Illinois Interchange

Illinois Technology Transfer Center

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BRIGHTER SIGNS FOR BETTER ROADWAY SAFETY

By Leo Rickertsen, Freelance Transportation Writer

This November, the U.S. will likely have new guidelines by which traffic signs, signals and pavement markings are designed, installed and maintained. Sign "minimum reflectivity" standards will be included in the next MUTCD (Manual on Uniform Control Devices) and should also be introduced in November. The Federal Highway Administration (FHWA) states that the change "seeks to improve the night visibility of traffic signs by requiring agencies to replace all signs that do not meet driver needs."

How do we know whether a sign "meets driver needs?"

A sign's nighttime visibility is measured by "retroreflectivity" which is a scientific term that describes how well the sign bounces light from a vehicle's headlamps back to the driver's eyes. FHWA has published minimum retroreflectivity values that each sign must meet. In addition, signs degrade over time. We must continuously monitor retroreflectivity to make sure signs stay in compliance and replace

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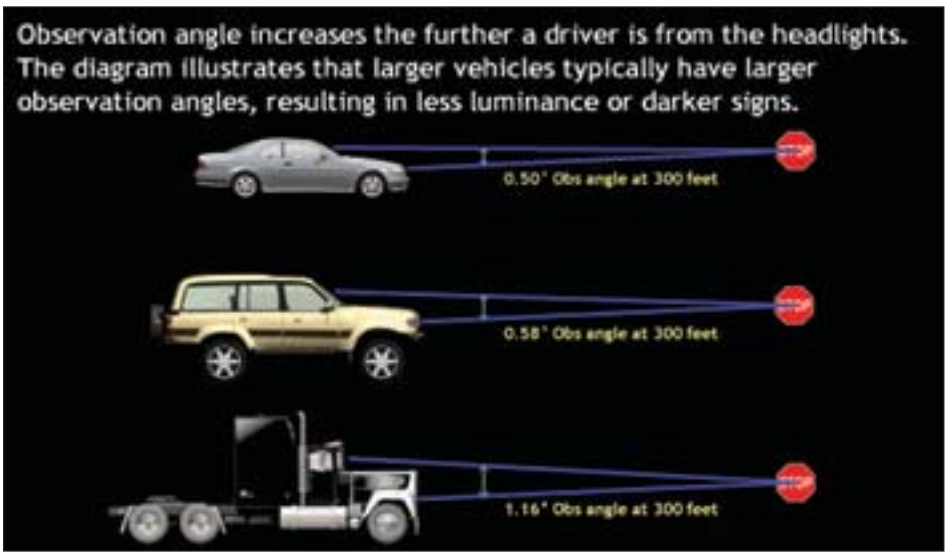

INSIDE:

Please pass this on to other interested parties in your office.

Illinois Department of Transportation
Bureau of Local Roads and Streets

Federal Highway Administration

FROM THE DESK OF...

The Local Technology Assistance Program (LTAP) is a nationwide effort primarily financed by the Federal Highway Administration, individual state departments of transportation, and universities. Its purpose is to foster a safe, efficient, and environmentally sound surface transportation system by improving the skills and increasing the knowledge of the transportation work force and decision makers. The Illinois Technology Transfer Center is one of the 58 LTAP Centers in the United States.

Across the country, 38,000 local agencies - small and large cities, rural and urban counties, and tribal governments - maintain nearly three million miles of roads and some 29,000 bridges. LTAP is a direct, hands-on method for moving innovative transportation technologies out of the lab, off the shelf, and into the hands of the people who maintain our local streets and roads:

- public works directors and staff
- city and county engineers
- local highway safety officers
- transportation planners
- street and road maintenance superintendents and staff
- certified technicians
- skilled roadway laborers

As an LTAP Center, Illinois hosted the National Local Technology Assistance Program Association's (NLTAPA) 25th Annual Conference in Chicago, IL from July 23 – July 26, 2007. NLTAPA's main objectives are to build awareness about LTAP in the transportation community, assist FHWA with developing strategies for the program, and strengthen the capacity of each center to best meet the needs of its customers. This conference provides an opportunity for LTAP Centers to discuss common concerns, learn from others' successes and failures, and interact with peers and partner organizations.

The conference was highlighted by the opening remarks of Joe Toole, FHWA's Associate Administrator for Professional and Corporate Development and a keynote address by Professor Bruce Seely, the Social Sciences Chair of Michigan Technological University. Numerous special sessions dealt with a variety of training, management, operations, and communications topics. The conference concluded with a banquet and fireworks display on Navy Pier.

Thank you to all of the national sponsors and special thanks to the Illinois Association of County Engineers, the Illinois Asphalt Pavement Association, and Illinois Chapter of the American Public Works Association for their sponsorship of this event.

