TR News November-December 2013: Designed for Implementation and Impact: SHRP 2 Products and Procedures

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COVER: Accelerated bridge construction at Keg Creek, Iowa. SHRP 2 products and procedures are beginning to make a lasting, beneficial impact on the renewal, congestion relief, reliability, and safety of the nation's roadways. (Photo: FHWA)

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features articles on innovative and timely research and development activities in all modes of transportation. Brief news items of interest to the transportation community are also included, along with profiles of transportation professionals, meeting announcements, summaries of new publications, and news of Transportation Research Board activities.

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COMING NEXT ISSUE

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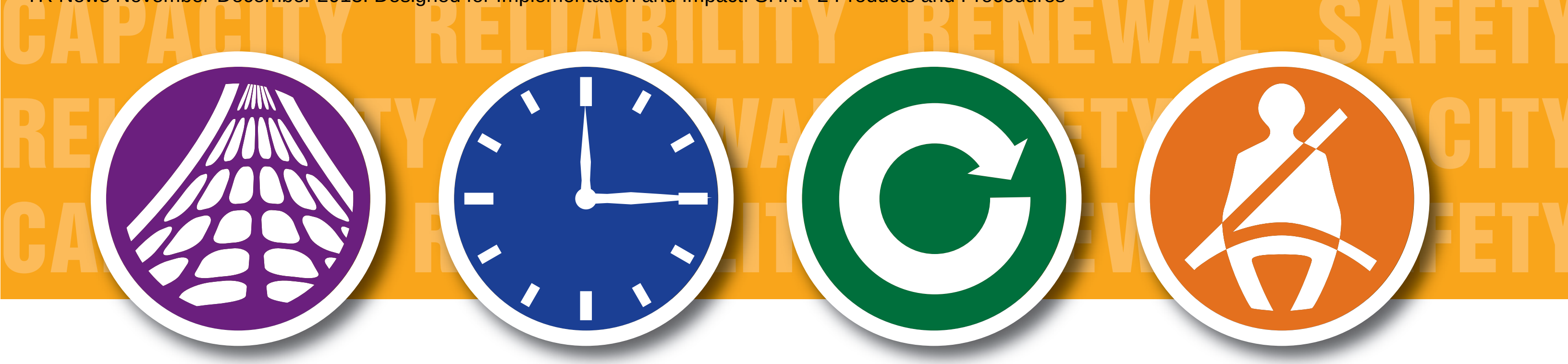
A boom in the domestic energy industry is having an impact on transportation infrastructure—a feature in the January–February 2014 issue of *TR News* examines the effects on low-volume roadways in Texas, and sidebars present reports from Iowa and Pennsylvania. Other features offer practical findings from a 26-state pooled-fund study on winter maintenance challenges; the megaproject under way to replace the Gerald Desmond Bridge in the Port of Long Beach, California; and implementation of SHRP 2 accelerated bridge construction pilot projects in New York and Iowa. Also included is the annual roundup of innovative approaches and trends gathered from the 2013 state partnership visits by TRB senior program officers—and more.



INTRODUCTION

Research Designed for Implementation and Historic Impact

ANN M. BRACH

The author is Director of the second Strategic Highway Research Program, Transportation Research Board of the National Academies, Washington, D.C.

Highway transportation leaders in the United States have a history of turning to special-purpose research programs to address strategically important issues. The American Association of State Highway Officials Road Test, administered by the Highway Research Board, 1956 to 1960, developed standards for the emerging Interstate Highway System. The first Strategic Highway Research Program, managed by the National Research Council, 1987 to 1993, focused on improving the quality and cost-effectiveness of some of the most critical operations for highway agencies, including asphalt paving and winter maintenance.


PHOTO: TRB ARCHIVE


PHOTO: CENTER FOR TRANSPORTATION RESEARCH, UNIVERSITY OF TEXAS AT AUSTIN

PHOTO: WAYNE B. SYMONDS

(*Above, right:*) The AASHO Road Test in the late 1950s set the standards for the future of America's highways. (*Middle:*) Laboratory testing under the first Strategic Highway Research Program for Superpave®, which revolutionized asphalt pavement design. (*Below:*) A toolkit promoting accelerated bridge construction techniques is among the products developed through SHRP 2.

21st Century Endeavor

The success of these efforts suggested a similar approach to the transportation leaders who designed the second Strategic Highway Research Program (SHRP 2) on the cusp of the 21st century, under the sponsorship of the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) and the management of the Transportation Research Board. These leaders envisioned significant improvements in three areas of high priority to highway customers:

◆ Drastically reducing the numbers of injuries and fatalities on highways;

◆ Expediting the delivery of highway projects, both in the construction of new facilities and in the renewal of operating facilities; and

◆ Minimizing the negative impacts of congestion on safety, quality of life, and the economy.

Focus Areas and Objectives

The resulting program comprises four research focus areas known by the short forms of their names: Safety, Renewal, Reliability, and Capacity. Instead of

Signing the Memorandum of Understanding for SHRP 2 in January 2006: Richard Capka, FHWA; John C. Horsley, AASHTO; and Ralph J. Cicerone, National Academy of Sciences. (*Standing, left to right:*) Robert E. Skinner, Jr., Dennis Judycki, Anne Canby, Allen Biehler, Nicholas Garber, Ann Brach, C. Michael Walton, Neil Pedersen, Rebecca Brewster, John Njord, Neil Hawks, and Henry G. Schwartz.

referring to specific disciplines, the terms reflect the strategies identified by experts and stakeholders across the country for addressing the three overarching objectives of the program:

◆ *Safety.* Earlier studies had shown that driver behavior contributes to more than 90 percent of crashes. To make a significant improvement in highway safety, SHRP 2 fielded the largest-ever naturalistic driving study. The data generated will supply an unprecedented understanding of how a driver interacts with the roadway and the vehicle.

◆ *Capacity*. Delays in project delivery are often the result of communication and institutional issues. SHRP 2 has assembled a framework for collaborative decision making, with accompanying tools for travel demand modeling, economic analysis, and performance measurement, among others.

◆ *Renewal*. Ineffective interactions with railroads and utility companies lead to some of the longest delays in fixing facilities; SHRP 2 provides practical tools, such as model agreements, for improving these interactions. Several engineering innovations are available for reducing delay and mitigating disruption from infrastructure renewal activities, including technologies for accelerated bridge construction and modular pavements. SHRP 2 identified the obstacles to a more widespread use of these innovations, addressed the obstacles through focused research, and packaged the resulting materials as a toolbox that allows application of the technologies throughout an agency's roadway system by local contractors using local materials.

◆ *Reliability*. Nonrecurring traffic events leading to unpredictable travel times are the cause of more than 50 percent of roadway congestion. SHRP 2 applies the concept of travel time reliability to measure, monitor, and mitigate this unpredictability through an operations strategy. SHRP 2 products include management guidance and training, as well as tools for applying travel time reliability in the modeling, analysis, planning, and design of facilities.

Multidisciplinary Collaboration

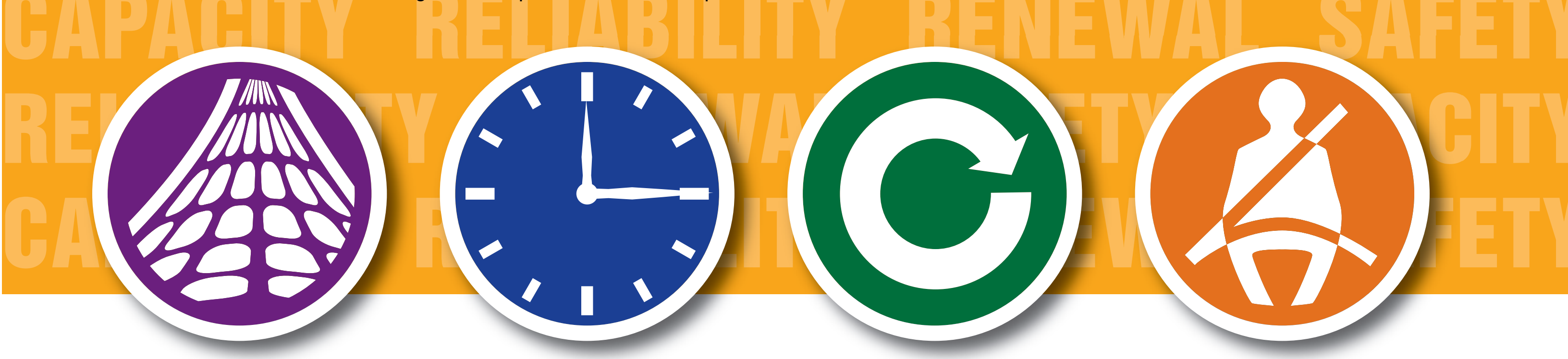
Each strategy has required the collaboration of multiple stakeholders—highway agency personnel and the private-sector companies that support them, as well as representatives from railroads, utilities, the police, firefighters, auto manufacturers, and environmental agencies. The disciplinary areas for the research were determined by what was needed to achieve the stated objectives. In addition to traditional highway disciplines, such as pavements, bridges, and traffic safety, SHRP 2 engaged the behavioral and social sciences, as well as advanced technologies, in pursuing a systems approach to solutions, a defining characteristic of the program.

The feature articles and sidebars in this issue of *TR News* describe some of the results from each focus area of SHRP 2. These features are bracketed at the front with an article by Neil Hawks illustrating how transportation agencies can apply SHRP 2 products in many typical scenarios and at the conclusion with a piece by Kirk Steudle outlining the robust program by AASHTO and FHWA to implement the SHRP 2 products. All together, the articles in this issue provide a substantial overview of the program. More information on SHRP 2 products can be found at www.trb.org/SHRP2; information about how transportation agencies are using the products and about implementation support is posted at www.fhwa.dot.gov/goSHRP2.

Tracking an Extensive Scope of Progress

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users authorized SHRP 2 in 2005 and funded the program at $223 million. SHRP 2 will conclude after nine years of operation in March 2015. More than 700 volunteer experts from transportation agencies; other federal, state, and local agencies; private-sector companies; and universities have participated in the more than 120 committees that developed and oversaw the work. More than 400 private, academic, and public organizations conducted the research, development, and pilot testing of SHRP 2 products. With the research phase nearly complete, large-scale implementation efforts are under way by FHWA and AASHTO.

Appreciation is expressed to Charles Fay, Senior Program Officer, TRB, for his work in developing and coordinating the articles in this issue.



Imagining the Second Strategic Highway Research Program in Action

A Product Showcase Scenario

NEIL HAWKS

The author retired as Director of the second Strategic Highway Research Program (SHRP 2) at the end of 2011, after 29 years in a variety of senior management assignments at the Transportation Research Board and the National Research Council, including program manager for the first SHRP.

As the second Strategic Highway Research Program (SHRP 2) heads toward completion, transportation agencies will be interested in the outcome of the program's strategic goals. The four goals are

1. To develop a consistent and systematic approach to renewing America's highways rapidly while minimizing disruption and producing longer-lasting facilities—addressed in the Renewal focus area;
2. To improve highway safety significantly—addressed in the Safety focus area;
3. To provide a highway system with reliable travel times—addressed in the Reliability focus area; and
4. To develop approaches and tools that systematically integrate environmental, economic, and community requirements into the analysis, planning, and design of new highway capacity—addressed in the Capacity focus area.

Points of Entry

These are grand goals, and success will depend on the adoption of SHRP 2 products into general transportation practice. Transportation agencies, however, will want to know how the products apply in practice and what benefits they can gain before adopting new technologies, procedures, and practices, no matter how innovative.

Each agency is unique, with its own needs, priorities, conditions, and finances; therefore each must decide which products or groups of products are the best starting point for implementation. Finding that point of entry requires a clear picture of the nature and application of the SHRP 2 products; guidance in formulating the questions would be helpful. The

Photo: I'm Rich, Flickr

SHRP 2 research aims for safer highways, reliable travel times, and better approaches to renewing highway facilities and planning and designing new capacity. SHRP 2 has developed a hypothetical, highway-focused scenario to illustrate the everyday applicability of its products.

Map of the imaginary SR-85 highway corridor, used to illustrate the multidisciplinary applications of SHRP 2 products.

implementation teams assembled by the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) will assist agencies in implementation activities, but some simple illustrations of how and where SHRP 2 products might be deployed will help agencies articulate their first questions.

Puzzling Out an Illustration

SHRP 2 products vary markedly and apply to different phases of transportation project delivery. Some look and sound as though they emerged from traditional research programs—the design standards developed for prefabricated concrete bridges are an example. Highway professionals can readily grasp the underlying concepts and recognize the value of application. Other products seem abstract and unfamiliar when described, and picturing how such a product would be applied in practice is not easy; the Transportation for Communities: Advancing Projects Through Partnerships (TCAPP) product is an example.

Because of this breadth of applications, different people within an agency will evaluate the SHRP 2 products from the perspectives of their own specialties, and the product's overall value to an agency may not be obvious. For instance, how will TCAPP and new methods to identify pavement delamination both accelerate project delivery?

Within a transportation agency, planners are likely to evaluate one product and pavement engineers the other. Yet a strategic connection bridges the two disciplines—both products will improve project decision making and will limit the time lost in revisiting decisions made in the planning and design phases of project delivery.

This concept is difficult to describe, much less to illustrate, but illustrations can help transportation agencies and their industry partners invest wisely in implementing SHRP 2 products. Late in 2011, SHRP 2 staff and researchers negotiated the initial turn from research to implementation and puzzled over how to illustrate the potential applications of SHRP 2 products and the strategic connections among them.

A realization emerged that the connecting element was the highway. This insight led to the development of a scenario that focused on the highway and not on the SHRP 2 products. The canvas for the scenario featured an imaginary highway corridor that could illustrate real-world applications of various SHRP 2 products and how they might work together to meet an agency's needs and thereby fulfill the SHRP 2 goals. This device was useful in showing how frequently SHRP 2 products could apply and how frequently the SHRP 2 products complemented each other, even when applied at different times in the life cycle of a highway.

Painting the Vision

The canvas for painting the vision of product applications featured a hypothetical State Route 85 (SR-85) that runs between Old Town and New Town. The road is showing the stresses and strains of increasing age and expanding traffic. Cultural and natural features are likely to pose challenges to plans to operate, renew, expand, or relocate the road.

The following sketch captures the essence of the road from Old Town to New Town, the road's conditions, geographical situation, and some assumptions about the region. Although fictional and planted with features to showcase SHRP 2 products, the road from Old Town to New Town has the feel of an everyday highway. Agency planners and engineers should find it familiar and, equipped with SHRP 2 product descriptions, could reproduce the exercise. Agencies considering implementation of SHRP 2 products may find it useful to repeat this exercise with real highway segments from their own networks.

The Road

Old Town and New Town are approximately 40 miles apart on SR-85. Old Town was founded in the late 1700s and grew into a city in the 1820s with construction of the Big Muddy River Canal, which is no longer in use. Many Federal and Victorian period buildings line the waterfront but are falling into disrepair. Old Town has hopes for gentrification. Although slowly losing population, Old Town remains the employment center of the region, mostly with light industry.

A few miles to the southeast of Old Town is the Hamlet, the original colonial settlement, with an agricultural history. A handful of colonial homes, some on the National Register of Historic Places, line either side of "The Street," as SR-85 is called in the Hamlet. The Street has become a destination for day-tripping tourists. Rumors of an old fort in the vicinity persist, but no ruins have been found.

New Town grew up after the Western and Pacific (W&P) Railroad came through, circa 1900. Another growth spurt occurred when Interstate 50 (I-50) was constructed around 1970, but growth has stagnated since then. Lately, several new housing developments have popped up in the vicinity of New Town. Most of the breadwinners commute to jobs in Old Town. Plans for a new intermodal freight transfer facility near New Town have found support in the business communities of both New Town and Old Town.

The Forest and the Park

The forest covers a broad swath of land between the Hamlet and New Town. Although parts of the forest are privately owned, the state-owned areas east of the appropriately named Little Pristine River have never been logged and may be the habitat of several rare and endangered species.

The state park lies inside the forest and includes major recreation areas on both sides of SR-85, including fishing access to Little Pristine River, a lake for swimming and boating, campgrounds, and a recreational vehicle (RV) park. The intersections with the access roads to the recreation areas are the sites of frequent traffic crashes. These intersections also cause nonrecurring congestion, when park access traffic conflicts with commuter and through traffic.

The Little Pristine River is notable for the purity of its waters and lively fishing. The river is the last refuge in the state for an endangered freshwater clam.

State Route 85

SR-85 is a jointed portland cement concrete road constructed in the 1930s and often resurfaced with asphalt mixes and seal coats. Frequent maintenance is required.

SR-85 constitutes the main street for both Old Town and New Town. Although traffic volumes are moderately heavy, rush hour congestion occurs on both Main Streets. Occasionally, congestion in New Town backs up the exit ramps onto the mainline of

Historic buildings in Cumberland, Maryland, front National Road, the first improved highway in the United States. SHRP 2 products can address planning issues in areas that contain historic districts, archaeology sites, business districts, or railroads.

Photo: Dina-Roberts Wakulczyk

Photo: JayRaz, Flickr

Analysis of data from the Naturalistic Driving Study can facilitate a better understanding of road curve safety and crash prevention methods.

I-50. Nonrecurring congestion is increasing, particularly in the vicinity of the state park.

The steel truss bridges over the Big Muddy and Little Pristine Rivers are structurally sufficient but functionally obsolete—the lanes are too narrow. The bridge that carries SR-85 over the mainline of the W&P Railroad is structurally deficient, and weight restrictions are likely within the next several years.

SR-85 crosses the single track of the W&P Railroad spur at grade. The grade crossing is equipped with traditional crossing gates.

The alignment of SR-85 is generally straight, except for the infamous "85 Curve" between the forest and New Town. Although the radius of this curve conforms to design standards, and warning signs are deployed in accord with current standards, lane departures are frequent on the segment, occasionally with fatal consequences.

Interstate 50

Constructed in the late 1970s, the twin bridges that carry I-50 across SR-85 are showing deck deterioration. Joints and bearings are also suspect.

The concrete pavement ramps and bridge approach slabs reveal distress, but the mainline pavements, reconstructed in the 1990s, are in good condition.

Traffic is moderate, but truck volumes are heavy. As noted, rush hour traffic occasionally backs up onto the mainline of I-50.

SHRP 2 Research in Action

The SHRP 2 research teams of contractors and staff were asked to identify how the state transportation agency could apply specific SHRP 2 products to improve the road from Old Town to New Town. The research teams considered all phases of the potential project, from programming and planning to operations and maintenance, as they identified product applications.

The teams identified approximately 175 situations for applying SHRP 2 products. A few selected applications are described here, with the focus on the highway, beginning with a problem that the highway agency could encounter with SR-85 and discussing how SHRP 2 products may apply. The SHRP 2 products do not magically solve problems but are tools to help highway planners, engineers, and managers solve problems and make better decisions.

Problem 1. Should SR-85 be relocated to an entirely new alignment or be expanded, retaining the current alignment?

TCAPP is a robust resource for integrating environmental, economic, and community requirements systematically into the analysis, planning, and design of the alignment and expansion options.[1] TPICS, the transportation project impact component of TCAPP, can be used to determine which option is likely to provide the better eco-

[1] www.transportationforcommunities.com/.

nomic outcome.[2] The Decision Guide component will ensure that consensus is reached at each key decision point in the planning process and that the decisions are based on the appropriate information with the right stakeholders participating.

Problem 2. What are the ecological priorities presented by plans to expand the capacity of the SR-85 corridor?

TCAPP contains a set of tools to identify ecological priorities within a region, so that the highway planning process can avoid or minimize impacts. In all likelihood, neither the relocation nor the expansion of SR-85 will be free of impacts; therefore early identification is imperative for treating these impacts appropriately and avoiding delay. A highway solution that early on considers regional ecological priorities—as opposed to site-specific priorities—can benefit regional conservation planning.

Problem 3. How can the travel-time reliability of SR-85 be improved?

The SR-85 alignment is prone to nonrecurring congestion in the vicinity of the state park. The SHRP 2 Reliability by Design guidelines offer useful improvements to the roadway geometry, along with design tools for spot improvements at the state park and at other locations, such as the I-50 exit ramps and the Old Town and New Town business districts. The limited changes to the roadway geometry will have the secondary benefit of generally improving traffic safety.

Problem 4. How can response to traffic incidents be improved and the average incident clearance time be reduced?

In cooperation with other agencies, SHRP 2 has developed training curricula, guides, and tools to coordinate training for incident responders from public safety and transportation agencies.[3] Responders who thoroughly understand the roles played by their counterparts from other agencies can interact more safely and efficiently at the scene, lowering risks for themselves and for motorists and improving agency response time.

