Good Practices: Incorporating Safety *into Resurfacing and Restoration Projects*

U.S.Department of Transportation
Federal Highway Administration

December 2006

Technical Documentation Page

1. Report No. FHWA-SA-07-001	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Good Practices: Incorporating Safety into Resurfacing and Restoration Projects		5. Report Date December 2006 6. Performing Organization Code
7. Author(s) Mahoney, Kevin M; Julian, Frank; Taylor, Harry W., Jr.		8. Performing Organization Report No.
9. Performing Organization Name and Address Data Solutions & Technology Inc. (DST) 9901 Business Parkway, Ste. R Lanham, MD 20706-1887 (research) Vanasse Hangen Brustlin, Inc (VHB) 8300 Boone Blvd., Ste. 700 Vienna, VA 22182-2626 (editorial and production)		10. Work Unit No. 11. Contract or Grant No. DTFH61-03-C-00111 (DST) DTFH61-05-D-00024 (VHB)
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Highway Administration (FHWA) Office of Safety 400 Seventh Street, SW, HSSD Washington, DC 20590		13. Type of Report and Period Domestic Scan Covered June – August 2005 14. Sponsoring Agency Code FHWA/HSSD

15. Supplementary Notes. The Federal Highway Administration (Office of Safety), the American Association of State Highway and Transportation Officials (AASHTO), and the National Association of County Engineers (NACE) cosponsored this Scan Tour. The Scan Team Members were Ernest J. Blais, Keith Cota, Lawrence B. Hummel, N. Kent Israel, Frank Julian, Bernie Kuta, Kevin M. Mahoney, Susan G. Miller, and Harry W. Taylor, Jr. FHWA Office of Safety Contract Task Order Manager was Debra Chappell.

16. Abstract.
Integrating safety improvements into resurfacing and restoration projects is a subject of long-standing interest by Federal, State, and local transportation agencies. A Scan Tour was conducted to identify and subsequently observe good practices in this area. The scan team visited Colorado, Iowa, New York, Pennsylvania, Utah and Washington State. The Scan Team met with each State DOT and county agencies in three States and observed completed projects in all States. Despite wide variations in agency operating environments (e. g., funding levels and flexibility, public expectations, environmental regulations), the report identifies a set of common issues host agencies confronted in developing integrated resurfacing-safety improvement programs, and also observed a set of common success factors.

Good practices are reported within institutional and technical categories. Good institutional practices include commitment to integrate safety into pavement preservation projects, establishing a system that allows for multifunded projects (pavement, safety) and allocates cost items by fund, allowing for flexible project development cycles, strengthening State-local relationships, developing an expedient procedure for acquiring minor rights-of-way, and engaging safety experts in the project development process. Good technical practices include identifying targeted safety countermeasures, making selective geometric improvements, installing traffic control devices and guidance features, improving roadsides, and improving private and public access points.

17. Key Words: Pavement; resurfacing; restoration; rehabilitation; preservation; management; preventative maintenance; 1R, 2R; 3R; roadside; rumble strip; rumble stripe; safety enhancements; scan	18. Distribution Statement No restrictions.

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 70	22. Price

Form DOT F 1700.7 (8-72) Reproduction of completed pages authorized

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Abbreviations and Acronyms

1R	Abbreviation for "resurfacing" and generally refers to a category of projects that provide for an asphalt overlay with little or no other work.
2R	Abbreviation for "resurfacing, and/or restoration" and generally refers to a category of projects that provide for an asphalt overlay and other minor work.
3R	Abbreviation for "resurfacing, restoration, and rehabilitation." Some agencies use this term to describe all projects that provide an overlay of greater than 1.5 inches. Other agencies use the term to describe the projects to which the Federally approved 3R design criteria apply
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADAAG	ADA Accessibility Guidelines
ADT	Average Daily Traffic
BHSTE	Bureau of Highway Safety and Traffic Engineering (PennDOT)
CA	Certification Acceptance
CDOT	Colorado Department of Transportation
CRAB	County Road Administration Board (Washington State)
CRC	Van Buren County (Michigan) Road Commission
DOT	Department of Transportation
FHWA	Federal Highway Administration
GIS	Geographic Information Systems
HES	Hazard Elimination-Safety, a Federal-aid program
HSIP	Highway Safety Improvement Plan
IADOT	Iowa Department of Transportation
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991 (Public Law 102-240)
ITS	Intelligent Transportation Systems
LA DOTD	Louisiana Department of Transportation and Development
LAG	*Local Agency Guidelines Manual* (WSDOT)
LCSI	Low Cost Safety Improvement, a PennDOT program
LOSS	Level of Service of Safety. A convention used by CDOT reflecting a relationship between a roadway segment's actual and expected crash frequency and severity for a specific exposure level, measured in annual average daily traffic.
LPA	Local Public Agency
LTAP	Local Technical Assistance Program
MVM	Million Vehicle Miles
NACE	National Association of County Engineers

NCHRP	National Cooperative Highway Research Program
NPDSE	National Pollution Discharge Elimination System
NYSDOT	New York State Department of Transportation
PMS	Pavement Management System
PennDOT	Pennsylvania Department of Transportation
PM	Preventive Maintenance, as defined by AASHTO as an activity performed to extend the functional condition of the pavement without increasing structural capacity.
OSR	Operational Safety Review (UDOT)
RAP	Rural Arterial Program (WSDOT)
SPF	Safety Performance Functions (CDOT)
SIMS	Safety Information Management Systems
UDOT	Utah Department of Transportation
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

Including safety improvements in pavement resurfacing and restoration projects is a subject of long-standing interest. All transportation agencies have ongoing programs to continuously improve safety. Likewise, all agencies have ongoing programs to preserve the serviceability of pavement surfaces with asphalt overlays and other interventions. The integration of these two endeavors is the focal point of historic controversy, ongoing interest, and a domestic scan. The scan, cosponsored by the American Association of State Highway and Transportation Officials (AASHTO), the National Association of County Engineers (NACE), and the Federal Highway Administration (FHWA), was conducted to document and disseminate information on good practices by State Departments of Transportation (DOTs) and local agencies to integrate safety improvements into resurfacing and pavement restoration projects.

A scan on this subject was considered timely in light of evolving agency missions and legislative developments. The once-separate domains of maintenance and capital construction are converging. Successive Federal transportation acts, culminating with the 1991 Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), broadened the eligibility of Federal-aid funds. Since ISTEA, FHWA Division Offices, State DOTs, and local governments have developed innovative approaches to integrating preservation and safety. The purpose of the scan was to identify, document, and disseminate information on these good practices.

Agencies have multiple objectives and limited resources. Programs and projects are developed to balance competing needs and limited funds. Integrating safety improvements into resurfacing is a resource-efficient method of pursuing infrastructure and safety goals. Resurfacing programs are not the only mechanism through which safety improvements are implemented. Further, resurfacing programs *cannot* be the means by which all existing highways are upgraded to meet all current criteria and standards related to geometry, traffic control, and safety appurtenances; however, incorporating selected, cost-effective safety improvements in resurfacing and restoration projects *can* provide extended public benefits. Attributes of successful programs include:

- The agency's resurfacing program is considered to be an element of its overall safety strategy.
- Agency leadership supports an integrated resurfacing-safety strategy.
- Funding of integrated safety improvements is recognized as an appropriate expenditure.
- Safety improvements are targeted and cost-effective.
- "Scope creep" does not interfere with timely resurfacing.

These success factors were observed in all of the States visited during the scan, albeit to varying degrees. Integrated resurfacing-safety programs don't come into existence instantaneously. Successful programs are developed over time and may be akin to a *journey* that involves changing organizational paradigms and culture. The States and counties visited are all on a *journey* to the goal of well-integrated programs. Some agencies are further along than others.

This report encompasses both *how* (i.e., process) integrated programs function and *what* is being accomplished (i.e., completed projects). It is written primarily for Federal, State, and

local agency personnel in appointed and career executive positions, bureau and district/region managers that have a role in establishing direction and priorities within transportation agencies.

Scan Team members observed numerous good practices in use by State DOTs and local governments. These practices have been organized into two broad categories — institutional and technical. Some reported practices are widely used; the Scan Team observed others only at a single agency. **There is, however, one indispensable attribute of a successful program: the desire and commitment of agency leaders—appointed and career—to routinely enhance safety in conjunction with infrastructure preservation.**

CHAPTER 1: INTRODUCTION

Legislators, policy makers and transportation professionals face the challenge of allocating transportation resources for expenditures that will preserve and extend mobility and those that will preserve and improve highway safety. This is not a simple task, and not one for which there is a consensus approach. The following relevant background information will help the reader understand why there is a range of policies and practices, and the steps taken to formulate the scan team and the scan locations.

BACKGROUND

Through the early 1970s, transportation agencies (and predecessor highway departments) had very distinct approaches to *construction* and *maintenance*. The scope and definition of highway construction were largely determined by applying geometric design criteria and standards, which are intended to provide motorists with safe and efficient travel. Engineers made design decisions. The fundamental purpose of maintenance has historically been to preserve the serviceability of existing facilities. The driving surface (i.e., pavements and bridges) receives primary attention. In many States, their Highway Safety Improvement Program (HSIP) is the sole or primary mechanism for implementing safety improvement projects.

The clean separation between construction and maintenance processes began to change with enactment of the Federal-Aid Highway Act of 1976, which amended the U. S. Code definition of "construction" to include resurfacing, restoration, and rehabilitation (3R). This made 3R work on Federal-aid highways eligible for Federal funding. The legislation did not address the design standards that should be applied to the 3R projects and this subject was to become a matter of controversy for years. In significant part, the controversy involved the degree to which safety improvements should be included in 3R projects. In the Surface Transportation Assistance Act of 1982, Congress indicated the objective of 3R program was "[t]o preserve and extend the service life of highways and enhance highway safety."

Although the American Association of State Highway and Transportation Officials (AASHTO) and Federal Highway Administration (FHWA) attempted to develop national standards for Federal-aid 3R projects, these attempts met significant challenges. Instead, individual State Departments of Transportations (DOTs) were given the opportunity to develop standards that, if approved by FHWA, could be used on Federal-aid, nonfreeway 3R projects. The vast majority of States have FHWA-approved 3R standards. The Intermodal Surface Transportation and Efficiency Act of 1991 (ISTEA) identified *preventive maintenance* as a new Federal-aid eligible activity. Previously, all maintenance was the responsibility of the States. The ISTEA also established the National Highway System (NHS), for which the FHWA establishes design standards. Although conformance to design standards (including 3R standards) is not required for Federal-aid preventive maintenance activities, appropriate ways to maintain or enhance the current level of safety and accessibility should be considered. Isolated or obvious deficiencies should always be addressed. Safety enhancements can be deferred and included within an operative safety management system or included in a programmed future project. Preventive maintenance projects may not adversely impact the safety of the traveled way or its users.

Appendix A includes the FHWA policy memorandum on preventive maintenance project eligibility.

The provisions outlined above allow for flexibility in the use of Federal funds for resurfacing projects. Many FHWA Division Offices now work with State DOTs to develop tailored approaches that meet the needs of individual States. For resurfacing projects, integrated safety interventions are often selected through analysis of crash data rather than application of dimension-based and/or geometric criteria. To some observers, this approach is the third phase in the resurfacing project evolution: (1) standards and dimension-based criteria, (2) resurfacing only, and (3) integration of selected safety improvements in resurfacing.

The scan report attempts to capture many of the promising organizational processes and technical approaches.

SCAN PURPOSE AND PARTICIPANTS

Federal, State, and local transportation agencies endeavor on a routine and ongoing basis to improve the methods by which existing highways are preserved and safety is improved. Combining pavement preservation and safety improvements in a single project is potentially more effective than separate interventions along the same facility. The American Association of State Highway and Transportation Officials (AASHTO), Federal Highway Administration (FHWA), and National Association of County Engineers (NACE) cosponsored a scan tour to identify and disseminate information on practices that effectively integrate safety improvements into resurfacing and pavement restoration projects.

A Scan Team assembled by the sponsoring agencies included personnel with expertise in highway design, local government operations, maintenance, pavement management, project development, and safety. Additionally, FHWA arranged for a report facilitator. The Scan Team met with State DOT and FHWA Division (i.e., local office located in each State) personnel in each of the six States and with county engineers in three States. Because of scheduling conflicts, the entire Scan Team was not able to visit every scan destination. However, four Scan Team members participated in all activities and visits. The Scan Team members provided a wealth of knowledge and input to the goal of this report The Scan Team members included the following:

- Ernest (Ernie) J. Blais, P.E., Assistant Division Administrator Connecticut Division, FHWA (Scan Team Co-Chair).
- Keith Cota, P.E., Chief of Consulting Design, New Hampshire Department of Transportation (Scan Team Co-Chair).
- Lawrence (Larry) B. Hummel, P.E., County Highway Engineer Manager, Van Buren County (Michigan) Road Commission.
- N. Kent Israel, P.E., Road Design Engineer, Louisiana Department of Transportation and Development.
- Frank Julian, Safety Engineer, Safety and Design Technical Service Team, FHWA.
- Bernie Kuta, P.E., Pavement and Materials Engineer, Pavement and Material Technical Service Team, FHWA.