Kevin Burke III, P.E.
T2 Program Manager

NLTAPA CONFERENCE SILVER SPONSOR

The American Public Works Association is an international educational and professional association of public agencies, private sector companies, and individuals dedicated to providing high quality public works goods and services. APWA provides a forum in which public works professionals can exchange ideas, improve professional competency, increase the performance of their agencies and companies, and bring important public works-related topics to public attention in local, state and federal arenas. The Illinois Chapter membership is composed of public works officials throughout Illinois. For more information, please visit their website at **www.illinois.apwa.net**.

NLTAPA CONFERENCE PLATINUM SPONSOR

The Illinois Association of County Engineers is the collective forum of the 102 appointed county officials in direct charge of county highway transportation in Illinois. Since 1914, the Association has served to provide for the exchange of ideas and information aimed at improving the county highway engineering profession and county highway engineering services to the public.

County Engineers, as provided by Illinois law, are appointed by the various county boards and approved by the Illinois Department of Transportation (IDOT). They must be graduate, licensed professional engineers experienced in highway transportation. The County Engineer's responsibilities include the administration of the county road agency, coordination of funding for the township road agencies in the county and representation of the county's interests with IDOT. They are responsible for the construction, maintenance, and safe operation of the 16,571 miles of designated county highways in Illinois.

For more information, please visit IACE's website at **www.iaceng.org**.

NLTAPA CONFERENCE GOLD SPONSOR

IAPA, the ILLINOIS ASPHALT PAVEMENT ASSOCIATION, has been serving as an industry resource and a vital communications channel for those involved in virtually every facet of the asphalt industry in Illinois, since our founding in 1938.

The **MISSION** of the Illinois Asphalt Pavement Association is to:

- Promote the improvement and advancement of quality asphalt pavement construction in Illinois;
- Provide assistance to members in the areas of research, technical specifications, environmental issues, education, promotion, government relations, and other related areas;
- Educate potential buyers and specifiers of asphalt pavements as to the pavement's characteristics and benefits.

IAPA also co-sponsors the Recycled Asphalt Pavement (RAP) training course offered through the Illinois Technology Transfer Center.

For more information, please visit IAPA's website at **www.il-asphalt.org**.

ROLLING WHEEL DEFLECTOMETER (RWD)

An Innovative Device for Measuring Pavement Deflections at High-Speed

By Doug Steele, Senior Engineer, Applied Research Associates, Inc. and Bill Vavrik, Principal Engineer, Applied Research Associates, Inc.

Figure 1. One of the RWD's four lasers used to measure deflection.

Background

Illinois local road agencies are responsible for maintaining several thousand miles of highway pavement. Traditionally, highway engineers have used pavement visual conditions to make roadway management decisions, such as which roads to program for improvement and what types of improvements to make. While visual distress surveys provide valuable information regarding a road's condition—such as the types cracking and their potential causes—they lack a direct measure of the pavement's structural condition. In the past, pavement structural response has been measured with nondestructive deflection devices, such as the Benkelman Beam, Road Rater, and Falling Weight Deflectometer (FWD). While these devices have proved useful for project-level applications, they lack the productivity and mobility required for network-level assessment.

The RWD Device

The RWD is an innovative device for the high-speed structural evaluation of highway pavements. It was developed by Applied Research Associates (ARA), Inc. for the Federal Highway Administration (FHWA). The RWD is designed to collect continuous deflection profiles at normal highway speeds, without the need for lane closures (and the safety hazards that come with them). It uses four triangulation lasers (figure 1) mounted on a rigid beam beneath the RWD trailer to calculate the deflection produced by the trailer's dual-tire, 18-kip single axle (see figure 2). Data is collected in real-time by the RWD's data acquisition equipment located in the truck's cab, using proprietary hardware and software. The RWD has undergone extensive field testing and is currently being deployed for use by highway agencies. It is intended for use in the network-level evaluation of highways for pavement management purposes.

Field Results

The RWD has performed full-scale demonstrations for several state highway agencies, including Texas, Indiana, Minnesota, and Iowa. Locally, the RWD was recently used in the implementation of a pavement management system (PMS) for Champaign County. Field testing has demonstrated the RWD's ability to efficiently and accurately measure pavement deflection due to an actual moving wheel load, something that previous devices were not capable of doing. Figure 3 shows the results of multiple RWD passes on Texas FM-50, a low-volume, chip seal pavement. The high deflections (i.e., up to 50 mils) reflect the low structural capacity of the thin pavement, and the multiple passes show good repeatability between test runs.

Figure 4 shows data from Indiana SR 1, consisting of three distinct pavement sections on the same road. The RWD clearly shows the change in deflection—and therefore pave-

Figure 2. The RWD measures the deflection of an actual truck at moving speeds.

ment structural capacity—where changes in pavement thickness and condition occur. As the pavement becomes thinner and weaker, the pavement deflections increase and become more variable (e.g., between mile markers 75 and 85). In fact, this was also reflected in the pavement's surface condition, which presented a high degree of fatigue cracking. Pavements with good structural capacity and uniformity produce low, uniform deflections, such as the section from mile marker 65 to 75.

