STRATEGIC HIGHWAY RESEARCH PROGRAM 2
Reliability Focus Area
Overview
Providing Reliable Travel Times on the Highway System
Revised June 17, 2009

The central goal of the SHRP 2 Reliability focus area is to reduce non-recurring congestion and improve travel time reliability through incident reduction, management, response and mitigation.

The Reliability Technical Coordinating Committee (TCC) met on April 20-21 to make scheduling changes to the program. The SHRP 2 Oversight Committee approved the revised Reliability Research Program shown in Table 1 on June 15, 2009. It reflects the expanded work program and all project contracts executed through June 1, 2009.

Table 1: SHRP 2 Reliability Research Program
Approved June 2009

Project No.	Project Title	Budget	Start	Duration (months)
Active Projects				
L03	Analytic Procedures for Determining the Impacts of Reliability Mitigation Strategies	$1.75M	February 2007	30
L06	Institutional Architectures to Advance Operational Strategies	$1M	February 2007	31.5
L01	Integrating Business Processes to Improve Reliability	$0.4M	March 2008	18
L07	Evaluation of Costs and Effectiveness of Highway Design Features to Improve Travel Time Reliability	$2.75M	January 2008	48
L12	Training and Certification of Traffic Incident Responders	$1.0M	March 2008	27
L13	Requirements and Feasibility of a System for Archiving and Disseminating Data from SHRP 2 Reliability and Related Studies	$0.375M	September 2008	18
L11	Evaluating Alternative Operations Strategies to Improve Travel Time Reliability	$1.0M	September 2008	18
L10	Feasibility of Using In-Vehicle Video Data to Explore How to Modify Driver Behavior that Causes Non-recurring Congestion	$0.3M	February 2009	12
L04	Incorporating Reliability Performance Measures in Planning and Operations Modeling Tools	$1.25M	February 2009	36
L02	Establishing Monitoring Programs for Travel Time Reliability	$1.8M	March 2009	36
	Sub Total	$11.625M		

Current Contract Negotiations				
L14	Effectiveness of Different Approaches to Disseminating Traveler Information on Travel Time Reliability	$1.0M	Anticipated Fall 2009 Start	24
	Sub Total	$1.0M		
Programmed for 2009				
L05	Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes	$1.5M	RFP July 2009	24
	Sub Total	$1.5M		
Programmed for 2010				
L08	Incorporating Non-recurrent Congestion Factors into the Highway Capacity Manual Methods	$0.5M	RFP TBD	24
L09	Incorporating Non-recurrent Congestion Factors into the AASHTO Policy on Geometric Design	$0.5M	RFP TBD	24
L10a,b,c	Using In-vehicle Video Data to Explore How to Modify Driver Behavior that Causes Non-Recurring Congestion	$1.2M	TBD (if feasible)	18
L13a	Design and Implement a System for Archiving and Disseminating Data from SHRP 2 Reliability and Related Studies	$1.125M	TBD (if feasible)	12
L15	Reliability Innovations Deserving Exploratory Analysis (IDEA)	$0.5M	Announcement January 2010	3 to 24
L16*	Assistance to Contractors to Archive Their Data for Reliability Projects	$0.35M	RFP March 2010	24
L17*	A Framework for Improving Travel Time Reliability	$1.8M	RFP March 2010	18
C07**	Integrating SHRP2 Products into the Collaborative Decision Making Process	$0.25M	Ongoing project, amended	36
	Sub Total	$6.225M		
	TOTAL	**$20.35M**		

* Projects L16 and L17 were added to the SHRP 2 Reliability research program on November 14, 2008.

** The Reliability TCC and Oversight Committee allocated $250,000 in Reliability program funds to Capacity Project C07 so that travel time reliability considerations are included in the Collaborative Decision Making Framework for new highway capacity projects. This is an ongoing 2008 RFP SHRP 2 Capacity project and will use year 2010 Reliability program funds. Project C07 is scheduled to be completed in 2012.

