

SOLICITATION NUMBER, DTRT57-08-R-20021

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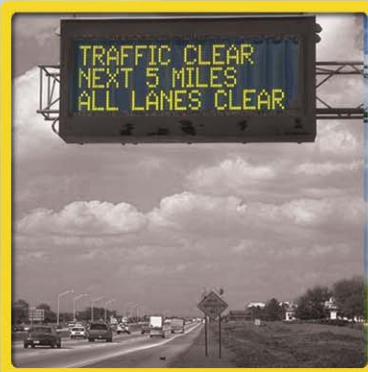


**REVISED PROPOSAL**  
**SAFE AND EFFICIENT TRAVEL**  
**THROUGH INNOVATION AND PARTNERSHIPS**  
**FOR THE 21ST CENTURY**  
**(SAFE TRIP-21)**

SUBMITTED BY:  
UNIVERSITY OF MARYLAND  
ON BEHALF OF  
THE I-95 CORRIDOR COALITION



TECHNICAL & COST PROPOSAL





5000 College Ave, Suite 3103  
Technology Ventures Building  
College Park, MD 20742-6601  
301-403-4525 Telephone

Center for Advanced Transportation Technology

October 9, 2008

Mr. Orin Cook  
Contracting Officer  
DOT/RITA/VOLPE National Transportation Systems Center  
55 Broadway, Kendall Square  
Cambridge, MA 02142  
Dear Mr. Cook:

Based on further discussions, the University of Maryland on behalf of the I-95 Corridor Coalition is pleased to submit the following revised technical and cost proposal to the Volpe National Transportation Systems Center in response to Solicitation No. DTRT57-08-R-20021.

If you have any questions, I can be reached at: (703) 389-9281 or [geschoener@comcast.net](mailto:geschoener@comcast.net).

We would be happy to further discuss our proposed approach with you. We look forward to an opportunity to work with you on this very important initiative.

Sincerely,

A handwritten signature in black ink that reads "George E. Schoener".

George Schoener

University of Maryland, Principal Investigator  
I-95 Corridor Coalition, Executive Director

**Broad Agency Announcement DTRT57-08-R-20021**

**Safe and Efficient Travel through Innovation and  
Partnerships for the 21<sup>st</sup> Century (SAFE TRIP-21)**

**University of Maryland  
On behalf of  
The I-95 Corridor Coalition**

**Principal Investigator:** George Schoener, Executive Director  
University of Maryland/I-95 Corridor Coalition

**Technical Contact:** Bill Stoeckert, Travel Information Coordinator  
University of Maryland/I-95 Corridor Coalition

**Business Contact:** Kathy Frankle  
University of Maryland

**Primary Subject Area:** Test Site with Mobility Service Applications



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## EXECUTIVE SUMMARY OF REVISIONS

On March 28, 2008, the I-95 Corridor Coalition submitted a proposal to RITA's Volpe National Transportation Systems Center in response to Solicitation Number DTRT57-08-R-20021 entitled Safe and Efficient Travel Through Innovation and Partnerships for the 21<sup>st</sup> Century (SAFE TRIP-21). The Coalition's proposal sought RITA's support to expand the Coalition's Vehicle Probe Project so that the potential of using vehicle probe data to generate mobility benefits could be effectively publicized at the November, 2008 ITS World Congress in New York City. The proposal specifically sought funding for the following:

- Expanding the core transportation network coverage of the Vehicle Probe Project to also include freeways in the states of Connecticut and New York.
- Developing a website that would enable the public to better plan trips in an easy to use way, taking advantage of the travel time data available from the Vehicle Probe Project.
- Creating a video that would explain the attractive and important features of the Coalition's Vehicle Probe Project to professional and lay audiences participating the ITS World Congress and subsequent events.

At the time, the Coalition was motivated to support RITA's demonstration and promotion of VII concepts at the ITS World Congress. We believed that the media would be naturally attracted to having accessibility to, and displays and explanations of, real-time travel time data for freeways in the New York City Tri-State area. The transportation network expansion to Connecticut and New York would have enabled this, and the proposed website and video would have provided RITA and the Coalition with the ability to effectively generate publicity and interest in vehicle probe and VII concepts.