- Susan G. Miller, County Engineer, Freeborn County, Minnesota.
- Harry W. Taylor, Jr., Road Departure Safety Team Leader, FHWA (now retired).
- Kevin M. Mahoney, P.E., Senior Research Associate, Pennsylvania State University (Scan Team Report Facilitator).

Appendix B presents biographies of the Scan Team.

CHAPTER 2: SCAN DESTINATIONS

The scan destinations were identified through a review of available information. The following were considered indications of a strong State program:

- States have developed written guidance on safety considerations for resurfacing projects.
- Analysis techniques use historical safety performance.
- States provide assistance and leadership to local agencies for incorporating safety improvement in resurfacing programs.
- Safety effects of resurfacing program have been documented.

After reviewing available information related to these factors, a number of strong programs were identified. As a practical matter, it was only possible to visit six States. The following States were visited during three separate trips, as shown in table 1.

Table 1: States (and dates) visited by scan team.

State	Dates visited
Colorado	June 20 – 21, 2005
Washington State	June 22 – 24, 2005
Pennsylvania	July 18 – 20, 2005
New York	July 21 – 22, 2005
Utah	August 22 – 23, 2005
Iowa	August 24 – 26, 2005

A summary and highlights of the visit to each destination are provided below.

COLORADO (June 20 to 21, 2005)

The Colorado Department of Transportation (CDOT) issued its *Procedures for Addressing Safety Requirements on Resurfacing, Restoration, Rehabilitation (3R) Projects* Design Bulletin in March 2005. The Design Bulletin applies to all resurfacing projects with an overlay of more than 1.5 inches, but does not apply to reconstruction. The new procedures were developed by a process development team with representation from CDOT central and region offices and the FHWA Division Office. The procedures were developed in response to a Quality Assurance Review that found a lack of consistency on the types of safety improvements included in resurfacing projects. The team that developed the new guidance sought to:

- Establish a rational process for determining an appropriate design for a specific set of conditions.
- Document key decisions without extensive design variance approval paperwork.
- Reflect cradle-to-grave project management style and minimize “hand offs.”
- Conserve engineering resources.
- Support tort liability management effort.

- Fulfill FHWA requirements.
- Function for both State-only and Federal-aid funded projects because having separate processes would be too cumbersome.

The 3R safety consideration procedure is based on analysis of the facility's historic safety performance rather than on dimensional values for specific features. Safety Performance Functions (SPF) are used to assess the magnitude of safety problems on highway segments that will be resurfaced. The SPF reflects a relationship between traffic exposure (measured in ADT) and crash count for a unit of road section. The SPF developed by CDOT provides an estimate of expected crash frequency and severity, as a function of exposure, for similar facilities. A facility's performance and its amenability to safety improvement are classified using a system referred to as the level of service of safety, or LOSS. The LOSS reflects a relationship between a roadway segment's actual and expected crash frequency and severity for a specific exposure level, measured in annual average daily traffic. Additional analysis is conducted in the form of pattern recognition and direct diagnostics to define specific accident patterns susceptible to correction, and proposed improvements within the scope of the project. To expedite project development, the safety analysis is recommended to be accomplished prior to the scoping.

The CDOT central office's Safety and Traffic Engineering Branch, in conjunction with the Region design team, formulate the safety analysis and recommendations. Additionally, the CDOT central office's Pavement Management System section provides input to the resurfacing project selection process. The regional offices have primary responsibility for project delivery and considerable discretion. Project development is results oriented and expedient. When needed, an environmental specialist is included in scoping field views to render decisions. The roles of CDOT region and central office organizations appeared complementary and cooperative.

The Colorado Transportation Commission establishes funding levels for specific programs, including the Surface Treatment Program and Safety Enhancement Pool. The primary purpose of the Surface Treatment Program is to maintain the condition and drivability of the State highway system. A limited number of activities are eligible for this funding. In addition to paving and surface improvements, Surface Treatment Program funds may be used for minor safety work (i.e., signing, striping, delineation etc.), shoulder-up work, guardrail adjustments, and other items needed to complete the surface treatment are also eligible. Additionally, Americans with Disabilities Act (ADA) requirements are met with Surface Treatment Program funds. Enhancements that are desirable or mandated (e.g., upgraded bridge rail and guardrail) can also be implemented, but are not eligible for Surface Treatment Program funds. The annual Surface Treatment Program allocation is approximately $143 million. Approximately 11 percent of these funds ($16 million) are expended for essential safety items associated with the resurfacing work, including work zone traffic control, raising guardrail, and adding or reapplying pavement markings. The Safety Enhancement Pool funds safety improvements included in resurfacing projects are not eligible for the Surface Treatment Program. Safety Enhancement funds are in the range of $4 to $7 million annually.

WASHINGTON STATE (June 22 to 24, 2005)

Government in Washington State, at the State and county level, is very engaged in transportation, and resurfacing and pavement restoration programs are quite refined.

The Washington State Department of Transportation (WSDOT) approach to project development and design, including consideration of safety improvements, is provided in the *DOT Design Manual*. The *DOT Design Manual* includes five design matrices; each provides applicable standards and criteria for various project types (e.g., preservation, improvement) and highway facility elements (e.g., NHS route, mainline; non-NHS route, mainline). "Basic Safety" is generally provided for preservation projects and refers to a list of required and discretionary items, including delineation; rumble strips in accordance with roadside safety policy; adjustment of existing features affected by resurfacing; replacement of deficient signing; relocation, protection, or provision of breakaway features for sign supports, luminaires, and electrical service poles inside the design clear zone; sight distance restoration at intersections and curves; nonstandard bridge rail upgrades; and barrier terminals and bridge end protection, including transition upgrades in accordance with traffic barrier policy. Other improvements are also considered such as spot safety improvements and roadside safety hardware.

WSDOT operates with specific allocations and eligibility directives. Preservation is a legislatively established program; Pavement Preservation was funded at $255.1 million for the 2003 to 2005 biennium. For the same period, $140.3 million was provided for the Safety Improvement program. WSDOT was directed by its legislature to use a project selection process that preserves the existing State highway system and restores existing safety features, while giving consideration to lowest life-cycle cost. This mandate applies to the approximately 19,000 lane miles of State-maintained pavements. The objectives of the Safety Improvement program are to provide the safest possible highways with the available resources and to improve pedestrian safety. Safety Improvement-funded projects typically consist entirely of safety measures and extend along a corridor or throughout an area. Safety Improvement funds are not normally used for resurfacing projects, although a project may be funded from both the Preservation and Improvement programs when the work can be completed within the Preservation program cycle time. Approximately 12 percent of Pavement Preservation funds are expended on safety restoration; they consist mostly of Basic Safety, as previously described.

Local governments in Washington State have a significant role in transportation. There are 39 counties in Washington State, all of which have legislated responsibilities for highway maintenance and improvement. Counties obtain funds from several sources including local taxes, Federal-aid (i.e., FHWA-administered funds passed through WSDOT), and State resources. In 2005, approximately $250 million in Federal-aid highway funds was suballocated to Washington State local governments (i.e., counties, cities, towns, port districts, and Native American tribes). This amount is approximately 50 percent of all the Federal funds allocated to Washington State; 100 percent of Federal-aid Hazard Elimination-Safety (HES) funds are passed through to local governments.

The County Road Administration Board (CRAB) is an independent entity of Washington State created by State statute. The mission of the CRAB is to preserve and enhance counties transportation infrastructure by providing standards of good practice, fair administration of

funding programs, visionary leadership, and integrated progressive and professional technical services. The CRAB and WSDOT are separate organizations that cooperate in several areas related to county highway programs. To receive State and State-allocated funds, a county must comply with certain organizational and accountability requirements. State law requires that each county have a properly staffed road organization, headed by a professional engineer who serves as the county engineer. The CRAB issues annual certificates of compliance for county road programs that are found to meet all requirements. In those cases where the CRAB does not issue a certificate of compliance to a specific county, the governor may withhold funds. The CRAB also administers the Rural Arterial Program (RAP), which funds reconstruction of rural high-volume arterials. The RAP was established in 1983 by the Washington State Legislature to mitigate the effects of heavy freight (e.g., timber) traffic on rural arterials caused by rail system abandonment. RAP funding is derived from 2 percent of the 28-cent-per-gallon State gas tax. County engineering departments have relationships with, and accountability to the CRAB and WSDOT.

PENNSYLVANIA (July 18 to 20, 2005)

The Pennsylvania DOT (PennDOT) is a decentralized organization. Central office bureaus provide specialized expertise and organization-wide services (e.g., crash database organization, network-level safety analysis and screening, pavement management). Each of the 11 districts develops and executes a business plan. The plans include numerous components that address PennDOT's five strategic focus areas, including those related to infrastructure preservation and safety. There is substantial variety in district priorities, capital and maintenance budgets, customer expectations, and staffing. During the scan, the team visited two district offices; this report is based on observations at those districts.

PennDOT has jurisdiction for about 40,000 of the approximately 120,420 roadway centerline miles in Pennsylvania. Two-lane rural roads comprise much of the highway network, including the State system. Many miles of roadway were constructed with 18-ft wide bases and usable roadways of approximately 16 ft; 33-ft rights-of-way are common. District 3 has been pursuing a multiyear program to attain a 20-ft minimum roadway within existing rights-of-way, in conjunction with resurfacing. Roadway segments have been prioritized based on traffic volumes. Much of the work is completed with State forces through a phased approach. Early work consists of extending culverts, base widening and clearing; follow-on activities are paving, pavement markings, and appurtenance installation. Approximately 30 to 47 highway miles are widened within District 3 annually. The 5-year plan has specific goals and is updated annually.

Contract resurfacing projects are common in all PennDOT districts. Generally, the resurfacing program is initiated and managed by the maintenance manager for a geographic area. Pavement conditions, known performance problems, and input from external sources are considered in developing the program. Senior district managers, including a design manager and bridge engineer, field view the designated route segments. This group determines the scope, specific features to be addressed or provided, and identifies potential problems. Crash histories are reviewed as part of project definition.

Resurfacing work is funded primarily with State maintenance and capital funds. Capital funds are programmed and maintenance funds are distributed for State highways in each county on

the basis of a legislated formula. Except for Interstate routes, Federal-aid is used infrequently for resurfacing. Generally, a conceptual scope is determined first and funding options are then considered based on eligibility. A final determination on scope and funding is made after scheduling and project development (e.g., criteria, environmental, right-of-way) factors are considered. Projects involving geometric improvements require environmental review and are generally developed over a 2-year period if no additional right-of-way is required. When geometric alterations are not proposed, the development process is expedient and nearly always performed by State forces. Safety improvements are considered for all resurfacing projects, with or without geometric improvements. PennDOT has a Low Cost Safety Improvement (LCSI) program with a 2005-2006 budget of $10 million. However, this is not the upper limit (i.e., maximum permissible level) of expenditures for the safety strategies identified in the LCSI program. The same LCSI strategies are often incorporated in capital and maintenance projects and funded through other programs. The LCSI implementation guidance identifies 12 crash categories and 32 suggested countermeasures, with each crash category having from one to six countermeasures.

PennDOT has adopted the national safety goal to reduce fatalities to 1.0 per 100 million-vehicle miles (100 MVM) by 2008. Each district's plan identifies strategies to be executed (e.g., intersection improvement, tree removal, curve legend replacement, rumble strips) on an annual basis in pursuit of the goal. The calendar year 2004 rate of 1.40 fatalities per 100 MVM was an all-time low for Pennsylvania. Each district has a Safety Review Committee that reviews project scopes and design exceptions.

NEW YORK (July 21 to 22, 2005)

The New York State Department of Transportation (NYSDOT) delivers programs through a decentralized organization using very systematic and process-oriented approaches. Centralized responsibilities include policy setting, coordination, technical assistance, and information systems functions. Technical guidance and procedures for its programs are quite sophisticated. Project development and operational functions are executed primarily in NYSDOT's 11 regional offices. These general characteristics and division of responsibilities extend to the scan topics. The NYSDOT's Main Office has established a set of programs and promulgated corresponding procedures related to the incorporation of safety improvements in resurfacing projects.

