ENTERPRISE Transportation Pooled Fund Study TPF-5 (231)

ENTERPRISE

FY 2015 Work Plan

FINAL

Prepared by

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Program Overview

The ENTERPRISE Program represents a forum for collaborative Intelligent Transportation Systems (ITS) research, development, and deployment ventures reflecting the interests of governmental entities and industrial groups. This forum also facilitates the sharing of technological and institutional experiences gained from individual ITS projects conceived and initiated by each participating entity. The intent is to use a pooled fund program as a mechanism to support jointly-sponsored ITS projects of shared interest. These projects form this annual ENTERPRISE work plan. The scope of the ENTERPRISE Program promotes North American ITS development, reflecting the active involvement of U.S. and Canadian member agencies. ENTERPRISE also seeks to take advantage of technologies being developed outside North America. ENTERPRISE's European member is the Dutch Ministry of Transport, Rijkswaterstaat.

ENTERPRISE has approved a number of work plans since its inception in 1991 and completed numerous projects. Each project has followed the vision of ENTERPRISE which defines the program's global view of highway travel. ENTERPISE aims to be consistent with the vision of higher bodies, such as ITS America and ITS Canada, concerning the development and use of ITS technologies and the benefits that this will bring. ENTERPRISE envisions a highway system in which advanced technologies continue to support the safe, efficient, convenient, and socially and environmentally sound movement of people and goods. Complete details on previous work plans and individuals projects are available through the program website at: http://enterprise.prog.org/.

Financial Status

ENTERPRISE North American members contribute $30,000 or more annually to the pooled fund and are reimbursed for program travel. Non North America members contribute $25,000 or more per year to the program and are not reimbursed by ENTERPRISE for program travel expenses. In FY 2015 (October 1, 2014 through September 30, 2015), 12 member agencies are anticipated to contribute financially to the projects included in this work plan.

Projects

During 2014 member agencies submitted project ideas for this FY 2015 Work Plan. The initial project ideas were reviewed by the ENTERPRISE Executive Board and a selected number of projects were approved for development of full project proposals to describe the project ideas in additional detail. The project proposals were then reviewed and voted on by the board and finally approved at the August 2014 Executive Board meetings as projects for the FY 2015 Work Plan. Complete details on the project selection process can be found in the ENTERPRISE Management Plan which is posted on program website: http://enterprise.prog.org/.

The following table summarizes the voting results and estimated project costs to complete the approved projects.

Table 1: FY 2015 Work Plan Funding Plan

Expense	Estimated Costs	
2015 Projects		
Project 1: ITS at International Borders	$80,000	
Project 2: Unmanned Aerial Vehicles (UAV) Road and Incident Reporting	$50,000	
Project 3: Integrate Active Work Zone Notifications into Traveler Information Dissemination Systems	$80,000	
Project 4: Truck Rollover Systems Best Practices	$60,000	
Project 5: Policies, Laws, and Agreements for the Use of Fiber	$35,000	
Project 6: Portable Travel Time Displays and Integrated Corridor Management with Parallel Routes—Phase 1	$50,000	
Program Administration Support	$60,000	
Member Travel Support (two in person meetings)	$40,000	
Other expenses	$3,000	
Revenue		**Estimated Revenue**
Carryover from previous work plans		$15,000
Work Plan 2014: Intelligent Work Zone – Phase 2*		$50,000
Project Specific Contributions from Members - Ontario MTO**		$20,000
Member Annual Contributions 9 members x $30,000 • Georgia DOT, Illinois DOT, Idaho Transportation Department, Iowa DOT, Minnesota DOT, Oklahoma DOT, Pennsylvania DOT, Texas DOT, Washington State DOT 1 member x $50,000 • Kansas DOT 2 members x $35,000 • Michigan DOT and Ontario MTO		$390,000
Total (Revenue vs. Expenses)	**$458,000**	**$475,000**

**Intelligent Work Zone – Phase 2 was approved in Work Plan 2014 as a placeholder and no formal scope was identified. During the August 2014 ENTERPRISE Board Meeting members agreed to remove the project and carry forward the project funds ($50,000) to Work Plan 2015*

*** MTO contributes $20,000 annually to be used for warrants efforts as needed. Given that the 2014 Work Plan warrants work will be starting in October 2014 the board did not approve any warrants work for work plan 2015. Therefore, the $20,000 contribution will be used toward the pool of 2015 projects.*

The states will be directly involved with finalizing contractor cost estimates, scopes of work and schedules for each of the projects to ensure concurrence with the final mix of projects contracted for this work plan.

Additional project details for the approved projects are included on the following pages.

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2015 Work Plan

2015 Project #1
ITS at International Borders

Project Background, Summary, and Objectives:

Several ENTERPRISE member agencies (Arizona, Idaho, Michigan, Minnesota, Ontario, Texas, and Washington) have transportation networks within their jurisdictions that intersect with international borders. Management and coordination of traffic operations and security at these borders often requires extensive agency resources. In addition, it is important to provide accurate and timely traveler information, such as border wait times, alerts, and construction notices, to the traveling public in order to effectively manage traffic movement across borders. For example, the Washington State DOT's Traveler Information website includes a web page that communicates information about Traffic at the Canadian Border. This information and coordination is especially important to support safe and efficient commercial vehicle travel between the U.S and its bordering countries.

