

A Framework for Improving Travel Time Reliability

DETAILS

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The Second
S T R A T E G I C H I G H W A Y R E S E A R C H P R O G R A M



SHRP 2 REPORT S2-L17-RW-1

A Framework for Improving Travel Time Reliability

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with

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ICF International
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America's highway system is critical to meeting the mobility and economic needs of local communities, regions, and the nation. Developments in research and technology—such as advanced materials, communications technology, new data collection technologies, and human factors science—offer a new opportunity to improve the safety and reliability of this important national resource. Breakthrough resolution of significant transportation problems, however, requires concentrated resources over a short time frame. Reflecting this need, the second Strategic Highway Research Program (SHRP 2) has an intense, large-scale focus, integrates multiple fields of research and technology, and is fundamentally different from the broad, mission-oriented, discipline-based research programs that have been the mainstay of the highway research industry for half a century.

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SHRP 2 was authorized in August 2005 as part of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). The program is managed by the Transportation Research Board (TRB) on behalf of the National Research Council (NRC). SHRP 2 is conducted under a memorandum of understanding among the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), and the National Academy of Sciences, parent organization of TRB and NRC. The program provides for competitive, merit-based selection of research contractors; independent research project oversight; and dissemination of research results.

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FOREWORD

David J. Plazak, *SHRP 2 Senior Program Officer, Capacity and Reliability*

This project was designed to assemble, organize, and document the complete diverse results and products of the SHRP 2 Reliability research focus area. The project report and associated products will help transportation agency decision makers and individual practitioners to understand the principles and value of management and operations programs, guide the design and resourcing of such programs, and provide technical knowledge and tools for effective program delivery on a regular basis to improve travel time reliability. There were three main tracks of the L17 research agenda:

1. To assess the current state of research in the realm of travel time reliability and to identify and assess critical gaps that might impede progress by transportation agencies in improving travel time reliability on their highway systems. This assessment included both SHRP 2 and non-SHRP 2 efforts; for instance, recent research sponsored by partners of TRB such as FHWA, AASHTO, Institute of Transportation Engineers (ITE), the National Transportation Operations Coalition (NTOC), and the Intelligent Transportation Society of America (ITS America). The results of this gap assessment led to the selection of a small number of “gap-filling” research topics that could be completed during the time available for the L17 research project.
2. To develop a suite of branding and marketing materials. These materials were designed to be customized by individual transportation agencies to communicate the value of transportation systems management and operations (TSM&O) to internal and external stakeholders, decision makers, and the general public.
3. Most importantly, a prototype web-based Knowledge Transfer System (KTS) was designed and constructed to be used by TSM&O practitioners in state DOTs, metropolitan planning organizations, regional transportation agencies, and local transportation agencies to understand how to improve the operations and reliability of their systems in a comprehensive manner. The KTS highlights all of the results of the SHRP 2 Reliability research projects but also goes beyond them. The intent was to provide a “one-stop shop” on the web for learning about TSM&O and improving travel time reliability. The results of the other two L17 research tracks—the gap-filling research and the branding and marketing materials—are also included on the KTS.

The L17 project was intended to serve as the location of reference for the full SHRP 2 research and as the initial foundation for a future comprehensive resource site. TRB will be handing off the products of L17 at the end of the life of the SHRP 2 research program in early 2015. An Operations Center of Excellence (OCOE) has been proposed as the new home for the KTS and other L17 products; the business planning for the center was under way as of mid-2013.

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Executive Summary

As a capstone project in the Reliability program, SHRP 2 Project L17, A Framework for Improving Travel Time Reliability, is intended to integrate products from other SHRP 2 projects as well as from other current sources of transportation systems management and operations (TSM&O) information.

The main objectives of SHRP 2 Project L17 are the following:

- Provide the means for mainstreaming reliability findings and products.
- Develop diverse “value of Reliability/TSM&O” messaging pieces.
- Provide an accessible synthesis of reliability findings and products.
- Develop a user-driven comprehensive Knowledge Transfer System (KTS).
- Develop Reliability/TSM&O branding and a marketing plan for the KTS.

To accomplish these objectives, the project has been divided into three tracks:

- Content Building;
- KTS; and
- Branding and Communication.

This report presents the results of the four project phases dealing with (1) Synthesis, (2) Gap Analysis, (3) Gap Filling, and (4) the KTS and the work activities that have been completed to achieve the project objectives. The key recommendations and findings that have been developed are identified in the remainder of this executive summary.

Literature Synthesis and Review

Content building activities within the project address the first three stages of effective knowledge transfer. Evaluation of the SHRP 2 program projects for relevance to the KTS content was the highest priority. All active and concluded projects under the Reliability focus area were selected to be reviewed. In addition, six projects under the Capacity focus area were identified as relevant to Reliability and TSM&O. Two projects under the Renewal focus area and one project under the Safety focus area were considered to have useful information to the existing knowledge base of Reliability and TSM&O. As a result, 21 projects from the SHRP 2 Program (12 from Reliability, six from Capacity, two from Renewal, and one from Safety) were selected to be included in the synthesis summary task.

In addition to those SHRP 2 projects, other significant reports and documents that collectively define the current state of practice in the areas of reliability and TSM&O were also reviewed and evaluated. These are referred to as Tier 1 documents because of their current importance and

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stature in defining the Reliability/TSM&O state of the practice. The documents that were selected included publications from the Federal Highway Administration (FHWA), state departments of transportation (DOTs), selected websites, and other research documents and papers. As a result, 34 additional documents were added to the final list for review. Thus, 55 documents were reviewed. The complete list of these documents is provided in Appendix A.

The document review process involved assigning each of the 55 documents to team members based on their areas of expertise and involvement with the document production. As part of the document review, a high-level overview was prepared for each document according to the following topical areas:

- Summary of the work;
- The project's recommendations for future research;
- Practical application procedures and opportunities;
- Caveats or limitations associated with the key products and findings; and
- Related work that may also be of interest.

In order to concentrate the review process output in a single location, a synthesis web-based tool was developed so that the team could input the results of the document review and easily access and summarize that information.

Addressing Gaps in Knowledge

The SHRP 2 Project L17 research plan called for conducting gap-filling research in Phase 3. As part of the Phase 2 gap analysis activities, the research team performed an extensive evaluation of gaps that act as a barrier for mainstreaming TSM&O practices. As a result of a prioritization exercise, the research team identified as high priorities the following gap-filling projects:

- Project 1: Persuasive TSM&O Case Study Briefing Book
- Project 2: Deployment Guidance for TSM&O Strategies
- Project 3: TSM&O Program and Budget Development
- Project 4: Standard Evaluation and Reporting Procedures for TSM&O Strategies
- Project 5: Synthesis on Valuing Travel Time Reliability
- Project 6: Key Sub-Audience Business Case and Communication Strategies to Support Mainstreaming of Transportation Systems Management and Operations (TSM&O)
- Project 8: Integration of Operations into Transportation Decision Making

Project 7 was replaced by Project L31. Project 8 was funded through the Capacity research area of SHRP 2. Projects 9, 10, and 11 were judged to be of low or medium priority and were not pursued. The facts and statistics described in Project 12 were, in fact, provided in the case study briefing book pages (Gap-Filling Project 1) and the business case primer (Gap-Filling Project 6). The six L17 gap-filling projects can be found at this SHRP 2 web page: <http://www.trb.org/main/blurbs/169243.aspx>.

Following review and input from the Technical Expert Task Group (TETG), the research team finalized the list of gap-filling projects and developed refined work plans for each project. Each of these seven projects was completed during the Phase 3 effort. Table ES.1 describes each of the project descriptions and the guidance provided for each of the gap-filling activities.

Knowledge Transfer System

Effective knowledge transfer begins with new knowledge that is achieved, often in incremental bits and pieces, through basic or applied research, new experiences, and even the outcomes of trial-and-error experiments (Learn and Capture). In order to maximize their collective value,

Table ES.1. Gap-Filling Projects

#	Description	Objective	Product	Schedule in Months	Priority for L17
1	Persuasive TSM&O Case Study Briefing Book for Decision Makers	To provide compelling examples from state and regional experience that support the benefits of TSM&O in terms that are directly relevant to decision makers.	Mini briefing book for decision makers	9	High
2	Deployment Guidance for TSM&O Strategies	To provide guidance for matching the deployment of TSM&O strategies to institutional, highway, and traffic conditions.	Guidebook	9	High
3	TSM&O Program and Budget Development	To develop guidelines for determining short-term programs and budgets as well as procedures for identifying long-term needs for TSM&O within an agency.	Guidebook	9	High
4	Standard Evaluation and Reporting Procedures for TSM&O Strategies	To provide guidance on how to conduct field evaluations of operations strategies and to use the results both internally and externally.	Guidebook	6	High
5	Synthesis on Valuing Travel Time Reliability	To provide interim guidance on how to value travel time reliability until a full-scale research project is completed.	Guidebook	6	High ^a
6	Key Sub-Audience Business Case and Communication Strategies to Support Mainstreaming of TSM&O	To develop business case and communication strategies for up to an additional six sub-audiences to supplement brand, communication strategies, and sample materials being developed as part of the L17 scope.	Business cases and report	6	High
7	Development and Delivery of CEO Workshops	To conduct workshops for new CEOs and Chief Engineers to demonstrate TSM&O benefits and successful practices.	Workshop materials and briefing report	9	High ^b
8	Integration of Operations into Transportation Decision Making	To provide technical staff and policy makers the decision-making structure and supporting information needed to integrate consideration of operational improvements into overall transportation decision making during planning, programming, corridor planning, and NEPA/permitting.	Separate application in TCAPP	12	High ^c
9	TSM&O in the “new context of” constrained transportation improvements	To provide resource material that focuses on identifying the set of recent changes in the context for transportation improvement—state and regional—that have constrained conventional (capacity) improvements and imply greater need for focus on efficient and effective operations of the existing network. The material would be designed to be used by policy and planning staffs.	“Responding to Constraints” handbook and related web material	9	Medium
10	Development of a TSM&O Course	To develop course materials for one graduate-level course on TSM&O.	Course material and “train-the-trainer” material	9	Medium
11	Guidance and Application Procedures for Predicting the Performance of TSM&O Strategies	To develop guidance for applying analysis, modeling, and simulation tools in the evaluation of emerging TSM&O strategies.	Guidebook	12	Low
12	Facts and Stats for TSM&O	To summarize readily available quantitative information regarding implementation statistics, benefits, and costs of TSM&O strategies to incorporate in the KTS.	Database and report	6	High

Note: Shaded rows represent recommended gap-filling projects for L17 Phase 3. NEPA = National Environmental Policy Act of 1969; TCAPP = Transportation for Communities—Advancing Projects through Partnerships.

^a A full-scale follow-on project is recommended for developing a recommended practice for valuing travel time reliability.

^b This project has been replaced by Project L31.

^c This project became part of Project C01.

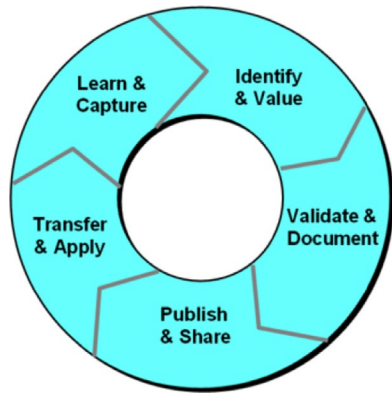


Figure ES.1. The knowledge transfer process.

these bits and pieces of new knowledge are brought together and interrelated through a synthesis type of activity (Identify and Value). A critical review of the synthesized information will often reveal knowledge gaps where the accumulated knowledge is not sufficient to produce a cohesive, useful, and usable product. Where such knowledge gaps are found, they must be filled in order to avoid a premature disruption of the overall knowledge transfer lifecycle process (Validate and Document).

Development of a KTS within the project addresses the final two stages in effective dissemination of knowledge and information. When all critical gaps have been filled, the new knowledge set will be fully functional and usable to everyday practitioners (Publish and Share). The new knowledge set enters into the mainstream of practice through awareness, acceptance, and application by the practitioners (Transfer and Apply).

In order to identify and consider the various elements and requirements of an effective knowledge transfer within the project scope, the team reviewed websites and other means of transferring information both internal and external to the transportation sector. The team has also outlined several options for the KTS website design. This knowledge transfer process is illustrated in Figure ES.1.

At each stage in the knowledge transfer process, interaction with key audiences—both users and key authorizers—is needed to ensure that audience context, needs, and issues are addressed.

Key Findings

The state of the practice is still developing. Right now there is no organized KTS within the SHRP 2 Reliability program areas of interest. In addition, there are no systematic activities in place to identify and fill knowledge gaps. One essential finding from the research is that travel time reliability is not a stand-alone topic, but instead is integral to the larger practice of TSM&O. For this reason the design of the KTS must be broad enough to provide the umbrella structure needed to incorporate the many individual elements of TSM&O. In addition, for a KTS to be completely effective, it is necessary to transfer both explicit and tacit (anecdotal) information. Although content in the form of documents, reports, and other published information is a key feature of knowledge transfer, equal importance must be given to the knowledge developed by individual practitioners that can only be shared by more direct communication in the form of workshops, peer exchanges, blogs, forums, and other social media.

Additional key findings regarding knowledge transfer include the following:

- There are four principal audiences whose needs must be met: policy makers, practitioners (important subsets also exist for these last two audiences), researchers, and the public at large.
- A fair amount of explicit information is already available through nine different TSM&O-focused websites. However, nontechnical information is not well supported by these websites, and most have agendas other than just knowledge transfer. These agendas influence the information and the way that knowledge is made available.

- The kinds of knowledge needed by the principal audiences include
 - Definitions and FAQs;
 - Research results;
 - Analytic tools and procedures;
 - Standards and regulations;
 - Benefit and cost information and database;
 - Institutional, program, and process guidance;
 - Outreach and marketing materials;
 - Current and upcoming professional activities;
 - Technical and peer interchange and interaction opportunities; and
 - Education and training.
- Most websites and sponsors have agendas other than just knowledge transfer; these agendas influence the information and the way that knowledge is made available.
- No current systematic activities exist to identify and fill knowledge gaps.
- Activities necessary to developing an effective KTS go beyond simply storing relevant knowledge and include
 - Identifying important knowledge;
 - Capturing and storing the important knowledge;
 - Identifying use audiences;
 - Analyzing, understanding, and organizing the relevant knowledge;
 - Sharing, transferring, and disseminating the relevant knowledge;
 - Discussing and interacting among and within use audiences;
 - Maintaining the site; and
 - Updating and expanding the KTS.

Based on the background summarized previously, certain key conclusions were reached regarding the important directions for a TSM&O KTS:

- A web-based tool can provide convenient one-stop access to the complete range of existing and new TSM&O information.
- There is no need to duplicate the extensive libraries of existing websites, and a cooperative strategy would be beneficial among existing website sponsors.
- Prioritization of information available on existing websites, as well as additional synthesis, cataloging and cross-classifying, is needed. In particular, the needs of policy makers, planners, and managers are not well addressed by existing website resources, and there are gaps that can be filled with only modest resources.
- The KTS should incorporate best practice features, including social media and outreach capabilities.
- An effective KTS will require active and ongoing management. While there is a range of management burdens implied for the several following options, increased functionality introduces the need for increased management (and funding).

Five options, which are not mutually exclusive, have been defined in Chapter 3 for consideration.

Options 1 and 2 have relatively modest burdens:

1. Support of coordinated, cooperative modifications to selected existing TSM&O-focused websites to better achieve overall KTS objectives.
2. One or more single function websites that would provide specific knowledge category resources on separate websites.

Options 3 through 5 introduce significant management responsibilities. Even when the activities are restricted to a website alone, the scope and sustaining requirements suggest a dedicated

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staff. Option 5 adds activities beyond the web function that is the focus of this project. However, the “Operations Center of Excellence” concept with its external and “live” activities and with the implied sponsor and sustainability may also have the stronger likelihood of supplying the full range of needed KTS functions.

3. A comprehensive web-based portal with searchable links to other existing websites plus selective creation and hosting of new material.
4. A new stand-alone, comprehensive website hosting the complete range of relevant knowledge categories for all relevant topics.
5. An Operations Center of Excellence-based web portal integrated with other related non-web-related and live KTS activities.

Key Recommendations

The SHRP 2 Project L17 contribution to a complete and functional KTS should be a web-based product. Phase 3 began by developing an initial version of the site map, site structure, content structure, and functionalities for a TSM&O website. Based on the analysis presented in Chapter 3 and on an evaluation of the five options described previously, the following recommendations are made:

- The portal approach (Option 3) is the most efficient because it combines needed new content with connections to existing resources.
- The KTS will be developed and brought online incrementally to retain flexibility regarding ultimate hosting and relationships to existing sites.
- The useful results (including reports, analysis methods, and tools) of recently completed SHRP 2 Reliability program projects will be among the first elements to be included on the new website.
- Gap-filling work activities identified earlier in Table ES.1 will also become new knowledge elements on the website.

Finally, a conversation was initiated at the start of Phase 3 with SHRP 2 staff, TETG members, and Technical Coordinating Committee (TCC) members for the purpose of resolving the question of both mid-term and long-term sustainability of the KTS. In summary, while initial site design, beta hosting, and improvements in response to community reviews will take place within the current scope of this project, consideration must be given to supporting the site hosting and maintenance activities after the current project. In addition, experience with other SHRP 2 web projects indicates that a range of improvements will result from initial experience that will exceed the scope of the current project.

In Phase 3, the website design considered two key factors:

- *Existing knowledge transfer resources.* KTS-like activities by agencies and associations were reviewed for strengths and weakness. The state of the practice in KTS-like activities outside the domain was also reviewed as the basis for the KTS prototype development.
- *State of community of practice.* The audiences relevant to reliability and, more broadly, to TSM&O are fragmented both by type of institution and individual organizations into a set of sub-communities (such as individual practitioners in a state DOT, practitioners in a consultancy, or members of a committee), which themselves are only weakly established within their own context.

The initial KTS website has six basic resources:

1. Searchable database with all SHRP 2 final products, including a standardized synthesis of each and key wording for search.

2. Links to (and syntheses of) a limited number of other key TSM&O documents in areas not covered by SHRP 2 research.
3. Reports on major research gaps in standards format.
4. FAQs.
5. A glossary, developed by the TRB Regional Transportation Systems Management and Operations (RTSMO) Committee.
6. Business case and outreach materials for custom tailoring.

The most important functionality of the website is the search mechanisms for finding SHRP 2 products as well as a limited number of selected non-SHRP 2 TSM&O documents (being added to by contract over the next 2 years). The search can be completed by a combination of topic and knowledge type and by date or author agency.

The initial site (and its functions) has been reviewed by the SHRP 2 L17 TETG and circulated to many organizations, including the TRB RTSMO Committee, ITE, the Intelligent Transportation Society of America, and the AASHTO Subcommittee on Systems Operations and Management. Only a few (but very helpful) comments have been received.

Under the current L17 scope and budget with the maintenance modification, the KTS website will be maintained through December 31, 2014. Additional SHRP 2 Reliability products will be added to the website as they become available. A limited number of non-SHRP 2 documents will also be added, and the calendar will be updated on a quarterly basis. For more information about the KTS, refer to the SHRP 2 L17 website: <http://www.trb.org/main/blurbs/169243.aspx>.

Branding and Communication

At each stage in the knowledge transfer process, interaction with key audiences—both users and the key authorizers—is needed to ensure that audience context, needs, and issues are addressed. The SHRP 2 Project L17 research approach includes several representative key audience “communities” that provide perspective and guidance to the development of the KTS as well as branding and communication activities.

Phases 1 and 2 of the project were guided primarily by the user community, a diverse group of practitioners representing a key target audience for the research. A second group, the institutional community, represented key organizations and agencies that have existing websites as well as a long history of supporting individual aspects of TSM&O. Another key audience identified for the KTS was the research community with specific interest in supporting academic curricula changes that will enhance the ability to advance TSM&O within the transportation sector. To support this perspective, the project team selected members for the Academic Advisory Team. The final outreach group identified to support the research was the user network—an evolving group of practitioners who are included in the project because of their interest in it. It is anticipated that members of the established outreach communities will encourage peers to join the user network as the project continues.

The user community met 11 times during the project and provided input for each of these tasks:

- Content synthesis validation;
- Identification of target audience segments;
- Development of draft business cases;
- Validation and prioritization of existing content gaps;
- Development of the brand promise;
- Key messages for communication to target audiences;
- Input on website features and usefulness; and
- Input on communication materials.

The institutional community met twice during the project. Its initial discussions centered on the development of a knowledge transfer framework, as well as lessons learned with respect to successful communication through a website and development of a supporting brand.

As the project progressed, the growing interest in SHRP 2 Reliability implementation and the creation of an “Operations Center of Excellence” eliminated the need for a formal institutional community. Many of the members of this group take part in these higher-level discussions and are, therefore, well aware of the advances made in the SHRP 2 L17 project research. In conjunction with the TETG chairman, it was decided that this community would not be engaged further within the L17 project. Members would be consulted and updated on an individual basis as well as within meetings and workshops external to the project.

The synthesis phase of SHRP 2 Project L17 included identification of existing branding and communication activities within TSM&O. This included a detailed review of 25 websites at the national, state, and local levels in order to identify common themes across websites, key terms used to communicate these themes, communication messages, and a general understanding of the effectiveness of each site at reaching its intended audience.

The branding synthesis provided the basis for the development of target audience definitions and the key messages that are most likely to resonate with each. Phases 1 and 2 resulted in a definition of three essential target audiences and the messages to communicate with each. These audiences and related messages provide the “case for change” needed to advance TSM&O and have been validated by the user community. Phase 3 included the development of a brand promise along with business cases and guidance on using them to communicate the value of TSM&O. These outcomes are documented in the business case primer, which is available as Gap-Filling Project 6 at <http://www.trb.org/main/blurbs/169243.aspx> and on the KTS. Phase 4 focused on the development of communication materials that provide the means to deliver the business case messages.



Key Findings

The target audience for TSM&O and its related aspect of travel time reliability is divided into three types:

- The Investment Decision Maker (Policy Maker) audience represents individuals who make decisions or recommendations related to allocating funds for improvements. These are often the policy makers within an agency, but can also include senior and mid-level managers who make recommendations for allocation of funding for TSM&O improvements.
- The Implementer (Practitioner) audience includes individuals who implement TSM&O improvements or services, including real-time operations as well as those responsible for longer-term related project development and design.
- The Traveler audience represents both business and personal travelers whose individual decisions about their route, time of departure, distance, or schedule affect the transportation system.

It is clear from the branding synthesis and interface with the user community that effective communication is audience dependent. It is essential to segregate the individual “sound bites” into the target audiences where they will be the most effective. Chapter 4 provides the key messages that have been drafted for each of these audiences.

To develop the brand and supporting communication materials in Phase 3, the project team sponsored a branding workshop with members of the user community and the TETG. This workshop drew from the target audience and key messages developed previously to identify essential terms and themes that the brand must effectively communicate. The interface between these two groups within a workshop setting ensured broad support of the initial brand developed within the project. Following the branding workshop, other outreach groups considered the results of this meeting and provided further recommendations, validation, and support for the draft brand

and messages. When the beta version of the KTS was developed, the brand and messages were further tested and enhanced to increase the brand's ability to represent and advance TSM&O.

The business case primer was developed following the branding workshop. The primer provides instructions on why a business case is important, definitions of the target audience, how to use the key messages in various engagement opportunities, and sample materials for individual target audiences. Four primary materials were developed in Phase 4 as a means to deliver the messages available through the business case primer:

- A brochure targeted to the traveling public;
- A fact sheet for implementers to use in spreading the word; and
- Two slide presentations (one for implementers and one for decision makers).

These communication materials were reviewed by the user community, the SHRP 2 L17 project team, and the TETG members. The intent was to provide them through the KTS in a format that could be adjusted for use by individual agencies. A communication strategy was the final deliverable for Phase 4. This document is intended to provide recommendations for KTS outreach following the completion of the L17 research.

CHAPTER 1

Introduction

Travel time reliability is an emerging topic that is becoming more important to understand. Unreliable travel time can occur due to recurring congestion (bottlenecks and poor traffic signal timing) and to nonrecurring congestion (traffic incidents, weather, work zones, and special events). However, there is a lack of common understanding among transportation policy makers and professionals regarding the concept of travel time reliability and how to improve it.

Roadway reliability can be improved through the application of Transportation Systems Management and Operations (TSM&O) strategies. The relationship between travel time reliability and TSM&O is described as follows:

Travel time reliability is a major component of the congestion problem. Both anecdotal and technical studies indicate that average congestion levels have—and are continuing—to grow in our cities. In their 2005 report, Texas Transportation Institute researchers found that congestion levels in 85 of the largest metropolitan areas have grown in almost every year in all population groups from 1982 to 2003. But, it's not just the typical or average condition that's important. The notion of *travel time reliability*—how consistent (or variable) travel conditions are from day-to-day—has taken on increasing importance. The variation in travel times is now understood as a separate component of the public's and business sector's frustration with congestion problems. Travelers adjust to variability by planning for additional time beyond what is typical, to ensure that they arrive on time. This extra planning time has costs associated with it that have not traditionally been accounted for in transportation analyses. Because systems operations and management deal directly with the root causes of unreliable travel (e.g., incidents, weather, work zones, demand surges), they can reduce the travel variability experienced by our customers. (AASHTO Subcommittee on Systems Operations and Management Subcommittee 2008 *Strategic Plan*, p. 5.)

Only a few agencies throughout the United States have successfully implemented a comprehensive TSM&O program to

address travel time reliability. Two that have been successful are the Virginia and the Washington State DOTs. Thus, there is a need to provide a common understanding of the causes of unreliable travel time and the actions that can be pursued to address this problem.

The SHRP 2 Project L17, A Framework for Improving Travel Time Reliability, was intended to address this need by moving TSM&O into mainstream agency practice. This was accomplished by organizing project activities into three parallel tracks:

- Track A: Developing a synthesis of relevant literature and identifying gaps in knowledge that need to be filled.
- Track B: Conceptualizing, building, and testing a Knowledge Transfer System (KTS).
- Track C: Enhancing branding and communication of TSM&O strategies to encourage their widespread distribution throughout the profession.

These three tracks are illustrated in Figure 1.1.

Project Description

SHRP 2 Project L17 is a capstone project in the Reliability program because it was intended to integrate products from other SHRP 2 projects as well as from other sources of TSM&O information.

The main objectives of the project were to

1. Provide the means for mainstreaming reliability findings and products;
2. Develop diverse “value of Reliability/TSM&O” messaging pieces;
3. Provide an accessible synthesis of reliability findings and products;
4. Develop a user-driven comprehensive KTS; and
5. Develop reliability branding and marketing plans for the KTS.

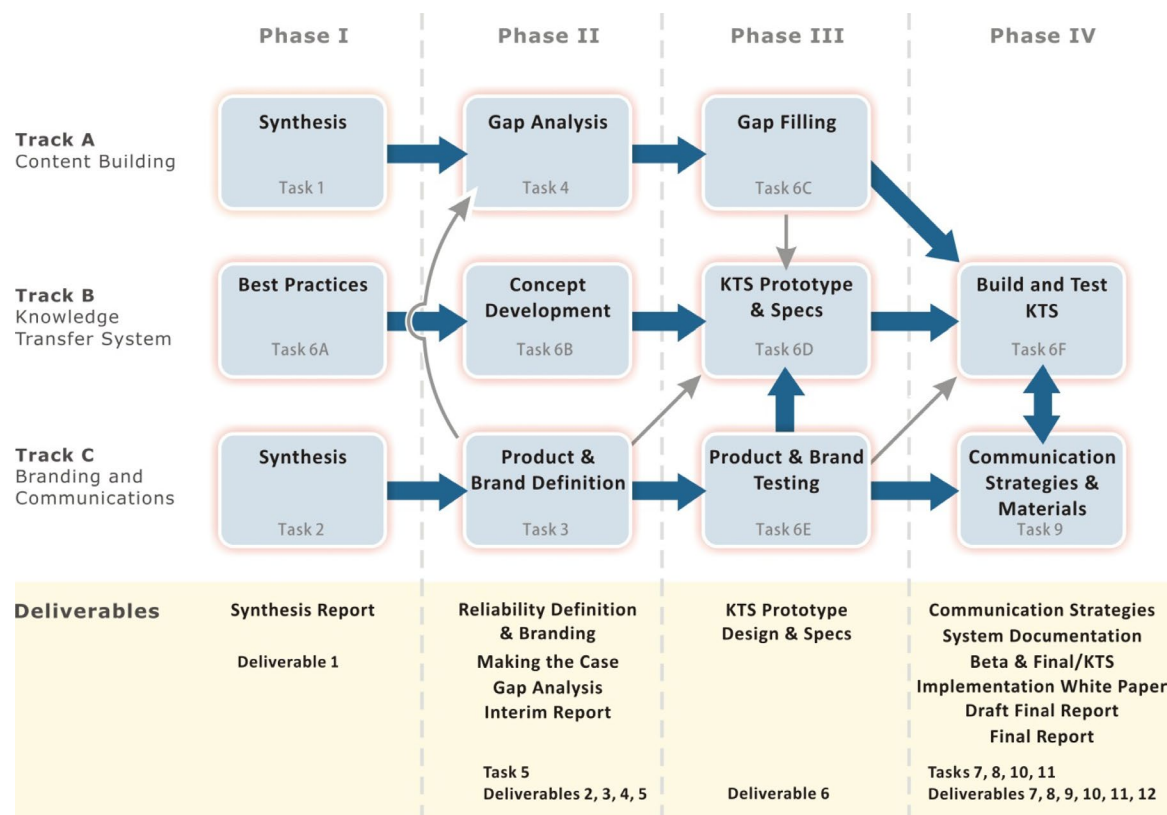


Figure 1.1. Work flowchart for Project L17, as organized into three tracks.

To accomplish these objectives, the following products were developed: A KTS was developed to accomplish the first and fourth objectives. A series of communication strategies, an academic white paper, and a business case primer were developed to accomplish the second and fifth objectives. A summary of TSM&O reports and documents and the gap-filling projects were conducted to accomplish the third objective.

Scope of Work

This section briefly describes the relevant tasks and activities of each track that were conducted during the SHRP 2 L17 project. Further details and the key findings on each track are described in the remaining chapters.

Phase 1: Synthesis

Phase 1 of the project included (a) a comprehensive synthesis of key reliability and TSM&O content, (b) the current state of the practice with respect to KTSs in and outside the transportation arena, and (c) a summary of existing TSM&O-related branding and communication materials. To support these three activities, outreach activities with user and institutional communities were conducted so that the team could gain feedback from key players in the TSM&O area and improve the KTS. Following is

a summary of the main activities that were conducted for each track in Phase 1.

Track A: Content Building

- Task 1: Identified the objective of the relevant research to be synthesized.
- Task 2: Developed a useful structure and format for the content synthesis.
- Task 3: Reviewed available material.
- Task 4: Prepared synthesis report.

Track B: KTS

- Task 1: Reviewed and evaluated knowledge needs in the transportation field.
- Task 2: Reviewed the current state of the practice in KTSs within the transportation field.
- Task 3: Reviewed and evaluated KTS examples from outside the transportation field.

Track C: Branding and Communication Methods

- Task 1: Identified and summarized existing TSM&O-related branding and communications methods and activities.

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- Task 2: Identified and summarized academic community support activities for TSM&O.

Phase 2: Gap Analysis

Phase 2 of the project described the KTS functionalities and identified existing gaps based on knowledge identified in Phase 1. This phase also included the formal establishment of user and institutional community groups as well as formal meetings in order to get feedback on gap filling and KTS functionalities. These community groups were also used to identify important business cases and to help develop the brand that will be used to mainstream reliability and TSM&O. Following is a summary of the main activities within each track in Phase 2.

Track A: Content Building

- Task 1: Identified products necessary for implementing SHRP 2 Reliability research.
- Task 2: Identified remaining gaps in reliability estimation, improvement strategies, and institutional arrangements.
- Task 3: Evaluated content gaps.

Track B: KTS

- Task 1: Identified options for the KTS components.
- Task 2: Identified functions needed for a Reliability/TSM&O KTS.
- Task 3: Prepared a conceptual design of the KTS.

Track C: Branding and Communications

- Task 1: Developed an appropriate segmentation of the target audience.
- Task 2: Identified appropriate business cases by target audience.
- Task 3: Developed the brand.
- Task 4: Prepared a status report on academic curricula.

Phase 3: Gap Filling**Track A: Content Building**

The objective of this phase was to carry out a series of modest-sized projects that would result in a more comprehensive,

useful, and usable KTS. The projects to be performed resulted from the gap analysis effort conducted in Phase 2 and included a mix of synthesis, analysis of data already collected for SHRP 2 research, limited analytics, limited simulation, and limited additional field data collection as needed. The product of the Phase 3 effort was a synthesis report or guidebook for each gap-filling project.

Track B: KTS Prototype and Specs

- Task 1: Reviewed gap-filling materials from other tracks.
- Task 2: Determined the content structure of the web-based component.
- Task 3: Identified website considerations and specifications.

Track C: Product and Brand Testing

- Task 1: Gathered user network reaction to product and brand definition.
- Task 2: Created consensus and commitment for long-term implementation.

Phase 4: Build and Test the KTS**Track B: Build and Test the KTS**

- Task 1: Incorporated synthesis and gap-filling content that was previously developed into the final KTS structure.
- Task 2: Developed the website component of the KTS.
- Task 3: Beta tested the KTS.
- Task 4: Developed KTS documentation.
- Task 5: Prepared the implementation academic white paper.

Track C: Communication Strategies and Materials

- Task 1: Developed web content to support the KTS.
- Task 2: Developed communications samples.
- Task 3: Reported on the state of academic curricula.
- Task 4: Developed the communications strategy.

The remainder of this final report is divided into three chapters: Chapter 2, Existing Reliability/TSM&O Content; Chapter 3, Knowledge Transfer System; and Chapter 4, Branding and Communication.

CHAPTER 2

Existing Reliability/TSM&O Content

Approach

There is a large and still-growing set of reports, papers, presentations, and other documents available to anyone who begins to look into the specific area of travel time reliability within the larger umbrella term of Transportation Systems Management and Operations. This fact alone defines an important and intimidating barrier for newcomers to the field. There is so much information available from so many different sources and in so many different formats that it is difficult for newcomers to quickly and efficiently distill these resources into the relative few that collectively define the current state of the practice within this fast-evolving field.

With this thought in mind, the project team began by recognizing that its experience in the field and its knowledge of which existing resources fall into the “Tier 1” category of being seminal works describing the state of the practice would be valuable contributions toward mainstreaming reliability and TSM&O into everyday practice. Therefore, the project team spent considerable effort in identifying and selecting a specific set of documents for review that, in its judgment, fall into the Tier 1 category defined previously. In addition to helping the target user community find easier access into this emerging field, this select set of documents also provides the project team with insight into both the knowledge gaps remaining to be filled and their relative importance to a useful and functional knowledge database.

The document selection process involved several iterations among the team members in order to identify the most relevant existing documents. The document list was refined through a series of internal team meetings. Although the document list is not considered final at this point, the team believes that the selected documents capture the essence of the current state of the practice of Reliability and TSM&O.

The process started with the team evaluating all the active and concluded SHRP 2 Program projects under the Reliability focus area. In addition, six projects under the Capacity focus

area were identified as relevant to Reliability and TSM&O. Two projects under the Renewal focus area and one project under the Safety focus area were considered to have useful information to the existing knowledge base. As a result, 21 projects from the SHRP 2 Program (12 from Reliability, six from Capacity, two from Renewal, and one from Safety) were selected to be included in the synthesis summary task.

In addition to the SHRP 2 projects, other significant reports and documents that collectively define the current state of the practice in the areas of Reliability and TSM&O were also reviewed and evaluated. These are referred to as Tier 1 documents because of their current importance and stature in defining the Reliability/TSM&O state of the practice. The documents that were selected included publications from FHWA, state DOTs, selected websites, and other research documents and papers. As a result, 34 additional documents were added to the final list for review. Thus, 55 documents were reviewed. The complete list of these documents is provided in Appendix A.

The document review process involved assigning each of the 55 documents to team members based on their areas of expertise and involvement with the document production. As part of the document review, a high-level overview was prepared for each of the documents according to the following topical areas:

- Summary of the work;
- The project’s recommendations for future research;
- Practical application procedures and opportunities;
- Caveats or limitations associated with the key products and findings; and
- Related work that may also be of interest.

In order to concentrate the review process output in a single location, the team developed a synthesis web-based tool in which to enter the results of the document review process and easily access and summarize the information.

Organizational Taxonomy

Before the document review began, an organizational taxonomy was created to classify and categorize documents according to their focus within the Reliability and TSM&O areas. The purpose of this taxonomy structure was to organize documents into different categories that are familiar to practitioners so that they could easily find and browse the information in the KTS.

The team developed an initial outline for the taxonomy structure using a top-down approach. Team members identified (a) the range of audience types that can be expected and would be encouraged to use the KTS, (b) typical reasons that each audience type would be drawn to the KTS, and (c) the kinds of information each audience type would be seeking from the KTS. This led to an initial taxonomy for the database structure that would facilitate the KTS visit purposes being contemplated. This initial taxonomy was then refined based on subsequent reviews of key reliability-related websites to see how information was disseminated on them. The result was a taxonomy that facilitated the document review process.

The final taxonomy table is structured in three levels, in which Levels 1 and 2 classify the document in terms of content (business processes, strategies and treatments, data and analytic tools). Level 3 classifies the document in terms of information type (guidance, current research, case study). Table 2.1 shows the taxonomy table structure. The taxonomy categories are described in the next subsections.

Business Processes

This category relates to business processes that need to be undertaken by agencies in order to maximize the benefits of incorporating a formal Reliability and TSM&O program into their core structure. The subcategories consist of Planning, Programming/Budget, Performance Measurement, Procurement, and Project Development.

Technical Processes

The technical processes category mainly discusses the need for standards, verification, and validation, while dealing with the implementation of technical and technological aspects of a Reliability and TSM&O program. The subcategories consist of System Architecture/Engineering, Verification and Validation (V&V), Vehicle Technologies/Connected Vehicles, and Standards.

Institutional Issues

The institutional issues category is focused on addressing institutional and human resources challenges in order to maintain a successful Reliability and TSM&O program. The subcategories consist of Leadership, Organization/Staffing, Recruitment/Retention, Funding, Collaboration, and Public-Private Partnership (PPP).

Strategies and Treatments

Several intelligent transportation system (ITS) and related strategies are available to effectively improve and track travel time reliability performance. The key is to identify the most suitable set of strategies and to be able to continuously evaluate how they are affecting travel time reliability. These strategies are divided into the following subcategories: Active Traffic Management/Travel Demand Management/Pricing, Work Zone Management, Integrated Corridor Management, Traffic Incident Management/Emergency Transportation Operations, Road Weather Management, Arterial Traffic Control Device Operations, Freeway Operations, Freight Management Operations, Traveler Information, and Roadway Geometric Design.

Data and Analytic Tools

A fundamental way that travel time reliability can be improved is through the proper use and evaluation of existing data. Several innovative ways to handle and predict data, estimates of the economic benefit of travel time reliability, and methods for data collection and management can be found in this category. The subcategories are as follows: Reliability Predictive Methods, Evaluation of Operations Strategies, Data Collection and Management, Performance Measurement, and Economic Analysis of Reliability/Costs and Benefits.

Outreach and Marketing

Marketing Reliability and TSM&O is an important component of making policy makers, decision makers, practitioners, and the traveling public aware of the benefits provided by implementing programs that address nonrecurring disruptions on traffic. This taxonomy category was further divided into the following subcategories: Business Cases, Branding, and Communicating Reliability Information.

Education

The educational component of Reliability and TSM&O is fundamental to train local agencies' staff and to incorporate this concept in early stages of transportation engineering careers. The subcategories for this level are Course Curricula and Training Programs.

Important Remaining Gaps

After the taxonomy structure was defined, each document was assigned to one or more cells in terms of content and information type. After all documents were reviewed, each cell of the taxonomy table was populated so that initial gaps in the literature could be identified. Figure 2.1 illustrates the number of documents available for each cell in the

Table 2.1. Taxonomy Structure

Level 1	Level 2	Level 3 - Information Types					
		Guidance/ Standard/ Policy	State of Practice/ Current Research	Case Studies	Cost and Benefit Database	Facts and Stats	New Stuff
Business Processes	Planning						
	Programming/Budget						
	Performance Measurement						
	Procurement						
	Project Development						
Technical Processes	System Architecture/Engineering						
	Verification and Validation (V&V)						
	Vehicle Technologies/Connected Vehicles						
	Standards						
Institutional Issues	Leadership						
	Organization/Staffing						
	Recruitment/Retention						
	Funding						
	Collaboration						
	PPP						
Strategies and Treatments	Active Traffic Management/Travel Demand Management/Pricing						
	Work Zone Management						
	Integrated Corridor Management						
	Traffic Incident Management/Emergency Transportation Operations						
	Road Weather Management						
	Arterial Traffic Control Device Operations						
	Freeway Operations						
	Freight Management Operations						
	Traveler Information						
	Roadway Geometric Design						
Data and Analytic Tools	Reliability Predictive Methods						
	Evaluation of Operations Strategies						
	Data Collection and Management						
	Performance Measurement						
	Economic Analysis of Reliability/Costs and Benefits						
Outreach/Marketing	Business Cases						
	Branding						
	Communicating Reliability Information						
Education	Course Curricula						
	Training Programs						



Figure 2.1. Taxonomy table summary. Black areas are not applicable (NA).

matrix. Using this matrix, the team was able to identify information gaps in specific categories as discussed in the next subsections.

Business Processes

For business processes there is a lack of benefit and cost information regarding the implementation and maintenance of a successful Reliability and TSM&O program.

Technical Processes

There is a lack of case studies related to technical processes.

Institutional Issues

Documentation addressing recruitment under institutional issues was not found during the synthesis. In addition, facts and statistics for one-half of the subcategories were not found for this level.

Strategies and Treatments

This category is probably the most well-covered topic, given the range of documents that discuss the application of ITS and related strategies to improve travel time reliability.

Data and Analytic Tools

Under data and analytic tools, more facts and statistics are needed.

Outreach and Marketing

Few business case documents were found.

Education

This is the category with the fewest number of documents. This is an important gap to be filled in order to spread the knowledge of Reliability and TSM&O and to make these programs successful.

In general terms, sufficient qualitative information (Guidance and Standards, State of the Practice) has been found across most of the main categories. However, quantifying benefits on travel time reliability, especially when it comes to business and institutional (agency-related) matters is a major gap that has been identified.

In addition to identifying the number of documents that apply to each subject area in the taxonomy table, the project team assessed the quality and depth of material in each document. To conduct this assessment, the team conducted

a high-level review of the contents of each of the 55 documents. Appendix A provides a list of the documents and a brief summary of many of them.

Key Gap-Filling Options and Recommendations

This section describes the results of the team's Phase 2 gap analysis effort. The goal of this activity was to establish a set of gap-filling projects to conduct in Phase 3 following approval from the TETG. The team prioritized the overall list of gap-filling projects, recognizing that not all gaps will be able to be filled as part of the SHRP 2 L17 project. This effort focused on gaps that needed to be addressed to effectively mainstream TSM&O practices. Gaps were identified by considering the primary needs and barriers the target audiences face in terms of understanding the value of operational strategies to improve reliability and implementing these operational strategies.