The New York State safety strategy is comprehensive and involves several agencies. Figure 1 shows the NYSDOT elements of the strategy. Development, maintenance, and ongoing improvement of the Safety Information Management System (SIMS) are centralized functions. As shown, the safety goal is pursued through a series of routine operations (e.g., resurfacing) and proactive strategies.

SIMS is used to identify Priority Investigation Locations, which are roadway segments or intersections targeted for review because of their crash history. SIMS is also used to analyze the safety record of segments targeted for resurfacing. Pavement conditions, operations and safety are principal considerations in determining project types (i.e., 1R, 2R, and 3R).

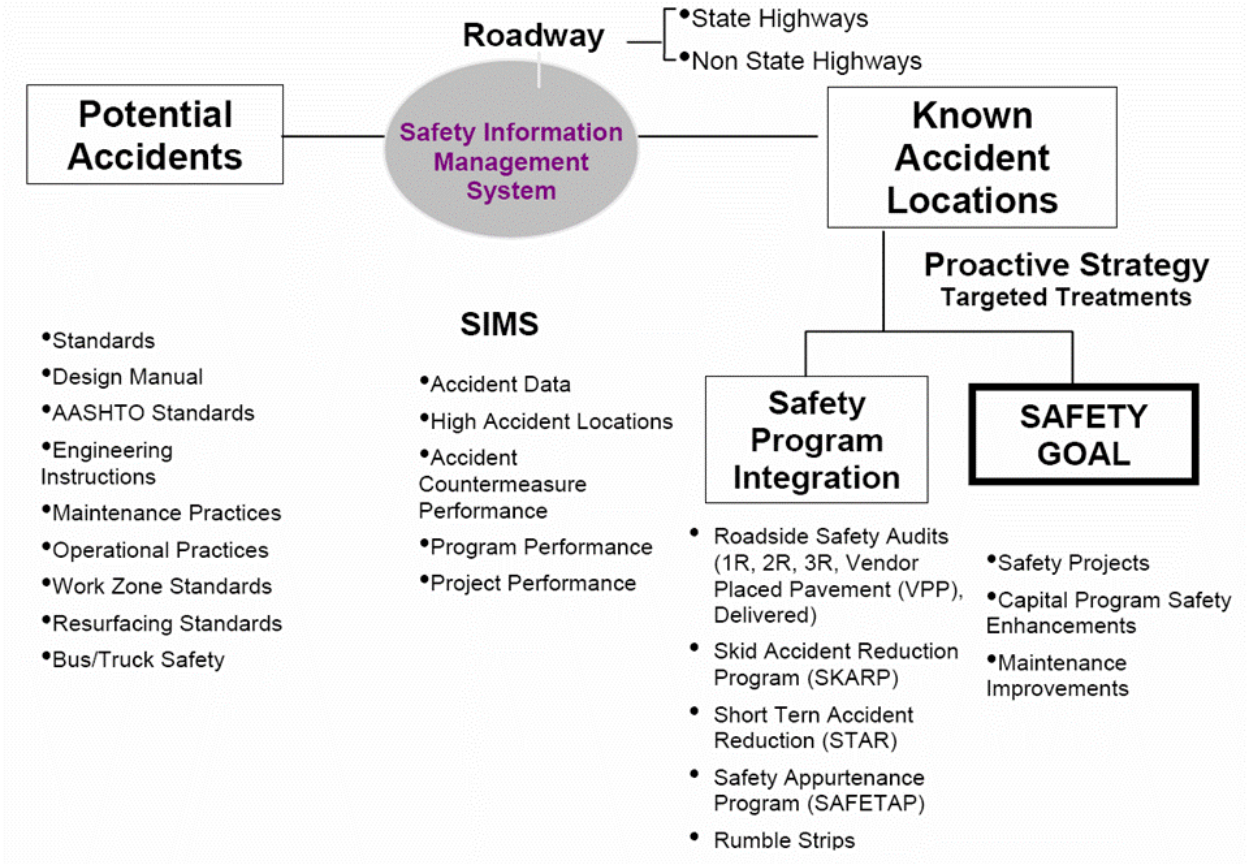

Figure 1. NYSDOT elements of State safety strategy.

The NYSDOT project development guidance is fairly specific guidance on *what* safety treatments should be considered or provided and *when* the safety features should be completed. Safety measures are designated for completion in one of the following three time frames:

- *Before* the paving contract.
- *During* the paving contract.
- *Before, during,* or *as soon as possible following* completion of the paving contract.

Project development and delivery cycles vary for the array of resurfacing program types. The 1R projects are implemented in 4 to 6 months and even less time when the work is added to ongoing contracts. The 2R projects generally proceed from inception to construction in less than a year, whereas 3R projects take 2 to 3 years.

NYSDOT's regional offices are responsible for project development. The Scan Team observed a number of completed NYSDOT and county resurfacing projects in the field, including a completed safety edge (30° to 35° asphalt fillet). This recently developed technique is used to mitigate the edge drop-off that can result from resurfacing without *backing up* the adjacent shoulder.

UTAH (August 23 to 24, 2005)

Within the Utah Department of Transportation (UDOT), project design, including plan development for resurfacing projects, is delegated to four regional offices. Several functions and controls remain at the central office, including bridge design, right-of-way acquisition, and management of the traffic and safety program.

UDOT fund categories are designated on the basis of primary purpose. Approximately $50 million, consisting of Federal and State funds, is programmed annually for surface preservation. Approximately $11 million is available for traffic and safety work, of which approximately $7 million funds traffic signals and intelligent transportation systems (ITS). Projects with multiple funding sources are rare. The scan focused on surface preservation projects, which may incorporate safety improvements.

UDOT has three different sets of procedures and guidance for various scopes of resurfacing projects. The *Resurfacing, Restoration, and Rehabilitation Standards for Non-Freeway Systems* were issued in January 2005. The *Purple Book* is a guidance document for only resurfacing work, which is a subset of 3R projects. Projects developed using the *Purple Book* must fit a fairly specific profile. In addition to pavement work, which may involve overlays up to 4 inches of resurfacing, curb ramps that comply with the *Americans with Disabilities Act Accessibility Guidelines* (ADAAG), and selected safety improvements are included in these projects. The safety features are identified through an Operational Safety Review (OSR). The *Orange Book* is the third guideline. The *Orange Book* addresses pavement preventive maintenance, primarily thin overlays and surface treatments; geometric improvements or enhanced safety features are not provided. Both *Purple Book* and *Orange Book* projects are completed within existing rights-of-way, which are generally wide enough to accommodate geometric and roadside improvements. The UDOT is working on programmatic Federal-aid eligibility for both *Purple Book* and *Orange Book* projects.

The OSRs are prepared by the UDOT central office Traffic and Safety unit and include a review of infrastructure conditions (e.g., geometry, appurtenances, traffic control devices, etc.) and safety history. Three years of crash count data are collected. Historical crash rates and severities are computed and compared to expected rates. Single-vehicle crashes are broken into more specific types (e.g., wild animal, domestic animal, run-off-road, etc). Safety recommendations are formed on the basis of cost-benefit analysis. Typical improvements include a variety of traffic control (e.g., signing, delineation) and roadside (e.g., mail box supports, culvert extension, and guardrail) treatments. Generally, when guardrail meets NCHRP 230 crash requirements, it is not replaced. If an installation does not meet NCHRP 230 but is warranted, NCHRP 350 compliant guardrail is installed.

UDOT has adopted the national safety goal to reduce fatalities to 1.0 per 100 MVM by 2008. Highway fatalities have declined steadily in recent years. Ironically, this positive trend has increased the challenge of securing safety funds as some high-level decision makers consider recent safety performance to be adequate.

The State of Utah provides assistance to counties and incorporated municipalities under the Class B and C Road Program. Apportionments are made on the basis of road and street mileage open

to public travel, over which a two-wheel drive vehicle may travel. Fund distribution is based 50 percent on population and 50 percent on *weighted* road miles. One paved road mile has a weight of five (5); a gravel road mile has a weight of two (2); and other road types carry a weight of one (1) per road mile. Class B and C Road Program funds may be used for construction; maintenance; equipment purchases and rental; engineering and administration; right-of-way; Federal fund match; ancillary buildings; and yards. The Class B and C Program is administered by UDOT through its Local Government Liaison Unit. Technical assistance is available from the Local Technical Assistance Program (LTAP) centers.

The Scan Team was not able to meet any local government officials or visit any locally administered projects, but members did learn about the UDOT Roadway Safety Improvement program that uses Federal-aid Hazard Elimination-Safety (HES) funds to assist counties to improve warning and regulatory signing. The UDOT provides both technical assistance (e.g., reviewing designs) and sliding-scale funding. The actual match required by participating counties is sometimes less than 7 percent. The UDOT has a goal of assisting two counties per year under this program.

IOWA (August 24 to 26, 2005)

Over the past several years, Iowa Department of Transportation (IADOT) has changed its 3R program development approach. State highway resurfacing project typically entails a 4-inch overlay (two lifts of 2 inches each) with an anticipated service life of 20 years. Annual Statewide 3R program expenditures are approximately $60 million. As of March 2001, IADOT's six district offices are responsible for scoping, designing, and delivering the 3R program. Previously, the central office was also involved in project development. The IADOT Central Office staff developed and executed a transition plan to assist in decentralizing 3R project delivery. District office staffs were trained on conducting inventories and project scope concepts. After the decentralization was complete, the Office of Traffic and Safety conducted a quality improvement program (referred to as 3R Safety Audit Field Reviews). This was not an *audit* in the conventional sense or a compliance review; rather, it is a proactive educational and advocacy initiative. The audit team consisted of personnel from the IADOT Office of Traffic and Safety, FHWA Division Office, Iowa State University Center for Transportation Research and Education, and an independent safety consultant. Resident IADOT district office staff also participated. The six district offices were visited between November 2001 and October 2004. Written reports of each district visit and a Statewide summary report were prepared. Observations, strengths, and potential improvements were noted. In addition to the 3R Safety Audit Field Reviews, the IADOT Office of Traffic and Safety delivers an ongoing educational program of instruction and workshops for project-level decision makers. Several safety-related courses are offered annually.

The following safety countermeasures are considered for all 3R projects:

- Improving superelevation on horizontal curves.
- Extending small culverts with openings in the shoulders or fore slope, where right-of-way permits.
- Upgrading guardrail, including bridge approach guardrail.

- Adding two to six ft paved shoulders and shoulder rumble strips.
- Adding offset turn lanes.
- Flattening transverse driveway entrance slopes.
- Constructing safety dikes opposite T-intersections.
- Removing fixed objects within the clear zone.
- Placing chevrons on horizontal curves.
- Replacing warning signs with the florescent-yellow signs.

In addition to the above, the following additional improvements are considered on NHS routes:

- Widening of narrow travel lanes.
- Upgrading granular shoulders with surface treatments.
- Converting existing four-lane undivided urban streets to three-lane facilities.

Safety improvements are selective rather than "all or nothing." Individual hazards and corresponding improvements are assessed individually. Crash analysis is a routine part of these evaluations and project development.

The proportion of 3R expenditures for safety features was previously estimated at 3 percent, mostly for guardrail. Subsequent to that review and estimate, the type of safety improvements and proportion of 3R expenditures has increased.

There are approximately 113,518 centerline miles of roadways in Iowa of which approximately 8,881 are under IADOT jurisdiction. Counties own approximately 88,740 miles of the 102,812- (86.3 percent) mile rural system. Local government units (e.g., counties, cities, towns) own approximately 9,956 of the 10,706 (93.0 percent) centerline miles of roads and streets within urban areas. IADOT and the 99 counties have substantial rural highway maintenance and enhancement responsibilities. IADOT has an active outreach and partnership with local government units. Training, policy and technical guidance (e.g., cost-benefit analysis, guardrail systems), and crash data and analysis are provided at no cost. A series of County 3R Safety Workshops were delivered under IADOT leadership and assistance from Iowa State University and consultants. County personnel are provided with hard copy crash location maps and instructed on how to generate additional crash reports. Local Systems Engineers located in each IADOT district participated in the workshops and provide ongoing, routine assistance to counties and municipalities.

CHAPTER 3: COMMON ISSUES

All visits were coordinated in advance with host agencies. Appendix C contains the set of *amplifying questions* provided in advance of the scan visits. The agenda and format for visits varied somewhat but typically included an entrance conference at the State DOT headquarters featuring an overview of the scan's purpose and scope by one of Scan Team cochairs. Representatives from FHWA Division Offices and DOT headquarters accompanied the Scan Team throughout the visits. The Scan Team met with personnel of DOT offices in all States, either at the district/region or central office. The involvement of project-level personnel provided useful insights into the development, design, and implementation of resurfacing projects. Additionally, the Scan Team met with county engineers in Washington State, New York, and Iowa. Appendix D includes the names and contact information for key contacts in host States and counties.