Responders to the all-too-frequent crashes at the 85 Curve include personnel from the state department of transportation (DOT) maintenance division, state and local police, the local fire department, emergency medical and ambulance services, and local towing services. All of these responders are needed, but if they are untrained or unaware of the roles and requirements of the other responders, the incident clearance will be delayed, causing congestion and raising the risk of secondary crashes.

Problem 5. How can the risk of crashes at the state park intersections and at the 85 Curve be reduced?

Coordinated response to incidents is essential, but not enough. Under the "do nothing" option for SR-85, traffic volumes are likely to increase, as is the number of fender benders in the park and of lane departure crashes at the 85 Curve.

Two SHRP 2 Safety Data Analysis Studies are addressing these traffic crash types and the degree to which driving behavior can increase or decrease crash risk. A third study is exploring the contributions of driver distraction and inattention to crash risk. The report, *Addressing Driver Performance and Behavior in Traffic Safety,* summarizes the Phase 1 work of four research teams that analyzed data from the SHRP 2 Naturalistic Driving Study (NDS).[4]

These analysis projects are early examples of the work that can be done with the SHRP 2 NDS and Roadway Information databases. A 2015 issue of *TR News* will address the value of these unique and unprecedented data sets.

Problem 6. What can be done with the bridge over the W&P Railroad in New Town?

Whatever the plans for highway improvements in the SR-85 corridor, replacement of the structurally deficient bridge over the railroad is a necessity. SR-85 is only 2 lanes at this point, however, and normal bridge construction practices will involve lengthy and disruptive traffic restrictions.

SHRP 2 has produced an Accelerated Bridge

[2] http://tpics.us/.

[3] www.trb.org/Main/Blurbs/166877.aspx.

[4] www.trb.org/Main/Blurbs/168727.aspx.

Photo: Rudy Salakory

Tools in TCAPP can help identify a region's ecological priorities, such as wetlands endangered species. In the SHRP 2 exercise scenario, the Little Pristine River is a refuge for freshwater clams (*above*).

Photo: Hall 2007

Construction of a concrete overlay on the E40/A10 road from Brussels to Ostend in Belgium. Preservation techniques to extend pavement service life are presented in the SHRP 2 Report *Using the Existing Pavement In-Place and Achieving Long Life*.

Construction Toolkit that includes standard plans and design details for prefabricated bridge elements that are simple, light, and easy to erect.[5] Fully prefabricated bridges can cut construction time from months to weeks, greatly reducing the associated disruptions for New Town.

Photo: Tom Scullion

SHRP 2 research has explored highway preservation systems such as air-coupled ground-penetrating radar.

Problem 7. What can be done to avoid delays in the project to replace the railroad bridge?

Construction projects that involve highways and railroads often experience major delays in reaching agreements between the railroad company and the transportation agency. The SHRP 2 report, *Strategies for Improving the Project Agreement Process Between Highway Agencies and Railroads*, with its associated web-based training tools, addresses successful practices for project coordination, as well as model legal agreements that have proved successful in assuring the timeliness of construction.[6] Communications and cooperation between both parties are essential for avoiding confusion, conflict, and delay.

Problem 8. How can the deteriorating SR-85 pavement be held together until construction of a new or rehabilitated pavement?

No matter how quickly planning can progress for a new or renewed SR-85, the start of construction is likely several years away, and the highway must be maintained in the interim. Many pavement preservation techniques were developed for lower-volume roads, and agencies are reluctant to apply these methods to roads like SR-85.

The SHRP 2 reports, *Preservation Approaches for High Traffic Volume Roadways*[7] and *Guidelines for the Preservation of High-Traffic-Volume Roadways*,[8] describe preservation treatments and strategies for higher-volume roads. These strategies can extend the service life of older pavements. If the wait for reconstruction will be long, an agency could opt for an alternative pavement rehabilitation project using strategies discussed in the SHRP 2 report, *Using the Existing Pavement In-Place and Achieving Long Life*.[9]

Strategic Payback

This exercise includes products from each of the four focus areas of SHRP 2 research and illustrates how these products, both singly and in combination, will successfully address all four strategic goals of the program. The products are designed for easy integration into transportation practice. Agencies can select from the array of SHRP 2 products to fit their needs and resources. More extensive selections will yield a bigger payback, but a smaller selection addressing crucial problems will have a significant impact also.

Other articles in this issue provide greater detail about the products of the SHRP 2 program. The program was designed to equip transportation agencies with the means to meet users' expectations of safe and reliable trips on roads planned, built, and operated to help communities thrive.

No set of examples can illustrate the depth and breadth of the full gamut of SHRP 2 products. To learn more, visit the SHRP 2 website[10] and the SHRP2 Solutions website hosted by FHWA to support implementation.[11]

Readers are invited to use the road from Old Town to New Town to delve deeper into SHRP 2. Review the product briefs and fact sheets on the web pages and locate application sites for the products on the sketch map. Additional suppositions can be made about the Old Town–New Town area—for example, both underground and overhead utilities are likely to be found in and around Old Town or New Town, and the SHRP 2 products related to public utilities would be applicable.

SHRP 2 researchers and staff would like to know how these exercises work out. Readers are invited to send the results to SHRP2@nas.edu.

[5] www.trb.org/Main/Blurbs/168046.aspx.
[6] www.trb.org/Railroads/Blurbs/164283.aspx.
[7] www.trb.org/Main/Blurbs/165280.aspx.
[8] www.trb.org/Main/Blurbs/164965.aspx.
[9] www.trb.org/Main/Blurbs/168146.aspx.
[10] www.TRB.org/SHRP2.
[11] www.fhwa.dot.gov/goSHRP2.

SHRP 2 RENEWAL FOCUS AREA

Lasting Renewal with Minimal Disruption

Building a Highway Network into the Future

CATHERINE NELSON AND STEVEN DeWITT

Nelson recently retired as Manager, Technical Services, and Chief Engineer, Oregon Department of Transportation, Salem, and is immediate past Chair of the Renewal Technical Coordinating Committee of the second Strategic Highway Research Program. DeWitt is Alternative Delivery Technical Manager, Parsons Brinckerhoff, Raleigh, North Carolina.

The Keg Creek Bridge replacement in Iowa applied SHRP 2 accelerated bridge construction techniques.

A robust, high-quality transportation system is a key to the livability of communities and the economic vitality of the nation. An aging highway infrastructure, however, threatens the mission of all transportation agencies to provide a safe and efficient transportation system. The challenge is to restore the national network of roads and bridges to meet the demands of tomorrow with minimal disruptions today.

The Renewal focus area of the second Strategic Highway Research Program (SHRP 2) has worked to meet this challenge with a three-pronged research strategy: develop a consistent, systematic approach to completing highway projects quickly, with minimal disruption to the community, and produce long-lasting facilities. A successful renewal effort

- ◆ Reduces the time for preparation and execution;
- ◆ Minimizes disruptions to traffic, utilities, and neighborhoods; and
- ◆ Extends the time between renewal activities.

Suite of Products

The SHRP 2 Renewal focus area has developed a suite of research products across five project areas: pavements, bridges, utilities and railroads, nondestructive testing, and project delivery. The research has generated a variety of tools, ranging from new technologies, best practice guides, and training, to new processes, procedures, and methods. The outcomes and solutions of the Renewal research address today's transportation challenges by providing technical and institutional tools for systematic application throughout development and delivery.

With few exceptions, the products in the Renewal focus area build on the current body of knowledge and create opportunities to expand the application of an innovation, to quantify and validate current thinking, or to provide gap-filling technical or procedural improvements to move novel concepts into mainstream acceptance and use.

SHRP 2 Renewal research has created new and enhanced tools to aid in the reconstruction and maintenance of aging roads and bridges. These tools

Prefabricated elements of bridge systems save money and time. The SHRP 2 ABC Toolkit also allows local contractors to prefabricate and install components using conventional equipment.

enable practitioners to manage the complexities and risks of accelerated construction and to limit the economic disruptiveness of infrastructure construction and repair. System safety also improves with reductions in the number and frequency of construction zones. Many of the proposed techniques employ sustainable strategies, such as preservation and reuse of materials, and maintain regional economic opportunities by recommending methods that local contractors can perform.

The suite of Renewal products spans the project delivery cycle, from planning through design, procurement, and construction and on to operations and maintenance. These total life-cycle products are not limited to major and complex projects but are scalable for renewal projects of varying size, scope, and complexity.

Highlighted below are some of the SHRP 2 Renewal products designed to minimize traffic disruptions, promote traffic and worker safety, and accelerate project delivery for long-lasting facilities.

A SHRP 2 project demonstrating infrared and ground-penetrating radar technologies as nondestructive testing techniques on hot-mix asphalt resulted in NDToolbox, an electronic resource for practitioners.

In addition, four transportation agencies have provided accounts of piloting SHRP 2 products (see accompanying articles on pages 16–20).

Rapid Approaches

The bridge designs and construction techniques that constitute the SHRP 2 Accelerated Bridge Construction (ABC) Toolkit are among the hallmarks of the Renewal focus area.[1] The toolkit includes standard concepts for structural plans and details for prefabricated systems and elements. Standardization can speed delivery and lower costs on similar bridge replacements by reducing design time and minimizing fabrication in the field. Moreover, local contractors using conventional equipment can perform the prefabrication and erection by applying the toolkit components and techniques. The Vermont Agency of Transportation has piloted the ABC Toolkit (see article, page 16).

Risk Management

Rapid renewal project requirements can magnify risk, and risk management is critical to success. In the United States, however, integration of rapid renewal processes is rare at a program level and on nonmajor projects. Rapid reconstruction typically involves complex logistical requirements, complicated contractual procedures, and restrictive regulatory requirements, all of which necessitate careful planning and execution throughout the project delivery cycle.

SHRP 2 researchers have developed guidance based on a formal risk management process. The *Guide for the Process of Managing Risk on Rapid Renewal Projects* includes implementation materials and practical application elements.[2] This SHRP 2 product can assist agencies and the contracting industry in developing a risk-mitigation culture to yield more effective project delivery.

Managing Complexity

The complexities of rapid renewal projects often differ from those of traditional projects. SHRP 2 research examined the management elements of complex projects and developed products that include strategies for dealing with the unique challenges, as well as guidance on approaches to facilitate sound decision making.

The guide presents a five-dimensional approach to project management that adds project context and funding mechanisms to the three standard considerations of cost, schedule, and technical requirements.[3] The practical tools and techniques are designed to be

[1] www.trb.org/Main/Blurbs/168046.aspx.
[2] www.trb.org/Policy/Blurbs/168369.aspx.
[3] www.trb.org/Main/Blurbs/167481.aspx.

immediately applicable and to fit into an agency's accustomed approach to project management.

Used in concert with the risk management guide, the management strategies can enhance project success through the various stages of development and delivery. The project management products accommodate a scalable approach that can be applied to a variety of infrastructure projects.

Performance Specifications

Traditional method specifications often conflict with the performance-based objectives of rapid renewal projects and may limit the creativity that is required to meet the project goals. Performance-based specifications that emphasize the desired results allow materials suppliers and the contracting industry to provide creative solutions for faster project delivery, minimal disruption, and greater durability.

SHRP 2 has produced a guide with model performance specifications for various project elements—such as pavements and bridge decks—for a variety of contract delivery methods, such as design–build.[4] Addressing knowledge and deployment gaps, the guide focuses on implementing a performance specification approach at the technical and management levels.

Nondestructive Testing

Improving the quality of in situ condition data and accelerating data collection techniques have been long-standing goals for agencies. During project planning, condition assessments of facilities often need to be completed quickly to inform renewal decisions. During construction, defects and quality control issues must be identified quickly, so that corrections can be implemented. Many standard tests and processes require lengthy periods to collect and interpret data. SHRP 2 research examined nondestructive testing (NDT) to address these issues.

NDT projects have focused on technology development and independent evaluation of current and emerging technologies. The SHRP 2 Nondestructive Testing Toolbox provides information about equipment and test methods to assist with evaluating concrete bridge decks and with assessing the uniformity, debonding, and stripping in asphalt pavements; the smoothness of concrete pavements; and a variety of other project elements.[5]

Worker Fatigue

Rapid renewal and accelerated construction practices can exacerbate worker fatigue, posing safety issues for workers and the public at construction sites. Methods for dealing with fatigue tend to be informal. The Worker Fatigue Reference Manual developed under SHRP 2 can help agencies integrate fatigue countermeasures into safety management programs.[6] The product includes guidance on work scheduling and related organizational procedures, reference material on fatigue management, training material for managers and workers, and outreach materials.

[4] www.trb.org/Main/Blurbs/169107.aspx.

[5] www.ndtoolbox.org/content/shrp2-ndt-projects.

SHRP 2 Renewal Project 21, Composite Pavement Systems, developed model construction specifications and material selection guidelines.

Minimal Disruption

Transportation agencies routinely attempt to balance three objectives for renewal projects: maximize available resources, minimize disruption to the public, and improve the durability and quality of the highway features. Agencies are pressed to find strategies and technologies to address these objectives, which occasionally conflict.

Assessing Impacts

Historically, agencies have minimized disruptions to traffic by taking a project-specific approach. As traffic increases, however, making evaluations at the corridor and network levels increases in importance. SHRP 2 has developed a software tool that assesses the impacts of a renewal program, compares the sequencing scenarios of specific construction projects, and then develops an optimal schedule for renewal programming.

[6] www.trb.org/Main/Blurbs/168143.aspx.

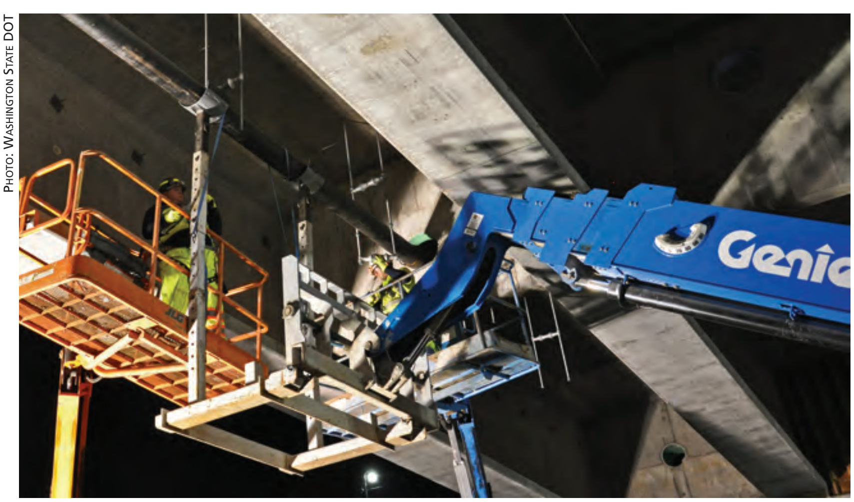


PHOTO: WASHINGTON STATE DOT

Highway agencies often conduct repairs at night to avoid traffic disruption. The Work Zone Impact and Strategy Estimator can be used to evaluate strategies for managing construction impact on traffic.

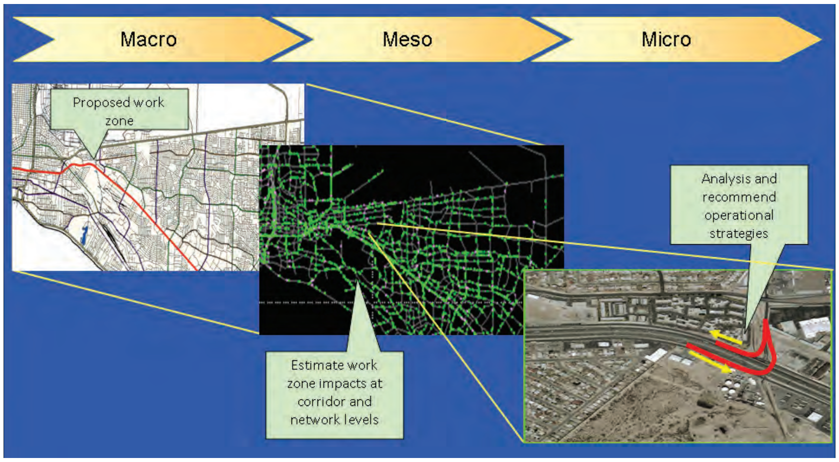


FIGURE 1 The Work Zone Impact and Strategy Estimator (WISE) allows multiresolution modeling for evaluating the impact of work zones and determining corrective strategies.

The Work Zone Impact and Strategy Estimator (WISE) is applicable at the planning and the operational levels (see Figure 1, above).[7] As an operational tool, WISE can evaluate the regional impact of various strategies at the project level, such as day–night operations, innovative contracting, rapid construction techniques, advanced maintenance of traffic plans, and public information programs.

Utilities and Railroads

Utilities and railroads often share the roadway right-of-way (ROW) and can affect renewal projects. Unresolved or undetected conflicts are a leading cause of delays in project delivery and construction and of increases in costs. Involving utility owners and railroads early in project development is essential to improve coordination and communication and to avoid conflicts. The SHRP 2 products have focused on the fundamental relationships between highway agencies, utilities, and railroads.

Much of the data on utility location, composition, and ownership on highway ROW is incomplete and difficult to assemble. SHRP 2 researchers have synthesized best practices spanning the project life cycle and have identified products that address the organizational barriers to relocating utilities effectively.[8] Researchers developed a Utility Conflict Matrix to organize, track, and manage conflicts. Maryland DOT has pilot-tested the tool (see article, page 17).

Current technology can only detect 80 percent to 90 percent of utilities, but the undetected utilities can have detrimental effects on project costs and schedules. SHRP 2 examined current and emerging technologies that increase accuracy in locating and mapping utilities before they become construction hindrances.

A web-based decision support tool, Selection Assistant for Utility Location Technologies (SAULT), guides practitioners through a series of options about a project's environment to provide decision support for identifying the appropriate and effective utility-locating methods and technologies for the site.[9] The SHRP 2 utility suite also includes prototypes for data collection and storage, imaging, modeling, and utility detection.

Researchers also examined strategies that encourage cooperative relationships between railroads and agencies to reduce issues during renewal projects. Products include model legal agreements, recommended business practices, sample contracts, and training materials to resolve underlying sources of conflicts and to streamline review and agreement processes.[10] A searchable, virtual library of these resources is in development.

Long-Lasting Facilities

Producing durable facilities reduces costs and disruption to users during the infrastructure life cycle. SHRP 2 has developed a series of guidelines for design and construction of pavements and bridges to assist practitioners in building facilities with a long service life.

Extending Bridge Life

SHRP 2 researchers believe that a 100-year bridge life is attainable with today's construction practices if three main principles are followed:

1. Use improved, durable materials and systems in construction;
2. Apply improved techniques for preventive maintenance at the optimal time; and
3. Develop and apply a serviceability approach to design.

SHRP 2 projects developed two key products. The *Design Guide for Bridges for Service Life* is a comprehensive reference for the service, performance, and durability of bridge systems, subsystems, and components (see Figure 2, page 15).[11] The Service Life Guide Specification and Framework offers model design recommendations to enhance the service life of standard bridges.[12]

In-Place Pavements

SHRP 2 researchers also examined ways to extend the service life of in-place pavements. The research

[7] www.trb.org/StrategicHighwayResearchProgram2SHRP2/Pages/WISE-712.aspx.
[8] www.trb.org/Main/Blurbs/166731.aspx.
[9] www.trb.org/Publications/Blurbs/165879.aspx.
[10] www.trb.org/Publications/Blurbs/164283.aspx.
[11] www.trb.org/Main/Blurbs/168760.aspx.
[12] http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2422.

delivered methods to incorporate in-use pavements into new pavement structures that can perform well for 50 years or more. These methods can accelerate construction, reduce project costs, and provide sustainable solutions.

Researchers developed a web-based decision support tool for use with transportation agencies' normal pavement design processes, a pavement design scoping tool that incorporates the renewal strategy selections, a project assessment manual, a best practices synthesis, decision matrices, model specifications, and life-cycle cost analyses. Washington State DOT has piloted these procedures and guidelines (see article, page 18).

Pavement Preservation

Pavement preservation is also critical in extending the life of roadways. Strategic, incremental investments can prolong pavement life, but high-volume roadways can present difficult conditions for applying these techniques. SHRP 2 researchers therefore documented the state of the practice of preservation for asphalt and concrete pavements and developed guidance on matching pavement condition with suitable treatments for high-traffic-volume roadways.[13]

Other Pavement Techniques

In addition, the researchers surveyed modular pavement techniques, focusing on precast concrete pavement (PCP) systems. They developed model design specifications, as well as guidelines for the installation and inspection of PCP systems for practitioners.[14]

SHRP 2 researchers also looked at other methods for reconstructing and developing new roadways and evaluated composite pavement systems under a variety of climate and traffic conditions. The construction specifications and techniques, life-cycle costing recommendations, and training materials address two types of composite pavement systems: hot-mix asphalt over portland cement concrete (PCC) and PCC over a structural PCC layer.[15] Illinois Tollway has implemented these recommendations for modular pavement and composite pavement systems (see article, page 19).