The products from the gap-filling activities complemented the framework of the KTS produced as part of this project. However, the gap-filling activities were not intended to address implementation of other SHRP 2 Reliability products. The SHRP 2 product implementation gaps were identified as part of a separate effort being led by SHRP 2 in connection with a Reliability Program Workshop held in Irvine, California, in March 2011.

A multistep process was undertaken to develop the list of recommended gap-filling projects. First, a half-day brainstorming session was conducted as part of a working meeting to identify and discuss gaps in TSM&O. Following the meeting, a summary of gaps was circulated among team members and discussed and modified as part of weekly conference calls. From this effort, 12 gap-filling projects were identified. For each of these projects, a one-page research problem statement was prepared. Following completion of these problem statements, the gap-filling projects were prioritized and the set of recommended projects for Phase 3 was identified. Projects were prioritized both in terms of need and also of their feasibility within the schedule and budget constraints of the project. Table 2.2 summarizes the 12 gap-filling projects identified by the research team. The projects shaded in gray represent the high-priority projects that were carried out in Phase 3.

As shown in Table 2.2, a total of six projects were carried out in Phase 3. These projects addressed communication needs (Projects 1 and 6), technical guidance (Projects 2, 4, and 5), and program and budgeting (Project 3). Two additional projects were identified as high priority (Projects 7 and 8). Project 7 has become SHRP 2 Project L31. Project 8 was funded through the Capacity area of the SHRP 2 program. The results of this project were included in the SHRP 2 Project L17 KTS. Projects 9,

Table 2.2. Gap-Filling Projects

#	Description	Objective	Product	Schedule in Months	Priority for L17
1	Persuasive TSM&O Case Study Briefing Book for Decision Makers	To provide compelling examples from state and regional experience that support the benefits of TSM&O in terms that are directly relevant to decision makers.	Mini briefing book for decision makers	9	High
2	Deployment Guidance for TSM&O Strategies	To provide guidance for matching the deployment of TSM&O strategies to institutional, highway, and traffic conditions.	Guidebook	9	High
3	TSM&O Program and Budget Development	To develop guidelines for determining short-term programs and budgets as well as procedures for identifying long-term needs for TSM&O within an agency.	Guidebook	9	High
4	Standard Evaluation and Reporting Procedures for TSM&O Strategies	To provide guidance on how to conduct field evaluations of operations strategies and to use the results both internally and externally.	Guidebook	6	High
5	Synthesis on Valuing Travel Time Reliability	To provide interim guidance on how to value travel time reliability until a full-scale research project is completed.	Guidebook	6	High ^a
6	Key Sub-Audience Business Case and Communication Strategies to Support Mainstreaming of TSM&O	To develop business case and communication strategies for up to an additional six sub-audiences to supplement brand, communication strategies, and sample materials being developed as part of the L17 scope.	Business cases and report	6	High
7	Development and Delivery of CEO Workshops	To conduct workshops for new CEOs and Chief Engineers to demonstrate TSM&O benefits and successful practices.	Workshop materials and briefing report	9	High ^b
8	Integration of Operations into Transportation Decision Making	To provide technical staff and policy makers the decision-making structure and supporting information needed to integrate consideration of operational improvements into overall transportation decision making during planning, programming, corridor planning, and NEPA/permitting.	Separate application in TCAPP	12	High ^c
9	TSM&O in the “new context of” constrained transportation improvements	To provide resource material that focuses on identifying the set of recent changes in the context for transportation improvement—state and regional—that have constrained conventional (capacity) improvements and imply greater need for focus on efficient and effective operations of the existing network. The material would be designed to be used by policy and planning staffs.	“Responding to Constraints” handbook and related web material	9	Medium
10	Development of a TSM&O Course	To develop course materials for one graduate-level course on TSM&O.	Course material and “train-the-trainer” material	9	Medium
11	Guidance and Application Procedures for Predicting the Performance of TSM&O Strategies	To develop guidance for applying analysis, modeling, and simulation tools in the evaluation of emerging TSM&O strategies.	Guidebook	12	Low
12	Facts and Stats for TSM&O	To summarize readily available quantitative information regarding implementation statistics, benefits, and costs of TSM&O strategies to incorporate in the KTS.	Database and report	6	High

Note: Shaded rows represent recommended gap-filling projects for L17 Phase 3. NEPA = National Environmental Policy Act of 1969; TCAPP = Transportation for Communities—Advancing Projects through Partnerships.

^a A full-scale follow-on project is recommended for developing a recommended practice for valuing travel time reliability.

^b This project has been replaced by Project L31.

^c This project became part of Project C01.

10, and 11 were judged to be of low or medium priority and were not pursued at this time. The facts and statistics described in Project 12 were provided in the case study briefing book pages (Gap-Filling Project 1) and the business case primer (Gap-Filling Project 6).

Following an initial review of the gap-filling projects by the TETG at the June 28–29, 2011, meeting in Washington, D.C., the TETG recommended further analysis to examine potential overlap and conflict with other SHRP 2 activities. Accordingly, the project team conducted a detailed assessment of all products being produced from all projects in the SHRP 2 Reliability program (including Projects L1 through L17), the proposed gap-filling projects (GF Project 1 through GF Project 12), and the planned development projects approved by the SHRP 2 Oversight Committee. The project team identified “go-to” products for each of the taxonomy cells shown in Figure 2.1. A go-to product is one that practitioners would refer to as a primary source of information to address a question on a particular topic. The results of this mapping exercise confirmed that the proposed gap-filling projects do not overlap with other ongoing or planned SHRP 2 research activities, and that each of the gap-filling projects addresses an identified gap, as shown in Appendix B.

Gap-Filling Project Summaries

The gap-filling projects were conducted during Phase 3 to supplement the information contained on the KTS so that it would provide a more comprehensive, useful, and usable source of information for TSM&O. The results of these efforts were a set of guidebooks and reports describing a synthesis of practice. These documents are posted on the SHRP 2 website at <http://www.trb.org/main/blurbs/169243.aspx>. A broad overview of the contents of each document is provided next.

GF PROJECT 1—Persuasive TSM&O Case Study Briefing Book for Decision Makers

Many key decision makers in transportation—whether elected or appointed—have a modest background in transportation. (Among state DOT CEOs, 50% come from outside transportation and serve for an average of 2.5 years.) It is important, therefore, to provide information that presents the payoffs from increased program attention and investments in TSM&O in terms that are related to both the external and internal policy environment for such decision makers. This project used some existing best-case examples that relate the advantages of TSM&O. The examples were organized to deal with the range of state and regional contexts (large versus small, urban versus rural) and with policy, program, and resource issues that are typically facing decision makers. The material was tightly

organized; heavy on examples, graphics, and illustrations; and designed for the nontechnical decision maker audience. The product from this effort was a series of single-page summaries (referred to as briefing book pages) that provide compelling examples from state and regional experience that support the benefits of TSM&O in terms directly relevant to decision makers. These pages are shown in Appendix C.

GF PROJECT 2—Deployment Guidance for TSM&O Strategies

A common question posed by operators who already have TSM&O activities under way is, where do we deploy next and what do we deploy? Guidance is needed to support agencies in deciding what, when, and where TSM&O strategies should be deployed, both in the short term and in the long term. To accomplish this objective, a synthesis of current practice was undertaken through a series of case studies with state operations personnel. Specifically, the following issues were addressed:

- What would agency personnel like to know to further enhance the deployment strategies and the logistics of deployment?
- What funding issues are faced in trying to expand deployment and how have they been resolved?
- What strategies are considered when funds become available or authorized? What are the gaps in knowledge about how best to deploy them when ready?
- For a recent deployment example, what were the conditions and context of the application?
- To what degree have technical and analytic procedures been applied to deployment planning?
- What deployment strategies are not producing the desired results?
- What other agencies or entities would benefit from further cooperation in order to integrate dynamic strategies like incident management and work zones?
- What other issues have occurred with current deployment strategies?
- Have other agencies influenced current deployment procedures?
- What lessons were learned from early experience and how did deployment processes change based on these?

Based on the case studies, the project defined several general approaches or models that states have used in deployment planning, including both formal and informal approaches. In addition to the synthesis of the practice, this project also defined the structure for a more detailed guidebook on this subject.

GF PROJECT 3—TSM&O Program and Budget Development

Other functional areas (e.g., pavements, safety, and bridges) have long-standing procedures for developing annual programs and budgets and for identifying their long-term needs in the periodic needs assessments conducted by state DOTs. No comparable processes exist for TSM&O. Planning documents such as deployment plans and architectures exist but are usually disconnected from annual program and budget development and are not well integrated into the same needs identification process as other functional areas. This project created guidance on how annual TSM&O programs should be developed, particularly in light of the trend toward performance-based management of the transportation system. Because TSM&O strategies address both congestion and safety concerns, it is imperative that a cross-cutting approach be developed so that a TSM&O program is integrated with those of planning, construction, and safety. In the long term, the analytic process that determines future transportation needs must also account for TSM&O. Budget development is critical to the long-term success of TSM&O programs. Gap-Filling Project 2 considered budgeting as part of the deployment planning process. However, securing funding is so vital that this project took a more in-depth look at the subject.

GF PROJECT 4—Standard Evaluation and Reporting Procedures for TSM&O Strategies

Operators are increasingly being asked, what benefits have we received from our TSM&O activities? Ongoing performance monitoring systems are just now being deployed to help answer that and other questions, but many issues remain. There is no standard way of developing performance measures or collecting and managing data from different sources. Past evaluations have used a variety of data and methods, making it difficult to identify exactly what the benefits of operations are and how the results can be applied in different situations. Without standardized guidance, different agencies are likely to develop their own particular approaches, a situation which can pose problems in uniformity, consistency, and data validity. It is highly important to ensure that evaluations are done with rigor and that they use consistent methods. This is to ensure that the results will be transferable to other areas. With the passage of the MAP-21 legislation (and its emphasis on performance management of the highway programs), guidance on conducting evaluations will be valuable to practitioners. Project evaluations will be a key component of a performance management system and are a valuable adjunct to systemwide trend monitoring. Evaluations of deployed TSM&O strategies are being promoted as a major part of ongoing performance monitoring programs. The results of evaluations can be used as a way to promote TSM&O. Finally, a standard method for reporting the

results would demonstrate how TSM&O improvements provide cost-effective solutions to congestion and safety problems. This synthesis of current practice provided guidance on how to conduct field evaluations and how to use the results both internally and externally.

Gap-Filling Project 4 produced a guidebook that presents a step-by-step procedure for conducting before-and-after evaluations of operations strategies. It included defining a standard set of performance measures, data processing methods, controlling for external factors, and comparative analysis techniques.

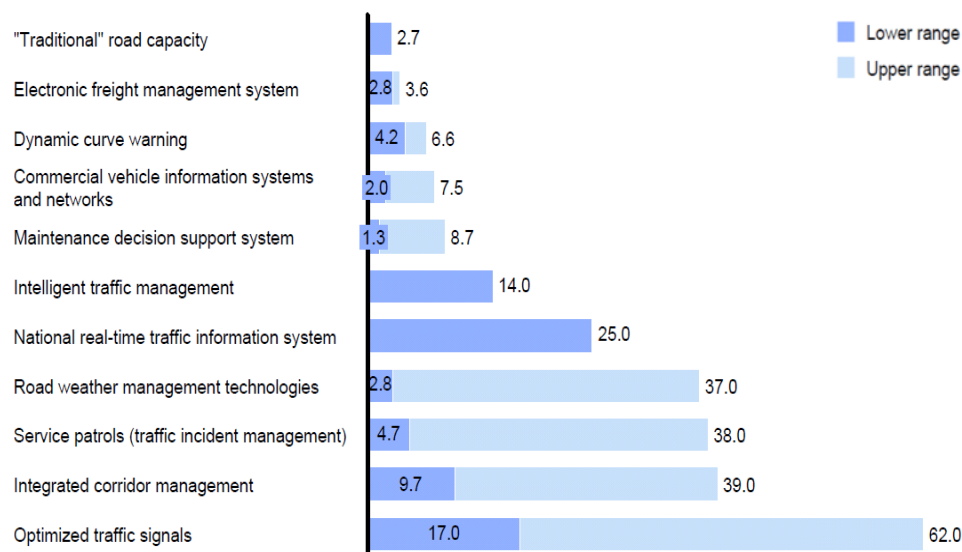
GF PROJECT 5—Synthesis on Valuing Travel Time Reliability

There have been various methods suggested for valuing travel time reliability. These methods include (1) quantifying the value of travel time based on stated preference surveys, (2) quantifying the value of travel time based on revealed preference travel logs, and (3) applying the value of time to changes in measured travel time after the application of TSM&O treatments. The third method is referred to as the options theoretic approach. Associated with each of these methods are widely varying levels of real-world experience, case-study experience, or both. The extensive amount of international experience that has already been accumulated in this area is not yet well recognized in the United States. Comprehensive resolution of this issue would involve a separate SHRP 2 Reliability research project. In the interim, a methodology is needed that provides guidance to practitioners in their day-to-day practice. This project summarized domestic and international experiences into a set of best-practice recommendations on how to value travel time reliability until the full-scale research project is completed.

GF PROJECT 6—Key Sub-Audience Business Case and Communication Strategies to Support Mainstreaming of TSM&O

The purpose of the branding and communication track of the SHRP 2 L17 project was to develop business cases and sample communication materials that can support the mainstreaming of TSM&O at federal, state, and regional transportation agencies. The SHRP 2 Project L17 scope included the development of the business case and sample communication materials for three primary target audiences:

1. *Investment Decision Makers*: policy-level decision makers at any level (federal, state, and regional) and mid-managers who have primary responsibility for recommending investment priorities to policy decision makers.
2. *Implementers*: practitioners who work at all government levels (federal, state, and regional) from all disciplines,



Source: *Intelligent transportation systems*, Capitol Research, Council of State Governments, April 2010; *Transport for London, 2007*; *Intelligent transportation systems benefits, costs, deployment, and lessons learned desk reference: 2011 update*, U.S. Department of Transportation, September 2011; *Urban mobility plan*, Seattle Department of Transportation, January 2008; McKinsey Global Institute analysis.

Figure 2.2. Strategies and payoffs of TSM&O.

including multiple types of engineering, planning, district, headquarters, and transportation management center managers and staff.

3. *Travelers*: passengers and freight.

While the high-level business case for each of these individual target audiences is similar, these audiences are very broad. The goal of supporting mainstreaming TSM&O can be advanced by the development of more tailored business cases and sample materials for key sub-target audiences. The objective of this project was to supplement the current SHRP 2 Project L17 scope to identify up to six “sub-audiences” that are most essential to driving TSM&O integration and developing business cases, communication strategies, and sample materials to address these audiences. Sub-audiences may include specific positions at a transportation agency such as the district engineer, senior planner, or other positions identified as central to advancing the TSM&O brand. The materials that were developed for these sub-target audiences were integrated into the business case primer (discussed in Chapter 4).

GF PROJECT 8—Integration of Operations into Transportation Decision Making

The traditional state DOT decision-making processes for planning, selecting, and funding capacity and operational improvements have been disconnected. Capacity and operational improvements frequently rely on separate funding sources, sometimes on different time cycles, and usually involve

different technical staff and decision makers. In recent years, the transportation industry at the federal, state, and regional levels has focused on the impact that operational improvements can have on mobility, particularly in congested areas. The remaining challenge is to integrate operations across the industry by having each state DOT or metropolitan planning organization take this information and apply it to its specific technical and funding decision-making processes. The objective of this project was to incorporate the operational improvement decision-making process into the Transportation for Communities—Advancing Projects through Partnerships (TCAPP) web tool so that practitioners understand how to systematically identify and evaluate operational improvements as a part of the overall transportation decision-making process. The result of this effort was a systematic “how-to” guide that is flexible and adaptable enough for agencies to tailor to their individual needs.

Documentation was assembled to quantify the effectiveness of TSM&O treatments. These treatments have a significantly high benefit-cost ratio as compared with traditional roadway expansion. They also lead to significant reductions in delay, incidents, and crashes. Figure 2.2 summarizes these results for 10 TSM&O strategies. The numerical values for each strategy represent benefit-cost ratios that have been calculated for each strategy. Of course, the benefits will vary based on local conditions, but these data clearly demonstrate the beneficial results that operational treatments bring to the roadway system.

For more information on infrastructure productivity, see http://www.mckinsey.com/insights/mgi/research/urbanization/infrastructure_productivity.

CHAPTER 3

Knowledge Transfer System

This chapter of the report discusses the findings associated with Track B of SHRP 2 Project L17, which identified the requirements of a KTS effective enough to support the development of a more reliable transportation system.

Reliability and the Broader Systems Operations and Management Context

An overarching conclusion reached early in this research was that a KTS with significant audience appeal and utility cannot be confined to reliability alone. Reliability is not a stand-alone consideration in practice and policy as well as in DOT program, strategy, or organization. Instead, reliability must be considered within the broader view of TSM&O. The data, methods, and performance measurement considerations related to achieving improved reliability are usually combined with those related to improving capacity, safety, delay, and other performance considerations. The conventional strategies addressing the causes of congestion—both recurring and nonrecurring—are usually intended to affect combinations of these performance indicators. Existing knowledge resources related to reliability [such as the FHWA and Research and Innovative Technology (RITA) websites] are found combined within a range of other related topics. An effective KTS must respond to the reality that the audiences will look for and find reliability material within knowledge resources key to a range of broader, related topics. This “embeddedness” of reliability is a central reality in how reliability is addressed by practitioners and policy makers.

The research team believes that a KTS targeting reliability alone would not be visible or useful to the intended KTS users, given the relative immaturity of TSM&O policies and programs. This broader context is reflected in the current discussion about the value of a “center for excellence” for TSM&O that would provide an active vehicle for promoting and supporting the development of TSM&O-related concepts such as reliability. Therefore, this project assumed that reliability can

be best promoted in a KTS that is focused broadly on TSM&O. Within such a KTS, reliability considerations can be highlighted. In the remainder of this chapter, the focus is on supporting TSM&O as a whole—and reliability within it.

The focus of this track’s work was on developing approaches through a KTS for TSM&O-related knowledge transfer and creating a web-based portal to provide access to this knowledge. However, it is recognized that an effective KTS—in addition to a website—will involve ongoing, managed, face-to-face activities. Issues and options for non-web-based activities are identified, but no specific recommendations were offered for these components of a comprehensive KTS.

Overarching KTS Framework

The identification of the requirements, options, and evaluation criteria for an effective KTS followed a general systems engineering approach. The mission of the KTS in terms of its presumed program and institutional operating environment is identified as shown in Figure 3.1. User needs are identified in terms of the range of audiences. The framework shown in Figure 3.1 considers the following:

- The kind of knowledge that needs to be transferred to support key audiences (in support of Track A).
- A review of the existing KTS activities and media (in support of Track C).
- The functional requirements for knowledge transfer.
- Specific categories of knowledge and the user-related criteria that must be met for an effective KTS.
- Existing KTS activities that can be reviewed for strengths and weakness.
- A series of options for overcoming the identified gaps.

An incremental approach to the rollout and implementation of the KTS was proposed, one that could be initiated immediately to accommodate the need to make SHRP 2 Reliability

products available as soon as practical and that can be adjusted as experience and needs dictate.

The mission of the KTS in terms of its presumed program and institutional operating environment was identified. User needs were identified in terms of the range of audiences. The functional requirements for knowledge transfer were identified in terms of specific categories of knowledge and the user-related criteria that must be met for effective KTS. Finally, existing alternatives were reviewed for strengths and weakness and, in light of this gap analysis, a series of gap-filling projects was proposed.

Figure 3.1 indicates the relationship between the SHRP 2 Project L17 Reliability research and other SHRP 2 Reliability projects. After interim or final products of other SHRP 2 projects are reviewed and finalized, they can be incorporated into

the web-based KTS and structured within the appropriate knowledge category for ease of access.

Knowledge Domain of Interest and Context

Improving knowledge transfer regarding reliability must take place within the institutional setting where the relevant information can be put to use. In the policy, practice, and institutional arrangements of transportation agencies, pursuit of reliability is in a set of strategic conventions focused on real-time operational management of the roadway network— together known as TSM&O.

Reliability is seldom a stand-alone focus of transportation policy or practice. Reliability-related data, methods, guidance, training, strategies, and other results from SHRP 2 research

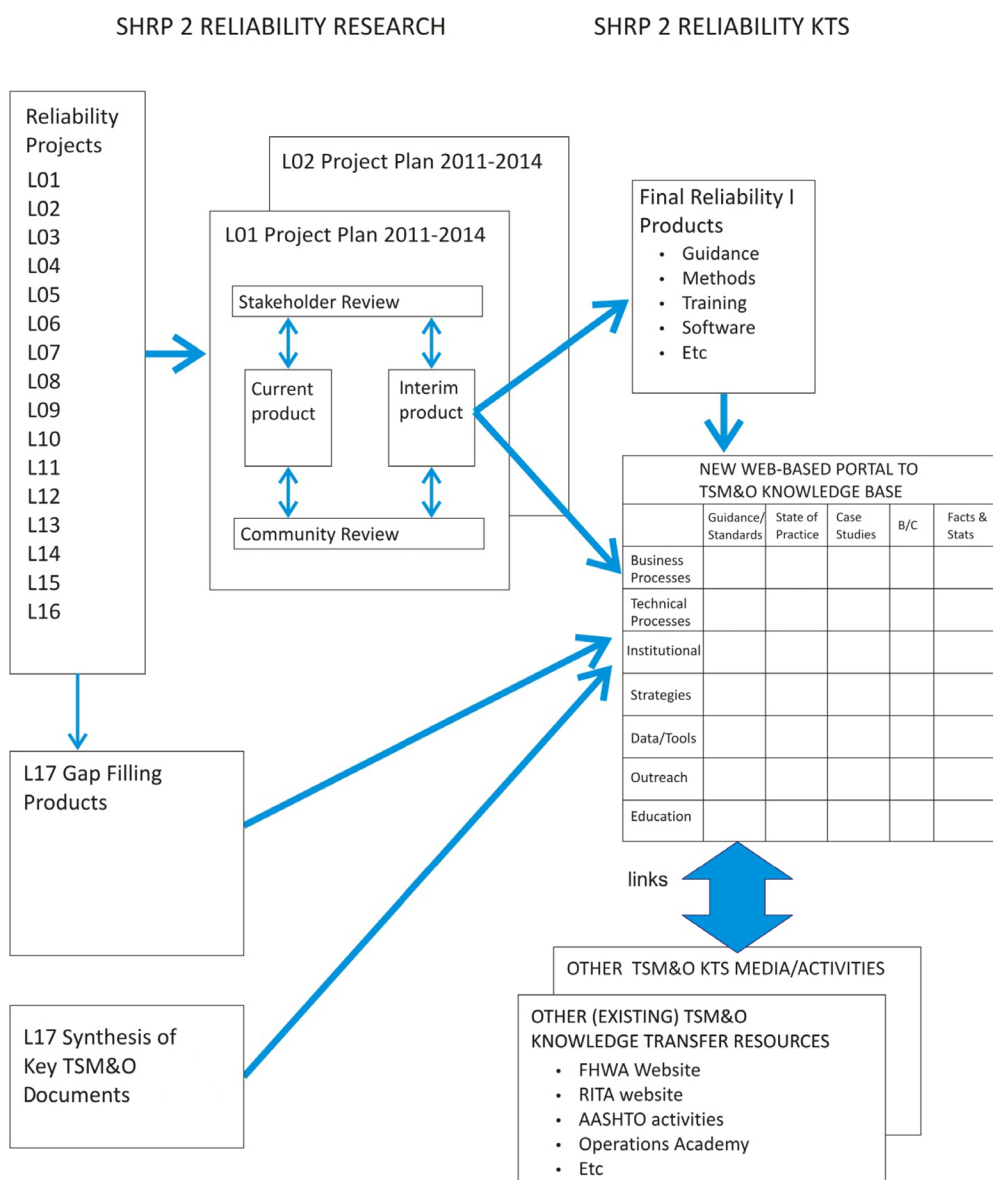


Figure 3.1. KTS framework.

can be appropriately positioned in the context of the knowledge framework of TSM&O—as perceived by key user audiences. An effective KTS must relate to the institutional context of practice that focuses on TSM&O and place reliability in the appropriate real-world context.

While congestion expressed in terms of travel time delay is widely recognized as a problem, the disruptions caused by unpredictable incidents (nonrecurring congestion) is less well understood. Most agencies have some activities addressing the principal problems—typically embodied in a TSM&O program.

The state of the practice regarding roadway TSM&O (and reliability within it) is developing and uneven, hampered by lack of an organized KTS. The substantive technical coverage of a KTS that includes reliability must incorporate the scope of current practice related to TSM&O. That technical coverage also must recognize that many process and institutional features required to support effective TSM&O, related both to recurring and nonrecurring congestion, are not congruent with current practice and yet must be included.

Audiences

The knowledge of interest is directly related to the interests of the users and the creators of the knowledge. Thus, a KTS must be developed with their needs and interests in mind, and in light of the key relations among them. There are four principal audiences: practitioners, policy makers, researchers and educators, and the public at large.

Practitioners who are involved in development and delivery of strategies related to TSM&O constitute the major user and the key target of a KTS in terms of the short-run objective of improving the state of the practice that affects the level of transportation system reliability. Practitioners include public agency transportation professionals and managers at all levels of government whose involvement may range from planning to design to field operations. They also include individuals in closely related fields within agencies such as maintenance and traffic engineering. Practitioners also include those in non-transportation entities with jurisdiction over key elements of roadway level of service related to reliability, law enforcement, and emergency response activities (with transportation agency support). Finally, practitioners also include private providers of both technology and services.

Policy makers provide an authorizing environment that supports both organized practice and research. Transportation agencies exhibit a wide variation in understanding and interest regarding TSM&O at the policy level, reflecting agency transportation context, culture, and the technical exposure of the leadership.

Researchers and educators as an audience are typically based in an academic, research entity, or consultant setting. They are

responsive to, and even dependent on, the level of policy and programmatic interest within the transportation community overall. Given their academic position, the researcher audience overlaps substantially with educators focused on undergraduate or graduate education.

The traveling public (including private transportation enterprise) has a largely unarticulated interest in TSM&O, even though it may be suppressed by an assumption that delay and unreliability are inevitable and their causes unmanageable. The commercial transportation community has a more compelling and economic interest, and it conventionally employs several reliability-related strategies to cope with the current transportation levels of service. In both cases, the growing availability and quality of real-time travel condition information increase their awareness of reliability and their significance as an audience.

Audiences exist more or less as “communities of practice,” united by members’ common interest in a particular domain or area and by the members’ involvement in the development and sharing of information and experiences. Communities of practice can be important mechanisms for knowledge transfer. They include members of associations (such as AASHTO, ITS America, or I-95 Corridor Coalition), graduates of the Operations Academy senior management program, the incident management community [National Traffic Incident Management Coalition (NTIMC) and National Transportation Operations Coalition (NTOC)], and members of a particular agency, government, or private entity.

Knowledge Transfer Systems

As discussed in the previous chapter, the project team began by listing 12 basic categories of knowledge for any given topic:

- *Definitions and FAQs*: terminology describing TSM&O-related phenomena, practices, programs, and strategies.
- *Access to ongoing and completed research*: searchable access to research activities and products.
- *Technical understanding and analytic tools*: descriptions and measurements of traveler behavior and traffic dynamics in response to both supply and demand characteristics and changes, as well as related methods for analysis, forecasting, and evaluation.
- *State of the practice as documented in case studies, lessons learned, and success stories*: organization of relevant policy and program practice experience in transferable and useful form.
- *Facts and statistics*: material recording and organizing phenomena and institutional characteristics and practices, including deployment databases.
- *Standards and regulations*: commonly accepted industry approaches regarding systems, technology and practices, and relevant federal or state regulations.

- *Cost and benefits database*: measures of implementation resource requirements and outputs and outcomes in transferable form.
- *Guidance*: oriented to program, technical, and business processes and institutional factors.
- *Outreach and marketing*: executive persuasive support (rationale and justification); materials organizing information in a form that provides policy, program, and resource support for TSM&O.
- *Current professional activities*: calendared notification/description of activities of interest, including speakers bureaus and expert interviews.
- *Technical and peer interaction and support*: peer-to-peer interchange and support opportunities.
- *Education and training*: information resources regarding current educational and training activities.

While these categories might be combined or further stratified in one manner or another, each is very important to one or more audiences, and each must be accommodated in a comprehensive KTS. Each of these categories may have reliability-related information or have such information developed. The material appropriate to many of these categories is currently modest or nonexistent.

Definition of an appropriate TSM&O KTS must relate substantive topics of interest to the various categories of knowledge appropriate to each topic for the relevant audience. The knowledge categories that need to be accessed and made transferable fall into two classes: explicit (documented) or implicit/tacit (experience, anecdotes).

Given the rapid and uneven development of the state of the practice, methods to capture and disseminate implicit knowledge must be incorporated as preconditions to effective dissemination. A KTS is more than a passive repository of useful information. The full range of TSM&O KTS activities, which



Figure 3.2. KTS activities.

include both “pre-transfer” (such as extracting and organizing) and “post-transfer” (such as management and updating), should be considered as shown in Figure 3.2.

A set of criteria has been developed that characterize an effective, functioning KTS. The criteria are relevance, comprehensiveness, user tailored, accommodating, up-to-date, easy to find, easy to use, promoting community, providing learning opportunities, and stimulating involvement.

With regard to the particular medium used to transmit this information, a range of options exist for the effective transfer of both explicit and implicit knowledge. Table 3.1 lists these options and indicates the relative strengths of both electronic and live KTS. As an example, social media are becoming an increasingly prevalent mode of knowledge sharing and should be part of a comprehensive KTS.

Table 3.1. Relative Strengths and Weakness of KTS Media

	Captures Explicit	Captures Tacit	Easy to Update	Ease of Use—Tailoring	Ease of Access	Builds Community	Ongoing Management
Publications	✓						✓
Subscriptions	✓						✓
Conferences/Workshops		✓		✓		✓	✓
Training	✓					✓	✓
Surveys	✓	✓		✓			✓
Expert/peer advice		✓		✓		✓	✓
Websites, including those with dialogue	✓		✓	✓	✓	✓ (partial)	✓
Wikis		✓				✓	✓
Social networks		✓	✓	✓	✓	✓	✓

Best Practices

Current State of Play in TSM&O-Related KTS

Existing knowledge related to TSM&O (and reliability) that is technical and explicit is available through extensive media (e.g., websites, publications) or existing organizations—especially those of the FHWA Office of Operations as well as the RITA ITS Joint Program Office (JPO). This includes technical understanding and analytic tools, state of the practice (case studies and lessons learned), facts and statistics, standards and regulations, and a cost and benefits database as set forth previously.

Nine existing websites were identified that include material related to reliability. However, these sites focus on the provision of TSM&O knowledge resources and seldom address reliability as a stand-alone topic:

1. FHWA Office of Operations Main Site: <http://www.ops.fhwa.dot.gov/index.asp>.
FHWA Office of Operations web-page subject pages: <http://www.ops.fhwa.dot.gov/prgmdirectory.htm>.
2. RITA ITS: <http://www.its.dot.gov/>.
RITA ITS Resources Pages: <http://www.itslessons.its.dot.gov/its/itsbcllwebpage.nsf/krhomepage>.
ITS/Operations Resource Guide 2009: http://www.its.dot.gov/press/announcement/resource_guide.htm.
3. I-95 Corridor Coalition: <http://www.i95coalition.org/i95/Default.aspx>.
4. AASHTO Subcommittee on Systems Operations and Management: <http://ssom.transportation.org/Pages/default.aspx>.
5. ITS America: <http://www.itsa.org/>.
6. Institute of Transportation Engineers (ITE): <http://www.ite.org/M&O/default.asp>.
7. NTOC: <http://www.ntoctralks.com/index.php?PHPSESSID=a1607e7ce8b6b7e81e56d0fa1dd5739e>.
8. NTIMC: <http://ntimc.transportation.org/Pages/default.aspx>
TIM Network: <http://sites.google.com/site/timnetworksite/>.
9. AASHTO Transportation Systems Management and Operations Guidance: <http://www.aashtotsmoguidance.org/>.

Several of the 12 categories of knowledge important to more effective TSM&O—especially nontechnical—are not well supported by the existing TSM&O-related websites or other KTS activities. These include definitions, FAQs, outreach and marketing, and guidance. Tacit knowledge (currently undocumented or anecdotal) is also not systematically captured or transferred beyond various ad hoc methods that are web based and include some training, and those domain-wide activities that are not coordinated.

Live interchange takes place via conferences and workshops, professional capacity building, peer interchange, and limited

online dialogue. The topics and scheduling are ad hoc and uncoordinated. The awareness of these activities is supported by the sponsors' websites with limited centralized compilation.

There is no current systematic activity to identify and fill the gaps represented by the missing knowledge categories highlighted in this report relating to TSM&O overall, especially related to policy audiences (FAQs, definitions, outreach and marketing), the capture of undocumented tacit knowledge, systematic dialoguing, and community building. With regard to reliability within a TSM&O framework, an initial contribution to the explicit categories of knowledge is being made by the SHRP 2 Reliability program.

Substantively, there is only modest criteria-based screening on existing websites. Those documents that are synthesized may not be useful or up to date for key audiences. Dated material is not removed. Much of this material is also available through publications.

Existing TSM&O website activities are supported by the U.S. DOT or via association dues from public or private interests or a combination thereof. Some of these KTS websites and their sponsors, including those in the private sector, have a range of focus beyond knowledge transfer and technical community dialogue such as regulation, lobbying, standards development, investment, and competitive products and services. The sponsors of existing KTS activities have distinct interests and business models. In the public sector, these relate to program support and in the private sector, they relate to member support and loyalty. These orientations influence their knowledge transfer interests.

Implications of the Current State of Play for Future KTS Development

These findings raise several questions that affect the appropriate approach to a KTS:

- No existing website is structured for access to knowledge about reliability specifically. However, it is possible to capitalize on the existing sites and also to supplement them through a web-based tool with the appropriate search mechanism.
- A KTS system focused on reliability alone would be unlikely to have major utility to the intended audiences. Promoting reliability depends on improving access to knowledge (of all types) related to TSM&O in general. A KTS built around this broader scope has the best chance of attracting users.
- There is no single concept or vision regarding the knowledge that key audiences need related to TSM&O. Therefore, a clear, structured approach is essential to ensure key KTS criteria are being met. One possible vision is a web-based tool that provides convenient, one-stop access to the complete range of existing and new TSM&O-related knowledge categories regarding the substantive topics of interest to key

audiences, as well as opportunities for communicating, contributing, and interacting. Such a site would contain all newly created reliability-focused research, tools, guidance, models, and so on, and a search mechanism to find reliability-related material embedded on other existing TSM&O documents.

- Existing KTS activities of FHWA and RITA provide a large amount of explicit knowledge (documentary material). There is no need to duplicate the extensive document libraries that exist on these websites; however, prioritization (by audience) as well as additional synthesis and cataloging or indexing is needed.
- FHWA and RITA have made some important attempts to prioritize and synthesize available material for the practitioner. There are both general categories of knowledge and specific topics that are not provided in either live or electronic form. A strategy needs to be developed regarding the development and provision of the appropriate mix of tacit and explicit knowledge and their coverage by topic area.
- Some audience needs are entirely absent in existing KTS sites. These important gaps need to be filled as part of the TSM&O KTS strategy and appear to be manageable development challenges with only modest resources. Specifically, the existing material emphasizes the needs of practitioners but does not address the needs of planners and senior managers. Existing material also emphasizes the engineering and tactical aspects of the strategies while ignoring management and outreach.
- Existing TSM&O websites offer a substantial core of knowledge and KTS features on which to build a comprehensive KTS, although no single site provides functions that cover all the KTS knowledge categories. A cooperative strategy should be developed among website sponsors to share knowledge resources and to consider features and functions to be added. The success of the Operations Academy listserv demonstrates the importance and value of cooperative features.
- Some sites outside the TSM&O arena have interesting and applicable features. These include access to state-specific materials, various inputting and updating tools, structured menus for search, broadcasts of updates, “find it fast” functions for areas of special current interest, links to blogs, interactive dialogue features, collaborative features for creating and linking to relevant information, home page functionalities such as buttons and cursor-over detailing, audience-specific points of entry to the website, and links to other websites and blogs. Development of a KTS website should consider best practice features.
- Social media may represent an important source of technology transfer and community-of-practice building. Social media are becoming more important among the emerging

audience members. A KTS website should make use of social media, including commercial products, to reach and support audience development.

- Few websites have outreach activities associated with their presence through which their availability and potentially interested audiences are announced.
- An effective KTS requires active management. A business model, including staffing and ongoing resource support, is essential to realize any level of KTS improvement in TSM&O.

Options for Transferring Knowledge

Having identified the topics, categories, media, and qualitative criteria for KTS, a key question remains: Who performs the needed management functions to both establish and maintain the KTS? Before establishing any KTS serving a community of interests, certain management actions must be taken:

- Secure consensus agreement among key knowledge sponsors and providers about role and functionalities of the new KTS.
- Establish an oversight entity.
- Identify and agree on relationships among existing KTS and sponsors.
- Develop a strategic plan for KTS (may be part of the Operations Center of Excellence study).
- Secure sustainable resource commitments.
- Secure appropriate management and staff.
- Prepare the detailed plans that define and specify the overall approach to be used, including functions and technologies.

After establishment of a KTS, there are a set of continuing challenges, as depicted in Table 3.2. The scope of these requirements will, of course, vary depending on the scope of the substantive topics and knowledge categories for topics to be included. It should be apparent that these functions cannot be “automatic” but will require continuous management attention by one or more staff.

The key KTS options that are discussed next will vary regarding their management requirements. Inspection of Table 3.2 suggests the key role that management plays in the several KTS functions and, by implication, what KTS features and qualities would be absent without a high level of day-to-day management.

Recommendations for Implementation

In light of the current state of play and key issues raised, five options were developed as possible ways, either singly or in combination, to fill the KTS gaps for TSM&O (and reliability within it). Each option offered a different combination of

Table 3.2. Key Management Challenges of a KTS

KTS Function	Management Challenge
Identifying domain-relevant knowledge	<ul style="list-style-type: none"> • Staff capability to identify needed knowledge [could be supported by survey and audience participation and use validation (hits)] • Identification of relevant topics and knowledge categories • Policy advisory group and sponsor consideration of target audience, topics, and knowledge categories
Capturing and storing the relevant knowledge	<ul style="list-style-type: none"> • Hosted site • Staff capability and appropriate software • Procedure and priorities to interact with possessors of relevant tacit knowledge • Soliciting contributions
Targeting the audiences and relevant transfer mechanisms	<ul style="list-style-type: none"> • Knowledge captured related to widest appropriate range of discrete audiences • Content stratified by relevance to audience types • Audience media preferences and habits recognized
Organizing knowledge in a way it can be used	<ul style="list-style-type: none"> • Policy decisions regarding hosted information versus linkage • Staff capability to map topics and categories, create syntheses, summarization, formatting, and searches • Allocation of knowledge categories to limited Tier 1 and Tier 2 web pages • Programming capability research mechanisms, visualization, look and feel • Quality control
Sharing/transferring/disseminating the knowledge via appropriate techniques	<ul style="list-style-type: none"> • Hosted and managed websites on sustainable basis • Real-time management of dynamic information (calendar function, training opportunities) • Developing and operating links to social networks
Discussing the transferred knowledge	<ul style="list-style-type: none"> • Real-time management of interactive features (live concierge function) • Real-time management of push and pull features • Knowledge transfer testing by observing its recall, use, and satisfaction
Maintaining, updating, and expanding the knowledge base	<ul style="list-style-type: none"> • Maintaining site links and updating material and/or links in all knowledge categories by topic
Sustaining KTS operations	<ul style="list-style-type: none"> • Budgeting and programming staff, contractor, hosting, and related resources • KTS staff interaction with policy entity

scope and functionality, as well as differing relationships to the existing KTS activities and sponsors:

1. *Support of and modifications to selected existing TSM&O-focused websites.* This approach is designed to supplement existing knowledge transfer activities without the establishment of a separate website. Arrangements would be made to support working with existing KTS sponsors to fill specific gaps in their existing KTS activities. This implies minimal additional management support, depending on the existing management of these sites.
2. *One or more single function websites.* These new websites would provide specific knowledge category resources on separate websites, such as a managed guidance website, a current research website, and a managed practitioner dialogue website (set of topical blogs or groups). This option may require minimal management by virtue of the narrow scope of each site.

Options 3 to 5 introduce significant management responsibilities. Even when the activities are restricted to a website alone, the scope and sustaining requirements suggest a dedicated staff. Option 5 adds activities beyond the web function

that is the focus of this project. However, the center concept with its external and live activities, and with the implied sponsor and sustainability, may have the stronger likelihood of supplying the full range of needed KTS functions.

3. *A comprehensive web-based portal incorporating links to other existing websites.* Such a website provides the best audience-related knowledge in all of the key knowledge categories by combining two approaches: (1) searchable links to related content pages of other existing websites and (2) selective creation of new material.
4. *A new stand-alone comprehensive website.* This website would host the complete range of relevant knowledge categories for all relevant topics. In this fashion, the website would be similar to the FHWA Office of Operations website, but with additional knowledge categories and website functionalities not currently available.
5. *An Operations Center of Excellence, including a web portal and other functions.* This type of KTS would be part of a more broadly managed activity. It would include a managed portal with features similar to that described in Option 3, additional activities to fill gaps, and either links to related

content pages of other websites amplified with a strong “push” orientation or aggressive selection, development, or summation of the types of knowledge seen as relevant to its audiences.

Strengths and Weaknesses of Implementation Options

Table 3.3 offers a preliminary evaluation of relative strengths and weaknesses of the five options, determined by which options provide the desired criteria. It is not surprising that those options that involve the greatest management level of effort can, in theory, provide the most effective KTS. A key challenge will be assessing the trade-offs among these options.

Key Recommendations

The SHRP 2 Project L17 contribution to a complete and functional KTS should be a web-based product. Phase 3, therefore, began by developing an initial version of the site map, site structure, content structure, and functionalities for a TSM&O website. The following recommendations are made on the basis of the analysis presented in this chapter and an evaluation of the five options described previously.