ITS technologies and systems used at borders often serve a critical purpose in assisting agencies with traffic management, security, and traveler information. As such, ENTERPRISE agencies would benefit from learning about the current state of practice for the use of ITS technologies at international borders. Enhanced knowledge of available technologies, uses, and benefits will equip ENTERPRISE members with potential solutions to improve agency coordination and management.

The objective of this project is to provide ENTERPRISE members with a summary of current and emerging practices for the use of ITS technologies at international borders. The project will form a project team comprised of transportation agency representatives with relevant expertise, review literature and traveler information websites to gather relevant information, and hold a workshop that convenes transportation agencies to share best practices and exchange information.

Scope of Work with Task Descriptions:

Task 1: Establish a Project Team

To initiate the project, a project team will be formed to guide the project, provide input on needs and issues, and to identify the current and emerging state of practice for ITS at international borders. The project team will be comprised of representatives from ENTERPRISE agencies who have expertise with transportation issues at borders and ports, such as Traffic Management Center (TMC) operators, Traveler Information managers, and others with relevant expertise. The project team will be convened

early in the project, to identify needs and issues that currently utilize or could benefit from ITS solutions, provide initial input about practices within their agencies, and identify border states/provinces of particular interest to be engaged in project. The project team will be engaged to identify agencies and individuals to participate in the workshop to be conducted in Task 4.

Task 2: Identify Needs and Issues at Borders

Efforts in Task 2 will identify and document the needs and issues impacting travel in and around international border crossings. The Project Team, established in Task 1 will be critical to Task 2. The research team will work with the Project Team, as well as any additional industry experts identified, to document the needs. In addition, the research team will go beyond documenting the needs currently met by existing systems to document as many needs as possible (whether or not current technologies or approaches exist to address them). The results of Task 2 will be summarized as part of the Task 3 deliverable.

Task 3: Identify ITS Deployments Related to the Needs Identified for Border Crossings

In this task, the project will research existing deployments of ITS (both operational, planned, or being considered) that assist transportation agencies with traffic management, safety, and/or security at international borders, and therefore address the needs identified in Task 2. This task will include a combination of a literature review, a survey of existing information systems (e.g. websites and phone systems), one-on-one discussions with representatives from DOTs and border crossing agencies (both in the US and Canada) to identify as many ITS approaches as possible. This review will be conducted for two purposes: 1) to identify and gather information about as many ITS solutions addressing the needs identified in Task 2 as possible; and 2) to identify agencies that should be pursued for involvement in the workshop to be held during Task 4.

Task 4: Organize and Conduct a Workshop to Share Best Practices

This task will organize and hold a workshop for agencies (ENTERPRISE members and non-member agencies with international borders) to share their experiences and to hear other states' experiences related to the use of ITS solutions to assist in managing traffic at borders. Issues and technology solutions related to commercial vehicle travel will be a focus of the workshop. Information shared during the workshop will focus on (but not be limited to) the following:

- How ITS technologies are being used,
- Effectiveness of the technologies,
- Best practices,
- Lessons learned,
- Deployment considerations, and
- How the technologies enhance coordination with the bordering country.

This task will work with the project team to identify participants, compile an invitation list, invite participants, plan the agenda, coordinate logistics such as meeting space and hotel room blocks, coordinate with invited presenters, coordinate travel reimbursements with workshop participants, and create a workshop summary.

Task 5: Project Summary Report

A project summary report will be prepared to document findings, including the literature search, traveler information website review, and workshop summary.

Project Schedule at the Task Level:

It is anticipated that it will take 12 months to complete this project.

Task	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Task 1: Establish a Project Team												
Task 2: Identify Needs and Issues at Borders and Ports												
Task 3: Identify ITS Deployments Related to the Needs												
Task 4: Organize and Conduct a Workshop to Share Best Practices												
Task 5: Project Summary Report												

Project Deliverables:

Deliverable 1: Summary of Border Crossing Needs and ITS Solutions to the Needs
Deliverable 2: Workshop Summary
Deliverable 3: Project Summary Report

Project Cost:

Deliverables	Cost
Deliverable 1: Summary Border Crossing Needs and Available ITS Solutions to the Needs	$30,000
Travel Reimbursement for Workshop Participants	$20,000
Workshop Preparation and Planning	$10,000
Deliverable 2: Workshop Summary	$10,000
Deliverable 3: Project Summary Report	$10,000
Total Cost	**$80,000**

Relationship to Similar Activities and Projects If Known: None Known

Project Champion: TBD

Project Participants (Agencies): TBD

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2015 Work Plan

2015 Project #2
Unmanned Aerial Vehicles (UAV) for Road and Incident Reporting

Project Background, Summary, and Objectives:

Unmanned Aerial Vehicles (UAVs) could hold great potential for use by transportation agencies. Potential uses include applications such as road condition reporting, monitoring of remote/rural roadways, incident detection, and coordination with incident response efforts. The Ministry of Transportation of Ontario (MTO) currently uses Unmanned Aerial Vehicles (UAVs) for traffic incident analyses, hovering cameras above incident sites to take pictures for later analysis. Another current MTO use for UAVs is to test potential locations for permanent camera mounting. In the future, MTO plans to use UAVs for road weather reporting and pavement monitoring along rural roads in remote locations. Research in Michigan is also evaluating aerial monitoring of pavement conditions, potholes, ruts, roughness, etc. In addition, many other transportation agencies are considering the use of UAVs for similar functions.