THEMES

The Reliability research projects are grouped into four subject matter themes. Each theme will yield findings and products that will directly apply to the 4 strategic objectives: reduction of non-recurring incidents, improved incident management; improved incident response and mitigation of the effects of incidents on highway users. In addition, newly approved Project L17 ("A Framework for Improving Travel Time Reliability") is intended to integrate the results of all four themes and Projects L01 through L16 in a cohesive fashion and will provide the business case for transportation agencies to improve travel time reliability.

- **Theme 1. Data, Metrics, Analysis, and Decision Support**
  The research conducted within this theme will determine data types, methods of measurement and analytical tools that will enable the monitoring of travel times and associated reliability, permit the development of performance measures and models that enable the evaluation of effectiveness of actions to control and mitigate non-recurring congestion. The projects included in this theme are:

  Project L02: Establishing Monitoring Programs for Travel Time Reliability and Mobility
  Project L03: Analytic Procedures for Determining the Impacts of Reliability Mitigation Strategies
  Project L04: Incorporating Reliability Performance Measures in Planning and Operations Modeling Tools
  Projects L13 and L13a: Design and Implement a System for Archiving and Disseminating Data from SHRP 2 Reliability and Related Studies
  Project L16: Assistance to Contractors to Archive Their Data for Reliability and Related Projects

- **Theme 2. Institutional Change, Human Behavior, and Resource Needs**
  Significant reduction of congestion related to non-recurring events will require significant changes to the internal organization and business practices of transportation and public safety agencies. Historical relationships among these public agencies and with other organization involved in incident response and management must also be modified to increase effectiveness. Impact mitigation will require effective communications with highway users and the modification of counterproductive driver behavior in proximity to incidents. Research under Theme 2 will address this human side of non-recurring congestion. The projects include:

  Project L01: Integrating Business Processes to Improve Reliability
  Project L06: Institutional Architectures to Advance Operational Strategies
  Projects L10 and L10a: Use of In-vehicle Video Data to Explore How to Modify Driver Behavior that Causes Non-recurring Congestion
  Project L12: Training and Certification of Traffic Incident Responders
  Project L14: Effectiveness of Different Approaches to Disseminating Traveler Information on Travel Time Reliability

- **Theme 3. Incorporating Reliability in Planning, Programming, and Design**
  There is an intimate relationship between the frequency of non-recurring congestion related to incidents and general effective capacity of a highway network or segment. Effective reduction in the frequency and/or impacts of non-recurring incidents can reduce or delay the need for additions to highway capacity. At present, however, transportation agencies need improved tools to identify and evaluate the effectiveness of infrastructure or operational countermeasures or to quantify the impacts of non-recurring congestion on overall highway capacity. Theme 3 addresses these issues. The projects are:

  Project L05: Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes
  Project L07: Evaluation of Costs and Effectiveness of Highway Design Features to Improve Travel Time Reliability
  Project L08: Incorporation of Non-recurrent Congestion Factors into the Highway Capacity Manual Methods
  Project L09: Incorporation of Non-recurrent Congestion Factors into the AASHTO Policy on Geometric Design

- **Theme 4. Fostering Innovation to Improve Travel Time Reliability**
  The gains in travel time reliability derived from institutional and behavioral change will be major, but will largely be one-time, short-term gains. Gains derived from analysis, decision support tools and design responses will also be large initially and continued research in these areas will produce steady, but less dramatic improvements. The theme 4 research is designed to foster innovative thinking that will form the foundation for long-term reductions in non-recurring incidents and improvements to travel time reliability.

  Project L11: Evaluating Alternative Operations Strategies
  Project L15: Reliability Innovations Deserving Exploratory Analysis (IDEA)

PROJECT DESCRIPTIONS BY THEME

Theme 1. Data, Metrics, Analysis, and Decision Support

L02: Establishing Monitoring Programs for Travel Time Reliability

Budget: $1,800,000 (36 months)

Objective: Develop a guidebook on how to establish monitoring programs for travel time reliability. These programs will 1) collect travel time data over time and across locations; 2) provide information in a timely manner to effectively manage transportation operations and contribute to policy, planning, and programming; and 3) to the extent

feasible, relate fluctuations in travel time reliability to the seven major factors that influence it.