With the passage of time, however, accomplishing these objectives in time for the November World Congress is no longer realistic. We appreciate the opportunity that RITA has provided to revise our proposal to better meet RITA's current objectives for the testing and evaluation of concepts that use the VII/Vehicle Probe data to provide transportation benefits to the public.

Therefore, we propose to modify our proposal as summarized below.

- Removal of Expanded Transportation Network Coverage - Since demonstration of coverage of freeways in the Tri-State region at the World Congress is no longer possible, we propose removing the portion of our proposal dealing with expansion of transportation network coverage to Connecticut and New York.
- Removal of Video Development - With the removal of the expanded coverage, we also propose removing the development of the explanatory video.
- Equipment Rental for 2008 World Congress Demonstration - The Coalition does plan to include a demonstration of its Vehicle Probe Project at the 2008 ITS World Congress. The Coalition and INRIX have already made most of the investments necessary for



making arrangements for the demonstration. We would be pleased to also feature the relationship of the project to the SAFE TRIP-21 program, and ask only for consideration of a small RITA investment to cover still needed equipment rental (monitors, electrical and communications lines).

- Long Distance Trip Planning Using Real-Time Travel Time Data – As explained in our March 28 proposal, the transportation network coverage of our Vehicle Probe Project includes nearly 2,000 miles of freeways and 1,000 miles of arterials in an area extending from New Jersey to North Carolina. Numerous long distance trips occur daily in and through this area. These trips are made by commercial freight carriers, intercity buses, and private vehicles. We propose to enable the SAFE TRIP-21 program to evaluate how having reliable real-time travel time data available influences the trip planning decisions of long distance travelers. We would do this by identifying a targeted set of frequent long distance travelers (e.g., commercial carriers, intercity buses, frequent business travelers), and constructing a website where travelers can obtain the up-to-date travel time information on alternate routes to their destination. Through surveys and interviews, the SAFE TRIP-21 program would be able to evaluate whether the information is positively influencing travel decisions, and why or why not.
- Displaying Travel Times in Public Areas – Areas where many travelers gather are natural targets for display of the real-time travel time data being acquired as a result of the Vehicle Probe project. The Coalition proposes to work with the SAFE TRIP-21 program and the Virginia DOT to test and evaluate the effectiveness of displaying travel time data at VDOT Welcome Centers and at the Tyson's Corner shopping mall in the Northern Virginia area. The latter would prove to be an excellent test location as traffic tie-ups in the region during the period of the test will be even more severe and unpredictable than normal because of HOT-lane construction in the area. The SAFE TRIP-21 program could conduct evaluations via on-site surveys and interviews.
- Providing Travel Time Information to Airport Users – The Coalition has been working with BWI Airport to develop a website that will provide information on ground transportation options that will enable passengers to better plan their trips to and from the airports, whether by public transportation, taxi, van, bus or private vehicle. We propose to work with the SAFE TRIP-21 program and BWI Airport to test and evaluate the value of enhancing this website by including the real time travel time data provided by the vehicle probe project, and other real time data about modes serving the airport, to incorporate the real time information needed by the traveler. Travel time data currently provided by the website does not account for current or predicted travel conditions. We propose to accomplish this by making the information available through kiosks located within the BWI terminal, through wireless devices (e.g., cellular phones), and through the Airport's website. The project will enable the SAFE TRIP-21 program to undertake an evaluation based on on-line and on-site surveys and interviews.



- More Efficient and Safer Work Zones – The Coalition will work with the Volpe Center and the North Carolina DOT in testing and evaluating how providing advance information about work zone travel times and speeds can improve the efficiency and safety of work zone operations. Two tests/evaluations are proposed. One would be conducted in a more congested area to better measure whether providing advance information about travel times through the work zone area will divert traffic from the area and improve the efficiency of traffic flow through the work zone. The second would be in a more rural area to better measure whether providing advance information to drivers about queues and average speeds ahead will reduce speeds approaching the work zone, and whether providing information about current average speeds can lead to more targeted and cost-effective enforcement.



## TECHNICAL CONCEPT

The material below follows the Proposal Submission Requirements contained in Section 3 of the original Volpe Center Broad Agency Announcement.