The objective of this project is to research the state of knowledge in the use of UAVs for traffic and operations management applications and develop a concept of operations and project design for use in a potential future phase of the project to conduct a demonstration and evaluation of UAVs.

Scope of Work with Task Descriptions:

Task 1: Literature Search
During this task, a literature search will be conducted to document current and completed efforts by agencies to deploy and test UAVs for transportation related applications and what has been learned through these projects. Topics to be researched will also include regulations, laws, and policies related to UAVs. In addition ENTERPRISE member transportation agencies that have experiences with UAVs will be contacted to summarize any additional information not found through the online literature search.

Task 2: Concept of Operations and Functional Requirements
In Task 2, a Concept of Operations (ConOps) document will be developed. The intent of the ConOps will be to identify the needs that are not currently addressed by existing systems (or those that are addressed but could benefit if addressed by UAVs). Once the needs are understood, the ConOps will identify the concepts for how UAVs could address specific needs. Finally, a set of system requirements will be defined to describe what UAVs must do to accomplish the concepts and address the needs stated in the ConOps.

Task 3: Project Design

During this task, a project design will be completed based on the information gathered and documented in Task 1 and 2. The project design will create a scope of a project that ENTERPRISE members could vote on for future funding. The Project Design will attempt to test and/or demonstrate as many of the concepts and requirements that were identified in Task 2, as possible. The Project Design would identify test sites (e.g. agencies willing and able to be test sites), project technologies (either equipment purchases or contributed at no cost), and project participants (that may include vendors, researchers, or others with UAV experience).

The intent of Task 3 is that ENTERPRISE members will have a clear understanding of the plan for a demonstration project, the costs associated with it, and the participants that are willing to be involved.

Project Schedule at the Task Level:

It is anticipated that it will take 6 months to complete this project.

Task	Month					
	1	2	3	4	5	6
Task 1: Literature Search						
Task 2: Concept of Operations and Functional Requirements						
Task 3: Project Design						

Project Deliverables:

Deliverable 1 - Literature Summary

Deliverable 2 - Concept of Operations and Functional Requirements

Deliverable 3 - Project Design Summary

Project Cost:

Deliverables	Cost
Deliverable 1: Literature Summary	$10,000
Deliverable 2: Concept of Operations and Functional Requirements	$20,000
Deliverable 3: Project Design	$20,000
Total Cost	**$50,000**

Relationship to Similar Activities and Projects If Known:

- A Michigan DOT research project, "Evaluating the use of Unmanned Aerial Vehicles (UAVs) for Transportation Purposes," is developing UAV technology that provides aerial monitoring of road and bridge conditions. (Michigan Department of Transportation State Planning and Research Part II Program – Research and Implementation Manual, July 2013, Revised June 2014 – Appendix 2.12)

- The Ministry of Transportation of Ontario (MTO) currently uses Unmanned Aerial Vehicles (UAVs) or purposes such as traffic incident clearance and locates for camera locations. In the future, MTO plans to use UAVs for road weather reporting and monitoring of rural roads in remote locations, especially during inclement weather.

Project Champion: Dennis Tessarolo, MTO

Project Participants (Agencies): TBD

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2015 Project #3
Integrate Active Work Zone Notifications into Traveler Dissemination

Project Background, Summary, and Objectives:

It is typical for traveler information dissemination systems (e.g. Traveler Information websites, Smartphone applications) to display information about construction work zones, such as type of construction, lane closures (length and/or duration of closure), and detours. However, there are often challenges relaying the information about the impacts of roadwork to the staff responsible for preparing the travel information content for websites and 511 phones systems. As a result, often the road work descriptions on websites and phone systems are generic (e.g. "expect intermittent lane closures from June 15 to August 30th").

While there may be a disconnect between the physical lane closures and restrictions and the travel information systems, the staff in the field regularly post messages to drivers using devices such as portable DMS or dynamic arrow boards.

The intent of this project is to pilot an approach that would allow field equipment (e.g. portable DMS, arrow boards, etc.) to automatically transmit their location and message displayed to the central reporting system used to create travel information. For example, if a portable DMS was located at Mile Marker 241 and the message displayed was "Right lane closed next 2 miles". This information could be relayed to the central reporting system and an automated event created that described "Right lane closed from MM 241 to 243", without any manual intervention to relay the information. Similarly, when the DMS was turned off (or message changed) the event could be removed from the system.