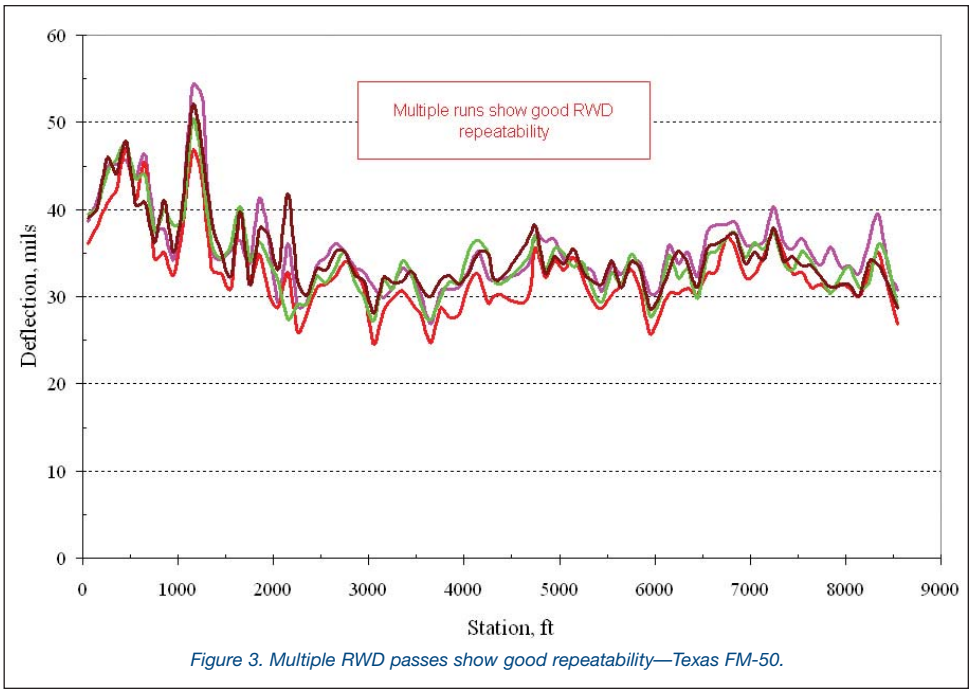

Figure 3. Multiple RWD passes show good repeatability—Texas FM-50.

RWD Uses and Benefits

The RWD was developed to provide never-before-available deflection data for network-level highway applications. The end result to highway agencies is better allocation of limited highway funds by identification of pavement sections that are in need of structural improvement and the selection of the most appropriate rehabilitation strategy, such as surface treatment, asphalt overlay, or reconstruction.

The specific benefits provided by the RWD include:

- The RWD can operate over a broad range of speeds—ranging from 10 to 65 mph—allowing it to blend in with the surrounding traffic stream.
- It does not require lane closures; thereby, increasing safety to field crews and the traveling public, while eliminating lane closures to that are inconvenient to highway users.
- The RWD is a nondestructive test and, therefore, does not damage the pavement's structural integrity.
- It has good productivity—typically testing 100 to 200 miles per day—allowing for the testing of entire highway networks in a matter of days.
- Data can be provided to highway agencies in formats that are readily usable in their pavement management activities, including linkage to Geographical Information Systems (GIS).

For more information on the RWD, please contact Doug Steele at (217) 356-4500 or **dsteele@ara.com**.