### Meeting Test Site Requirements

*The I-95 Corridor Coalition offers a test site that is unique in its geographical coverage and in its ability to immediately provide a stream of data collected from a variety of sources that will be able to support private and public traffic management and travel information applications designed to provide the public with mobility benefits.*

In terms of coverage, the Coalition is already under contract with INRIX to acquire travel time data on 1,530 miles of freeway and 1,000 miles of arterial streets in an area that extends from New Jersey to North Carolina.

In terms of schedule, we began acquiring data from INRIX in July. These data are being provided to our state DOT member agencies with certain restrictions on their usage. Discussions and plans have already occurred within the Coalition and with member agencies about how the data can be used in applications to generate public mobility benefits. Some of these ideas are included in this revised proposal.

In terms of the seven requirements listed in the Broad Agency Announcement:

- The contract between the University of Maryland (acting on behalf of the I-95 Corridor Coalition) and INRIX defines the transportation network that will be the test site. The transportation network coverage map is shown on Figure 1.
- The express purpose of the Coalition's Vehicle Probe Project is to provide its member agencies with a comprehensive source of travel time information to be used for testing, evaluation and deployment of a wide range of traffic management, traveler information, and performance measurement applications to demonstrate mobility benefits. These applications will be developed by individual Coalition member agencies and by the Coalition (on behalf of its members) as ideas and priorities are developed.
- The proposed test network passes through some of the most congested regions in the nation, including the New York,

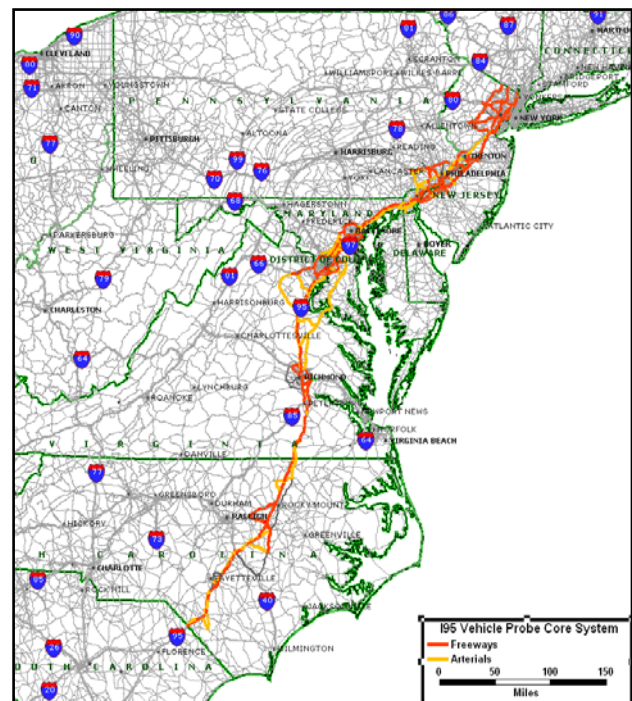


Figure 1: Core Coverage Map



Philadelphia, Baltimore, and Washington DC metropolitan areas. The segments of I-95 that connect these metropolitan areas are frequently congested, especially on holiday and summer weekends. When a significant incident occurs, traffic can be delayed for hours, to the detriment of economic efficiency, fuel efficiency and the environment.

- The data being acquired by the Coalition and its member agencies will be archived so that an initial baseline and time stream of data over the entire network will be available for analysis purposes. The data will, for example, be able to support analyses of network performance over time, network performance during major incident periods, effects of weather incidents, etc.
- The Coalition will be happy to support the promotion of SAFE TRIP-21 at important events. The Coalition has been an active participant at ITS America Annual Meetings for years, and has resources available, including personnel, to support the presentation of our project as part of RITA's SAFE TRIP-21 initiative.
- The Coalition encourages site visits and demonstrations during the operational test. Our Vehicle Probe Project has already generated much excitement and interest in the community, and we will certainly devote resources to sharing what we learn from it with others, not only through site visits and demonstrations, but also through articles in professional journals, presentations at technical meetings, and other forms of technology transfer.
- The Coalition has provided a framework for sustaining the test bed and applications development beyond the test period. The term of the INRIX contract is ten years. Although the Coalition's role will be fulfilled through a three-year demonstration and testing period, the contract enables any Coalition member organization to add funding to it to continue to acquire INRIX data beyond the three-year test period.
- The beauty of the Coalition approach is that no continuing investment in the operation and maintenance of public infrastructure is required. The Coalition and its members are INRIX customers who will continue to pay for data as long as the data is of sufficient quality and helps the agencies with their missions to serve the traveling public. The operation and maintenance of the systems and relationships necessary to obtain and process the data will be maintained by INRIX using income obtained from the Coalition and its other public and private sector customers.