All transportation agencies have some similarities; yet, each is also distinctive. Climate, cultural, demographic, economic, governance, and terrain factors all influence the operating environment, mission, and methods of a transportation agency. A number of factors that shape an agency's operating environment and its performance related to the scan subject are discussed below.

BALANCING AND FUNDING NEEDS: SURFACE CONDITIONS AND SAFETY

There are insufficient resources to address either all pavement preservation needs *or* all safety needs. Therefore, allocating resources among pavement *and* safety needs is difficult for all agencies.

The degree of emphasis—and level of investment—agencies commit to incorporating safety improvements in resurfacing varies substantially, even among the States visited. The degree of discretion that agency leaders and individual professionals exercise also varies. For several State DOTs, the level of safety investment is determined at the State level. For example, DOTs in Washington State and Colorado are guided by agency-wide safety expenditure amounts.

The eligibility guidance used by the NYSDOT and PennDOT are less specific. Geometric improvements that are made as part of resurfacing are not necessarily attributed to a safety improvement fund.

For States with less specific and definitive guidance, agency decision makers at all levels exercise substantial discretion. Extensive safety investments were made in some programs and projects; in other cases, safety improvements were modest. The differences related to perceptions about needs and priorities.

LEADERSHIP SUPPORT AND INSTITUTIONAL CULTURE

Every agency endeavors to preserve its roadways and improve safety; however, not every agency pursues these goals through integrated processes. Incorporating safety improvements into resurfacing involves consideration of funding, priorities, observable results, delivery schedules,

and tort liability issues). In the face of competing objectives, resource allocations must align with public priorities. The Scan Team noted that leadership is needed to force resolution of priorities among competing needs and to integrate separate functional domains (e.g., maintenance and safety bureaus). Leadership can also play a critical role in securing resources and determining eligibility. In the States visited, career professionals and executives have successfully developed and implemented programmatic approaches to balancing and integrating their pavement preservation and safety improvement goals.

> "There might not be another DOT activity at the project location for another 10 years."
>
> Paul Jesaitis
> Project Development Engineer
> Colorado DOT

The evolution and development of agency practices were discussed with several of the agencies visited. In some States, integration of safety into resurfacing is outlined in the DOT-FHWA Stewardship Agreement. In other cases, it was determined that an integrated strategy was the logical means to pursue two goals. Resurfacing is often the only improvement an agency will make to a road segment during a 5- to 20-year period. Therefore, resurfacing projects are the best (and perhaps only practical) opportunity to enhance safety. Mobilization, traffic control, and contract administration costs are not substantially increased by incremental contract items. Agency executives with cross-functional responsibilities, either Statewide or for a specific geographic area, were generally supportive of integrating safety into resurfacing.

DOT staffs in the States visited also tended to embrace both functions (i.e., pavement preservation and safety improvement) as inherent organizational responsibilities. For some agencies, the notion of integrating safety into pavement projects was deeply ingrained and unquestioned. Other agencies are in transition and working through the policy and technical issues related to making safety investments through a program with a traditional infrastructure focus.

MEASUREMENT AND EFFECTIVENESS

Agencies have to account for resources and demonstrate progress toward established goals. All State DOTs visited had information systems related to infrastructure conditions (e.g., pavement management systems) and safety. Pavement-related measures include lane-miles paved, tons of asphalt placed, and ride quality (typically measured using the International Roughness Index). DOTs also have safety goals and plans. Example safety measures are crashes per reporting period (typically one year), crash rates, annual fatalities, fatal crash rates, pedestrian-involved crashes, pedestrian fatalities, and impaired driver-related crashes.

In general, agencies can readily relate pavement preservation investments to outcomes. The type and interval of resurfacing and restoration interventions are the dominant factors affecting pavement conditions. Conversely, the link between specific safety outcomes and investments is less certain. Reported safety statistics are influenced by many factors, such as legislation (e.g., seatbelt and helmet use, speed limits), enforcement efforts, weather patterns, and reporting thresholds. These factors, and the random nature of crashes, make it very difficult to isolate the effect of safety countermeasures, especially over short intervals (e.g., year-to-year) and at specific locations. Consequently, reported safety improvements are often stated in terms of

investments and visible features. For example, agencies may report rumble strip installation (measured in units of length) as a measurable safety improvement. There is little doubt that rumble strips, in aggregate, prevent crashes and the associated consequences. However, it is a difficult and subjective exercise to estimate the number of fatalities and injuries averted by the installation of specific rumble strips during a reporting period. One agency safety manager indicated that the absence of clear safety investment-results relationships makes it difficult to attain additional resources.

During the scan, detailed measurement plans were observed in New York, Pennsylvania, and Washington State. PennDOT uses a business planning process and relevant parts of the two district business plans were reviewed during the scan. The plans tend to be outcome oriented and tied to the organization's global goals, which include specific safety objectives and maintenance outcomes. WSDOT has a rigorous reporting process and submits quarterly reports, known as *Grey Notebooks* to the Washington State Transportation Commission. These reports provide information on capital program expenditures, system performance and condition, safety, and a host of other measures. Pavement conditions are reported as the percent of pavements in good condition; for 2003, the level was at 90 percent. Washington State traffic fatalities and fatality rates are reported, along with a comparison to other States. Each of the States visited monitors and reports basic performance and results but the detail and frequency of reports varies substantially.

PAVEMENT CONSIDERATIONS

Resurfacing and pavement restoration projects are *initiated* with a *primary* purpose of improving roadway surface conditions and extending the utility of existing pavement structures. This is true in every State and county visited. NYSDOT also has a program to resurface roadways with high wet-road crash levels and low skid resistance. The role of Pavement Management Systems (PMS) in resurfacing project initiation varies by DOT. The UDOT uses its PMS to identify the next scheduled pavement intervention for every State-maintained road segment. This information is organized into a Plan for Every Section of Road and serves as the primary basis for the annual resurfacing program. In Colorado, each CDOT regional office identifies resurfacing project priorities. These priorities are reviewed by the central PMS section. The regional office and PMS section lists typically do not match identically and the two groups collaborate to develop a final list. The PMS section attempts to have 70 percent of its recommended mileage programmed. For most States, PMS condition data is one of several sources of information considered in developing the annual resurfacing program. The observations of maintenance personnel and input from the public and elected officials are also factors in programming projects. PMS includes extensive inventory data, including valuable safety management and project development information. PennDOT's PMS provides information on pavement edge drop-offs.

Pavement resurfacing and restoration strategies range from surface treatments to multicourse overlays. Several States use their PMS for preliminary identification of intervention alternatives. The final determination of a pavement strategy is typically based on field observations and, in some cases, materials testing and analysis. Superpave mixes are commonly used for overlays. Stone Matrix Asphalt mixes are used occasionally for resurfacing major routes in Washington State.

Inadequate pavement cross slopes and superelevation rates are often addressed in conjunction with resurfacing. Pavement edge drop-offs are typically, but not always, addressed with either shoulder backup or sloped pavement edges (e.g., Safety Edge).

PROJECT DEVELOPMENT

Each agency has a unique approach to scoping and designing resurfacing and restoration projects. For transportation agencies, project development is a business process. As such, the project development process covers the assignment of roles, funding amounts and eligibility, timing of actions and schedules, and a host of technical guidance.

All State DOTs visited are decentralized organizations; however, the distribution of roles and responsibilities between headquarters and field offices varies from State to State. Agencies attempt to involve personnel with the necessary skills and perspectives and still deliver projects in a timely fashion. Nearly all Iowa and Pennsylvania resurfacing project development decisions are made by local DOT units (e.g., regions/districts). Colorado and Utah DOT Traffic and Safety headquarter personnel perform project safety analyses and develop recommendations. In the WSDOT process, headquarters develops design guidance and approves project definition (Program Management is a headquarters bureau). Figure 2 provides a simplified flow chart of WSDOT's pavement preservation project development process.

> "Our process is a rational basis for reaching decisions without being unduly burdensome or paper intensive."
>
> Bryan Allery
> Traffic & Safety Engineer
> Colorado DOT

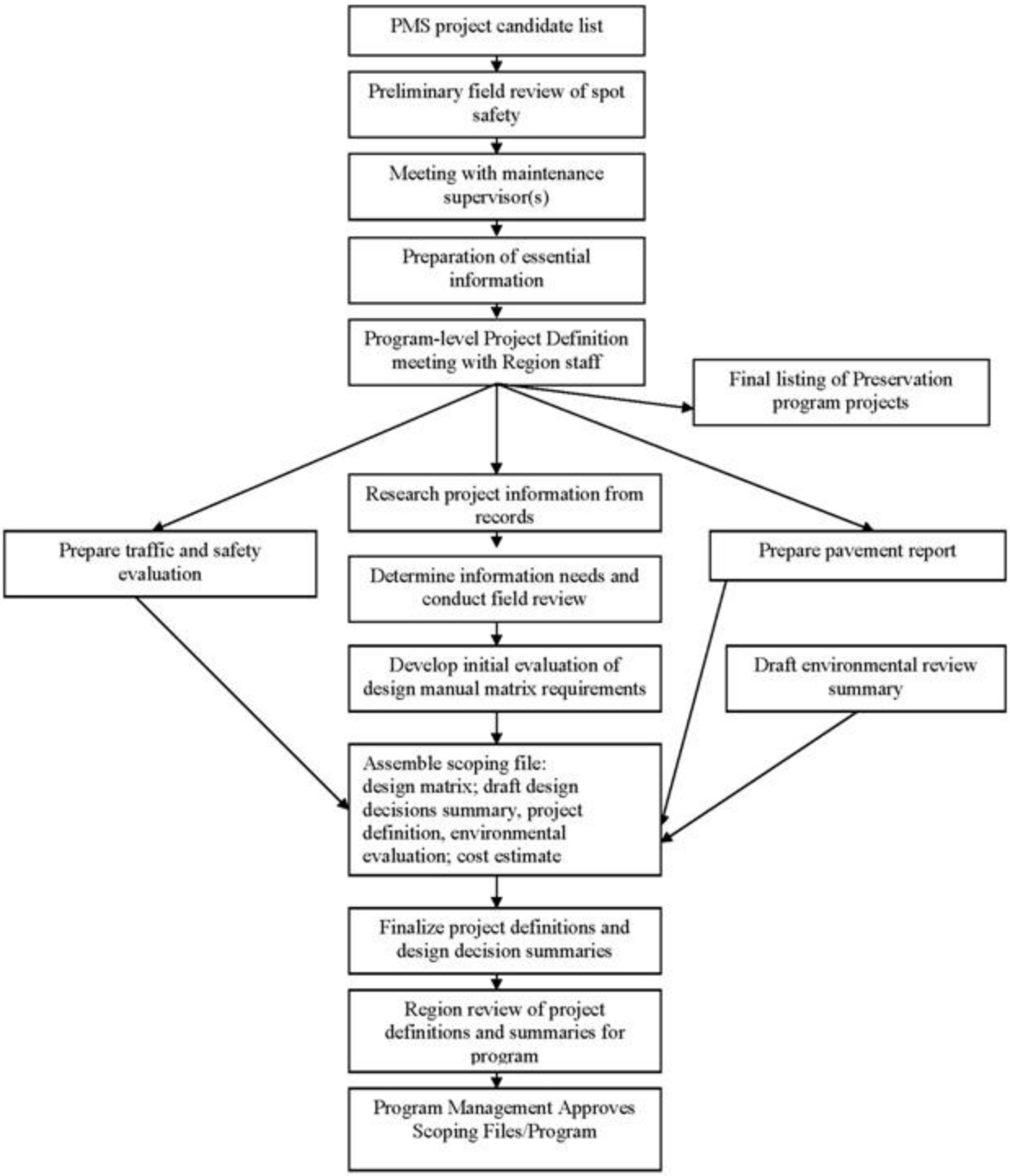

Figure 2. Simplification of WSDOT pavement preservation project development process.

Several agencies have different types of pavement restoration programs and distinct project development processes exist for each. For capital-funded 3R projects, PennDOT uses the project development process and criteria in its *Design Manual*. Less formal procedures, which vary by district, are employed for maintenance-funded projects. NYSDOT has project development guidance for each restoration program (i.e., 1R, 2R, nonfreeway 3R, freeway 3R). A series of factors (e.g., pavement needs, safety record, scope of improvement, right-of-way needs, impacts, controversy) are used to determine which program a specific project should be processed under. At the time of the scan, UDOT was developing a process diagram for resurfacing projects to be used in lieu of the current flow chart, which applies to all projects but is considered unnecessarily complex for resurfacing projects.