- The portal approach (Option 3) is recommended as the most efficient approach because it combines needed new content with connections to existing resources. This option appears to be the most promising approach both in its structure and scope. It provides a multi-audience single point of entry and navigation capability to existing website materials as well as material that might be created in gap filling. The portal function is also important for audiences other than the experienced practitioners. Finally, the portal option leaves several options open, including integration into a future Operations Center of Excellence. If established, this center of excellence could provide an ongoing management function as it becomes available.
- The KTS will be developed and brought online incrementally so as to retain flexibility regarding hosting and relationships to existing sites. Recognizing the need to gain experience, the lead times to develop new materials, and questions of sponsorship resource availability, an incremental approach to KTS development is appropriate. A start-up website can be designed with an increasing set of web-based functions scaled to management resources as they become available. At the appropriate point in time, web-based functions can be supplemented with live activities (e.g., managed dialogues,

Table 3.3. Strengths and Weaknesses of KTS Options

KTS Criteria	KTS Website Options				
	Support of and Modifications to Selected Existing Websites	One or More Single Function Websites	Comprehensive Web-based Portal Incorporating Links to Other Existing Web-sites	New Stand-alone Comprehensive Website	Operations Center of Excellence, Including a Web Portal and Other Functions
Minimum Duplication of Existing Material	✓	✓		✓	
Comprehensiveness Regarding Major Knowledge Categories and Topics			✓		✓
Provision of Current Priority and/or Lead-in Information			✓	✓	✓
Filling of Both Knowledge Category and Topic Gaps	✓	✓	✓	✓	✓
Provision for Range of Audiences			✓	✓	✓
Accommodation of Implicit Knowledge Transfer					✓
Provision of Community Building Features					✓
Provision of Peer-to-Peer Activities			✓	✓	✓
Level of Active Management Required	✓	✓	✓	✓	✓
Low Cost	✓	✓			
Obvious Sponsorship	✓				
Ability to Capitalize on Social Media			✓	✓	✓

workshops, and peer-to-peer managed interactions). A decision regarding “calibration” can then be taken in stages with periodic review by SHRP 2 Project L17 oversight entities. However, given the lead time, the start-up work needs to begin as soon as possible.

- The useful results (including reports, analysis methods, and tools) of recently completed SHRP 2 Reliability program projects will be among the first knowledge elements to be included on the new website. Products from SHRP 2 Reliability projects such as those from Projects L01, L06, L07, L13, and the AASHTO TSM&O Guidance tool derived from SHRP 2 Project L05 can be posted as part of a first increment in a KTS website to make the research immediately available.
- Gap-filling work activities identified earlier will also become new knowledge elements to be included on the new website. Several of the gaps relate to key knowledge categories other than research and, in the opinion of the L17 project team, need to be filled for an effective KTS. For several of these work activities, a modest level of effort is involved. This work began immediately with the initiation of Phase 3.
- At the start of Phase 3, a conversation was initiated among SHRP 2 staff, TETG members, and Technical Coordinating Committee (TCC) members to resolve the question of both mid-term and long-term sustainability of the KTS. It is not too soon to consider the sustainability of a TSM&O website. NCHRP Project 20-07 (298) that is under way is considering an Operations Center of Excellence. This project is focusing on alternative business models associated with a range of scopes for a center that aims to improve practice. These capabilities relate directly to a key need identified in this project, namely, the concierge or management requirements that users frequently encounter and the related resource requirements and sources needed to meet these needs. The relationship between the SHRP 2 Project L17 KTS and the options developed in NCHRP 20-07 (298) need to be closely coordinated regarding their intersecting objectives in the long term.

In summary, initial website design, beta hosting, and improvements in response to community reviews took place within the current scope of this project. In addition, it was determined that close coordination must be maintained with the issues raised in NCHRP 20-07 (298), including management burdens. Special attention must also be given to supporting the site hosting and maintenance activities beyond the time period of the project.

Development of the KTS Concept

As described in the original scope: “The KTS will incorporate content, communications and branding and outreach in the appropriate relationships with the intent of developing them

as a mutually reinforcing ‘system’—branding and communications both persuading and motivating use of technical and guidance content materials and outreach (non-web) activities designed to work with and reinforce (and perhaps update) the content.”

The tasks for this phase are the following:

- Task 1: Review gap-filling materials from other tracks.
- Task 2: Determine content structure of web-based component.
- Task 3: Determine website considerations and specifications.

The tasks in Phase 4 focused on development of the KTS prototype:

- Task 1: Incorporate synthesis and gap-filling content that was previously developed into the final KTS structure.
- Task 2: Develop website component of the KTS.
- Task 3: Beta test the KTS.
- Task 4: Develop KTS documentation.

All of the tasks for both phases were completed. However, they were not conducted in the same order as in the scope of work. In addition, the scope was expanded based on the experience gained as the work proceeded. Two major influences affected the scope as well as the substance and order of the tasks undertaken:

- First, the initial technical analysis-based recommendation was that the KTS scope had to address the knowledge needs of TSM&O overall and not be confined to the SHRP 2 Reliability program products. This was intended to attract a larger audience and to serve the needs of the TSM&O practitioner community. This recommendation was accepted by the TETG and the TCC.
- Second, since the time the original scope was developed, a large number of reliability and TSM&O activities were initiated that impact the context for and role of a TSM&O KTS.

These two findings led to an expansion of the substantive scope of the KTS (including its functions) to support the broader needs of the TSM&O community and to support evolution into a broader, expanded functional KTS through subsequent efforts. Consistent with this broadened perspective, the following section presents the findings in the order in which the work was undertaken. It summarizes both the technical reports and the KTS website, which are separate contract products.

Content as per Original Scope

The original L17 scope, developed in 2009, called for the development of a website to serve as a repository for all

SHRP 2 reliability products, thus functioning as the “cap-stone” to the research effort. As originally scoped, the initial KTS website included

- A database containing all SHRP 2 Reliability final products;
- Syntheses and links for all the products and placement in a searchable data base;
- Selected research “gap” reports;
- Business case marketing and outreach resources;
- FAQs; and a
- TSM&O glossary.

As noted in the next section, this scope was significantly expanded.

Audience Characteristics and Knowledge Needs Research

The modified approach was based on a review of the audiences and their knowledge needs, which together led to the expanded scope. The audience for the KTS includes the complete array of potential users who were self-identified as being focused on TSM&O: practitioners, policy makers, and researchers. Reliability is a key, but not the only, objective. Practitioners vary in their level of involvement and knowledge, including those who are fully engaged in TSM&O and occasional users. TSM&O is a relatively small area of investment within the overall transportation agency program area, averaging about \$1.4 billion per year. This is generally 1% to 2% of state DOT investment over a multiyear period. There is a small (but committed) number of full-time practitioners. A preliminary estimate, based on contacts with FHWA, state DOTs, local governments, associations, and TRB, suggests a current audience of 1,200 to 1,600. This audience represents both the public and private sectors and at several levels of government, and it may be expected to grow as TSM&O becomes an increasingly competing focus of DOT efforts.

Building on the experiences of the SHRP 2 L06 research and workshops and the Operations Academy curriculum and discussions, the SHRP 2 L17 state-of-the-practice review identified substantive topics and types of knowledge needed by practitioners. Figure 3.3 identifies the combinations of technical topics and types of knowledge that constitute the matrix of knowledge needs. It also reveals areas where knowledge is minimal or nonexistent.

Impact of Other Context Activities on KTS Content and Function

In addition to the consideration of audiences and their knowledge needs, other context factors have evolved that affect both the orientation and focus of a KTS. Over the last

3 years, while the KTS research and development has been under way, there has been a wide range of ongoing related activities that have improved the understanding of audience characteristics, knowledge needs, and structure of the community. These activities indicate a substantially elevated level of interest since the KTS concept was conceived several years ago. In combination, these activities have provided a better sense of the context for the KTS and how that relates to the larger needs of the audiences for a KTS. Of special importance are the following:

- *The role of the KTS in the SHRP 2 overall implementation.* There are a range of reliability research products that might be modified for more robust access and use in a web-based format. The KTS can be used to support the dissemination of other SHRP 2 products, including modifying such sites to do this in a more effective manner.
- *The role of the KTS regarding the Regional Operations Forums.* The forums will function not only as knowledge transfer, but as a principal contact with the current state of the practice nationwide and related knowledge needs. The KTS can be enhanced to include information relevant to the forums.
- *The relationship to the development and implementation of a possible Operations Center of Excellence (OCOE).* An OCOE is under study via a separate NCHRP project. This study is identifying the potential functions of a staffed OCOE that would involve both web and nonweb activities promoting knowledge transfer, new knowledge development, community of practice support, and visibility. In this study, special attention is being given to nonweb activities and to issues related to cost, business models, and governance. The KTS can be developed to support the functions of an OCOE.

Figure 3.4 illustrates the range of ongoing activities that could potentially synergize with a KTS.

Content and Website Design Direction

Given the previous consideration of scope, three key factors affected the website design:

- *Existing knowledge transfer resources.* The team reviewed the state of the practice in KTS-like activities outside the domain as the basis for the KTS prototype development. The FHWA Office of Operations website and the RITA JPO website have very large, and substantially undifferentiated, databases of federally sponsored materials that are often difficult to navigate. Existing associations (AASHTO, ITE, ITS America, NTOC) provide limited state-of-the-practice resources, although they provide functions supporting the development of a community of practice, such as information on

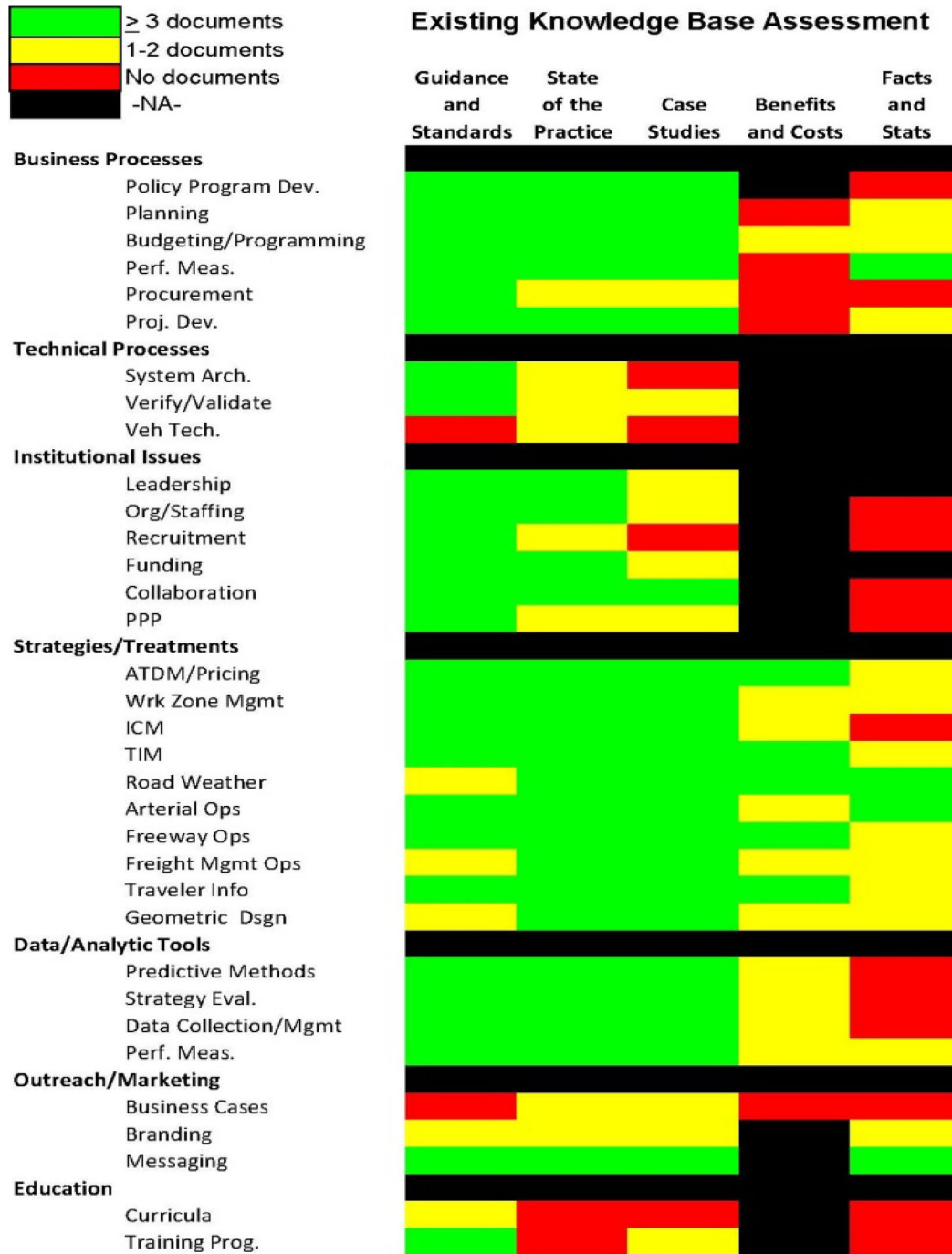


Figure 3.3. TSM&O audience knowledge needs and availability. Black areas are not applicable.

current events, conferences, and committee activities. No current site offers an easily searchable database covering the range of information needed.

- *Reliability as a Component of TSM&O.* One finding from the L17 research is clear: Reliability is not a stand-alone consideration in practice and policy nor is it separately addressed in DOT programs, strategies, or organizational structure. It is considered integrally within the broader focus on TSM&O.

Existing knowledge resources related to reliability (such as the FHWA and RITA websites) are found embedded within a range of other related topics. Therefore, a KTS confined to SHRP 2 products would be of limited interest, attract a small audience, and have a minimal impact on the state of the practice.

- *State of Community of Practice.* The audiences relevant to reliability and, more broadly, TSM&O are fragmented both

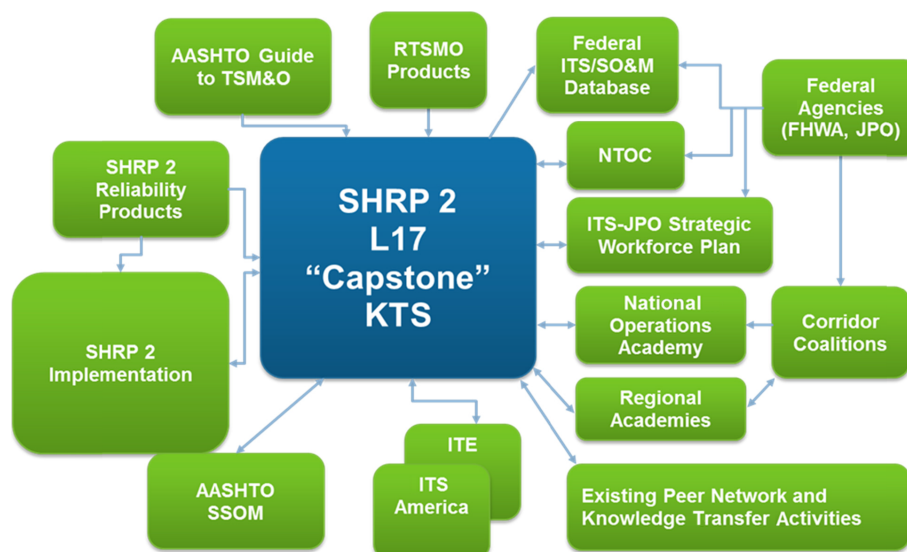


Figure 3.4. The context for the L17 KTS.

by type of institution and individual organizations into a set of subcommunities (such as individual practitioners in a state DOT, practitioners in a consultancy, or members of a committee), which are only weakly established within their own context.

KTS Scope Implications: TETG and TCC Direction

These perspectives were presented to the L17 TETG and to the overall Reliability TCC and resulted in a consensus to incorporate the broader perspective. From this point in the project, the functional scope was considered to be the full range of topics and knowledge needs for TSM&O.

Beginning with the L17 Interim Report, the scope for the KTS therefore broadened in two dimensions:

- *TSM&O-Focused Scope.* The enhanced scope covers the complete range of TSM&O-related knowledge topics and categories, defined substantially by current and emerging practices. The scope addresses impacts not only to reliability but also to other performance measures such as delay, safety, throughput, and environmental impacts.
- *Broader Range of KTS Functions.* A full function KTS was defined as a comprehensive website that supports knowledge transfer and community building. The KTS concept was expanded beyond the transfer of existing knowledge with search and syntheses to a broader range of functions designed to both support and build practice, research, and policy:
 - Develop new useful knowledge as defined by varied communities of interest.

- Support the development of communities of interest, encourage level of interest, and support peer interaction and experience transfer.
- Increase the visibility of the TSM&O domain.

The functional requirements for knowledge transfer were identified as those that would provide a robust first entry point or portal to TSM&O practice, standards, case studies, analysis, data, and guidance, including the following:

- Providing a key subject and key word searchable data base covering selected, key information of interest to audiences, covering the range of TSM&O topic and knowledge types depicted previously in this chapter.
- Offering syntheses of key materials to support efficient user identification of relevant materials.
- Highlighting new materials as they become available.
- Providing outreach and marketing materials to promote TSM&O on a cut-and-paste basis for users to tailor to their context.
- Containing education and background materials by way of FAQs and glossary to help “brand” TSM&O.
- Presenting news and events of interest to users as well as a calendar of events.

The Need for Phasing

The original SHRP 2 L17 project budget does not support the development of a website with the full range of added functions described here. Therefore, the start-up KTS has been designed for both development and maintenance. It includes all of the primary functions called for in the original project scope as well as several enhancements to improve its utility. In addition,

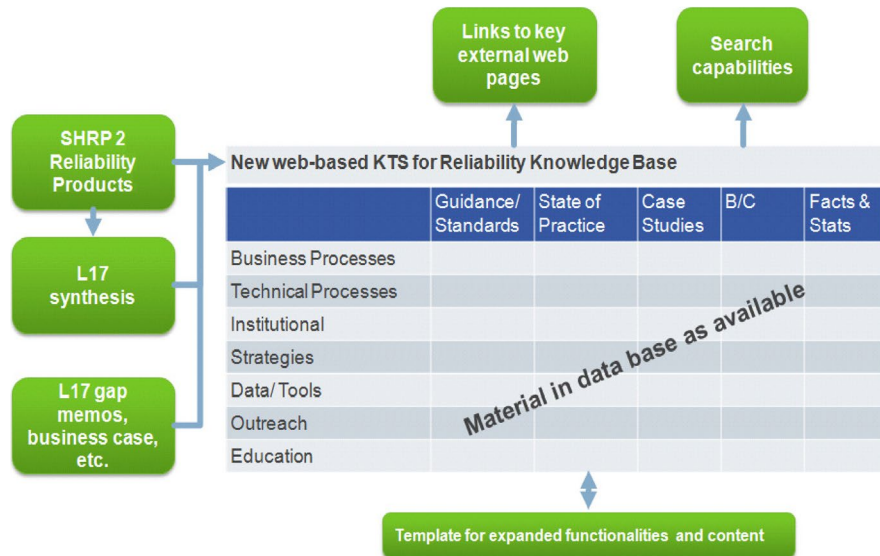


Figure 3.5. KTS search filtering.

however, the start-up site was designed specifically to evolve with minimal redesign or reprogramming costs into the “ultimate” TSM&O KTS website prototype (called “Enhanced”).

The start-up KTS website has six basic resources:

- A searchable database with all SHRP 2 Reliability and related final products, including a standardized synthesis of each and key wording for search;
- Links to (and syntheses of) a limited number of other key TSM&O documents in areas not covered by SHRP 2 research;
- Reports on major research gaps in standards format;
- FAQs;
- A glossary, developed by the TRB Regional Transportation Systems Management and Operations (RTSMO) Committee; and
- Business case and outreach materials for custom tailoring.

The Search Function

The most important functionality of the website is the search mechanisms for finding SHRP 2 products as well as selected non-SHRP 2 TSM&O documents. These documents are being added to by contract over the next 2 years. Users can search by a combination of topic and knowledge type and by date or author agency. Figure 3.5 shows the structure of the database and search function.

Evolutionary Approach

Table 3.4 illustrates the potential functional evolution from the start-up KTS to the future enhanced KTS with a broader TSM&O focus. The center column, Start-up KTS—Reliability Capstone per Scope, shows the functionality and content as

Table 3.4. KTS Phasing

SHRP 2 Website	Start-up KTS: Reliability Capstone per Scope	Full/Enhanced TSM&O Portal
Driving Concept	<ul style="list-style-type: none"> • Showcase/access SHRP 2 Reliability products 	<ul style="list-style-type: none"> • Enhanced to attract and retain TSM&O community of practice use
IT Functions	<ul style="list-style-type: none"> • Basic website prototype • Basic search and related utilities • Capability to expand functionality 	<ul style="list-style-type: none"> • Complete portal functionality • Links to key external resources • Customized searches and syntheses • Peer networks/dialogue and tech support • Push/outreach/marketing functions
Content Development	<ul style="list-style-type: none"> • Incorporate L17 content • Incorporate other SHRP 2 products • Selected syntheses/gap reports • FAQs/glossary • Business cases 	<ul style="list-style-type: none"> • Assessment of knowledge gaps • Elements of success subpages • Key external website/document links • Updated calendar/news/events • Subscription-based e-mail newsletter • Enhanced marketing and outreach material • Peer network input

per the original L17 scope. This start-up KTS design includes a few modest functioning additions to the L17 KTS scope to provide a website with enhanced stand-alone potential.

The right column, Full/Enhanced TSM&O Portal, indicates the future expanded functionalities that have been accommodated through the staged approach to design and programming. The design (home page, subpages, drop-down menus) and much of the basic programming for the enhanced KTS have been developed but are hidden from view in the current prototype in order to avoid future redesign and reprogramming costs. However, these enhancements require significant content development and ongoing site management that are not accommodated in the current L17 scope and budget.

Enhanced Functionality

As shown in Figure 3.6, the KTS research, combined with the parallel efforts of the NCHRP OCOE study, suggests that the

community of practice needs more than documentary resources—especially with regard to defining the practice both inside and outside agencies—and also needs to promote peer-to-peer interaction. These community-building activities include posting a calendar of events and training opportunities, push features and use of social media, some dialoguing functions, peer-to-peer support, and presentation of material designed to achieve greater visibility. These features are fully functional with content produced by SHRP 2 as the start-up KTS.

Objectives and Functions of a Fully Functional KTS

In addition, the initial KTS has been designed with functionalities that support the “capability to expand” shown in italics. The enhanced functionalities website, as described in Figure 3.6, was designed to the prototype level to ensure a smooth

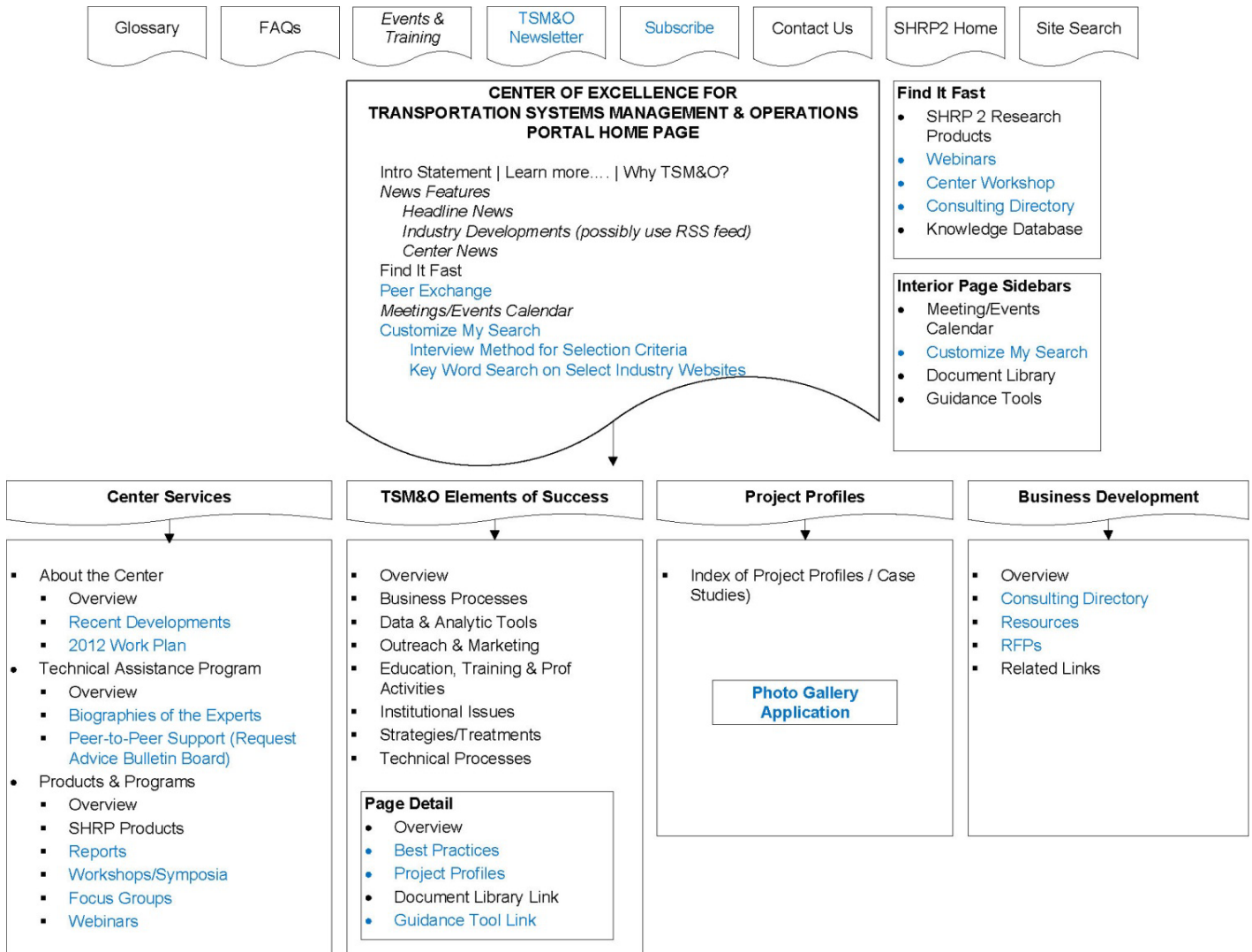


Figure 3.6. KTS site map illustrating start-up and enhanced functionalities.

transition if the necessary additional programming and content development were added as part of a subsequent phase.

Figure 3.6 presents the site map for the KTS previously described. The following is a brief explanation of the site map's contents:

- The first row represents the global navigation links accessible on every web page.
- The large box in the second row represents the home page contents.
- Find It Fast in the second row contains customizable short cuts accessible on the home page.
- Interior Page Sidebars are links accessible on every interior page.
- The third row is the main navigation that will function as drop-down menus.
- The fourth row represents the items on each of the aforementioned drop-down menus, each item leading to a web page. Each main bullet point (e.g., About the Center, Technical Assistance Program, and Products & Programs) is a drop-down selection under a main menu item (such as Center

Services). Each of these web pages has additional detail/content, represented by the second tier of bullets in the case of Center Services and Business Development and by the bullets inside the Page Detail box for TSM&O Elements of Success.

The functionalities in black will be operational at the end of the current project scope. The basic programming for the functions in blue has been provided; however, as most of these features are designed around content that is not yet developed or accessible (or which requires active management), they are not included in the start-up KTS, except for basic programming and design to support later enhancements. These features may be displayed with an “under development” notation or suppressed, such that the non-operational functionalities are not visible.

KTS Look and Feel

The website has been designed to be attractive and user friendly as well as functional. Figures 3.7 and 3.8

The screenshot shows the KTS home page with the following elements:

- Header:** Navigation menu (Home, About, News, Resources, Glossary, FAQs, Events & Training, Contact Us, SHRP2 Home) and a search bar.
- Logo:** KNOWLEDGE TRANSFER SYSTEM Transportation Systems Operations & Management.
- Welcome Section:** Text describing the website's purpose for practitioners, researchers, and policymakers.
- Headline News:** A section with tabs for 'Headline News', 'Future Events', and 'Recent Publications'. It lists news items from August 2012, such as 'U.S. Secretary Ray LaHood & Senior Transportation, Law Enforcement, Fire and EMS Executives to meet on Traffic Incident Management June 26 and 27, 2012'.
- Making the Business Case:** A section with a briefcase icon and text: 'Find suggested language and success stories for communicating your business case'.
- Upcoming:** A section titled 'MEETINGS & EVENTS' featuring a calendar for November 2012. The calendar shows dates 1 through 30, with the 15th and 16th highlighted in orange.
- Customized Knowledge Search:** A section with a blue background and text: 'Find the key documents you need: Topical Industry Websites, Searchable Knowledge Database'.
- Footer:** 'Contact Us | Download Adobe Reader'.

Figure 3.7. KTS home page—start-up KTS.

illustrate the initial and enhanced evolutionary version of the KTS.

Start-Up Website—Functions, Design, and Costs

The scope of the start-up KTS site was adjusted to accommodate the existing available budget under the current contract.

- *Start-Up Site Maintenance and Hosting.* SHRP 2 has provided for basic site hosting, updating, and maintenance of the start-up site through December 31, 2014. This includes the addition of new SHRP 2 Reliability products as they become available, the addition of a limited number of non-SHRP 2 key documents of interest to practitioners, and calendar updates.
- *Cost to Develop and Operate an Enhanced KTS.* To support informed forward planning, a detailed analysis has been undertaken of the functionality issues. Table 3.5 provides further detail associated with the potential enhancements. Its scope estimates have been

Table 3.5. Activities for an Enhanced KTS

	Activities
IT Functions	<ul style="list-style-type: none"> • Program for full functionality • Program custom search • Program newsletter push • Establish peer-to-peer functionality and networks • Manage content and site
Content Development	<ul style="list-style-type: none"> • Synthesize SHRP 2 materials as available • Identify and develop “elements of success” pages • Work with community and identify gaps • Refine marketing and outreach materials • Prepare newsletter • Develop other knowledge as proposed
Content Management	<ul style="list-style-type: none"> • Identify key TSM&O materials, synthesize, and/or link • Scan all activities, summarize, and post • Develop and manage initial P2P activities • Manage links with other sites
Institutional	<ul style="list-style-type: none"> • Outsource contract management (content experts) • Work with advisory group • Project management • Coordinate with other organizations • Make presentations

Note: Detailed breakdown based on level of effort for similar AASHTO projects. P2P = peer-to-peer.

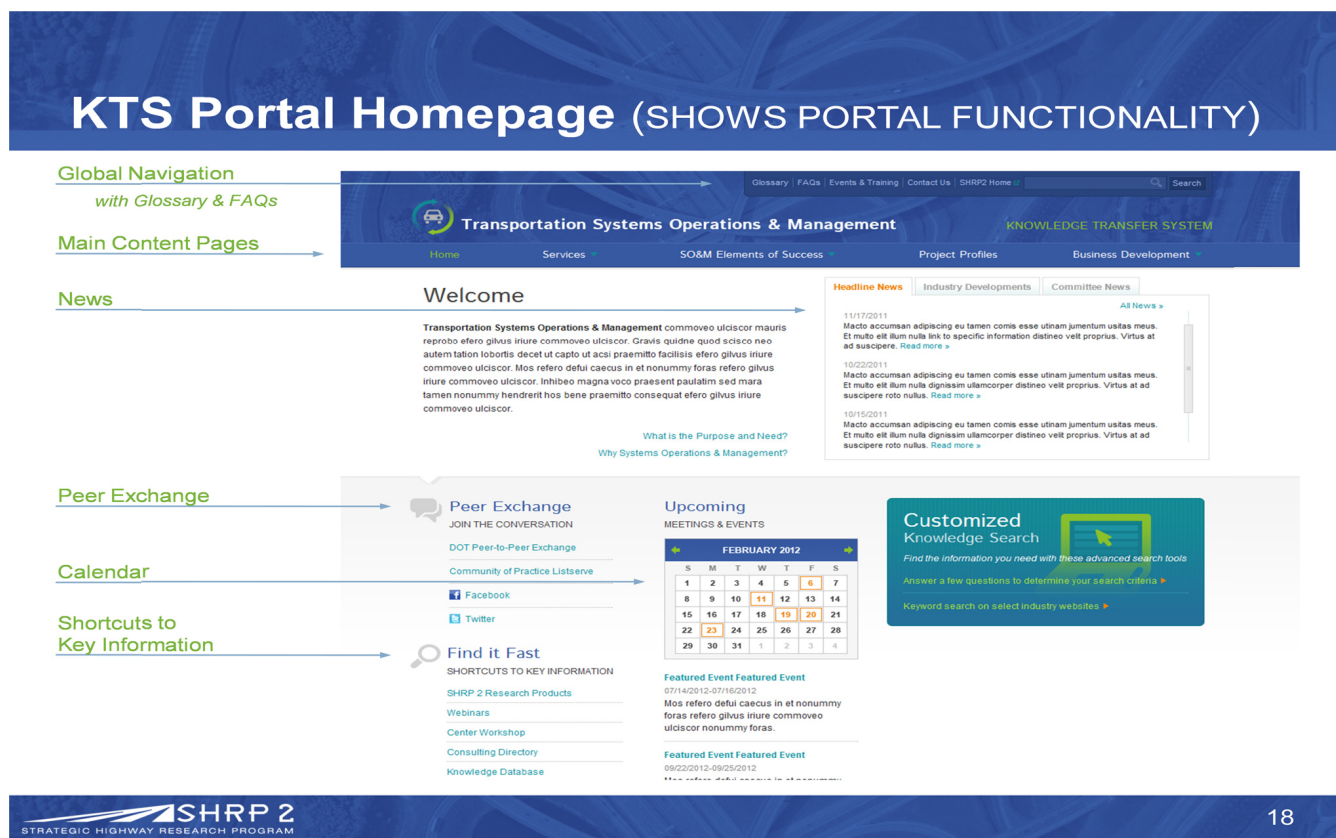


Figure 3.8. KTS home page—enhanced KTS.

informed by best practice in other domains of transportation.

Summary of Current Status

For more information on the KTS, see the SHRP 2 website: <http://www.trb.org/main/blurbs/169243.aspx>. The site and its functions have been reviewed by the SHRP 2 L17 TETG and circulated to many organizations, including the TRB RTSMO Committee, ITE, ITS America, and the AASHTO

Subcommittee on Systems Operations and Management (SSOM). Only a few (but very helpful) comments have been received.

Under the current SHRP 2 L17 scope and budget with the maintenance modification, the KTS website (as described previously) will be maintained through December 31, 2014. SHRP 2 Reliability products will be added to the website as they become available. A limited number of non-SHRP 2 documents will also be added and the calendar will be updated on a quarterly basis.

CHAPTER 4

Branding and Communication

Overview

The central product of the SHRP 2 Project L17 research was a Knowledge Transfer System (KTS). Knowledge transfer moves beyond disseminating (pushing) information to include seeking (pulling) information so that it is both received and used—creating a critical link between research and practice.

Effective knowledge transfer is, therefore, getting the right information to the right people at the right time in the right format. The result is connecting practitioners and policy makers to information that will help them make informed decisions, take advantage of available resources, and maximize benefits. In order to reach its full potential and be truly instrumental, a KTS must be able to adapt itself to a wide range of audiences and users. Individual users may come to the table with differing levels of readiness with respect to embracing travel time reliability and operational strategies as key components of their agency mission. The KTS developed within this research will have three main components:

- *Technical content.* What practices, processes, and policies will advance TSM&O?
- *Form and structure.* How is information communicated clearly, effectively, and succinctly?
- *Communication, branding, and outreach.* What are the best ways to connect with transportation professionals, who are the ultimate implementers?

The following sections discuss branding, communication, and outreach activities. Critical to the approach for development of all products of the project was the outreach to key users and supporters of the SHRP 2 Reliability program research. Throughout this project, the user community (one of the four outreach groups) was very active and provided significant input into the branding and communication work.

In the proposal, three other outreach groups were identified: the institutional community, the academic advisory team, and

the user network. These groups represent audiences that are interested in advancing TSM&O in different ways. The user network was identified as a targeted expansion of the user community. The project team's initial concept was that the user community would invite a larger peer network into the L17 research. As the project progressed, the user community consistently participated in meetings and e-mail discussions. However, a formally recognized user network did not materialize.

The institutional community represented agencies and organizations that have been involved in advancing TSM&O for many years with branding and outreach efforts of their own. Examples are the FHWA Office of Operations, ITS America, NTOC, and the I-95 Corridor Coalition. These participants have websites of their own and the relationship of these websites to the KTS is of primary importance. The institutional community met twice formally within the SHRP 2 L17 project. As the interest in an Operations Center of Excellence grew, these participants became engaged in external meetings, workshops, and dialogue that essentially replaced the vision of their role in the SHRP 2 L17 project.

The academic advisory team was targeted to the specific interest of the L17 TETG in developing academic curricula that would make engineering and technology students aware of TSM&O as a career option as well as obtain initial training to support that interest. The academic white paper was the only product in this project that addressed this interest. In lieu of meeting formally as a group, the project team engaged individual researchers and academicians to collect information that informed the completion of the academic white paper. Limited input has been received; however, the research conducted was informative and provided some specific insights and findings.

Definition and Purpose

TSM&O will be enhanced by a commonly understood definition with associated benefits that is communicated to a variety of audiences. The current definition and image of TSM&O

remains fuzzy, at least in part because related terminology and definitions have changed and broadened over time. Over the years, transportation “operations” has been referred to by a variety of terms, including system operations and management (SOM), TSM&O, TSO&M, ITS, congestion management, and system reliability. A 2007 marketing evaluation of TSM&O’s difficult integration into the mainstream of transportation agency activities concluded with a fundamental concern: “There is no definable customer for a definable product at a definable time.” One aspect of this research will be to determine the importance of brand definition and communication to the overall success of advancing TSM&O.

The key challenge facing the SHRP 2 Reliability program is convincing decision makers and practitioners that travel time reliability is a core responsibility for transportation agencies. For successful dissemination of the Reliability program research, decision makers and practitioners must understand the importance of travel time reliability, incorporate this understanding in project planning, and promote the benefits of applying TSM&O solutions to prevailing problems. Significant barriers have either thwarted or slowed this necessary evolution in many states and across many transportation agencies.

As the capstone project for the Reliability program, the purpose of this project is to advance and integrate TSM&O into mainstream agency practice. This project will play a critical role in integrating the findings, methods, and recommendations of all other Reliability research in addition to providing a bridge to key elements of the SHRP 2 Capacity program. Although the most important product of this research and the Reliability program is a KTS that will serve as an effective means for moving research findings and products into everyday practice, efficient communication and outreach to key audiences to make the KTS a living resource is equally important and is considered a fundamental component of the SHRP 2 L17 project.

Branding Synthesis for Travel Time Reliability

The purpose of Phase 1 of the L17 project was to synthesize the information that exists in support of mainstreaming TSM&O. The branding synthesis effort focused on a variety of existing websites that attempted to communicate various aspects of TSM&O to the relevant audiences: policy makers, practitioners, and travelers. This overview included a detailed review of 22 websites at the national, state, and local levels to identify common themes across websites, key terms used to communicate these themes, communication messages, and a general understanding of the effectiveness of each site at reaching its intended audience. These websites are listed in Table 4.1. Appendix D provides further details on the researched websites for the branding synthesis.

Table 4.1. List of Websites Used for Branding Synthesis

Branding Synthesis Websites
• AASHTO
• Association of Metropolitan Planning Organizations (AMPO)
• FHWA, Office of Operations
• ITE—Management & Operations/ITS Council
• RITA–ITS Joint Program Office
• National Transportation Operations Coalition (NTOC)
• ITS America
• I-95 Corridor Coalition
• National 511 Program
• NTIMC
• OmniAir Consortium
• Operations Academy
• Galvin Project to End Congestion
• Florida Road Rangers
• Georgia NaviGator
• Minnesota Guidestar
• North Carolina IMPACT
• Kansas City Scout
• Niagara International Transportation Technology Coalition (NITTEC)
• Operation Green Light
• Towing and Recovery Incentive Program (TRIP)
• National Association of State EMS Officials (NASEMSO)

Travel time reliability is an emerging and complex topic that lacks a common definition and understanding. It is critical at this initial stage to find the themes or elements that help capture a definition or common understanding of travel time reliability and its role in addressing congestion. In addition, the term Reliability means different things for “customers” and for “owners/operators.” Lack of a common language makes progress toward improving travel time reliability more difficult. It is clear that effective communication is audience dependent, and this phase of the research represented the first step at segregating the individual “sound bites” into the target audiences where they will be the most effective.

Branding TSM&O

Although the initial vision for the SHRP 2 L17 project was to develop a brand for TSM&O, the identification of reliability as a potential “word that works” for communication and marketing was expressed from the outset. In Phase 2 of

the research, the project team held a “branding workshop” to consider the potential for developing a brand. The workshop reached a consensus that branding TSM&O was not necessary or advisable within this limited project time frame. The participants reached agreement on a brand promise in lieu of a specific brand. This brand promise provided a common understanding that allowed communication messages and materials to be developed. Although the brand promise was edited and revised several times by individual groups within the project, the final approved language states clearly the features of TSM&O that are essential to communicate:

We promise travelers and shippers that we will manage traffic and incidents as well as provide timely and accurate travel information so that they can make informed decisions to minimize their unexpected delay and improve the safety of their travel.

The following are the core elements that this version promotes, which are needed for the development of communication materials:

- *Audience for TSM&O:* travelers and shippers.
- *What is provided:* manage traffic incidents and give timely and accurate information.
- *Customer role:* make informed decisions.
- *Outcomes:* minimize unexpected delay and improve safety.

Agreement on the brand promise early in Phase 2 supported the completion of the business case primer. The primer provides instruction and messages for transportation practitioners to use in order to advance the understanding and support of TSM&O within their own agencies.

Communication: Building the Business Cases

In Phase 1, the project team and user community group identified three specific target audiences that collectively represent the universal audience for the TSM&O brand and messages: Investment Decision Makers, Implementers, and Travelers. Investment Decision Makers include both policy decision makers and any staff that recommend funding allocations to policy makers. The Implementers target audience includes all functional area practitioners that plan, design, implement, or operate TSM&O improvements or services. Travelers include both passenger and freight users of the transportation system.

These three audiences represent the highest-level audience categorization. Within these categories, individual business cases can be developed to communicate more specifically with the variety of positions in transportation agencies as

well as with travelers represented by the general public and freight providers. While there is some overlap among audience categories in the topics of interest, the key messages were developed to speak to the identified audience as effectively as possible.

In Phase 2, messages were developed and refined for each of these audience segments and the business case primer document provides the necessary instruction on how to use the messages to greatest effect. One of the outcomes of development of the business case messages was the recognition that there were a limited number of audiences, each was unique, and that each needed to be communicated with differently. In addition to the difference in the general public traveler audience and the freight provider, the user community identified safety specialists and incident management professionals as potential “sub-audiences” of the three primary audience types. This was identified as a “gap” with respect to communication and resulted in the commitment of funds in Phase 3 for development of sub-audience business cases in Gap-Filling Project 6.

To develop sub-audience messages in Phase 3, the project team conducted several focused interviews with representatives of these four audience types. The user community provided recommended interviewees and the necessary introductions to support this method of collecting information as well as validation that the message ultimately included in the business case primer would resonate with the intended audience. Gap-Filling Project 6 was highly successful in developing the sub-audience messages.

Communication Materials and Strategy

Phase 4 activities in Track C provided the transfer to audience definition and business case messages in a concrete format needed to engage the audience. Table 4.2 was used to help the user community understand how the individual efforts in the previous phases were essential precursors to developing materials to be used for communication. This table also identifies that the availability of communication materials does not represent the final step. Beyond the SHRP 2 L17 research project, the champions or ambassadors created in the user community will need to “take action and follow through.”

The user community helped to identify the types of materials that would be most useful in advancing TSM&O to the various target audiences. Four specific communication materials were identified and developed:

- Trifold brochure (general public Travelers).
- One-page fact sheet (Implementers).
- Two slide presentations (Investment Decision Makers, Implementers).