### **Risk Factors**

Many of the risks that would ordinarily impede progress on a project of this nature have already been successfully addressed, particularly the institutional ones. As an organization, the I-95 Corridor Coalition has worked successfully to achieve cross-jurisdictional cooperation throughout its fifteen year life in areas as diverse as incident management, truck parking and freight rail transportation. As it pertains to the Vehicle Probe Project, the Coalition has already:

- Enlisted the active participation of member agency personnel in the development of the RFP and evaluation of proposals.
- Addressed and resolved complex issues such as restrictions on usage of the data being acquired, facility coverage and expansion of the network.



- Reserved a significant portion of its annual budget to support the demonstration and testing of the Vehicle Probe Project over a three-year period.
- Conducted a successful procurement activity through the University of Maryland leading to the selection of INRIX and execution of the contract under which INRIX is now working.
- Initiated acquisition of the data from INRIX and evaluation of that data.

As the Coalition's Vehicle Probe Project proceeds, several risk factors will need to be actively managed. While important for the long term success of the concept, these factors will impose little if any threat to our ability to successfully deliver the operational tests we propose. They include:

- The accuracy of the data being acquired. More specifically:
  - The time it takes to detect unexpected congestion caused by incidents, construction zones or poor roadway conditions, and the accuracy of the data acquired under these conditions.
  - The accuracy of the data on the covered arterial network. Traffic flow on arterials tends to be much more variable than on freeways because of perturbations caused by traffic signals, turning movements, bus stops, traffic accidents, etc. The adequacy of arterial data to support the applications described in this proposal has not yet been verified. The ability of the INRIX data to capture major arterial travel time disruptions caused by these events in a timely way will be investigated carefully.
- The success of INRIX as a business. The Coalition has entered into a business arrangement with INRIX. The Coalition is buying data from INRIX on behalf of its member agencies, and INRIX has agreed to provide the data in specified ways and to meet specified performance requirements. The success of the initiative is dependent on INRIX' ability to meet the contract specifications and sustain its business otherwise through the sale of data to other private and public organizations.
- The management of restrictions on public agency usage of the data acquired from INRIX. In general, the contract terms governing member agency use of the INRIX data are liberal, providing them, for example, with the ability to use the data for transportation planning and operational analyses, service and data quality validation analyses, and other internal organization applications, including the right to archive the data and use it for internal organization purposes for an unlimited period of time in the future.
- The development of robust applications that turn the data into information that can be used to better manage traffic and inform the public. The Coalition has built the data "field of dreams," the challenge is to now encourage researchers and developers to "come to it" to improve the performance of current applications and to develop new ones, particularly in important areas such as transportation network performance measurement and management.

### **Use of ITS Standards/Protocols**

ITS projects generally rely on professionally developed industry standards for the transmission of data, such as SAE codes or IEEE standards. However, the core products we are developing



for the operational tests involve graphical depictions of speed and travel time data via websites and displays, for which those standards do not necessarily apply. The project will rely upon commonly agreed to standards regarding navigation-level data sets, web design and usability.

In the delivery of its product, Inrix adheres to industry standards regarding TMC location codes, standard XML codes and private industry standards for dynamic content.

The web design community follows a general trend of endorsing a set of standardized best practices for building web sites, and a philosophy of web design and development that includes those methods. General commonly accepted standards for the use of ITS websites will be addressed. In regards to the interactivity of the maps, users will have the ability to select a desired region, which will cause the map to automatically zoom and re-center. Another website feature, though not a standard, will be the use of easily recognized colors to represent speed information to the end user.