Project Summary: There is a need to collect archival and real time information that can be used to assess travel time reliability for planning, programming, project development, and operations. Traffic detectors that generate archival and real-time data (e.g. from loops, license plate readers, microwave detectors, etc.) are sources of travel time data from which data on travel time reliability can be generated. This data can be used to develop predictive models and manage the network in real time. However, the traffic detector coverage of highway networks throughout the country is far from complete. There is a need to provide guidance on how to use sound statistical techniques and other rigorous analytical methods to provide more complete coverage, to extrapolate travel times gathered on one section to nearby sections, and to develop aggregated measures of travel time reliability that build up detector site data to the district, county, and statewide levels. Guidance is also needed on a raft of technology issues including 1) the most appropriate type of traffic detector technology to implement in different circumstances 2) how to convert automated traffic recorders that can generate static information on travel times to sources of real time information and 3) how to integrate data on the various sources of non-recurrent congestion.

Project L03: Analytic Procedures for Determining the Impacts of Reliability Mitigation Strategies

Budget: $1.75 million (24 months)

Objective: The objective of this project is to develop the technical relationships between reliability improvement strategies and reliability performance measures.

Project Summary: Phase I of this project will identify countermeasures and performance measures that are fundamental to measuring improvement in travel time reliability. Based on this information, the contractor will prepare an experimental design and field data collection and analysis plan. Phase II will consist of pilot studies to field test the data collection effort and, if the pilots are successful, performance of the full data collection plan. Phase III will consist of analysis of the data and development of the statistical relationships between the measures taken to improve reliability and reliability performance.

Project L04: Incorporating Reliability Performance Measures into Planning and Operations Modeling Tools

Budget: $1.25 million (36 months)

Objectives: The objectives of this project are to (1) develop the capability of producing measures of reliability performance as output in planning and traffic simulation models; and (2) determine how travel demand forecasting models can use these reliability measures to produce revised estimates of travel patterns.

Project Summary**:** If reliability performance is to be an established part of the transportation investment decision process, these models must have the ability to estimate reliability as a function of highway and traffic conditions. This is significant for both planning future improvements and evaluating current deployments, and is supported by evidence that travelers make choices of trip time, mode, and route by considering travel time reliability. This project has two phases. The first phase is aimed at modifying planning and traffic simulation models so that they can provide reliability estimates as output. Building on the results of Project L03 and, possibly L02, this phase will develop the underlying relationships between reliability and travel demand. These relationships will be incorporated into three selected model types—a travel demand forecasting model, a microscopic traffic simulation model, and a macroscopic traffic simulation model. This phase involves developing conceptual plans for incorporating the key relationships into the selected model; if necessary, proof of concept software to modify the models will be developed. In the second phase, tests will be conducted on a travel demand forecasting model, modified to incorporate how travelers use reliability information, to determine the effects on trip generation and traveler choice of mode, route, and destination.

Project L13: Requirements and Feasibility of a System for Archiving and Disseminating Data from SHRP 2 Reliability and Related Studies

Budget: $375,000 (18 months)

Objective: To make all data in all of its forms gathered in each of the SHRP 2 Reliability Research Projects available over the internet to researchers and others for validation of research results and for future use. The archived data might include related data that is not of a sensitive nature from other SHRP 2 focus areas such as Safety. Sensitive data can potentially violate privacy or proprietary rights.

Project Summary: Determine the requirements for a Reliability data archiving and dissemination system and determine whether it is desirable to store and disseminate various classes of data. Determine if it is feasible/desirable to input and disseminate the data over the internet. Assess the feasibility of developing such a system for the $1.2 million allocated for the follow-on project, L13a. This includes as assessment of whether

the design and implementation can be accomplished within 12 months. The project now also includes the development of a prototype data archive using data from Project L03.