Table 4.2. Implementing the TSM&O Communication Strategy

1-Marketing— Phases 1 and 2	2-Communications— Phases 3 and 4	3-Outreach— Beyond L17
Identify the “market” for your product	Develop ways to communicate the value	Take action and follow through
Research your audience	Create the product that describes benefit (tactics)	Disseminate the message using tactics
Identify subsets of your audience	Integrate the value with the right tactic	Meetings, presentations, e-mails, webinars
Identify the behavior change desired	Develop the plan for dissemination of the value	Make a commitment; stay engaged
Evaluate your market selection	Create materials to communicate the product to the market	Evaluate and adjust your plan to improve

In addition to these materials, the TETG identified the strong communication potential offered by a short video. The TETG interest is to ask a respected member of the transportation community to “tell the story” of how TSM&O has assisted the member’s agency in its mission.

Lessons Learned

It is immediately apparent that the term “reliability” is not currently part of the mainstream communication messaging. In fact, only the FHWA Office of Operations website makes reliability part of its mainstream communication messaging, primarily through its *Operations Story*—a nine-page communication piece available through a link in the website. ITE also uses the term reliability in its management and operations mega issue white paper. More common are the key terms congestion, safety, efficiency, recurring and nonrecurring, ITS, real-time information, and systems management of work zones, incidents, and weather.

The development of the brand promise supports this conclusion that promoting reliability as a brand is not useful. The concept of reliability, however, is an essential part of the value of TSM&O. By addressing “unexpected delay,” the transportation agency is improving travel time reliability. Although a specific brand name or “word that works” has not been identified in the SHRP 2 L17 project, the appropriate ways to communicate the concept of reliability and nonrecurring congestion to various audience segments are included in the business case messages.

Another theme that emerged in the branding synthesis is that of partnership. It appears that strong value is placed on

collaboration within the TSM&O community of practice. Large groups such as NTOC, ITS America, I-95 Coalition, and AASHTO overlap strongly with the federal and state transportation agencies that implement policies. This is observed in their membership, leadership, and resource sharing. This established sense of collaboration provides a strong foundation for reaching all target audiences; however, the message must become more focused, cohesive, and common across all partners in order to be clearly understood and valued.

There does not appear to be any single website that attempts to communicate its message to all potential target audiences. Not surprisingly, the purpose of each website often differs, depending on the target audience. Portions of websites targeted to policy makers are focused on advocacy messages often related to just one aspect or strategy of TSM&O. Many of these websites also include a practitioner-focused section that provides more education or technical assistance aimed at moving the policy objective into practice. These messages that are aimed primarily at the policy or practitioner level most often communicate a great deal of information through many distinct messages without the use of a common theme or term. The breadth of TSM&O represents a challenge for all audiences to understand without an umbrella or unifying concept. The individual aspects of TSM&O come across more as silos to those who are not directly engaged in this functional area.

Communication to the Traveler audience is especially challenging. It most often occurs in a narrow interest area such as incident response or ITS message boards. The current purpose appears to be to simply provide drivers with information, as opposed to educating drivers on the actions they can take in response to that information. The importance of communicating not only what reliability is but also why it is important and how it can be achieved appears to be largely missing at this time.

Although websites can be a very effective means of communicating to all audiences, it is necessary to bring that audience to the site. The limitations for the websites surveyed often relate to their ability to connect with the intended audience. More traditional means of communicating, such as brochures and presentations, can be effective but may reach a much narrower audience. This perspective has been considered in the development of the KTS and plans for the Operations Center of Excellence.

The dedication of the user community within the SHRP 2 L17 project represented an important lesson learned. Practitioners are eager for ways to promote and advance TSM&O and are willing to devote their limited available time to assist in meeting this need. The members of this group were ready to offer recommendations and support for the development of messages and materials. They had a strong sense of what did not work and what was most effective. In particular, the interviewees for the sub-audience business case messages were

very supportive of the interest and effort by the project team. The contributions of these transportation professionals were the primary elements of success for Track C activities.

Conclusions

“Congestion” appears to be the most effective sound bite to support Reliability/TSM&O communication at this time. Since all audiences are also travelers, congestion is a part of everyone’s context and this creates a common understanding. Through relating travel time reliability as an aspect of congestion, the concept of reliability is elevated and normalized. This relationship between travel time reliability and congestion becomes the highest tier of communication messages, from which related individual concepts filter down to the individual audiences. It is essential that each tier of messaging tie back to the congestion theme in order to clearly advance the effectiveness of TSM&O strategies and policies. It appears that this lack of connection between the commonly understood concept of congestion and the more abstract concept of reliability is at least one aspect of what has been missing in attempts to communicate the message thus far.

Transportation professionals are actively promoting TSM&O in their agencies and among their peers. The support provided by communication messages and materials is highly desired as a tool to improve these efforts. At the conclusion of the project, user community members individually requested access to the materials and templates developed so that they could tailor these materials to their context and improve their ongoing activities.

Any brand selected for travel time reliability must be considered along with its ability to attract the audience. To meet this requirement, there must be a good understanding of the target audience as well as the most effective means to communicate with them. The key messages and communication methods identified in this synthesis provide a strong foundation for the next phase of the SHRP 2 L17 project. The lessons learned about message effectiveness will be considered by the outreach communities in order to begin branding activities and the development of communication materials.

Outreach: Audience Interactions

As part of Phase 1 and 2 activities, the L17 team defined and formed user and institutional communities. Regular virtual meetings with the user community were held and a face-to-face user community–TETG Branding Workshop occurred in conjunction with the TETG meeting in late June 2012. Following the branding workshop, the user community continued to meet for the entire project period. This group led the development of the business case messages for the

business case primer, supported the identification of sub-audiences and the development of appropriate messages for them, and critiqued various communication materials in order to ensure they were appropriate for the target audience and for the practitioners’ needs.

Eleven user community meetings were held during the project period and each has added significantly to the identified research products. The community reported that they found value in attending the meetings and appreciated the way in which the meetings were conducted. Their ongoing and consistent participation was one of the most important factors in the successful development of communication messages and materials.

The majority of the work in Phases 1 and 2 of the project was focused on understanding the state of the industry in KTSs and TSM&O resources. As a result, the priority of the outreach in these early stages was to solicit user perspective on defining the target audience and developing the supporting business cases. As the synthesis phase was completed, the user community helped to identify research gaps and to validate the framework of information that the KTS should provide. Early in Phase 2, the user community participated in the branding workshop with the TETG and provided subsequent refinement of the brand promise. In Phases 3 and 4, the user community responded to concrete products as they were developed: the business case primer, sub-audience messages, and communication materials. The user community provided input and validation in the following discussion topics.

Defining Reliability

The core concepts of reliability have been identified as variability in travel time related to a specific facility or trip and over a significant period of time. The relationship between travel time reliability and TSM&O was discussed.

Target Audience

The user community reached agreement on three broad audience categories whose support of TSM&O is essential:

- **Investment Decision Maker:** individuals who make recommendations or decisions related to allocating funds for reliability related improvements.
- **Implementer:** individuals who implement reliability improvements, including both real-time operations and longer-term reliability-related project development and implementation (includes anyone not making investment decisions).
- **Traveler:** travelers (both business and passengers) whose individual decisions about their route or schedule affect reliability.

The user community also identified positions and functions within their specific organizations that would fit best into the three identified categories.

Business Case Development

For each target audience, the user community identified the compelling messages that should be used to support TSM&O.

- For Investment Decision Makers (Investors), this included customer expectation, the economy, performance monitoring on investment, and data measurement. Other topics included environmental benefits, shipment efficiencies, increased safety, and reduced travel delay.
- For Implementers, the business case messages included discussion of modeling, benefits for travel time, safety benefits, system preservation, and resource efficiencies. The business case also should focus on increased productivity, reduced peak periods, reduced incident response times, reduced congestion and increased public satisfaction, and lower costs with significant benefits, as compared to capacity-adding projects.
- The Traveler audience included freight providers as well as the general public. Messages should include the value of reliable or predictable travel as well as congestion relief. The business case for the traveler audience also should provide an opportunity to educate drivers on the role they play in ensuring reliability and how they personally affect the reliability of roads.

Communication of the Business Case

The project team produced draft business case message summaries for the Investor, Implementer, and Traveler audiences. These summaries were reviewed by the user community members and revisions made based on their suggestions for improvement.

Research Gaps

The project team provided a summary of the research gaps identified in the synthesis phase for consideration by the user community. Members were asked to identify those gaps that were most important to fill and to identify documents that could help fill them. The user community members noted that implementation challenges should be discussed, as well as solutions to address those challenges.

Sub-Audience Business Cases

The user community identified the appropriate sub-audiences for unique messages and provided the project team with

names and contact information for potential interviewees within each sub-audience. Following the development of sub-audience messages, the group reviewed and provided recommendations for message improvement.

Communication Materials

The user community identified the types of communication materials that were desirable for use by practitioners. When draft materials were developed and presented, the group provided strong feedback to help improve the brochure. They identified potential methods for using the Investor and Implementer slide presentations together or drawing from each to form a single presentation for the target audience.

One meeting of the institutional community was also held during Phase 1 and a second meeting was held at the end of Phase 2. The primary objective of the initial meeting was to frame the SHRP 2 L17 research purpose and products, along with the institutional community's role within the project. The group also discussed the challenge faced in reaching the target audience through a website. The members provided helpful perspectives such as the following:

- Keep the website current.
- Organize the information in a user-friendly manner.
- Recognize situational user needs.
- Use a variety of interlinked outreach efforts.
- Target part of the website toward policy makers.

The institutional community also discussed the upcoming branding workshop and important considerations to be given to the selection of a brand. Regionalism, communication, data sharing, and performance measures were suggested as parts of the branding message that could bring together the disparate parts of TSM&O.

The second meeting focused on lessons learned from their own experience in communicating through their websites. This information was passed along to the full project team for consideration as the KTS was developed.

Additional Interactions

Regular interactions with other SHRP 2 contractors, TCC, and TETG were held as part of Phase 1 and 2 activities. These are the key events:

- Delivered project update meeting with the TETG during TRB 2011 Annual Meeting.
- Held a team meeting to brainstorm concepts and content for CEO brochure during TRB 2011 Annual Meeting.
- Delivered a project overview presentation at the SHRP 2 Reliability Workshop held during the TRB 2011 Annual Meeting.

- Participated in a telephone conference call with TETG members on February 18, 2012, to introduce the project scope and budget and to discuss project progress.
- Produced and delivered a first version of the CEO brochure, which included a series of brainstorming, development, and review meetings with SHRP 2 staff and TCC members.
- Initiated, scheduled, and participated in the first contractors meeting in conjunction with the SHRP 2 Reliability Implementation Workshop, which was held during March 2–4, 2011, in Irvine, California.

Current Status of Academic Curricula in Support of TSM&O

The SHRP 2 L17 project has identified educators at the university level in civil engineering, transportation planning, and related management fields as part of the target audience for this research. This is an important component of the research since it appears that transportation-related degree programs provide limited or no coverage of the role of TSM&O within their current curriculum. The result is a limited opportunity for future transportation professionals to be aware of the field and receive training to understand or become engaged in TSM&O.

In response to this interest in educators and academic curricula, the outreach approach included the Academic Advisory Team (AAT). The purpose of this outreach team was to help validate the current status of academic curricula and identify barriers and opportunities associated with enhancing academic support for TSM&O. Potential candidates for the AAT were identified and invitations to participate were sent. Those contacted by phone were aware of the SHRP 2 L17 research and interested in participating. However, others who were available only by e-mail did not respond to the invitation. The project team identified several barriers to forming an interactive team of academicians. The primary barrier was the school year schedule and the lack of availability during summer months or when individuals are on sabbatical. Another barrier was the ability to specifically identify those teaching courses relevant to TSM&O. This level of detail was not readily available for all universities from websites and research. It appeared that without a specific introduction by a peer or colleague, educators were reluctant to commit to this level of participation. After repeated attempts to engage a number of teaching professionals, the project team elected to develop the academic white paper solely from research and to request review by a few selected individuals who were willing to engage. This approach proved to be the most feasible way to gather insight into the state of academic curricula in support of TSM&O.

During initial conversations with potential AAT members, the project team solicited information on current TSM&O course offerings and individual perspectives on the current

state of academic curricula to support TSM&O. This information was combined with synthesis research and provided a current status of curricula. The resulting academic white paper received very limited review by those actively engaged in teaching. In general, the conclusions through research were confirmed by experience. The academic white paper is provided in Appendix E.

Overview

The results of a recent study, *Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management* (Cronin et al. 2012), identified some of the barriers to introducing future transportation professionals to the TSM&O field:

SOM interfaces with many disciplines and transportation modes, both internal and external to the organization, as well as with functions such as emergency management and public safety, and the concerns of the general public (Michigan Department of Transportation 2008; Victoria Transport Policy Institute 2010). As the emphasis on transportation management and operations increases, the demand for personnel with skills in these areas is also increasing. Transportation agencies are experiencing a shortage of SOM professionals with the suitable skills and knowledge to move beyond more traditional civil engineering functions to the broader and more diverse SOM activities. According to interview participants, the desired skill set and knowledge base cannot be acquired simply from college or university courses, but rather is obtained through on-the-job experiences. Currently, the SOM workforce is being depleted due to retirement of transportation practitioners and a shortage of graduates from education programs with the cross-disciplinary perspective and skills needed to meet the functional requirements of SOM tasks.

Among the many recommendations included in this report are two with particular significance to this research. The first was a recommendation to “Develop SOM Curriculum Content for Related Higher Education Courses and Training Programs.” The unique skills required of TSM&O professionals draw on a combination of engineering, communications, technology, and systems management that requires a multidisciplinary education. Although this mix of topic areas can be very attractive to students considering the field, their awareness of employment opportunities needs to increase. A second recommendation was to establish student internship programs more broadly within transportation agencies. This approach allows agencies to identify where supportive programs are offered and provide a paid opportunity for students to participate in the hands-on experience that is very relevant to a career in TSM&O. Although the lack of skilled applicants is a common problem across the transportation

sector, TSM&O is particularly disadvantaged by the lack of supportive curricula.

The research team's principal source of information on existing university courses was the FHWA's National Transportation Training Resource (NTTR) database, which is the repository for the results from the NCHRP 20-77 project to create and populate a transportation operations training framework. That database includes 642 TSM&O-related courses, of which 384 are offered by academic institutions. There are 69 academic institutions with courses in the database, though about half the institutions offer fewer than five relevant courses. Because there has been no attempt to maintain or update the NTTR database, it does not necessarily represent the current state of the practice. At this time there are no sustainable updating mechanisms; however, it is the most inclusive resource available.

This information was supplemented by a recent report by Gitman (2010) describing the state of the practice in transportation training at community colleges. Community college programs related to transportation focus on the areas of automotive technologies, commercial driving, or supply chain and logistics. It is unclear how much connection is being made between relevant transportation programs and TSM&O careers. Initial research indicated that most training in TSM&O is focused on professional development, not on developing an overall TSM&O-focused university curriculum. While not sufficient, existing resources such as the Operations Academy and university transportation centers are providing opportunities for current engineers and planners to expand their TSM&O-related knowledge and skills. The Operations Academy is geared to mid- and senior-level managers at transportation agencies, and therefore it does not represent entry-level academic support for TSM&O.

Research identified several papers proposing university courses or degree programs to address the need for TSM&O training at the university level. But it is unclear how many of these courses or programs have been put into practice. Most work in the area of university transportation curricula appears, however, to be focused on the transportation field more generally.

One additional resource was noted during review of the academic white paper. The Consortium for ITS Training and Education (CITE) comprises university and industry associations to provide advanced transportation training and

education through an online resource. CITE offers a combination of individual-study, instructor-led, and certificate programs. CITE focuses on traffic engineering and ITS courses. The courses identified were captured in the NTTR database and are therefore included in this research.

The academic white paper identified the core competencies necessary to support a career in TSM&O. The breadth of TSM&O skills requires business and people skills in addition to technical skills provided by civil engineering and similar curricula. The relationship between the Operations Academy focus areas, the NTTR database, and the identified core competencies was presented in this report. These are some of the lessons learned:

- Gaps in technical competencies exist in traffic safety, emergency management, project management, and ITS devices and architecture.
- It is unclear how well the People and Self-Management core competencies are represented within the technical courses offered.
- Student awareness of TSM&O as a career path is not currently measured; however, proposed topic areas for an undergraduate introductory transportation engineering course do not include references to ITS, telecommunications, or emergency management issues.

The breadth and depth of TSM&O-related competencies drives home the challenges of preparing undergraduates to be TSM&O professionals coming out of college. First, the multidisciplinary background that is needed to help students succeed in the field is a significant challenge in and of itself. Creating cross-disciplinary degrees is difficult at many academic institutions and requires the student and the student's advisor to know early in an academic career that this is the desired career path. Because TSM&O is not a well known or fully established discipline within the transportation engineering field, students are often not aware of this as a career option early enough in their course of study. Moreover, even if the lack of student awareness of TSM&O can be overcome, the current civil engineering curriculum is demanding, requiring many students to study 5 years to receive their undergraduate degree. In general, civil engineering undergraduates have only 40 or so hours of instruction on all topics specifically related to transportation engineering. This significantly limits the time available to address non-engineering-related TSM&O competencies.

Bibliography

- Adler, J. L., G. F. List, B. Menyuk, and M. Cetin. 2000. Advanced Educational Technologies and Intelligent Transportation Systems Training: State of the Practice. *Transportation Research Record 1729*, pp. 65–74.
- Cambridge Systematics, Inc. 2008. American Association of State Highway and Transportation Officials Subcommittee on Systems Operations and Management 2008 *Strategic Plan*. AASHTO, October.
- Cronin, B., L. Anderson, D. Fien-Helfman, C. Cronin, A. Cook, M. Lodato, and M. Venner. 2012. *NCHRP Report 693: Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management*. Transportation Board of the National Academies. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_693.pdf.
- Gitman, K. 2010. *Transportation Workforce Development at Community Colleges*. University of Vermont Transportation Research Center, Report 10-002, March.
- Christy, C. J., and S. Kikuchi. 2003. Urban Transportation Planning Education Revisited: Reading the Dials and Steering the Ship. *Transportation Research Record 1848*, pp. 57–63.
- Kyte, M., A. Bill, and R. K. Young. 2010. Everything You Need to Know About Transportation Engineering in 40 Hours. *ITE Journal*, 80 (10), pp. 40–43.
- Michigan Department of Transportation. 2008. *Aligning MDOT for an Operations Focus*. Presentation to the AASHTO Subcommittee on Systems Operations and Management, August. <http://www.transportation.org/sites/ssom/docs/2008%20meeting/17%20SSOM%20Ops%20Focus%20SSOM%202008.pdf>.
- Polzin, S. E., and B. G. Ward. 2002. Designing an Interdisciplinary Educational Program to Support Transportation Workforce Development. *Transportation Research Record 1812*, pp. 143–150.
- Saka, A. A. 2010. A Prototype Undergraduate Degree Program in Transportation Systems. *2010 TRB Annual Conference*.
- SHRP 2 L17 Gap-Filling Projects and KTS. <http://www.trb.org/main/blurbs/169243.aspx>.
- U.S. Department of Transportation, Federal Highway Administration. 2010a. *Catalog of Transportation Education, Training, and Workforce Development Programs and Resources*. August.
- U.S. Department of Transportation, Federal Highway Administration. 2010b. National Transportation Training Resource database. <http://www.ntrr.dot.gov/>.
- University of Maryland Center for Advanced Transportation Technology. 2009. Transportation Operations Framework, NCHRP Project 20-77. <http://www.catt.umd.edu/research/transportation-operations-framework>.
- Victoria Transport Policy Institute. 2010. *Operations and Management: Managing Existing Road Systems for Efficiency and Economy*. Victoria, BC, Canada. <http://www.vtpi.org/tm/tm111.htm>.

APPENDIX A

Summary of Existing Reliability/TSM&O Content

A brief summary of the relevant documents under each of the seven Level 1 categories (Business Processes, Technical Processes, Institutional Issues, Strategies and Treatments, Data and Analytic Tools, Outreach and Marketing, and Education) follows. The document numbers (1 through 55) are referenced at the end of each brief summary, and a complete list of the reviewed documents is provided at the end of this appendix.

Business Processes

A Framework for Collaborative Decision Making on Additions to Highway Capacity (SHRP 2 C01) is an integrated, systems-based framework that can be used to reach collaborative decisions on projects designed to expand highway capacity. This framework can also provide a portal to other relevant research that has been incorporated into the decision guide as well as to supporting documentation, references, and guidance (1).

Performance Measurement Framework for Highway Capacity Decision Making (SHRP 2 C02) provides information to a data-driven, collaborative decision-making process through interface with the decision guide developed in the SHRP 2 C01 project. The framework captures performance measures across five planning factors: transportation, environmental, economic, community, and cost (2).

Integrating Business Processes to Improve Travel Time Reliability (SHRP 2 L01) identifies the core of operations business processes within transportation management that have day-to-day influence over operations and network performance and, in turn, positive impacts on travel time reliability (7).

Establishing Monitoring Programs for Travel Time Reliability (SHRP 2 L02) is being carried out to “develop system designs for programs to monitor travel time reliability and to prepare a guidebook that practitioners and others can use to design, build, operate, and maintain such systems.” The guidebook also describes the analytical techniques and

system functional specifications for developing a reliability monitoring system. The guidebook provides guidance about the data collection, data management, computational engine, and management of a travel time reliability monitoring system (8).

Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes (SHRP 2 L05) develops the means—including technical procedures—for state DOTs and MPOs to fully integrate mobility and reliability performance measures and strategies into the transportation planning and programming processes (11).

Project Management Strategies for Complex Projects (R10) helps transportation agency personnel more effectively manage complex projects (19).

Strategic Approaches at the Corridor and Network Level to Minimize Disruption from the Renewal Process (R11) provides a software tool that will allow a program manager to assess the impacts of a renewal program and compares different sequencing scenarios of projects in light of desired performance objectives (20).

A Primer on Performance-Based Highway Program Management (AASHTO) describes the basic principles involved in applying performance measurement to the state budgeting and program delivery process, and it profiles how 11 states have applied these principles to improve performance and accountability (22).

Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations—A Desk Reference (FHWA) is a resource designed to enable transportation planners and their partners to build a transportation plan that includes operations objectives, performance measures, and strategies that are relevant to their region, that reflect the community’s values and constraints, and that move the region in a direction of improved mobility and safety (24).

Congestion Management Process: A Guidebook (FHWA) assists practitioners in their efforts to integrate the congestion

management process into the overall metropolitan transportation planning process, including the development of the Metropolitan Transportation Plan and the Traffic Improvement Plan (29).

Statewide Opportunities for Integrating Planning, Operations, and Safety: A Reference Manual (FHWA) describes specific actions or opportunities for transportation professionals to begin working toward integrating planning, operations, and safety for various levels of decision making: statewide, regional, corridor, and project. The specific actions are provided in “opportunity fact sheets,” which describe the individual opportunities along with associated challenges, benefits, persons involved, and recommended steps to begin implementation (46).

Statewide Opportunities for Linking Planning and Operations (FHWA) is designed to raise awareness of the benefits and opportunities for coordinating planning and operations activities within state DOTs, targeted at mid-level DOT planning and operations staff (47).

Technical Processes

Feasibility of Using In-Vehicle Video Data to Explore How to Modify Driver Behavior That Causes Nonrecurring Congestion (L10) is intended “to examine existing studies using video cameras and other onboard devices to collect data and determine the potential for using these data to explore how to modify driver behavior in an attempt to reduce nonrecurring congestion” (14).

Requirements and Feasibility of a System for Archiving and Disseminating Data from SHRP 2 Reliability and Related Studies (L13) presents the results of a feasibility study that assesses the technical, economic, and business aspects of developing, operating, and maintaining a long-lived archival system that preserves and makes readily available to researchers and practitioners information from SHRP 2 Reliability and related projects (17).

Metropolitan Transportation Management Center, Concepts of Operation (FHWA) identifies successful practices and lessons learned from operations concepts at eight transportation management centers (TMCs) throughout the United States and Canada (38).

Optimizing the System: Saving Time, Saving Lives (AASHTO) is a basic informational report that describes how TSM&O strategies can reduce the impacts of nonrecurring congestion and “optimize the system.” Topics discussed include traffic incident management (TIM), work zone management, road weather management, strategies employed in rural areas, signalized intersection optimization and interjurisdictional coordination, freeway operation strategies (including ramp metering and managed lanes), traveler information services, ITS tools for commercial vehicles (including weighing and

inspection), and vehicle technologies and infrastructure integration (Vehicle/Infrastructure Integration Initiative—now referred to as “Connected Vehicles”) (41).

Institutional Issues

Institutional Architectures to Improve Systems Operations and Management (L06) combines both research and guidance relating to the institutional preconditions within state DOTs for effective management of nonrecurring congestion. The objective of the project is to identify the preconditions to “institutionalizing” TSM&O as a continuously improving formal agency program (12).

Training of Traffic Incident Responders (L12) establishes a framework for training and certifying the capability of responders to achieve the National Unified Goal. The project prepared a complete TIM Training Course Guidance that was successfully field-tested in Indiana and Georgia (16).

Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management (NCHRP 20-86) provides research that considers the supply and demand of TSM&O workforce, both now and in the future; the actions transportation agencies may take to attract, recruit, develop, and retain skilled staff with needed capabilities; and the tools that are available or may be developed to assist agencies in their efforts to ensure the availability of skilled professionals to meet the growing demand (25).

Transportation Systems Operations and Management Guide (NCHRP 03-94) is a web-based guidance tool to assist key transportation agency managers responsible for TSM&O activities—for example, operating a transportation management center or an incident management program, managing traveler information dissemination—to develop strategies to improve their capability and effectiveness in program implementation and deployment (40).

Real-Time Traveler Information Services Business Models: State of the Practice Review (FHWA) summarizes current prevalent business models, which include public sector funded, franchise operations, private sector funded, and business-to-business models. It addresses issues such as roles and responsibilities within the models and pros and cons of the various approaches, and it provides case studies of traveler information programs throughout the country (42).

Regional Transportation Operations Collaboration and Coordination: A Primer for Working Together to Improve Transportation Safety, Reliability, and Security (FHWA) is based on the premise that to improve the reliability, safety, and security of transportation systems operating across jurisdictional and organizational boundaries, continuous collaboration and coordination is essential. Agreement must be reached on a shared operations vision, a concept for how regional activities should be operated over time, what measures to use to

assess effectiveness, and how to make improvements to achieve expectation in operating performance (43).

Strategies and Treatments

Understanding the Contributions of Operations, Technology, and Design to Meeting Highway Capacity Needs (C05) provides a summary of the operational improvement strategies found to be most effective in enhancing network performance characteristics. An important finding was that the effects of any given treatment are dependent on network conditions. Another finding was that nonlane-widening strategies tested in the Portland network had little effect on average travel time but substantial benefits in improved reliability (5).

Identification and Evaluation of the Cost-Effectiveness of Highway Design Features to Reduce Nonrecurrent Congestion (L07) focuses on the role of geometric design treatments to reduce nonrecurrent congestion and on providing better guidance on highway agencies on the use of such treatments. The key objective of the project is to evaluate the cost-effectiveness of promising highway design treatments capable of reducing delays due to key causes of nonrecurrent congestion (13).

Evaluating Alternative Operations Strategies to Improve Travel Time Reliability (L11) identifies and evaluates strategies and tactics to satisfy travel time reliability requirements of users of the roadway network. The report provides an analysis of trends, future outcomes, strategies, and technological innovations that will affect travel time reliability. In addition, it provides a roadmap discussing funding, institutional, and technological challenges of roadway agencies (15).

Effectiveness of Different Approaches to Disseminating Traveler Information on Travel Time Reliability (L14) quantifies improvements in the communication of travel reliability information to affect traveler choices such that system performance improves, develops a lexicon for communicating travel time reliability concepts among transportation professionals and travelers, and develops prioritized, near-term strategies for improved dissemination of travel-time reliability information to guide state DOTs and other public sector transportation agencies (18).

Active Traffic Management: The Next Step in Congestion Management (FHWA) assesses European experiences to determine how agencies can integrate managed lane strategies into their congestion management program, network, and corridor planning and how managed lanes fit into the development of highway improvement projects (23).

Best Practices in Traffic Incident Management in Florida (Florida DOT) describes task-specific and cross-cutting issues or challenges commonly encountered by TIM responders in the performance of their duties and strategies for overcoming these issues and challenges that are novel, effective, or both (26).

Best Practices of Rural and Statewide ITS Strategic Planning (FHWA) creates a systematic process for implementing an initial ITS strategic plan in rural and small urban environments (27).

Freeway Management and Operations Handbook (FHWA) provides an overview of the various institutional and technical issues associated with the planning, design, implementation, operation, and management of a freeway network. These programs include flexible work schedules that allow employees to travel off-peak (or work at home), amenities to improve the safety and efficiency of biking and walking, ride-matching services for vanpools and carpools, community-based car-sharing, employer-subsidized transit passes, guaranteed emergency rides home for transit users, and incentives to decrease employer-paid parking (32).

Improving Traffic Signal Management and Operations: A Basic Service Model (FHWA) provides a guide for achieving a basic service model for traffic signal management and operations. The report assesses the current state of traffic signal management and operations policy and provides guidance for agencies to more effectively allocate resources to improve traffic signal operations for motorists (34).

Road Weather Management (FHWA) describes the challenges of road weather and its effect on highway safety, capacity, and reliability. At a high level, the brochure describes the current actions transportation system operators are taking to warn travelers of changing weather, manage the transportation infrastructure, and respond to conditions in real time (44).

Traffic Congestion and Reliability Trends and Advanced Strategies for Congestion Mitigation: Final Report (FHWA) focuses on travel time reliability as a measure of congestion and includes the following:

- Characteristics and sources of congestion;
- Definition of travel time reliability and significance of reliability to travelers;
- Recent trends in congestion, especially reliability;
- Strategies to address congestion problems; and
- New tools and initiatives for dealing with congestion.

The report includes a summary of existing congestion mitigation strategies and then a set of strategies that were on the horizon at the time of the report (50).

Traffic Incident Management Handbook (FHWA) provides guidance for regions establishing or advancing TIM programs. Numerous examples and resources are provided to guide agencies on establishing and advancing individual programs. Details on program development, policies, laws, and process are presented to guide in the advancement of TIM programs (51).

Work Zone Operations Best Practices Guidebook (FHWA) is a compilation of best practices for work zone mobility and safety management in the United States. Each section begins with an assessment of the state-of-the-art practice and a

description of how transportation agencies can achieve the state of the art (55).

Data and Analytic Tools

Improving Our Understanding of How Highway Congestion and Pricing Affect Travel Demand (C04) presents findings on how income, auto occupancy, carpooling, and travel distance affect the willingness to pay and the value of travel time and travel time reliability. The report also presents useful information related to the future of modeling and how reliability can be efficiently incorporated into existing and new models (4).

Understanding the Contributions of Operations, Technology, and Design to Meeting Highway Capacity Needs (C05) provides improved analytic methods and procedures that were developed for use in existing mesoscopic dynamic traffic assignment models. These methodological enhancements included (a) recognizing the probabilistic nature of capacity on both freeways and arterials, (b) accounting for queuing effects on downstream discharge rates at signalized intersections, and (c) allowing drivers to learn from past experiences and to adjust their individual travel paths on the basis of their most recent two-week travel histories (5).

Analytical Procedures for Determining the Impacts of Reliability Mitigation Strategies (L03) develops methods to predict travel time reliability. Two types of models were developed. The first type was Predicting Reliability Metrics as a Function of the Mean Travel Time Index and the second type was Predicting Reliability as a Function of Causal Factors (9).

Incorporating Reliability Performance Measures in Operations and Planning Modeling Tools (L04) describes a proposed framework and functional requirements for the inclusion of travel time reliability estimates in transportation network modeling tools. The report demonstrates the process of simulating travel time distributions in response to factors that cause both demand variation (special events, variation in individual driver behavior, closure of alternative modes) and supply variation (weather, work zones, incidents, variation in individual driver behavior, traffic control, dynamic pricing) at the regional and corridor levels (10).

Congestion Management Process: A Guidebook (FHWA) discusses data and analytic tools (specifically visualization communication and analysis tools) to demonstrate how they can be used to predict reliability, evaluate operations strategies, and collect and manage data (29).

Cost-Effective Performance Measures for Travel Time Delay, Variation, and Reliability (NCHRP 618) presents a framework and cost-effective methods to estimate, predict, measure, and report travel time, delay, and reliability performance data. The guidebook presents and assesses performance measures currently believed to be most appropriate for estimating and reporting travel time, delay, and reliability from a

perspective that system users and decision makers will find most understandable and relevant to their experience and information needs (30).

Guide to Effective Freeway Performance Measurement: Final Report and Guidebook (NCHRP Web Only Document 97) includes measures related to typical congestion levels, travel time reliability, and throughput. It also includes supporting measures on the nature of roadway events that impede traffic flow: incidents, weather, and work zones (33).

Traffic Analysis Toolbox Volume I: Traffic Analysis Tools Primer (FHWA) provides an overview of the different types of traffic analysis tools and describes their role in transportation analyses. The nine volumes that follow address specific types of tools, including traffic microsimulation modeling software and work zone modeling and simulation (48).

Outreach and Marketing

Public Roads Magazine, Volume 71, Number 5—Integrated Corridor Management (FHWA Article) discusses the integration of operations such as TIM, work zone management, traffic signal timing, managed lanes, real-time traveler information, and active traffic management, and how such integration helps maximize the capacity of all facilities and modes across the corridors and allows for greater mobility (36).

Real-Time Traveler Information Services Business Models: State of the Practice Review (FHWA) describes communicating reliability information through traveler information services, business models and plans, branding, data collection, processing, and disseminating tools and techniques. (42).

Travel Time Reliability: Making It There on Time, All the Time (FHWA) is a brochure designed to provide a high-level understanding of travel time reliability and its impacts on the transportation system. It describes travel time reliability with explanatory figures and explains why it is important and how it affects travelers. It provides measures used to quantify travel time reliability and the steps required to develop travel time measures. Finally, it presents case studies on developing travel time measures and some examples of travel time measurement (52).

List of Reviewed Documents

SHRP 2 Products and Reports

1. D'Ignazio, J. A. *SHRP 2 Report S2-C01: A Framework for Collaborative Decision Making on Additions to Highway Capacity*. Draft available at <http://www.trb.org/Main/Blurbs/166046.aspx>.
2. Louch, J. H. 2009. *SHRP 2 Report S2-C02-RR: Performance Measurement Framework for Highway Capacity Decision Making*. Transportation Research Board of the National Academies, Washington, D.C.

3. Cambridge Systematics, Inc., et al. 2009. *SHRP 2 Report S2-C02-RR: Performance Measurement Framework for Highway Capacity Decision Making*. Transportation Research Board of the National Academies, Washington, D.C.
4. Donnelly, R. 2013. *SHRP 2 Report S2-C04-RW-1: Improving Our Understanding of How Highway Congestion and Pricing Affect Travel Demand*. Transportation Research Board of the National Academies, Washington, D.C. Web-only document at <http://www.trb.org/Main/Blurbs/168141.aspx>.
5. Kittelson & Associates. *SHRP 2 Report S2-C05: Understanding the Contributions of Operations, Technology, and Design to Meeting Highway Capacity Needs*. Draft available at <http://www.trb.org/Main/Blurbs/166939.aspx>.
6. RSG et al. *SHRP 2 Report S2-C10A: Dynamic, Integrated Model System: Jacksonville-Area Application*. Draft available at <http://www.trb.org/Main/Blurbs/169685.aspx>.
7. Burgess, L. 2009. *SHRP 2 Report S2-L01-RR-1: Integrating Business Processes to Improve Travel Time Reliability*. Transportation Research Board of the National Academies, Washington, D.C.
8. List, G. *SHRP 2 Report S2-L02: Establishing Monitoring Programs for Travel Time Reliability*. Draft available at <http://www.trb.org/Main/Blurbs/168765.aspx>.
9. Margiotta, R. 2013. *SHRP 2 Report S2-L03-RR-1: Analytical Procedures for Determining the Impacts of Reliability Mitigation Strategies*. Transportation Research Board of the National Academies, Washington, D.C.
10. Stogios, Y., Mahmassani, S., and Vovsha, P. forthcoming. *SHRP 2 Report S2-L04: Incorporating Reliability Performance Measures in Operations and Planning Modeling Tools*. Transportation Research Board of the National Academies, Washington, D.C.
11. Vandervalk, A. *SHRP 2 Report S2-L05: Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes*. Draft available at <http://www.trb.org/Main/Blurbs/168854.aspx>.
12. Lockwood, S. 2012. *SHRP 2 Report S2-L06-RR-1: Institutional Architectures to Improve Systems Operations and Management*. Transportation Research Board of the National Academies, Washington, D.C.
13. Potts, I., Harwood, D., Hutton, J., Fees, C., Bauer, K., Kinzel, C., and Frazier, R. *SHRP 2 Report S2-L07: Identification and Evaluation of the Cost-Effectiveness of Highway Design Features to Reduce Nonrecurrent Congestion*. Draft at <http://www.trb.org/Main/Blurbs/169767.aspx>.
14. Rakha, H., et al. 2011. *SHRP 2 Report S2-L10-RR-01: Feasibility of Using In-Vehicle Video Data to Explore How to Modify Driver Behavior That Causes Nonrecurring Congestion*. Transportation Research Board of the National Academies, Washington, D.C.
15. Zegeer, J. 2013. *SHRP 2 Report S2-L11-RR-1: Evaluating Alternative Operations Strategies to Improve Travel Time Reliability*. Transportation Research Board of the National Academies, Washington, D.C.
16. Owens, N., et al. 2012. *SHRP 2 Report S2-L12-RW-1: Training of Traffic Incident Responders*. Transportation Research Board of the National Academies, Washington, D.C. Web-only document at <http://www.trb.org/Main/Blurbs/166877.aspx>.
17. Tao, D., Spotts, J., and Hess, E. 2011. *SHRP 2 Report S2-L13-RW-1: Requirements and Feasibility of a System for Archiving and Disseminating Data from SHRP 2 Reliability and Related Studies*. Transportation Research Board of the National Academies, Washington, D.C. Web-only document at <http://www.trb.org/Publications/Blurbs/165408.aspx>.
18. Kuhn, B., Higgins, L., Nelson, A., Finley, M., Ullman, G., Chrysler, S., Wunderlich, K., Shah, V., and Dudek, C. *SHRP 2 S2-L14: Effectiveness of Different Approaches to Disseminating Traveler Information on Travel Time Reliability*. Draft at <http://www.trb.org/Main/Blurbs/168809.aspx>.
19. Shane, J. *SHRP 2 Report S2-R10: Project Management Strategies for Complex Projects*. Draft at <http://www.trb.org/Main/Blurbs/167481.aspx>.
20. Ismart, D. *SHRP 2 Report S2-R11: Strategic Approaches at the Corridor and Network Level to Minimize Disruption from the Renewal Process*. Draft at <http://www.trb.org/Main/Blurbs/168143.aspx>.
21. Hunt, J. E., Vandervalk, A., and Snyder, D. 2011. *SHRP 2 Report S2-S03-RW-1: Roadway Measurement System Evaluation*. Transportation Research Board of the National Academies, Washington, D.C. Web-only document at <http://www.trb.org/Publications/Blurbs/165410.aspx>.

Other TSM&O Resources and Documents

22. AASHTO. 2008. *A Primer on Performance-Based Highway Program Management: Examples from Selected States*. AASHTO, Washington, D.C.
23. Mirshahi, M. et al. 2007. *Active Traffic Management: The Next Step in Congestion Management*. FHWA, U.S. Department of Transportation.
24. Worth, P., Bauer, J., Grant, M., Josselyn, J., Plaskon, T., Candia-Martinez, M., Chandler, B., Smith, M. C., Wemple, B., Wallis, E., Chavis, A., and Rue, H. 2010. *Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations: A Desk Reference* (No. FHWA-HOP-10-027). FHWA, U.S. Department of Transportation.
25. Cronin, B., Anderson, L., Fien-Helfman, D., Cronin, C., Cook, A., Lodato, M., and Venner, M. 2012. *NCHRP Report*

- 693: *Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management*. Transportation Research Board of the National Academies, Washington, D.C.
26. Florida Department of Transportation and Center for Urban Transportation Research at the University of South Florida. 2005. *Best Practices in Traffic Incident Management in Florida, BC353-47*.
 27. Dankocsik, C., Zarean, M., Register, D., and Timpone, K. 2002. *Best Practices of Rural and Statewide ITS Strategic Planning*. FHWA, U.S. Department of Transportation.
 28. Maryland Department of Transportation. 2008. *CHART Non-Constrained Deployment Plan*. Office of CHART and ITS Development, State Highway Administration, Hanover, Md.
 29. Grant, M., Bowen, B., Day, M., Winck, R., Bauer, J., Chavis, A., and Trainor, S. 2011. *Congestion Management Process: A Guidebook*. FHWA, U.S. Department of Transportation.
 30. Pickrell, S. 2007. *NCHRP Report 618: Cost-Effective Performance Measures for Travel Time Delay, Variation, and Reliability*. Transportation Research Board of the National Academies, Washington, D.C.
 31. Sparks, J., Schuh, J., and Smith, A. 2009. *Field Operations Guide for Safety/Service Patrols*. FHWA, U.S. Department of Transportation.
 32. Neudorff, L. G., Randall, J. E., Reiss, R., and Gordon, R. 2003. *Freeway Management and Operations Handbook*. FHWA, U.S. Department of Transportation.
 33. Cambridge Systematics, Inc. et al. 2006. *NCHRP Web Only Document 97: Guide to Effective Freeway Performance Measurement—Final Report and Guidebook*. Transportation Research Board of the National Academies, Washington, D.C.
 34. Denny, R. 2009. *Improving Traffic Signal Management and Operations: A Basic Service Model*. FHWA, U.S. Department of Transportation.
 35. Federal Highway Administration. 1995. *Improving Traffic Signal Operations: A Primer*. FHWA, U.S. Department of Transportation.
 36. Cronin, B., Mortensen, S., and Thompson, D. 2008. *Integrated Corridor Management. Public Roads Magazine, Volume 71, Number 5*.
 37. ITS Joint Program Office. Knowledge Resources. Research and Innovative Technology Administration, U.S. Department of Transportation. <http://www.benefitcost.its.dot.gov>.
 38. Intelligent Transportation Systems. 1999. *Metropolitan Transportation Management Center, Concepts of Operation*. U.S. Department of Transportation.
 39. National Transportation Operations Coalition. 2005. *NTOC Performance Measurement Initiative: Final Report*.
 40. Lockwood, S. 2013. *Transportation Systems Operations and Management Guide, NCHRP Project 03-94*. Transportation Research Board of the National Academies, Washington, D.C. Web-only document available at www.aashtotsmoguidance.org.
 41. AASHTO. 2004. *Optimizing the System: Saving Time, Saving Lives*. American Association of State Highway and Transportation Officials, Washington, D.C.
 42. Burgess, L., Toppen, A., and Pretorius, P. 2007. *Real-Time Traveler Information Services Business Models: State of the Practice Review*. FHWA, U.S. Department of Transportation.
 43. Federal Highway Administration. 2004. *Regional Transportation Operations Collaboration and Coordination: A Primer for Working Together to Improve Transportation Safety, Reliability, and Security*. FHWA, U.S. Department of Transportation.
 44. Federal Highway Administration. 2004. *Road Weather Management [Brochure]*. FHWA, U.S. Department of Transportation.
 45. Pisano, P. 2010. *Seasons of Achievement: Accomplishments of the Road Weather Management Program*. U.S. Department of Commerce.
 46. Grant, M. et al. 2010. *Statewide Opportunities for Integrating Planning, Operations, and Safety: A Reference Manual*. FHWA, U.S. Department of Transportation.
 47. Louch, H., Flanigan, E., Jeannotte, K., and Titze, C. 2008. *Statewide Opportunities for Linking Planning and Operations: A Primer*. FHWA, U.S. Department of Transportation.
 48. Alexiadis, V., Jeannotte, K., and Chandra, A. 2004. *Traffic Analysis Toolbox Volume I: Traffic Analysis Tools Primer*. FHWA, U.S. Department of Transportation.
 49. Margiotta, R., and Spiller, C. 2012. *Recurring Traffic Bottlenecks: A Primer Focus on Low Cost Operational Improvements*. FHWA, U.S. Department of Transportation.
 50. Cambridge Systematics, Inc. 2005. *Traffic Congestion and Reliability Trends and Advanced Strategies for Congestion Mitigation—Final Report*. FHWA, U.S. Department of Transportation.
 51. Ownes, N., et al. 2010. *Traffic Incident Management Handbook*. FHWA, U.S. Department of Transportation.
 52. Taylor, R. 2006. *Travel Time Reliability: Making It There on Time, All the Time*. FHWA, U.S. Department of Transportation.
 53. Virginia Department of Transportation. 2006. *VDOT NOVA Smart Travel Program Plan: Executive Summary*.
 54. Lockwood, S. 2009. *VDOT Statewide Systems Operations Program*.
 55. Federal Highway Administration. 2007. *Work Zone Operations Best Practices Guidebook*. FHWA, U.S. Department of Transportation.