### **Privacy Principles**

This project will demonstrate, in real-world applications, that it is possible to utilize data transmitted from operating vehicles without violating individual or corporate privacy. For nearly two years, INRIX has been operating a nationwide GPS-based vehicle probe network without a single issue related to privacy arising. None of the data that INRIX provides to its customers can be traced back to an individual vehicle probe report. Further, most all raw GPS probe vehicle data reports provided to INRIX by its contractors is stripped of any sort of vehicle identification information. The INRIX data fusion engine does not require “point pairs” of data from a vehicle to determine traffic flow but instead utilizes each individual data point as a unique position report. INRIX receives no Personally Identifiable Information (PII) to operate its services, does not require it and does not seek it.

### **ITS World Congress Display**

The Coalition will be demonstrating its Vehicle Probe Project at the November, 2008 ITS World Congress in New York. The Coalition and INRIX have already made most of the investments necessary for arranging the demonstration. We would be pleased to also feature the relationship of the project to the SAFE TRIP-21 program, and ask only for consideration of a small RITA investment to cover still needed equipment rental (monitors, electrical and communications lines). This cost has been included in our cost proposal.

We would also be happy to participate with RITA on future events, such as the 2009 ITS America Annual Meeting, including displays, brochures, etc. A small optional budget for this purpose has also been included in our cost proposal.

### **Leveraging Other USDOT Funding**

The I-95 Corridor Coalition has already chosen to invest a significant portion of its annual budget in the Vehicle Probe Project. I-95 Corridor Coalition funding is provided through an annual set-aside in SAFETEA-LU. The amount of the set aside is currently \$7 million annually (although we generally receive about \$1 million less than that amount because of obligation



limitations). The Coalition is investing \$3.7 million in the acquisition of data over a three-year period. In addition, the Coalition invested \$75K in the RFP development, proposal review, and contract negotiations process; is planning to invest \$300K in the evaluation of the data it is acquiring; has a \$250K project that will be initiated shortly that will examine the use of vehicle probe data to measure system performance; and a \$150K project that will also begin shortly to design an archived data management system to ensure that vehicle probe and other data are available indefinitely for various analysis purposes. The Coalition's total investment in vehicle probe activity is nearly \$4.5 million for three-years, about 25% of its total funding over this same period.

Member states are supplementing the INRIX contract to acquire data on routes that are not covered under the original agreement. For example, North Carolina plans to invest roughly \$1.6M to obtain additional network coverage using in part Federal funding that it obtained under the USDOT's Corridor of the Future program. New Jersey has expanded coverage to roughly double the freeway mileage in the original INRIX contract, adding over 400 miles. For this expanded coverage, New Jersey is investing \$1.25 million in state funds. This additional coverage will enhance the utility and value of the long distance trip planning application that we propose to develop and test.

In addition, INRIX is contributing coverage of the 1,000 miles of arterials included in the Coalition's Vehicle Probe Project, at an estimated value of \$1.15 million over the 16-month duration of the SAFE-TRIP effort.

The I-95 Corridor from Maine to Florida was designated by the USDOT as one of its *Corridors of the Future*. We believe that our Vehicle Probe Project is a prime example of what the USDOT wanted to achieve through this program. It is an excellent illustration of the cooperative investment of public and private resources to reduce traffic congestion along one of the nation's most heavily congested corridors using state-of-the-art technology.

### **Relationships with Other Organizations**

The members of the I-95 Corridor Coalition have long recognized that the region's complex and growing transportation management and operations problems must be addressed through a multi-state partnership that provides a mechanism for coordinating and resolving issues in a spirit of cooperation and consensus. The Coalition is a forum for policy makers and transportation officials to address transportation management and operations issues of common interest. Our volunteer, consensus-driven organization enables state, local, and regional member agencies to work together to improve transportation system performance along the corridor far more than they could working alone. The Coalition has served successfully as a model for multi-state/jurisdictional interagency cooperation and coordination since 1993.

Illustrating how it regularly operates, a Coalition Working Group consisting of personnel from state DOT member agencies was actively involved in the preparation of the vehicle probe RFP, the evaluation of proposals received, and the negotiations of contract terms. With the ability to leverage dedicated Coalition staff and on-going member involvement through the Working



Group and our standing Travel Information Services Program Track, we offer to RITA, at no cost to the project, an established organizational framework for coordinating project activities.

In addition, because its success lies in the sale of its data, INRIX is motivated to enter into additional agreements with other public and private organizations. The latter may include automobile manufacturers, personal navigation device manufacturers, satellite and HD radio service providers, mobile phone applications developers, web portals and location-based service developers, and fleet managers. Although these agreements will be private contracts between INRIX and other organizations, they will effectively serve a public good by making quality data on the transportation system available to many people in a variety of convenient ways.