TORT LIABILITY

The specter of tort liability looms over every transportation agency. The influence of tort claims on resurfacing project decisions varies substantially among the agencies visited and is largely a result of the prevailing legal climate (e.g., statutory limits on the nature and magnitude of agency liability). In general, agency procedures and project-level documentation were viewed as an integral part of the agency's tort management strategy.

Numerous transportation agency personnel indicated concern about litigation and expressed the opinion that a litigious environment contravenes public interest. Several engineers expressed reluctance to make any geometric improvements unless all applicable criteria were attained. Several engineers expressed the opinion that simple resurfacing involves less tort exposure than projects that alter infrastructure but do not result in attainment of all applicable criteria. Even well-informed, well-considered, and well-documented deviations (e.g., design exceptions) are considered risky. Tort concerns were expressed most strongly in New York and Washington State.

ENVIRONMENTAL REGULATIONS AND PROCESSES

Roadway infrastructure modification can trigger environmental processing and permitting requirements. Several transportation engineers indicated that the substantive environmental protection requirements were considered out-of-balance with seemingly minor impacts. Implementation of the National Pollution Discharge Elimination System (NPDES), Phase II Stormwater Program is particularly challenging. Various States indicated that NPDES implementation provisions discourage cross-section improvements (e.g., widening, paving shoulders). The time and staff effort needed to develop documentation and secure permits is at cross purposes with transportation agency goals of expedient project development and delivery.

The Scan Team observed several measures to manage the environmental process for resurfacing projects. CDOT includes environmental specialists on project teams and WSDOT is developing geographic information systems (GIS) overlays to identify environmentally sensitive areas (e.g., threatened and endangered species habitat, wetlands). Programmatic permits, where applicable, are very beneficial.

AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE

Compliance with the ADAAG is a major cost and organizational challenge for many agencies, including all State DOTs. The status of compliance and strategies for attaining compliance varies substantially among the States visited. As a result of litigation, the UDOT is developing an inventory of curb ramps along State highways that will be used to identify noncompliant facilities. After the inventory is complete, dedicated contracts will be let to install compliant curb ramps. CDOT provides ADA compliance measures in other projects, including resurfacing. A number of ADA measures were observed in CDOT resurfacing projects during the scan. When included in resurfacing projects, the cost of ADA compliance items is typically assessed to the same fund category.

CHAPTER 4: LOCAL GOVERNMENT PERSPECTIVES

Local governance structures and emphasis on highways vary across the States visited. In all except one State visited, counties have significant levels of highway ownership. In Pennsylvania, a small fraction of rural highway mileage (less than 0.1 percent) is under county jurisdiction. In contrast, counties in Washington State are responsible for over 35,000 centerline miles (approximately 57 percent) of rural roads and nearly a quarter of the State's urban mileage. State DOTs provide varying levels and forms of assistance to local agencies. The LTAPs operate in all States. Some DOTs provide substantial financial resources to local governments and have dedicated organizational units to facilitate effective and eligible expenditures. In some States, the level of State-local interaction appears low, at least with respect to resurfacing programs and associated safety considerations.

The Scan Team met with county engineers in Iowa, New York, and Washington State. Funding for local public agency (LPA) resurfacing is derived from three sources: (1) Federal-aid passed through the State DOT, (2) State-aid, and (3) locally generated revenues (e.g., property, sales taxes). All of the county personnel were engineering professionals and displayed a high level of commitment to safety improvement. The counties have systematic processes to maintain and improve infrastructure and safety.

LPAs in Washington State are very active in the transportation arena. Substantial Federal-aid and State-aid is provided to LPAs. The Scan Team met with 17 representatives from 15 counties, including nine county engineers. The WSDOT Highways and Local Programs Division have a principal mission of assisting local governments use their Federal-aid funds efficiently and in compliance with applicable requirements. A member of this WSDOT division participated in the entire Washington State scan visit. The arrangements between WSDOT and local government units appear to be extremely cooperative and productive. Key mechanisms used to provide assistance to local agencies are noted below.

Certification Acceptance (CA) is a method of delegating certain Federal-aid highway program decisions to non-Federal transportation agency partners. State DOTs routinely accept these responsibilities, duties, and authorities. In Washington State, approximately 100 local agencies, including all counties, operate under CA. These agencies can expedite project delivery by self-approving many items (e.g., location and design, utility agreements, public hearings, plans, specifications and estimates, contract awards, construction administration) that would require WSDOT and/or FHWA approval if the administering agency did not have CA.

WSDOT has developed *Local Agency Guidelines Manual* (LAG) and *City and County Design Standards* (published as *Design Manual*, chapter 42). The LAG outlines procedures for the following phases:

- Programming.
- Environmental.
- Right-of-way.
- Consultant selection.
- Design.

- Contract documents (plans, specifications and estimate).
- Construction.
- Project maintenance.

The *City and County Design Standards* contains design criteria and guidance for three types of projects: (1) new construction and reconstruction, (2) 3R projects, and (3) 2R projects. The publication pertains to facilities classified as principal arterials, minor arterials, and collectors. Separate committees develop the city and county standards, each comprised of six representatives from the relevant level of government unit (i.e., city or county). Other participants include representatives from WSDOT, the FHWA Division Office, and four other organizations. The joint committee is chaired by a WSDOT Highways and Local Programs representative, who has approval authority for the document.

The Washington State counties range widely in population, geography, and demography. King County has a population of approximately 1.8 million, while Wahkiakum County has about 3,800 residents. The larger counties tend to incorporate all anticipated improvement in resurfacing projects. Conversely, larger, urban LPAs often develop separate projects for basic paving and specialty work that provide for one or a few items (e.g., guardrail, pavement reflectors, or signs). Some LPAs use rigorous pavement management systems to identify needs and projects. Other local counties plan resurfacing programs using a fixed cycle and treatment (e.g., chip seal every 7 years). Despite the variations, a number of comments were common to several county engineers:

- Documentation of key decisions (e.g., design report) is extremely important.
- Upgrading all geometry and roadside features is not feasible in conjunction with routine resurfacing.
- Sight distances are reviewed as part of scoping and sometimes improved.
- Crash data are typically reviewed as part of scoping; county personnel are often acutely aware of serious crash locations.
- Clearly discernible "crash clusters" are rare.
- In some counties, low-severity crashes are underreported.
- Noncrashworthy mail boxes are a technical and public relations challenge.
- Efforts to consolidate access points are sometimes successful.
- Sign vandalism is a problem.

County personnel in several States noted the lack of in-house technical specialists. Each State has an LTAP center, supported by Federal and State funds, which provides technical assistance to local governments on transportation matters. Each State center operates somewhat differently but most provide training programs, an information clearinghouse, newsletters and personalized technical assistance. The LTAP centers and State DOT personnel can provide valuable specialized technical knowledge.

> "We don't have a lot of funds, so I have to use what we get efficiently. The assistance I get from NYSDOT safety personnel helps me do that."
>
> Fred Howard
> County Engineer
> Rensselaer County, NY

Resurfacing and safety programs are principal areas of subject areas for all LTAP centers. Additionally, the State DOTs in Iowa and Washington State have prepared technical publications related to LPA-administered resurfacing projects. These publications were frequently mentioned in discussions with agency personnel.

Budget and cost considerations motivate innovation. This is especially true for local agencies and the Scan Team observed several low-cost measures. An example is the use of plastic pipe side drains in conjunction with slope flattening.

As noted, the Scan Team met with county engineers in Iowa, New York, and Washington State, all of whom obtained crash data from the State and used this information to identify safety problems. County engineers also had close working relationships with law enforcement agencies, sheriffs and local units of State police. These relationships are useful in working on short- and long-term traffic safety problems.

Many of the institutional practices and all of the technical good practices observed could be useful to local government transportation organizations.

CHAPTER 5: OBSERVED GOOD INSTITUTIONAL AND TECHNICAL PRACTICES AND STRATEGIES

During the scan, numerous good practices were observed, some used by one agency and some used by several or all agencies visited. They are classified as either institutional or technical good practices and are discussed below.

INSTITUTIONAL PRACTICES

Institutional Practice 1 - Integrate Safety into Preservation Projects

The scan confirmed the premise that integrating safety improvements into resurfacing and restoration projects is generally an effective and efficient method of simultaneously pursuing two transportation goals. In many cases, resurfacing projects are the only regular (or quasi-regular) road improvement activity. A number of "base" actions are needed to develop and implement a resurfacing project. Base actions include an inventory of existing conditions and features, development of specifications, contract bidding and award, contractor mobilization, and construction administration. The cost of these items is substantial and does not change significantly with modest scope expansion. The intersection area in figure 3 represents shared base costs that result in economy of effort and cost.

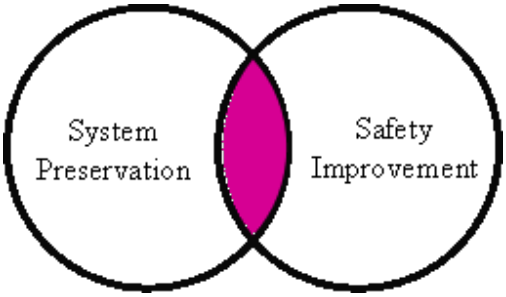

Figure 3. Incorporating safety improvements in system preservation.

However, there are situations where separate projects for pavement and safety improvement are advantageous, such as area- or corridor-level focused safety projects (e.g., rumble strip, barrier placement). When safety improvements are the sole or primary scope of the project, unit costs are often lower than where the same treatment is included in a resurfacing project.

Institutional Practice 2 - Establish Multifund Project Tracking

Transportation funds are suballocated into numerous categories corresponding to a primary purpose, system, or mode. Flexibility varies. In some cases, categorical allocations are legislatively prescribed and explicitly define eligible expenditures and amounts. In others cases, agency leaders and managers have substantial discretion on proportional allocation and eligibility. The addition of safety improvements to resurfacing projects may be viewed by some as misappropriation. All operational units of transportation agencies have target expenditure levels for major program areas. As indicated by table 2, when a single activity is intended

to accomplish multiple purposes (e.g., pavement preservation and improved safety), the cost associated with each improvement should be attributed to the appropriate program.

The absence of this capability will inhibit cost-effective multipurpose projects and encourage delivery of only single-purpose projects. The ability to distribute the cost of a single project to multiple cost centers is an important asset.

Table 2. Example tabulation of split-funded projects.

Project	Pavement preservation share	Safety improvement share	Other fund share	Total Cost
SR 56, Sect 5B	358,215	57,551	36,875	452,641
SR 114, Sect 6G	876,284	45,842		922,126
SR 765, Sect 15E	982,057	78,452	258,138	1,318,647
SR 595, Sect 23D	591,882	53,985	35,807	681,674
SR 88, Sect 13F	1,298,125	99,212		1,397,337
SR 302, Sect 9B	487,381	85,368	128,375	701,124
SR 472, Sect 3C	584,682	78,318		663,000
TOTAL	$5,178,626	$498,728	$459,195	$6,136,549

Institutional Practice 3 - Allow for Flexible Project Development Cycles

Resurfacing projects are awarded each and every year. Ideally, the need to meet targeted awards should not result in projects that exclude cost-effective improvements. However, if the time allowed for project development is very short (e.g., 4 to 8 months) and all projects in the development phase are needed to attain contract award goals, then safety improvements may be omitted when they require longer preconstruction phases. Some resurfacing projects can be properly developed in a short period of time; however, additional time may be needed to include cost-effective safety improvements. During the scan, several techniques were observed that provide for additional development time when needed and still allow the agency to attain its resurfacing and contract award goals. Annual lettings are comprised of projects with a variety of development periods as conceptually illustrated in figure 4, where project development ranges from 1 to 3 years. To implement this concept, all resurfacing projects are scanned to estimate their needs and scope. These estimates are used for tentative plans (i.e., programming and letting schedule). To compensate for unanticipated delays in the delivery of some projects, additional "clean" projects (i.e., no complicating factors and amenable to rapid development) are added to the program. This approach is common, but not universal.

The NYSDOT resurfacing program involves different categories designated as 1R, 2R, and 3R, based on the pavement and nonpavement scope. Development periods vary. The 1R projects involve routine maintenance activities and can be delivered in as little as 4 months. The 2R projects, which involve more extensive pavement work (i.e., multiple layer overlay) and other potential improvements (i.e., cross-section improvements), can often be delivered in 12 months.