APPENDIX B

Analysis of Gap-Filling Projects

Tables B.1 through B.5 address, respectively, SHRP 2 research project categories, potential overlapping projects, SHRP 2 Reliability projects, Project L17 gap-filling projects, and SHRP 2 development projects.

Table B.1. SHRP 2 Research Project Categories

		[A]	[B]	[C]	[D]	[E]
		Guidance and Standards	State of Practice	Case Studies	Benefits and Costs	Facts and Stats
Business Processes						
1	Policy Program Dev. Planning Budgeting/Programming Performance Meas. Procurement Project Development	L31, GF1, GF9	L31, GF9	GF1, GF9		GF9
2		GF8, L06, GF9		GF9	GF9	GF9
3		L05, L05-1 and -2, GF3, GF9	GF3	L05, L05-2, GF1, GF9	GF9	GF9
4		L05, L06		L05-2		
5						
6		GF2	GF2	GF2	GF2	GF2
Technical Processes						
7	System Architecture Verify/Validate Vehicle Technology	L13, L13-1				
8						
9			L10			
Institutional Issues						
10	Leadership Org/Staffing Recruit- ment Funding Collaboration PPP	L06, GF1, GF9	GF9	GF1		
11		L06, GF1	GF9			GF9
12		L06				
13		GF9	GF9			
14		L06, GF9	GF9			GF9
15		GF9	GF9			GF9

(continued on next page)

Table B.1. SHRP 2 Research Project Categories (continued)

		[A]	[B]	[C]	[D]	[E]
		Guidance and Standards	State of Practice	Case Studies	Benefits and Costs	Facts and Stats
Strategies/Treatments						
16	ATDM/Pricing	L11-1-3			L11	GF12
17	Work Zone Mgmt ICM	L11-1-3				GF12
18	TIM	L11-1-3				GF12
18	Road Weather Arterial Ops Freeway	L11-1-3			L11	GF12
19	Ops Freight Mgmt Ops Traveler	L11-1-3			L11	GF12
20	Info Geometric Design	L11-1-3				GF12
21		L11-1-3			L11	GF12
22		L11-1-3			L11	GF12
23		L11-1-3				GF12
24		L11-1-3			L11	GF12
25		L11-1-3	L07			GF12
Data/Analytic Tools						
26	Predictive Methods	L04, L08, L03, L03-1-5				
27	Strategy Evaluation	GF11, L03, L03-1-5, L05, GF4	GF4	L35C, L05-2	GF5, L35-A and -B	
28	Data Collection/Mgmt	L02, L02-4, L13		L02		
29	Performance Measures	L03	L03			
Outreach/Marketing						
30	Business Cases Branding	L17, GF6, GF1, GF9	L17	L17		
31	Messaging	L17	L17	L17		
32		L17, GF6, GF1, GF9	L17	L17		
Education						
33	Curricula	GF10	GF10	GF10		GF10
34	Training Program	L12, L12-1, L13A-1	L31	L12-1		

Note: PPP = public-private partnership; ATDM = Active Transportation and Demand Management; ICM = integrated corridor management.
 Key: Green = Topic is well-covered; Yellow = Topic is covered but could use more attention; Red = Topic needs attention; Black = Not applicable.

Table B.2. Explanation of Potential Overlapping Projects

Cell Number in Table B.1	Referenced Projects	Reasons They Are Not Duplicative
A1	L31, GF1, GF9	L31 will develop workshops focusing on broad strategies and messaging for CEOs and Senior Executives. GF1 is a briefing book intended for a broader group of decision makers. GF9 produces a Handbook that focuses specifically on the persuasive elements of change management strategies.
B1	L31, GF9	L31 will develop workshops focusing on broad strategies and messaging for CEOs and Senior Executives. GF9 focuses specifically on change management strategies in response to funding constraints and constraints on traditional capacity improvements.
C1	GF1, GF9	GF1 is designed as a high level resource for decision makers and provides a broad range of information at a general level. GF9 will focus specifically on change management strategies in response to funding constraints and constraints on traditional capacity improvements.
A2	GF8, L06, GF9	GF8 provides the structure for including TSM&O in transportation decision making in Planning, Programming, Corridor Planning, and Environmental Review. This is not provided by any of the other projects.
A3	L05, L05-1 and -2, GF3, GF9	L05 and its follow on activities will not provide guidelines for determining short-term budgets and procedures for identifying long-term needs (GF3). GF9 provides resource material to support change management strategies.
C3	L05, L05-2, GF1, GF9	GF1 is focused on state CEOs whereas the target audience for L05 is local, regional, and state planners. GF9 is specifically providing resources to support change management in TSM&O.
A4	L05, L06	The primary audience for L05 is local, regional, and state planners. The target audience for L06 is broader and includes decision makers.
A7	L13, L13-1	L13-1 is a follow-on to L13, and its purpose is to develop a prototype data repository based on the concept and specifications developed in L13.
A10	L06, GF1, GF9	L06 addresses leadership from a CMM perspective—how to improve; GF1 specifically targets state CEOs and their senior executives; GF9 provides persuasive materials for change management.
A11	L06, GF1	L06 has a broad audience and focuses on CMM. GF1 is specifically aimed at CEOs and their senior executives.
A14	L06, GF9	L06 provides a CMM framework; GF9 provides persuasive materials.
A16–A25	L11-1–3	These three projects will involve the development of a planners guide, an operational and design toolkit, and a web-based toolkit for congestion-reduction treatments (to improve travel-time reliability). Together, they will provide a comprehensive resource for transportation system planners, designers, and operators.
A26	L04, L08, L03, L03-1–5	Both will rise to the level of “Go-To” documents. L04 deals with predictive methods associated with travel demand forecasting models, whereas L08 deals with predictive methods associated with HCM procedures.
A27	GF11, L03, L03-1–5, L05, GF4	GF11 provides guidance for applying the various analysis tools that are being developed in SHRP 2. GF4 provides guidance for conducting before/after studies.
C27	L35C, L05-2	L35C case studies will specifically address economic evaluation models; L05-2’s case studies will be broader and focus on other aspects such as planning, programming, and budgeting.
D27	GF5, L35-A and -B	GF5 will provide a synthesis of current knowledge on alternate ways to value travel-time reliability. This will be an interim guidance document that will be available prior to the completion of L35A and L35B. These two subsequent documents (L35A and L35B) will involve the development of an economic model and validation for valuing travel-time reliability.
A28	L02, L02-4, L13	L02 is intended to prepare a guide book to help agencies develop a new monitoring system by outlining potential functionalities and providing instructions about how to create such a system, which means that high level information will be focus of the project. L13 focus on data archiving system functionality and how different reliability data can be efficiently stored and managed, which means that L13 provides in-depth information regarding systems architecture and data archiving/management procedures.

Table B.3. SHRP 2 Reliability Research Projects

L01	Integrating Business Processes to Improve Travel Time Reliability
L02	Establishing Monitoring Programs for Mobility and Travel Time Reliability
L03	Analytic Procedures for Determining the Impacts of Reliability Mitigation Strategies
L04	Incorporating Reliability Performance Measures in Operations and Planning Modeling Tools
L05	Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes
L06	Institutional Architectures to Support Operational Strategies
L07	Evaluation of Cost-Effectiveness of Highway Design Features
L08	Incorporation of Travel Time Reliability into the Highway Capacity Manual
L09	Combined with L08, Incorporation of Nonrecurrent Congestion Factors into the AASHTO Policy on Geometric Design
L10	Feasibility of Using In-Vehicle Video Data to Explore How to Modify Driver Behavior that Causes Nonrecurring Congestion
L11	Evaluating Alternative Operations Strategies to Improve Travel Time Reliability
L12	Improving Traffic Incident Scene Management
L13	Archive for Reliability and Related Data
L14	Traveler Information and Travel Time Reliability
L15	Innovative IDEA Projects
L16	Assistance to Contractors to Archive Their Data for Reliability and Related Projects

Table B.4. Gap-Filling Projects

#	Description	Objective	Product	Schedule in Months	Priority for L17
1	Persuasive TSM&O Case Study Briefing Book for Decision Makers	To provide compelling examples from state and regional experience that support the benefits of TSM&O in terms that are directly relevant to decision makers.	Mini briefing book for decision makers	9	High
2	Deployment Guidance for TSM&O Strategies	To provide guidance for matching the deployment of TSM&O strategies to institutional, highway, and traffic conditions.	Guidebook	9	High
3	TSM&O Program and Budget Development	To develop guidelines for determining short-term programs and budgets as well as procedures for identifying long-term needs for TSM&O within an agency.	Guidebook	9	High
4	Standard Evaluation and Reporting Procedures for TSM&O Strategies	To provide guidance on how to conduct field evaluations of operations strategies and to use the results both internally and externally.	Guidebook	6	High
5	Synthesis on Valuing Travel Time Reliability	To provide interim guidance on how to value travel time reliability until a full-scale research project is completed.	Guidebook	6	High ^a
6	Key Sub-Audience Business Case and Communication Strategies to Support Mainstreaming of TSM&O	To develop business case and communication strategies for up to an additional six sub-audiences to supplement brand, communication strategies, and sample materials being developed as part of the L17 scope.	Business cases and report.	6	High
7	Development and Delivery of CEO Workshops	To conduct workshops for new CEOs and Chief Engineers to demonstrate TSM&O benefits and successful practices.	Workshop materials and briefing report	9	High ^b

(continued on next page)

Table B.4. Gap-Filling Projects (continued)

#	Description	Objective	Product	Schedule in Months	Priority for L17
8	Integration of Operations into Transportation Decision Making	To provide technical staff and policy makers the decision-making structure and supporting information needed to integrate consideration of operational improvements into overall transportation decision making during planning, programming, corridor planning, and NEPA/permitting.	Separate application in TCAPP	12	High ^c
9	TSM&O in the “new context of” constrained transportation improvements	To provide resource material that focuses on identifying the set of recent changes in the context for transportation improvement—state and regional—that have constrained conventional (capacity) improvements and imply greater need for focus on efficient and effective operations of the existing network. The material would be designed to be used by policy and planning staffs.	“Responding to Constraints” handbook and related web material	9	Medium
10	Development of a TSM&O Course	To develop course materials for one graduate-level course on TSM&O.	Course material and “train-the-trainer” material	9	Medium
11	Guidance and Application Procedures for Predicting the Performance of TSM&O Strategies	To develop guidance for applying analysis, modeling, and simulation tools in the evaluation of emerging TSM&O strategies.	Guidebook	12	Low
12	Facts and Stats for TSM&O	To summarize readily available quantitative information regarding implementation statistics, benefits, and costs of TSM&O strategies to incorporate in the KTS.	Database and report	6	High

Note: Shaded rows represent recommended gap-filling projects for L17 Phase 3. NEPA = National Environmental Policy Act of 1969; TCAPP = Transportation for Communities—Advancing Projects through Partnerships.

^a A full-scale follow-on project is recommended for developing a recommended practice for valuing travel time reliability.

^b This project has been replaced by Project L31.

^c This project became part of Project C01.

Table B.5. SHRP 2 Development Projects

Reference	Project	Product Title	Implementation Activities	Start Year
Year 2011				
Group 1: Organizing Transportation Agencies to Improve Reliability				
L34	L34 (L01)	Operations Business Process for Self-Assessment Tool	Develop Operations Business Process Self-Assessment web tool for improving reliability	2011
L31	All Reliability (L31)	Outreach on Operations and Reliability to CEO, Chief Engineers, and Executive Management	Develop training and workshop material and conduct workshops on Operations and Reliability for CEO, Senior Executives, and State DOT Chief Engineers	2011
L32C	L32C (L12)	Interdisciplinary Train the Trainer Post-Course Assessment Tool	Develop and test interdisciplinary post-course assessment tool for “train-the-trainer” course developed in L12	2011
L32A	L32A (L12)	Conduct Train-the-Trainer Course for Incident Responders and Managers	Conduct 10 customized pilots of the train-the-trainers course for incident responders	2011
L32B1	L32B (L12, Approved in November 2010)	Training and Certification of Traffic Incident Responders	Develop Training material and Conduct CEO level training on traffic incident responders	2011

(continued on next page)

Table B.5. SHRP 2 Development Projects (continued)

Reference	Project	Product Title	Implementation Activities	Start Year
L32B2	L32B (L12, Revised June 2011)	E-Learning for Training Traffic Incident Responders and Managers	Develop e-tools for training traffic incident responders	2011
L32C	L32C (L12)	Training and Certification of Traffic Incident Responders	Research extension—Feasibility study on training and certification of traffic incident responders (Changed to assessment of course.)	2011
Group 2: Reliability Planning, Programming, and Geometric Design				
L35A	L35A (L11)	Economic Evaluation Model to Assess Improvements in Travel Time Reliability	Research extension—Develop concepts, strategies, and models to determine valuing improvements in travel time reliability	2011
L35B	L35B (L11)	Validation of Economic Evaluation Models to Assess Improvements in Travel Time Reliability	Research extension—Validate concepts, strategies, and developed models to determine valuing improvements in travel time reliability	2011
L35C	L35C (L11)	Application of Economic Evaluation Models to Assess Improvements in Travel Time Reliability	Research extension—Conduct demonstration pilot projects and apply developed models to determine valuing improvements in travel time reliability in real-time project applications scenarios and for operations strategies	2011
Group 3: Analytical Tools for Reliability				
L33	L33 (L03)	Urban Freeway Models Validation	Research extension—Perform validation of urban freeway models	2011
Group 4: Data Collection for Reliability				
		No products identified for 2011		
Year 2012				
All Reliability Program Products				
OpsAcad	All	Regional Ops Academy for Operations and Management	Develop syllabus, curriculum, and training materials and conduct pilot sessions on a regional scale and establish a framework for a Regional Level Operations Academy	2012
AgencyTst	All	Agency Testing of SHRP 2 Reliability Products	Develop a framework that serves as a single-stop-shop access for state DOT, MPO, and other local agency professionals and perform field tests, pilots, and demonstration projects and mainstream reliability products as they become available	2012
Group 1: Organizing Transportation Agencies to Improve Reliability				
		No products identified for 2012		
Group 2: Reliability Planning, Programming, and Geometric Design				
L05-1	L05	Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes	Develop web-based interactive tool for integrating reliability into transportation planning, programming, and budgeting.	2012
L05-2	L05	Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes	Develop and conduct pilot tests of the handbook and reference guide for integrating reliability into transportation planning, programming, and budgeting	2012
L07-1	L07	Costs and Effectiveness of Highway Design Features	Perform outreach design concepts to improve reliability	2012

(continued on next page)

Table B.5. SHRP 2 Development Projects (continued)

Reference	Project	Product Title	Implementation Activities	Start Year
Group 3: Analytical Tools for Reliability				
L03	L03	Analytical Procedures for Determining the Impacts of Reliability Mitigation Strategies	Develop to the results of L03.	2011
L02-1	L02	Travel Time Reliability and Mobility Monitoring Programs	Research extension—Develop diagnostic analytical tool for reliability monitoring system	2012
Group 4: Data Collection for Reliability				
		No products identified for 2012		
Year 2013				
Group 1: Organizing Transportation Agencies to Improve Reliability				
L11-1	L11	Evaluating Alternative Operations Strategies	Develop and apply planner's guide to reliability	2013
L12-1	L12	Training and Certification of Traffic Incident Responders	Develop and implement national TIM training plan	2013
Group 2: Reliability Planning, Programming, and Geometric Design				
L07-2	L07	Costs and Effectiveness of Highway Design Features	Research extension—Develop analytical methods for small metropolitan areas and for other weather-related conditions	2013
L04-2	L04-2	Incorporating Reliability Estimation into Planning and Operations Tools	Research extension—Verify the research on incorporating reliability in planning and operations models and perform outreach activities	TBD
Group 3: Analytical Tools for Reliability				
L04-3	L04-3	Incorporating Reliability Estimation into Planning and Operations Tools	Develop guidebook for validation of advanced modeling methods incorporating reliability (ref and training manual)	2013
L04-1	L04-1	Incorporating Reliability Estimation into Planning and Operations Tools	Research extension—Develop prototype software for scenario manager and trajectory processor, including pseudo code specs	2013
Group 4: Data Collection for Reliability				
L13-1	L13	Design and Implement a System for Archiving and Disseminating Reliability Data	Research extension—Develop prototype repository for all SHRP 2 Reliability related data to be stored in the cloud with innovative metadata description	2013
L13A-1	L13A	Design and Implement a System for Archiving and Disseminating Reliability Data	Develop training on Reliability data archive	2013
Others Not Programmed				
Group 1: Organizing Transportation Agencies to Improve Reliability				
		No products identified		
Group 2: Reliability Planning, Programming, and Geometric Design				
L11-2	L11	Evaluating Alternative Operations Strategies	Research extension—Develop toolkit of operational and design treatment assessments	2013
L11-3	L11	Evaluating Alternative Operations Strategies	Research extension—Create web-based toolkit for congestion reduction treatments	2013
L08-1	L08	Filling Gaps in the Highway Capacity Manual to Address Reliability (TBD)	Research extension—Filling gaps in the HCM to address reliability (TBD)	TBD

(continued on next page)

Table B.5. SHRP 2 Development Projects (continued)

Reference	Project	Product Title	Implementation Activities	Start Year
Group 3: Analytical Tools for Reliability				
L03-2	L03	Analytical Procedures—To Determine Effects of Congestion Mitigation Methods	Research extension—Fill gaps in analytic tools for key facility types and conditions not addressed in Project L03	2013
L02-2	L02	Travel Time Reliability & Mobility Monitoring Programs	Research extension—Develop next generation monitoring pilot	TBD
L02-3	L02	Travel Time Reliability & Mobility Monitoring Programs	Research extension—Develop next generation modeling pilot	TBD
L02-4	L02	Travel Time Reliability & Mobility Monitoring Programs	Research extension—Guidebook and web tool to interactively connect the above mentioned Products 1, 2, and 3 of L02.	TBD
Group 4: Data Collection for Reliability				
		No products identified		

APPENDIX C

Briefing Book Pages

511NY

New York State

TSM&O Category: [Automated Traveler Information Systems \(ATIS\)](#)

Problem: The traveling public lacks a comprehensive, reliable, and single location of traffic, transit, and emergency notifications to make informed trip decisions.

Solution: Develop a useful, high quality, and readily available 511 information system with a customizable platform of web, phone and mobile applications to access the information in real-time.

Project Description:

- 511NY covers the transportation system and services throughout New York State
- Information is available about: traffic and transit conditions including incidents and construction, paratransit, major-crossings such as bridges and tunnels, weather, transit trip-planning, carpools, airports, tolling, and commercial vehicle information.
- My511NY is a free, personalized service on the phone, web, and app that allows a user to customize 511 based on their preferences
- 511NY provides mobile apps for Blackberry, iPhone and Android devices
- 511NY Transit Trip Planner allows a user to plan a trip across multiple transit services, agencies, operators, and states

Results:

- 511NY has seen growth in usage across all elements of the program: landline, mobile app downloads, and social media
- Positive results have encouraged expansion of the system to include an updated rideshare page with a ridematching app, and border crossing information
- Public feedback has been generally positive

Cost: The NY State Transportation Improvement Program (STIP) has a four-year (2011-14) program operational cost of \$27 million provided by Congestion Mitigation and Air Quality (CMAQ) funds.

What's in it for me?

- 511 data and dynamic message signs reduced traffic queues 50% during Thanksgiving, 2009
- Benefit-cost ratios for ATIS projects can exceed 16:1 during a major incident through traffic diversion
- 511 can reduce work zone travel time delay by 50%

Contact: Todd Westhuis, NYSDOT Project Director, twesthuis@dot.state.ny.us 518-457-7962
 Mary Harding, NYSDOT Outreach Coordinator, mharding@dot.state.ny.us

Keywords: 511, traffic, transit, information, weather, incidents, trip-planning, web, mobile, ATIS, ITS

Project Team: NYDOT and dozens of other New York state transportation and police agencies provide information to 511NY. 511NY also incorporates data from surrounding states and Canada.

Quote: "511 has proven to be an invaluable information resource for highway traffic conditions...All people have to do is call 511 or visit the website at 511NY.org and the service is available 24 hours a day, seven days a week."

Joan McDonald, NYSDOT Commissioner

Multimedia:

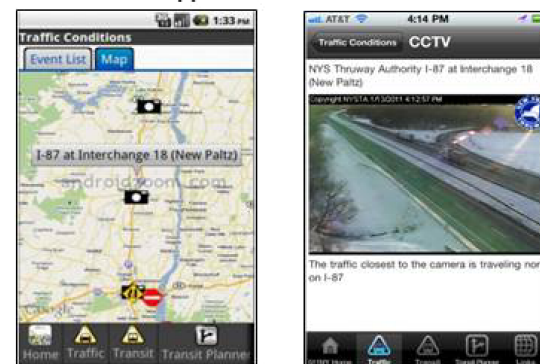
[511NY.org: Traffic, Travel and Transit Information](#)
[Sample of My511NY Customized Trip Information by Phone](#)

511NY Transit Trip Planner Web Application



Source: 511NY

511NY Mobile Apps for Android and iPhone



Source: 511NY

11/08/12

Dallas Integrated Corridor Management

Dallas, TX

TSM&O Category: [Integrated Corridor Management](#)

Problem: The congested US-75 project corridor plays a critical role in moving people through a region with rapid population growth and major employment centers. Road expansion is not an option.

Solution: Operate the US-75 corridor to incorporate multiple solutions involving ITS applications, travel demand management, enhanced transit options, special use lanes, and pricing strategies.

Project Description:

The Dallas ICM project will be implemented in 2013 and will include the following assets and strategies:

- ITS infrastructure including surveillance cameras, dynamic message signs on arterials and US-75, traffic sensors and vehicle detection, responsive traffic signals, transit signal priority, and data archive
- Transportation Management Center that combines TxDOT, DART and Dallas County Sheriff Department
- HOV/HOT lanes
- Route and mode diversion strategies for incident and crash/mobility assistance patrols
- Smart parking systems at light rail stations
- Expanded traveler, weather, and 511 systems

Results:

These results are taken from the Analysis, Modeling, and Simulation Phase of the project:

- Annual travel time savings are approximately 740,000 person-hours
- 3% improvement in travel time reliability
- Nearly 1 million gallons of fuel saved annually
- 9,400 tons of mobile emissions reduced
- Benefit-Cost ratio approximately 20:1

Cost: The ICM program will cost \$13.6 million over a 10-year period with funding from the USDOT, local share, DART, and other federal funds

What's in it for me?

- Improved mobility and travel time reliability
- Reduced fuel consumption and mobile emissions
- ICM benefits accrue faster at higher levels of travel demand and during non-recurrent congestion
- Simulation work has resulted in improvements to analysis tools and modeling methodologies

Contact: Koorosh Olyai, ICM Program Manager, Dallas Area Rapid Transit, olyai@dart.org, 214-749-2866

Keywords: ICM, corridor, ITS, HOT, HOV, AMS, transit, signal priority, multimodal, modeling, operations

Project Team: Dallas Area Rapid Transit (DART), Cities of Dallas, Highland Park, Richardson, Plano, and University Park, North Central Texas Council of Governments, North Texas Tollway Authority, TxDOT

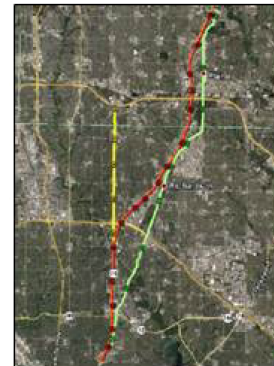
Quote: "The ability of the parallel arterials to handle traffic was confirmed during the analysis, modeling and simulation phase of the ICM project. The modeling assessment showed as much as a 20:1 benefit to cost could be achieved by implementing alternative diversion routes and shifts to transit."

Koorosh Olyai, Dallas Area Rapid Transit

Multimedia:

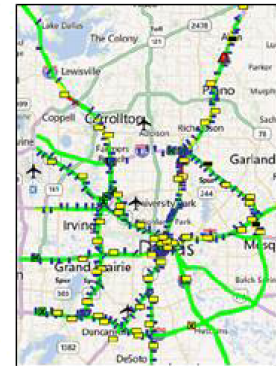
[Dallas ICM Initiative Presentation from ITS America 2012](#)

Arterial Street Monitoring



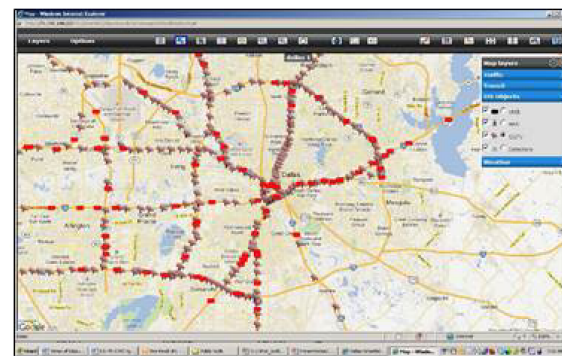
Source: DART

Incident Diversion



Source: DART

SmartNET ITS Device Map



Source: DART

11/08/12

Freeway and Arterial System of Transportation (FAST) Las Vegas, NV

TSM&O Category: [Agency Management and Coordination](#)

Project Team: RTC (Las Vegas MPO), Clark County, NDOT, Cities of Las Vegas, North Las Vegas and Henderson

Problem: Metro areas lack unified system management and operations coordination across multiple jurisdictions.

- Need for consistent TSM&O program implementation
- Competition for TSM&O and ITS funding
- Increased jurisdictional coordination would improve management of regional transportation systems

Solution: Form a cross-agency partnership with strong leadership to make system-wide transportation decisions.

Project Description: The Regional Transportation Commission (RTC) formed FAST to manage the Southern Nevada transportation network.

- FAST is an integrated ITS organization with involvement from all local jurisdictional partners.
- Responsible for both the regional freeway and arterial network.
- FAST monitors traffic through extensive video imaging, CCTV, and inductive loop detection.
- FAST controls traffic through signal systems, ramp meters, DMS and lane use control signs.

Results:

- Coordinated decision-making among jurisdictional partners.
- Rapid build-out of ITS infrastructure throughout the Las Vegas region.
- Decrease in non-recurrent delay
- Improved incident management
- Better informed public on traffic conditions.

Cost: Major costs are system-wide ITS infrastructure, TOC development, with minor costs associated with intra-agency coordination efforts, and performance evaluation work. However, collaboration created efficiencies and reduces duplicative efforts.

What's in it for me?

- Coordinated signals can reduce traffic delay from 15–40% and travel time by up to 25%
- Ramp meters can reduce peak period collisions from 15–50% and increase travel speed (8–16%)
- Traffic incident management through CCTV cameras and video imaging can reduce effects of roadway lane closures from 14–28% and incident clearance times from 37–51%

Contact: Mary Martini, District 1 Engineer, Nevada DOT, mmartini@dot.state.nv.us

Keywords: management, coordination, ITS, freeways, arterials, ramp meters, signals, operations

Quote: “FAST is rooted in a history of collaboration between NDOT and the cities and county in Southern Nevada. From the perspective of the motoring public, they enjoy a seamless delivery of services and the efficiencies of shared resources.”

- Mary Martini, NDOT District 1 Engineer

Multimedia:

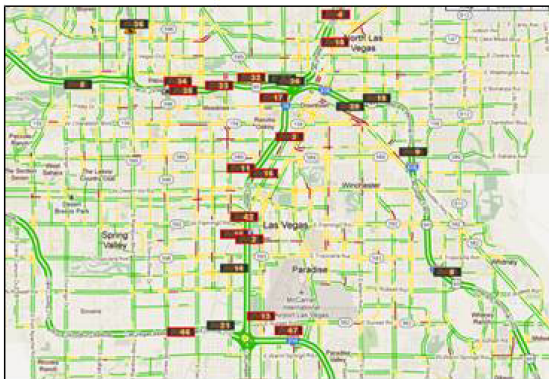
- [FAST website](#)
- [Daily PM commute traffic update](#)
- [FAST Frequently Asked Questions](#)

Performance Monitoring and Measuring System Dashboard



Source: Nevada Department of Transportation

Interactive DMS Map



Source: Nevada Department of Transportation

11/08/12

Coordinated Work Zone Management Program

I-94, Michigan

TSM&O: [Work Zone Management](#)

Project Team: MDOT: 3 Regions, 8 Transportation Service Centers, Operations Field Services Division

Problem: Non-recurrent work zone congestion caused by construction/maintenance during peak travel hours, traffic incidents, and bad weather results in reduced travel time reliability. In addition:

- Work zones were not managed on a corridor level.
- Work zones lacked standardized implementation.
- Greater communication needed between DOT, contractors, and emergency responders.

Solution: Measuring and reducing user delay costs creates the motivation to improve work zone congestion thereby increasing travel time reliability.

Project Description: Michigan DOT formed an I-94 partnership to implement the following:

- Set travel-time goals, measures, and strategies to account for work zone performance.
- Increase collaborative effort with contractors and emergency responders.
- Use traffic data and performance management software to measure program results.
- Increase communication clarity, consistency, and frequency to public.

Results:

- User delay costs incurred from work zones, incidents, and weather events reduced 25% between 2010 and 2011 for the first segment under study.
- Bi-weekly meetings corridor construction meetings and communication efforts have increased collaboration among partners.
- Work zones in corridor are coordinated and procedures have been standardized.
- Travel time and other performance metrics are measured and analyzed using accountability and reporting software.

Cost: Traffic data, performance management software, and staff time are the primary costs of this program. The measured savings in user delay costs far exceeds the capital and labor outlays.

What's in it for me?

- Public experiences less unexpected delay and smoother travel through work zones and increases support for programs that produce results
- Another state DOT used automated speed detectors and message signs to shift traffic to an alternate road. This reduced ADT 16–19% and delay by 50% in the work zone.

Contact: Jason Firman, Congestion and Mobility Engineer, Michigan DOT, firmanJ@michigan.gov

Keywords: work zone management, performance measures, delay, safety, emergency responders, corridors

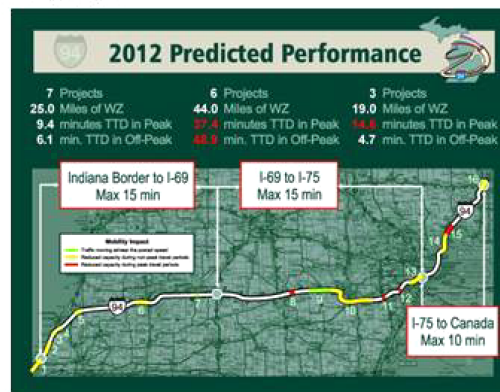
Quote: "Coordination across work zones, increased communication and collaboration between partners and investments in performance management tools have reduced unexpected delay."

Jason Firman - Congestion and Mobility Engineer

Multimedia

- [MDOT's Work Zone Safety Message - \(MP3 Audio File\)](#)
- [Mi Drive](#)

I-94 Corridor



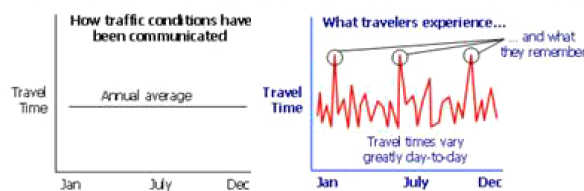
Source: Michigan Department of Transportation

2011 Causes of Significant Delay



Source: Michigan Department of Transportation

Travel Condition Communication vs. Traveler Experience



Source: Federal Highway Administration

95 Express

Florida

TSM&O Category: [Managed Lanes](#)

Problem: Managing congestion through construction of new travel lanes along heavily traveled corridors is no longer effective or financially feasible for several reasons, which include

- Limited availability of federal and state funds
- High construction, ROW and environmental costs
- Public and legislative opposition to roadway widening

Solution: Use the existing system more efficiently by implementing pricing mechanisms, transit and TDM strategies.

Project Description: The 2-phase project covers 22 miles of Interstate 95 (I-95) from Miami to Ft. Lauderdale and includes

- Physically separated express lanes (2 per direction)
- Dynamically priced tolls
- Bus Rapid Transit Service
- No tolls for 3+ carpools, vanpools and hybrid vehicles
- Police enforcement of HOT lane compliance
- Incident management resources
- Dynamic message signs and 511 service
- Ramp metering

Results:

- Survey data say that 80% of regular users agree that 95 Express provides a more reliable trip
- Traffic volumes and revenue exceed projections
- 95 Express Bus ridership more than doubled compared to pre-95 Express conditions.
- Increased travel time reliability
- Increased travel speeds in both Express and General Purpose lanes
- All major goals for the project were met or exceeded.

Cost: Phase 1A and 1B constructions costs were \$132 million. Operations and maintenance costs were approximately \$8.2 million in FY 2011, not including transit costs.

What's in it for me?

- General purpose lanes travel speeds more than doubled during the AM and PM peaks
- Vehicle volumes on I-95 increased 70% during the AM peak period and 20% during the PM peak period.
- Project is an example of efficient forward-thinking free-market approach to transportation.

Contact: Rory Santana, ITS Manager, FDOT District 6, Rory.Santana@dot.state.fl.us

Keywords: tolling, bus rapid transit, HOT lanes, carpools, pricing, corridors, managed lanes

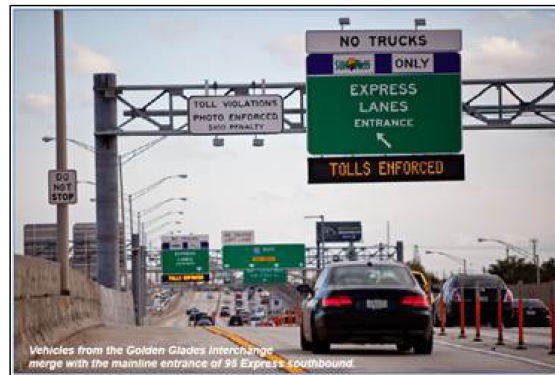
Project Team: FDOT, Broward County, Miami-Dade County, South Florida Commuter Services, USDOT, MDX, Florida's Turnpike Enterprise

Quote: "The use of managed lanes in this congested corridor has provided travel time and reliability benefits that have exceeded the cost of constructing and maintaining the managed lanes."

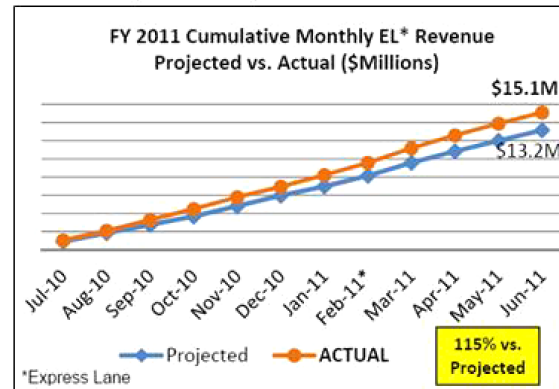
Rory Santana, ITS Manager, FDOT

Multimedia

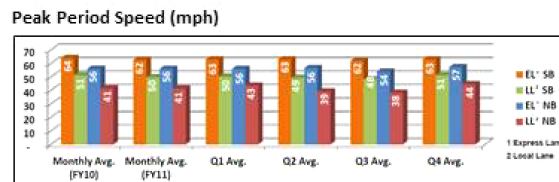
- [About 95 Express](#)
- [95 Express Project Operations and Benefits](#)
- [FY2011 95 Express Annual Report](#)



Source: Florida Department of Transportation



Source: Florida Department of Transportation



Source: Florida Department of Transportation

Kansas City Scout

Kansas and Missouri

TSM&O Category: [Regional Traffic Management](#)

Problem: The highway system in the Kansas City metropolitan area operates at capacity during the peak periods. Recurrent and non-recurrent congestion creates unnecessary delay. Inadequate funding, environmental concerns, and construction costs make increasing capacity expensive and challenging.

Solution: Design, implement, and manage an integrated traffic management system using ITS technologies to make regional transportation safer and quicker.

Project Description: KDOT and MoDOT partnered to create a traffic management system, KC Scout, which covers more than 125 miles of freeway in greater Kansas City.

- About 300 cameras monitor highway conditions
- Imbedded sensors measure and gauge traffic flow
- Electronic message boards update travelers along the freeways and suggest re-route guidance
- Motorists can access a Highway Advisory Radio system or monitor traffic on the KC Scout website
- Ramp meters regulate the rate vehicles enter the freeways from on-ramps
- Comprehensive Bi-State Incident Management Program

Results:

- The public experiences less delay and smoother travel
- The public supports DOT for effectively using tax dollars and improving traffic conditions
- Travel time savings, reduced crashes, fuel consumption, and emissions provide benefits to system users and the general public

Cost: The project's initial cost was \$43 million, with the majority of the funding (80–90 percent) coming from FHWA and the remainder paid for by KDOT and MoDOT.

What's in it for me?

- Ramp metering has decreased freeway merging crashes on I-435 by 64%
- KC Scout produced a benefit-cost ratio of 8:1 to system users and management agencies
- There was a decrease in the travel time index, which indicates an increase in system reliability
- Incidents affecting traffic for more than 90 minutes have been reduced

Contact: Gina Myles, Community Relations Coordinator, Gina.Myles@modot.mo.gov

Keywords: ramp metering, incident management, freeways, delay, ITS, capacity, traveler information

Project Team: KDOT and MoDOT

Quote: "Utilizing Intelligent Transportation Systems like Scout is paramount to increasing safety, relieving congestion and adding capacity in times where adding additional lanes and building high-cost highway construction projects are just unfeasible."

- E. Jason Sims, Manager, Kansas City Scout

Multimedia:

- [KCScout.net website](http://KCScout.net)
- [@KansasCityScout Twitter Timeline](#)
- [2011 Ramp Metering Evaluation Report](#)
- [Kansas City Scout Commercial](#)

Real-time Camera Snapshots available on KCScout Website

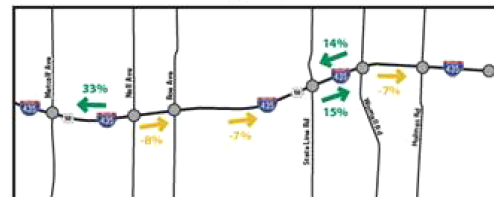


Source: Kansas and Missouri Departments of Transportation

Segment Travel Time Reductions on I-435



Morning



Afternoon

Source: Kansas and Missouri Departments of Transportation

➔ Travel time decrease
➔ Travel time increase

11/08/12

SFpark

San Francisco, CA

TSM&O Category: [Parking Management](#)

Problem: Difficulty in finding street parking creates traffic congestion, pollution and wastes drivers' time.

Solution: Use a combination of technologies (sensors, new parking meters and real-time parking data) to price parking on a demand-responsive basis with the goal that at least one space on every block with meters is open at all times.

Project Description: The following project elements are part of the *SFpark* program.

- Sensors in on-street parking and City-owned garages track when and where parking is available
- Parking data is made available to the public via [SFpark.org](#), smartphone applications, and 511
- Adjust meter and garage pricing up and down to match parking demand
- Longer time limits at parking meters
- Garage facility upgrades to make them more convenient
- The goal of the pricing adjustments is to have at least one parking space on every block
- New meters are provided to make it easier to pay with a variety of methods

Results: *SFpark* is currently being evaluated by SFMTA and the US Department of Transportation (USDOT). Areas for evaluation will include

- Change in parking availability
- Ability of the program to reduce congestion caused from circling and double parking
- Effect on greenhouse gas emissions
- Improvement in public transit performance
- Effect on commercial viability in study area

Cost: Funding for the *SFpark* project comes primarily from a \$19.8 million grant from the USDOT's Urban Partnership Program

What's in it for me?

- Managing residential and business parking can result in increased take-home pay for workers, increased profit for businesses, reduced monthly apartment or commercial rents, and the ability for property owners to sell or lease surplus spaces.

Contact: Jay Primus, Program Manager, SFMTA, jay.primus@sfmta.com

Keywords: parking, pricing, revenue, ITS, safety, operations, data, transit, real-time, data, greenhouse gas emissions

11/08/12

Project Team: USDOT, FHWA, San Francisco Municipal Transportation Agency (SFMTA)

Quote: "We're counting on the fact that people are expert when it comes to parking. We only need a few people to see there is a price difference and choose to park in a different location to open up just a few spaces here and there."

Jay Primus, Program Manager (SFMTA)

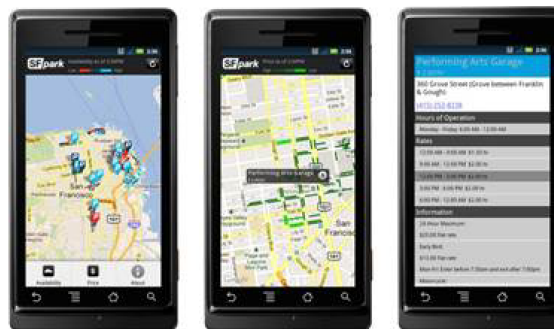
Multimedia:

[SFpark Overview Video](#)

[SFpark Launch Event Video](#)

[Making the Streets of San Francisco Easier to Park On](#)

SFpark Android App Screenshots



Source: SFpark

SFpark Pilot and Control Areas



Legend: Pilot area (orange), Control area (blue). Source: SFpark

Tow Truck Response Strategy Evaluation

Portland, OR

TSM&O Category: **Incident Management**

Project Team: ODOT Incident Responder, City of Portland Tow Desk, tow truck operators

Problem: Roadway incidents are estimated to contribute to 25% of total congestion.