### **Test Site Features**

The I-95 Coalition's Vehicle Probe Project is considered an enabling technology, in that it provides the underlying traffic flow data essential to the success of numerous planning, engineering, operational applications. The leadership of the Coalition as well as its membership recognizes that the successful implementation of this technology is dependent upon the degree to which these applications are implemented. For this reason, applications that use these data are being funded and led both by the individual agencies as well as those that are being sponsored and managed by the Coalition. The following highlights features of the Vehicle Probe Project, and provides additional information on the operational tests that we are proposing.

- Ability to demonstrate measurable impacts and benefits that meet SAFE TRIP-21 goals and objectives – The stated objective of the project is to identify applications that are deployment-ready and will lead to transformational changes and advances. The Vehicle Probe project is deployment ready, based on a contract whose work started on 2/1/08. It will lead to transformational changes, in that for the first time, comprehensive real-time and archived data will be available for a major multi-state corridor that will enable planning, operations and performance measurement that, until now, has never been possible.
- Open architectures – The data formats and location coding associated with the Vehicle Probe data have been published and made available to both USDOT and the core states associated with the project. Both the Coalition and its membership have documented plans to use these data for applications intended to alleviate congestion, enhance mobility and increase the safety of motorists and commercial vehicle operators traveling in the I-95 Corridor through improved traveler information, extended diversion information, and more rapid incident response. The multiple toll agencies involved with this project are considering the use of these data for various EPS applications.
- Ability to receive and process electronic data rapidly – The Probe Project is developed on the principle of receipt and dissemination of data with a maximum latency of 5 minutes. The agencies receiving the data, all have plans for its integration into their traffic management systems for the purpose of dissemination to motorists using dynamic message signs, websites, and 511 applications.

It is interesting to note that the effect of the maximum latency requirement and other Coalition performance requirements has been to “raise the bar” for the quality of data that



INRIX is providing to all of its customers, including private organizations such as BMW, Clear Channel, Ford, Mapquest and Tom Tom.

- Capability to operate and maintain ITS technologies – The Vehicle Probe Project is based entirely on the concept of outsourcing the data collection and distribution. To that extent, it represents a potential model for future operation and maintenance of ITS technologies.
- Provisions for building out the test site – The contract that has been awarded for the Vehicle Probe Project has specific provisions for project expansion. The contract is an Indefinite Delivery Indefinite Quantity (IDIQ) contract with a ten year period of performance that allows the addition of tasks to expand coverage throughout the entire I-95 Corridor. Plans are currently underway to expand the coverage beyond the I-95 Corridor both within and outside the core states.
- Ability to leverage and enhance functionality – the contract that has been awarded for the Vehicle Probe Project has provisions for functional expansion through the issuance of task orders that permit the development of applications identified by individual members of the Coalition, as well as those that are identified by the Coalition itself. A number of applications are currently under consideration. The contract can also serve as a vehicle to acquire services for the integration of Vehicle Probe data into member’s individual traffic management systems.
- Ability to extend lessons learned – There are already many lessons learned from this project, the most significant of which is the process by which multi-state needs can be accommodated, and multi-state funding (that is incompatible with pooled fund projects) can be contributed to a major project. This information is being shared with the Joint Program Office. It is anticipated that much information of interest to the USDOT will be generated by this project in the future. It is anticipated that through a combination of formal project documentation, detailed project evaluations, presentation at technical meetings, dissemination of information to Coalition membership at its annual meetings, and informal contacts with USDOT personnel, these lessons will be communicated to the overall transportation community.
- Ability to integrate SAFE TRIP-21 ITS applications – The Coalition is investing in the development of applications that take advantage of the rich source of data being provided under the Vehicle Probe Project. Projects that will be initiated this year include one that will examine how the data can be used to measure transportation network performance, and one that will design an archived data management system. In both cases, and with all future applications development work, the Coalition will work closely with representatives of its member agencies to ensure that the resulting applications will help them achieve their missions.

Under the SAFE TRIP-21 program, the Coalition proposes to work with the Volpe Center in testing two SAFE TRIP-21 applications as described below.