A World-Class Infrastructure

Each of the SHRP 2 products provides a tool for highway agencies to build long-lasting infrastructure quickly and with minimal disruption, but these products collectively can have a greater impact in supporting an agency's mission—and the national transportation vision—to rebuild and preserve a world-class highway infrastructure system to serve the traveling public and the nation for many years to come. New York State DOT, for example, has undertaken this systematic approach to implementation, applying more than a dozen of the products of the SHRP 2 Revewal and other focus areas across the state on several projects.

[13] www.trb.org/Publications/Blurbs/165280.aspx.
[14] www.trb.org/Main/Blurbs/167788.aspx.
[15] www.trb.org/StrategicHighwayResearchProgram2SHRP2/Blurbs/168145.aspx.

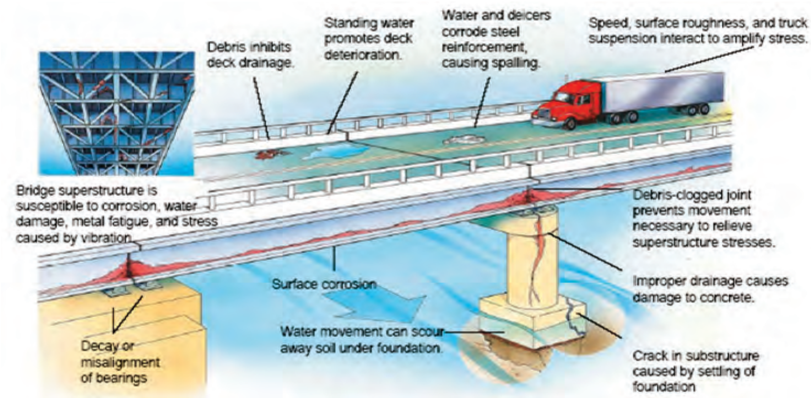


FIGURE 2 SHRP 2 Renewal Project 19A, Service-Life Design Guide for Bridges, addresses bridge durability under different exposure conditions and constraints.

PHOTO: VIRGINIA DOT

In-place recycling on I-81, a major thoroughfare in Virginia. Methods to incorporate in-use pavements into new, long-lasting pavement structures can lead to faster and more cost-effective in-place pavements.

Accelerating Bridge Delivery in Vermont

Traffic, Construction, Safety, and Economic Benefits

WAYNE SYMONDS

The author is Program Manager, Vermont Agency of Transportation, Montpelier.

The opportunity for the Vermont Agency of Transportation (VTrans) to pilot the Accelerated Bridge Construction (ABC) Toolkit[1] in February 2012 was timely. The SHRP 2 standardized approach for workhorse bridges dovetailed with the goal of Vermont's newly created Accelerated Bridge Program. Standardizing the construction details is vital in reducing design time, gaining acceptance from contractors, and reducing construction costs. At the same time, VTrans was beginning designs for several emergency replacement projects after damage from tropical storm Irene in August 2011.

VTrans selected two emergency replacement projects to pilot the toolkit. The projects typified many bridges in the state's inventory; favorable results would extend to many other projects.

The recommended details in the ABC Toolkit matched up well with the VTrans bridge inventory. The first pilot project was a bridge with a 70-foot span over the Hancock Branch on Vermont Route 125.[2] The pilot project, designed in-house by the accelerated bridge design team, used a prestressed NEXT–D beam superstructure on precast integral abutments with precast approach slabs.

The design started by modifying the ABC Toolkit details to follow VTrans' typical details more closely. The modifications did not customize the toolkit details but adjusted standard details for use on the Hancock project and subsequent projects. Bids were opened in September 2012, and the low bid came in at 15 percent below the engineer's estimate. The timing of the contract award allowed sufficient lead time for the fabricator to produce the prefabricated elements. The project was constructed in May and June 2013, with no issues in the field, and earned positive comments from the construction contractor.

[1] http://www.trb.org/Main/Blurbs/168046.aspx.
[2] Hancock ER-BRF 0174(16).

PHOTO: WAYNE SYMONDS

Vermont Agency of Transportation (VTrans) piloted techniques for precast bridge elements, such as this integral abutment, designed by a VTrans team.

The second project was a bridge on Vermont Route 105 over Cold Brook.[3] This bridge, also with a 70-foot span, used a prestressed NEXT–D beam superstructure on integral abutments with precast approach slabs. Replacing this structure required a permit for a short-term road closure of up to 21 days. The Brighton project was designed in-house by applying the details developed for the Hancock pilot, which had streamlined project development. Bids were opened in October 2012, and the low bid was 30 percent below the engineer's estimate; construction began in July 2013.

The SHRP 2 ABC Toolkit has helped VTrans minimize road closures and improve the safety of bridge construction sites; this benefits the agency and the traveling public. The standardized approach encourages local contractors to develop new skills applicable to many other kinds of projects and to gain a competitive edge.

VTrans has completed the design of five other ABC projects, advertised in 2013 for construction in 2014, employing prefabricated bridge units and precast deck on steel beam units. The projects follow the same model of modifying the ABC Toolkit details to follow VTrans' typical details.

[3] Brighton ER-STP 034-3(25).

PHOTO: WAYNE SYMONDS

A precast abutment is delivered for a bridge over Hancock Branch on Vermont Route 125. By modifying details in the SHRP 2 ABC Toolkit, VTrans quickly replaced this and another bridge damaged by Hurricane Irene.

SHRP 2 RENEWAL FOCUS AREA

Avoiding Project Delays from Utility Conflicts

Maryland Applies a Procedural Matrix

NELSON P. SMITH, JR.

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The Maryland State Highway Administration (SHA) frequently has had to delay the advertisement date or the notice to proceed for highway projects because of setbacks in relocating utilities. The experience is common for state highway agencies. One of the major causes of the delays is that the identification or resolution of utility conflicts occurs too late in the process.

To identify and resolve utility conflicts before the project letting, Maryland SHA recently piloted the Utility Conflict Matrix (UCM) developed under the second Strategic Highway Research Program (SHRP 2). The agency identified six projects in four metropolitan districts in Maryland for the pilots; the projects varied in scope, number of conflicts, type, and level of design completed.

Although implementation of the UCM is in the early stages, the initial results have been positive. Stakeholders—including project design staff and district utility engineers from Maryland SHA and personnel from utility companies—have reported improvements in communication, coordination, and the timely resolution of conflicts.

Identifying and resolving utility conflicts early on may not be a new approach, but Maryland SHA has gained a new tool in the UCM, which defines a methodical process for identifying and resolving conflicts to minimize the likelihood that hidden conflicts will cause delays.

For many state highway agencies, the late identification of underground utilities leads to project delays for necessary relocations.

Photo: District of Columbia DOT

Photo: Nelson P. Smith, Jr.

Underground utilities discovered when Maryland State Highway Administration piloted a SHRP 2 tool to identify utility conflicts.

Maryland SHA's six pilot sites represented a cross section of projects to determine if the UCM was better suited to a particular type of project. Few new conflicts were identified on the pilot that was furthest along in the design process, yet the results were positive—an unexpected need for additional subsurface information was discovered, eliminating a potential conflict during construction.

On the other projects, application of the UCM has revealed conflicts that may otherwise have gone undetected until later in design or during construction. One of the pilots is exploring application of the UCM on a design–build project.

Maryland SHA's pilot program noted one drawback to the SHRP 2 tool—the initial task of populating the UCM with data required more time and effort than originally anticipated. The agency is exploring the possibility of using a program to automate the initial data entry and to adapt the UCM to fit the needs of all users within the agency. Nevertheless, the UCM has proved valuable to Maryland SHA in identifying, mitigating, resolving, and eliminating utility conflicts with highway projects.

SHRP 2 RENEWAL FOCUS AREA

Long-Lasting Pavement Solution for an Interstate

Guide Helps Washington State Meet Project Goals

JEFFREY S. UHLMEYER

On Interstate 5 (I-5) northbound between Burlington and Bellingham, Washington, old concrete panels beneath the asphalt were causing severe transverse cracking along a stretch of 11.6 miles, or 23.08 lane miles. The Washington State Department of Transportation (DOT) placed hot-mix asphalt (HMA) over the faulted pavement in the early 1990s, and maintenance crews sealed large cracks as a temporary solution in 2009 and 2010.

Looking for a long-lived, cost-effective solution, Washington State DOT agreed to pilot the procedures in the guide produced by the second Strategic Highway Research Program (SHRP 2), *Using the Existing Pavement In-Place and Achieving Long Life*,[1] during the I-5 Joe Leary Slough to Nulle Road Vicinity project. A web-based decision support tool, the guide contains procedures for identifying when pavements can be used in place, as well as approaches to incorporate the original pavement material into the new structure.

PHOTOS: JEFFREY UHLMEYER

Old concrete panels beneath I-5 in Washington State caused severe cracking in the roadway (*top*). Washington State DOT piloted a web-based decision support tool for in-place pavement recycling and seated the concrete with an asphalt concrete overlay (*bottom*).

Project Goals and Options

Washington State DOT's goals were to provide a long-lasting pavement solution for the I-5 rehabilitation, advertise the project within four months, and hold expenditures within a budget of $25 million. The SHRP 2 guide provided a valuable reference in speeding up the pavement selection and scoping process and in identifying the best strategies for rehabilitation with in-place pavements, leading to three viable options:

◆ CSOL—crack and seat the concrete with an 8.4-inch asphalt concrete overlay;

◆ Asphalt rebuild—pulverize the pavement in place for an 8.4-inch crushed surfacing base course (CSBC) with a 13-inch hot-mix asphalt (HMA) overlay; or

◆ Concrete rebuild—place a 4.2-inch CSBC, overlay with 4.2 inches of HMA, then overlay 13 inches of portland cement concrete pavement.

Applying the Tool

To meet the project schedule, Washington State DOT immediately started the pavement design and the preparation of technical documents for the contract. The decision support tool provided the technical information for implementing the CSOL method, an alternative that the agency had not used previously; this increased management's comfort level.

The project team relied on the tool's resource documents, especially the best practices and specifications. The guide quickly and concisely educated practitioners at a detailed level on national and international practices; although correspondence with other agencies was not eliminated, the decision support tool focused the project team's efforts.

By the time the I-5 project went to Washington State DOT engineers, the team was confident in its success. The agency was able to develop the CSOL technical documentation and contract specifications within the time frame and advertised the project in the required four months.

Cost Savings

Washington State DOT awarded the project in February 2011 with design–build procurement. The 4.2-inch HMA overlay was removed, the pavement was cracked and seated, and an 8.4-inch overlay of HMA applied. On 5 lane miles, after the 4.2-inch HMA overlay was removed, the pavement received a dowel bar retrofit and 4.2 inches of HMA overlay. Miscellaneous repairs also were made to northbound and southbound ramps. The total initial cost of the project to the agency was $14.553 million, with an average cost of $582,000 per lane mile.

By identifying additional pavement rehabilitation alternatives, the SHRP 2 decision support tool assisted Washington State DOT in achieving significant savings initially and over the pavement's life cycle. The CSOL method saved Washington State DOT 19 percent in initial agency costs, 16 percent in agency costs for the roadway life cycle, and 28 percent in user costs over the life cycle. In addition, the method reduced construction-required lane closures by 43 percent.

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[1] www.trb.org/Main/Blurbs/168146.aspx.

SHRP 2 RENEWAL FOCUS AREA

Building Green with Precast and Composite Pavements

Illinois Tollway's Experience

STEVEN GILLEN

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Precast concrete pavement (PCP) systems and composite pavements provide a long service life, excellent surface characteristics, and structural capacity. Composite pavements offer the additional benefits of economy and sustainability with recycled and locally available materials.

Two projects of the second Strategic Highway Research program (SHRP 2), on Modular Pavement Technology[1] and on Composite Pavement Systems,[2] have addressed gaps in knowledge and have developed recommendations for construction specifications and techniques, life-cycle costing, and quality management. The Illinois Tollway successfully implemented these recommendations and incorporated them into the agency's 15-year, $12 billion capital program, Move Illinois: The Illinois Tollway Driving the Future. By applying the SHRP 2 recommendations, the Illinois Tollway has accelerated project delivery, reduced the impact on traffic, improved safety, and achieved cost savings.

[1] www.trb.org/Main/Blurbs/167788.aspx.
[2] www.trb.org/StrategicHighwayResearchProgram2SHRP2/Blurbs/168145.aspx.

A concrete ready-mix truck wind-rowing concrete for the top lift of a composite pavement in front of a single-lane slip-form paver on the Reagan Memorial Tollway.

A two-lane composite paving train places two lifts of concrete pavement on the Reagan Memorial Tollway, Interstate 88.

Composite Pavement

In 2010, the Illinois Tollway conducted field trials of the composite pavement standards in using an asphalt-over-concrete composite to construct the ramps off the Tri-State Tollway, Interstate 94, onto Milwaukee Avenue in northeastern Illinois. The project was ideal for testing the feasibility and design methods of two-lift composite pavements and of ternary concrete mixes with moderate levels of recycled asphalt pavement (RAP).

Applying the SHRP 2 guidelines, with consultation from the University of Illinois, the Tollway prepared material and construction specifications. A 9-inch, low-cost portland cement concrete (PCC) lower lift was placed, cured, textured, and sprayed with a tack coat to bond a top layer of 2-inch, high-quality, dense-graded warm-mix asphalt (WMA). In the PCC layer, 30 percent of coarse aggregate was RAP, mixed with PCC and 20 percent to 25 percent fly ash. The transverse joints were sawed and sealed in the WMA layer over the PCC joints.

In 2012, the Tollway tested an all-concrete, wet-on-wet, two-lift composite pavement as part of a 1-mile rebuilding and widening project on the Reagan Memorial Tollway, Interstate 88, near Aurora, Illinois. All trial operations were successful.

Incorporating high levels of recycled materials or

A two-lane belt placer spreads the top lift of concrete over a bottom lift of "green" concrete in front of a slip-form paver, creating a composite pavement on the Reagan Memorial Tollway.

lower quality, local virgin materials aligns with the Tollway's commitment to apply sustainability principles to the Move Illinois program and provides major benefits. Extensive testing demonstrated no reductions in performance or in pavement life with two-lift composite pavements.

A top lift of premium quality and virgin materials also can yield cost savings. A rebuilding and widening project on the Jane Addams Memorial Tollway, Interstate 90 between Rockford and Elgin, placed 750,000 square yards of composite concrete pavement. Compared with recent prices for similar projects with standard pavement details, the bid prices came in lower than usual, and the bids for 2014 projects have submitted unit prices a few dollars less per square yard.

Precast Concrete

The Illinois Tollway adapted the model design specifications and guidelines developed in SHRP 2 for precast modular pavement to produce its own generic specifications. The Tollway first applied the generic system in 2010 on a ramp section at an Interstate-to-Interstate interchange that required emergency replacement and minimal traffic disruption. In 2012, the detail was modified for extensive patching work, as nighttime repair crews placed nearly 700 panels at isolated locations on the heavily traveled Tri-State Tollway, Interstate 294, adjacent to O'Hare International Airport.

The generic system accelerated project delivery and improved the efficiency of the design and construction of modular pavement systems. The approach also has minimized the impact on traffic by reducing the durations of lane closures and has increased competition, causing bid prices to decline steadily. Although direct cost savings from precast versus cast-in-place methods may not be appreciable, the agency reduced costs for customers by eliminating massive traffic backups and improving roadway safety.

Building Green

Building on the work of SHRP 2, these successful trials of composite and of precast pavements have helped the Illinois Tollway accomplish the goals of making the Move Illinois program the "cleanest and greenest" in the agency's history and of building green through the next 14 years.

Efforts are under way to reconstruct and widen approximately 62 centerline miles of Interstate expressway with new composite concrete pavements. Large quantities of precast pavement are being placed in repairs and reconstruction throughout the 286-mile Tollway system, with minimal disruption to customers. These rapid techniques represent major advances, efficiencies, and savings.

MOVE ILLINOIS
The Illinois Tollway
DRIVING THE FUTURE

Crews place a precast panel on the central Tri-State Tollway, Interstate 294.

A precast panel in place on the northbound Tri-State Tollway near Roosevelt Road, Illinois Route 38.

Maximizing Highway Capacity

Strategic Initiatives Address Collaboration, the Environment, the Economy, and Travel Needs

MARK VAN PORT FLEET

The author is Director, Bureau of Highway Development, Michigan Department of Transportation, Lansing, and Chair of the SHRP 2 Capacity Technical Coordinating Committee.

Demographic, social, and economic forecasts through the middle of the 21st century indicate that additional highway capacity will be needed, and experience demonstrates that collaboration and compromise will be required. Although much of the projected highway capacity expansion involves widening and upgrading highways, decision makers and the public demand that transportation agencies get the most out of the existing infrastructure beforehand.

Transportation agencies must be stewards of the natural environment and must consider natural habitats, wetlands, and air quality. Agencies also are expected to support economic development in their communities and are charged with accelerating the delivery of the right transportation solutions.

Because planning and delivering highway capacity involves many interests with diverse points of view and goals, finding the most appropriate solution is inherently difficult. But a failure to work together creates endless loops of redoing the plans and designs; this in turn may incur lawsuits, delays, and cost escalations.

The charge to the Capacity focus area projects of the second Strategic Highway Research Program (SHRP 2), therefore, was to

> develop approaches and tools for systematically integrating environmental, economic, and community requirements into the analysis, planning, and design of new highway capacity.

To achieve this charge, the research program was designed to develop tools and resources to support and encourage the following:

- Collaborative decision making,
- Ecological approaches to integrating environmental protection and transportation planning,
- Better understanding of the economic impacts of highway investments, and
- Improved tools for the analysis of travel demand behavior.

All of these are important in advancing the state of the practice of transportation planning and capacity project development. Examples of progress made toward each of these goals through the SHRP 2 Capacity focus area are described in the accompanying articles.

PHOTO: D. ALLEN COVEY, VIRGINIA DOT

Wetlands were incorporated into a project to replace the Huguenot Bridge over the James River in Virginia. Transportation agencies must consider environmental impacts of construction and rehabilitation projects.

Improving the Planning and Delivery of Highway Capacity Projects

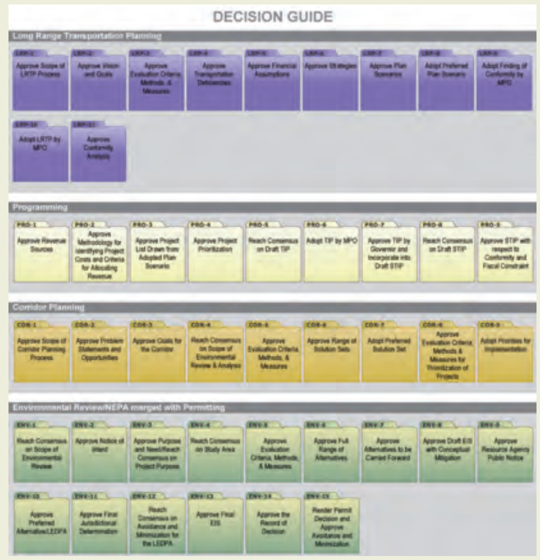
Decision-Support System Emphasizes Collaboration

JANET D'IGNAZIO AND BEVERLY BOWEN

D'Ignazio is Vice President, and Bowen is Senior Manager, ICF International, Durham, North Carolina.

Transportation for Communities: Achieving Projects Through Partnerships (TCAPP) is a web-based resource that provides a systematic approach to planning, programming, and developing highway capacity projects. According to the central concept of TCAPP, engaging the right people at the right time with the right information will speed project delivery and will provide the flexibility of considering nontraditional solutions.

TCAPP applies data collected from 23 detailed case studies of innovative and collaborative practice. These data were combined with findings from a series of facilitated workshops with transportation professionals from the Federal Highway Administration (FHWA), state departments of transportation (DOTs), metropolitan planning organizations (MPOs), resource agencies, and stakeholder representatives to inform the TCAPP framework.