- Incidents reduce freeway capacity (see table)
- Non-recurrent congestion cannot be mitigated by capacity improvements
- Incidents decrease travel time reliability

Solution: Reduce the time it takes to remove vehicles after an incident has occurred.

Project Description: A comparative evaluation of three different towing strategies on the I-5/I-405 loop in downtown Portland. The three strategies are

- Typical: Tow trucks are dispatched after on-site verification from ODOT Incident Response
- Staged: Tow trucks standing by at a strategic location are dispatched by Incident Response
- Instant: Tow trucks are dispatched by the TMOC after an incident is reported.

Results:

- Staged and instant dispatch strategies reduced tow truck arrival times.
- Instant dispatch was 50 times cheaper than staged dispatch
- Incident management staff recommended dispatching tow trucks as soon as an incident was determined to have operational or safety impacts

Cost: An instant dispatch towing strategy is a low-cost solution to reducing the effects of incident-related congestion. Dispatching tow trucks before verification risks tow cancellation fees, but the value in decreasing incident-related delay far exceeds the additional cost expenditures.

What's in it for me?

- A one-minute reduction in clearing a primary crash reduces the likelihood of a secondary crash by 2.8% and improves travel time in the affected area by four minutes
- Improved traffic incident management can reduce average incident duration by about 25%.

Contact: Eric Hathaway, Kittelson & Associates, ehathaway@kittelson.com

Keywords: incident management, towing, freeways, safety, crashes

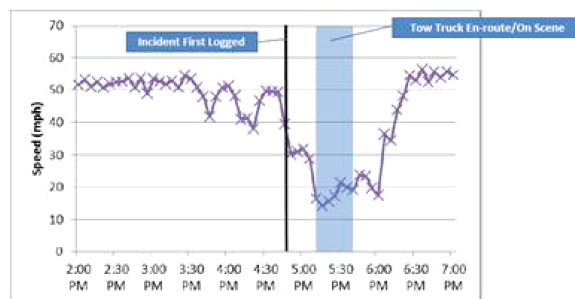
Quote: "Implementing the instant dispatch system has increased capacity on our most congested corridor by decreasing towing response times 30% at an annual cost of under \$2,000."
- Dennis Mitchell, ODOT Regional Traffic Engineer



Proportion of Segment Capacity Available under Incident Conditions (2010 HCM Exhibit 10-17)

Number of Lanes	Shoulder Disablement	Shoulder Crash	One Lane Blocked	Two Lanes Blocked	Three Lanes Blocked
2	0.95	0.81	0.35	0.00	-
3	0.99	0.83	0.49	0.17	0.00

Stall Blocking One Lane Speed Profile



Source: Incident Management Evaluation Report (November, 2011)

11/08/12

UDOT Weather Management System

Utah

TSM&O Category: [Weather](#)

Project Team: UDOT

Problem: Weather events can cause non-recurrent congestion, crashes, and decrease travel time reliability. Automated weather information systems may produce unreliable forecasts, are expensive to implement, and can be slow to adapt to quickly changing conditions.

Solution: Develop a customized road weather information system (RWIS) and supporting infrastructure that relies on human forecasters.

Project Description: UDOT’s RWIS program includes:

- A customized system with non-proprietary weather data that is developed, built, and operated by UDOT
- Weather forecasters in the Traffic Operations Center (TOC) that produce twice daily forecasts and are available 24/7 to field maintenance personnel
- A traveler information weather program available at the UDOT Traffic website, via mobile phone apps and the Utah 511 service
- Collaboration with the National Weather Service on weather advisories and traffic impacts
- Road surface forecasts for maintenance crews
- Archived data, forecasts and traveler information for review and future projects and research

Results:

- More accurate and timely weather forecasts
- Personal interactions between forecasters, engineers, and field personnel result in improved operations and responses to weather events
- Reduced costs to install and maintain weather equipment
- Cost savings from in-house operations, program management, and preventative maintenance

Cost: An evaluation by the Western Transportation Institute determined that, on average, the UDOT RWIS program saves \$2.2 million per year for snow and ice control activities. These savings generate a benefit/cost ratio that exceeds 10:1.

What’s in it for me?

- Better weather forecasts and traveler data
- Faster responses to weather events
- Lower costs from in-house data management
- A DOT wet pavement detection and advisory system reduced crashes by 39 percent.

Contact: Leigh Sturges, UDOT Weather Operations Manager, leighsturges@utah.gov

Lisa Miller, Traveler Information Manager/PIO, lisamiller@utah.gov

Keywords: weather, RWIS, operations, maintenance, non-recurrent congestion, safety, reliability, traveler information
11/08/12

Quote: “Having meteorologists on site at the Traffic Operations Center and developing our own Road Weather Information System has consistently produced better data and better outcomes for UDOT maintenance projects while doing so at a fraction of the cost of automated systems used in other states.”

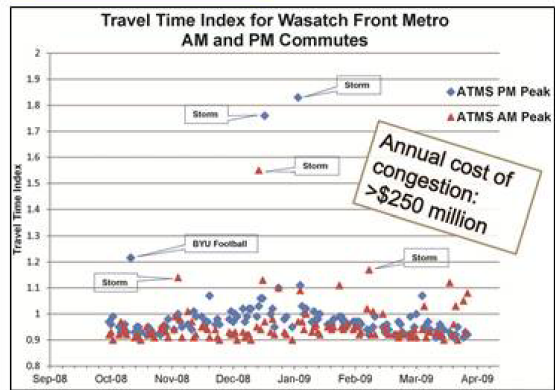
Leigh Sturges – UDOT Weather Operations Manager

Multimedia:

[UDOT Traffic – Road Weather page](#)

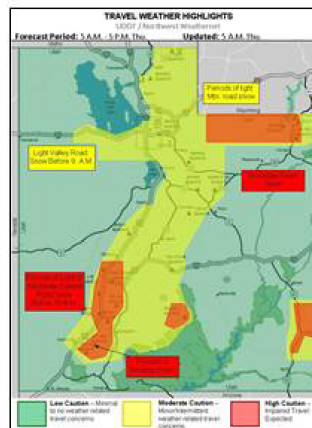
UDOT Traffic App for: [iPhone](#) | [Android](#)

[UDOT Transportation Blog](#)



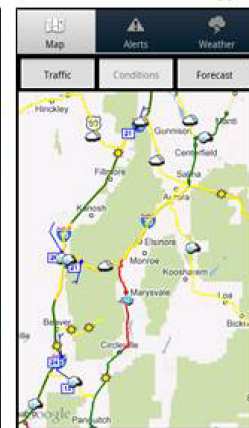
Source: Utah Department of Transportation

Traveler Information Forecast



Source: Utah Department of Transportation

Android Road Conditions App



I-5 Variable Speed Limits and Lane Control

Washington State

TSM&O Category: [Active Traffic Management](#)

Project Team: Washington State DOT

Problem: Growth in travel in congested freeway corridors exceeds transportation agencies' ability to provide sufficient roadway capacity.

Solution: Variable speed limit and lane control signs dynamically adapt to changing highway conditions to smooth traffic flow, manage demand and reduce congestion-related crashes.

Project Description: The project covers a 7-mile long section of I-5 northbound in Seattle and was activated August 10, 2010.

- 15 overhead gantries, spaced approximately ½ mile apart through the 7-mile project area.
- Gantries display dynamic speed limits, lane closures, merge arrows, warning information and variable messages.
- Speed adjustments are automated and based on measured changes from imbedded sensors.
- Lane control changes are human-initiated, but software automates the process of updating the signage and messages.
- Variable speed limit signs show a minimum of 40 mph, even if traffic is moving more slowly.
- Project has potential to improve congestion and safety.

Results:

- Positive public perception of the project.
- Well-covered on local news.
- A project performance report expected to be released within the next couple of months.

Cost: \$23.8 million for preliminary engineering and construction costs.

What's in it for me?

- Lane control and speed harmonization may reduce fatality and injury crashes by 30 percent
- Speed harmonization effects may increase roadway capacities by approximately 5 percent.
- Information displayed on roadway gantries can reduce corridor travel times up to 20 percent

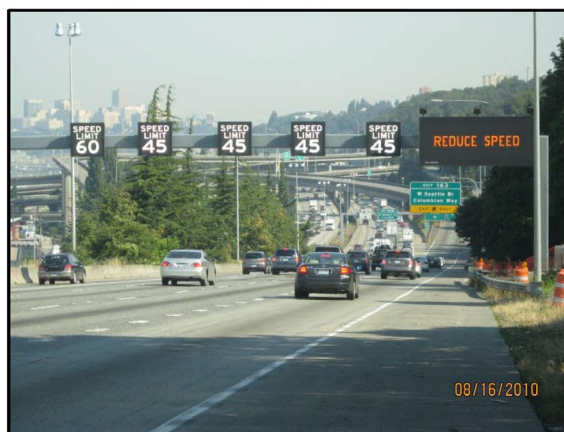
Contact: Morgan Balogh, Freeway Operations Engineer, WSDOT, baloghm@wsdot.wa.gov

Keywords: active traffic management, variable speed limits, congestion, safety, capacity

Quote: "Paying attention and responding to the signs makes the road safer for drivers and emergency responders. We are seeing drivers move out of the closed lanes, and that creates a safer buffer."
- Washington State Patrol Capt. Steve Burns

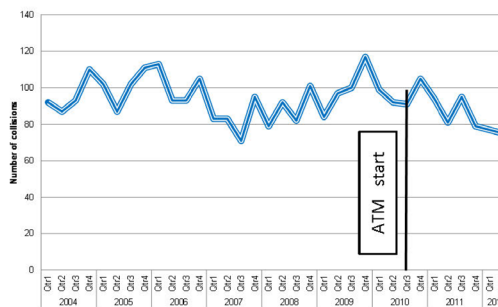
Multimedia:

- [Smarter Highways Video Simulation](#)
- [I-5 Smarter Highways in Use with Disabled Semi-trailer](#)
- [WSDOT Blog: Smarter Highways](#)



Source: Washington State Department of Transportation

I-5 Smarter Highways: Preliminary Collision Data



Source: Washington State Department of Transportation

APPENDIX D

Researched Websites for Branding Synthesis

The Brand: AASHTO— Subcommittee on Systems Operations and Management (SSOM)

<http://ssom.transportation.org/Pages/default.aspx>



What Is the Product Being Marketed?

Champion concepts, policies, resources, research, organizational structures and institutional relationships that **integrate operations and management** into the activities of member agencies. <http://ssom.transportation.org/Pages/SSOMStrategicPlan.aspx>

What Is the Mission?

To support AASHTO's vision through the incorporation of highway operations and management as an integral component of institutional and technical excellence. <http://ssom.transportation.org/Pages/SSOMStrategicPlan.aspx>

Key Message

The various strategic goals of SSOM

- Advancement of State DOTs in their organizational structure and focus on operations
- Enhanced use of performance monitoring and measurement to operate systems on a real-time 24-7 basis
- Improved coordination with and focus on operations by other committees and subcommittees of AASHTO
- Enhanced development and deployment of technology, standards, and best practices

- Improved coordination and partnerships with other stakeholders, interests, and associations
- Cooperation with the private sector for technology and information services

Effective Sound Bites

Transportation agencies are increasingly finding that systems operations and management is a highly important aspect of delivering transportation services to customers, **beyond simply building and maintaining highways**. A good analogy is the electric utility industry. After power plants and transmission lines are constructed, a utility's focus shifts to **operating the system by balancing loads and ensuring that peaks are handled**, all with an eye to providing service. The same model can be used in transportation.

Because conditions on the transportation system are constantly changing in terms of **demand and disruptions**, the system must be operated so that it can **adapt to this unstable environment**. http://ssom.transportation.org/Documents/FR1_SSOMStrategicPlan_101808.pdf

The Participants

The SSOM is established as a cross-cutting Subcommittee with close liaisons with other AASHTO committees, and membership on SSOM by members of other committees is encouraged. SSOM is made up of many different practitioners from all across the country. http://ssom.transportation.org/Documents/FR1_SSOMStrategicPlan_101808.pdf

The Audience

Task forces are ad hoc groups, made up of transportation practitioners, and are constituted temporarily by the SSOM for a specific task or activity related to the strategic goals of the SSOM. Each task force is charged with a set of action

items and a defined timeline for outputs of the work. http://ssom.transportation.org/Documents/FR1_SSOM StrategicPlan_101808.pdf

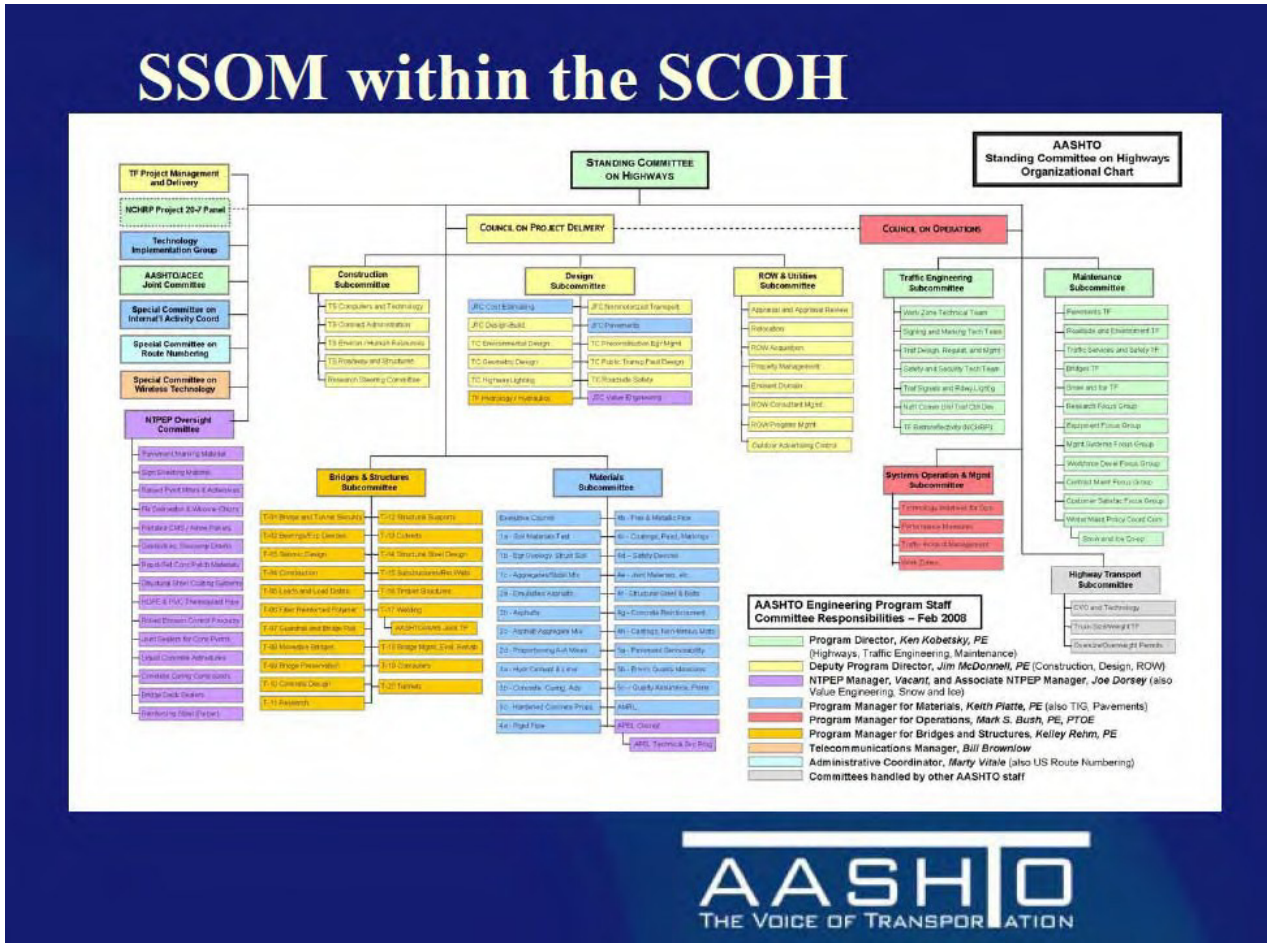
Communication Methods

At a minimum, some form of communication is provided on a quarterly basis to the entire SSOM membership. Communication methods include newsletters, e-mails, webinars, and postings on an SSOM website. Ad hoc communications

announcing the accomplishments of a task force or SSOM activities are encouraged and can occur at any time.

Barriers, Limitations, Challenges to Successful Communication

- Materials sent to non-transportation agencies, Congress, and the general public must be rephrased in understandable ways, so that the messages do not get lost in any technical or engineering jargon.



<http://ssom.transportation.org/Pages/2008MeetingPresentations.aspx>

The Brand: Association of Metropolitan Planning Organizations (AMPO)

<http://www.ampo.org/index.php>



Tag Line

AMPO is focused on metropolitan transportation planning, with the goal of keeping MPOs viable and empowered through innovative solutions. <http://www.ampo.org/what/index.php>

What Is the Product Being Marketed?

AMPO is a nonprofit, membership organization established in 1994 to serve the needs and interests of “metropolitan planning organizations (MPOs)” nationwide. The AMPO Operations Work Group brings together **practitioners in consultation with FHWA leadership** to address the management and operations (M&O) requirements in SAFETEA-LU and to focus on best practices in **incorporating transportation systems operations and management into the planning process, performance measurement, and data** for operations planning. <http://www.ampo.org/content/index.php?pid=114>

What Is the Mission?

AMPO is the transportation advocate for metropolitan regions and is committed to enhancing MPOs’ abilities to **improve metropolitan transportation systems**. <http://www.ampo.org/what/index.php>

Key Message

At AMPO, we strive to support our members with the information needed to carry out all the functions of an MPO. Whether you are a travel modeler, an air quality specialist, a policy director, or a manager, we have something for you. <http://www.ampo.org/what/index.php>

Effective Sound Bites

The quality of metropolitan transportation infrastructure—highways, bridges, airports, transit systems, rail, and ports—is a primary factor in American **economic competitiveness**. It is for this reason that the members of AMPO are particularly interested in current legislation and concepts under consideration by Congress, the Administration and key lawmakers.

Where **coordination and collaboration**, together with stakeholder involvement, are working as envisioned, better decisions are being made.

Collaboration is the essence of SAFETEA_LU, TEA-21, and ISTEA. This landmark legislation reflects an innovative type of federalism—one in which, for the first time, a significantly new federal transportation policy direction is being implemented through a **state and local partnership arrangement**. <http://www.ampo.org/what/index.php>

The Participants

The nine-member AMPO Board of Directors is directly elected by the membership, including the President and Vice President. Local elected officials who are active members of their respective MPOs play a vital leadership role in the affairs of AMPO. Full-membership in AMPO is open to all MPOs and associate memberships are available to all interested parties.

The Audience

Any participating Metropolitan Planning Organization, and its citizens.

Communication Methods

AMPO is recognized as the leader in providing **technical expertise** and assistance to the MPO community. The member-run Technical Committee is working to define the planning practices that lead to development of good systems. The three AMPO Work Groups, Travel Modeling, Air Quality, and Operations, each meet twice a year to share their expertise, network, learn, and advance the MPO technical community.

AMPO offers the best tools and resources for MPOs seeking to gain knowledge in any facet of the metropolitan planning field. The AMPO Annual Conference is quickly becoming known as the premiere event for MPOs to learn and network. Sessions are taught by experts and offer a combination of presentations and hands-on learning. <http://www.ampo.org/membership/index.php>

Barriers, Limitations, Challenges to Successful Communication

- Smaller MPOs might not have the staffing or administrative capacity to fully benefit from AMPOs services, particularly the conferences.
- The website has information specific to AMPO and does not connect more broadly to other supporting information.

The Brand: Federal Highway Administration Office of Operations

<http://ops.fhwa.dot.gov/aboutus/aboutus.htm>



Tag Line

21st century operations using 21st century technologies.

What Is the Product Being Marketed?

Better operation of the transportation system holds the potential for substantially improving the way agencies address **recurring and nonrecurring congestion** in all parts of the country and on all parts of the highway system. **An operations approach** to the transportation network is a viable and effective strategy to **improve traffic flow** and **meet growing travel demands**. http://ops.fhwa.dot.gov/aboutus/one_pagers/opsstory.pdf

What Is the Mission?

The FHWA's Office of Operations provides national leadership for the **management and operation of the surface transportation system**. The office is responsible for FHWA's efforts in the areas of **congestion management**, Intelligent Transportation Systems (ITS) deployment, **traffic operations**, emergency management, and freight management and operations. <http://ops.fhwa.dot.gov/aboutus/aboutus.htm>

Key Message

The Federal Highway Administration has identified **congestion** as one of its priority areas. To address this priority area, the FHWA's Office of Operations has recently begun an initiative to reduce highway congestion through better operating the highway network. Better approaches to operations on the transportation network are a viable and effective strategy to help **improve traffic flow** and meet growing travel demands. As better operations become a strategy more fully applied to transportation, it will require **rethinking of how services are delivered** to those who depend on the transportation system. Effectively addressing the congestion problem will hinge on the **ability to** reshape traditional transportation organizations into "21st century operations using 21st century technologies."

The program areas within the Office of Operations are helping to **change the mindset of traditional transportation**

organizations by developing and implementing programs, training, and tools to support

- National recognition of the importance of operations;
- Institutional and regional change to enhance operations; and
- Advancements in 21st century operations.

Effective Sound Bites

We can do more to **operate the transportation system** so that it **performs better to meet customer expectations** regardless of the demands placed on it.

Increasingly, **mobility is jeopardized by congestion and unexpected delays**. The Texas Transportation Institute estimates that in 2001, 75 of the largest metropolitan areas experienced 3.5 billion vehicle-hours of **delay**, resulting in 5.7 billion gallons in **wasted fuel** and \$69.5 billion in **lost productivity**.

The three main causes of **nonrecurring congestion** are traffic incidents ranging from flat tires to overturned trucks with hazardous materials (25 percent of congestion), work zones (10 percent of congestion), and adverse weather (15 percent of congestion).



Welcome to the Planning for Operations Website

The goal of this website is to promote multimodal planning practice that supports 21st century transportation system management and operations. In order to link 21st Century operational services into the transportation planning and programming process, transportation planners and operators should have a common understanding of the mobility, safety, and efficiency benefits of linking planning and operations.

When disruptions occur during non-peak periods or on normally uncongested roads they create a “**surprise**” for **travelers**. A mid-afternoon trip that is planned for 20 minutes suddenly turns into a frustrating 40-minute crawl.

However, there are things that can be done to keep congestion from severely degrading the quality of life in our cities, undermining the competitiveness of our industries, and reducing the **safety and reliability of our national transportation system**. Successfully **reducing the effects of congestion and unexpected delays** requires three coordinated approaches—construction, preservation, and operation.

National recognition of the importance of operations—FHWA leads the effort to increase the emphasis on and visibility of transportation operations.

Aggressive management of temporary disruptions, such as incidents, work zones, weather, and special events, can reduce the impacts of these disruptions and return the system to “full capacity.”

The Participants

FHWA Office of Operations actively collaborates with numerous other DOT offices, including those of Planning, Safety, and RITA as well as with FTA. In addition, the diverse areas within Operations include topics such as Planning for Operations, arterial and freeway management, ITS, real-time traveler information, work zone and incident management, and operations performance measurement.

The Audience

In providing national leadership for management and operation of the transportation system, the Office of Operations provides policies and programs to support all transportation agencies. Through the creation of a National Transportation Operations Coalition (NTOC), the FHWA is **working with the leadership of 13 transportation associations**, including the Institute for Transportation Engineers (ITE), the American Association of State Highway and Transportation Officials (AASHTO), the Intelligent Transportation Society of America (ITS America), the American Public Transportation Association (APTA), **to increase national attention to the importance of more effectively managing and operating the surface transportation system**.

Communication Methods

The Office of Operations website and the related links provide access to a large amount of useful material readily available to the transportation practitioner. However, the level of information is overwhelming for decision makers

who are a primary target audience for this material. Programs included initiate policies and programs, training and technology transfer to advance the operational practices and capabilities of transportation agencies. They also provide relevant products and services, as well as technical support and assistance. Virtual Teams are made up of personnel from various FHWA offices. <http://ops.fhwa.dot.gov/aboutus/aboutus.htm>

Barriers, Limitations, Challenges to Successful Communication

- The FHWA Office of Operations website contains a wealth of material, but the key message is buried as a PDF that is easily overlooked.
- Intended audience appears to be decision makers across all areas of the transportation sector. The message is comprehensive—noting that congestion must be addressed in many ways and has both a recurring and nonrecurring component.

The Brand: Institute of Transportation Engineers—Management & Operations/ITS Council

<http://www.ite.org/councils/ITS/default.asp>



Tag Line

A Community of Transportation Professionals: Your source for expertise, knowledge and ideas.

What Is the Product Being Marketed?

The name indicates the two-fold focus of the Management & Operations/ITS Council. Congestion in urban areas, safety and unexpected delays in rural areas, and growing challenges of freight movement are difficult issues facing transportation professionals. Increasingly, cutting-edge transportation organizations focus on the impacts to their customers based

on the performance of the transportation system. **Transportation Systems Management and Operations** has been defined as an emphasis area by ITE's International Board of Direction. <http://www.ite.org/councils/ITS/default.asp>

What Is the Mission?

The Council is focused on better operation of the highway network to confront transportation challenges through the **use of ITS and transportation system management strategies**. <http://www.ite.org/councils/ITS/default.asp>

Key Message

The council oversees multiple activities and develops products and services necessary to **advance the deployment of ITS** and to **improve operational efficiency** of the roadway network. In addition, the council manages more than 20 activities associated with the development of information to assist those in the Management and Operations and ITS fields. <http://www.ite.org/councils/ITS/default.asp>

Effective Sound Bites

Better operation of the highway network is the newest approach to confronting the transportation challenges of the 21st century. Congestion in urban areas, safety and unexpected delays in rural areas, and growing challenges of freight movement are compelling issues facing transportation professionals. Increasingly, **cutting edge transportation agencies** are focused on the performance of the transportation system as it impacts customers. That performance-based, customer-focused attitude characterizes the 21st century transportation organization. Technology innovations, such as **intelligent transportation systems**, give us new and better tools to **make the most of the available roads and capacity**.

The Institute of Transportation Engineers (ITE) is actively involved in developing and promoting the vision for future transportation agencies and future transportation professionals. These agencies and professionals will **manage**

the performance of the transportation network to meet the needs of our customers. To this end, ITE identified "transportation system management and operation" as an Institute mega issue.

Achieving a vision for a 21st century transportation system encompasses technical skills, applying real-time, proactive management techniques in a variety of application areas, and changing our institutional arrangements to better serve the customers.

Today's transportation professionals are responsible for building, maintaining and operating a transportation system that is safe, reliable and secure for our customers. <http://www.ite.org/aboutite/index.asp>

The Participants

Membership in ITE Councils is open to any ITE member. Membership in one Council from each category (employer-type and technical) is free. If you are an ITE member, you may join as many Councils as you like. Within each Council there are various committees to join, each covering a different topic of interest. <http://www.ite.org/councils/index.asp>

The Audience

Engineering and Transportation practitioners with an interest in Management and Operations and ITS.

Communication Methods

Council members receive newsletters and special mailings that cover emerging trends, proposed legislation and regulation, as well as participate in Internet discussion groups and other council-sponsored activities. <http://www.ite.org/councils/index.asp>

Barriers, Limitations, Challenges to Successful Communication

- Information displayed and discussed in the council may be too technical for some of the audience.

The Brand: Research and Innovative Technology Administration (RITA)—ITS Joint Program Office

http://www.its.dot.gov/its_jpo.htm



What Is the Product Being Marketed?

The ITS program director leads the JPO, which is composed of program managers and coordinators of the U.S. DOT's multimodal ITS initiatives. In addition, individual staff members manage technology transfer functions, such as **National ITS Architecture development** and maintenance, standards development, professional capacity building, and **program assessment**.

What Is the Mission?

As directed by Congress in its founding legislation, RITA leads DOT in

- Coordinating, facilitating, and reviewing the Department's research and development programs and activities;
- Advancing innovative technologies, including intelligent transportation systems;
- Performing comprehensive transportation statistics research, analysis, and reporting; and
- Providing education and training in transportation and transportation-related fields. http://www.rita.dot.gov/about_rita/

Key Message

The Research and Innovative Technology Administration coordinates the U.S. Department of Transportation's research programs and is charged with advancing the deployment of **cross-cutting technologies** to improve our Nation's transportation system. <http://www.facebook.com/DOTRITA?v=wall&ref=ts&a=4&>

Safe-Trip 21, a RITA Initiative

The SafeTrip-21 program is designed to **improve safety** and **reduce congestion** by identifying and harnessing existing technology and adapting it for transportation needs. SafeTrip-21 will solicit information about technological applications that are both oriented toward DOT goals (safety, mobility, environmental stewardship, energy independence, and security) and ready for testing and integration into a field-test environment.

RITA's Volpe Center is using its experience in the areas of ITS and system development and deployment to lead the effort.



SafeTrip-21 strives to find applicable and viable approaches to mitigate congestion and improve safety through new technology. “SafeTrip-21 will show how technology can enhance the travel experience, and will demonstrate that significant advances in solving transportation problems do not have to require large infrastructure investments.”

SafeTrip-21 builds on the DOT's Vehicle Infrastructure Integration (VII) program by providing **an accelerated deployment and testing environment for technologies** that are already being considered for their applicability in the transportation arena. The overall VII initiative seeks to deploy advanced vehicle-to-vehicle and vehicle-to-infrastructure communications that can keep vehicles from leaving the road and enhance their safe movement through intersections.

The Participants

The Administrator of the Research and Innovative Technology Administration oversees the ITS Program. The ITS JPO has Department-wide authority in coordinating the ITS program and initiatives among the following DOT Offices: FHWA, FMCSA, FTA, FRA, NHTSA, and the Maritime Administration (MARAD).

The Audience

RITA's research efforts focus largely on practitioners and those with research ties.

Communication Methods

On a regular basis, RITA updates its Facebook page and Twitter account. RITA coordinates its efforts through research programs and publications. One new effort, the Transportation Research Collaboration Pilot website (<http://www.transportationresearch.gov/Pages/index.aspx>) was built in an effort to improve the collaborative capabilities offered to transportation researchers and other related stakeholders both inside and outside DOT. The initial phase of this effort will focus on improving collaboration among the four regional networks comprising the National Transportation Knowledge Network, approximately 60 University Transportation Centers (UTCs), and the collaborative work of Position Navigation and Timing. Other transportation research topics/entities will be added as the site develops into a full-fledged venue for transportation research collaboration. RITA also presents its latest research at the annual TRB conference.

Barriers, Limitations, Challenges to Successful Communication

- The RITA website does not appear to be intended for use by the general public. The publications are large research documents rather than brochures or easily digestible material.
- Intended audience appears to be government officials/administration rather than public or system users.

The Brand: National Transportation Operations Coalition (NTOC)

http://ops.fhwa.dot.gov/nat_dialogue.htm



Tag Line

An important foundation for **institutionalizing management and operations** into the transportation industry.

What Is the Product Being Marketed?

NTOC currently consists of a number of subcommittees and action teams who are actively working on activities to **promote management and operations strategies** and benefits to

stakeholders. Current subcommittees and action team focus areas include

- **Performance Measurement and Reporting**
- Traffic Signal Systems and VMS Benchmarking
- Linking Planning and Operations
- Operations Funding
- Freight Operations
- Communications and Outreach

http://ops.fhwa.dot.gov/aboutus/one_pagers/ntoc.htm

What Is the Mission?

To improve management and operation of the nation's existing transportation system so that its performance will exceed customer expectations. http://ops.fhwa.dot.gov/nat_dialogue.htm

Key Message

Today, following the success of the National Dialogue on Transportation Operations, transportation professionals are embracing the need to **improve the performance** of the Nation's transportation system through a **stronger commitment to management and operations**. Now more than ever, the operations community is accepting the call to move from a dialogue on the issues of **system mobility, reliability, and security** to promoting and supporting actions necessary to meet the challenges these issues present. http://ops.fhwa.dot.gov/aboutus/one_pagers/ntoc.htm

Effective Sound Bites

We will know we are successful when

- Customer surveys indicate consistently increasing satisfaction with the performance of the transportation system.
- The focus of decision makers and transportation agencies includes **continuous performance-based delivery of services** in addition to implementation of individual projects.
- Performance measures are in place that are understandable, measurable, and are used effectively in making decisions improving transportation systems performance.
- Managing and operating the transportation system are integral parts of a funding and staffing continuum that also includes planning, design, construction, and maintenance.

NTOC will also seek to establish an inventory of **available educational and professional capacity building resources available** to the Operations practitioner, define an Operations

discipline, and develop a roadmap for fully developing the professional capacity of the Operations community.

The Participants

NTOC is an alliance of national associations, practitioners, and private sector groups. http://www.ntoctracks.com/ntoc_members.php

The Audience

The site is targeted toward practitioners and sponsored by FHWA to promote information sharing.

Communication Methods

NTOC developed four steps for communicating their message:

1. Developing a comprehensive/coordinated outreach program.
2. Summarizing operations benefits data.
3. Developing products aimed at decision makers.
4. Creating a shared management and operations website.

With the new NTOC focus areas of sustainability, economic growth and competitiveness, safety, livability, and capacity building as priorities, NTOC will focus on compiling and disseminating this knowledge to membership through existing channels, such as the NTOC newsletter, website, stakeholder e-mails, and webcasts.

Barriers, Limitations, Challenges to Successful Communication

- The forum, webcasts, and calendar of upcoming events seem to be inactive and bare, and this could deter members from visiting the site often.

The Brand: ITS America

<http://www.itsa.org/>



What Is the Product Being Marketed?

An effective, national, intelligent transportation system (ITS). ITS America assists in **information sharing** among

professionals to foster the use of **advanced technologies** in surface transportation systems. http://www.itsa.org/aboutus/c3/About_Us.html

What Is the Mission?

To be proactive leaders for all ITS stakeholders by promoting collaboration and networking in research, development, and design of **ITS technologies** to accelerate their deployment and sustain the environment. The vision is to help **save lives, time, and money** and sustain the environment through broad deployment of interoperable ITS technologies. http://www.itsa.org/aboutus/c3/About_Us.html

Key Message

ITS America is the leading advocate for technologies that **improve the safety, security, and efficiency** of the nation's surface transportation system. The formation of ITS America was motivated by the recognition that while numerous existing organizations were actively involved in transportation issues, no single organization existed to focus exclusive attention on emerging technologies. http://www.itsa.org/aboutus/c3/About_Us.html

Effective Sound Bites

ITS America knows that connections are key to achieving your business goals. We will connect you to the industry leaders and help you build relationships that will build your business. We represent a diverse group of ITS professional and organizations—a diversity you will not find in other associations. http://www.itsa.org/careerbusinessdevelopment/c27/Career_and_Business_Development.html

Technologies and solutions are available today to transform the future of our nation's transportation system, and we have a tremendous opportunity to work with the new Congress and Administration to incorporate ITS solutions into the next transportation bill. <http://www.itsa.org/advocacy/c63/Advocacy.html>

The Participants

ITS America is a non-profit organization governed by three councils: the Coordinating Council, the Policy and Business Council, and the State Chapters Council (a volunteer body). Its members include a variety of ITS stakeholders, including private corporations, public agencies, and academic institutions. The complete member list is quite extensive, as described under the "Membership" tab, which can be accessed at <http://www.itsa.org/membership/c20/Membership.html>.

Funding for ITS comes from a variety of sources:

- Federal funds
 - ITS earmarked funds
 - Competitive grants (CICAS, ICM, etc.)
 - Road construction funds
 - NHTSA 164 Sanction funds (TOCCs)
- State funds
- Local partnership contributions
- Private partner contributions

The Audience

ITS America is focused on its members, who are involved in all facets of ITS research, planning, development, and deployment. State DOTs, regional and local transportation and planning agencies, private companies that provide ITS products and services, auto manufacturers and suppliers, research organizations, academic institutions, and transportation associations all derive benefit from their interaction as ITS America members.

Communication Methods

Their Strategic Plan outlines their mission, vision, and outlines their organization's goals. <http://www.itsa.org/itsa/files/pdf/ITSAStrategicPlanBrochure.pdf>

Various members have developed resources and marketing materials for other state chapters to draw from. For example, the Engaging State Departments of Transportation presentation from ITS Minnesota. <http://www.itsa.org/state-chapters/chapter-resources>


ITS America hosts forums on five different topic areas: Safety, Personal Mobility, Commercial Vehicle & Freight Mobility, the Sustainable Transportation Working Group, as well as Cross-Cutting Issues not easily embodied in one Forum. http://www.itsa.org/forumsandworkinggroups/c38/Forums_-_Task_Forces_-_Working_Groups.html

The knowledge center maintains a database of recent, relevant research on ITS. http://www.itsa.org/knowledgecenter/c60/Knowledge_Center.html



ITS Georgia
Intelligent Transportation Society

Fact Sheet
1Q 2006
www.itsga.org



ITS GEORGIA is a group of organizations that support ITS technology as a way to significantly reduce congestion and improve the performance, safety and efficiency of our transportation system.

ITS Georgia provides a forum for advocacy, facilitation, integration, and for learning more about Intelligent Transportation Systems.

Our members include federal, state and local transportation agencies, ITS technology and service providers, large private and commercial transportation system users, universities, and other interested parties with missions that involve, or are affected by, the transportation system. We also support students with an interest in ITS careers.

We are the state Chapter of ITS America. ITS America is the organization that provides technical advice and assistance to the ITS DOT.

CHAPTER MEETINGS

ITS Georgia Chapter meetings for the first half of 2006 have been set. Dates are: January 19, February 23, March 30, April 27, May 25, June 29, July 27. Meetings begin at 11:30 and are held at the Lundermilk Center, 40 Courland St., Atlanta.

ANNUAL MEETING

Our 2006 annual meeting will be held September 24 - 26 in Chattanooga. More details to come.



ITS Georgia
Intelligent Transportation Society

Fact Sheet
1Q 2006
www.itsga.org

ITS Georgia News

ITS Georgia Names 2005 Excellence in ITS Award Winners

SAVANNAH, GA – The Intelligent Transportation Society of Georgia announced the winners of the 2005 Excellence in ITS awards.

The categories and winners are:

- Outstanding Volunteer Award** – Anthony Bradford, Georgia Department of Transportation (GDOT), Chairman of the ITS Georgia Membership Committee.
- Outstanding Public Member Agency Award** – Georgia Division office of the Federal Highway Administration.
- Outstanding Private Member Agency Award** – National Engineering Technology Corporation (NET).
- Innovation: Outside the Box Award** – GDOT District 2.
- Project of Significance Award** – Ramp Metering Atlanta's Downtown Connector.

New ITS Georgia Members

 The City of Valdosta General Engineering Division is a technical support division for other city departments, and is the home of the city's traffic engineering division. City Engineer: Von Shipman, (229) 259-3530. E-mail vshipman@valdostacity.com Or visit the City of Valdosta www.valdostacity.com on the web.

 Since 1988, **B&E JACKSON & ASSOCIATES, INC.**, a civil engineering consulting firm, has been widely recognized for providing economical engineering design solutions to State, County and City Departments of Transportation and Public Works agencies throughout the Southeastern United States. For more information visit, www.bejackson.com

ITS Georgia Officers and Committee Chairs

Marvin Woodward, President – GRTA	William Buchanan, Activities - Geostats
Anthony Bradford, Vice President - GDOT	Shahram Malek, Administrative - Iteris
Christine Macaulay, Secretary – PB Farradyne	Marvin Woodward, Annual Meeting - GRTA
Susie Dunn, Treasurer – ARC	Bobbie Saughvi, Communications – Street Smartz
Shahram Malek, Immediate Past President	Marwan Abboud, Elections - Arcadis
	Anthony Bradford, Membership - GDOT

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Source: http://www.itsa.org/itsa/files/pdf/ITSGA_factsheet.pdf

Barriers, Limitations, Challenges to Successful Communication

- ITS America is involved with IntelliDrive. The connection is mentioned, but not clear. It may be through the public communication marketing component of ITS America.
- The website is only geared toward transportation professionals—easy to navigate, but jargon-heavy, so would not be used easily by the public.

The Brand: I-95 Corridor Coalition

<http://www.i95coalition.org/i95/Home/tabid/36/Default.aspx>



Tag Line

Working Together to Accelerate Improvements in Long-Distance Passenger Travel and Freight Movement

What Is the Product Being Marketed?

The I-95 Corridor Coalition is a voluntary alliance of transportation agencies, toll authorities, and related organizations from Maine to Florida. The Coalition provides a forum for key decision and policy makers to address transportation management and operations issues of common interest, and is an opportunity for state and local agencies to work together to improve transportation system performance far more than they could working individually. Activities include training, projects, traveler information access, and a resource library.

During the 1990s, the focus of the Coalition's program evolved from studying and testing **intelligent transportation systems (ITS) technologies** to a broader perspective that embraced **integrated deployments** and **coordinated operations**. The Coalition's perspective evolved from a concentration on highways to one that encompasses all modes of travel and focuses on the **efficient transfer of people and goods** between modes. Facilitation of regional **incident**

management in areas such as **pre-planning, coordination** and **communication** among transportation and **public safety** agencies in the corridor remains a key part of the Coalition's focus. Today, the Coalition emphasizes **information management** as the underpinning of seamless operations across jurisdictions and modes. <http://www.i95coalition.org/i95/Home/WhatistheCoalition/tabid/112/Default.aspx>

What Is the Mission?

Our vision is that the transportation network in the region will be safe, efficient, seamless, and intermodal, and will support economic growth in an environmentally responsive manner. Our goals are to improve mobility for people and goods, enhance safety for all travelers, and improve the economic vitality of the region. <http://www.i95coalition.org/i95/Home/WhatistheCoalition/MissionStrategies/tabid/114/Default.aspx>

Key Message

A partnership of transportation agencies and related organizations, from Maine to Florida and in Canada, working together to accelerate improvements in transportation across multiple jurisdictions and throughout all modes.

Effective Sound Bites

The Corridor's extreme congestion and limited capacity to expand make **Intelligent Transportation Systems (ITS)** an essential element in regional growth and economic vitality.

The Coalition and its member agencies are using **innovative technology, improved coordination** and cooperation, **system integration, incident management** and new approaches to **shared communication** to provide a seamless and responsive transportation network.

Both the traveling public and economy have benefited, and the results are saved time, saved money, and saved lives.

The Participants

The I-95 Corridor Coalition is an alliance of transportation agencies, toll authorities, and related organizations, including public safety, from the State of Maine to the State of Florida, with affiliate members in Canada. The Coalition works closely with state DOTs, SafeTrip-21, FHWA, AASHTO, ITS America, and the 511 program. <http://www.i95coalition.org/i95/Home/WhatistheCoalition/tabid/112/Default.aspx>

The Audience

The “Traveler Information” portion of the website is geared toward the traveling public: <http://www.i95travelinfo.net/>.