### Long Distance Trip Planning Using Real-Time Travel Time Data

The I-95 Coalition's Vehicle Probe Project is considered an enabling technology, in that it provides the underlying traffic flow data essential to the success of numerous planning, engineering, and operational applications. The leadership of the Coalition as well as its membership recognizes that the successful implementation of this technology is dependent upon the degree to which these applications are implemented.

The Coalition exists to improve the long distance movement of people and goods through the region. A core issue, therefore, is how the vehicle probe data that the Coalition is acquiring can be used for this purpose. A core, practical application of the enabling technology is the graphical depiction of speed and travel time data via an integrated, fully interactive website. This website will be unlike anything currently available to travelers seeking pre-trip information on the Internet. While commuters and long distance travelers have the option of checking road conditions, sometimes even travel times on interactive maps of statewide and regional road networks, never before has a website been presented to the public that will provide long distance real time travel time information. At a single glance, travelers will be able to assess travel conditions on long stretches of highway, in between several metro areas.

In planning trips using the travel data in an easy-to-use way, users will have the ability to select a desired region, which will cause the map to automatically zoom and re-center. Another website feature, though not a standard, will be the use of easily recognized colors to represent speed information to the end user.

ITS projects generally rely on professionally developed industry standards for the transmission of data, such as SAE codes or IEEE standards. However, our core product is the graphical depiction of speed and travel time data via an integrated website, for which those standards do not necessarily apply. The project will rely upon commonly agreed to standards regarding navigation-level data sets, commercially available base mapping, web design and usability.

Coalition member states will be recruited to link their statewide and metropolitan-based websites to this new service and encourage promotion to raise awareness and usage during the evaluation phase.

The establishment of this website will enable the SAFE TRIP-21 program to evaluate the use of this real-time travel time data by long distance travelers; commercial freight carriers, intercity buses, and private vehicles. Usage statistics and user surveys could be collected to illustrate not only how much the data is used, but if the data is in fact changing the behavior of long distance travelers. Internet statistics could be collected to assess usage, and on-line surveys conducted at various points to determine how well the website is influencing long-distance trip planning and influencing en-route decision making.



### Displaying Travel Times in Public Areas

Providing local and/ or regional travel time information in high-trafficked public areas is an underutilized method of disseminating information to travelers. This effort focuses on the near-term traveler – someone that is committed to making a trip, or continuing a trip within a couple of minutes of using the available information.

The vehicle probe data will be provided in a color-coded map format, similar to the multi-state website, using large-screen displays in three locations in Virginia situated along or adjacent to I-95. Through other efforts under development by Virginia DOT, the displays will also include additional travel information, which will vary depending on location and intended user – local shopper vs. multi-state through traveler, for example.

Coverage will be provided primarily along I-95, but could also display the alternate routes of US-1 and US-301 as appropriate, depending on the location of the Welcome Center.

The locations selected for the large-screen displays are:

- Tyson's Corner shopping mall in Northern Virginia
  - This deployment requires numerous display screens strategically located near the exits to provide mall patrons a quick overview of the travel conditions they will experience in this highly congestion region. As multiple major transportation construction projects are planned to commence in 2009, the displays will be an important part of managing the travel in the region and travelers' expectations.
  - Vehicle probe data for the immediate area covers some of the region's most the highly congested roadways - I-495 and I-66.
  - During the evaluation timeframe, VDOT may choose to expand the coverage area to include the Dulles Toll Road. This could be done relatively easily, and would be part of a much larger data initiative currently under consideration by VDOT.
- Virginia DOT Welcome Centers
  - This deployment is comprised of a single screen per location at welcome centers along I-95 in Virginia. The two candidates welcome centers are:
  - Fredericksburg - the northern most welcome center along I-95; 50 miles south of Washington, DC, which currently has a large-screen in place.
  - Skippers - the southern most facility, just across of the North Carolina state line which will have a large-screen deployed within in 40 days of a notice to proceed.
  - Vehicle probe data along I-95 will be the primary focus, though arterial data for alternate routes, like US-1 and US-301, is also available for dissemination and may prove to be the most beneficial information to the traveler.