The 3R projects often entail substantial pavement improvements, including sections of reconstruction, and geometric improvements. The development process may be complicated (e.g., substantial right-of-way, public involvement) and generally requires 2 to 3 years for completion. For several other agencies, the resurfacing program is developed from project identification through construction in 12 months or less. For IADOT, the typical timeframe from identification to construction of 3R projects is 3 years.

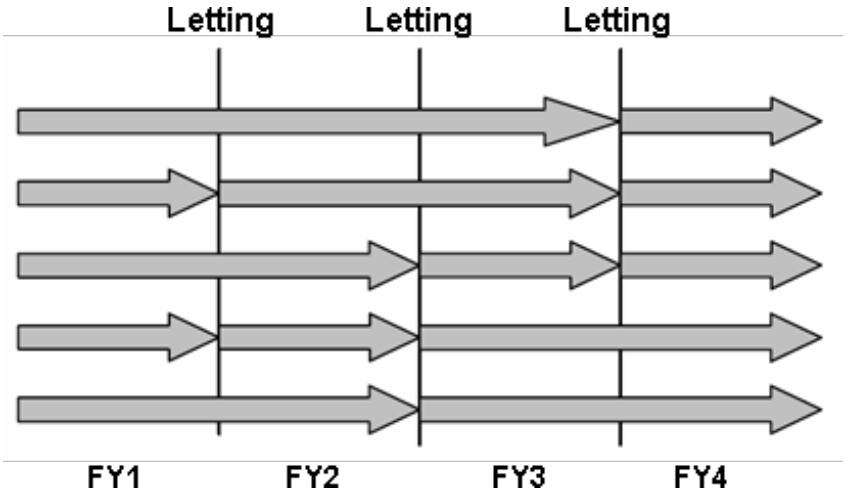

Figure 4. Flexible project development cycles.

Institutional Practice 4 - Strengthen State-Local Relationships

Local government units (e.g., counties, towns, cities) have jurisdiction over approximately 75 percent of the public highway mileage in the United States. Ownership of two-lane rural roads is even more highly concentrated with local governments. State DOTs have *direct* responsibility and control over only a fraction of the facilities with the highest crash rates. Yet States can substantially influence local transportation efforts.

In addition to direct responsibility for State-owned highways, State DOTs provide valuable leadership and support to local transportation organizations. DOTs can support local efforts in many ways including funding, technical assistance, and identification of high-crash locations on locally owned highways and streets.

Most State DOTs assist local government units with the development of Federal-aid and State-aid projects through dedicated units/staff (e.g., local systems office, municipal services) that provide technical services and act as liaisons. Given the extent of locally owned highways, the Scan Team noted the importance of efforts to educate and share information with local jurisdictions. The benefits of information and analysis systems can be magnified by extending their application to local agencies. Many LTAP centers offer courses in low-cost safety improvements, resurfacing, pavement management and traffic safety. These topics are the basic building blocks for integrating safety improvements into resurfacing. A collaborative effort by DOT local government liaison units and LTAP centers would provide institutional encouragement and technical support for local government efforts.

Institutional Practice 5 - Develop a Procedure for Expedient Acquisition of Minor Rights-Of-Way

Right-of-way acquisition is often time consuming. When an otherwise desirable safety improvement is found to require additional right-of-way, the agency must decide between a delay in project delivery or omitting the improvement. Some agencies have a categorical policy: no right-of-way is to be acquired for resurfacing projects. Therefore, the combination of limited rights-of-way and a time-consuming acquisition process are a major impediment to improving safety through resurfacing projects. A streamlined process for acquiring small areas and slivers is very useful and increases the range of improvements that can practically be considered in resurfacing projects. NYSDOT has this authority (known as "de minimis"), and routinely employs it as part of resurfacing, especially for 2R projects.

Institutional Practice 6 - Engage Safety Experts in Project Development

Transportation agency missions have transitioned from system construction to system preservation and enhancement. Transportation organizations have evolved to meet the new mission. Responsibilities are being reassigned from headquarters to local DOT units (e.g., district/region offices) that are closer to the point of delivery. Deploying the needed expertise to local DOT offices is a challenge because technical specialists have traditionally been located in centralized bureaus. Safety analysis is a complex and evolving discipline. Specialized knowledge is required to identify cost-effective safety improvements. During the scan, a spectrum of arrangements was observed for engaging safety expertise in project development. In some State DOTs (e.g., Colorado, Utah), the central office bureaus are responsible for conducting the analyses and formulating recommendations, In other State DOTs, the central office safety office serves in an advisory and instructional role. For example, IADOT has decentralized 3R project delivery. The Office of Traffic and Safety, which previously had direct involvement in project development, was recast into an educational and resource role. In recent years, this office has worked diligently and successfully to instill a safety ethic and skill set within the district office design groups. Periodically, safety audits are conducted of completed resurfacing projects by teams of personnel from several organizations. In other States, safety analysis responsibilities are distributed between central and district/region offices. Both NYSDOT and PennDOT perform certain crash analysis functions and screening centrally and provided to the district/region offices. Each PennDOT district office has a safety review committee. The review and concurrence of these committees is needed for each 3R project.

TECHNICAL PRACTICES

Technical Practice 1 - Identify Targeted Safety Improvements

Selective safety upgrades can be integrated into resurfacing projects. Universal improvement to meet all current new-construction standards is not feasible from a cost or scheduling perspective. Identifying specific and cost-effective safety improvements requires consideration of infrastructure and crash data. PMS and other input are used to schedule pavement restoration. Comprehensive and accurate crash data is a valuable asset to safety analysts. Several States visited are systematically improving crash data through multiple location coding options (e.g.,

GPS, route and mile marker, street address), additional descriptive data fields, and electronic reporting and retrieval. During the scan, the Team observed several promising crash record and statistical analysis techniques.

The CDOT designs resurfacing projects through a unique approach. Safety improvements are identified largely on the basis of crash data analysis, rather than dimensional criteria. The Empirical Bayes statistical method is used to combine safety performance functions for categories of roadways and observed accident frequencies into a single estimate of the expected accident frequency. This analysis leads to a LOSS determination, which reflects the likelihood of improving safety through intervention.

In Iowa, crash data and analysis are developed and distributed to State and local agencies. Some reports on trends, year-to-year comparisons, and specific categories (e.g., motorcycle, fatal) are developed on a bi-weekly basis. The IADOT has a close and productive relationship with the Iowa State University, Governor's Traffic Safety Bureau, and the enforcement community. The Iowa Traffic Safety Data Service is a product of that partnership and provides users with readily available crash data analysis resources and uses geographic information systems technology. IADOT central and district offices, counties, and the enforcement community are principal users of these data and analyses.

> "Data allows us to optimize the effectiveness of safety improvements."
>
> Tom Welsh
> Safety Engineer
> Iowa DOT

Pennsylvania has an ambitious Low Cost Safety Improvement program. The implementation guidance developed by PennDOT's Bureau of Highway Safety and Traffic Engineering (BHSTE) identifies 12 crash categories and 13 suggested countermeasures, with each crash category having from one to five countermeasures. These safety improvements can be self-standing (i.e., safety only projects) or integrated into other projects, such as resurfacing. The BHSTE is developing additional analytic capabilities based on historical safety performance that assist in the selection of appropriate safety countermeasures. The UDOT Traffic and Safety unit prepares Operational Safety Reports for certain resurfacing projects. These safety reports recommend safety improvements and provide the benefit/cost ratio associated with implementation.

Technical Practice 2 - Make Selective Geometric Improvements

The Scan Team observed that agencies visited during the scan invest in a range of geometric improvements as part of resurfacing projects. Common improvements include:

- Auxiliary lanes (turn lanes and climbing lanes).
- Cross-slope improvement.
- Drainage (additional inlets, improve cross drain capacity).

- Segment roadway cross-section improvements:
    - Traveled way widening.
    - Shoulder addition and widening.
    - Paving aggregate shoulders, full or part width.
- Sight distance improvements by vegetation clearing and slope work.
- Sight distance improvements by lengthening vertical curves.
- Superelevation improvement.

Figures 5 through 10 illustrate examples of some of these types of improvements.

Figure 5. Upgrade climbing lane added with resurfacing in Colorado.

Figure 6. Addition of turning lane in Iowa. (Source: Courtesy of IADOT)

Figure 7. Before resurfacing and realignment in New York.
(Source: Courtesy of NYSDOT)

Figure 8. After resurfacing and realignment to improve intersection sight distance in New York.
(Source: Courtesy of NYSDOT)

Figure 9. Before resurfacing and cross-section improvements in Thurston County, Washington.
(Source: Courtesy of Douglas Bramlette, Thurston County, Washington)

After

Figure 10. After resurfacing and cross-section improvements in Thurston County, Washington.
(Source: Courtesy of Douglas Bramlette, Thurston County, Washington)

Technical Practice 3 - Install Traffic Control Devices and Guidance

All agencies visited routinely install and/or upgrade selected traffic control devices in conjunction with resurfacing projects, including the following specific measures:

- Edge rumble strips.
- Centerline rumble strips.
- Curve delineation/warning (pavement markings and chevrons).
- Pavement markings.
- Reflective pavement markers.
- Sheet delineation (on median barrier).
- Signs.
- Signal upgrades.

Several examples of these treatments are provided in figures 11 through 15.

Figure 11. Rumble stripe during construction in Iowa. (Note: edge lines are repainted *after* rumble stripe cut.).
(Source: Courtesy of IADOT)

Figure 12. Centerline and edge rumble strips in Washington State.

Figure 13. Sheet delineation on median barrier in Colorado.

Figure 14. Before placement of chevrons on horizontal curve in Iowa.
(Source: Courtesy of IADOT)

Figure 15. After placement of chevrons on horizontal curve in Iowa.
(Source: Courtesy of IADOT)

Technical Practice 4 - Improve Roadsides

All States visited on the scan are aware of how important the roadside is for rural highway safety. The roadside safety principles outlined in the AASHTO *Roadside Design Guide* are considered in developing resurfacing projects. Specific conditions (e.g., slopes, drainage structures, mail boxes, existing barrier systems) are addressed through a combination of policy, analysis and judgment.

PennDOT District 3 employs two strategies worthy of note—selective clearing and "Ground to Sky." Trees are part of the natural environment but pose a threat to errant vehicles when located close to a roadway. PennDOT has an initiative of selectively removing trees within the right-of-way. Locations and corridors are identified using GIS data. A dense forest canopy prevents sunlight from reaching the road surface and contributes to slick driving conditions, including black ice. The Ground to Sky treatment removes trees and branches thereby allowing sunlight to reach the roadway surface. Public opposition to tree removal (for both strategies) is sometimes strong. PennDOT has instituted procedures to reduce negative reactions. Adjacent landowners are provided with advance notice of removal and may be allowed to retrieve the harvested wood. PennDOT tracks the safety records of roadways where tree countermeasures are used and reports positive results.

All agencies evaluate and selectively include countermeasures in resurfacing projects to reduce the frequency and severity of run-off-road crashes, which are overrepresented on two-lane rural roads. The following strategies were observed during the scan:

- Bridge rail, connection and transition improvements.
- Culvert end treatments (traversable).
- Culvert extensions.
- Installation of side drains (in swales) and slope flattening.
- Edge drop-off mitigation (shoulder backup, safety edge).
- Flattening transverse (driveway, median turnaround) slopes.
- Guardrail installation.
- Guardrail replacement.
- Guardrail adjustments.
- Guardrail terminal upgrades.
- Headwall replacement (with inlets).
- Mailbox (control or replacement).
- Obstacle removal.
- Obstacle delineation.
- Removal of unwarranted barriers.
- Rigid barrier installation and adjustment.
- Selective clearing.
- Slope stabilization.
- Utility pole relocation.

Figures 16 through 26 show several examples of roadside interventions.

Figure 16. Bridge approach rail, Iowa. (Source: Courtesy of IADOT)

Figure 17. Traversable culvert grate, Iowa. (Source: Courtesy of IADOT)

Figure 18. Culvert extension in Iowa. (Source: Courtesy of IADOT)

Figure 19. Full shoulder pavement with shoulder backup in Pennsylvania.

Figure 20. Safety edge in New York.

Figure 21. Box beam guardrail in New York. (Source: Courtesy of NYSDOT)

Figure 22.Guardrail terminal and pavement in Colorado.

Figure 23. Crashworthy mailbox installation in Washington State.

Figure 24. Close up of a crashworthy mailbox installation in Washington State.