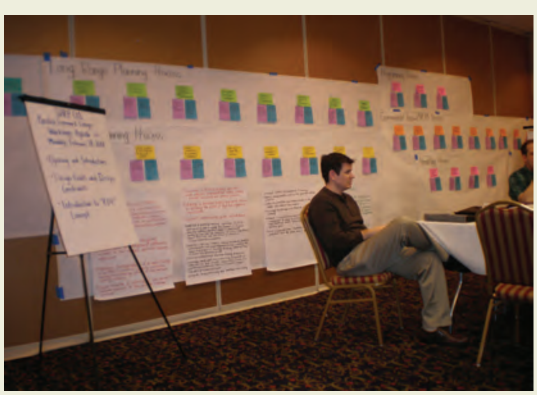


The TCAPP Decision Guide offers information for every step in the process of decision making.

Supporting Key Decisions

The framework—known as the Decision Guide—provides detailed information for key decisions, from long-range planning through the record of decision. The key decisions are common to all transportation agencies and reflect laws and regulations, as well as successful practice.

TCAPP supports the interests and roles of partners and stakeholders in transportation planning and project development. TCAPP also includes support for other topics in which collaboration is essential to success, including performance measurement, conservation planning and environmental permitting, controlling greenhouse gas emissions, achieving smart growth, and developing public–private partnerships.



TCAPP design workshops convened transportation professionals from federal, state, and local agencies as well as stakeholder and planning organizations.

TCAPP offers a basic decision support system for planning, programming, and project development activities by providing information that practitioners need. By identifying the data and tools to support key decision making, the guide streamlines a process that is often complicated and difficult to understand. The guide can be used for troubleshooting or as a roadmap for changing a process. By directing attention to the who, what, when, and how at each key decision point, the guide can improve the way that agencies lead, participate in, and inform decision making.

The primary features of TCAPP are applications that focus on individual topics through a subset of key decisions. Transportation planners will find support for developing the long-range plan or corridor plans. Engineers and environmental resource specialists can collaborate during planning and project development to deliver projects that protect the environment. Professionals who support stakeholder engagement in transportation decision making will find information on when and how to use stakeholder input. Practi-

Right-Sizing a Major Project in Washington State

BRIAN SMITH

The Washington State Department of Transportation (DOT) used the Transportation for Communities: Achieving Projects Through Partnerships (TCAPP) tool in reevaluating a proposed $1.2 billion extension of a state route for airport and seaport access. The project involved closing a highway gap on a new alignment, as well as substantially modifying the major north–south Interstate in Washington.

To evaluate phasing the project and open road tolling, the Washington State DOT team used a range of TCAPP tools, including the Decision Guide and Corridor Planning Key Decision Points, the stakeholder involvement techniques, the methods for decision-maker identification and inclusion, the stakeholder collaboration assessment, and tips from selected case studies. In defining the scope of Phase 1, the project team reduced the initial cost estimate by approximately $400 million yet preserved most of the project's benefits. The effort gained support from all participating agencies and elected officials.

The author is Director, Multimodal Planning, Washington State Department of Transportation, Olympia.

PHOTO: TCAPP

TCAPP presents real-world examples of decision making processes, such as for the I-5/Beltline Interchange Project in Oregon.

tioners will benefit from learning how to incorporate emerging topics of interest into decision-making activities, such as greenhouse gas planning, performance measurement, and public–private partnerships.

Addressing Challenges

Transportation plans and projects are subject to challenges from a variety of sources. Sometimes sorting out the specifics of a problem to identify the right solution is difficult. TCAPP offers three assessments to prioritize areas for improvement, as well as strategies for improvement or for overcoming a barrier.

One of these, the stakeholder collaboration assessment, may be the most important, because stakeholder support is essential to a project's success. TCAPP offers a way to look at potential issues for stakeholders and to target input. The assessment can help identify ways to improve communication, understanding, and commitment with stakeholders.

A stakeholder collaboration application indicates the decisions that most require input. Asking the right questions at the right time can yield the support that transportation plans and projects need to be successful.

Evolving Product

TCAPP will continue to evolve as the Capacity focus area projects of the second Strategic Highway Research Program (SHRP 2) come to conclusion. Additional topics, including freight and operations, will be incorporated as TCAPP moves from the beta version to its final form and host agency.

Pilot test projects have become a major source of information for improving TCAPP, with 12 teams of practitioners providing insights into what is valuable and what is still needed. Transportation agencies in California, Colorado, Minnesota, Oregon, South Carolina, Washington State, Virginia, and West Virginia have used TCAPP and the applications it contains to support transportation planning, programming, and project development.

More information about this SHRP 2 resource and about how professionals are using the beta version is posted at the Transportation for Communities website.[1] Four assessment workshops, held around the country in the first half of 2013, presented TCAPP to more than 100 transportation professionals from many states. FHWA is planning to implement TCAPP in 2014 under a new brand name, after incorporating further improvements.

[1] transportationforcommunities.com.

Washington State DOT's I-405 Corridor Program is included as a case study in the TCAPP decision support tool.

PHOTO: WASHINGTON STATE DOT

The Integrated Ecological Framework

A Step-by-Step Approach for Integrating Transportation and Conservation Planning for Improved Outcomes

SHARA HOWIE, SHANNON COX, AND SHARI SCHAFTLEIN

Howie is Sector Relations Manager, NatureServe, Boulder, Colorado; Cox is an energy, environment, and transportation consultant in Durham, North Carolina; and Schaftlein is Program and Policy Development Team Leader, Federal Highway Administration, Washington, D.C.

Across the country, significant efforts have promoted, applied, and demonstrated the integrated, collaborative approach to transportation planning and project development described in the FHWA publication *Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects.*[1] These efforts have ensured that ecological needs are understood and considered earlier in the transportation planning process. The evidence that this approach can achieve positive, measurable ecosystem, economic, and societal outcomes is compelling.[2]

To advance this approach, SHRP 2 Capacity research developed the Integrated Ecological Framework (IEF), a peer-reviewed technical guide to implementing Eco-Logical, step by step.[3] The IEF draws on approaches to conservation assessment and planning that are well-established and innovative, to provide transportation planners and resource specialists with a standardized, science-based approach to identifying ecological priorities in decision making.

In addition, the framework builds on efforts by federal and state natural resource and transportation agencies addressing organizational, process, and policy challenges, to accelerate project delivery while achieving net environmental benefits.[4]

The IEF responds to the following critical needs:

[1] See also *TR News*, September–October 2013, pp. 22–27, www.trb.org/Main/Blurbs/169928.aspx.

[2] See *A Practitioner's Handbook: Optimizing Conservation and Improving Mitigation Through the Use of Progressive Approaches,* http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(67)_FR.pdf.

[3] Supporting information for the IEF, including the purpose and outcome of each step, case studies, tools and methods, data and technical questions, is available through Transportation for Communities: Advancing Projects Through Partnerships, www.transportationforcommunities.com/shrpc01/natural_application.

[4] Implementing the IEF is the focus of a webinar series sponsored by FHWA. Additional information is available at www.environment.fhwa.dot.gov/ecological/eco_webinar_series.asp.

PHOTO: OREGON DOT

The project to add a new segment to US-20 between Pioneer Mountain and Eddyville in Oregon piloted the Integrated Ecological Framework.

◆ To identify in the early stages of transportation planning the potential impacts on ecological resources and to avoid or minimize the impacts during implementation, achieving efficient project delivery;

◆ To direct mitigation toward conservation priorities that are ecosystem-based, yielding ecologically effective results and economically valuable ecosystem services;

◆ To pursue collaborative decision making for more effective and efficient outcomes; and

◆ To provide transparent and measurable processes that can be replicated, improving accountability and the ability to gauge success.

The IEF supports transportation planning and the consideration of environmental factors before project development but also addresses transportation decisions at the project level. Implementation of the IEF can produce statewide information about the location and needs of rare and imperiled species and habitats. This information can minimize environmental impacts through region-scale environmental screening of route alternatives and mitigation strategies, design and construction considerations, and maintenance procedures.

In addition, the IEF lays the foundation for implementing a watershed approach to the Clean Water Act Section 404 permitting, and an ecosystem-based approach to conservation and consultation under Section 7 of the Endangered Species Act. A region-scale approach to these processes will yield better results in the restoration of aquatic resources, in species and habitat recovery, and in ecosystem health.[5]

[5] Technical details for conducting the IEF are provided in *An Ecological Approach to Integrating Conservation and Highway Planning, Volume 2*, available at www.trb.org/Main/Blurbs/166938.aspx. A manager's guide to the IEF is available at www.trb.org/Main/Blurbs/169516.aspx.

The Integrated Ecological Framework Goes to South Park

DAVID G. ANDERSON

PHOTO: MICHAEL MENEFEE

The Colorado Department of Transportation (DOT), Colorado State University, and other partners conducted a pilot test of the Integrated Ecological Framework (IEF) in the South Park area of the state, including surrounding areas along Highway 285. The area is a hotspot of biodiversity and home to many rare and imperiled species, with a variety of rare and sensitive habitats, such as ancient peat lands, called fens, that are important for conservation and for the benefits they provide to people.

By implementing Steps 1 through 6 of the IEF, the Colorado team was able to bring conservation stakeholders together, assemble data, and generate a comprehensive vision for development, conservation, restoration, and mitigation. As a part of the study, the team developed useful products to support planning for transportation and growth in the area. For example, the team identified a set of "no regrets" mitigation opportunities based on the best conservation science and data available, to ensure that the biological wealth of the area remains intact.

The author is Director and Chief Scientist, Colorado Natural Heritage Program, Colorado State University, Fort Collins.

The Nine Steps in the Integrated Ecological Framework

1. Build a strong, collaborative partnership of transportation and natural resource specialists. Create a shared vision representing the environmental and transportation goals for the planning region. Develop the collaborative framework necessary for cooperative decision making, data development and management, analyses, planning, and implementation.

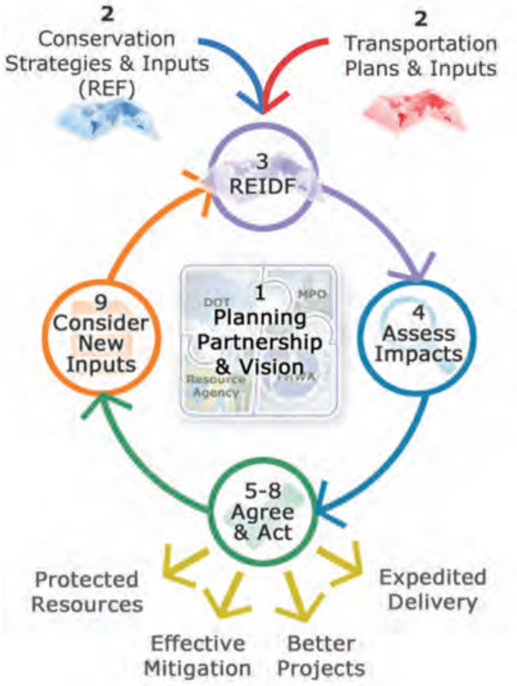
2. Gather data, expertise, and other inputs about the natural and built environment. Represent all high-priority conservation and restoration areas and goals in a regional ecosystem framework (REF). Draft an initial plan to meet transportation goals.

3. Integrate the conservation and transportation information and goals into a regional ecosystem and infrastructure development framework (REIDF).

4. Characterize scenarios for transportation and other land use. Assess the effects of transportation scenarios on conservation objectives, create a preferred scenario, and create an ecosystem-based mitigation strategy to address the remaining impacts.

5–8. Carry out innovative, ecosystem-based crediting strategies, interagency agreements, mitigation plans, programmatic consultations, and permitting to support transportation plans and conservation objectives.

9. Continue to develop and maintain dynamic information on environmental and transportation needs and goals, access to cutting-edge conservation and assessment methods, and mitigation monitoring results to support a viable partnership vision and planning at the local, watershed, ecoregional, or state level.



Improving Analysis Tools for Passenger Travel

TOM ROSSI AND GORDON GARRY

Travel modeling is evolving from an aggregate, trip-based approach to a dynamic, completely disaggregate methodology, and a SHRP 2 project has made a key contribution to the advance. The project, Partnership to Develop an Integrated, Advanced Travel Demand Model and a Fine-Grained, Time-Sensitive Network, has integrated a disaggregate activity-based model with a traffic simulation model, DynusT, to create a new, completely disaggregate model.[1] Both component models are implemented with open-source software.

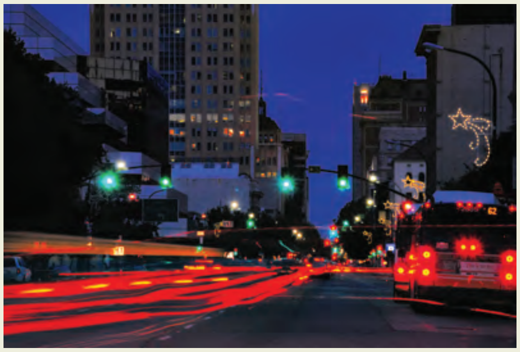


PHOTO: C. M. KEINER, FLICKR

The Sacramento Area Council of Governments is testing tools developed by SHRP 2 for analysis of traffic signal coordination and other scenarios.

The integrated model that is the main product of the SHRP 2 project simulates the complete set of activity and travel choices for each individual in an urban area, including activity type, location, travel mode, time of day, and highway and transit route choices. The model's simulation of transit vehicles and of individual person tours via transit is a unique feature.

Testing Scenarios

The new integrated model has been implemented for the Sacramento, California, region. The model's analysis results demonstrate a more accurate sensitivity to policy variables than models using aggregate demand or assignment procedures. The Sacramento Area Council of Governments (SACOG), the regional metropolitan planning organization, is testing this sensitivity through a series of policy and project tests.

The tests, on the new integrated model and on an activity-based model with aggregate assignment, include analysis of signal coordination, freeway bottlenecks, a new transit line, transit schedule coverage, interchange improvements, and road pricing for a high-occupancy toll lane. Although the scenarios are hypothetical, the tests represent the types of policies and projects that SACOG examines in its regional transportation planning.

The benefits of disaggregate models are well documented. One of the main advantages to an activity-based travel demand model is the ability to summarize results at various levels of aggregation, allowing the effects of transportation investments or policies on specific population segments to be analyzed. On the traffic simulation side, the capability of considering the interactions among vehicles can yield a much more realistic and accurate assessment of traffic operations. Both types of models take advantage of the simulation of individual agents to minimize aggregation error, a long-standing problem with conventional travel models.

Rossi is Principal, Cambridge Systematics, Inc., Cambridge, Massachusetts. Garry is Director of Research and Analysis, Sacramento Area Council of Governments, California.

Pioneering Features

Practitioners have used activity-based travel models and traffic simulation for years. Although outputs from activity-based demand models sometimes have been used as inputs to traffic simulation models, the two models have not been integrated. Because regional models still use aggregate traffic assignment methods, the outputs of activity-based models must be aggregated to create trip tables. The input for traffic simulation models consists of trip rosters, which generally are created by disaggregating trip tables.

The process of aggregating demand model outputs and then disaggregating them into trip tables is inefficient and can introduce errors. The SHRP 2 integrated model eliminates the need for the aggregation–disaggregation process, resulting in more efficient and accurate modeling.

The Sacramento modeling project is unique because of the simulation of transit demand. The activity-based model produces person tours made by transit, as well as by automobile and nonmotorized modes. The integrated model simulates not only the vehicle trips made by bus and rail as part of the traffic simulation, but also the person-tours via transit. In other words, the simulation comprises the entire transit journey, including the walk or automobile access to the transit stop, the waiting time, the boarding of a specific transit vehicle, the ride to the alighting stop, and the walk or automobile egress. This first-of-its-kind simulation allows a more accurate evaluation of transit operations and policies, because it does not rely on aggregate headways or on groups of transit vehicle runs.

[1] www.trb.org/Main/Blurbs/169685.aspx.

PHOTO: DAN ALLISON, FLICKR

Sacramento's activity-based model is the first of its kind to simulate person-tours via transit as well as trips via other modes.

Understanding the Impact of Highway Capacity Projects on the Economy

GLEN WEISBROD AND STEVEN FITZROY

Weisbrod is President, and Fitzroy is Senior Vice President, Economic Development Research Group, Boston, Massachusetts.

Many local, regional, and state transportation planners and consultants have attended public meetings at which proponents claim that a proposed project will save the local economy, and opponents counter that the effects will be detrimental to the economy or to the local quality of life. For the staff of transportation planning agencies, determining the validity of either party's claims or the issues that are likely to arise can be difficult.

To inform discussion and decision making with real-world experience, SHRP 2 developed a national database of case studies on the economic and land development impacts that have followed the completion of highway and highway–intermodal projects. The associated software tool for viewing and using this information is called TPICS, for Transportation Project Impact Case Studies; the tool can be accessed on the web.[1]

Documented Impacts

The database comprises 100 completed case studies, with pre- and postproject data, to show changes in economic and land development conditions. Each case study portrays changes in the immediate project areas, compares the changes with corresponding county and statewide trends for the same time period, and uses interviews to identify the relative influence of the transportation project on the economic outcomes. Whenever possible, the impacts are measured in terms of changes in property values, building construction, tax revenue, employment, and income levels.

The case studies represent all major project types, including intercity highways, urban beltways, local access roads, bridges, interchanges, and intermodal passenger and freight terminals. The projects span all regions of the continental United States, urban and rural settings, and different levels of economic distress.

The TPICS web tool provides transportation planners with a way to search for relevant case studies by type of project and type of location or setting. The case studies offer details of the projects, the economic impacts, and the factors that affected the outcomes. The web tool also allows users to specify a type of proposed project to see the range of impacts that would be expected based on the case study experience.

[1] www.tpics.us.

PHOTO: VIRGINIA DOT

Among the case studies featured in the TPICS database is the construction of I-295 in Virginia.

Applying the Tool

These features have three important uses:

1. Early-stage policy or strategy development, for identifying the magnitude and types of tradeoffs to consider;
2. Early-stage sketch planning, for identifying local barriers and success factors to address in later, more detailed planning steps; and
3. Information for public hearings and discussions, by showing how similar types of projects have affected other areas.

In addition, researchers can access the 100–case study database for further analysis and can develop and add case studies, increasing the usefulness of the TPICS database. The SHRP 2 report, *Interactions Between Transportation Capacity, Economic Systems, and Land Use*, describes in detail the findings that emerged from an analysis of patterns in the case studies.[2]

In terms of the multistage transportation planning process, TPICS supports the initial screening of proposals and the development of sketch-level, conceptual plans. The tool does not require information on project costs or the expected impacts on traffic flow. The user specifies a type of project and location or setting, and TPICS displays the range of typical costs, typical impacts, and the local factors in the impacts. TPICS therefore does not replace the need at later planning stages for a project-specific analysis of transportation and economic conditions; a project-specific analysis requires more sophisticated tools for forecasting travel demand and economic impacts.

[2] www.trb.org/Main/Blurbs/166934.aspx.


TPICS users can narrow their searches by type of project and type of location.

Minnesota Kicks the Tires on TPICS

Pilot-Testing a Web Tool for Assessing Economic Impacts

MATT SHANDS

Not long ago, mobility, access, and safety determined the priorities and the selection of most investments in transportation infrastructure. Today, with an increasingly competitive global economy and a political emphasis on job creation, many state departments of transportation (DOTs) and regional metropolitan planning organizations have established programs to direct funding toward transportation projects that promote business expansion and economic development. In response, SHRP 2 has produced a web-based, economic impact assessment tool, Transportation Project Impact Case Studies, or TPICS, that provides access to a national database of case studies for assessing the potential economic effects of transportation improvement projects.

SHRP 2 enlisted Minnesota DOT, along with partners at the University of Minnesota and Regional Economic Models, Inc., a firm based in Amherst, Massachusetts, to pilot-test the TPICS web tool. The test will analyze and compare the findings derived from the model against the observed economic impacts of the completed projects.


Photo: Matt Shands

Minnesota DOT and partners will pilot test the TPICS web tool to compare the predicted and observed economic effects of transportation improvement projects.

Two benefits are expected from the pilot test: first, the Minnesota DOT team will conduct a review of the TPICS tool and make recommendations; second, case studies of the 20 projects that the team is evaluating could be added to the project database. Both efforts will contribute substantially to the utility of the tool.

The author is Economic Development Program Director, Minnesota Department of Transportation, St. Paul.