Project L13a: Design and Implement a System for Archiving and Disseminating Data from SHRP 2 Reliability and Related Studies

Budget: $1,125,000 (12 months)

Objective: To make all data in all of its forms gathered in each of the SHRP 2 Reliability Research Projects available over the internet to researchers and others for validation of research results and for future use. The archived data might include related data that is not of a sensitive nature from other SHRP 2 focus areas such as Safety. Sensitive data can potentially violate privacy or proprietary rights.

Project Summary: Assuming Project L13 results in a recommendation to design and implement the Reliability data archive, this project would refine the requirements developed under Project L13, prepare a detailed design and system architecture including database tables, determine the development environment, prepare a test plan, develop the system (hardware, software, communications), prepare system documentation and a user manual, test the system, modify the system as required, populate the system with the data from completed or partially completed SHRP 2 projects, and finally make the system operational for users.

Project L16: Assistance to Contractors to Archive Their Data for Reliability and Related Projects

Budget: $350,000 (24 months)

Project Summary: SHRP 2 Contractors performing reliability or related work in the Reliability and other areas (e.g. Capacity) do not have provisions in their contract requiring them to prepare the various types of data they use or produce for inclusion in the archive likely to be developed under Project 13a. Many of the contractors are likely to need a small amount of supplemental financial resources (to be determined on a case-by-case basis) in order to archive their project data. In addition resources would be provided for technical assistance. Reliability project data can take a wide variety of forms including metadata, alpha-numeric data, video, reports, web pages, and software.

Scope of Work: Assuming feasibility of a data archive is established, Project 13a would build and populate the archive. The contractor for this supplemental archive project/activity would establish criteria for determining whether extra funds should be provided to other reliability contractors (or those doing related work in other program areas such as Capacity), make recommendations for the allocation of funds, and once

these extra funds have been provided to each SHRP 2 contractor doing reliability related work, communicate specifications, ensure correct metadata descriptions, or assist in data transfer protocols, and provide technical assistance populating the archive. This project builds on Project L13 and L13a.

Theme 2. Institutional Change, Human Behavior, and Resource Needs

Project L01: Integrating Business Processes to Improve Reliability

Budget: $400,000 (18 months)

Objectives: The objective of this project is to identify and report on successful practices that integrate business processes to improve travel time reliability. These business processes concern operations and related activities that directly or indirectly affect travel time reliability in a significant manner. Integration may refer to tying together certain steps of a specific business process and/or integrating more than one business process. The research also needs to address strategies that integrate business processes concerning the seven major sources of unreliability that affect non-recurrent congestion.

Project Summary: There is a pressing need to integrate the business processes associated with highway operations to improve travel time reliability. However, transportation agencies have frequently taken a piecemeal approach. This project will develop case studies and guidance regarding successful integration of business processes and related procedures that improve travel reliability. Examples of integration include but are not limited to: adopting an outcome-oriented, customer focus throughout a department; developing and implementing travel time reliability performance measures that permeate plans, programs, projects, and operations; coordination, cooperation, and communication among those responsible for system operations and management including incident response; technologies and software for integrating data collection, archiving, and analysis, and disseminating information about operating conditions to road users; and successful integration of strategies aimed at more than one of the seven major causes of non-recurring congestion. (e.g. incidents, weather). Agencies may have been successful in integrating the components in one of these functional areas, but in addition, it is desirable to find those instances where agencies managed to integrate across a number of these areas and thereby achieve more of an overall emphasis on operations and reliability rather than just a maintenance, construction, or traffic management focus.

Project L06: Institutional Architectures to Advance Operational Strategies

Budget: $1.0 million (42 months)

Objective: The objective of this project is to undertake a comprehensive and systematic examination of the way agencies should be organized to successfully execute operations programs that improve travel time reliability.