◀ **Figure 25. Before utility pole relocation in New York.**
(Source: Courtesy of NYSDOT)

Figure 26. After utility pole relocation in New York. ▶
(Source: Courtesy of NYSDOT)

Technical Practice 5 - Improve Private and Public Access Points

Access points are locations of inherent conflict. At-grade intersections and property access design techniques can be employed to eliminate or manage conflicts. The following types of access improvements are included in resurfacing projects by agencies visited during the scan:

- Safety dikes.[1]
- Intersection reconfiguration (horizontal and vertical realignment).
- Commercial entrance consolidation.
- Commercial entrance reconfiguration.
- Farm drive consolidation.
- Farm drive reconfiguration.
- Lighting.

An agency's ability to change existing access points and regulate additional access is based primarily on statutory and regulatory authority. Agencies with limited authority may request but

[1] A *safety dike* is a clear zone created on the far side of a T-intersection by relocating utility poles, making the ditch slope traversable, and removing other fixed objects to lessen the severity of a crash if a motorist fails to stop at the intersecting side road.

not require modification, consolidation, and elimination of access points. Of the States visited, Colorado has the most legislative authority to control access. CDOT routinely modifies access points as part of its resurfacing projects. IADOT also strives to improve existing access points.

Figures 27 through 30 illustrate a selection of access modifications.

Figure 27. Safety dike in Iowa. (Source: Courtesy of IADOT)

Figure 28. Realignment of intersecting roadways (reduce/eliminate skew) in New York.
(Source: Courtesy of NYSDOT)

Figure 29. Alteration of vertical alignment to improve sight distance at the intersection of two county roads in Iowa.

Figure 30. Farm field entrance slope flattening in Iowa. (Source: Courtesy of IADOT)

CHAPTER 6: SUMMARY

Every State and local transportation agency resurfaces roadways to preserve their functional serviceability. Likewise, every transportation and public works agency takes steps intended to improve safety. The resources devoted to each function, and the extent to which these initiatives are integrated, can vary substantially. The scan was undertaken to identify and disseminate information on practices that effectively integrate safety improvements into resurfacing and pavement restoration projects.

Through a review of published materials, an e-mail survey, and outreach to professional contacts, six States were identified as scan destinations. Visits were conducted during three separate two-State trips in June, July, and August 2005. The Scan Team coordinated with the host DOTs and FHWA Division Offices in advance to clarify the nature and scope of the visits. Host agencies were gracious and extremely cooperative in developing itineraries. Each destination was unique, but most visits involved meetings at DOT headquarters with personnel in bureaus (e.g., design, pavement management, programming, safety) and local DOT units. The Scan Team met with county engineers in Iowa, New York, and Washington State.

Every agency operates in a unique environment that influences how it approaches the incorporation of safety in resurfacing. One of the most significant factors is the allocation of resources between surface conditions and safety needs. The "balance point" is reached differently within each agency. In some cases, funding for infrastructure preservation and safety improvements are allocated separately, with specific eligibility guidance applying to each. Other agencies operate with fewer programmatic fund sources, less precise eligibility criteria, and generally greater discretion on defining and scoping resurfacing projects.

The extent of support by an agency's leaders and its institutional culture are critical factors in determining the degree to which safety improvements are incorporated into resurfacing. All agencies and many individuals exercise some level of discretion over how limited resources are invested. These decisions reflect judgments on the proper use of funds and relative priorities. All of the personnel encountered during the scan believe that safety should be improved in connection with resurfacing projects. Some personnel and agencies consider it essential to integrate safety improvements in resurfacing projects. Others consider safety improvements desirable but are reluctant to extend project development time or make substantial discretionary expenditures to attain the improvements.

All agencies are accountable for achieving progress toward infrastructure and safety goals. Accountability methods and measurement vary. Measurements may be expressed as output (e.g., lane miles treated, guardrail installed) or outcomes (e.g., ride quality, crashes per year). Pavement restoration has an immediate measurable effect on ride quality, which allows the effects of paving investments to be reliably measured. It is far more difficult to measure the results of safety investments as crashes are rare, even at high-risk locations, and affected by many factors beyond the roadway infrastructure.

Resurfacing programs are driven by pavement conditions; this is true for every DOT and county visited during the scan. The process of defining a project's elements, including the

scope of pavement and safety work, varies substantially. The techniques, personnel involved and timeframe for resurfacing project development also vary. All of the DOTs visited are decentralized organizations and local DOT units are responsible for project delivery. DOT headquarter units participate in advisory or decision-making roles in the areas of pavement management, safety analysis and countermeasure identification and programming. The observed agency relationships were all deemed to function fairly well, leading to the conclusion that there is no single *right way* to assign roles or distribute responsibilities within a decentralized organization.

In most States, local governments (e.g., counties, cities, towns) own the majority of roadways. However, individual local government units may have very limited jurisdiction, perhaps just a few miles. In addition to funding, States have institutional and technical capabilities that are of great value to local government. Each State supports an LTAP center to provide local governments with technical assistance. Several of the DOTs work very closely with counties, substantially increasing the effectiveness of county efforts and expenditures.

Tort liability is a substantial concern of many transportation agencies, State and local. This concern weighs on managers and individual professionals in determining the scope of resurfacing projects. There is a sentiment that designing projects with no improved features results in less liability exposure than projects that provide some improvements but fall short of meeting all applicable criteria. Tort concerns were expressed most strongly in New York and Washington State.

Integrating safety improvements into resurfacing can be an effective way to preserve both mobility and safety. Based on DOT visits, leadership support is needed to develop and implement an integrated strategy, because it may involve new priorities and direction. Revamped organizational processes and operational guidance will be needed to articulate policy, expectations, and methods of pursuit. The Scan Team identified the following good practices that support attainment of pavement preservation and improved safety:

Institutional Practices:

Integrate Safety into Preservation Projects
Establish Multifund Project Tracking
Provide for Flexible Project Development Cycles
Strengthen State-Local Relationships
Develop an Expedient Procedure for Minor Right-of-way Acquisition
Engage Safety Experts in Project Development

Technical Practices:

Identify Targeted Safety Improvements
Selectively Improve Geometry
Install Traffic Control Devices and Guidance
Improve Roadsides
Improve Private and Public Access Points

The good practices have been noted as either institution or technical. Institutional practices are related to the capabilities, culture, and priorities of an agency. Agencies do not necessarily have

the ability to adopt these practices on their own. Some (e.g., expedited right-of-way acquisition) may require legislation, rulemaking, or negotiation with stakeholders (e.g., contractor associations, local governments). Technical practices tend to be matters that are wholly or substantially within the purview of transportation agencies.

Appendix A

FHWA Memorandum:
Preventive Maintenance Eligibility
October 8, 2004

MEMORANDUM

U.S. Department of Transportation
Federal Highway Administration

Subject: **ACTION**: Preventive Maintenance Eligibility Date: October 8, 2004

From: /s/ Original signed by:
King W. Gee
Associate Administrator for Infrastructure

Refer To: HIAM-20

To: Directors of Field Services
Division Administrators
Federal Lands Highway Division Engineers

Timely preventive maintenance and preservation activities are necessary to ensure proper performance of the transportation infrastructure. Experience has shown that when properly applied, preventive maintenance is a cost-effective way of extending the service life of highway facilities and therefore is eligible for Federal-aid funding. By using lower-cost system preservation methods, States can improve system conditions, minimize road construction impacts on the traveling public, and better manage their resources needed for long-term improvements such as reconstruction or expansion. Preventive maintenance offers State DOT's a way of increasing the return on their infrastructure investment.

During the 1990's, Congress incrementally broadened, through legislation, the applicability of Federal-aid funding to preventive maintenance activities. Congress' acknowledgement of preventive maintenance activities as an eligible activity on Federal-aid highways is a logical step that reinforces the importance of implementing a continuing preventive maintenance program. Each of these actions was conveyed to the field through a series of memoranda. This policy memorandum supersedes the related memoranda listed in the attachment.

The FHWA division offices have an important role in promoting system preservation and are encouraged to work closely with their State DOT counterparts to establish a program that identifies eligible preventive maintenance measures for all roadway assets on Federal-aid highways. The AASHTO defined preventive maintenance "as the planned strategy of cost effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system without increasing structural capacity." Projects that address deficiencies in the pavement structure or increase the capacity of the facility are not considered preventive maintenance and should be designed using appropriate 3R standards. Functionally, Federal-aid eligible preventive maintenance activities are those that address aging, oxidation, surface deterioration, and normal wear and tear from day-to-day performance and environmental conditions. Preventive maintenance activities extend the service life of the roadway asset or facility in a cost-effective manner.

Division offices should proactively work with their State partners to establish a preservation component, which is composed of various preventive maintenance activities and treatments. These include roadway activities such as joint repair, seal coats, pavement patching, thin overlays, shoulder repair, restoration of drainage systems, and bridge activities such as crack sealing, joint repair, seismic retrofit, scour countermeasures, and painting. Many other activities that heretofore have been considered routine maintenance may be considered Federal-aid eligible on an area-wide or system-wide basis as preventive maintenance (i.e., extending the service life). This might include such work items as regionwide projects for periodic sign face cleaning, cleaning of drainage facilities, corrosion protection, spray-applied sealant for bridge parapets and piers, etc. These typical preventive maintenance work items are not intended to be all-inclusive but are rather a limited list of examples.

The final eligibility determination should be the result of collaboration between the division and the State DOT. This determination should be based on sound engineering judgment and economic evaluation, allowing flexibility in determining cost-effective strategies for extending the service life of existing pavements, bridges, and essential highway appurtenances on Federal-aid highways.

All preventive maintenance projects should consider appropriate ways to maintain or enhance the current level of safety and accessibility. Isolated or obvious deficiencies should always be addressed. Safety enhancements such as the installation or upgrading of guardrail and end treatments, installation or replacement of traffic signs and pavement markings, removal or shielding of roadside obstacles, mitigation of edge drop offs, the addition of paved or stabilization of unpaved shoulders, or installation of milled rumble strips should be encouraged and included in projects where they are determined to be a cost effective way to improve safety. To maintain preservation program flexibility, and in accordance with 23 U.S.C. 109(q), safety enhancements can be deferred and included within an operative safety management system or included in a future project in the STIP. In no way shall preventive maintenance type projects adversely impact the safety of the traveled way or its users.

As with any Federal-aid project, adequate warning devices for highway-rail grade crossings within the project limits or near the terminus shall be installed and functioning properly per 23 CFR 646 before opening the project to unrestricted use by traffic. For projects on the NHS, all traffic barriers shall comply with the FHWA September 29, 1994, memorandum entitled Traffic Barrier Safety Policy and Guidance, signed by E. Dean Carlson. This work can be accomplished by force account or through other existing contracts prior to final acceptance.

The FHWA supports the increased flexibility for using Federal-aid funding for cost-effective preventive maintenance. The Maintenance Quality Action Team (MQAT) is developing technical guidance on preventive maintenance activities and transportation system preservation as a whole; that technical guidance is under development and will be issued in the near future. For further information please contact Christopher Newman of the Office of Asset Management, at (202) 366-2023 or Christopher. Newman@fhwa.dot.gov, or visit the Transportation System Preservation website at http://www.fhwa.dot.gov/preservation/index.htm

Attachment

Attachment: Memoranda Superseded by Preventive Maintenance Memorandum

- 01/27/04 Stewardship of Preservation and Maintenance
- 01/11/02 HBRRP Funds For Preventive Maintenance (23 U.S.C. 116(d))
- 10/30/98 Implementation of TEA-21 Interstate Maintenance Guidelines
- 08/19/98 Phase Construction for Safety Considerations
- 06/18/97 Transportation System Preservation
- 03/21/96 Preventive Maintenance Revision to 23 U.S.C. 116
- 10/12/93 Safety and Geometric Considerations for Interstate Maintenance Program Projects
- 06/14/93 Interstate Maintenance Program
- 07/27/92 Preventive Maintenance

- 5/21/92 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) Implementation Interstate Maintenance Program

Appendix B

Scan Team Members

Ernest (Ernie) J. Blais, P.E.
Scan Team Co-chair
Assistant Division Administrator
Connecticut Division, FHWA

Ernest (Ernie) is currently the State of Connecticut Division Administrator to administer the total Federal-aid highway program. Mr. Blais has served with FHWA for more than 30 years. Prior to his current assignment, he served as Chief, Engineering Services Section of the California Division; Program Operations Engineer, Statewide Systems & Operations Engineer, District Engineer and Planning & Research Engineer in the Ohio Division; Implementation Manager in the Washington DC Implementation Division; Research Engineer, Area Engineer and Assistant Area Engineer in the California Division; and Highway Engineer, Washington DC Office of Policy Planning Mr. Blais is a registered Professional Civil Engineer in California and a member of the American Society of Civil Engineers. Mr. Blais earned a B.S. in Civil Engineering from University of Massachusetts, Dartmouth.