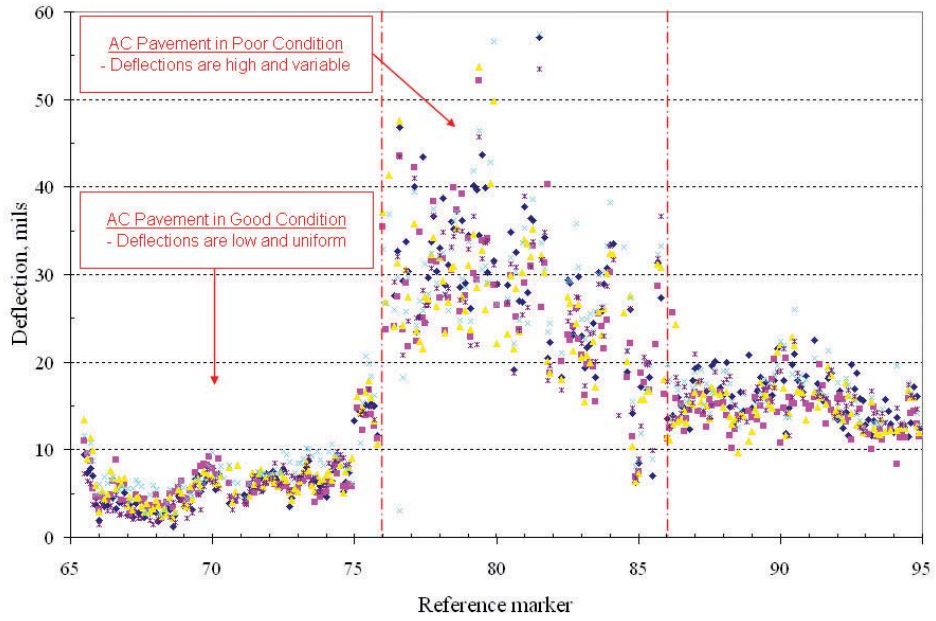

Figure 4. The RWD clearly detects changes in pavement structure.

PAVEMENT MANAGEMENT SYSTEM SUCCESS STORY

CHAMPAIGN COUNTY

Jeff Blue, P.E., County Engineer, Champaign County Highway Department

Figure 1. Fatigue cracking of the AC surface due to heavy, repeated wheel loads on CR 9.

Champaign County has one primary population center that makes up over half of the county population. This population center is comprised primarily of the City of Champaign, City of Urbana, and the University of Illinois. Like many local government agencies, Champaign County has competing interests in the allocation of limited highway improvement and maintenance funds.

Champaign County's current annual road maintenance and construction budget is approximately $3 million. Of this total road funds, $2 million are dedicated to improving and maintaining the county's highway network. The other $1 million are allocated to improving roads that are not owned or maintained by Champaign County. These diverted funds are dedicated to funding "fringe road" projects that are generally owned or operated by the City of Champaign, City of Urbana, or other local agency.

The issue of funding highway improvements on non-county roads is a significant issue between the County and local government agencies. It is generally recognized that transportation improvements lead to economic development and growth, therefore the County has a vested interest in improving area transportation facilities, even if they are not specifically within County jurisdiction. This creates a need for an analytical means to determine the required funding for the county owned roads while still providing funds to the local agencies to improve the overall transportation network and foster economic development.

Recently, the county implemented a pavement management system using the Rolling Wheel Deflectometer (RWD) as a means to improve budgeting, planning, incorporate pavement preservation, and have a scientifically defensible means of showing the funds required to maintain the highway network in acceptable condition.

Pavement Management System Implementation Approach

The PMS implementation followed through the following activities to provide the data, models, and economic analysis capabilities needed for active pavement management.

Network Definition & Condition Assessment PMS requires knowing what you have and its condition. Using a digital video system, images of the pavement were recorded and a pavement distress survey conducted. Figure 1 shows the pavement distresses from a flexible pavement section. Pavement roughness data was collected with a high-speed laser profiler, and pavement deflections were measured with the RWD. Figure 2 shows the RWD deflection profile of CR 32, identifying strong and weak pavement sections.

Determine Pavement Performance Trends The county has primarily asphalt and composite pavements. Pavement performance models were developed that show on average an HMA road requires rehabilitation after 14 years.

Pavement Preservation, Rehabilitation, and Reconstruction Champaign

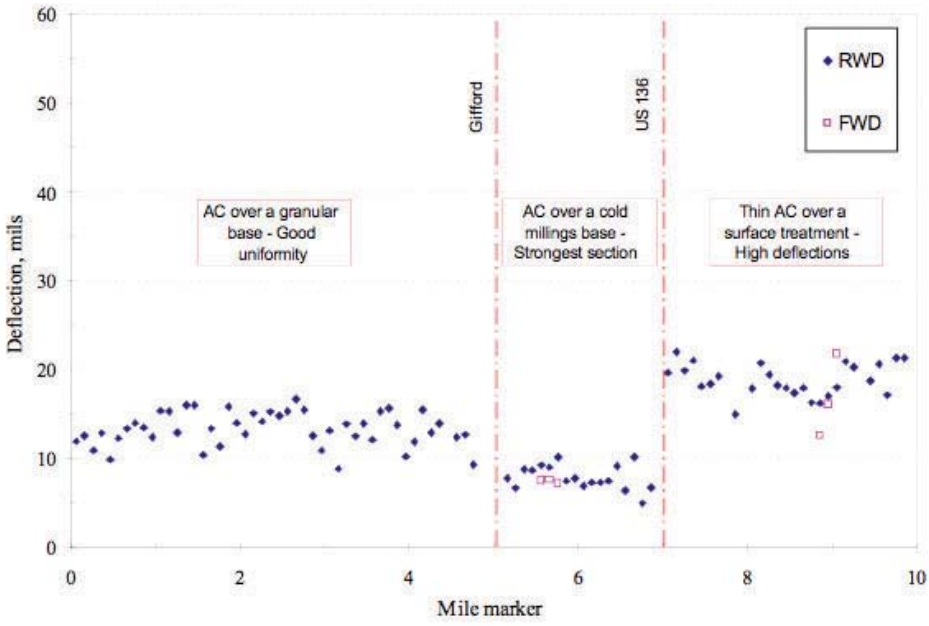

Figure 2. Example of three distinct pavement deflection profiles on CR 32.