Project Summary: The first phase of the project will begin with a workshop to frame the key issues involved in creating an institutional architecture that supports and manages operational activities that can improve travel time reliability. The contractor will identify and assess institutional change that have been made at exemplary transportation agencies and analyze how these changes are applicable to other agencies. The fundamental principles of organizational theory will be investigated to determine how they apply to transportation agencies as well. A draft report will be prepared with findings and recommendations. It will be reviewed in a series of regional executive forums by senior transportation officials to determine their potential for widespread application. A final report will provide transportation agencies with guidance on institutional architecture components that support operations activities. Specific tasks for Phase II will depend on the need for additional development to support implementation in transportation agencies.

Project L10: Feasibility of Using In-vehicle Video Data to Explore How to Modify Driver Behavior that Causes Non-recurring Congestion

Budget: $300,000 (12 months)

Objective: To infer from various research efforts that have used in-vehicle video in combination with other data different ways to improve travel time reliability by reducing inappropriate driver responses that contribute to non-recurring congestion. The research would also potentially draw upon the first year or two of data collected under the naturalistic driving study within the SHRP 2 Safety Focus Area.

Project Summary: Accidents resulting in fatalities and injuries may occur if a driver behaves in an inappropriate or less-than-optimal fashion in response to factors that cause or contribute to non-recurring congestion. These include incident scenes, work zones, inclement weather, roadside distractions, and queues of vehicles. This project would inventory prior research that has used in-vehicle video, interview the principals involved in the research, obtain samples of data from each research project to the extent it is available, and make a determination regarding whether the in-vehicle video in combination with other information acquired in the research reveal instances where drivers contribute to non-recurrent congestion and provide insights on how to change

driver behavior in order to improve travel time reliability. This project will provide recommendations on whether or not to perform follow-on studies that use in-vehicle video data to modify driver behavior that causes non-recurring congestion. The feasibility study will also address whether the follow-on work can be performed for the amount budgeted, $1,200,000. The feasibility study also needs to address whether the planned time period for the follow-on work, 18 months, is sufficient.

Project L10a,b,c: Using In-vehicle Video Data to Explore How to Modify Driver Behavior that Causes Non-recurring Congestion

Budget: Multiple awards totaling $1,200,000 (18 months)

Objective: To infer from various research efforts that have used in-vehicle video in combination with other data different ways to improve travel time reliability by reducing inappropriate driver responses that contribute to non-recurring congestion. The research would also potentially draw upon the first year or two of data collected under the naturalistic driving study within the SHRP 2 Safety Focus Area if those data are available.

Project Summary: Two or three parallel studies will draw inferences from in-vehicle video and accompanying data from past field studies and possibly the first year or two of data collected the SHRP 2 naturalistic driver study (S07). Researchers will look for instances where drivers have gotten into accidents or contributed to non-recurring congestion in the presence of incident scenes, work zones, inclement weather, roadside distractions, and queues of vehicles. The researchers will need to prepare experimental, analysis, and data collection plans; acquire the data archives that include in-vehicle video data, analyze the data, identify behavior that contributes to non-recurring congestion, and attempt to deduce ways to modify such behavior. The scope of work will include a final report with recommendations.

Project L12: Training and Certification of Traffic Incident Responders

Budget: $1,000,000 (27 months)

Objectives: The objective of this project is to establish the foundation for certifying the capability of responders to achieve the National Unified Goal (NUG) for Traffic Incident Management: responder safety; safe, quick clearance; and prompt, reliable, interoperable communications. Most important is for responders to acquire a common set of core competencies that promote a shared understanding of the requirements for achieving the safety of responders and motorists, quick response, and effective communications at traffic incident scenes. Types of responders include police, fire, emergency management, emergency medical services, private sector responders such as towers and hazmat

responders, and operations and maintenance personnel from transportation agencies. Many organizations with different responsibilities are often involved in responses to traffic incidents, particularly major ones. Incident scenes can quickly become confusing and dangerous places for both motorists and responders. It is imperative that responders have the appropriate core competencies to deal with different stages of an incident and a common understanding of the basic needs for dealing with traffic incidents as enunciated in the NUG.