The rest of the website is targeted toward industry professionals.

Communication Methods

2007 Communication plan: http://www.i95coalition.org/i95/Portals/0/Public_Files/I95%20CC%20Communications%20Plan_Final.doc.

Strategy 1: Learning and Information Sharing

- Facilitate communication and learning among members and partners.
- Conduct forums and provide training on topics of critical importance.
- Foster networking in support of sharing experiences and mutual education.

Strategy 2: Information Management

- Provide easier access to information for system management and operation.
- Provide a source of long-distance travel information that will be disseminated to the traveling public.
- Provide a source of information to support future investment decisions of the Coalition and its member agencies.

Strategy 3: Facilitate Deployments Across Jurisdictions and Modes

- Promote multimodal and intermodal coordination.
- Encourage interoperability among jurisdictions.

The Brand: National 511 Program

<http://www.fhwa.dot.gov/trafficinfo/511.htm>

Home

Google Search

WWW www.deploy511.org

Deployment Coalition

What is 511? Deployment Status Marketing Ideas Guidelines Usage Statistics Coalition

What is Deploy511.org?

Deploy511.org is a repository of information for the 511 deployment community designed to help you develop, launch, publicize, maintain, evaluate, and improve your 511 system.

Presentations from the most recent 511 Coalition Working Group meeting are available here.

- Foster adoption of standards and procedures that promote deployment.
- Coordinate information exchange to enhance the speed of deployment and seamless operations.

The U.S. DOT/Research and Innovative Technology Administration (RITA) and the I-95 Corridor Coalition have partnered, through the SafeTrip-21 Initiative, to create a variety of travel time information resources—as well as other innovative programs. <http://www.i95coalition.org/i95/Home/tabid/36/Default.aspx>

In addition to the development of a regional vehicle probe travel data collection and dissemination program, the Coalition’s activities include promotion of integrated 511 Corridorwide information, travel information coordination efforts, and operation of the I-95 website to facilitate rapid distribution of current information. <http://www.i95coalition.org/i95/Home/WhatistheCoalition/MissionStrategies/tabid/114/Default.aspx>

Current projects include the Integrated Corridor Analysis Tool (ICAT), an analysis and planning tool that is currently under development, to provide a GIS-based, multi-state transportation network (containing roadway and traffic data) that will cover the full 16-state Coalition region. <http://www.i95coalition.org/i95/Home/I95CorridorFacts/tabid/173/Default.aspx>

Barriers, Limitations, Challenges to Successful Communication

Jargon is technical: Not everyone may understand the terminology used to describe the information contained on the website.

Tag Line

America's Traveler Information Telephone Number

What Is the Product Being Marketed?

Providing access to traffic and traveler information via one nationwide, three-digit telephone number (511), as designated by the Federal Communications Commission (FCC). That is, to get that information to the driver and shipper by this country's most common means of communication—the telephone. The product is reliant on data collection through ITS. In 1999, the U.S. Department of Transportation (U.S. DOT) petitioned the Federal Communications Commission for a three-digit dialing code for travel information, and was assigned 511 in 2000. In 2001, the Cincinnati, Ohio, area became the first in the country to use 511 for travel information. <http://www.fhwa.dot.gov/crt/lifecycle/511.cfm>



Information provided by 511 services varies widely both by provider (ranging from state DOTs to local transportation and transit agencies) and by information provided (from **traffic delays** and weather to transit and tourism information). <http://www.deploy511.org/whatis511.html>

What Is the Mission?

The goal of the 511 Deployment Coalition is “the timely establishment of a national 511 traveler information service that is sustainable and provides value to users.”

The intent is to implement 511 nationally using a bottom-up approach facilitated by information sharing and a cooperative

dialogue through the national associations represented on the Policy Committee, the governing body of the program.

Key Message

Telephone services for travelers provide real-time information about work zones, traffic incidents, and other causes of **congestion**. They allow travelers to make more informed decisions about their travel routes or modes, and **increase safety** by **helping motorists avoid areas with** congestion or incidents.

Effective Sound Bites

- 511 will be a customer-driven multi-modal traveler information service, available across the United States, accessed via telephones and other personal communications devices, realized through locally deployed interoperable systems, enabling a safer, more reliable and efficient transportation system. http://www.deploy511.org/docs/guidelinesv2.0.htm#_Toc50757171
- The national interoperability goal of seamless functionality may be achieved by focusing on developing a consistent user interface across 511 systems and a reliance on industry standards for data sharing. <http://www.deploy511.org/program-documents.html> (Implementation Guidelines Version 3.0)
- One easy-to-remember number, regardless of the traveler's location, gives travelers choices—choice of time, choice of mode of transportation, choice of route—which saves lives, time, and money. <http://www.fhwa.dot.gov/trafficinfo/511what.htm>

The Participants

The 511 Policy Committee includes people from OnStar, Transportation Cabinet Department of Highways, I-95 Corridor Coalition, Industry Operations Cellular Telecommunications Internet Association, ITE, AAA, AASHTO, Tellme Networks, Inc. (technology group), Navigation Technologies, APTA, and local transportation authorities. The deployment coalition works closely with I-95 Corridor Coalition and participating state Departments of Transportation.

Use 511 and Enjoy a Safe Trip!

- Use your wireless phone responsibly, preferably not while driving.
- Road conditions can change quickly. Monitor conditions frequently.
- Travel at speeds appropriate for conditions.
- Be aware of slow moving cone removal equipment.
- Report any unexpected conditions.
- Buckle up!

Travel Info

511 is a service of the Iowa Department of Transportation, in partnership with the Iowa State Patrol and the telecommunications companies serving Iowa. (Some phone companies do not offer 511 service.)

If 511 is unavailable or calling is too expensive, call 800-288-1047.

Look inside to find your free 511 window cling!

Dial 511 Iowa Travel Info

What does Iowa's 511 Travel Info service have to offer?

- Easy-to-remember, three-digit number
- Hands-free voice recognition
- Improved winter road condition descriptions
- Information for the entire state, a region, city/town, or specific highway
- A reliable source of information
- Trip planning and on route decision-making tool

Travel safe. Dial 5-1-1.

About Iowa's Travel Info Service

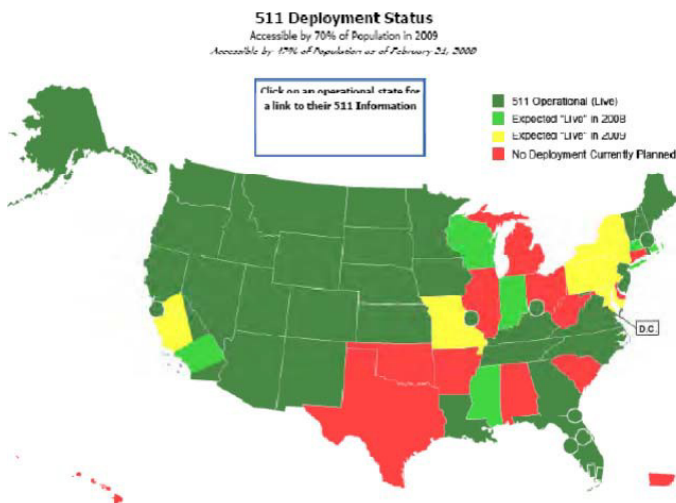
- Available 24 hours a day/seven days a week
- Covers interstate and U.S. routes in Iowa
- Part of a nationwide number for travel information
- No charge to wireless callers
- 35- to 50-cent charge applies to pay phone users
- Normal airtime and roaming charges apply to wireless callers
- Road construction and maintenance information coming spring 2003

The Audience

The 511 deployment coalition targets policy makers and practitioners.

Communication Methods

511 uses signs, bumper stickers, bus wraps, public announcements, newsletters, variable message signs, transit ride-sharing messages, billboards, and general advertising to deploy its message. A variety of marketing materials are also available. <http://www.deploy511.org/market-materials.html>



Barriers, Limitations, Challenges to Successful Communication

Access to, and therefore recognition of, 511 traveler information systems remains limited. By 2010, the majority of the country is expected to have 511 access. Until then, brand recognition can only be expected in areas where it is active and provides a valuable resource.

The Brand: NASEMSO—Highway Incident and Transportation Systems (HITS)

<http://www.nasemsd.org/Projects/HITS/index.asp>



What Is the Product Being Marketed?

The purpose of the Highway Incident and Transportation Systems (HITS) Committee is to engage NASEMSO on highway safety issues relevant to EMS, collaborate with highway safety partners to promote their understanding of EMS and to **identify opportunities for cooperative efforts** to reduce injuries and save lives, and provide input to NASEMSO Executive Committee on highway safety concerns.

What Is the Mission?

To support its members in developing EMS policy and oversight, as well as in providing vision, leadership and resources in the development and improvement of state, regional and local **EMS and emergency care systems**. <http://www.nasemsd.org/About/>

Key Message

We achieve our mission by the participation of all the states and territories, by being a strong national voice for EMS, an acknowledged key resource for EMS information and policy, and a leader in developing and disseminating evidence-based decisions and policy. <http://www.nasemsd.org/About/>

Effective Sound Bites

A seamless **nationwide network** of **coordinated** and **accountable** state, regional and local EMS and emergency care systems. The systems use public health principles, data and evidence as a basis for safe and effective care in day-to-day operations as well as during catastrophic events.

Organization goals:

- To promote the orderly development of coordinated EMS systems across the nation.
- To promote uniformly high-quality care of acutely ill and injured patients.
- To provide a forum for the exchange of information and the discussion of common concerns among state EMS officials.
- To facilitate interstate cooperation in such areas as patient transfer, communications, and reciprocity of EMS personnel.
- To disseminate pertinent information to our membership and others.
- To maintain ongoing and effective liaison with state and national governments, professional organizations, and other appropriate public and private entities.
- To improve the quality and efficiency of state EMS program administration.
- To enhance the professional knowledge, skill and abilities of state EMS officials and staff.
- To encourage research and evaluation in all areas of EMS.
- To serve as a permanent national advocacy group for EMS.

<http://www.nasemsd.org/About/>

The Participants

HITS committee members include state and territorial EMS directors, medical directors, training coordinators, data managers, trauma managers, EMS for Children managers plus corporate and associate members.

The Audience

EMS professionals (state and local) and corporate sponsors/associates.

Communication Methods

The Strategic Plan details the goals and objectives of NASEMSO, as decided by the executive committee. The annual reports (2005–2010) detail the organization’s purpose and efforts: <http://www.nasemsd.org/About/DocumentDownloads/>.

In addition to these documents, NASEMSO supports a mentor program (peer counseling between new and veteran EMS directors), an EMS Leadership Skills Workshop, a regularly updated newsletter called “Washington Update,” an official, professional journal specific to NASEMSO, a website, and sponsors an annual meeting where new equipment, technology, and services are displayed. <http://www.nasemso.org/About/DocumentDownloads/documents/NASEMSOAnnualReport2010.pdf>

Barriers, Limitations, Challenges to Successful Communication

Very specific to EMS professionals and/or those in fields that are directly related

The Brand: National Traffic Incident Management Coalition (NTIMC)

<http://timcoalition.org/?siteid=41&pageid=590>



What Is the Product Being Marketed?

The National Traffic Incident Management Coalition (NTIMC) is a **multi-disciplinary partnership** forum spanning the public safety and transportation communities to coordinate experiences, knowledge, practices, and ideas. NTIMC is committed to **safer and more efficient management of all incidents** that occur on, or substantially affect, the nation’s roadways in order to

- Enhance the safety of on-scene responders and of motorists passing or approaching a roadway incident.
- Strengthen services to incident victims and to stranded motorists.
- **Reduce incident delay and costs** to the traveling public and commercial carriers.

What Is the Mission?

To link public safety and transportation communities to define, standardize, and **advance the state of traffic incident management** practice. <http://timcoalition.org/?siteid=41&pageid=2782>

Key Message

NTIMC promotes multidisciplinary, multi-jurisdictional Traffic Incident **Management** (TIM) programs. <http://timcoalition.org/?siteid=41&pageid=2782>

Effective Sound Bites

One-quarter of the traffic congestion in the United States is caused by nonrecurring traffic incidents. While we have learned to function around high levels of recurring congestion during regular peak travel periods, unexpected travel delay is especially destructive to the economy. For every minute that an Interstate lane is blocked during peak congestion, four minutes of travel delay result. Clearing the road quickly requires responders to work together efficiently to accomplish the many tasks involved in traffic incident management: EMS, emergency communications, fire, law enforcement, transportation, towing and recovery, hazmat, public information.

Through NTIMC, public safety and transportation organizations join together to promote responder safety policies (such as move-over laws); to encourage the use of new technologies and gear protecting responders during roadside operations; and to promote improved safety procedures and traffic incident responder training.

Good traffic incident management is built on strong operational partnerships between transportation and public safety. When we work together side-by-side every day to manage the routine incidents, we build the strong relationships and cooperative policies we need to manage the transportation impacts of major incidents.

The Participants

The National Traffic Incident Management Coalition (NTIMC) is a unique forum where national organizations representing major stakeholders involved in traffic incident response work together. Our members represent the Emergency Medical Services, Fire, Law Enforcement, Public Safety Communications, Towing and Recovery, and Transportation communities.

The Audience

Practitioner audience across many functional areas.

Communication Methods

The website has various publications and products and a list of resources available to all who visit. The full Coalition holds a meeting three times a year and the executive summaries/

summary newsletters provide quick recaps of the news from each meeting, although detailed meeting minutes are also available.

Barriers, Limitations, Challenges to Successful Communication

It is very difficult to find any mention or link to NTIMC from the AASHTO website.

The Brand: OmniAir Consortium

<http://www.omni-air.org/>



Tag Line

Advancing Standards and Interoperability for a Better Transportation System

What Is the Product Being Marketed?

OmniAir is a nonprofit technology-focused trade association created to help achieve the deployment of advanced transportation technologies and applications through the member-defined OmniAir Certification program. OmniAir serves as a **catalyst for intelligent transport systems (ITS)** in general, but specifically the deployment of cooperative technologies such as Dedicated Short Range Communications (DSRC), the communications protocol underpinning the safety and mobility goals of U.S. DOT and IntelliDrive. <http://www.omni-air.org/who-we-are/>

What Is the Mission?

OmniAir members share a unified objective: to improve mobility, efficiency, and safety for the traveling public and **create cost savings and market opportunities** for the operators and suppliers of current and next-generation DSRC systems. <http://www.omni-air.org/who-we-are/about-omni-air/>

Key Message

By testing for standard hardware and application protocols that, together, permit “True Interoperability,” the Consortium works to ensure that all members and users of DSRC realize the maximum benefit from their OmniAir-certified products in a **safe, reliable, innovative, cost-competitive, and dynamic** environment. <http://www.omni-air.org/who-we-are/about-omni-air/>

Effective Sound Bites

OmniAir has a variety of initiatives that staff and members work on in response to requests from the Board of Directors or clients such as U.S. DOT. Initiatives fall into four categories (Hardware, Applications, Deployment, and Education and Outreach), all sharing the common theme of DSRC and supportive of OmniAir goals. Any OmniAir member may participate in any of the initiatives.

DSRC is a communications service that supports both Public Safety and Private operations in vehicle-to-roadside and **vehicle-to-vehicle communication** environments. DSRC complements satellite, WiMax, 3G, and other communications protocols by providing the highest data transfer rates in circumstances where minimizing latency in the communication link and isolating relatively small communication zones are important.

The Participants

OmniAir members are organizations and individuals from both the public and private sector who are intricately involved in the transportation telematics field and who understand the potential of next generation DSRC systems. Members represent hardware and software vendors, public sector transportation professionals, transportation consultants, engineers, and others who support open, interoperable, reliable, and cost-effective DSRC systems. Members participate directly in the strategic development of the Consortium, its advisory committees and certification services.

The Audience

Organizations and people from the public and private sector intricately involved in ITS and telematics and who appreciate the great potential of open-standards-based systems.

Communication Methods

OmniAir committees are active forums that work explicitly to advance the goals of the Consortium. As the democratizing element of OmniAir, all members may participate and influence a committee and many members join OmniAir just to participate in a particular activity or project. The success of OmniAir’s committees comes down to (1) relevant projects; (2) committed, knowledgeable, and available chairs; and (3) devoted experts. In-person meetings on various projects are held throughout the year in varying locations.

Barriers, Limitations, Challenges to Successful Communication

- It seems that you must sign up to be a member before you can see what detailed role you will play in the process.
- Unclear from the website as to how members converse, contact, and work with each other.

The Brand: Operations Academy

<http://www.operationsacademy.org>



What Is the Product Being Marketed?

The Operations Academy is designed to address the problem of lack of professional transportation management and operations personnel. It is based on the concept of **total immersion in the subject of transportation management and operations**, using a mix of classroom instruction, workshops, and analysis of existing systems to ensure the retention of the principles being presented. The academy will provide opportunities to practice and internalize the principles learned, which is not possible in traditional classes and short courses.

What Is the Mission?

For participants to be able to demonstrate knowledge of the technical tools of management and operations and the conditions under which they can be effectively applied.

Key Message

The Operations Academy has been modeled after successful leadership training programs offered in other fields. It includes two parts: an initial pre-study program followed by a 2-week (10-day) total immersion program. The academy will provide a significant development opportunity to career professionals in transportation management and operations.

Program Description

Formal Classroom Training. Formal classroom training organized around the six fundamental principles of management and operations: (1) Operations as a system, (2) Leveraging Improved Mobility and Safety through Operations, (3) Performance Measurement, (4) Customer Service, (5) Organization, (6) Management.

Workshops. Workshops will include small group exercises, with specific roles assigned to each participant. Participants will address difficult transportation management and operations challenges and propose solutions based on the principles provided during the classroom training. Solutions will be presented at a final session attended by leaders from the transportation agencies that have sponsored the participants. Participants will also be required to complete an evaluation of their agency's operations program.

Field Studies. Field studies will be conducted by workshop participants. Visits will be made to at least three transportation

operations facilities. Participants will be required to analyze these facilities and recommend improvements.

The Participants

The development of the Operations Academy has been funded by the I-95 Corridor Coalition. Other supporting organizations include the National Transportation Operations Coalition (NTOC), the Federal Highway Administration (FHWA), and the Institute of Transportation Engineers (ITE).

The Audience

Mid- to high-level managers whose existing or future responsibilities include management and operations of the transportation system.

Communication Methods

The website is an informative portal that effectively explains the function of the Operations Academy (<http://www.operationsacademy.org/index.html>). There is also a downloadable PowerPoint presentation that further explains the program offerings and there are brochures available for download and distribution. <http://www.operationsacademy.org/PDF/Press%20Release-Presentations-Brochures/Operations%20Academy%20Presentation-%20Oct%202010.ppt>

Barriers, Limitations, Challenges to Successful Communication

- The Academy relies completely on its parent organization, the I-95 Coalition, to help spread the word of its existence. The link for Operations Academy is hidden under the training tab of the I-95 Coalition website.
- It seems to only be sought by those who know it exists and their knowledge only stems from limited word of mouth.

The Brand: Galvin Project to End Congestion

<http://reason.org/news/show/galvin-project-to-end-congesti-1>

What Is the Product Being Marketed?

The Galvin Project and the Reason Foundation have joined forces to develop **practical, cost-effective solutions to traffic congestion**, a policy initiative that will save our cities and significantly increase our urban mobility through innovative engineering, value pricing, public-private partnerships, and innovations in performance and management.

Founded in 1968, the Reason Foundation is a nonprofit organization advancing “free minds and free markets.” The Reason Foundation advances a free society by developing, applying, and promoting libertarian principles, including

individual liberty, free markets, and the rule of law. The Reason Foundation produces respected public policy research on a variety of issues. The Galvin Project Inc. is a private initiative begun in 2005 by former Motorola CEO Robert Galvin to support sustainable electrical power.

What Is the Mission?

To eliminate road congestion and restore the primacy of an efficient, dynamic, and progressive transportation network as a core component of urban life.

Key Message

In addition to adding road capacity, changing the way highways are managed can help to maximize the use of the capacity we have. The introduction of **Intelligent Transportation System technologies** can speed resolution to traffic delays, and electronic toll collection technologies can make extensive tolling practical. More importantly, **variable pricing of lanes** can keep traffic flowing all day by responding to changing demand.

Effective Sound Bites

Gridlock will lead to the death of major cities in the United States and elsewhere in the developed world by mid-century if dramatic change is not implemented. But just as cardiac surgery can sustain our circulatory systems, we can prevent these clogged arteries that will stop the economic heart of cities from pumping.

The old canard “we can’t build our way out of congestion” is not true. Adding innovative new capacity and improving the management of roads can eliminate chronic congestion.

Any city that ignores the threat and refuses to take up the challenge of eliminating congestion will find itself at an economic stand-still by mid-century. We can solve our congestion woes. We can upgrade to an innovative, market-driven, world-class transportation infrastructure. We can change the institutions that guide our transportation decisions to create greater responsiveness, robustness, and efficiency.

The Participants

Currently this movement is being run and aided by the Galvin Project and the Reason Foundation. Ideally, in the future, localities, regions, and states around the country will also be participating.

The Audience

The targeted audience for this information is decision makers.

Communication Methods

The website is the main tool for communication currently. It includes the

- project description, <http://reason.org/news/show/1007355.html>;
- vision statement, <http://reason.org/news/show/1007354.html>; and
- video renderings of potential transportation infrastructure solutions, <http://reason.org/news/show/1007358.html>.

“The Reason Foundation in Los Angeles is the nation’s foremost expert in free-market transportation alternatives such as toll roads and express highway lanes for commuter buses.”

—*Wall Street Journal*

“For 17 years, Mr. Poole has been the chief theorist for private solutions to gridlock. His ideas are now embraced by officials from Sacramento to Washington.”

—*New York Times*

“Truck-only toll lanes are the brainchild of Robert Poole, an engineer who oversees transportation studies at the Reason Foundation, a libertarian think tank in Los Angeles.”

—*USA Today*

Barriers, Limitations, Challenges to Successful Communication

- There is no actual program suggested or implementation strategy proposed yet. The Reason Foundation basically informs the visitors of the site that roadway capacity must be increased and better managed.
- No real outreach has been done to get the Galvin Project name and message out to decision makers on a wide-spread basis.

The Brand: Florida Road Rangers

<http://www.flroadrangers.com/index.asp>



Tag Line

Move It, Yes You Can!

What Is the Product Being Marketed?

Today's role of the now recognized "Road Rangers" has been expanded to include **highway incident management** on more than a thousand miles of highways, freeways, interstates and other primary roads in Florida. Road Rangers respond to all type of incidents and have become one of the most effective elements of the Department's incident management program.

What Is the Mission?

To do whatever it takes to restore the flow of traffic back to normal as quickly and as safely as possible by utilizing all of our many available resources.

Key Message

Florida DOT's Road Rangers provide a direct service to motorists by quickly clearing travel lanes of debris and damaged vehicles involved in minor noninjury crashes. Road Rangers also respond and assist motorists who have mechanical problems on the state's vast highway system.

Free Services include

- Providing auto fuel.
- Assisting with tire changes and other types of minor emergency repairs, including adding water to radiators of overheated vehicles.
- Providing engine oil.
- Aiding exhausted and stranded motorists.
- Providing free cellular telephone service for motorists to call friends or family to request help from a motor club or tow company.
- Providing a ride to the nearest exit or public facility.
- Ensuring no motorist is ever left behind.

The Participants

Initially implemented by Courtesy Cruiser, Inc., this free roadside service has grown into a Florida Department of Transportation entity (which costs a little more than \$19 million a year) and is assisted by the Florida Highway Patrol and Coastland Auto Center. It is one of the most successful public-private "service patrol" partnerships in the country. <http://www.flroadrangers.com/aboutroadrangers.asp>

The Audience

Drivers on Florida's busiest highways and interstates.

Communication Methods

In the early days of Road Rangers, when the trucks were called "Courtesy Cruisers," a local radio station would provide live updates about traffic conditions during rush hour Monday through Friday. Now Road Rangers have a website with live traffic maps and markings indicating places of possible congestion, due to accidents, construction, and so on.

Barriers, Limitations, Challenges to Successful Communication

- The website is not very informative: Other than the map with Google real-time traffic overlays, information is limited.
- There is no dedicated phone number for the Road Rangers service. The website suggests calling 911 and then asking for a nonemergency transfer to the Florida Highway Patrol. You can also dial *347 (FHP).

The Brand: Georgia NAVIGATOR Program

<http://www.georgia-NaviGator.com/>



Tag Line

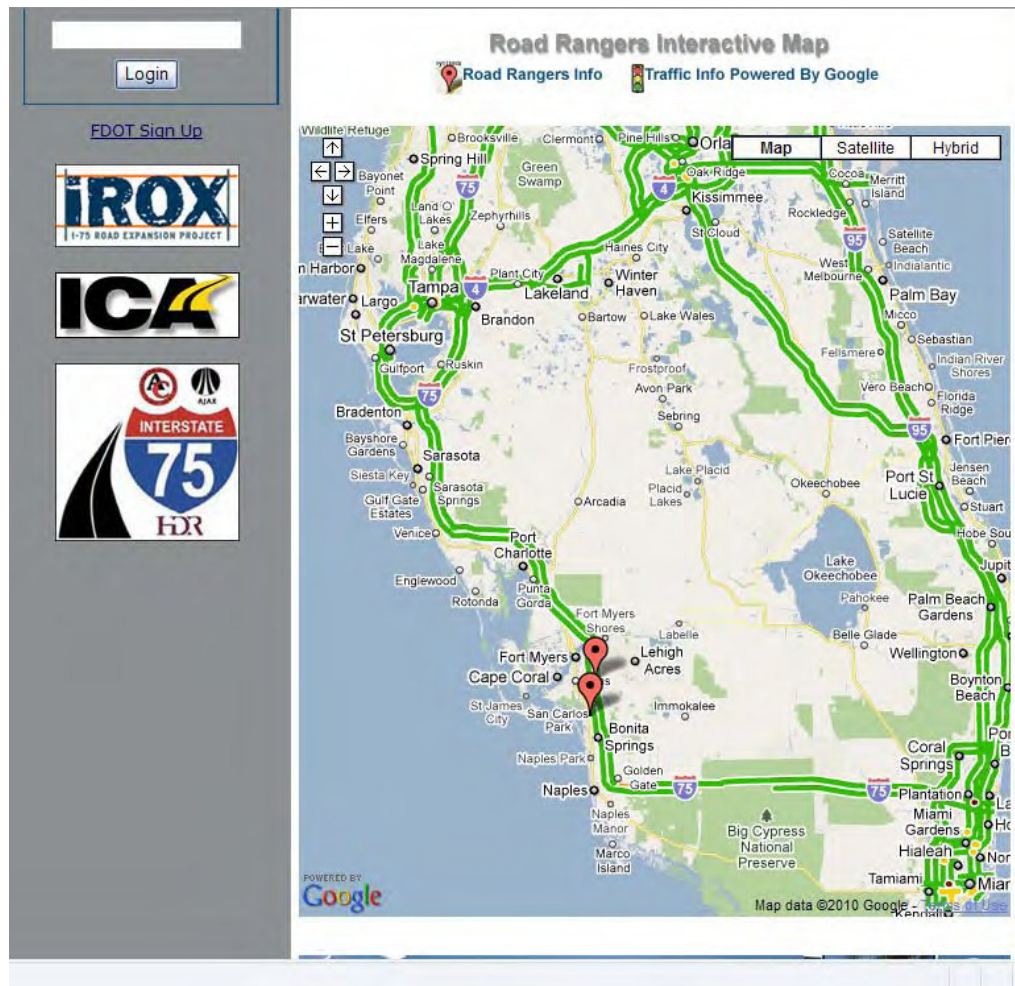
Real-Time Georgia Traffic Information

What Is the Product Being Marketed?

NaviGator was conceived and is being built as a statewide system. The Georgia Department of Transportation (GDOT) expects to complete NaviGator coverage in the Atlanta region by 2010. Completed coverage includes **traffic cameras, congestion sensors, changeable message signs (CMS)**, ramp meters, and Highway Emergency Response Operators (HERO) patrols. Outside of Atlanta, the NaviGator system now includes a hurricane evacuation system in the coastal areas. <http://mynav.georgiaNaviGator.com/www/contactus.jsp#3>

What Is the Mission?

GDOT's NaviGator program aims to **maximize the efficiency** of current and future transportation systems.



Key Message

GDOT is widely recognized for its comprehensive approach to **transportation management** and is proud to operate and maintain one of the most innovative ITS deployments in the United States. NaviGator and its partners will continue to evolve and meet the important challenges of urban mobility, air quality, and quality of life. <http://mynav.georgiaNaviGator.com/www/about.jsp#part9>

Effective Sound Bites

We're making it easier for you to get the information you need whenever, wherever. Choose the method that best works for you. <http://mynav.georgiaNaviGator.com/www/services.jsp>

The Participants

Georgia DOT runs the NaviGator program, which works together with Georgia's 511 program and is linked with the

national 511 program. Note that this program appears to be funded solely by Georgia DOT without federal assistance.

The Transportation Management Center is an important partner with this effort, as it uses the information from NaviGator to collect real-time information about traffic as well as incidents. Once incidents are confirmed, the proper authorities (such as police, fire, or Highway Emergency Response Operators) are notified so that they can respond to the incident. This information is then communicated to the traveling public through the NaviGator website and changeable message signs along the state roadway system. <http://www.georgia-navigator.com/about>

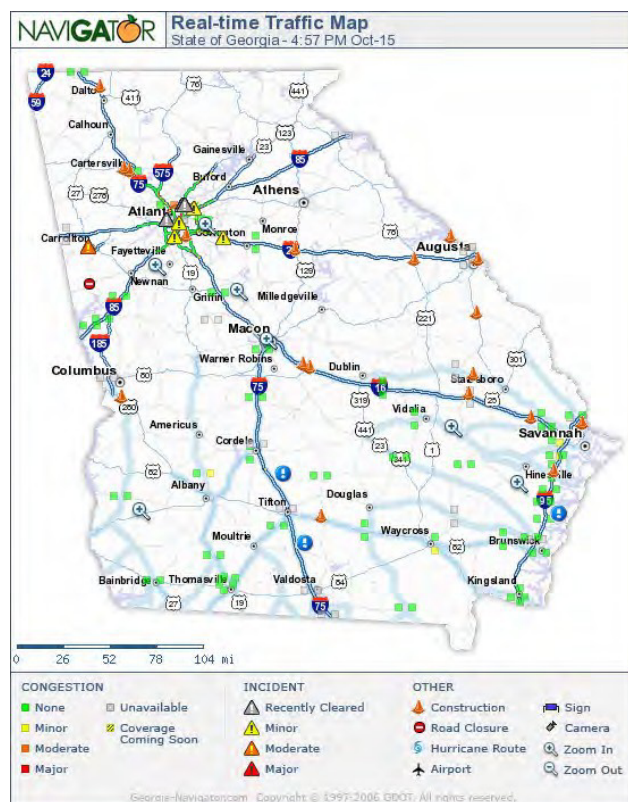
The Audience

The main audience is the traveling public. The website includes **real-time traffic information on incidents and construction** by showing traffic cameras, message signs, and trip times. There is an option to create a "My NaviGator" page with a personal traffic page. This page allows you to use NaviGator's

maps, traffic cameras, trip times, and more, or to set up an e-mail Traffic Alert to receive e-mail notifications of incidents in your specified area. <https://mynav.georgiaNaviGator.com/www/login>

Communication Methods

Website with real-time traffic map <http://mynav.georgiaNaviGator.com/www/map>, traffic cameras, mobile alerts, and changeable message signs all work together to provide the traveling public with real-time information. The website also includes a **trip time calculator**. <http://mynav.georgiaNaviGator.com/www/about.jsp#part9>



Barriers, Limitations, Challenges to Successful Communication

- Despite the program name, the website is difficult to navigate. As a result, there are many barriers to information transfer.
- The website does not contain direct links to either the national or state 511 or HERO websites, which appear to be integral partners of the program. There is a way to link to GDOT's website, but not any others. This could be a barrier to public and practitioner understanding of how these integrated and related efforts relate.

The Brand: Minnesota Guidestar



<http://www.dot.state.mn.us/guidestar/index.html>

What Is the Product Being Marketed?

The advancement of ITS technology and programs at the state and local level. Minnesota Guidestar performs a **broad range of ITS** activities including **needs assessments, research and development, full-scale** operational testing, and deployment of ITS strategies and technologies. Minnesota Guidestar has a strong partnership with the public sector, the private sector, and academia that has successfully produced innovative and unique programs and projects.

What Is the Mission?

The Minnesota Guidestar Board provides strategic direction and advice for statewide application of advanced technology and information systems in transportation. The Board serves as a catalyst for innovative partnerships and resource investment so desired outcomes can be achieved. http://www.dot.state.mn.us/guidestar/about_guidestar.html

Key Message

Minnesota Guidestar is the state's ITS program. ITS is the application of advanced technology to solve transportation problems, and supporting the movement of people, goods, and services.

Effective Sound Bites

Arterial Travel Time Using Bluetooth—The Arterial Travel Time project is focused on demonstrating how the use of Bluetooth technology can provide cost-effective, real-time, and accurate travel time information along Minnesota's arterials and will also demonstrate how travel time information might be used to measure performance of arterial traffic management and operations.

Collision Prevention Strategies—The intent of the Collision Prevention Strategies (CPS) program is to address the

problem of right-angle collisions at signalized intersections by focusing on red light violations as a surrogate measure.

Redundant Communications—The Redundant Communications Project addresses concerns over communications with ITS devices susceptible to failure because of “single lines” of communication. Redundant communications are used to connect to field devices, including portable changeable message signs and traffic detectors, via wireless connections. <http://www.dot.state.mn.us/guidestar/projects.html>

The Participants

Minnesota Guidestar is managed by the Minnesota DOT Office of Traffic, Safety, and Operations in conjunction with numerous public, private, and academic partners to conduct Intelligent Transportation Systems ITS research, operational tests, and deployment projects.

The Audience

The primary audience for this program is policy makers and research academics. There is an added interest in attracting practitioners, which is not yet well developed.

Communication Methods

The Guidestar website is not clearly advertised on the Minnesota DOT home page; visitors must go to the search page to find it. The website itself is not very interesting or user-friendly; it essentially is a platform to other projects that Guidestar has implemented.

Barriers, Limitations, Challenges to Successful Communication

- Possible ineffective communication. The projects implemented by Guidestar seem to be invisible to the policy makers and the general public who are unaware of the programs behind the operation and management changes.
- The website information is highly technical and appears to be aimed at the practitioner, which it has not yet attracted.



The Brand: IMPACT Public Information Program

<http://www.ncdot.org/doh/impact/>



Tag Line

Connecting people and places in North Carolina—**safely** and **efficiently**, with accountability and environmental sensitivity.

What Is the Product Being Marketed?

IMPACT is the North Carolina Department of Transportation's (NCDOT) **public information** program for road construction. IMPACT offers **communication** solutions for all types of **construction** projects. <http://www.ncdot.gov/doh/impact/default.html#0>

What Is the Mission?

The IMPACT program has three main goals: (1) promote **safety** in the work zone; (2) proactively **inform** the public of impacts from construction; (3) provide exceptional customer service. <http://www.ncdot.gov/doh/impact/default.html#0>

Key Message

IMPACT stands for Information Management Public Affairs, Construction and Traffic Control.

Effective Sound Bites

The need for public information will only continue to increase. The IMPACT team is ready to meet this challenge by providing motorists with **timely information** that will make traveling as **safe** and **convenient** as possible.

Achieving customer satisfaction is a priority of the IMPACT team. One hundred percent customer-driven, IMPACT is committed to proactively **informing the public of construction projects and their impacts** on the community.

Safety is the Department's number one priority. The safety of the motoring public and workers is paramount. An informed driver is a safe driver. Our goal is to **notify drivers about construction activities in advance** so they can adjust their plans accordingly. <http://www.ncdot.gov/doh/impact/default.html#0>

The Participants

IMPACT is a collaborative effort between a variety of NCDOT units: construction unit, traffic control section, highway divisions, and the communications office. Given that NCDOT is the only organization involved, the project team assumes the effort is state funded.

The Audience

The traveling public in North Carolina.

Communication Methods

IMPACT develops materials to notify the traveling public of construction projects they may encounter. While these materials are noted on their website, they are not available at this or any other known location. The website lists the following effective strategies as being available to reach the public with timely and accurate information:

- News releases to local television and radio stations, newspapers, traffic reporters, N.C. Highway Patrol, AAA of the Carolinas, the N.C. Trucking Association, etc.
- Brochures, fliers, and posters distributed to neighborhoods, local businesses, Chambers of Commerce, Visitor Centers, etc.
- Construction information meetings held in local communities.
- News stories or interviews that highlight work zone safety and specific project impacts. <http://www.ncdot.org/doh/impact/>

Barriers, Limitations, Challenges to Successful Communication

- There is a link under "Projects" on NCDOT's home page, <http://www.ncdot.gov/>; however, there is only one page of information, which provides limited information. This

web page for IMPACT is easy to navigate, as all of the information is in one place.

- It is difficult to determine exactly what product is being marketed and how a user is benefiting.
- There were no links to any brochures or public information material directly on the site and searching on NCDOT did not bring up anything further.
- Overall, it is difficult to gauge exactly how effective this project is given that the product is not readily apparent.

The Brand: Kansas City Scout

<http://www.kcscout.net/FAQ.aspx#q11>



Tag Line

Getting You There

What Is the Product Being Marketed?

Kansas City Scout is Kansas City's bi-state **traffic management system**. The Kansas and Missouri departments of transportation (KDOT, MoDOT) use cameras to monitor the highways from their **traffic management center** in Lee's Summit. Kansas City Scout has sensors that gauge traffic flow, large electronic message boards that send urgent traffic notices to drivers along the freeways, and a Highway Advisory Radio system that motorists in Missouri can tune to in the event of a freeway incident.

What Is the Mission?

Scout is designed to lessen traffic jams by improving rush-hour speeds, to increase safety by decreasing the number of rush-hour accidents, and to improve emergency response times to traffic situations.

Key Message

If you travel on Kansas City's metropolitan freeways, Scout has a direct impact on you. Scout cannot control what happens on the roadways, but it can detect and manage various traffic situations on its system. If a freeway lane is blocked for

any reason and traffic slows down, Scout will know and respond appropriately. In the event of an accident, a stalled car, or debris in the road, the sooner the response, the sooner the situation is resolved, and the sooner you are on your way.

Effective Sound Bites

Scout doesn't promise to relieve congestion and prevent accidents completely, but it is a system designed to **keep free-way traffic flowing as smoothly and safely as possible.**

As Kansas City's urban region continues to expand, congestion on the interstates keeps growing along with driver frustration. Motorists are tied up in traffic with little information about the length or extent of the delay they will experience. Rising to the challenge to empower motorists with real-time travel information and improve the quality of the commuting experience, Kansas City Scout launched Travel Times, a key weapon in congestion management, on January 8, 2007.

At \$43 million for an initial 75-mile project, Scout's deployment costs an average of \$573,000 per mile. That compares to a conservative \$3–6 million cost per mile for a single, new lane of roadway.

The Participants

The Kansas Department of Transportation (KDOT) and Missouri Department of Transportation (MoDOT).

Costs and Funding

The project's cost was \$43 million. Of that amount, the Federal Highway Administration (FHWA) contributed

80%–90% of the project cost. KDOT and MoDOT shared the remaining cost.

The Audience

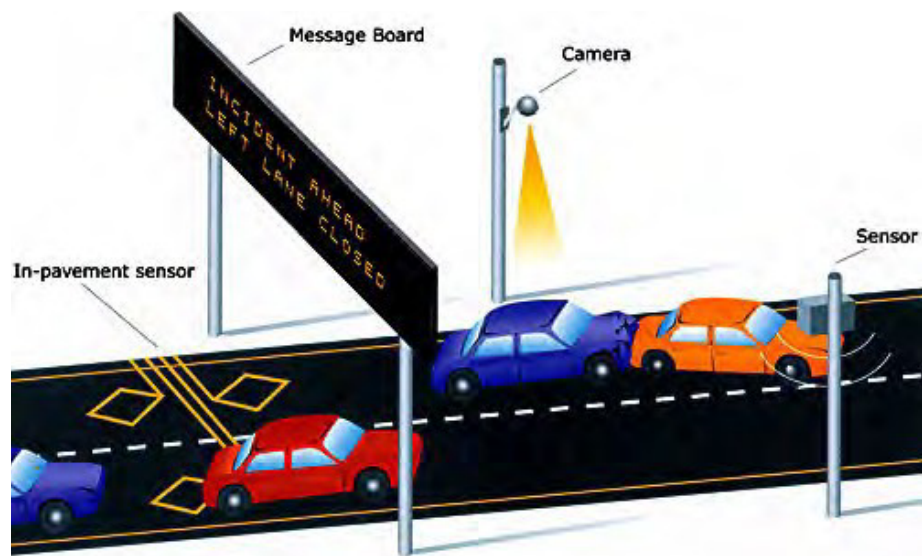
Kansas City's driving population, both passenger and freight.

Communication Methods

Kansas City Scout has its own very attractive website with lots of interactive features. The home page displays a large map of Kansas City with live traffic conditions. There are also Traffic Cam images available for viewing: <http://www.kcscout.net/Default.aspx>. One of Kansas City Scouts' biggest communication methods is using electronic messaging boards above major highways that alert drivers to varying traffic conditions. The Scout web page also has links to promotional videos, <http://www.kcscout.net/Promo.aspx>, and even a place to schedule a tour of the entire working system, <http://www.kcscout.net/ScheduleTour.aspx>.

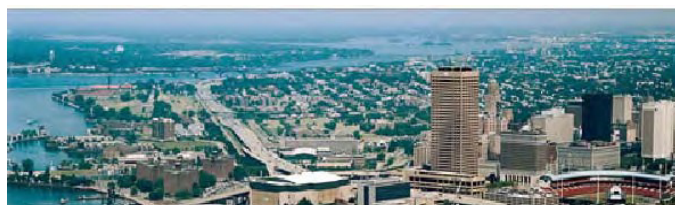
Barriers, Limitations, Challenges to Successful Communication

- While attractive, the website has so many features it is cumbersome to navigate and might overwhelm first time users looking for simple answers.
- The general public may not realize that highway notices and the website are designed to change driving habits (like slowing down, moving over, or choosing another route).



The Brand: Niagara International Transportation Technology Coalition (NITTEC)

<http://www.nittec.org/index.aspx>



Tag Line

Niagara International Transportation Technology Coalition . . . making the regional bi-national transportation system more **safe and efficient** . . .

What Is the Product Being Marketed?

The Niagara International Transportation Technology Coalition (NITTEC) is an organization of 14 agencies in Western New York and Southern Ontario whose goal is to **improve regional and international transportation mobility**, promote economic competitiveness, and minimize adverse environmental effects related to the regional transportation system. The system includes four international border crossings between Canada and the United States. NITTEC was developed to help get you where you are going safely and efficiently. Less time spent in congested traffic means **less energy consumption, less air pollution, and reliable travel times** for personal and business decisions.

What Is the Mission?