County used the PMS implementation as an opportunity to incorporate pavement preservation into the potential fixes to roadway problems. Figure 3 shows how routine maintenance, preventive maintenance, rehabilitation, and reconstruction are all considered in the management system. Since pavement deflections were incorporated in the PMS, a treatment selection matrix that includes pavement structure is used to identify when preventive maintenance, thin overlay, or thick overlay are acceptable. Figure 4 shows an example of the treatment matrix.

Development of Capital Program

The goal of the PMS implementation is to understand the ramifications of changes to funding on the roadway network. Figure 5 shows that with the current funding levels the pavement condition will decrease over the next 5 years and that an additional $500,000 per year is needed to keep the county road network at its current level. In addition to improved understanding of funding requirements, a capital projects list is generated with projects that give the best "bang for the buck."

The Bottom Line

Champaign County now plans projects based on the results of the PMS, and these results are already showing benefit. A PMS improves decision-making, quantifies the value of the highway network, improves communication between county stakeholders, and offers the ability to understand the ramification of changing investments on the County's roads.

As the County Engineer I established a simple goal for this project: "The overall goal is to provide an objective tool for the inventory, assessment, and management of Champaign County's road network." We have accomplished this goal!

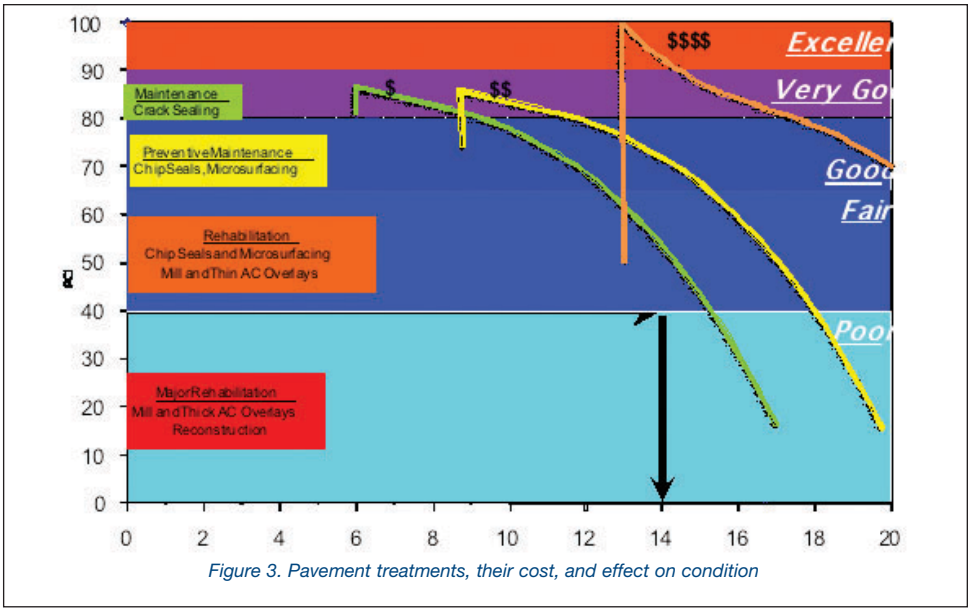

Figure 3. Pavement treatments, their cost, and effect on condition

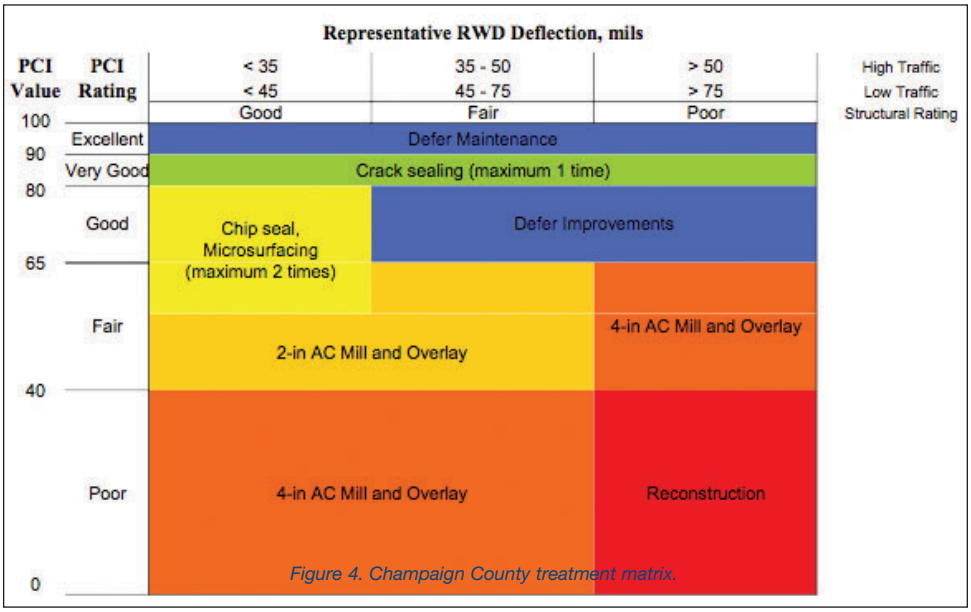

Figure 4. Champaign County treatment matrix.

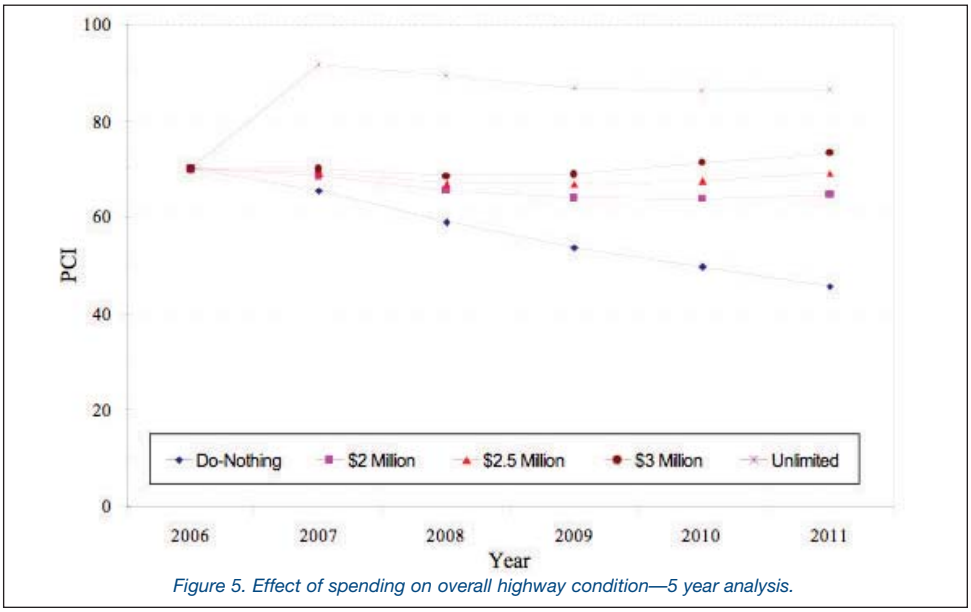

Figure 5. Effect of spending on overall highway condition—5 year analysis.

Continued from page 1

any before they fall below the new retroreflective minimums.

A wide range of vehicles drive on public roads. Retroreflective signs must accommodate them all. For safety, retroreflective performance must produce signs that are as bright and visible for drivers in tractor-trailers as they are for those in the smallest passenger car.