Providing Reliable Travel Times on the Highway System

CARLOS BRACERAS

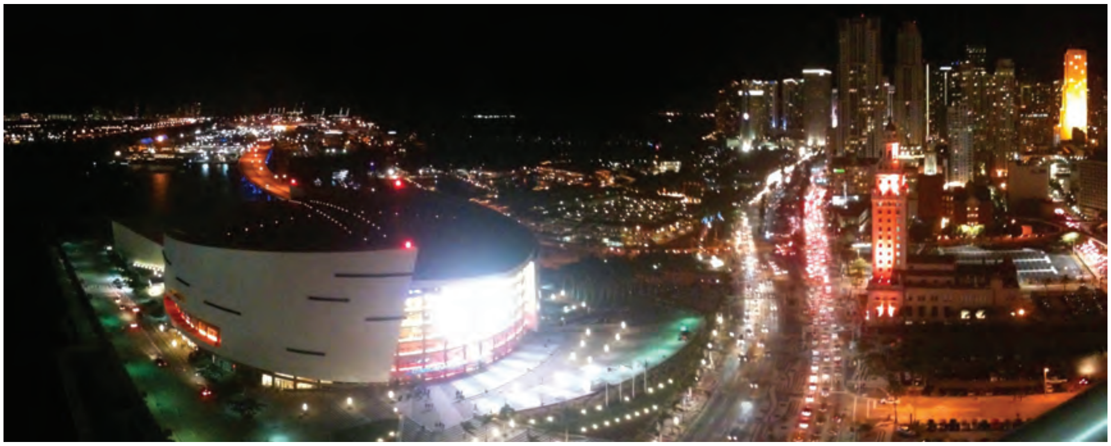


PHOTO: BOB B. BROWN, FLICKR

The author is Executive Director, Utah Department of Transportation, and Chair of the SHRP 2 Reliability Technical Coordinating Committee.

(*Above:*) Vehicles leaving an event at American Airlines Arena in Miami, Florida, generate traffic congestion. A SHRP 2 Reliability project aims to address nonrecurring events that cause traffic delays.

Every day, millions of people on the nation's roads encounter unanticipated delays that intensify regular congestion. What is being done to address this problem? Research conducted under the Reliability focus area of the second Strategic Highway Research Program (SHRP 2) is supplying many answers.

The concern is not about regularly occurring congestion—the predictable rush hour or holiday traffic that accounts for nearly half of all congestion—but about the random events that lead to a breakdown in traffic flow. Congestion has seven primary causes: incidents, weather that contributes to poor driving conditions, drivers encountering unexpected work zones, vehicles crowding in or out of special events, traffic devices that do not work properly, unusual surges in demand, and a base capacity that is inadequate to interact with these factors.

These interruptions to travel apply to urban and rural roads alike and cause travel times that are unreliable. For example, a crash blocking one or more travel lanes can endanger responders and road users and can create the potential for a secondary crash. For every minute responders spend to clear an incident, the likelihood that a secondary crash will occur increases nearly 3 percent.

Addressing Reliability

The SHRP 2 Reliability program aims to provide highway users with reliable travel times by preventing and reducing the impact of nonrecurring congestion. The approach is strategic. To study reliability, the research first established a definition of travel time reliability. Previous definitions varied, although many addressed the consistency of travel time and the failure to arrive on time; for SHRP 2, the definition that has proved most useful is "how travel time varies over time."

The program comprises four objectives:

- ◆ Organizing agencies to improve travel time reliability;
- ◆ Using data and analysis products to evaluate travel time reliability;
- ◆ Incorporating travel time reliability into planning, programming, and design; and
- ◆ Fostering innovation to improve travel time reliability (see sidebar, page 32).

PHOTO: WASHINGTON STATE DOT

Research to improve reliability has safety implications—for example, efficiently clearing lanes blocked by vehicle crashes decreases the potential for secondary crashes.

In a multidisciplinary course based on SHRP 2 Reliability research, a trainer shows how to exit a vehicle safely and how to clear an incident scene quickly.

Organizing Agencies

SHRP 2 Reliability research has examined internal and external organizational structures and communications for ways to improve operations and in turn travel time reliability. The products developed include the report, *Integrating Business Processes to Improve Travel Time Reliability*, which presents case studies documenting current business processes; an accompanying guide helps agencies improve current processes to address the reliability of travel time.[1]

Another product, *Institutional Architectures to Improve Systems Operations and Management*, developed a tool for managing change by applying the principles of the capability maturity model (CMM) used in the information technology industry for continuous quality improvement. The tool helps transportation agencies focus on improving system operations and management. An agency and its partners climb a ladder of capability, with each rung defined by elements of an organization, such as culture and leadership, organization and staffing, resource allocation, and partnerships. This approach to organizational improvement has gained adoption through workshops and an AASHTO website.[2]

To address the impact of incidents on safety and congestion, the Reliability program has developed a multidisciplinary training course on traffic incident management to achieve safe and quick clearance. A train-the-trainer program and software to deliver the training course online are in development. (For more information, see the article on page 35.)

To ensure the best use of the SHRP 2 Reliability products, an online Knowledge Transfer System in development will help communicate Reliability research findings, provide key documents on system management and operations, and communicate the business case for transportation system operations and management.

[1] www.trb.org/Main/Blurbs/165283.aspx.
[2] www.aashtosomguidance.org/.

Data and Analysis Products

Identifying the actions that could make travel more consistent and predictable requires measuring travel time reliability and diagnosing the causes of the variability. The *Guide to Establishing Monitoring Programs for Mobility and Travel Time Reliability* helps agencies add features to their traffic monitoring system to collect, visualize, and analyze data and to present information on travel time reliability.[3]

With these types of data, agencies can develop measures of reliability and can diagnose the causes of nonrecurring congestion. Agencies can deconstruct congestion and determine how often the different types of congestion and nonrecurring events occur together. For example, observations of travel over a period of a year will yield data on the ways that weather, incidents, and work zones combine to create nonrecurring congestion.

These observations are best visualized through a cumulative distribution function, which describes the percent of time that the travel time is less than a certain value, or through a probability distribution function. Almost all reliability performance measures of interest can be derived from the distribution functions; the improvement or decrease in reliability then can be graphed; as shown in Figure 1 (*below*), when either type of probability function shifts to the left or becomes narrower or more vertical, travel time reliability improves.

[3] www.trb.org/Main/Blurbs/168764.aspx.

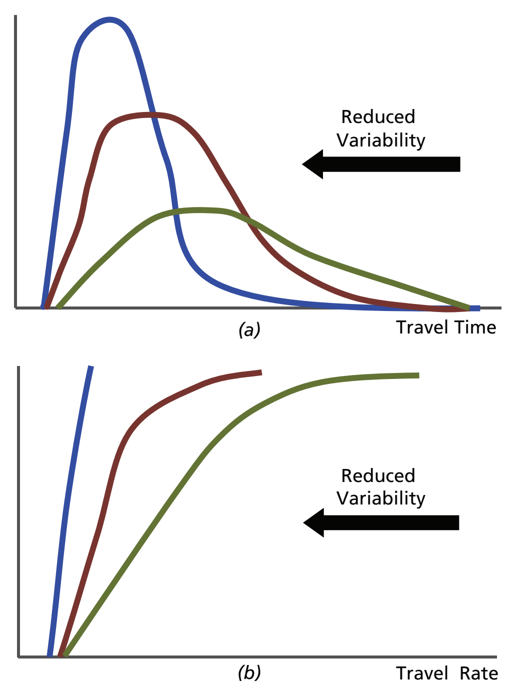


FIGURE 1 Two pictures of variability: (*a*) probability density function (PDF) and (*b*) cumulative distribution function (CDF).

The SHRP 2 Reliability focus area also is developing an Archive for Reliability and Related Data, a repository for all structured and unstructured data from the Reliability research projects—flat or binary files, relational data, statistical data, analytical tools and models, reports, software, pictorial data, and video.[4] When the archive is released in mid-2014, interested users will be able to preview the structured data with the visualization tools and to download data artifacts from the SHRP 2 research.[5]

Conveying simple and useful information about the variability of travel time to people getting ready for a trip is a challenge. SHRP 2 has researched message sets, formats, technology platforms, and visual and voice media to determine the best ways to communicate pretrip information on travel time reliability. A report, *Effectiveness of Different Approaches to Disseminating Traveler Information on Travel Time Reliability,* identifies ways of communicating effectively with road users and includes a compendium of approaches that need field testing.[6]

Planning, Programming, and Design

Effective reduction in the frequency of nonrecurring incidents can reduce or delay the need for additions to highway capacity. Nevertheless, transportation agencies need improved tools to identify and evaluate the effectiveness of infrastructure or of operational countermeasures or to quantify the effects of nonrecurring congestion on highway capacity.

The SHRP 2 Reliability projects have developed analytic tools for prediction, planning, and design, including models to estimate travel time variability and new methods for incorporating reliability into the *Highway Capacity Manual*. The methods are presented in the report, *Incorporation of Travel Time Reliability into the Highway Capacity Manual*, accompanied by two computational tools, as well as guidebooks that explain the analytic procedures.[7] Using the design guide and spreadsheet tool from the product, *Evaluating Cost-Effectiveness of Highway Design Features to Reduce Nonrecurrent Congestion*, agencies can evaluate the effect of a variety of design treatments on delay, safety, travel time reliability, and life-cycle benefits and costs.[8]

These analytic tools have common features (see Figure 2, right) and can be used to identify the variability of travel time in one of three ways:

[4] www.trb.org/Publications/Blurbs/165408.aspx.
[5] http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2342.
[6] www.trb.org/Main/Blurbs/168809.aspx.
[7] www.trb.org/Main/Blurbs/169594.aspx.
[8] www.trb.org/Main/Blurbs/169767.aspx.

PHOTO: DAVID GONZALEZ, MINNESOTA DOT

SHRP 2 has assembled a preliminary compendium of ways to communicate travel time reliability to motorists.

1. Data that capture all of the sources of variation in travel time that occur over an extended period, such as 1 year;

2. Statistical models that estimate or predict the variability in travel time as a function of the contributing factors; and

3. Scenario generators that produce a large number of randomly generated combinations of nonrecurring events.

Conveying the Value

The project, Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes, is supplying an essential piece of the research, by helping agencies articulate the benefits and costs of improvements in operations and reliability in comparison with other actions—important for practitioners communicating with decision makers.[9] All of the analytic models can

[9] http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2194.

FIGURE 2 Synthesis of methods to analyze travel time reliability. (O-D = origin–destination; B/C = benefit–cost ratio; TSMO = transportation system management and operations.)

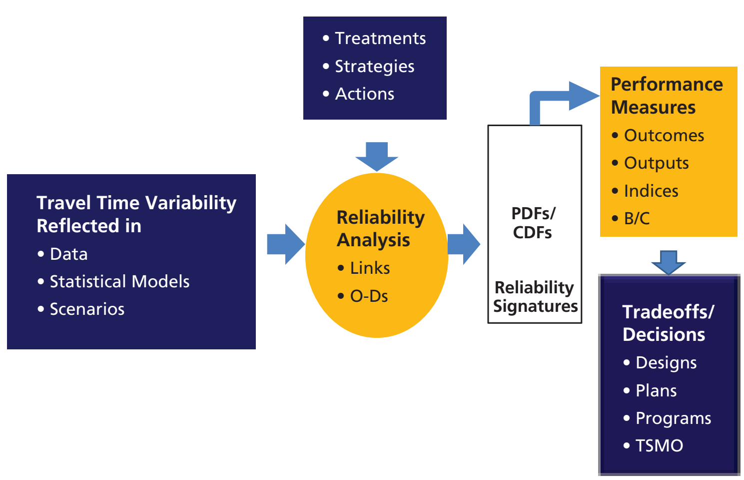


PHOTO: PATSY LYNCH, FEDERAL EMERGENCY MANAGEMENT AGENCY

Unpredictable weather events can lead to road damage and residual congestion, as in Boulder, Colorado, after a flood.

apply to planning and can help identify candidate projects for Transportation Improvement Programs.

Placing an economic value on improved travel time reliability for making investment decisions has received considerable attention. The SHRP 2 Reliability focus area has embarked on two studies that partner with public agencies to develop and test local methods for valuing travel time reliability. The research results will be presented to decision makers and considered in prioritizing highway projects.

Four agencies are piloting products under an integrated approach (see article, page 33). The agencies first will collect data to understand the causes of unreliability, then apply tools to analyze the options for improving reliability, and finally consider the results of the analysis in planning and programming.

Improving System Efficiency

Travel time reliability affects all trips, whether personal, work-related, or involving freight. Being late or too early because of unpredictable events such as crashes and weather has costs. In a time of tight funding, transportation agencies increasingly are recognizing that operational enhancements to improve travel time reliability are a cost-effective way to address congestion.

SHRP 2 Reliability research supports the federal legislation, Moving Ahead for Progress in the 21st Century, which establishes an investment program based on performance and outcomes. System reliability is one of the performance measures intended to improve the efficiency of the surface transportation system. The accompanying articles on pages 33–35 and below offer a look at some of the research into reliability and the practical methods for addressing nonrecurring congestion.

Fostering Innovation to Enhance Travel Time Reliability

LESLIE SPENCER FOWLER

A portion of the funding for the Reliability focus area of the second Strategic Highway Research Program (SHRP 2) has advanced promising new ideas to enhance travel time reliability into the proof-of-concept or prototype stage. Four Reliability projects were delivered under the National Cooperative Highway Research Program Innovations Deserving Exploratory Analysis, or IDEA, program. The projects produced the following results:

◆ A website was developed to deliver personalized travel time reliability information directly to drivers. The product provides drivers with travel time forecasts on the day of travel and up to five days in advance, with notifications delivered through a variety of communication channels. The framework is applicable to any congestion-prone corridor and can be integrated into travel information systems.

◆ PRISM, or Proximity Information Resources Management, a mobile application for special event management and communications, measures crowd size, density, and movements and transforms the data into useable information. The application includes an authorized communication link for event officials.

◆ Relteq Harmony is a decision support system for transportation network operators to determine the best possible responses to traffic events. Operators can evaluate advanced operational strategies ranging from improved traffic signal timing, freeway ramp metering, variable speed limits, flexible lane assignments, and alternative itinerary routing. This product can be used as a planning tool or a tactical tool that runs in real time.

◆ RIDEA, or Reliability IDEA, is an application that provides a graphical interface for accessing and visualizing commercially available Global Positioning System data and for conducting reliability routing experiments.

The author is Intelligent Transportation Systems Program Manager, Kansas Department of Transportation, Topeka.

Piloting Reliability Research

Four States Apply Products to Projects Under Way

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To make the core products of the Reliability focus area ready for implementation, the second Strategic Highway Research Program (SHRP 2) undertook four pilot projects in partnership with transportation agencies. The pilots take an integrated approach (see Figure 1, below) and involve

◆ Evaluating a set of five research products that address the data collection to monitor travel time reliability,

◆ Using the data with different types of analysis tools to consider options for improving reliability, and

◆ Addressing reliability within the planning and programming processes.

The resulting feedback will help make the products more ready for implementation.

California

In its recently adopted 2012 Regional Transportation Plan and Sustainable Communities Strategy, the Southern California Association of Governments (SCAG) committed to dramatically higher levels of funding for highway system preservation, operation, and maintenance.

A key to translating the long-term commitments to near-term actions rests on SCAG's ability to demonstrate to decision makers and stakeholders—that is, the implementing agencies—the economic benefit of projects that improve the efficient and optimal use of the highway system. SCAG expects that the range of SHRP 2 tools will help analyze baseline reliability performance, test alternative strategies, and incorporate reliability into benefit–cost analyses.

Florida

The Florida pilot will explore the use of SHRP 2 Reliability products to support the planning and operations of three corridors in Miami–Dade County. With improved data analysis and a modeling assessment of system performance that considers reliability, as well as other measures, the goal is to assemble a better selection of capacity improvements and advanced operations and management strategies.

Combining the SHRP 2 reliability monitoring system products with tools developed in Florida's previous efforts, the pilot will analyze data from multiple sources to factor reliability into the analyses of system performance. The analyses will identify issues to address in the corridors and will inform the selection of alternative improvement strategies.

The modeling techniques from SHRP 2 will identify the benefits of the alternative improvement strategies. Finally, SHRP 2 guidance will assist in the selection of processes that will benefit from the analysis of the corridors—for example, the long-range plan, programming, planning for operations, and operations—and in applying the analysis results.

Minnesota

Minnesota DOT, like many other transportation agencies, is facing the challenge of providing the highest return on investment for the highway system from limited funds. Some of the improvements under

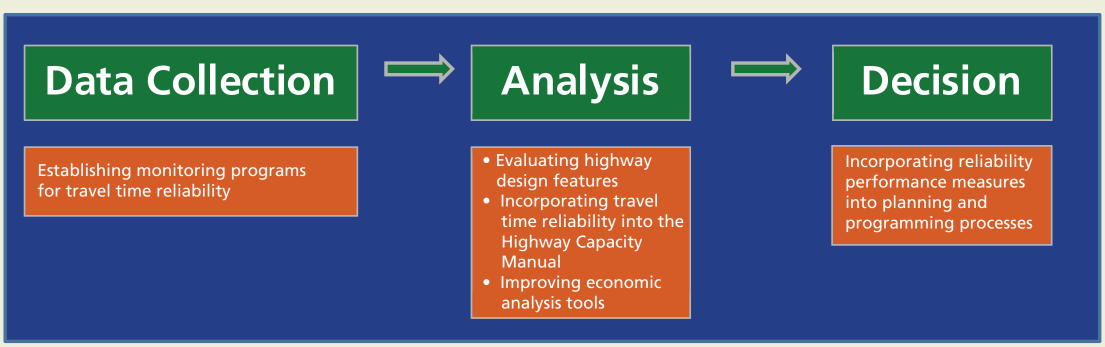

FIGURE 1 Integrated work flow of pilots.

PHOTO: UCUMARI, FLICKR

A pilot project analyzing three highway corridors in Miami–Dade County, Florida, will incorporate SHRP 2 reliability monitoring system products.

consideration include enhanced operational strategies and lower-cost projects—but these have not been evaluated adequately with traditional traffic analysis and benefit–cost tools.

In the pilot program, Minnesota DOT will use SHRP 2 products to evaluate travel time reliability on the system and to understand the causes of unreliable travel conditions. In particular, Minnesota will apply the spreadsheet tool from the project, Evaluation of the Costs and Effectiveness of Highway Design Features to Improve Travel Time Reliability, to help identify cost-effective solutions for improving system performance.

Washington

Washington State DOT is working to integrate operational and demand management strategies into its framework for making transparent, cost-effective decisions that keep people and goods moving and that support a healthy economy, environment, and communities. By considering how to incorporate the SHRP 2 Reliability analysis products into business and decision-making processes, Washington State DOT aims to improve its travel time reliability analyses at the facility, corridor, and system levels and to identify the best approaches for monitoring and analyzing travel time reliability in daily practice.

The agency has selected several corridors to test the SHRP 2 tools and procedures for travel time data management, monitoring, and analysis. The agency will apply the Reliability products to evaluate highway design features and operational strategies and to compare and analyze near-term alternatives on segments of the Interstate 5 corridor along Puget Sound, to maximize travel time reliability.

The agency also will evaluate the freeway and urban street methodologies and the Reliability spreadsheet tools developed for the *Highway Capacity Manual,* using data from test corridors in the greater Puget Sound area. The next step will be to quantify the economic impact of the alternatives and to compare the cost–benefit results with those from other projects that use the Global Positioning System and other data resources. Finally, the agency will consider how to apply the methods for measuring and estimating reliability to integrate operational strategies into the planning and programming procedures for prioritizing investments.

SHRP 2 RELIABILITY FOCUS AREA

Coordinating Traffic Incident Management

Curriculum Yields Promising Results Nationwide

RICHARD PHILLIPS

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Practitioners in the field of transportation have experienced first-hand the impact that traffic incidents can have on congestion and safety. The incidents create unsafe situations for the motoring public and responders and cripple traffic flow, resulting in unreliable trips.

A key project in the Reliability focus area of the second Strategic Highway Research Program (SHRP 2) has addressed this problem. The project has developed a curriculum and program on traffic incident management (TIM) for the many types of responders who report to incident scenes—for example, department of transportation (DOT), police, fire and rescue, towing and recovery, and emergency medical services personnel.[1] To improve the effectiveness and consistency of TIM operations, the training provides a common set of competencies to help responders achieve the objectives of the national unified goals for TIM: responder safety; safe, quick clearance; and prompt, reliable, interoperable communications.

Balanced Approach

The curriculum's balanced approach builds on previous initiatives led by the Federal Highway Administration (FHWA), the I-95 Coalition, and others. To date, the SHRP 2 project has delivered two products, the TIM Training Curriculum and a Train-the-Trainer Course. The national TIM Training Curriculum employs a variety of adult-learning techniques, including an interactive seminar, a case study analysis, a tabletop role-play and scenario, and a field practicum. During the day-and-a-half Train-the-Trainer Course, participants are exposed to the full scope of responder training materials and receive course materials to help teach others.

[1] www.trb.org/Main/Blurbs/166877.aspx.