Project Summary: This project commences by developing a checklist of responder actions and identification of core competencies. Next the creation of a curriculum occurs consisting of course objectives and instructional outlines for each type of responder. Course materials are prepared along with a recommended delivery approach. The project involves development of a recommended framework for certification and a pilot and evaluation of the certification process is conducted. Among the concluding tasks are to develop an approach to accreditation and marketing plan.

Project L14: Effectiveness of Different Approaches to Disseminating Traveler Information on Travel Time Reliability

Budget: $1,000,000 (24 months)

Objective: To address the accessibility and utility of traveler information, communication channels, and technologies and quantify the system performance effects (total delay and travel time reliability) of providing traveler information for person and freight transport through a variety of means under different circumstances.

Project Summary: There are many types of traveler information systems. These include normal commercial radio and TV rush hour reports, 511 services, dynamic message signs, highway advisory radio, and traveler-based devices (hand-held, in-vehicle) including satellite-based radio services, personalized cellular service, GM OnStar, and wireless internet such as BlackBerry.

This project proceeds in two phases. Phase I involves an assessment of the ability of road users to access traveler information relevant to travel time reliability and disseminated using different communication channels, technologies, and formats. A related research issue is whether traveler information, particularly content related to reliability, reaches road users in a manner and format that is useful to them. The scope of work in Phase I includes a literature review, a determination of the desires/needs of road users regarding traveler information about travel time reliability, an examination of the availability and perceived usefulness of such information, and an analysis of the gap between the desires/needs of road users and the accessibility and usefulness travel time reliability information that can be acquired from existing systems.

The second phase involves assessing how changes in the accessibility, presentation format, and utility of traveler information systems would affect road users' ability to take travel time reliability into account when making travel choices. This phase would also address the implications on system performance, especially travel time reliability. Phase II would require the development of an experimental plan, a data collection plan, and an analysis plan. These plans would address four different types of road networks: a state system, a major corridor, and two metropolitan networks. Once the data is collected and analyzed in accordance with these plans, an assessment would be made regarding the most effective ways to improve the reliability content of traveler information. In addition there would be an assessment of the effect of the improved traveler information on total delay and travel time reliability. This assessment would preferably be quantitative (simulation) but it could be qualitative or both. The research would conclude with a final report that includes conclusions and recommendations for improving the accessibility, presentation format, and usefulness of traveler information.

Theme 3. Incorporating Reliability into Planning, Programming, and Design

Project L05: Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes

Budget: $1.5 million (24 months)

Objectives: Currently, the technical procedures needed to incorporate mobility and reliability performance measures into the transportation investment process are not available, and as a result the effect of short- and long-term strategies addressing mobility and reliability on traditional capital expenditures cannot be determined. The objective of this project is to develop procedures for the transportation planning and programming process that demonstrate the benefits of operational strategies aimed at improving mobility and reliability and test these procedures in a number of agencies.

Project Summary: This project will have three phases and will build on the statistical relationships between countermeasures and reliability performance measures developed in Project L03. In the first phase, the contractor will develop corridor and network level strategies using countermeasures and strategies from Projects L03 and L11, integrated business processes identified in Project L01, and model results from Project L04, as well as information from other sources. The contractor will develop procedures for linking changes in performance measures to specific reliability improvement strategies (e.g., traffic incident management, work zone management). The second phase will consist of analyses of the tradeoffs in capital vs. operating expenditures that result from using mobility and reliability performance measures in the programming process. Both the short-range and long-range effects on transportation agency budgets and the user costs of shifting funds from capital improvements to operations-oriented strategies will be examined. The third phase will document how using performance measures fits into the

short-range programming process; identify process steps where the strategies selected via performance measures conflict with those from the traditional programming process; and assess the effects of using the performance measures on the annual budget, expenditure of funds by types of improvement, and the priority ranking of projects.

Project L07: Evaluation of Costs and Effectiveness of Highway Design Features to Improve Travel Time Reliability

Budget: $2.75 million (48 months)

Objective: The objective of this project is to evaluate the cost-effectiveness of promising highway design features capable of reducing delays due to key causes of non-recurrent congestion.