Why is higher visibility important?

The driving environment is changing in ways that increase safety concerns.

- Roadway fatalities occur more often at night than during the day based on miles traveled which makes nighttime visibility more significant.
- The overall population of drivers is getting older as the Baby Boomers age. Aging in general produces natural declines in eyesight, hearing, mobility and reaction times.
- Rural roads are more dangerous than other roads, with fatalities 2.75 times higher per 100 vehicle miles traveled.
- Drivers of larger vehicles (such as large pick-ups and SUVs and particularly commercial tractor-trailers) are disadvantaged by sign retroreflective inefficiency.
- The vast majority of late model vehicles come factory-equipped with VOA (visually/optically aimed) headlamps that are designed to "cut off" illumination at the edges to reduce glare but can also compromise sign performance by cutting visibility in half.

Taken together—older drivers, nighttime fatalities, dangerous rural roads and compromises in sign retro reflective efficiency—these changes stimulated the FHWA to develop new nighttime visibility standards for the MUTCD. In before and after studies (D.A. Ripley, 2005 Mid-Continent Transportation Research Symposium Proceedings), researchers stated that "implementation of highly reflective signs and pavement markings… showed statistically significant reductions in injury collisions following installation of highly reflective signs."

How are we meeting these new standards?

Sign sheeting comes in different grades to indicate the brightness of a new sign. Illinois Department of Transportation designations include types and performance levels from Type B (the lowest level, which will not meet the new MUTCD minimums) up to higher performance levels such A, AP, AZ, and ZZ.

Over time, higher brightness sheeting also maintains its reflective compliance longer. Tests backed by warranties indicate that the extended life of brighter sheeting such as Type A and Type AP deliver greater value. A longer lifecycle lowers total costs.