Who Is Taking the TIM Course?

- Law enforcement
- Fire and rescue
- Emergency medical services
- Transportation agencies
- Towing and recovery professionals
- Notification and dispatch personnel
- Hazardous materials management responders
- Coroners and medical examiners
- Public works professionals

PHOTO: SHRP 2

(*Above, right:*) The SHRP 2–developed traffic incident management curriculum comprises a hands-on tabletop scenario, case study analysis, interactive seminar, and field demonstration.

SHRP 2 is developing an e-learning tool and a postcourse evaluation tool. The e-learning tool will cover the TIM training curriculum for traffic incident responders and managers online and will include the role of dispatchers. The system follows a modular format similar to the training units in the classroom version.

The postcourse evaluation and assessment tool will help trainers assess the effectiveness of the materials in communicating the learning objectives of the curriculum. A second component will help agencies assess the effectiveness of the training agencywide and identify resources for effective TIM practices.

Positive Outcomes

As of November 2013, FHWA had conducted training courses in 27 states for more than 21,000 responders. The TIM training curriculum has been well received, and preliminary feedback indicates positive outcomes for individuals and agencies. For example, improved incident response practices in Atlanta, Georgia, reduced secondary crashes by 69 percent in 12 months, saving lives and millions of dollars in delays. A participant in Virginia commented that the course "has driven home the importance of agencies working together toward a common goal—quick clearance—to prevent further incidents."

FHWA has underscored its commitment by making the TIM training part of the second Every Day Counts initiative.[2] The goal is to hold at least one train-the-trainer workshop in each state and in most of the 75 largest metropolitan areas by the end of 2014.

[2] www.fhwa.dot.gov/everydaycounts/edctwo/2012/pdfs/edc _traffic.pdf.

SHRP 2 SAFETY FOCUS AREA

This Ain't Your Grandma's Safety Research

Naturalistic Driving Study Yields Long-Sought Data

FORREST M. COUNCIL

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Naturalistic Driving Study (NDS) data are applicable to many topics related to driver safety, including the effect of rain, low visibility, and other influences on crash risk.

PHOTO: SCOTT SCHILLER, FLICKR

Highway agencies and safety professionals working to make safer the nation's roads, vehicles, and drivers encounter many critical questions that cannot be answered with available data. These questions include the following:

◆ Even with lane and centerline markings, raised reflectors on the roadside, and upstream warning and advisory speed signs, highway curves are the site for two to three times as many crashes as adjacent noncurve sections. What driver behaviors are leading to this difference in crash risk, and what new countermeasures may reduce the risk?

◆ When is speeding most dangerous? Although the driving public is aware that higher speeds lead to more severe injury in a crash, and that traveling faster than other vehicles on the road increases the risk of a crash, many drivers travel at speeds above the posted limit. Under what roadway, traffic, weather, and visibility conditions does speeding lead to the highest crash risk? Which driver speeding behaviors may decrease with new vehicle or roadway designs?

◆ Although drivers understand that head-on collisions will likely lead to death or serious injury, many crashes result when vehicles drift into the opposing lane. How often do these involve driver fatigue or driver distraction, and what vehicle or roadway treatments may reduce the risk?

◆ Newer model passenger cars are equipped with more and more systems that provide information to the driver. What influence do these systems have, if any, on driver attention? Are safer ways available to provide the same information?

◆ How often does a driver's use of a cell phone contribute to a crash? Is texting more dangerous than talking on a cell phone while driving? Is it more dangerous for everyone? In all situations?

Data on Driving Behavior

Crash data traditionally have been used in addressing highway safety issues. Police who investigate the crash collect the data—but the police arrive at the crash scene after the crash has occurred and must make judgments about what the driver was doing at the time of the crash; the information comes from an examination of the scene and from interviews with the drivers and witnesses.

But sound answers to the critical questions noted above require accurate, detailed data on what the driver was doing before and during the crash sequence. These data have not been available, except in limited studies. This is about to change.

Thousands of volunteer drivers in six states have pioneered new territory by participating in the Naturalistic Driving Study (NDS) of the second Strategic Highway Research Program (SHRP 2). The NDS is the largest study of driving behavior ever conducted.

Driving behavior is the major factor in approximately 90 percent of roadway crashes. The highway safety experts who developed the SHRP 2 Safety focus area agree that significant improvement in road safety can be achieved only through a systems approach to understanding how drivers interact with and adapt to their vehicles, the traffic environment, the roadway characteristics, the traffic control devices, and the environmental conditions that together create the driving experience; they also agree that the driver remains the most difficult part of the system to study.

Obtaining robust, objective data about the driving experience requires collection in real time, in the driver's own vehicle, with equipment that the driver accepts. The SHRP 2 NDS has combined technologies to gather objective, scientific information about what happens before a crash, when drivers experience a near-crash, and when drivers drive without incident—that is, exposure data. What scientists, engineers, policy makers, and educators learn from these volunteer drivers and from the sensors in their cars will be the basis for significant improvements in highway safety. Real-world data about crashes, near-crashes, and contributing conditions are finally available.

What issues should be investigated, and which are most important?

SHRP 2 consulted highway safety practitioners and researchers to determine the high-priority safety issues, both for designing the data collection system and for determining the initial efforts to analyze the data. More than 400 research questions were gathered. Among the higher-priority issues were roadway departure, intersection safety, and driving performance, including impairment and distraction.

Regardless of the issue of interest, the intent of the study is to address the system of driver, vehicle, and context—the roadway, weather, traffic, mobile devices, other passengers, safety laws, and more—and to provide information to determine which crash risks are inherent in the relationship of a driver's performance to vehicular and contextual factors, and how countermeasures can reduce these risks.

What data are needed to address these issues?

To answer questions about what influences the risk of a collision, data are needed about drivers, vehicles, and roads—for example,

◆ What drivers see and what they are doing;

◆ The speed, the distance from the car ahead, acceleration, braking, seat belt use, geographic location, and vehicle characteristics and performance;

◆ The road type, geometry, shoulders, safety furniture, signage, and pavement markings; and

◆ The environmental variables, such as traffic, lighting, and weather conditions.

PHOTO: AAA FOUNDATION FOR TRAFFIC SAFETY

NDS data can shed light on the effect of handheld devices on driver safety.

The field study that ended in November 2013 has collected all of these data. Six NDS sites were selected to provide a range of demographics, geography, weather, state laws, road types, and road use. These sites, from west to east, were: Seattle, Washington; Central Indiana; Erie County, New York; Central Pennsylvania; Tampa, Florida; and Durham, North Carolina.

How were the data collected?

Driver, Driving, and Vehicle Data

An on-board data acquisition system (DAS) was designed and manufactured for installation in each volunteer's own vehicle. The DAS continuously recorded driver behavior and vehicle kinematics with four video cameras, velocity and acceleration sensors, a Global Positioning System, forward radar, an incident button, a light sensor, a passive alcohol sensor, and information from the vehicle's computer net-

PHOTO: VIRGINIA TECH TRANSPORTATION INSTITUTE

The four cameras mounted in NDS test car interiors have yielded detailed data on the behavior and environment of driver and passengers.

PHOTO: SHRP 2

Researchers collect data from a vehicle's on-board data acquisition system, as well as from participant questionnaires and crash investigations, to produce comprehensive portraits of crashes, near-crashes, and trips without incident.

work. Each trip was captured from start to end, providing not only information for an incident but also exposure data—key information for risk analysis. These data have not been available at this level of detail until now.

At the beginning of the study period, each volunteer underwent a series of assessments of driving-related skills and attributes, such as visual perception, visual–cognitive ability, psychomotor ability, physical ability, health and medication status, psychological factors, driving knowledge, and driving history. Crash investigations were conducted after certain kinds of crashes—for example, those in which air bags were deployed—to gather additional details. These data and the DAS data will be available and will be linked to the SHRP 2 Roadway Information Database (RID).

Roadway Data

Determining the relationship of roadway characteristics to crash risk and driver behavior requires detailed data about the road, such as the lanes and shoulders, the curvature, the grade, the cross slope, signage, and barriers, and about other characteristics, such as the median type, locations of rumble strips, and lighting. SHRP 2 has collected these types of data with automated data collection vehicles at highway speeds on the roadways most frequently traveled by the drivers in the study. These data cover approximately 12,500 centerline miles across the six NDS sites.

Public and private data sources have contributed additional roadway inventory, crash, traffic, weather, and work zone data, as well as information on safety laws. These acquired data cover more than 200,000 total centerline miles for the six NDS sites. All these data will reside in the RID, a geospatial database that will link with and provide context for each of the more than 5 million trips by the more than 3,000 study participants.

Summary Statistics

SHRP 2 Naturalistic Driving Study

- 3,152 study participants
- 5.4 million trips recorded continuously
- 3,958 vehicle years of data
- 49.6 million vehicle miles
- More than 1 million hours of video

How will the data be used?

These data will be used to answer research questions related to drivers, to vehicles, and to the roadway. The first three analyses of the data are under way as part of the NDS:

- The relationship between driver behavior and safety on curves,
- An evaluation of offset left-turn bays, and
- The development of an inattention–risk function for lead vehicle crashes.

These initial analyses will provide information not only on these topics, but also on the tools needed to help researchers in working with the SHRP 2 Safety data. A project brief, *Analyzing Driver Behavior Using Data from the SHRP 2 Naturalistic Driving Study*, provides an overview of these analyses.[1]

The management of the SHRP 2 Safety data and decisions about how the data will be provided to researchers in the next decades are in planning (see sidebar, page 39). Although privacy provisions protect the driver video data and other personal identifiable information (PII), qualified researchers can follow prescribed procedures to access and use these data. In addition, summarized data sets with the participants' PII removed will be accessible via the SHRP 2 Data Access website.[2]

The NDS and RID databases are each one of a kind but together will provide the richest source of information ever assembled to understand the system of driver, vehicle, and context. Highway agencies, academics, automobile manufacturers, consultants, and others will use the databases for decades to improve the safety and functioning of the nation's roads.

Unprecedented Resources

Never before has the science of highway safety had such a rich resource, which will not only make roads safer, but will support researchers in road safety disciplines, as well as in other disciplines related to surface transportation, such as operations and travel demand. The feature article on SHRP 2 implementation (page 40) includes sidebars about the initial plans of the American Association of State Highway

[1] http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_PB_S08_2013-05.pdf.

[2] https://insight.shrp2nds.us/.

and Transportation Officials and the Federal Highway Administration for use of the data.

The NDS and the RID developed in the SHRP 2 Safety focus area will help answer questions about real-world driver behavior that have not been answerable before. These new answers will lead to the development of safer roadways, safer vehicles, and ultimately, safer drivers.

More detailed information on this program, including data access and results for the analysis projects, will appear in a follow-up issue of *TR News*, scheduled for July–August 2015, dedicated to the work and findings of the SHRP 2 Safety focus area. In the meantime, please see *TR News*, September–October 2012, for additional details about the SHRP 2 naturalistic driving and roadway information data projects.[3]

PHOTO: VIRGINIA TECH TRANSPORTATION INSTITUTE

In addition to the four video camera views recorded continuously, a still image was captured every 10 seconds to assess the number of occupants in the vehicle. The image is blurred to protect the identity of individuals who had not consented to be in the study.

[3] www.trb.org/Main/Blurbs/168048.aspx; see pp. 30–35.

Ensuring the Long-Term Stewardship of the Safety Data

JOSEPH L. SCHOFER

In late 2012, the National Research Council established the Committee on Long-Term Stewardship of Safety Data from the Second Strategic Highway Research Program (SHRP 2). The committee's charge is to examine the long-term stewardship requirements for the SHRP 2 Safety data and to provide policy and technical advice about resource requirements, administrative and oversight structures, database management and security, and user access and support.

The expertise of the committee's 14 members includes highway safety, research, data management and security, confidentiality, statistics, economics, and law. The committee has published two letter reports that provide strategic guidance for deriving the most value from the data when SHRP 2 comes to an end. The reports are addressed to the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), and the American Association of State Highway and Transportation Officials (AASHTO).

Phased Approach

Among the recommendations in the committee's first letter report[a] are the following:

◆ Because of the uniqueness, scale, scope, and complexity of the data, as well as uncertainty about user demand and willingness to pay for access, devising a final plan for long-term stewardship would be premature; therefore, future oversight and administration of the data should proceed in a phased manner.

◆ A first phase of approximately 5 years should provide researchers with access to the data, collect information about user demand, and test various approaches to data access, pricing, and user support, assuring privacy and the integrity of the data.

◆ A governing body broadly representative of the key stakeholders should be formed to oversee Phase 1, make data management and access policies, and provide data access through contractors.

FHWA, NHTSA, and AASHTO have accepted the recommendation of a phased approach to implementation and have asked TRB to establish the governing body for Phase 1.

Applying Best Practices

In its second letter report,[b] the committee's recommendations address the following areas:

◆ Facilitating researcher access and use,
◆ Ensuring the confidentiality of the data,
◆ Developing intellectual property policies,
◆ Exploring approaches for building capacity for data use and for provision of user support services,
◆ Fostering a user community,
◆ Using best practices for managing large and sensitive data sets, and
◆ Developing a business plan for long-term, sustainable funding.

The governing body will begin work during 2014, aided by technical committees, so that the Phase 1 activities can begin in January 2015.

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[a] http://onlinepubs.trb.org/onlinepubs/reports/ LTSSHRP2_May_2013.pdf.
[b] http://onlinepubs.trb.org/onlinepubs/reports/LTSSHRP2 _October_2013.pdf.

Moving Research Results into Implementation

KIRK STEUDLE

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The suite of products rolling out of the second Strategic Highway Research Program (SHRP 2), a more than $200 million investment, is impressive. These products can improve the way transportation agencies do business and can save lives, save time, and save money for the users of the U.S. highway system. These outcomes are only possible, however, if state departments of transportation (DOTs) and other implementing agencies widely use the SHRP 2 products.

The ultimate measures of success for an applied research program and for SHRP 2 specifically are the following:

- The extent to which the products are incorporated into the everyday business practices of implementing agencies,
- How the products are used routinely to improve the delivery of services, and
- Whether users of the highway system experience improved safety, reduced congestion, and less disruption from construction activities as a result of the product applications.

PHOTO: MISSOURI DOT

More than 65 SHRP 2 products, from pavement preservation approaches to environmental review strategies, are available for implementation.

Designed for Implementation

Recommendations for SHRP 2 implementation were presented in Special Report 296.

The Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board (TRB) have developed an approach to facilitate the movement of research results and products into widespread use. To provide a context for the approach adopted by FHWA, AASHTO, and TRB, some historical perspective is helpful.

From the beginning, SHRP 2 was designed for implementation. The goal was to produce results that would be useful to professionals in transportation, as well as in other related fields. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the legislation that originally authorized SHRP 2, required TRB to "complete a report on the strategies and administrative structure to be used for implementation of the results" of SHRP 2 within two years of the research program's start. In January 2009, TRB published Special Report 296, *Implementing the Results of the Second Strategic Highway Research Program,* which included several recommendations on implementation and estimated that a $400 million budget would be needed.[1]

Addressing the Transition

As the research program progressed, the SHRP 2 Oversight Committee and the Technical Coordination Committees for each of the four focus areas began to address the transition from research to implementation. The committees recognized that research and implementation have no clear dividing line and that further work often is needed to convert research results into products for use by practitioners in the field.

[1] www.trb.org/Publications/Blurbs/160621.aspx.

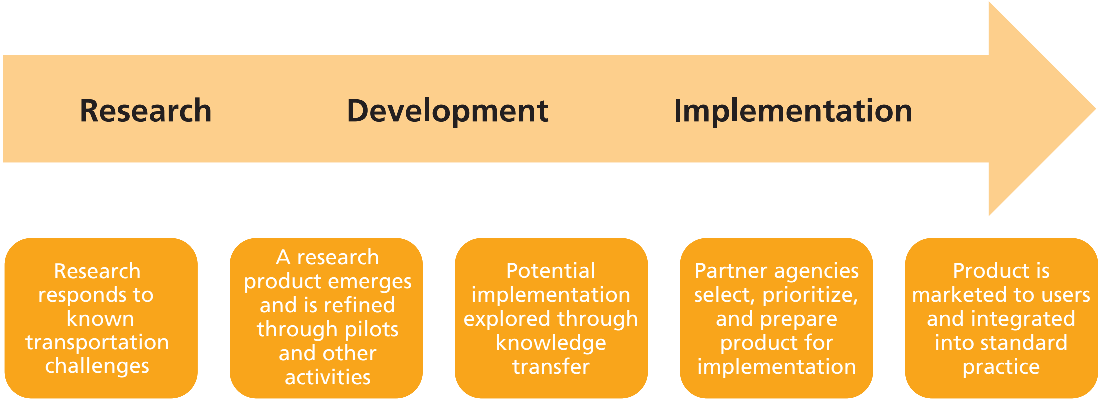

FIGURE 1 Continuum from research to implementation.

In many cases, pilot testing is necessary to identify refinements to the products and to demonstrate the benefits. The transition from research to implementation can be approached as a continuum (see Figure 1, above). TRB undertook several development activities to ensure that products would be ready for deployment when the research phase was complete.

FHWA, AASHTO, and TRB defined implementation as the routine use of a product in everyday business by state DOTs and other agencies. Following the recommendation of Special Report 296, FHWA has assumed the lead responsibility for managing SHRP 2 implementation, working in partnership with AASHTO, the National Highway Traffic Safety Administration (NHTSA), and TRB. The approach is

Assistance Program Accelerates Implementation

AMY LUCERO

To improve and accelerate the deployment of solutions from the second Strategic Highway Research Program (SHRP 2) by state departments of transportation (DOTs), metropolitan planning organizations, and local or tribal transportation agencies, the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) have established the SHRP 2 Implementation Assistance Program.

The assistance varies with the status of product development and the steps necessary to make the product ready for market. The assistance may be in the form of direct funding to the recipient, technical assistance through FHWA or AASHTO, or both. The assistance includes the following:

- **Proof-of-concept pilots** for products that FHWA and AASHTO are evaluating for final readiness before beginning widespread implementation. Contractor support may be provided during the pilot to collect data or to analyze the effectiveness of the product.
- **Lead adopter incentives** to offset implementation costs and help mitigate the risks for states willing to be early adopters. In exchange, recipients must document the implementation processes or serve as a peer champion to other states interested in implementing the product.
- **User incentives** to support implementation activities for products ready for widespread deployment and funding. Examples include conducting internal assessments, hosting peer exchanges, building capacity, providing training and technical assistance, or offsetting other implementation costs.

PHOTO: FHWA

A program to provide assistance for the implementation of SHRP 2 products, such as accelerated replacement of the Keg Creek Bridge in Iowa, has been established by state, local, and tribal agencies; FHWA; and the American Association of State Highway and Transportation Officials.

These implementation assistance opportunities are now available; opportunities are announced twice each year.

FHWA is establishing a Safety Analysis Center to provide technical assistance and learning opportunities for transportation partners to use the SHRP 2 Safety databases effectively. This includes assistance in scoping research and in applying new analytical approaches and tools. The implementation assistance will start when the SHRP 2 Safety databases come online in 2015.

Agencies interested in participating in the Implementation Assistance Program should visit FHWA's GoSHRP2 website, www.fhwa.dot.gov/goshrp2/.

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From Concept to Countermeasure

Applying Early Findings from the Naturalistic Driving Study

PAMELA A. HUTTON

The American Association of State Highway and Transportation Officials (AASHTO) anticipates enormous value from the data gathered in the Naturalistic Driving Study (NDS) managed by the second Strategic Highway Research Program (SHRP 2). The largest-ever study of its kind, with an extremely diverse group of participants, the NDS will yield many insights about driver behavior for those charged with ensuring that the nation's roadways are as safe as possible.

PHOTO: OREGON DOT

Oregon DOT's innovative dedicated green bicycle lanes; many state initiatives expect to benefit from actionable safety countermeasures from the SHRP 2 Naturalistic Driving Study.

To that end, AASHTO is pursuing an early SHRP 2 implementation activity, a concept-to-countermeasure initiative to demonstrate the use of the NDS database to state departments of transportation (DOTs) and others. With the support of the Federal Highway Administration (FHWA) and the Transportation Research Board (TRB), this initiative will demonstrate the usefulness of the entire dataset in the concept phase and perhaps lead to changes in AASHTO manuals, guidebooks, and other applications in the countermeasure phase. Through AASHTO's national network of state transportation professionals, the research results from the NDS can efficiently make their way into actionable countermeasures for the nation's roadways.