This project will develop 'model' systems engineering documents (Concept of Operations and System Requirements) that ENTERPRISE agencies could use when implementing solutions to integrate active work zone notifications into current Traveler Information dissemination systems. In addition, the project will work with ENTERPRISE agencies to evaluate existing system integration deployments and/or use the system engineering documents to procure, deploy, demonstrate, and evaluate a new system integration solution. Topics to explore during this project include how locations are reported, how the local message (on sign) is translated into details of an event for dissemination, and how existing events might be modified by sign information versus creating new events. It is anticipated that the project will be conducted in two phases:

- Phase I: Research Existing Systems and Develop Model Systems Engineering Documents
- Phase II: Work with ENTERPRISE Agencies to Evaluate Existing Deployments OR Procure a System and Conduct a Demonstration with an Evaluation

Scope of Work with Task Descriptions:

Phase I: Develop Model Systems Engineering Documents

Task 1: Establish a Project Team
During this task, a project team will be established, to guide the project and to provide input during the systems engineering process. It is envisioned that the project team will consist of representatives from ENTERPRISE agencies with technical expertise in Traveler Information systems and active work zone notification systems. In particular, any agencies that have deployed active work zone notification integration systems should be represented on the project team.

Task 2: Research Existing Systems Utilized by Agencies
This task will investigate and briefly summarize existing active work zone notification systems that are integrated into agencies' Traveler Information systems. For instance, the Iowa DOT will be contacted to collect information about their portable systems, and the project team will attempt to reach any additional agencies deploying systems related to this concept. Research during this task will also document the types of equipment and systems most likely to be integrated through the deployment being proposed (e.g. portable DMS, arrow boards, and condition reporting systems). This research is intended to help understand the limits and feasibility of accomplishing the overall goals of the project.

Task 3: Plan and Facilitate a Workshop to Define Scenarios and Needs
A workshop will be held with representatives from ENTERPRISE member agencies, to begin the systems engineering process. This task will organize and facilitate an in-person workshop (member travel reimbursement included) to engage participants in defining scenarios for potential deployments, as well as system needs for integrating active work zone notifications into Traveler Information dissemination systems. The scenarios will attempt to capture a range of applications brought forth by ENTERPRISE members, so that the resulting 'model' Concept of Operations and 'model' System Requirements documents can be used by agencies as a starting point for agency-specific procurements and deployments.

Task 4: Prepare Model Concept of Operations
This task will prepare a model Concept of Operations for integrating active work zone notifications into Traveler Information systems. The model Concept of Operations document will describe what is planned, who will operate and use the resulting integration/system, how the new functionality would integrate with the existing field devices and condition reporting system. The Concept of Operations will document one or more deployment scenario with associated operational concepts, issues/problems, and system needs.

Task 5: Prepare Model System Requirements
This task will prepare model System Requirements, based upon the needs defined in Task 3 and the Concept of Operations prepared in Task 5. The requirements will be testable, verifiable, and unambiguous descriptions of the functions that shall be performed by the system. The requirements, which will be written in a manner that will allow agencies to tailor them to their specific future deployments, will trace back to the concepts and needs developed in previous tasks.

Phase II: Work with ENTERPRISE Agencies to Evaluate Existing Deployments or Procure a System and Conduct a Demonstration

Anticipated Phase II tasks, not included in this project scope:

- Task 6: Identify Agencies for Evaluating Existing Deployments
  OR
  Task 6: Customize Systems Engineering Documents to Procure a System Integration at an ENTERPRISE Agency
- Task 7: Conduct a Demonstration
- Task 8: Evaluate the System(s)
- Task 9: Final Report

Project Schedule at the Task Level (Phase I):

It is anticipated that it will take 12 months to complete this Phase I of this project.

Task	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Task 1: Establish Project Team												
Task 2: Research Existing Systems Utilized by Agencies												
Task 3: Plan and Facilitate a Workshop to Define Scenarios and Needs												
Task 4: Create Model Concept of Operations												
Task 5: Create Model System Requirements												

Note: Phase II Schedule TBD

Project Deliverables (Phase I):

Deliverable 1 – Summary of Existing Systems Utilized by Agencies
Deliverable 2 – Model Concept of Operations
Deliverable 3 – Model System Requirements
Note: Phase II Deliverables TBD

Project Cost (Phase I):

Deliverables	Cost
Deliverable 1: Summary of Existing Systems Utilized by Agencies	$20,000
Member Travel to Workshop	$10,000
Deliverable 2: Model Concept of Operations	$30,000
Deliverable 3: Model System Requirements	$20,000
Total Cost	**$80,000**

Note: Phase II Cost TBD

Relationship to Similar Activities and Projects If Known:

- The ENTERPRISE Intersection Conflict Warning Systems (ICWS) Coordination and Systems Engineering project created the following model systems engineering documents:
    - Model Concept of Operations for ICWS
    - Model System Requirements for ICWS

  This proposed project would develop similar systems engineering products for Integration of Active Work Zone Notifications into Traveler Information Systems.