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TYPE B AND TYPE AP REFLECTIVE SHEETING

Signs made with Type B and Type AP sheeting may look similar during daylight conditions, but nighttime inspection reveals reflectivity differences. The higher level of brightness provides the nighttime visibility preferred by older drivers and is especially helpful in a visually cluttered environment.

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Factor	Type B	Type AP
Sign cost *(example only)*	$35.94	$40.63
Optical efficiency	7%	32%
Expected life	7 years	10 years
Cost per year	$5.13	$4.06

What does this mean for agencies across Illinois?

From the date of the final ruling (now scheduled for November, 2007), state and local agencies have two years to assess signs and prepare a replacement plan and seven to ten years to change out any non-compliant signs.

The new minimum reflectivity standards are intended to improve nighttime visibility for greater safety in all road conditions and for all drivers and pedestrians. IDOT is supporting that effort by upgrading to a minimum of Type AP and using Type ZZ for signing situations where optimal performance is needed.

For more information about the FHWA ruling, how to meet the new MUTCD standards and ways to accomplish this, visit **http://safety.fhwa.dot.gov/roadway_dept/retro/sign/sa03027.htm.**

To learn more about assessment and management methods visit **http://safety.fhwa.dot.gov/roadway_dept/retro/sign/back_method.htm**

IDOT HIGHWAY SAFETY INITIATIVES FOR LOCAL AGENCIES

By James P. Allen, P.E., Safety Implementation Engineer, IDOT and Kevin Burke III, P.E., Local Policy and Technology Engineer, IDOT

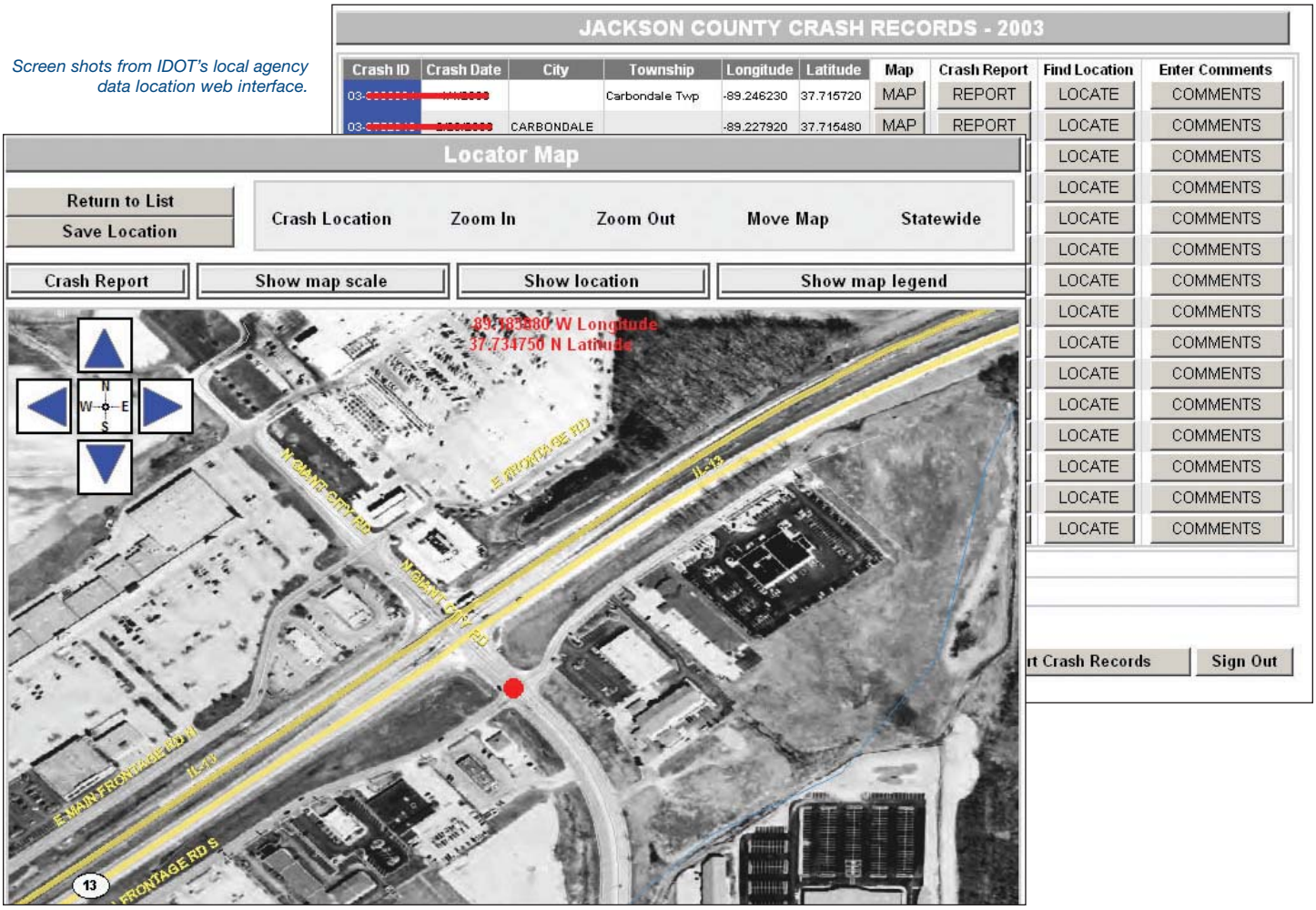
Over the last two years, Illinois Department of Transportation's (IDOT) Bureau of Safety Engineering, Bureau of Local Roads & Streets, Bureau of Information Processing, and Division of Traffic Safety have partnered to address fatalities and Class A injuries on the local highway system. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) federal legislation signed into law on August 10, 2005 established the Highway Safety Improvement Program (HSIP).