Because driver behavior plays a role in 90 percent of roadway crashes, states are eager to turn research findings into actionable and effective roadway safety countermeasures. AASHTO's committees comprise leaders in state DOTs who are knowledgeable about cutting-edge research like the NDS and who will implement the research results to improve roadway standards. Through its committees, AASHTO will gauge members' views on the most pressing safety issues for state DOTs. This information will facilitate beneficial short-term research with reduced data sets from the NDS.

In addition, AASHTO will look to use previous findings from TRB's NDS pilot studies to produce additional roadway safety countermeasures. With the help of FHWA and TRB staff and database experts, AASHTO will communicate with the professionals who are on the front lines of implementing roadway countermeasures and who can best discern which products will have the highest benefits as roadways are built, maintained, and operated.

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to enlist a critical mass of early adopters to use the product and to establish through experience a model for others to follow. The opinion of peers is key to widespread adoption of any new product. FHWA also may support a limited number of pilot tests when necessary.

Components of Success

The partner agencies agreed that successful implementation will include the following components:

- ◆ Attaining the tipping point of national adoption with a significant number—10 to 15 percent—of implementing agencies incorporating the SHRP 2 innovations into everyday practices;
- ◆ Creating nationwide interest among a broad cross section of implementing agencies and stakeholders in following the lead of the early implementers;
- ◆ Creating the support needed to transfer the innovation from early applications to standard practice by providing the necessary policies, manuals, guidance, specifications, codes of practice, training, information technology (IT) platforms, and professional technical support;
- ◆ Developing the institutional support within AASHTO and FHWA to perpetuate an innovation into standard, ongoing practice;
- ◆ Generating awareness, support, and use of the product among private-sector consultants, contractors, and material suppliers, and by their organizations;
- ◆ Having college and university students learn about the innovation in their studies and having researchers use the product to perform further research on the topic;
- ◆ Providing metrics for the success of the innovation and evaluating the impact of the innovation on practice; and
- ◆ Reducing the net cost of implementation to make the innovation financially attractive and administratively feasible, demonstrating the value of implementation.

Developing Plans

In spring 2012, FHWA, AASHTO, and TRB jointly developed an initial implementation plan to use the $81 million of implementation funds then available from SAFETEA-LU and its extensions. The plan identified 31 products in the Renewal, Reliability, and Capacity focus areas for implementation over a three-year period; set aside $10 million for Safety implementation, and allocated additional funds for outreach and communication, IT support, program management, and support for other products not in the plan.

In July 2012, Congress passed the Moving Ahead for Progress in the 21st Century Act (MAP-21), which authorized implementation of SHRP 2 through 2014. MAP-21, however, required the states to use a percentage of their Statewide Planning and Research (SPR) funds in 2013 and 2014 for SHRP 2 implementation; moreover, at least three-quarters of the states would have to agree on the percentage amount. Forty-five states voted for all states to set aside 4 percent of their SPR funds for SHRP 2 implementation. Added to funds from FHWA, the state funding increased the amount available for implementation to $169 million.

In spring 2013, FHWA and AASHTO developed a plan to implement 66 products from the Renewal, Reliability, and Capacity focus areas and to set aside $33 million for implementation activities for the databases developed in the SHRP 2 Safety focus area, including maintenance and support of the databases for five years. An AASHTO task force with representatives from 28 states provided input to the plan.

Support Activities

FHWA and AASHTO are working together to provide the following implementation support activities:

◆ Educating implementing agencies about SHRP 2 products and processes to gain ready adoption and use in everyday practices;

◆ Developing technical standards, policies, and construction specifications, as appropriate, for highway agencies to apply the SHRP 2 products within complex transportation environments;

◆ Training agency personnel in the use of the SHRP 2 products, increasing awareness and understanding of the innovations to achieve widespread adoption;

◆ Providing technical assistance to lead agencies, covering the costs of initiating the use of new products, and providing incentives to undertake demonstration projects; and

◆ Establishing communities of practice to facilitate peer-to-peer support.

With input from potential product users, implementation plans are being developed for each of the 66 products. These product-level implementation plans address goals and strategies, the target audiences, outreach and communications, budget, schedule, IT support, and evaluation.

Maximizing the Value

Implementation of individual SHRP 2 products will generate much value, but the greatest value will come from implementing combinations of products on individual highway or corridor projects. A strategic approach unified the development of research projects that were interrelated and supported each other; use of the interrelated products on a highway or corridor project therefore is likely to yield the greatest benefits. SHRP 2 products can be adapted to meet an implementing agency's specific needs or to fit an agency's business processes.

The 66 products available for implementation, plus the safety databases, are many more than any single agency will be able to implement. State DOTs and other implementing agencies should identify their highest-priority business needs and evaluate which SHRP 2 products can best help in meeting those needs.

The TRB, FHWA, and AASHTO websites offer extensive information about the products, the assistance available to support implementation, and the experiences of early users of the products:

◆ www.TRB.org/SHRP2;
◆ www.fhwa.dot.gov/goSHRP2; and
◆ http://SHRP2.transportation.org.

Pilot projects such as Iowa DOT's accelerated replacement of the US-6 bridge over Keg Creek—shown here in progress in October 2011—have demonstrated the practical, efficient products, tools, and procedures developed through SHRP 2.

PHOTO: FHWA

Chandra R. Bhat

Center for Transportation Research, University of Texas at Austin

A leading expert in travel-demand modeling and travel behavior analysis, Chandra R. Bhat is Director of the Center for Transportation Research at the University of Texas at Austin (UT Austin) and Adnan Abou-Ayyash Centennial Professor in Transportation in the Civil, Architectural, and Environmental Engineering Department. His research broadly focuses on the development of statistical and econometric methods to examine the relationships of behavioral dynamics and travel choices, transportation systems, and built environments.

"The fundamental study of the relationship between built environments and human movement has broad social and environmental implications for human quality of life, especially at the interface of transportation and urban policy, design, safety, public health, energy dependence, sustainable development, and greenhouse gas emissions," Bhat observes.

"Collaboration among individuals with expertise in social science and engineering has value and will lead to emergent ideas and innovative solutions to transportation-related challenges."

Through research into long-term travel choices, such as household vehicle ownership and responses to different greenhouse gas–reduction incentives, Bhat and his research team can create projections of regional, statewide, and even nationwide vehicle fleets and can estimate ways to reduce travel-based carbon footprints. Studies on work arrangements, such as telecommuting, and their effects on travel patterns can provide insight into transportation and planning policies to reduce congestion. Research into how individuals and households make daily travel decisions—whether and when to participate in an out-of-home activity, how to get there, where activities are located, and the sequence of daily activities—can lead to insights into the effectiveness of strategies to alleviate traffic congestion, from transit facility improvements to congestion pricing.

Bhat also focuses on aggressive driving behavior, its causes, and its implications to traffic safety. His 2010 study on teen drivers, "Examining the Influence of Aggressive Behavior on Driver Injury Severity in Traffic Crashes," received media attention and resulted in guidance supporting graduated driving license programs. Research on the use of nonmotorized transportation has allowed Bhat to examine demographic, social, attitudinal, and built environment correlations and the relationship between physical activity and travel.

"The fundamental driving force of my research is that a good understanding of the causal impacts of the physical environment on human activity—and on the way humans respond to and navigate through their built environments—can play a key role in designing policy strategies for preventive medicine, improved public health, enhanced economic competitiveness, and safe and reliable transportation," Bhat adds.

Bhat also has worked to develop advanced econometric and statistical methodologies for a variety of applications. His analytic methods for discrete choice models, hazard duration models, and joint model systems of discrete and continuous variables are used by researchers in such areas as environmental economics, marketing, defense studies, and education, as well as transportation. He is enthusiastic about his and his students' recent methodological work on multiple discrete–continuous models; statistical copula-based formulations; extensions of his maximum approximate composite marginal likelihood estimation approach; and formulations for accommodating spatial, social, and temporal dependencies in data.

"Collaboration among individuals with expertise in social science and engineering has value and will lead to emergent ideas and innovative solutions to transportation-related challenges," Bhat comments.

Bhat's doctoral dissertation at Northwestern University won the inaugural Milton Pikarsky Memorial Award from the Council of University Transportation Centers. In 1997, after teaching in the Civil Engineering departments at Northwestern University and the University of Massachusetts, Amherst, Bhat joined the Civil Engineering Department at UT Austin's Cockrell School of Engineering. He is a Professional Engineer in the state of Texas and has consulted for the Houston–Galveston Area Council, the Puget Sound Regional Council, Cambridge Systematics, Parsons Brinckerhoff, and King Abdulaziz University in Saudi Arabia.

Bhat is cochair of the TRB Education and Training Committee and is a member of the Special Committee for Travel Forecasting Resources, the Task Force on Ahead of the Curve: Mastering the Management of Transportation, and the Transportation Demand Forecasting Committee, which he chaired from 2001 to 2007. He has served on many other standing committees and task forces. With cochair Gregory P. Benz, Bhat overhauled the communications approach of the Transportation Education and Training Committee, which resulted in a detailed research agenda and an increase in paper submissions.

Susan B Herbel

Cambridge Systematics, Inc.

For more than 30 years, Susan B Herbel has devoted her career to road safety and has been instrumental in the development and implementation of many safety initiatives.

"In 1964, 45,645 people died on the nation's roadways," she observes. "Today, that number is just over 30,000. Although the figure still is too high, there is no doubt that research played an important role in bringing the number down."

Since the early days of her career, Herbel has remained at the forefront of traffic safety research. In 1998, she began creating and advancing strategies for incorporating safety as a priority planning factor, which became a requirement that year in the surface transportation reauthorization, the Transportation Equity Act for the 21st Century. Her efforts led to the formation of the Transportation Safety Planning (TSP) Working Group in 2000, an informal coalition of federal agencies and transportation organizations such as the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration, TRB, the American Association of State Highway and Transportation Officials, AAA, and the Governors Highway Safety Association.

"There is no doubt that research played an important role in bringing down the number of deaths on the nation's highways."

After helping to found the TSP Working Group, Herbel also organized and facilitated its meetings and conferences for more than 10 years. She has led safety planning forums across the country and currently is lead instructor for the TSP course offered by the National Highway Institute. She also is principal investigator for National Cooperative Highway Research Program (NCHRP) Project 08-76, developing a framework for institutionalizing safety in transportation planning processes.

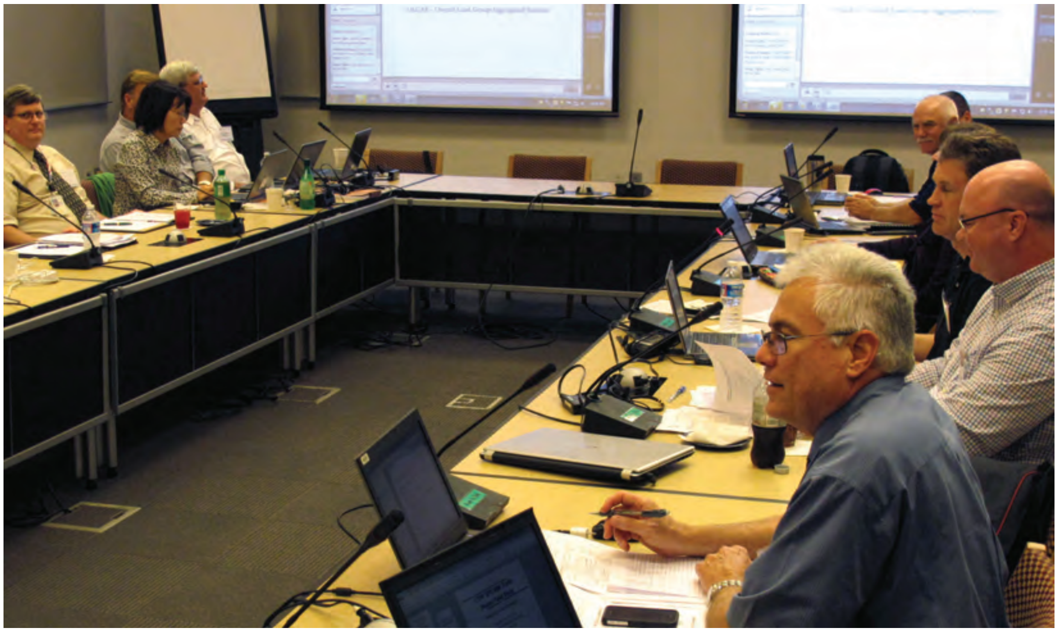
The decline in road deaths since 2006—even as vehicle miles traveled has increased—can be partly attributed to a more collaborative and scientific decision-making process, Herbel notes. "Publication of the *Highway Safety Manual*, lessons learned from achievement in other countries, an improved set of low-cost safety countermeasures, integrated planning processes, and many other factors associated with safety improvements are based on research," she comments, adding that the data from the second Strategic Highway Research Program's Naturalistic Driving Study will provide a substantial source of information and new successes in safety.

Since the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users in 2005 and, in 2012, the Moving Ahead for Progress in the 21st Century Act (MAP-21), Herbel has assisted states and metropolitan planning organizations to develop and implement strategic highway safety plans (SHSPs). This comprises such efforts as coalition building and facilitation; research and data analysis; technology transfer; countermeasure development, selection, evaluation, and prioritization; and developing management systems for the SHSPs. Herbel also ensures that employers, the public health community, and other partners are involved in the SHSP process. She has worked on FHWA projects to develop the Implementation Process Model and the Evaluation Process Model and to update the *Champion's Guide to Saving Lives*, all of which support SHSP development, implementation, and evaluation. She also has been involved in projects for NCHRP and FHWA to identify methods for setting safety targets and developing performance measures, a MAP-21 requirement.

Herbel received bachelor's and master's degrees in political science from Kansas State University in Manhattan, Kansas, and a Master's in Public Administration as well as a Ph.D. in public law from the University of Oklahoma in Norman.

In 1997, Herbel began a long and active involvement in TRB standing committees as a member of the Alcohol, Other Drugs, and Transportation Committee. She helped establish the Task Force on Women's Issues in Transportation and served on the committee until 2007. She assisted with the agenda, organization, and fundraising for four of the five international conferences on women's issues in transportation. She also chaired the NCHRP Project Panel on Evaluating Highway Safety Grants and the Task Force on Highway Safety Workforce Development, which she also helped shepherd to full committee status. She is a member of the Transportation Safety Management Committee, the Road Safety Workforce Development Committee, the Safety and Systems Users Group, the Safety Section, and several subcommittees. Recently, she helped plan the first International Conference on Safety Culture.

Other work includes NCHRP projects on a model curriculum for highway safety core competencies, impacts of an aging population on systems planning and investments, and best institutional practices for supporting safety initiatives, as well as a major project analyzing crash data from 49 states for *Crashes vs. Congestion: What's the Cost to Society?*, released in 2011 by AAA.



DATA COLLECTION FOR SMOOTHER PAVEMENTS— The Expert Task Group on Long-Term Pavement Performance (LTPP) Special Activities met October 15–16 at the National Academies' Keck Center in Washington, D.C., to advise the TRB LTPP Committee on data collection and analysis of pavements under stress from loads and environmental conditions. The ETG ensures that the LTPP database contains sufficient amounts of high-quality data to support LTPP studies by the Federal Highway Administration and the American Association of State Highway and Transportation Officials.

IN MEMORIAM

Ronald F. Kirby, 1944–2013

Transportation planning expert and former TRB Executive Committee member Ronald F. Kirby died on November 11, 2013. He was 69.

Director of Transportation at the Metropolitan Washington Council of Governments (MWCOG), Kirby was at the helm of many important, high-profile transportation projects in the Washington, D.C., region: express lanes on the Beltway, the Intercounty Connector in Maryland, and the rebuilding of the Woodrow Wilson Bridge. He also worked diligently to advance the concept of telework in the region and to increase funding for the Washington Metropolitan Area Transit Authority. His collaborative, magnanimous style brought together representatives of opposing transportation interests to work on solutions to the region's many transportation challenges.

Photo: Risdon Photography

Ronald Kirby guides a session at the TRB 2009 Annual Meeting.

Born in Adelaide, Australia, Kirby received a bachelor's degree in 1964 and a Ph.D. in applied mathematics in 1970 from the University of Adelaide. After moving to the United States to work at the Planning Research Corporation, he joined the Urban Institute as a researcher, eventually heading the institute's transportation program before moving to MWCOG in 1987.

Kirby was active in TRB for more than two decades. He joined what is now the Paratransit Committee in 1974 and served as its chair from 1980 to 1986. He also was a member of the Committee for a Study of Strategic Transportation Data Needs and, from 1987 to 1990, served on the Technical Activities Council. In 2002, Kirby joined the Executive Committee and served on its Subcommittee on Planning and Policy Review from 2003 to 2005. He was a member of the Oversight Committee for the second Strategic Highway Research Program from 2005 to 2008 and was a regular participant at TRB Annual Meetings.

Under Kirby's direction, regional transportation plans gained legitimacy as valuable, pragmatic tools for jurisdictions to develop and implement priorities; at the time of his death, he was preparing MWCOG's Regional Transportation Priorities Plan for the National Capital Region.

INNOVATIVE INFORMATION SYSTEMS—Linda K. Cherrington (*left*), Texas A&M Transportation Institute, presides over the opening session at the Transit GIS Conference, October 16–17 at the Keck Center. Transit professionals and industry stakeholders shared geographic information systems (GIS) solutions, industry best practices, and new technologies and explored ways to use GIS to improve the safety, reliability, sustainability, and operation of public transportation.

COOPERATIVE RESEARCH PROGRAMS NEWS

Guide Specification for the Design of Concrete Bridge Beams Prestressed with Carbon Fiber–Reinforced Polymer Systems

Prestressing concrete bridge girders with carbon fiber–reinforced polymer (CFRP) has gained acceptance in the United States because the process can eliminate the corrosive effects of prestressing steel. Although some research has shown that CFRP is a viable alternative to prestressing steel in bridge girders, the lack of a nationally accepted design specification has limited its application in bridge construction.

The University of Houston has received a $500,000, 36-month contract [National Cooperative Highway Research Program (NCHRP) Project 12-97, FY 2013] to develop a proposed guide specification for the design of concrete beams prestressed with CFRP systems for bridge applications.

For more information, contact Amir N. Hanna, TRB, 202-334-1432, ahanna@nas.edu.

Assessing, Coding, and Marking Highway Structures in Emergency Situations

Several state departments of transportation have adopted processes for assessing, coding, and marking highway structures in natural disasters or other emergencies. These processes, however, are not uniform and generally do not address differences in highway structure types or traffic levels. The processes also often do not explicitly consider the practices of other organizations that respond to emergencies.

Oregon State University has received a $399,655, 24-month contract (NCHRP Project 14-29, FY 2013) to develop a process for assessing highway structures in emergency situations, guidelines for coding and marking, and selected training and implementation material.

For more information, contact Amir N. Hanna, TRB, 202-334-1432, ahanna@nas.edu.

TRANSIT PROJECT SELECTION—Vincent Valdes (*left*), Federal Transit Administration (FTA), discusses upcoming Transit Cooperative Research Program (TCRP) projects with Matt Welbes and Therese McMillan, FTA. The TCRP Oversight Committee met October 25 at the Keck Center to select projects for the fiscal year (FY) 2014 program. Operating on a reduced budget, TCRP is sponsoring six projects in 2014, on topics from improving transit system disaster resiliency to planning park-and-ride facilities, pending final determination of funding.

NEWS BRIEFS

Photo: Argonne National Laboratory

Testing an electric vehicle at Argonne National Laboratory. According to an interim report from the National Research Council, better charging infrastructure would encourage adoption of electric vehicles.

Exploring Barriers to Electric Vehicle Use

No serious technical barriers are hindering the deployment of charging infrastructure for plug-in electric vehicles (PEVs) at residences, workplaces, and in public places, according to an interim report from the National Research Council (NRC). Examining the infrastructure needs for widespread adoption of PEVs in the United States, the NRC Committee on Overcoming Barriers to Electric-Vehicle Deployment studied automobile manufacturers and dealerships, customers, vehicle charging infrastructure, and the electric grid.

According to the interim report, barriers to the purchase of PEVs include a lack of familiarity with the vehicles among the public and among auto dealership employees, fewer model choices, and higher purchase prices. Few data are available on customer perceptions and attitudes about PEVs.

Most residences with access to a garage or carport have the ability to charge a PEV at home. Multifamily residences, rentals, or dwellings with only on-street parking pose more of a challenge, but increased workplace and public charging infrastructure can address this need, according to the report. Standardizing the many components of charging infrastructure—for example, payment methods and plugs—is critical.

The report concludes the U.S. electric infrastructure has the capacity to support the expansion of PEV technology.

To view the report, visit http://www.nap.edu/catalog.php?record_id=18320.