Project Champion: Cory Johnson, MnDOT

Project Participants (Agencies): TBD

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2015 Project #4
Truck Rollover Systems Best Practices

Project Background, Summary, and Objectives:

Truck rollovers on curves and curved freeway ramps can result in fatalities, injuries, delays, and damages to vehicles and/or the roadway. Transportation agencies that are considering the use of truck rollover warning systems to help prevent truck rollovers at high-risk freeway ramps need information about the technologies that are available for this purpose.

This objective of this project is to provide an overview of truck rollover warning system technologies and best practices for the use of these systems. Specifically, the project will aim to understand:

- What situations are most likely to improve with rollover warning systems?
- Which technologies increase likelihood of success (e.g. speed/weight/weather sensors)?
- What concerns, if any, should agencies be aware of when deploying rollover warning systems?

This project will conduct research to document existing truck rollover warning system technologies and any previous research on the safety benefits of deployed systems. The project will poll agencies that have deployed truck rollover warning systems to collect best practices information such as system configurations, uses, effectiveness, and deployment considerations. The project will consolidate and document any available crash analyses conducted at individual sites, as this information is available. In addition, ENTERPRISE may wish to consider initiating an effort to encourage a national evaluation of the effectiveness of truck rollover systems to reduce rollover crashes, especially if the project finds that crash analyses have not been systematically conducted and documented for agency deployments to date. In this case, the project could initiate a national evaluation, or support one initiated by another organization.

Scope of Work with Task Descriptions:

Task 1: Literature Search and Research of Known Deployments

To initiate the project, a literature search will be conducted to identify any completed research other informational materials that document system configurations for truck rollover warning systems, uses and/or roadway geometric conditions for implementing such systems, and effectiveness in terms of crash reductions and safety improvements. In addition to the literature review, outreach efforts and communications with contacts at state agencies will be conducted to identify as many truck rollover systems as possible beyond those formally documented in literature.

Task 2: Research Details of Existing Truck Rollover Warning Systems

Efforts in Task 2 will be dedicated to contacting the agencies operating the truck rollover warning systems identified in Task 1 to gather as much information about the systems as possible. One tool to gather information will be an on-line survey, asking questions about system configurations, conditions where systems are in-place (e.g. roadway geometrics, weather), decision-making processes for deploying systems, deployment concerns, and whether or not a crash analysis data is available. Nonetheless, it is recognized that DOTs receive many surveys and other tools and approaches will be used to contact agencies directly and work with them to explain the project intent and to gather details of the systems deployed. Ideally, during Task 2, the Research Team will establish a relationship with individuals responsible for the deployment of the rollover warning systems in each state and perform follow up communications to understand the long-term impacts of the systems and any changes in configurations that were implemented. At the conclusion of Task 2, a matrix of information describing each truck rollover system will be delivered. The Project Team can discuss plans for extending Task 2 to allow for follow up communications (e.g. gathering any crash statistics 1, 2, or 3 years after deployment).

Task 3: Consolidate Crash Analyses and/or Encourage a National Evaluation

In this task, the project will consolidate crash analysis results collected during Task 2 and summarize observations resulting from examining the various conditions and any resulting changes in crash patterns after deploying truck rollover warning systems. The project will also work with ENTERPRISE members to determine whether a national effort to systematically evaluate the effectiveness of truck rollover systems is warranted. If so, the project will explore opportunities to initiate a national evaluation. The project will convene conference calls to discuss potential collaborations and mechanisms (e.g. USDOT funding, Pooled Fund project, or other) to build support and promote planning for the evaluation.

Task 4: Final Report

A final report will be prepared to document the research and findings, survey results, summary of best practices, crash analysis summary, and efforts to encourage and initiate a national evaluation of truck rollover warning systems.

Project Schedule at the Task Level:

It is anticipated that it will take 9 months to complete this project.

Task	Month								
	1	2	3	4	5	6	7	8	9
Task 1: Literature Review and Research on Known Deployments									
Task 2: Research Details of Existing Truck Rollover Warning Systems									
Task 3: Consolidate Crash Analyses and/or Encourage a National Evaluation									
Task 4: Final Report									

Project Deliverables:

Deliverable 1 – Literature Review Summary and Research on Known Deployments
Deliverable 2 – PowerPoint Presentation of Survey Results (Presented at an ENTERPRISE Board Meeting)
Deliverable 3 – Final Report

Project Cost:

Deliverables	Cost
Deliverable 1: Summary of Known Rollover Warning Systems	$20,000
Deliverable 2: Powerpoint Presentation of Research Results	$30,000
Deliverable 3: Final Report	$10,000
Total Cost	**$60,000**

Relationship to Similar Activities and Projects If Known: None Known

Project Champion: Cory Johnson, MnDOT

Project Participants (Agencies): TBD

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2015 Project #5
Policies, Laws, and Agreements for the Use of Fiber Communications

Project Background, Summary, and Objectives:

Transportation agencies that utilize fiber-optic infrastructure for telecommunications, ITS, and other applications may be in a position to leverage existing in-place infrastructure owned by other entities and/or share new DOT deployed infrastructure with other entities. In these cases, it is important for agencies to understand laws that govern the use and sharing of fiber-optics infrastructure, and to develop internal policies that provide procedural guidance. Agencies may not have the experience, processes, and/or agreements they need to enable sharing of fiber infrastructure with another entity.

