local agencies and MPOs requested the FHWA provide additional and advanced courses on pavement-management topics. Most have access to basic pavement-management courses through their technology transfer centers or other State-sponsored transportation agencies. The additional classes they suggested FHWA provide covered a wide range of topics, including:

- 1) How to translate pavement-management-system budget results into actions taken by a policy board or council;
- 2) Selecting the appropriate treatment for each roadway needing work;
- 3) Modification of the FHWA course offered in 1994 as required to keep it updated;
- 4) A continuing education program possibly transmitted by newsletter or through the Internet, alerting local agencies of recently passed legislation that may impact their street and road network;
- 5) How to identify and overcome institutional barriers in implementing a pavement-management system; and
- 6) What role can an MPO play in facilitating pavement-management at the regional level.

Past pavement-management training courses sponsored by the FHWA have proven to be useful and educational tools for local agencies, State DOTs, and MPOs. The list set forth above covers a wide range of alternatives. One that would have an immediate impact is the course on how and what role an MPO can play in facilitating pavement management at the regional level. Success has frequently been achieved where MPOs have become involved in pavement-management activities at the local level. MPOs can assume provided roles that range from developing and completely supporting

pavement-management systems to providing funding to assist local agencies in purchasing commercial software programs. These roles need to be defined and presented to MPOs throughout the United States. In areas where MPOs have not been involved in implementing pavement management, this course could assist in breaking down institutional barriers that historically existed between MPOs and local agencies. There are plenty of success stories to show that MPOs can impact local agency involvement on a regional basis. These case studies or examples could be included in the curriculum. A course of this type was presented by the FHWA in Region 1 a number of years ago. Such a course could act as an outline for the next generation of MPO involvement in regional pavement management.

Pavement Management as a Beneficial Tool, Not as a Mandate

Because of the ISTEA pavement-management requirement, pavement management is perceived by many State and local agencies as a regulation they must comply with rather than a tool that will assist them in documenting their pavement repair needs and making cost-effective decisions. Even with the suspension of the management-system requirement, many local agencies still consider a pavement-management system an unnecessary tool. Documentation that highlights the benefits of pavement-management systems would help sell the program to many skeptical agencies that still perceive it as something of no use to them. The documentation should define how a pavement-management system has benefitted local agencies by allowing them to spend limited taxpayers' dollars more cost-effectively.

Annual Awards for Effective Implementation and Use of Pavement Management

To encourage the use of pavement-management systems, the FHWA should establish an award to be given at the local agency and MPO levels to agencies in each State that do the most in promoting and using pavement-management systems. There are many awards that cities, counties, and MPOs can apply for each year. Many of these awards are touted by agencies as an exceptional achievement. In fact, it is not unusual for the elected board or council to write a letter of support for the applying agency. If an elected board or council is involved in applying for the award or has heard that a neighboring agency has received one in pavement management, the status of the program may be elevated. There are no guarantees that more local agencies and MPOs will begin to use a pavement-management systems if awards are given for their use, but cities, counties, and MPOs always showcase awards that they receive and are very proud of them.

Criteria for the award specifications could be developed by either the FHWA, the TRB subcommittee on Local Agency Pavement Management, or some other group. Once the criteria have been developed, the awards could be advertised through the National Association of Regional Councils, the National Association of County Engineers, the National League of Cities, and other municipal organizations. An evaluation committee could be formed to evaluate the entries based on the established criteria. An award should be given by each State for a city, county, and MPO. The winner of the State awards would then compete for a yearly national award. Such awards could encourage local agencies to use pavement management, and depending upon how the criteria are formulated, could improve the current pavement-management practices of some local agencies.

Training on Preventive Maintenance

To extend the life of a newly reconstructed street, many modern pavement manuals suggest that a properly timed preventive maintenance treatment, such as a chip or slurry seal, will protect a pavement from major damage and increase its life cycle. Preventive maintenance treatments are generally much less costly than reconstruction or an overlay. Local agencies have been using preventive maintenance as a strategy on their road systems, but many of them are placing these types of treatments at an inappropriate time on the life cycle curve. For instance, if a street suffers from alligator cracking, a chip seal, slurry seal, or any other preventive maintenance treatment is not the correct treatment. However, there are still agencies that place this type of treatment on a roadway with alligator cracking. A roadway that receives the treatment described above will almost immediately reflect the alligator cracks through the seal.

The FHWA could develop an aggressive educational campaign. Each time a preventive maintenance treatment is incorrectly applied, the cost of replacing the treatment is great. The local agency usually has to contend with a potentially adverse public information campaign. There is plenty of literature available on this subject, but it may be necessary to bring the information out to agencies through the “road show” service provided by the LTAP Centers. State-sponsored training sessions for local agencies offered in regions around the State could be another option.

Establish a FHWA Local Agency Pavement-Management Technical Working Group

An ongoing local agency pavement-management Technical Working Group (TWG) should be established to assist the FHWA in identifying changing priorities within the field. The group could assist the FHWA in identifying policy issues related to local agency pavement management, and act as a mechanism to keep local agencies aware of regulations and rules that impact them. As such, the TWG could serve to help establish future direction for the FHWA in assisting local agency pavement management. The TWG could be established with the assistance of the Transportation Research Board subcommittee on Local Agency Pavement Management. This TWG would enable the FHWA to obtain a better understanding of the issues pertinent to local agency pavement managers. The TWG would also enable local agencies involved in pavement management to better understand the FHWA. Further, such a working group would build upon communication that has already been established.