Project Summary: Crash investigation sites, pull-outs, median crossovers, and paved shoulder bypass lanes could speed up the arrival of emergency personnel and equipment at an incident or reduce the time it takes to re-open the travel lanes on a facility. Design features such as median crossovers and wide paved shoulders can make it possible to keep more traffic moving in work zones by enabling the use of contraflow lanes. There are also design features that can reduce the delays due to weather and special events. Many of these features are not currently included in standard highway design practices because of perceived high costs and the lack of data on the cost savings to the facility operator and the general public over the life of the project. The aim is to identify the full range of possible roadway design features; develop cost-effective designs for these features; and estimate the costs and effectiveness of the design features. Key project tasks include identify the state of reliability-related design practice in the U.S. and other countries, prepare a data collection plan concerning relevant designs and inputs needed to analyze their effect on reliability and costs, prepare an outline for a design guidebook, write the guidebook, prepare an information dissemination plan, and make presentations to key stakeholder groups such as the AASHTO Subcommittee on Design, the AASHTO Subcommittee on Traffic Engineering, and the AASHTO Standing Committee on Highway Traffic Safety.

Project L08: Incorporation of Non-recurrent Congestion Factors into the Highway Capacity Manual Methods

Budget: $0.5 million (24 months)

Objective: The objective of this project is to determine how data and information on the impacts of the differing causes of non-recurrent congestion on highway capacity can be incorporated into the performance measure and level of service estimation procedures contained in the Highway Capacity Manual (HCM). The HCM is the main tool of

designers for determining the appropriate size of a facility to meet future demand levels, but its limited information on the impacts of weather and work zones on freeway capacity is from other countries. No information is provided for other facility types or for other causes of non-recurrent congestion. The methodologies contained in the HCM for predicting volume, delay, speed, queuing, and other performance measures for alternative highway designs are not currently sensitive to incident management techniques and other operation/design measures for reducing non-recurrent congestion.

Project Summary: The contractor will review the work of Reliability Projects L03 and L07 and other sources and compile information on the frequency and capacity impacts of non-recurring incidents on highway capacity and how current and potential countermeasures can reduce the impact of non-recurrent congestion on facility delay, speed, queuing, and capacity. The contractor will then develop a plan for collecting data on significant gaps at selected U.S. sites for a variety of freeway, conventional highway, and urban street facilities.

The contractor will then develop a set of methodologies to accomplish the following: (a) predicting probability of occurrence and duration of non-recurring incidents for peak seasons, peak hours, and off-peak hours during the year as a function of the facility type, area type, terrain type, and other characteristics of the facility and its environs. This methodology should be sensitive to changes in operational strategies (e.g., incident management, work zone design, etc.); be capable of estimating capacity reduction as a function of event type and duration by season of year, day of week, hour of day; (b) predicting impacts on speed and delay of each event type that incorporates the probability of occurrence and duration of each event type; (c) predicting the effectiveness of various design and management strategies for reducing non-recurrent congestion.

Finally, the contractor—working with the TRB Committee on Highway Capacity and Quality of Service—will prepare draft sections of the HCM on the effect of non-recurrent congestion and the effectiveness of non-recurrent congestion management strategies for the urban arterials, signalized intersections, non-signalized intersections, freeway basic sections, freeway merge sections, freeway weaving sections, and freeway facilities chapters of the manual.

Project L09: Incorporation of Non-recurrent Congestion Factors into the AASHTO Policy on Geometric Design

Budget: $0.5 million (24 months)

Objective: The objective of this project is to develop guidance on roadway design features that support the reduction of delays due to the key causes of non-recurrent congestion so that such features can be included in the AASHTO Policy on Geometric Design of Highways and Streets, the primary document used by state DOTs and other

public agencies for the design of freeways, conventional highways, and urban streets. Currently this design guide does not provide explicit guidance on the placement and dimensions of facilities that support incident management, reduce the impacts of work zones, or improve travel time reliability in other ways.