Some state and provincial transportation agencies have established policies that govern the use of fiber and that guide sharing arrangements. For example, the Iowa DOT has benefited from using the fiber infrastructure owned by other entities within the state. These resources and best practices would be useful for ENTERPRISE agencies to learn from and model.

The objective of this project is to prepare a summary of resources (policies, laws, agreements) on the use of fiber communications at transportation agencies and to highlight best practices for sharing fiber infrastructure. The project will collect and summarize agencies' policies on fiber communications, state and federal laws and/or FHWA rules that govern the use of fiber, and any agreements or partnership strategies used for sharing fiber-optic infrastructure. In addition, the project will summarize best practices for the use of these policies, laws, and agreements, especially for facilitating resource sharing.

Scope of Work with Task Descriptions:

Task 1: Survey Transportation Agencies and Online Research

During this task, a survey mechanism will be developed and administered to ENTERPRISE state and provincial transportation agencies, to collect information about in-place policies, laws, and agreements for the use of and sharing of fiber-optic infrastructure. Non-ENTERPRISE agencies as directed by the project champion may also be surveyed to enhance the collection of information. The survey will request specific scenarios/example, best practices, and any information about cost savings achieved by sharing. The survey will also collect agreements and policy documents used by agencies. Agency representatives will be contacted, as needed, to clarify information submitted or request additional details. Online research will also be conducted to document laws and FHWA rules that govern the use and sharing of fiber infrastructure.

Task 2: Summarize Best Practices
This task will summarize best practices for the use and sharing of fiber-optic infrastructure, including relevant policies, laws, and agreements. The resulting best practices will be based upon information collected through the survey of state and provincial transportation agencies. Best practices will be shared with ENTERPRISE Board members via a presentation and a monthly Board meeting.

Task 3: Project Summary Report
A project summary report will be prepared to document all project findings, including a summary of survey results, best practices, example policies, and example agreements.

Project Schedule at the Task Level:

It is anticipated that it will take 6 months to complete this project.

Task	Month					
	1	2	3	4	5	6
Task 1: Survey Transportation Agencies and Online Research						
Task 2: Summarize Best Practices						
Task 3: Project Summary Report						

Project Deliverables:

Deliverable 1 – Survey
Deliverable 2 – Summary of Best Practices (presented at an ENTERPRISE Board meeting)
Deliverable 2 - Project Summary Report

Project Cost:

Deliverables	Cost
Deliverable 1: Survey	$20,000
Deliverable 2: Summary of Best Practices (presentation)	$10,000
Deliverable 3: Project Summary Report	$5,000
Total Cost	**$35,000**

Relationship to Similar Activities and Projects If Known: None Known

Project Champion: TBD

Project Participants (Agencies): TBD

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2015 Work Plan

2015 Project #6
Portable Travel Time Displays and Integrated Corridor Management with Parallel Routes – Phase 1

Project Background, Summary, and Objectives:

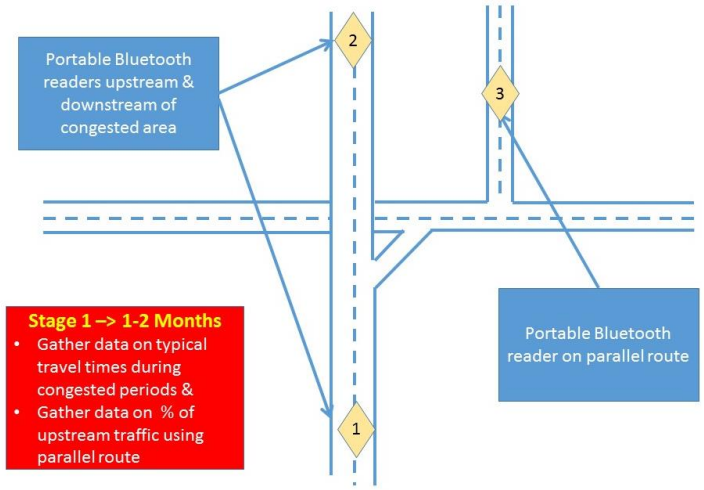
State DOTs have found that displaying travel time messages on Dynamic Message Signs (DMS) can be an effective mechanism for informing travelers about expected delays along their routes. An earlier ENTERPRISE project titled Assessing the Impacts of Travel Times on the Overall Network concluded that the displays of travel times that are roughly twice as long as normal travel times during that time of day will influence a sizeable percentage of travelers to divert to alternate routes when available. The display of travel times on DMS is not only intended to create diversions. Anecdotal feedback suggests that travelers appreciate knowing their travel time, as it reduces stress.

One finding of the Assessing the Impacts of Travel Times on the Overall Network project was that the rate of diversions when longer than normal travel times are posted varies by location, most likely heavily influenced by the availability of alternate routes and the general travel patterns of traffic. Therefore, a state DOT could not predict the impact that the deployment of travel time monitoring and DMS display will have at any location, and state DOTs could invest considerable funding at one location only to find that the impact on traffic delays is not recognized.