Local Transit Authority Combines Buses and Bicycling

Bike-n-Ride, a new program of Michigan's Bay Area Transportation Authority (BATA), has increased tourism and bicycle traffic in the northwest lower portion of the state. The program allows recreational bicyclists to ride 17 miles one way on the paved Leelanau Trail between Traverse City and Suttons Bay and return on one of two retrofitted school buses that have capacity for bicycles and child trailers. The bus service provides a safety net for riders of varying abilities, and has led to a 68 percent increase in ridership on the bike trail.

Local bike shops, as well as restaurants, have reported increased business from users of the bike trail. Project collaborators are considering other trails, connections with other municipalities, and seasonal opportunities for service expansion.

For more information, visit www.bata.net or call 231-941-2324.

Photo: Bay Area Transportation Authority

With room for 11 bicycles and child trailers, retrofitted vehicles allow bicyclists to make a return trip on the bus.

INTERNATIONAL

Asia Leads Global Freight Growth

Data collected by the International Transport Forum of the Organisation for Economic Co-operation and Development show imports to the European Union (EU) and United States still below levels before the economic crisis of 2008, with exports to and from Asia comprising most global freight growth.

According to ITF, U.S. external trade by sea is 13 percent below precrisis levels. Trade in the EU is 1 percent less than what it was in June 2008. Since early 2012, total trade by air has remained 5 percent below precrisis levels for the United States and 7 percent for the EU.

Export trade in the EU has risen 25 percent since June 2008, but imports are still 10 percent below precrisis levels. In the United States, exports are 8 percent higher than in June 2008, but imports are 25 percent lower.

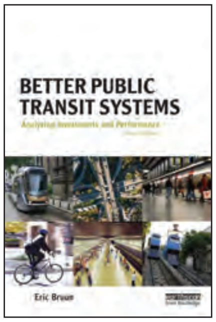
Rail freight volumes, in tonne-kilometers, remained stagnant through the end of 2012 in the United States and in the EU, at 5 and 9 percent below the 2008 peaks, respectively. Road freight volumes fell in the EU to 15 percent below the 2008 peak—the lowest figure reported since 2008.

According to ITF, China's imports by sea from North Atlantic economies have declined since mid-2012.

For more information, see www.internationaltransportforum.org/statistics/StatBrief/2013-07-Global-Freight.pdf.

Better Public Transit Systems: Analyzing Investments and Performance, Second Edition

Eric Christian Bruun. Routledge, 2013; 400 pp.; $69.95; 978-04-1570-600-1.



The revised edition of this volume presents tools for agencies, planners, and other professionals to define goals and objectives for new and existing public transit systems and to develop design alternatives. Route and network analysis, the impact of intelligent transportation systems, and cost model development are among the topics addressed. The author is a member of the Transit Management and Performance Committee at TRB.

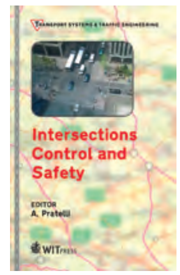
Commuting in America 2013

Alan E. Pisarski and Steven E. Polzin. American Association of State Highway and Transportation Officials (AASHTO), 2013; available at http://traveltrends.transportation.org.

The 16 brief volumes in this series from AASHTO examine historical shifts in employment patterns and sectors, elucidating the trends in work and commuting that influence critical transportation policy issues and investment priorities. Briefs cover population and worker trends and dynamics, vehicle and transit availability, vehicle ownership and licensure levels, and the use of transit services. Pisarski is a longtime TRB volunteer leader and recipient of the W. N. Carey, Jr., Distinguished Service Award.

Intersections Control and Safety

Edited by A. Pratelli. WIT Press, 2013; 164 pp.; $154; 978-18-4564-764-3.



Approximately one-third of all highway crashes occur at intersections. This volume contains research on relevant safety aspects of road intersections and new design and operations features that can help reduce crashes. Paper topics include design details, driver perception, pedestrian behavior, signal timing, capacity models, red-light running, and more.

The books in this section are not TRB publications. To order, contact the publisher listed.

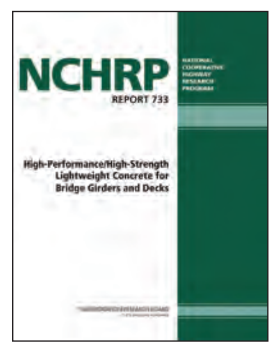
TRB PUBLICATIONS

High-Performance, High-Strength Lightweight Concrete for Bridge Girders and Decks

NCHRP Report 733

This report proposes changes to the AASHTO *Load and Resistance Factor Design (LRFD) Bridge Design Specifications* and the *LRFD Bridge Construction Specifications* to address the use of lightweight concrete in bridge girders and decks.

2013; 81 pp.; TRB affiliates, $41.25; nonaffiliates, $55. Subscriber categories: bridges and other structures; materials.



Hydraulic Loss Coefficients for Culverts

NCHRP Report 734

Presented in this volume are culvert designs that allow migratory species to pass through the culvert barrel, along with information on the refinement of hydraulic relationships and the development of new ones for culvert analysis and design.

2012; 113 pp.; TRB affiliates, $45; nonaffiliates, $60. Subscriber category: hydraulics and hydrology.

Long-Distance and Rural Travel Transferable Parameters for Statewide Travel Forecasting Models

NCHRP Report 735

A supplement to NCHRP Report 716, *Travel Demand Forecasting: Parameters and Techniques*, this report explores transferable parameters for long-distance and rural trip making for statewide models.

2012; 133 pp.; TRB affiliates, $47.25; nonaffiliates, $63. Subscriber categories: highways; planning and forecasting.

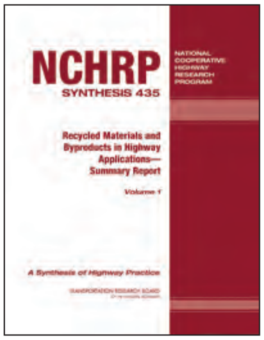
Design Guidance for High-Speed to Low-Speed Transition Zones for Rural Highways

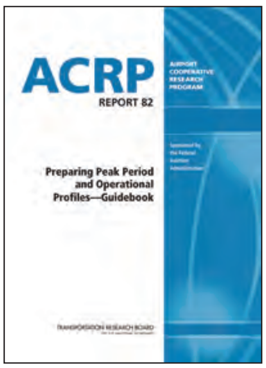
NCHRP Report 737

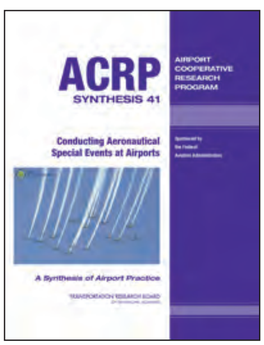
This volume presents guidance for designing the transition from a high-speed rural highway to a lower-speed section, a methodology for assessing these highway sections, and a catalog of treatments for potential problems.

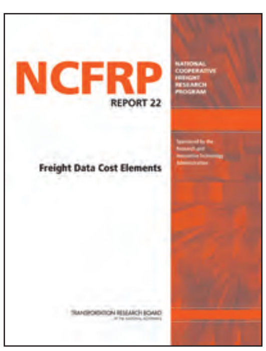
2012; 88 pp.; TRB affiliates, $42.75; nonaffiliates,

TRB PUBLICATIONS *(continued)*









$57. Subscriber categories: design; operations and traffic management.

Recycled Materials and Byproducts in Highway Applications
NCHRP Synthesis 435

This eight-volume synthesis is a guide for states revising the provisions of materials specifications to incorporate the use of recycled materials and industrial byproducts. Volumes 2–8 are in electronic format only and are available at www.TRB.org.

2013; 93 pp. (Volume 1); TRB affiliates, $43.50; nonaffiliates, $58. Subscriber categories: construction; environment; highways; materials.

Use of Transportation Asset Management Principles in State Highway Agencies
NCHRP Synthesis 439

The state of practice for transportation asset management among state departments of transportation is explored in this synthesis.

2013; 86 pp.; TRB affiliates, $43.50; nonaffiliates, $58. Subscriber categories: highways; maintenance and preservation.

Preparing Peak Period and Operational Profiles: Guidebook
ACRP Report 82

A process for converting annual airport activity forecasts into forecasts of daily or hourly peak period activity is presented in this guidebook. Included with the print version are two Excel-based software modules on CD-ROM.

2013; 130 pp.; TRB affiliates, $55.50; nonaffiliates, $74. Subscriber categories: aviation; operations and traffic management; planning and forecasting.

Assessing Opportunities for Alternative Fuel Distribution Programs
ACRP Report 83

This report comprises a guidebook and spreadsheet toolkit to help airports introduce and market alternative fuels to the airport community. The toolkit is provided on CD-ROM with the print version of the report.

2013; 114 pp.; TRB affiliates, $53.25; nonaffiliates, $71. Subscriber categories: aviation; energy; environment.

Guidebook for Preparing Airport Emissions Inventories for State Implementation Plans
ACRP Report 84

This guidebook offers a basic, intermediate, and advanced approach for preparation of an airport emissions inventory. The print version of the report includes a CD-ROM with an airport emissions estimator tool, appendixes, and other project-specific material.

2013; 59 pp.; TRB affiliates, $36.75; nonaffiliates, $49. Subscriber categories: aviation; administration and management; environment.

Conducting Aeronautical Special Events at Airports
ACRP Synthesis 41

This synthesis comprises available information and lessons learned on how to plan, organize, and conduct an aeronautical special event and restore normal operations afterward.

2013; 119 pp.; TRB affiliates, $45.75; nonaffiliates, $61. Subscriber categories: administration and management; aviation; operations and traffic management.

Integrating Environmental Sustainability into Airport Contracts
ACRP Synthesis 42

Presented in this volume are examples of how airports might help drive environmental sustainability performance improvements at their facilities by integrating environmental sustainability concepts into agreements with contractors, suppliers, and vendors.

2013; 68 pp.; TRB affiliates, $39; nonaffiliates, $52. Subscriber categories: aviation; environment; law.

Use of Market Research Panels in Transit
TCRP Synthesis 105

This synthesis describes the various types of market research panels, identifies issues to consider when engaging in market research and panel surveys, and provides examples of successful programs.

2013; 62 pp.; TRB affiliates, $36; nonaffiliates, $48. Subscriber categories: public transportation; planning and forecasting.

Freight Data Cost Elements
NCFRP Report 22

Identified are the specific types of direct freight transportation cost data elements required for public investment, policy, and regulatory decision making, as well as strategies for acquiring the data.

2013; 121 pp.; TRB affiliates, $45.75; nonaffiliates, $61. Subscriber categories: administration and management; economics; freight transportation.

TRB PUBLICATIONS *(continued)*

Synthesis of Freight Research in Urban Transportation Planning
NCFRP Report 23

This report explores policies and practices for managing freight activity in metropolitan areas, with a focus on last-mile–first-mile strategies as well as environmental issues and trading hubs or nodes.

2013; 89 pp.; TRB affiliates, $43.50; nonaffiliates, $58. Subscriber categories: freight transportation; planning and forecasting; terminals and facilities.

Development of Analysis Methods Using Recent Data
SHRP 2 Report S2-S01A-RW-1

This report introduces an approach to microscopic or individual event modeling of crash-related events, treating driver actions, initial speeds, and vehicle locations as inputs to a physical model describing vehicle motion.

2012; 100 pp. Subscriber categories: highways; safety and human factors. Available at http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S2-S01A-RW-1.pdf.

Training of Traffic Incident Responders
SHRP 2 Report S2-L12-RW-1

Presented are the results of a project that developed a training program for traffic incident responders and managers, with guidance both for trainers and for responders.

2012; 39 pp. Subscriber categories: education and training; highways; operations and traffic management.

A Multivariate Analysis of Crash and Naturalistic Driving Data in Relation to Highway Factors
SHRP 2 Report S2-S01C-RW-1

Explored in this volume are analysis methods for associating crash risk with quantitative metrics—or crash surrogates—from naturalistic driving data.

2013; 77 pp. Subscriber categories: highways; safety and human factors. Available at http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S2-S01C-RW-1.pdf.

Using Census Data for Transportation Applications
Conference Proceedings on the Web 10

This volume summarizes an October 2011 conference in Irvine, California, that focused on the critical role of census data in a wide range of transportation planning applications.

Available at http://onlinepubs.trb.org/onlinepubs/conf/CPW10.pdf.

Adapting Freight Models and Traditional Freight Data Programs for Performance Management: Summary of a Workshop
Conference Proceedings on the Web 12

The product of a spring 2013 workshop in Washington, D.C., this volume explores the adequacy of freight data and modeling to support performance measurement in public- and private-sector decision making.

Available at http://onlinepubs.trb.org/onlinepubs/conf/CPW12.pdf.

Demand Management and Carsharing 2012
Transportation Research Record 2319

Addressed in this volume are such topics as parking modeling and pricing, the equity implications of parking taxes, how employers view traffic congestion, travel choices and links to transportation demand management, and one-way carsharing.

2012; 120 pp.; TRB affiliates, $48; nonaffiliates, $64. Subscriber categories: administration and management; public transportation; planning and forecasting.

Environmental Justice, Social Factors, and Gender-Related Issues in Transportation 2012
Transportation Research Record 2320

The impact of environmental justice on transportation, automobile ownership and travel of the poor, the identification of mobility-impaired persons and their travel behavior, and the service needs of pregnant air passengers are among the topics presented in this volume.

2012; 110 pp.; TRB affiliates, $48; nonaffiliates, $64. Subscriber categories: society; policy; planning and forecasting.

Human Performance, User Information, and Simulation 2012
Transportation Research Record 2321

Authors present research on cell phone use, texting, the effect of external distractions on behavior and vehicle control, driver inattention, dynamic maximum speed limits, simulator scenarios for assessing novice drivers, and other subjects.

2012; 107 pp.; TRB affiliates, $48; nonaffiliates, $64. Subscriber category: safety and human factors.

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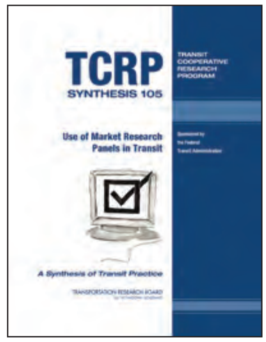

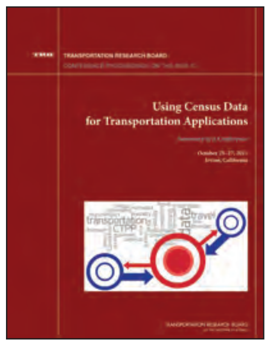

CALENDAR

TRB Meetings

February

4–5 Road Dust Best Management Practices Conference*
Minneapolis, Minnesota

March

3–4 Transportation Planning, Land Use and Air Quality Conference*
Charlotte, North Carolina

April

1–4 Joint Rail Conference*
Pueblo, Colorado

9–11 5th International Transportation and Economic Development Conference*
Dallas, Texas

14–16 5th International Conference on Women's Issues in Transportation*
Paris, France

14–17 Transport Research Arena Conference*
Paris, France

16–18 4th International Conference on Roundabouts
Seattle, Washington

22–25 NAFTANEXT: Energizing Sustainable Trade Corridors Across North America—The Intersection of Energy, Environment, Jobs, and Growth*
Chicago, Illinois

22–25 Third International Conference on Transportation Infrastructure*
Pisa, Italy

27–30 Innovations in Travel Demand Forecasting 2014
Baltimore, Maryland

28–30 10th National Conference on Transportation Asset Management
Miami, Florida

May

6–8 American Association of State Highway and Transportation Officials Geographic Information Systems for Transportation Symposium*
Burlington, Vermont

13 Workshop on Natural Gas as a Fuel for Freight Transport
Irvine, California

21–22 Development of Freight Fluidity Performance Measurements
Washington, D.C.

26–28 GeoShanghai International Conference 2014*
Shanghai, China

TBD Marine Transportation System Research and Technology Coordination Conference
Washington, D.C.

June

29–July 2 North American Travel Monitoring Exposition and Conference (NATMEC): Improving Traffic Data Collection, Analysis, and Use
Chicago, Illinois

TBD American Society of Civil Engineers 2nd Transportation and Development Institute Congress*
Orlando, Florida

TBD Workshop on Regional Transportation Systems Management and Freeway Operations
Irvine, California

July

7 Geosynthetics in Roadway Design
Laramie, Wyoming

7–11 7th International Conference on Bridge Maintenance, Safety, and Management*
Shanghai, China

9–11 5th International Conference on Surface Transportation Financing: Innovation, Experimentation, and Exploration
Irvine, California

10–11 9th Strategic Highway Research Program Safety Symposium
Washington, D.C.

15–18 9th International Conference on Short and Medium Span Bridges*
Calgary, Alberta, Canada

20–23 GeoHubei International Conference*
Hubei, China

20–23 Symposium on Alternative Intersection and Interchange Design
Salt Lake City, Utah

Additional information on TRB meetings, including calls for abstracts, meeting registration, and hotel reservations, is available at www.TRB.org/calendar. To reach the TRB staff contacts, telephone 202-334-2934, fax 202-334-2003, or e-mail TRBMeetings@nas.edu. Meetings listed without a TRB staff contact have direct links from the TRB calendar web page.

*TRB is cosponsor of the meeting.

INFORMATION FOR CONTRIBUTORS TO

TR NEWS

TR News welcomes the submission of manuscripts for possible publication in the categories listed below. All manuscripts submitted are subject to review by the Editorial Board and other reviewers to determine suitability for *TR News*; authors will be advised of acceptance of articles with or without revision. All manuscripts accepted for publication are subject to editing for conciseness and appropriate language and style. Authors receive a copy of the edited manuscript for review. Original artwork is returned only on request.

FEATURES are timely articles of interest to transportation professionals, including administrators, planners, researchers, and practitioners in government, academia, and industry. Articles are encouraged on innovations and state-of-the-art practices pertaining to transportation research and development in all modes (highways and bridges, public transit, aviation, rail, marine, and others, such as pipelines, bicycles, pedestrians, etc.) and in all subject areas (planning and administration, design, materials and construction, facility maintenance, traffic control, safety, security, logistics, geology, law, environmental concerns, energy, etc.). Manuscripts should be no longer than 3,000 words (12 double-spaced, typed pages). Authors also should provide charts or tables and high-quality photographic images with corresponding captions (see Submission Requirements). Prospective authors are encouraged to submit a summary or outline of a proposed article for preliminary review.

RESEARCH PAYS OFF highlights research projects, studies, demonstrations, and improved methods or processes that provide innovative, cost-effective solutions to important transportation-related problems in all modes, whether they pertain to improved transport of people and goods or provision of better facilities and equipment that permits such transport. Articles should describe cases in which the application of project findings has resulted in benefits to transportation agencies or to the public, or in which substantial benefits are expected. Articles (approximately 750 to 1,000 words) should delineate the problem, research, and benefits, and be accompanied by one or two illustrations that may improve a reader's understanding of the article.

NEWS BRIEFS are short (100- to 750-word) items of interest and usually are not attributed to an author. They may be either text or photographs or a combination of both. Line drawings, charts, or tables may be used where appropriate. Articles may be related to construction, administration, planning, design, operations, maintenance, research, legal matters, or applications of special interest. Articles involving brand names or names of manufacturers may be determined to be inappropriate; however, no endorsement by TRB is implied when such information appears. Foreign news articles should describe projects or methods that have universal instead of local application.

POINT OF VIEW is an occasional series of authored opinions on current transportation issues. Articles (1,000 to 2,000 words) may be submitted with appropriate, high-quality illustrations, and are subject to review and editing.

BOOKSHELF announces publications in the transportation field. Abstracts (100 to 200 words) should include title, author, publisher, address at which publication may be obtained, number of pages, price, and ISBN. Publishers are invited to submit copies of new publications for announcement.

LETTERS provide readers with the opportunity to comment on the information and views expressed in published articles, TRB activities, or transportation matters in general. All letters must be signed and contain constructive comments. Letters may be edited for style and space considerations.

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- All manuscripts should be supplied in 12-point type, double-spaced, in Microsoft Word, on a CD or as an e-mail attachment.
- Submit original artwork if possible. Glossy, high-quality black-and-white photographs, color photographs, and slides are acceptable. Digital continuous-tone images must be submitted as TIFF or JPEG files and must be at least 3 in. by 5 in. with a resolution of 300 dpi. A caption should be supplied for each graphic element.
- Use the units of measurement from the research described and provide conversions in parentheses, as appropriate. The International System of Units (SI), the updated version of the metric system, is preferred. In the text, the SI units should be followed, when appropriate, by the U.S. customary equivalent units in parentheses. In figures and tables, the base unit conversions should be provided in a footnote.

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