Project Summary: The contractor will review the results of L07 and other projects within the Reliability Research Program and identify cost-effective design features for reducing non-recurrent congestion for incorporation in AASHTO Policy Guide and prepare a report to be reviewed with appropriate AASHTO panels for comments and suggestions. Based on these reviews, the contractor, in conjunction with the AASHTO Subcommittee on Design, will provide background material to guide preparation of draft sections for the AASHTO design guide on specific design features for reducing non-recurrent congestion. This background material will be submitted to appropriate AASHTO panels for their consideration.

Theme 4. Future Needs and Opportunities to Improve Travel Time Reliability

L11: Evaluating Alternative Operations Strategies

Budget: $1,000,000 (18 months)

Objective: This research would identify and evaluate practical and innovative strategies and tactics to satisfy the travel time reliability requirements of users of the highway network – those engaged in both freight and person transport in urban and rural areas. These practical and innovative approaches must serve the present and the more distant future.

Project Summary: In this project the requirements of different types of road users will be set out regarding travel time reliability. Once the user requirements are established, there will be an assessment of the ability of transportation agencies, incident responders, and other stakeholders to meet the user requirements. The project includes formulating goals for improving travel time for the near term and the longer run (e.g. 2025) and developing corresponding performance standards or targets for travel time reliability. Concepts of Operations for the present and alternative futures will be developed and provide various pictures of systems operations and management. The Concepts of Operation will serve as a basis for gap analysis and insight regarding strategies and tactics, including innovative approaches that could reduce non-recurrent congestion.

Project L15: Reliability Innovations Deserving Exploratory Analysis (IDEA)

Budget: $500,000 (3 to 24 months for each project)

Objective: The objective of this project is to elicit from the research community, businesses and others innovative and practical ideas for improving travel time reliability and to provide initial funding for a portfolio of projects. The hope is to attract a range of ideas to fund with the expectation that one or two, when developed further and implemented, would eventually have a large impact and payoff.

Statement of Problem: There is considerable value in devoting a portion of the SHRP 2 research program's resources to the development of innovative ideas. The development of a portfolio of innovative projects will be modeled after the TRB program entitled Innovations Deserving Exploratory Analysis (IDEA). The TRB IDEA program funds two types of projects. Type I projects consist of the exploration of unproven concepts to demonstrate their validity. These are usually funded in the range of $25,000 to $100,000. Type II projects develop and test prototypes of proven concepts.

Reliability Focus Area Integration

Project L17: A Framework for Improving Travel Time Reliability

Budget: $1.8 million (18 months)

Objective: This framework would consolidate the project findings to provide decision makers and practitioners a guide to understand travel time reliability, incorporate reliability in project planning and promote the merit of systems operations and management solutions to prevailing problems. The business case for travel time reliability will be developed and communicated.

Statement of Problem: Travel time reliability is a new and complex topic to measure highway system operational performance and provide assistance for individual personal and freight travel decisions. The research will report the contributing impacts of the primary factors that cause unreliability and present a wide range of effective mitigation measures to counteract these factors. Decision makers will be able to select system operational measures, as an alternative to system expansion, to improve travel reliability, in many cases, at reduced cost and in short time frames. A web-based framework—similar to that being developed for C03—could be produced. The Framework is expected to:

- Clearly explain the benefits of improved travel time reliability for individuals, families, goods movement, and the economy as a whole.
- Make the business case for focusing on reliability to State DOTs, MPOs, and regional transportation planning and operating organizations.

- Package the results of the SHRP2 Reliability portfolio of projects in a concise and accessible manner. Provide a graphic illustration of how the projects fit together.
- Provide an accessible synthesis about what is known and not known about travel time reliability, both as a result of the SHRP2 program and from other research and practice.
- Provide a toolkit of travel time unreliability mitigation measures, including their general cost to implement, expected effectiveness, and most effective deployment conditions.

This project would also strongly relate to SHRP 2 Capacity Project C01, the Collaborative Decision-Making Framework.