Prioritization of the FHWA Efforts

The above efforts that local agencies suggested the FHWA should be involved in to better assist local agencies with pavement-management implementation will help local agencies in both the long and the short term. Of the eight described above, the one most likely to give the FHWA an immediately clearer picture of local agency concerns and problem areas is the establishment of a local agency technical working group. This would assist both local agencies and the FHWA in the long and the short term. Establishing such a working group should be the top priority, enabling the FHWA to establish a continual communication link to local agencies around the country on pavement-management issues and concerns. Such communication could allow the FHWA to build upon its

relationship with State and local agencies such that FHWA efforts in other pavement-management projects would be better received. The TWG could assist the FHWA in identifying future policy-related matters dealing with pavement management at the national level. Ideally, the TWG would be made up of representatives from local agencies, MPOs, and State DOTs.

In order to continue to improve their pavement-management and pavement repair practices, local agencies need to remain on the cutting edge of technology. In order for this to occur, local agencies need to attend good, sound pavement-management training courses. The FHWA/LTAP achieved a huge success in 1994 in development of the “train-the-trainer” course for local agency pavement management. Materials from this class are being used by many LTAP Centers in pavement-management courses they offer to local agencies in their States. To build upon this success, the second priority for the FHWA should be to develop pavement-management training courses. This would include updating the 1994 course, as well as developing new pavement-management course material. Of the courses described above, the highest priority should be given to the development of a class on the role an MPO can play in facilitating pavement-management systems at the regional level. This course would impact a large number of local agencies, and have a positive effect on the growing relationships between MPOs, State DOTs, and the FHWA.

Conclusions

One purpose of this assignment was to document the experiences of the local agencies that are implementing pavement-management systems so that other local agencies could apply the practices employed by the successful agencies. Visits to local agencies, MPOs, and technology transfer centers across the country showed how far many have gone in implementing pavement-management systems. These local agencies act as regional experts in local agency pavement management, and answer questions from other local agencies related to their experiences with the pavement-management systems they are using. A contact person from each of the local agencies visited is listed with a phone number at the end of each discussion in the success stories section of the report.

The Intermodal Surface Transportation Efficiency Act requirement of 1991 that all Federal-aid highways have a pavement-management system had a positive impact in encouraging many local agencies to implement pavement-management systems. Many of those same local agencies have said that they will continue to implement pavement-management systems even though the ISTEA requirement has been suspended, although it is unclear whether they will maintain the same schedule as that mandated by ISTEA. However, there are still many others that are unwilling to implement such a pavement-management system. There is no clear way to get these local agencies on board. The pavement-management system used by many of them for years consists of driving each of their roads and making decisions on what should be repaired while in the car. These agencies firmly believe that this is the most cost-effective method of identifying streets and roads for pavement repair. To date, no one has convinced them otherwise. Efforts should be made to work with these agencies to show them the benefits of pavement-management systems. Some of the recommended priorities for the FHWA effort listed in an earlier section of this report may influence these agencies to use pavement management.

MPOs have played an increasingly more important role in assisting local agencies in their regions to implement pavement-management systems since the passage of the ISTEA requirement. The MPOs visited during this IPA assignment developed a variety of methods to assist local agencies with pavement-management-system implementation. Some MPOs provided software and ongoing training and assistance, while other MPOs provided grants to local agencies to assist in the funding and development of pavement-management systems. In areas of the country where an MPO was involved in pavement-management-system implementation, a strong rapport developed among the local agencies and MPO through the technical advice they were provided with by the MPO. The suspension of the ISTEA pavement-management requirement came at least a year too soon for other MPOs in the country. Many of the local agencies in their regions did not trust the MPOs since the MPOs were perceived as incapable of providing technical support in the area of pavement management. Had the ISTEA requirement not been suspended, many of these local agencies would have been required to work with their MPOs in implementing pavement management. Through this type of communication, the barriers that exist between MPOs and their regional local agencies begin to break down. Once this process has begun, a trust develops between the agencies. This communication and trust between local agencies and MPOs has occurred in other areas of the country. Now that the ISTEA requirement has been suspended, the FHWA can best assist MPOs

through development of a training session to identify roles MPOs can play in assisting local agencies in their regions to implement pavement-management systems. This effort is highlighted in an earlier section of this report addressing how the FHWA can assist local agencies and MPOs with pavement-management implementation.

Technology transfer centers and the local technical assistance program centers, have been providing training and related courses on pavement-management systems throughout the country. Many of the centers have taught the FHWA course "Pavement and Road Surface Management for Local Agencies," available since Fall 1994. Some of the centers have been working with pavement management for years and have developed computerized pavement-management systems that they offer to local agencies for a minimum fee. For example, the Center at the University of New Hampshire developed the Road Surface Management System for local agencies and MPOs in the State. They also share RSMS with more than a dozen centers and local agencies in other States. Since all of the centers can not offer the same pavement-management expertise, many of the centers share resources such as trainers and classes. If pavement management continues to be an important issue at the national level, the LTAP Centers will develop this expertise over time. It is interesting to note that with the suspension of the ISTEA pavement-management-system requirement, some centers changed their priorities to meet more urgent needs in their States. Even with this development, LTAP Centers have provided an incredible array of classes in the area of pavement management and will continue to transfer important technical information to local agencies throughout the country.

Local agencies and MPOs have made great progress in implementing pavement-management systems during the past five years. Through the hard work of State DOTs, MPOs, local agencies, and LTAP Centers, many areas of the country have successfully implemented pavement-management systems. As a result, the level of communication between the affected agencies has improved and led to many local agencies benefitting from pavement-management-system implementation. However, there are still local agencies in this country that have not adopted a pavement-management system. Efforts must be made to reach out to these local agencies and encourage them to use such a system.