As a new Federal-aid funding core program, the HSIP was authorized to achieve a significant reduction in traffic fatalities and serious injuries on all public roads. HSIP includes the High Risk Rural Roads Program (HRRRP). In Illinois, these federal programs increased local safety dollars from around $700,000 per year to over $7,000,000 per year with increasing amounts each year of the authorization bill.

As part of SAFETEA-LU, IDOT developed a Comprehensive Highway Safety Plan (CHSP) - www.dot.il.gov/illinoisCHSP/default.html - with the goal of reducing fatalities on Illinois highways to 1,000 by 2008. Since 50% of the statewide fatalities occur on the local system, local highway agencies are vital to this goal. Therefore, besides only funding specific local projects through a competitive grant process, IDOT identified initiatives to improve highway safety at the local level.

ILLINOIS CRASH DATA

In Illinois, IDOT is responsible for storing all crash data. Prior to 2005, IDOT did not locate crashes on the local system in geographical format (GIS, longitude/latitude).



Screen shots from IDOT's local agency data location web interface.

Mock webpage for Local Safety Services crash analysis.

Therefore, local highway agencies needed to use wall maps with pins, paper maps with markers, or locate their own crashes in GIS. Since HSIP requires projects to focus on fatal and Class A injury crashes, historical crash data with location is needed. Recognizing this fact, IDOT worked closely with the Illinois Association of County Engineers (IACE) and Municipal Planning Organizations (MPOs) to provide $1,060,000 to counties and MPOs to begin locating all fatal and Class A injury crashes on the local system from 2001-2004.

LOCAL SAFETY SERVICES

"Crash Data Analysis & Engineering Solutions for Local Agencies" (R27-18) is a research project sponsored by IDOT with the Illinois Center for Transportation (ICT) - www.ict.uiuc.edu/default.asp. This project will evaluate other states' safety service programs for local agencies and develop a plan to establish a successful Illinois program. The research will help create a system to analyze crash data and develop reports useful to local agencies; and provide crash analysis to local agencies, including a list of potential improvements to reduce the incidence of crashes, when requested.

ROAD SAFETY ASSESSMENTS (RSA)

A RSA is a formal safety performance examination of an existing or future road or intersection by an independent assessment team. The RSA team considers the safety of all road users, qualitatively estimates and reports on road safety issues and opportunities for safety improvement. RSA training teams will introduce the concept to local agencies over the next several months. IDOT will then help establish regional RSA teams that will provide this service to neighboring local agencies. RSAs will serve as a useful tool for identifying good projects to apply for local HSIP funding.

RURAL LOCAL AGENCY TRAFFIC SIGN UPGRADE

In FY2007, IDOT identified four counties (Bond, Cumberland, Henderson, and Piatt) to participate in the pilot program. For FY2008, the pilot program was modified and extended to another 9 counties (Franklin, Iroquois, Marion, McDonough, Montgomery, Vermilion, Wayne, Whiteside, and Will). These counties were selected from each IDOT District based upon the number of fatal and Class A injury crashes over the past 5 years on the local system and financial need relative to rural mileage. The program is intended to upgrade existing regulatory and warning signs in rural areas for highways under the jurisdiction of road districts, counties, or municipalities (with population less than 5,000) to comply with minimum in service retroreflectivity levels proposed for the Manual on Uniform Traffic Control Devices (MUTCD). Each local agency participating will need a sign inventory, summary of quantities, and location map.

State of Illinois
Rod R. Blagojevich, Governor

Illinois Department of Transportation
Bureau of Local Roads and Streets

The Technology Transfer (T2) Program is a nationwide effort financed jointly by the Federal Highway Administration and individual state departments of transportation. Its purpose is to transfer the latest state-of-the-art technology in the areas of roads and bridges by translating the technology into terms understood by local and state highway or transportation personnel.

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