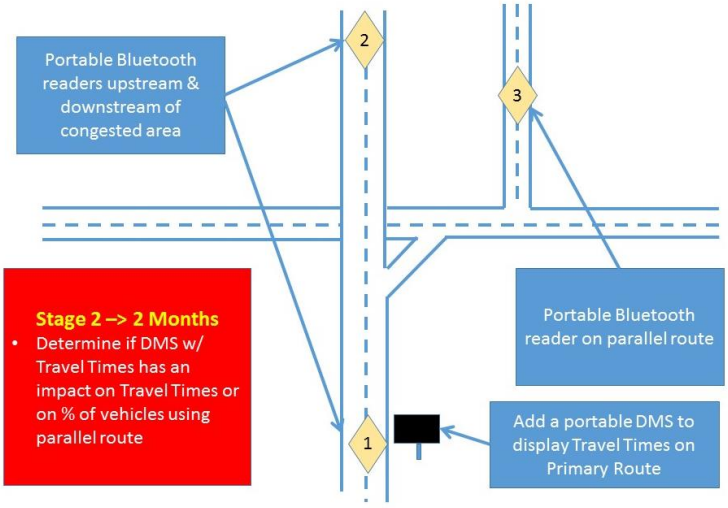
This project proposes the temporary procurement and deployment of portable systems to detect travel time and percent of vehicles diverting to alternate routes, coupled with a portable DMS display to inform travelers of the travel times. The goal of the temporary deployment of technologies is to assess if vehicles divert and reduce the congestion level, allowing DOTs to make informed decisions about investing in permanent systems.

If successful, this project would prove that a portable system (consisting of Bluetooth readers, portable DMS, communications, and processing) could be developed and deployed whenever state DOTs wish to assess the impacts that displaying travel times on a DMS would have on a stretch of highway experiencing recurring congestion. Three 'Stages' of deployment would be used to test the impacts of the portable system:

- ***"Stage 1"*** will be a deployment of Bluetooth monitoring devices at the upstream and downstream sections of the stretch of highway that experiences recurring congestion. Similarly, a Bluetooth reader will be installed on the alternate route to be used to understand what percentage of vehicles from the upstream reader is using the alternate route. There will e no display of travel times on the DMS during this stage; however travel times will be monitored and recorded. Stage 1 is expected to operate for 1-2 months.



- During ***"Stage 2"***, the systems deployed in Stage 1 will continue to operate, and a portable DMS will be added to the deployment displaying the calculated travel time on the main route (and possibly on the alternate if enough diversions occur to give accurate travel times). As in Stage 1, the travel times will also be stored for analysis as will the percent diversions (i.e. percent of vehicles from the upstream location detected on the alternate route). The intent of Stage 2 is to understand if the display of the travel time(s) has an impact on how many vehicles divert and/or an impact on the travel times (i.e. has displaying the travel time caused travelers to seek alternate routes and reduce the congestion levels). Stage 2 is expected to operate for 2-3 months.



- The intent of ***"Stage 3"*** is to understand if any of the impacts experienced during Stage 2 caused an overall change in behavior such that the travel time displays are no longer needed. For example, if some travelers opted for the alternate route based on the portable DMS, have they now developed a pattern of using that alternate route regardless of whether a DMS display informs them of the travel time. Therefore, during Stage 3, the DMS will be removed and no longer display travel times as measured by the Bluetooth devices. Travel times and the diversion rates (as measured by the Bluetooth readers) will continue to be monitored and

stored for analysis. The intent of Stage 3 is to provide additional information to state DOTs about whether a temporary travel time display will have long term impacts.

In addition to the three stages described above to help understand the impacts of travel time displays before deploying permanent systems, this project goes a step further by researching the impacts that proactive arterial street signal timing changes could have when integrated with travel time notification. For example, if a travel time message is displaying a travel time more than twice the normal time, and traffic is expected to divert, signal timing plans to 'flush' the diverted traffic along parallel arterials could be implemented. However, the decision to implement local signal changes is not governed solely by the need to provide alternate parallel routes. Instead, there are local institutional issues and priorities of the local roads that all must be considered. This is a critical part of the Integrated Corridor Management (ICM) initiative.

This project proposes a demonstration of a portable system to detect and disseminate travel times to understand the likely impacts of a more permanent system, together with a related arterial management approach to allow diverting traffic to quickly navigate the parallel alternate route. An initial planning stage to the project will work with 1-3 ENTERPRISE member agencies interested in the concept to explore all aspects and to allow a 'go no-go' decision for a later Phase 2 to actually deploy the systems.