The mission of the Niagara International Transportation Technology Coalition (NITTEC) is to improve mobility, reliability, and safety on the regional bi-national multimodal transportation network through **information sharing and coordinated management of operations**.

Key Message

NITTEC provides **real time traffic and roadway information** to improve traffic flows and enhance emergency

assistance for motorists using the transportation system. <http://www.nittec.org/about.aspx>

Effective Sound Bites

Real-time information reduces secondary incidents and improves response time by police and emergency vehicles. NITTEC provides real-time driving conditions to help motorists make informed decisions so they reach their destinations safely and efficiently.

Some NITTEC System Components

Traffic Operations Center (TOC)—The NITTEC 24-hour centralized **operation center** that collects and analyzes real-time traffic information for the purpose of distribution to NITTEC members, stakeholders, and the public.

Dynamic Message Signs (DMS)—A series of signs stationed along the highway network that are capable of displaying various messages that inform motorists of traffic conditions.

TRANSMIT—A system that gathers vehicle travel time information that can be used for detection of vehicular incidents, traffic congestion, and for notification of existing travel times.

Advanced Traffic Controllers (ATC)—A series of traffic counting stations that transmit real-time traffic information to the TOC to assist in **incident detection and response** and identify traffic congestion.

The Participants

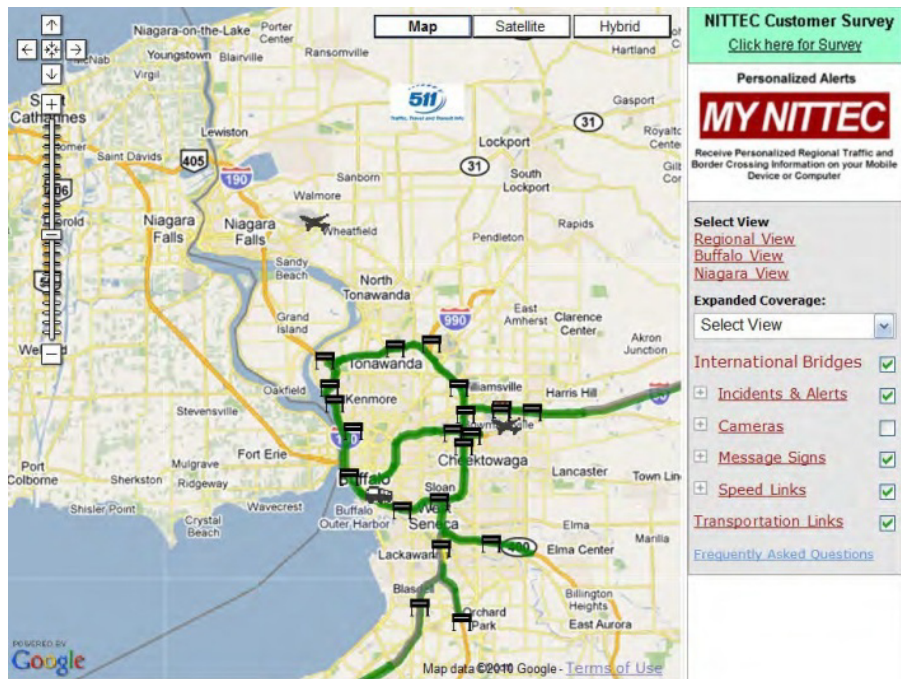
NITTEC is a Coalition of 14 agencies in Western New York and Southern Ontario. The NITTEC member agencies are represented on the Coalition's executive council, management council, and subcommittees. The executive and management council work collectively to arrive at the consensus on the development and operation of NITTEC, our Traffic Operations Center (TOC), and Regional Incident Management Collaboration.

The Audience

Western New York and Southern Ontario's transportation practitioners, stakeholders and their driving public.

Communication Methods

NITTEC operates a Traffic Operations Center (TOC) 24 hours a day 7 days a week that monitors traffic and informs the public, as well as the member agencies of the Coalition, about traffic situations. The information gathered in the TOC is disseminated to the regional Coalition agencies, local police



agencies, media outlets, emergency services, and directly to the public via 1610 AM radio and this website. Whether a slowdown may be caused by severe weather, construction, a public event, or a traffic accident, information regarding transportation issues on the local highways is disseminated through this website.

<http://www.nittec.org/advisories.aspx>

Barriers, Limitations, Challenges to Successful Communication

- None apparent

The Brand: Operation Green Light

<http://www.marc.org/transportation/ogl/about.htm>



Tag Line

Turning Stop Lights into Go Lights

What Is the Product Being Marketed?

Improve **coordination of traffic signals** (through synchronization) and **incident response** on major routes at the regional

level across state boundaries in order to reduce delay, improve traffic flow, and reduce emissions.

What Is the Mission?

Operation Green Light exists to significantly reduce air pollution, stops, delays, driver frustration, and fuel consumption in the Kansas City area by optimizing the **travel times, safety**

and traffic flow along arterial corridors. <http://www.marc.org/transportation/ogl/documents.htm>

Key Message

Operation Green Light provides local agencies an effective tool to manage traffic signal operations into the future and respond to changes in the way the public chooses to use these roadways; whether that means changes in vehicle traffic patterns or more use by pedestrians, bicyclists and transit riders.

Effective Sound Bites

Keeping a car well-tuned and maintained with proper tire pressure is a way to extend its useful life and reduce its environmental footprint. Likewise, retiming traffic signals for changing travel patterns is a cost-effective way to ensure the public continues to benefit from past investments in our regional streets and highways.

Operation Green Light will

- Create an environment that fosters multi-agency cooperation and region-centered thinking among member agencies.

- Respect the operating policies, procedures, and philosophies of various member agencies.
- Promote proactive understanding between member agencies.
- Provide exceptional quality signal-timing plans in the Kansas City region.

The Participants

Mid-America Regional Council, Kansas Department of Transportation, Missouri Department of Transportation, Federal Highway Administration, and 21 area cities in a multi-agency, regional collaborative effort.

The Audience

The targeted audience appears to be other agencies/ municipalities that may be encouraged to participate.

Communication Methods

Website linked to MARC and Kansas City Scout, but not readily visible as a stand-alone website. There is a YouTube video on the

OPERATION GREEN LIGHT
PRIORITY CORRIDORS

HOW MUCH DOES IT COST?
The first phase of Operation Green Light cost \$4.4 million, and the initial annual operating cost is \$1.4 million. The project is paid for by federal, state and local funds.

HOW BIG IS THE SYSTEM?
Phase 1 of the project covers more than 200 intersections in 14 cities. The entire system could eventually cover the same intersections throughout the region. Later phases could include a dedicated fiber-optic communications system and a joint traffic operations center with Kansas City Scout.

WHAT IS OPERATION GREEN LIGHT?
Operation Green Light is a cooperative effort to improve the coordination of traffic signals and incident response on major routes on both sides of the state line — throughout the Kansas City area.

WHAT DOES IT DO?
Operation Green Light helps synchronize traffic signals on major streets throughout the region, especially those that cross city limits. This reduces unnecessary delays, improves traffic flow and cuts emissions that contribute to ozone pollution.

WHY IS IT IMPORTANT?
Operation Green Light is important for three reasons:
• it will improve the flow of traffic on the most used arterial roads in the region, especially during peak travel demands;
• it will improve regional air quality; and
• it will provide a tool for state and local governments to better manage changes in traffic patterns with the Kansas City Scout freeway management system.

HOW DOES IT WORK?
The state and local governments that own traffic signals in this area are working together to make sure that the timing plans for the intersections on major routes are coordinated for more efficient flow of traffic. Although existing equipment is used wherever possible, some new communications equipment and software, and new signal controllers must be installed on the traffic signals on the system can communicate with each other and with a central operations center. This equipment and software help keep the traffic signals in sync with new timing plans.

HOW DOES IT HELP TRAFFIC FLOW?
Depending on factors like the length of a trip and the number of traffic lights, Operation Green Light could save seconds (or even minutes) for someone driving on a coordinated route, since thousands of vehicles travel along each road on a weekday. This could add up to noticeably improved traffic flow, especially during rush-hour periods in the morning and afternoon. Operation Green Light has reduced delays on synchronized routes by an average of 40 percent.

HOW CAN IT IMPROVE AIR QUALITY?
By increasing the amount of time motorists have to sit at intersections, Operation Green Light helps reduce emissions that contribute to the formation of ground-level ozone in the Kansas City area's main air pollutant.

WHO IS INVOLVED IN THE PROJECT?
The Mid-America Regional Council, 20 area cities, the Kansas and Missouri Departments of Transportation, and the Federal Highway Administration are working together to deliver Operation Green Light.

TURNING STOP LIGHTS INTO GREEN LIGHTS

1 Analyze location and traffic patterns from computerized traffic signals, without having to visit an intersection.

2 A wireless and fiber-optic communications system allows information to be sent instantly between the region through radio equipment on towers.

3 Access points direct information to the signals along a corridor.

4 An individual traffic signal receives the information, which is passed to the signal controller, a nearby cabinet.

website, <http://www.marc.org/transportation/ogl/video.htm>, as well as a 2-page brochure with technical information. <http://www.marc.org/transportation/ogl/pdfs/oglbroadure.pdf>

Barriers, Limitations, Challenges to Successful Communication

- The brochure communicates technical information rather than easily understood language. This does not appear to be targeted to policy makers, but rather to technical staff.
- Missed opportunity? This system seems to be invisible to the driving public.

The Brand: Georgia Towing & Recovery Incentive Program (TRIP)

<http://www.timetaskforce.com/trip.html>



Tag Line

Reducing the impact of commercial vehicle incidents in Atlanta!

What Is the Product Being Marketed?

The Georgia Towing and Recovery Incentive Program (TRIP) provides improved management of large-scale commercial

vehicle incidents. TRIP encourages the quick, safe clearance of these incidents by paying performance incentives to highly skilled, TRIP-certified towing and recovery companies for clearing wrecks within established clearance goals.

What Is the Mission?

To facilitate quick and safe clearance of commercial vehicle crashes by improving towing procedures. TRIP also aims to **improve traffic incident management (TIM)** in the region while building a mutually beneficial relationship within the towing community by making it more financially profitable to meet quick clearance goals.

Key Message

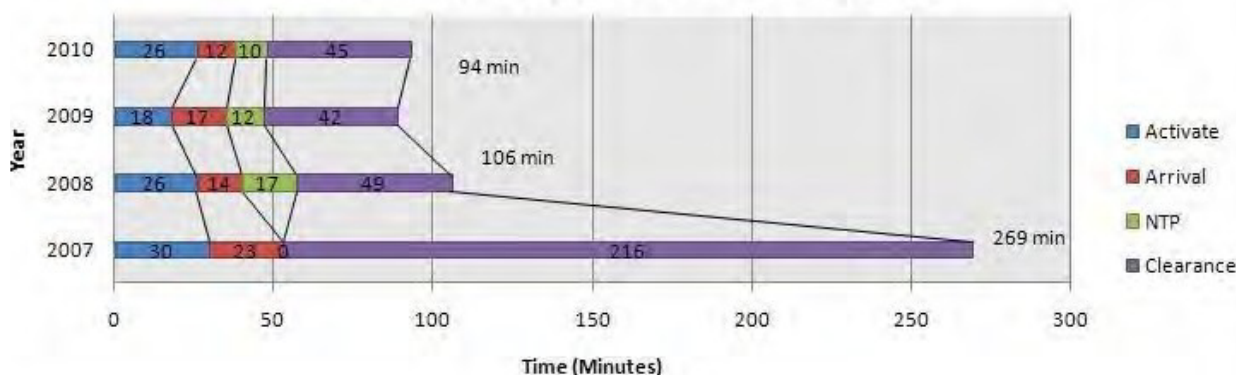
A TRIP is activated when incidents meet a predetermined set of criteria, which includes mostly complicated or extended incidents where large vehicles or spilled loads cannot be easily towed from the scene or have created a potential hazard to traffic. http://www.timetaskforce.com/documents/TRIP/Summary_v_07.pdf

Effective Sound Bites

In January 2008 the Georgia Towing and Recovery Incentive Program (TRIP) was implemented to pay heavy-duty recovery companies a monetary bonus for clearing commercial vehicle wrecks within 90 minutes. http://www.timetaskforce.com/documents/TRIP/TRIP%20Brochure_V15.pdf
TRIP will

- Improve traffic incident management in the region.
- Facilitate quick and safe clearance of commercial vehicle crashes.
- Improve towing procedures.
- Improve scene safety.
- Make it more profitable for the towing community to meet quick-clearance goals.

Time to Roadway Clearance 2007-2010



- Reduce the impact of major traffic incidents while meeting clearance goals.
- Reduce secondary incidents.

http://www.timetaskforce.com/ppt/09ppt/TRIP_April_09_ITS_Georgia_Presentation.ppt

The figure illustrates the improvements that followed the implementation of TRIP.

The Participants

The Atlanta region has a number of public and private organizations that work together as the Traffic Incident Management Enhancement (TIME) Task Force to improve the management of traffic incidents. In 2006, the TIME Task Force developed a Strategic Vision of initiatives to improve traffic incident management services and one of the high priorities was to safely remove large vehicle incidents from the roadways in a timely manner. The TRIP program was developed as part of this Strategic Vision.

The TRIP program operates with joint participation of GDOT, Georgia Regional Transportation Authority, and FHWA. Any interested wrecker company can participate in this program by responding to an open Invitation to Negotiate. When a company meets the inspection and performance qualifications, the geographic response zones are negotiated.

The Audience

The targeted audience appears to be the towing community as they develop a mutually beneficial relationship with the

region by earning profit to quickly clear accidents. Another beneficiary of the service is the driving public, as these large-scale incidents that significantly affect traffic in the region, cause long motorist delays, pollute the air, and create safety hazards are effectively mitigated.

Communication Methods

Website linked from Metro Atlanta's Traffic Incident Management Enhancement (TIME) Task Force: <http://www.timetaskforce.com/trip.html>. There is a 2-page brochure that explains TRIP to potential towing companies: http://www.timetaskforce.com/documents/TRIP/TRIP%20Brochure_V15.pdf.

There are also two PowerPoint Presentations that can be downloaded from the website: [http://www.timetaskforce.com/ppt/08ppt/Presentation_Aug_08%20\(TRIP\).ppt](http://www.timetaskforce.com/ppt/08ppt/Presentation_Aug_08%20(TRIP).ppt), and http://www.timetaskforce.com/ppt/09ppt/TRIP_April_09_ITS_Georgia_Presentation.ppt

Barriers, Limitations, Challenges to Successful Communication

- The link to the website is not prominent on the TIME Task Force web page. Once the actual page is located, the visitor interfaces with a website that is not easy to navigate.
- Concern that truck drivers unfamiliar with this service will not know to call the proper authorities and receive quick service and clean-up. The same concern exists for the average driver who sees an accident occur.

APPENDIX E

Available Curricula for Future TSM&O Practitioners

This academic white paper was prepared by ICF International.

Introduction

In preparing this white paper, the L17 team identified a number of research reports and resources developed by the transportation industry relevant to this topic:

- *University of Maryland Operations Academy (1)*. Sponsored by the I-95 Corridor Coalition, this “two-week, total immersion transportation management and operations program” for transportation systems operations and management (TSM&O) mid-level and senior managers represents industry efforts to provide support for current TSM&O practitioners. The preliminary self-study curriculum for the Operations Academy was used as the foundation for the TSM&O knowledge framework, which summarizes the industry’s perspective on the technical knowledge TSM&O practitioners should have.
- *FHWA’s National Transportation Training Resource (NTTR) database (2)*. This database is the repository for the results of the NCHRP 20-77 project which created and populated a transportation operations training framework (3). This project focused both on professional development and academic courses offered by “industry associations, federal government, universities, state departments of transportation, and private industry.” The resulting list of courses captures many, but certainly not all, TSM&O-related topics. The NTTR database was used to validate the TSM&O knowledge framework and is a source of information on current TSM&O-related courses.
- *The Institute of Transportation Engineers (ITE) Education Council, Curriculum Subcommittee knowledge tables and learning outcomes (4)*. ITE is developing “knowledge tables” as well as course learning outcomes to help guide educators in the selection of specific course material for transportation engineering students. The knowledge tables identify concepts, processes, and tools students should learn as well as how to apply the knowledge. Knowledge tables have

been completed for Traffic Operations and Highway Capacity, Geometric Design, Transportation Planning and Land Development, and Finance and Economics. Tables for Traffic Safety and for Transit and Non-Motorized are partially complete. Additional knowledge tables identified but not yet started include Systems, Asset Management, Pavement, and User Behavior/Human Factors. The relevant knowledge tables were used to validate technical knowledge information summarized from the Operations Academy curricula and the NTTR database.

- *Value-Added Employee Framework (5)*. The resources listed previously were developed by the transportation industry and focus on the technical knowledge TSM&O practitioners need. To help identify required technical skills, abilities, and nontechnical competencies, the L17 team used a framework developed by Edward J. Cripe and Richard S. Mansfield in their 2002 book *The Value Added Employee: 31 Competencies to Make You Irresistible to Any Company*. The Value-Added framework includes 31 core competencies grouped into three categories: People, Business, and Self-Management. A link provided in the Core Competencies section will provide the definitions of the 31 competencies. This information was used to identify the full spectrum of core competencies—technical and nontechnical—that shape a well-rounded TSM&O practitioner.
- *The Consortium for ITS Training and Education (CITE) (6)*. CITE is composed of university and industry associations to provide online advanced transportation training and education. CITE offers a combination of individual-study, instructor-led, and certificate programs focused on traffic engineering and ITS courses. The courses identified were captured in the NTTR database and are therefore included in this research.

These resources were used to identify both TSM&O core competencies and the courses and trainings that are available to develop those competencies.

Purpose

In a time when funding is shrinking and travel demand is growing, increasing congestion on our transportation system must be addressed with all available resources and strategies. Travel interruptions and delays resulting from unanticipated events contribute significantly to congestion and represent an area in which transportation agencies can make significant gains. The benefits of reducing nonrecurring congestion—fewer crashes, reduced vehicle emissions and fuel consumption, and others—can be realized through better understanding of strategies, new technology and practices, as well as reducing institutional barriers. The main goal of TRB’s SHRP 2 Reliability focus area is to reduce nonrecurring congestion and improve travel time reliability through incident reduction, management, response, and mitigation. As the capstone project for the Reliability program, L17 will play a critical role in integrating the findings, methods, and recommendations of all other Reliability research, in addition to providing a bridge to key elements of the SHRP 2 Capacity program. The objective of L17 is to advance the integration of TSM&O into mainstream transportation agency practice. The most important product of the L17 research, and the Reliability program overall, is a Knowledge Transfer System (KTS) that will serve as an effective means for moving research findings and products into everyday practice (7).

An important facet of advancing TSM&O into mainstream agency practice is ensuring that there are professionals available to staff and support TSM&O activities. While there is a strong need for TSM&O practitioners to fill vacancies in transportation agencies, as well as in the consulting firms that support them, the number of qualified candidates is limited. As transportation agencies shift from construction to a more “operate and maintain” focus, the need for entry- and mid-level TSM&O practitioners is anticipated to grow. This need will be exacerbated as practitioners in the Baby Boomer generation continue to retire. The resulting workforce gaps can be partly addressed through training for current transportation professionals, but it is also necessary to ensure that there are academic supports for developing future TSM&O professionals. Undergraduate and graduate programs provide the entry-level workforce necessary to support the TSM&O field in the long term.

There has been significant interest in academic support for TSM&O over the past several years. Research studies and working groups have addressed this issue either directly or indirectly. This paper compiles lessons learned and foundational support from prior National Cooperative Highway Research Program (NCHRP) studies and industry-led efforts identified through the L17 research to present the current status of undergraduate and graduate level curricula to address the need for entry-level TSM&O practitioners. First, the

paper presents a framework of core competencies, the skills and knowledge (technical and nontechnical), generally required for entry-level positions within TSM&O. This framework is then used to analyze current TSM&O curriculum offerings with a focus on courses for undergraduate and graduate students. This analysis offers lessons learned that highlight gaps within the transportation engineering curriculum that need to be addressed to ensure that more students are exposed to and prepared for careers in TSM&O.

What the Beginning Practitioner Needs

In a recent study, *Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management*, Cronin et al. 2012 identifies some of the barriers to introducing future transportation professionals to the TSM&O field. The report states the following about system operations and management (SOM):

SOM interfaces with many disciplines and transportation modes, both internal and external to the organization, as well as with functions such as emergency management and public safety, and the concerns of the general public. . . . As the emphasis on transportation management and operations increases, the demand for personnel with skills in these areas is also increasing. Transportation agencies are experiencing a shortage of SOM professionals with the suitable skills and knowledge to move beyond more traditional civil engineering functions to the broader and more diverse SOM activities (8).

The NCHRP 20-86 project found that leaders in the field recognize the challenge in finding candidates with the necessary broad background among current graduates. Many have also observed that students rarely become aware of TSM&O as a unique transportation discipline prior to graduation, and therefore are unprepared for this career path. One of the recommendations included in the NCHRP 20-86 report is to develop TSM&O curriculum content for higher education courses and training programs.

These recommendations address the fundamental and inter-related issues of course availability and student interest in the subject area. In order for transportation agencies to recruit individuals for entry-level positions within TSM&O, colleges and universities must provide an introduction to this area of transportation practice and equip students with the basic skills required for TSM&O work. Students primarily select courses to meet graduation requirements, and then to obtain the necessary background for an entry-level position. Currently, these two objectives may not align for TSM&O careers. The unique skills required of TSM&O professionals draw on a combination of engineering, planning, communications,

technology, and systems management that requires a multidisciplinary education. Although this mix of topic areas may be very attractive to students considering the field, their knowledge of TSM&O career opportunities needs to be increased. The challenge, therefore, is to both provide relevant coursework and to raise awareness of the field and the skills needed for TSM&O practitioners, so that students will be able to pursue the proper coursework. Any successful effort to close the gap in supplying entry-level TSM&O professionals must deal with both the knowledge and skills needed and the lack of awareness of TSM&O as a potential career path.

One of the most significant challenges in preparing this academic white paper has been to identify the core competencies, both technical and nontechnical, that an entry level TSM&O professional should have. Core competencies are the essential skills, knowledge, abilities, and qualities that are required to successfully perform a specific position. Research for this project did not uncover any information that identified specific TSM&O core competencies. Therefore, the approach was to “back into” core competencies from other studies and initiatives under way to address gaps in TSM&O academic coursework and professional training. A framework was necessary to make the connection between academic and training courses and core competencies.

The best foundation for this framework is the Operations Academy preparatory reading material. As a training course for practitioners, the Operations Academy curriculum does not repeat academic course work, but rather builds from that foundation. However, recognizing that participants enter the Academy at different stages in their career, pre-program self-study materials specific enough to help identify entry-level skills and competencies are provided as background to the training. While there are many TSM&O-related courses and training classes available, the Operations Academy is the only TSM&O “curriculum” specifically designed for existing TSM&O practitioners and, therefore, this represents the industry’s best thinking on what is needed to create a well-rounded TSM&O practitioner. For the purpose of this white paper, the Operations Academy material is used as a starting point to identify technical knowledge expected of undergraduate or graduate students as they enter the TSM&O field as practitioners.

In order to categorize the type of knowledge needed for entry into the TSM&O field, the pre-study materials in the Operations Academy were divided into focus areas to serve as the basis for examination of the current state of the practice for TSM&O academic curricula. The focus areas are

- Traffic Operations Analysis;
- Traffic Safety;
- Social and Institutional Issues;
- Transportation Planning;
- ITS Awareness/Devices/National Architecture;
- Data, Networks, and Telecommunications;

- Project Management; and
- Emergency Management.

This framework for technical knowledge was validated in two ways. First, the courses and training included in the NTTR database represent a subset of the knowledge that the NCHRP 20-77 research team identified as relevant for TSM&O practitioners. These offerings were mapped to this framework to identify inconsistencies and gaps. The two sets of categories are strongly related, and this provides validation that the Operations Academy categories developed from the pre-study materials are a useful surrogate for the entry-level technical knowledge needed for a career in TSM&O. As a final cross-check, the team compared the results of the Operations Academy and NTTR comparison to the currently available and relevant ITE knowledge tables. There were no inconsistencies.

These three sources provide an excellent picture of the industry’s assessment of the technical knowledge TSM&O practitioners need. Core competencies, however, go beyond knowledge and identify the underlying skills and abilities that are required to perform the job. For example, analytical thinking is a core competency for the rigorous analytical skills that support an engineering curriculum. To broaden our understanding of TSM&O core competencies beyond this initial assessment, the team used the Value-Added framework developed by Cripe and Mansfield (2002) to identify the core competencies—both technical and nontechnical—that are needed in an effective TSM&O practitioner. The framework includes 31 core competencies grouped into three categories: People, Business, and Self-Management.

Current Status of Academic TSM&O Curricula

The NTTR database includes 642 TSM&O-related courses, of which 378 are offered by academic institutions. There are 68 academic institutions with courses in the database. The NTTR database courses are focused on training for transportation engineers; the database contains a limited number of courses relevant to TSM&O outside of the traditional transportation (or civil) engineering field. Courses are classified by subject matter, using the framework developed for the project. The primary subject matter headings are: Real-time Operations, Systems Development and Information Technology, Project Management, Policy and Strategic Considerations, and Program Planning. The project team mapped the subject matter areas to the Operations Academy topic areas described previously in order to identify available academic training in each area.

The resulting focus areas were then used to consider the adequacy of courses that are available. Table E.1 summarizes and compares the information from each source. The Operations Academy detailed course outline, as the most recent and

continually updated resource, provides the foundation for analysis. The NTTR database illustrates the breadth of support that exists currently in each area while providing the detail about specific schools and their courses. (Note that courses listed in the NTTR database can be categorized under multiple subject matter headings, so the Current Course Availability column in Table E.1 should not be summed to get a total number of courses.)

Table E.1 also summarizes course offerings by AASHTO region (and AASHTO online) to give an overview of the extent to which the topics are available. Nonacademic courses in the NTTR database address knowledge gaps for current practitioners by highlighting the need for training in these areas. From the breadth of information, core competencies were identified for each skill category from the NCHRP 20-77 report and the Value-Added framework.

Table E.1 includes no distinction between undergraduate and graduate courses. It is expected that some of these topics would only be covered in a graduate program. The identification of “academic” courses was based on the institution offering the course, not on the audience for the course. Several universities offer professional development courses in addition to their undergraduate or graduate education and some of these offerings are likely included in the analysis as academic courses.

Issues and Lessons Learned

Analysis of the NTTR database points to a number of issues within current transportation academic course offerings relative to TSM&O careers. While there are courses offered in all identified focus areas, several have limited offerings or fewer offerings than would be expected. The gaps in technical competencies highlight areas that may need additional attention in the transportation engineering curriculum via course material or connections to other programs covering that subject area.

- *Traffic safety* does not have many courses in the database, even when counting the professional development courses, and is offered at relatively few institutions. This gap is notable given that the ITE Curriculum Subcommittee includes safety as one of its knowledge tables. The information is either being covered as part of courses that largely focus on other topics (and so were not classified as relating to this topic in the NTTR database) or is not covered at all.
- *Emergency management* courses are also limited and are only being taught at a handful of universities. This topic may be covered in other fields that relate to TSM&O.
- *Project management* course offerings are limited, especially compared to the number of professional development courses on this topic. There may be more project management courses offered in the construction management track of civil engineering programs that are not being captured

here. Of the 68 universities listed in the database, 37 offer a construction management track or program within their civil engineering department. It is not clear if courses from those tracks were included in the NTTR database.

- *ITS Awareness/Devices/National Architecture* courses are not as widely available as anticipated considering the significant focus on technology and funding support for this area that has been available in the past. It is possible that some ITS information is included in the telecommunications area, which is more robust.

In addition, it is unclear how well the People and Self-Management competencies are represented within the technical courses offered. Many of these skills could be addressed by integrating these skills as a part of an engineering course. For example, oral and written communication could be incorporated as a learning objective, including evaluation and grading, in selected engineering courses. Likewise, collaboration skills could be integrated into an engineering course by incorporating course material on collaboration theory and techniques and evaluated through team assignments or joint projects. It is unlikely that this approach would address all of the required core competencies; however, it represents a relatively basic approach to beginning to fill the gap.

None of the analysis performed using the Operations Academy and the NTTR database evaluates the extent of the barriers to student awareness of TSM&O as a career path discipline for entry level engineers. However, looking at the ITE Curriculum Subcommittee knowledge tables, the proposed topic areas for an undergraduate, introductory transportation engineering course do not include references to ITS, telecommunications, or emergency management issues. Project management is not included in the knowledge tables, but it is a topic area that may be covered in the broader civil engineering curriculum rather than in transportation-specific courses.

While there is limited time to discuss material in these courses, more mention of the full range of TSM&O topics could help to build awareness and interest in TSM&O careers.

Courses related to these topics are likely offered in other (nontransportation engineering) degrees where TSM&O may be supported. This perspective is validated by the NCHRP 20-86 research, which suggests there are several other degree programs (such as electrical engineering or computer science) where potential candidates for TSM&O careers may be found.

Though not incorporated into our summary table, the NTTR database information can also be supplemented by a recent report by Karen Gitman describing the state of the practice in transportation training at community colleges (9). This report finds that community college programs specifically related to transportation are mostly focused on the areas of automotive technologies, commercial driving, or supply chain/logistics. However, community colleges do offer both

Table E.1. Matrix of Current Academic Support for TSM&O

Operations Academy Focus Areas	Related Topic Areas from NCHRP 20-77	Core Competencies	Current Course Availability (NTTR Database)	Universities/Colleges that Currently Provide	Courses by AASHTO Region	Training Offered to Practitioners (NTTR Database)
<p>Traffic Operations Analysis</p> <ul style="list-style-type: none"> ▪ Traffic flow concepts ▪ Road user characteristics ▪ Freeway operations ▪ Intersections ▪ Transportation system management techniques ▪ Access management tools ▪ Travel demand management ▪ Incident management 	<ul style="list-style-type: none"> ▪ Systems engineering process/methods ▪ Operations strategies 	<p>Analytical thought and skills with focus on traffic engineering concepts, basic communication skills</p> <p>People Skills</p> <ul style="list-style-type: none"> ▪ Attention to communication ▪ Written communication ▪ Customer orientation <p>Business Skills</p> <ul style="list-style-type: none"> ▪ Diagnostic information gathering ▪ Conceptual thinking ▪ Technical expertise ▪ Results orientation ▪ Thoroughness <p>Self-Management Skills</p> <ul style="list-style-type: none"> ▪ Flexibility 	165 courses	46 universities	Region 1 (30) Region 2 (29) Region 3 (39) Region 4 (66) Online (1)	116 nonacademic courses
<p>Traffic Safety</p> <ul style="list-style-type: none"> ▪ Safety improvement program ▪ Crash records (rate, frequency, type) and understanding crash patterns ▪ Road safety audits ▪ Liability and negligence ▪ Traffic safety program 	<ul style="list-style-type: none"> ▪ Safety management 	<p>Analytical thought and skills with focus on traffic engineering concepts, basic communication skills</p> <p>People Skills</p> <ul style="list-style-type: none"> ▪ Attention to communication ▪ Written communication ▪ Customer orientation <p>Business Skills</p> <ul style="list-style-type: none"> ▪ Diagnostic information gathering ▪ Forward thinking ▪ Conceptual thinking ▪ Technical expertise ▪ Results orientation ▪ Thoroughness <p>Self-Management Skills</p> <ul style="list-style-type: none"> ▪ Flexibility 	3 courses	3 universities	Region 1 (1) Region 2 (1) Region 3 (1)	10 nonacademic courses
<p>Social and Institutional Issues</p> <ul style="list-style-type: none"> ▪ Types of federal, state, and local regulations that affect transportation decision making ▪ Public interaction and involvement ▪ Stakeholders and partners 	<ul style="list-style-type: none"> ▪ Management of real-time operations systems ▪ Organizational change management ▪ Policy development ▪ Program definition/concepts of operation (Conops) 	<p>General knowledge of social and economic issues related to transportation; strong communication and collaboration skills</p> <p>People Skills</p> <ul style="list-style-type: none"> ▪ Problem solving ▪ Attention to communication ▪ Oral communication ▪ Written communication ▪ Persuasive communication ▪ Interpersonal awareness ▪ Influencing others ▪ Building collaborative relationships ▪ Customer orientation 	87 courses	39 universities	Region 1 (31) Region 2 (13) Region 3 (14) Region 4 (27) Online (2)	35 nonacademic courses

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Table E.1. Matrix of Current Academic Support for TSM&O (continued)

Operations Academy Focus Areas	Related Topic Areas from NCHRP 20-77	Core Competencies	Current Course Availability (NTTR Database)	Universities/Colleges that Currently Provide	Courses by AASHTO Region	Training Offered to Practitioners (NTTR Database)
		<p>Business Skills</p> <ul style="list-style-type: none"> ▪ Diagnostic information gathering ▪ Analytical thinking ▪ Forward thinking ▪ Conceptual thinking ▪ Fostering innovation ▪ Results orientation ▪ Thoroughness ▪ Decisiveness <p>Self-Management Skills</p> <ul style="list-style-type: none"> ▪ Self-confidence ▪ Flexibility 				
<p>Transportation Planning</p> <ul style="list-style-type: none"> ▪ Integration of various transportation modes ▪ Growth management (policies, funding, environmental, vehicle) ▪ Transportation planning and modeling ▪ Performance measurement ▪ NEPA 	<ul style="list-style-type: none"> ▪ Performance measurement/dashboards/reports ▪ Link between operations and planning 	<p>Analytical thought and skills with focus on urban and transportation planning concepts; basic communication and collaboration skills</p> <p>People Skills</p> <ul style="list-style-type: none"> ▪ Attention to communication ▪ Oral communication ▪ Written communication ▪ Interpersonal awareness ▪ Building collaborative relationships ▪ Customer orientation <p>Business Skills</p> <ul style="list-style-type: none"> ▪ Diagnostic information gathering ▪ Analytical thinking ▪ Forward thinking ▪ Conceptual thinking ▪ Technical expertise ▪ Results orientation ▪ Thoroughness <p>Self-Management Skills</p> <ul style="list-style-type: none"> ▪ Flexibility 	127 courses	42 universities	Region 1 (33) Region 2 (17) Region 3 (25) Region 4 (51) Online (1)	45 nonacademic courses

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Table E.1. Matrix of Current Academic Support for TSM&O (continued)

Operations Academy Focus Areas	Related Topic Areas from NCHRP 20-77	Core Competencies	Current Course Availability (NTTR Database)	Universities/Colleges that Currently Provide	Courses by AASHTO Region	Training Offered to Practitioners (NTTR Database)
<p>ITS Awareness/Devices/National Architecture</p> <ul style="list-style-type: none"> ▪ Describing ITS ▪ Integrating systems ▪ Surveillance technologies ▪ Dynamic message signs and other information displays ▪ Traffic controller ▪ Radio and camera ▪ DMS applications ▪ Introduction to the national architecture ▪ Basic concepts of systems engineering ▪ Regional applications ▪ Standards and user service requirements 	<ul style="list-style-type: none"> ▪ Systems architecture ▪ Systems and technology 	<p>Analytical thought and skills with focus on IT systems and applications related to ITS; basic communication skills</p> <p>People Skills</p> <ul style="list-style-type: none"> ▪ Attention to communication ▪ Building collaborative relationships ▪ Customer orientation <p>Business Skills</p> <ul style="list-style-type: none"> ▪ Diagnostic information gathering ▪ Analytical thinking ▪ Conceptual thinking ▪ Technical expertise ▪ Fostering innovation ▪ Results orientation ▪ Thoroughness 	59 courses	29 universities	Region 1 (17) Region 2 (12) Region 3 (7) Region 4 (23)	51 nonacademic courses
<p>Data, Networks, and Telecommunications</p> <ul style="list-style-type: none"> ▪ Telecommunications fundamentals (signals, frequencies, voice and data, wire line and wireless) ▪ Networks (local area, wide area) ▪ Data communications (standards and applications) ▪ Architecture and communications 	<ul style="list-style-type: none"> ▪ Program languages and technology ▪ Visualization ▪ Network security ▪ Database management for operations ▪ Data management and evaluation 	<p>Analytical thought and skills with focus on data management and systems applications related to traffic management and operations; basic communication skills</p> <p>People Skills</p> <ul style="list-style-type: none"> ▪ Attention to communication ▪ Building collaborative relationships ▪ Customer orientation <p>Business Skills</p> <ul style="list-style-type: none"> ▪ Diagnostic information gathering ▪ Analytical thinking ▪ Conceptual thinking ▪ Technical expertise ▪ Fostering innovation ▪ Results orientation ▪ Thoroughness 	110 courses	50 universities	Region 1 (25) Region 2 (22) Region 3 (24) Region 4 (38) Online (1)	31 nonacademic courses

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Table E.1. Matrix of Current Academic Support for TSM&O (continued)

Operations Academy Focus Areas	Related Topic Areas from NCHRP 20-77	Core Competencies	Current Course Availability (NTTR Database)	Universities/ Colleges that Currently Provide	Courses by AASHTO Region	Training Offered to Practitioners (NTTR Database)
<p>Project Management</p> <ul style="list-style-type: none"> ▪ Project management (including ITS, financial aspects, procurement) ▪ Asset management 	<ul style="list-style-type: none"> ▪ Organization and staffing ▪ Project management ▪ Partnership development ▪ Performance management/ accountability ▪ Partnerships 	<p>Strong overall management, team building, communication, and collaboration skills</p> <p>People Skills</p> <ul style="list-style-type: none"> ▪ Establishing focus ▪ Providing motivational support ▪ Fostering teamwork ▪ Empowering others ▪ Managing change ▪ Managing performance ▪ Attention to communication ▪ Oral communication ▪ Written communication ▪ Persuasive communication ▪ Interpersonal awareness ▪ Influencing others ▪ Building collaborative relationships ▪ Customer orientation <p>Business Skills</p> <ul style="list-style-type: none"> ▪ Diagnostic information gathering ▪ Analytical thinking ▪ Forward thinking ▪ Conceptual thinking ▪ Initiative ▪ Results orientation ▪ Thoroughness ▪ Decisiveness <p>Self-Management Skills</p> <ul style="list-style-type: none"> ▪ Self-confidence ▪ Personal credibility ▪ Flexibility 	<p>33 courses</p>	<p>21 universities</p>	<p>Region 1 (12) Region 2 (3) Region 3 (3) Region 4 (12) Online (3)</p>	<p>65 nonacademic courses</p>

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Table E.1. Matrix of Current Academic Support for TSM&O (continued)

Operations Academy Focus Areas	Related Topic Areas from NCHRP 20-77	Core Competencies	Current Course Availability (NTTR Database)	Universities/Colleges that Currently Provide	Courses by AASHTO Region	Training Offered to Practitioners (NTTR Database)
<p>Emergency Management</p> <ul style="list-style-type: none"> ▪ Emergency response planning 	<ul style="list-style-type: none"> ▪ Security management 	<p>Analytical thought and skills with focus on risk assessment and contingency planning; strong communication skills and the ability to be decisive under pressure</p> <p>People Skills</p> <ul style="list-style-type: none"> ▪ Problem solving ▪ Fostering teamwork ▪ Attention to communication ▪ Oral communication ▪ Written communication ▪ Influencing others ▪ Building collaborative relationships <p>Business Skills</p> <ul style="list-style-type: none"> ▪ Diagnostic information gathering ▪ Analytical thinking ▪ Forward thinking ▪ Technical expertise ▪ Results orientation ▪ Decisiveness <p>Self-Management Skills</p> <ul style="list-style-type: none"> ▪ Stress management ▪ Flexibility 	<p>19 courses</p>	<p>3 universities</p>	<p>Region 3 (1) Region 4 (1) Online (17)</p>	<p>34 nonacademic courses</p>

general studies and technical courses that can feed into transportation careers: for example, computer information systems and electronics courses. Community colleges can serve a role in advancing TSM&O academic offerings through opportunities for positions in ITS-related industries such as maintaining equipment and staffing traffic management centers. It is unclear from this research how much direct connection is made between relevant transportation programs and courses and TSM&O careers. Nonetheless, this would provide another arena in which to develop TSM&O career interest.

The breadth and depth of TSM&O related competencies drives home the challenges of preparing undergraduates to enter the TSM&O field right out of college. First, the multidisciplinary background that is needed to help students succeed in the field is a significant challenge in and of itself. Creating cross-disciplinary degrees is difficult at many academic institutions and requires the student, and the student's advisor, to know early in an academic career that this is the desired career path. Since TSM&O is not a well known or fully established discipline within the transportation engineering field, students and college advisors are often not aware of this as a career option early enough in their course of study. Second, even if the lack of student awareness of TSM&O can be overcome, the current civil engineering curriculum is demanding, requiring many students 5 years to receive their undergraduate degree. In general, undergraduate civil engineering students only receive about 40 hours of instruction on all topics specifically related to transportation engineering. This significantly limits the time available to address nonengineering related TSM&O competencies.

Core Competencies

Edward J. Cripe and Richard S. Mansfield identified 31 core competencies grouped into three overall categories, People, Business, and Self-Management, in their 2002 book *The Value*

Added Employee: 31 Competencies to Make You Irresistible to Any Company. (Butterworth-Heinemann, Boston.) The 31 competencies are grouped under the categories People, Business, and Self-Management and include attributes such as establishing focus and fostering innovation. The competencies and definitions may be found at <http://www.workforce.com/article/20020903/NEWS01/309039977>.

References

1. I-95 Corridor Coalition. Operations Academy. <http://www.i95coalition.org/i95/Training/OperationsAcademy/tabid/90/Default.aspx>. Also see the Operations Academy website: <http://www.operationsacademy.org/>.
2. FHWA. National Transportation Training Resource. <http://www.nttr.dot.gov>.
3. Results of the NCHRP 20-77 research can be found at <http://www.catt.umd.edu/research/nchrp-framework.html>.
4. The materials developed by the subcommittee can be found on the Curriculum Subcommittee to the ITE Education Council web page: <http://www.ite.org/councils/Education/curriculum/default.asp>.
5. The website <http://www.workforce.com/article/20020903/NEWS01/309039977> provides the definitions included in the appendix as well as the observable behaviors that may indicate the existence of a competency in a person. The article is reprinted from Cripe, Edward J., and Mansfield, Richard S. *The Value-Added Employee: 31 Competencies to Make Yourself Irresistible to Any Company*. Butterworth-Heinemann, Boston, 2002.
6. Consortium for ITS Training and Education (CITE). Training Online: Web-based Transportation Courses. <http://www.citeconsortium.org/>.
7. For more information on this project, visit the SHRP 2 Reliability program website: http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/Public/Pages/Reliability_159.aspx.
8. TRB. *Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management* (NCHRP Report 693). 2012. <http://www.trb.org/Publications/Blurbs/166342.aspx>.
9. Gitman, Karen. *Transportation Workforce Development at Community Colleges* (Report #10-002). University of Vermont Transportation Research Center, March 2010. www.uvm.edu/~transctr/trc_reports/UVM-TRC-10-002.pdf.

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Related SHRP 2 Research

Integrating Business Processes to Improve Travel Time Reliability (L01)

Institutional Architectures to Improve Systems Operations and
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