Keith Cota, P.E.
Scan Team Co-chair
Chief of Consultant Design
New Hampshire Department of Transportation

Keith Cota manages, administers, and supervises consultant staff and consultants in the design of intermodal State and municipal transportation improvement projects. He was appointed a member in the AASHTO Technical Committee on Roadside Safety (TCRS) in 1992, and became its chairman in 2004. Mr. Cota earned a B.S. in Civil and Environmental Engineering in 1978 from Clarkson College of Technology at Potsdam, New York, and began his career with the New Hampshire DOT in summer 1978. He is a registered Professional Engineering in New Hampshire.

Lawrence (Larry) B. Hummel, P.E.
County Highway Engineer Manager
Van Buren County Road Commission
Lawrence, Michigan

Lawrence (Larry) B. Hummel oversees the day-to-day operations of the road commission and implementation of its preservation, rehabilitation, and reconstruction efforts. Mr. Hummel began his career as a highway engineer with the Van Buren County Road Commission (CRC). In 1999, he was appointed the Grand Region Bridge Engineer for the Michigan DOT. He returned to the CRC in 2002. Mr. Hummel received a B.S. in Civil Engineering from Michigan Technological University in 1993, and a Master of Public Administration from Western Michigan University in 2005. He is a registered Professional Engineer and a Licensed Residential Builder in the State of Michigan.

N. Kent Israel, P.E.
Road Design Engineer
Louisiana Department of Transportation and Development (LA DOTD)

N. Kent Israel has served LADODT for 34 years, currently as the Road Design Engineer Administrator. His expertise includes road design activities, geometrics design, road side safety, project management and project financing. Mr. Israel received a B.S. in Civil Engineering from Louisiana Tech University in 1969, and is a licensed professional Civil Engineer in the State of Louisiana.

Frank Julian
Safety Engineer
FHWA Resource Center
Safety & Design Technical Service Team

Mr. Julian began his FHWA career in 1986 with an assignment in the Florida Division as a highway engineer. . Mr. Julian was promoted to the Regional Safety Engineer for in 1996, and the following year participated in a national program that placed an FHWA engineer in the NHTSA Regional Office for a year. In 1998, Mr. Julian returned to the position of Regional Safety Engineer in FHWA, which subsequently became a FHWA Resource Center. Mr. Julian graduated from Auburn University with a B.S. in Civil Engineering.

Bernie Kuta, P.E.
Pavement and Materials Engineer
FHWA Resource Center
Pavement & Material Technical Service Team

Mr. Kuta's expertise and current duties are in the areas of pavement construction/materials, pavement warranties and specifications development, pavement life-cycle cost analysis and quality assurance programs. Mr. Kuta has 17 years with FHWA, including 7 years of experience in Division Offices as highway engineer and Pavements & Materials program manager. Mr. Kuta received the B.S. in Civil Engineering from the Colorado School of Mines in 1988, and is a Professional Engineer in the State of Utah.

Susan G. Miller
County Engineer
Freeborn County, Minnesota

In her current position, Ms. Miller manages more than 600 miles of roadway and 179 bridges. She has been in her current post for 5 years and also serves as Vice President, North Central Region, NACE. She is a registered Professional Engineer. Ms. Miller holds a B.S. in Civil Engineering from North Dakota State University.

Harry W. Taylor, Jr.
Road Departure Safety Team Leader (Retired)
FHWA Office of Safety

Harry Taylor joined FHWA in 1965, and is a graduate of the Highway Engineer Training Program. In 1975, he transferred to FHWA Headquarters in Washington, DC. Mr. Taylor's long service in FHWA's Safety Office includes participating in a variety of programs and initiatives. He graduated from Tennessee State University with a B.S. in Civil Engineering and subsequently earned a Masters in Engineering Administration from George Washington University.

Kevin M. Mahoney, P.E.
Report Facilitator

Kevin Mahoney joined the Penn State University in 1999, where he is currently a senior research associate and associate professor civil engineering. He previously worked for 12 year with the FHWA and as a private consultant for 7 years. He works primarily in the areas of project development, work zones, design, and the effects of design decisions on performance. Dr. Mahoney, a registered Professional Engineer in several States, served as the scan report facilitator.

Appendix C

Amplifying Questions

I. Project Level Decision Making

1. Do you have written procedures for developing resurfacing projects? [If yes, can we have copies?]

2. Is the Design function for your agency centralized or decentralized (e.g., districts, regions)?

3. Can you describe the complete development process (programming, design, construction/implementation) for resurfacing projects?

4. What is the approximate time frame for resurfacing project development (from programming to construction/implementation)?

5. What information, in addition to pavement condition data, is used in resurfacing project development?

6. Does a project ever begin (at programming) as resurfacing and subsequently get converted to another type? [If yes, what are common reasons?]

7. Can you describe any roadblocks you've encountered while trying to include safety features in a resurfacing project?

8. Did you obtain public input on the scope of resurfacing projects before construction? [If yes, describe what approach was taken and how this affected the resurfacing projects.]

9. Does your resurfacing project development process use benefit-cost analysis or similar approach to evaluating safety cost effectiveness? [If yes, what is the source of the crash reduction factors?]

10. Is your resurfacing project development guidance fairly objective/deterministic in terms of including safety features? (i.e., if two design teams had the same project information, would they usually end up including the same safety improvements?)

11. If you undertake a resurfacing project and defer or phase safety improvements, what are typical timeframes for completing the safety work after the resurfacing?

12. What superelevation criteria/guidance do you apply to resurfacing projects? What field control measures (e.g., inspection) do you employ to assure the designated superelevation is attained during construction?

II. Project/Program Evaluation

1. How long has your agency been using the current resurfacing project development process?

2. How was your resurfacing development process developed?

3. Has your resurfacing program been the subject of any reviews or studies (e.g., internal quality improvement initiative, research evaluation, legislative body inquiries)? [If yes, can you provide a copy of the results/documentation?]

What quality control procedures are used on resurfacing projects to ensure that safety and operations have not been adversely affected by the resurfacing such as reduction in the superelevation or increase in pavement drop-offs.

Appendix D

Key Contacts in Host States and Counties

	Name	Agency/Unit	Phone	email
Colorado	Bryan Allery	CDOT/Traffic & Safety, HQ	303-757-9967	bryan.allery@dot.State.co.us
	Bob Garcia	CDOT/Region 4 Traffic Engineer	970-350-2121	robert.garcia@dot.State.co.us
	Paul Jesaitis	CDOT/Project Development, HQ	720 497-6961	paul.jesatis@dot.State.co.us
	Corey Stewart	CDOT/Pavement Mgmnt, HQ	303-757-9299	corey.stewart@dot.State.co.us
	Marcee Allen	FHWA/CO Division, Safety	720-963-3007	marcee.allen@fhwa.dot.gov
Iowa	Troy A. Jerman	IADOT/ Traffic & Safety, HQ	515-239-1470	troy.jerman@dot.iowa.gov
	Tony Lazarowicz	IADOT/ District 3 Design	712-276-1451	tony.lazarowicz@dot.iowa.gov
	Thomas M. Welsh	IADOT/ Traffic & Safety, HQ	515-239-1267	tom.welsh@dot.iowa.gov
	Richard Storm	Woodbury County Engineer	712-279-6484	dstorm@siouxcity.org
	Jerry Roche	FHWA/IA Division, Safety	515-233-7323	jerry.roche@fhwa.dot.gov
New York	Dave Clements	NYSDOT/Safety, HQ	518-457-3537	dclements@dot.State.ny.us
	Barbara O'Rourke	NYSDOT/Safety, HQ	518-457-1910	borourke@dot.State.ny.us
	Norm Schips	NYSDOT/Design, HQ	518-485-8611	nschips@dot.State.ny.us
	Bruce Smith	NYSDOT/Safety, HQ	518- 457-0271	basmith@dot.State.ny.us
	Rick Wilder	NYSDOT/Design, HQ	518-457-5922	rwilder@dot.State.ny.us
	Fred Howard	Rensselaer County Engineer	518-283-0973	fhoward@rensco.com
	James A Growney	FHWA/NY Division, Safety	518-431-4125	jim.growney@fhwa.dot.gov
Pennsylvania	Michael Baglio	PennDOT/ Traffic & Safety, HQ	717-705-1706	mbaglio@State.pa.us
	David Burkhart	PennDOT/District 3, Maintenance	570-368-4226	daburhart@State.pa.us
	Bill Crawford	PennDOT/ Traffic & Safety, HQ	717-705-1437	wicrawford@State.pa.us
	Dan Dawood	PennDOT/Pavement Mgmnt, HQ	717-787-4246	ddawood@State.pa.us
	John Hess	PennDOT/Highway Quality, HQ	717-787-3518	johhess@State.pa.us
	Eric High	PennDOT/District 3, Design	570-368-4372	ehigh@State.pa.us
	Robert Hippenstiel	PennDOT/District 3, Maintenance	570-368-4259	rhippensti@State.pa.us
	Michael Keiser	PennDOT/District 8, Design	717-787-2692	mkeiser@State.pa.us
	Alan Keller	PennDOT/District 3, Safety	570-368-4260	alankeller@State.pa.us
	James Kendter	PennDOT/District 3, Executive	570-368-4200	jkendter@State.pa.us
	Brian Leighow	PennDOT/District 3, Maintenance	570-387-4266	bleighow@State.pa.us
	Leon Liggitt	PennDOT/District 3, Design	570-368-4346	lliggitt@State.pa.us
	Sunil Patel	PennDOT/District 8, Safety	717-783-3927	srpatel@State.pa.us
	Glenn Rowe	PennDOT/Traffic & Safety, HQ	717-787-3620	glen@State.pa.us
	Brian J. Toseki	PennDOT/District 3, Maintenance	570-368-4266	btoseki@State.pa.us
	Tim Wentz	PennDOT/District 3, Traffic	570-368-4210	towentz@State.pa.us
	Michael Castellano	FHWA/PA Division, Safety	717-221-4517	mike.castellano@fhwa.dot.gov

	Name	Agency/Unit	Phone	email
Utah	John Leonard	UDOT, Traffic & Safety, HQ	801-965-4045	jleonard@utah.gov
	Robert Hull	UDOT, Traffic & Safety, HQ	801-965-4273	rhull@utah.gov
	Richard Miller	UDOT, Preconstruction, HQ	801-965-4289	richardmiller@utah.gov
	John Njord	UDOT, Executive Director, HQ	801-965-4028	jnjord@utah.gov
	Craig Haskell	UDOT, Region 3 Design	801-222-3405	chaskell@utah.gov
	Roland Stanger	FHWA/UT Division, Safety	801-963-0078	roland.stanger@fhwa.dot.gov
Washington	Dick Albin	WSDOT/Design, HQ	360-705-7451	albind@wsdot.wa.gov
	Mike Gribner	WSDOT/Eastern Region	509-324-6095	gribnem@wsdot.wa.gov
	George Hilsinger	WSDOT/South Central Region	509-577-1700	hilsing@wsdot.wa.gov
	Dave Mounts	WSDOT/ Local Programs, HQ	360-705-7379	mountsd@wsdot.wa.gov
	Dave Olson	WSDOT/Design, HQ	360-705-7952	olsonda@wsdot.wa.gov
	Harold Peterfeso	WSDOT/Design, HQ	360-705-7230	peterfh@wsdot.wa.gov
	Doug Bramlette	Thurston County Asst Engineer	380-786-5133	bramled@co.thurston.wa.us
	Ross Kelly	Spokane County Engineer	509-477-3600	rkelly@spokanecounty.org
	Randy Hart	County Road Administration Board	360-753-5989	randy@crab.wa.gov
	Don Petersen	FHWA/WA Division, Safety	360-534-9323	don.petersen@fhwa.dot.gov

Appendix E

ACKNOWLEDGMENTS

ACKNOWLEDGEMENTS

The FHWA acknowledges AASHTO and NACE for their support in cosponsoring this scan, as well as their ongoing activities to enhance highway safety.

The FHWA appreciates the time and effort provided by the Scan Team members to ensure a document on good practices would be developed as envisioned.

The FHWA also recognizes the hosts and participant departments of transportation for their support, and cooperation to share information with the Scan Team:

Colorado
Iowa
    Woodbury County
New York
    Rensselaer County
Pennsylvania
Utah
Washington State
    Spokane County
    Thurston County

Finally, FHWA salutes all of our transportation partners in their commitment to reduce the number of fatalities and injuries on their highways.

Publication No. FHWA-SA-07-001

U.S. Department of Transportation
Federal Highway Administration (FHWA)
Office of Safety
400 Seventh Street, SW, HSSD
Washington, DC 20590

http://safety.fhwa.dot.gov