Scope of Work with Task Descriptions:

Phase 1: Initial Systems Engineering and Partnership Building Phase

The initial phase in this project will be a planning and systems engineering phase to work with 1-3 ENTERPRISE member agencies that are potentially interested in a pilot deployment as described by this project. While this project will achieve the most benefit if one or more ENTERPRISE member states deploy the temporary systems, all member agencies are encouraged to participate in Phase 1 process to learn about the institutional and technical challenges that are experienced. During Phase 1, a systems engineering process will be followed to develop the concepts of operation for each potential deployment site, and to work with any neighboring jurisdictions or other groups within the state DOT as necessary (e.g. those operating the alternate route).

A part of the planning stage in Task 1 will be to determine the extent to which DOT owned equipment could be used for a demonstration and/or if equipment would need to be leased for this project.

Phase 1 will conclude with the development of concise documents outlining the Concepts of Operation, Functional Requirements, and an overall Project Plan for deployment of the systems. At this stage, the agencies participating in Phase 1 will reach a 'go no-go' decision about whether or not to pursue the actual deployment through later tasks. Details of the costs and the scope of later tasks will be determined after the completion of Phase 1.

Note: At this time detailed costs are not estimated for Phase 2 (Tasks 2-5)

Task 2: Deployment Stage 1 – Monitoring Travel Times and Percent of Diversions

In this task, systems will be deployed as agreed in Task 1 for the sites that opted to proceed. The deployment in this task will be considered "Stage 1", with deployment of Bluetooth monitoring devices at the upstream and downstream sections of the stretch of highway(s) that experiences recurring congestion. Similarly, a Bluetooth reader will be installed on the alternate route to be used to understand what percentage of vehicles from the upstream reader is using the alternate route. There will be no display of travel times on the DMS during this stage; however travel times will be monitored and recorded. Stage 1 is expected to operate for 1-2 months.

Task 3: Deployment Stage 2 – Disseminating Travel Time messages at the upstream location

In this task, the systems deployed in Stage 1 will continue to operate, and a portable DMS will be added to the deployment displaying the calculated travel time on the main route (and possibly on the alternate if enough diversions occur to give accurate travel times). As in Stage 1, the travel times will also be stored for analysis as will the percent diversions (i.e. percent of vehicles from the upstream location detected on the alternate route).

The intent of Stage 2 is to understand if the display of the travel time(s) has an impact on how many vehicles divert and/or an impact on the travel times (i.e. has displaying the travel time caused travelers to seek alternate routes and reduce the congestion levels). A further intent is to trial the implementation of any strategies for real-time arterial management developed during Task 1 (either automatically or through manual download of updated signal timing plans). Depending upon the final decisions reached in Task 1, arterial signal timing changes may be implemented immediately when the travel times are posted, in anticipation of the likely change in travel diversions.

Stage 2 is expected to operate for 2-3 months.

Task 4: Deployment Stage 3 – Monitoring Impacts With Travel Times Removed

In this task, the system deployed will return to the same system as in Task 1. That is, the portable DMS will be removed (or turned off). The intent of Stage 3 is to understand if any of the impacts experienced during Stage 2 caused an overall change in behavior such that the travel time displays are no longer needed. For example, if some travelers opted for the alternate route based on the portable DMS, have they now developed a pattern of using that alternate route regardless of whether a DMS display informs them of the travel time. The intent of Stage 3 is to provide additional information to state DOTs about whether a temporary travel time display will have long term impacts.

Task 5: Evaluation and Analysis of Findings

While this project will hopefully provide useful information to the state DOT(s) that serve as deployment sites, the nature of the project is ideally to help all ENTERPRISE members understand if a portable system such as this is a viable "tool" to have to assess congested corridors. Task 5 will be an ongoing task to document institutional issues, challenges, findings, and overall reactions of the participating agencies. Task 5 would also make some predictions about the costs of such systems, should DOTs pursue them in the future. Also, if portable systems like this are found to be effective, Task 5 might

work with some vendors to educate them on the project and help them understand if there is a marketable product (e.g. a rentable suite of technologies that could work together as needed for this project).

Project Schedule at the Task Level:

The duration of this project is estimated at 15 months.

Task	Month														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Phase 1: Initial Systems Engineering and Planning															
Task 2: Deployment Stage 1 – Monitoring Travel Times and Percent of Diversions															
Task 3: Deployment Stage 2 – Disseminating Travel Time messages at the upstream location															
Task 4: Deployment Stage 3 – Monitoring Impacts With Travel Times Removed															
Task 5: Evaluation and Analysis of Findings															

Project Deliverables:

Phase 1: Project Plan & Systems Engineering Documents
Task 2: Stage 1 Deployment & Operation
Task 3: Stage 2 Deployment & Operation
Task 4: Stage 3 Deployment & Operation
Task 5: Final Evaluation Report

Project Cost:

Tasks	Cost
Task 1: Site Selections, System Procurement, Overall Planning	$50,000
Task 2: Deployment Stage 1	$TBD
Task 3: Deployment Stage 2	$TBD
Task 4: Deployment Stage 3	$TBD
Task 5: Evaluation and Analysis of Findings	$TBD
Total Cost	**$**

Relationship to Similar Activities and Projects If Known:

- ENTERPRISE Understanding the Impacts of Travel Times on the Overall Network Project

Project Participants (Agencies): TBD

Project Champion: TBD