Intercept surveys conducted in the field at various points in time could be used by the SAFE TRIP-21 program to obtain customer feedback and gauge usage. These could be designed to collect data on:

- The usefulness of the information
  - Actual or forecasted changes in travel – delay in departure, alternate routes, etc.
  - Desire to expand the program or number of displays
- Real-time, intermodal trip planning capabilities – The Coalition has also invested in a Passenger Information Program, designed to demonstrate how multimodal trip options and information can be provided to individuals seeking to travel between any two points in the region. The travel time data from the Vehicle Probe Project could serve as a source of information that could be provided to those planning trips so that they could make informed decisions that take into account trip times and costs for driving, air, rail and other options.

Under the SAFE TRIP-21 program, the Coalition proposes to work with the Volpe Center and BWI Airport in testing a real-time, intermodal trip planning capability enhanced with the addition of real-time data, as described below.

#### Providing Travel Time Information to Airport Users

An area where the I-95 Corridor has taken the lead concerning the longer distance (interstate and inter-city) trip is the integration of passenger information within two major airports: Baltimore Washington International Thurgood Marshall Airport (BWI) and Philadelphia International Airport. The Coalition has worked diligently to form institutional partnerships which are now in place. These efforts have focused on the dissemination of static information. Now, with the greater challenges posed by the SAFE-TRIP-21 program, the Coalition can build upon these efforts, and prepare for the management and dissemination of real time information concerning ground access services to major American airports. We plan to adapt the system we are developing for BWI Airport to include the use of real time and/or dynamically updated information. Our proposal would place this highly up-to-date travel information at ground information kiosks in the airport, and make it available via wireless devices such as cellular phones, and via the Airport's website.

The enhanced system would include the dissemination of real time information to the deplaning air traveler via kiosks within the airport showing ground transport detail *going from* the airport, and the dissemination of real time information to the passenger in the enplaning cycle via cell phones providing ground transport details *going to* the airport. Both elements of the system would operate off of the same database, and utilize the same algorithms; both elements would provide information for both roadway based modes and transit based modes. All data, whether designed to aid the traveler on the enplaning cycle or on the deplaning cycle, would be included in the website of each airport, allowing for access to all information by those with traditional Internet service facilities and connections.

We will deploy a series of “Real-Time Information Kiosks” at the baggage pick up areas or at ground transportation information booths, and adapt our trip itinerary planning software to



be usable on “touch screen” kiosk monitors, initially with travel information content consistent with what we have developed up to this point. However, the programmatic content will be changed to that needed by the traveler at the moment of departure from the airport. By way of example, there will be no data input form for “what day and what time do you want to travel?” This will be replaced by: “It is now exactly 4:07 PM, and the WMATA bus to Greenbelt leaves in 7 minutes.”

Each Information Kiosk would be capable of recommending trips via taxi, via shared ride van, and via public transportation. The user would be offered two recommended transit trips at an initial level of detail, from which one would be selected. The selected trip would be presented in great detail, including walking paths between modes, and available fare information. The Kiosk would print out the recommended transit trip itinerary if requested by the user.

The same kiosk would have highway route planning information. That program would first query the user about his/her destination, and build a ‘default’ routing path for the vehicle. The algorithm would then check the segments of that path for known (predicted) delays for construction etc. The system will include real-time travel time data on major routes in the region that are available from the Coalition’s Vehicle Probe Project. The proposed roadway routings would be shown on the large touch screen panel of the Kiosk, with increased detail for any segment requested by the user of the kiosk. The Kiosk would print out the final proposed routing for the driver, complete with updated construction alerts, and reported locations of unusual congestion at the time of printing.

In regard to the dissemination of information via wireless devices, the Coalition will look to work with private companies in order to take advantage of device display capability already available in the marketplace. The mobile information dissemination system would be dependent on the algorithm for managing real time information developed for the Airport Information Kiosks. Instead of the user interaction with the program via a touch screen, the user interacts via the keys on the wireless device.

In the first step, the device must identify the location of the user. If the user’s device is not properly GPS equipped, the location must be identified through telephony until an address or intersection is accepted by the program. Once the location of the user has been established, the program would continue on with the use of clarifying map graphics on the device screen.

When the algorithm knows where the user wants *to leave from* to get to the airport, a recommended transit trip itinerary can be quickly created by the same programs and data bases used in the Kiosk. The amount of graphic content provided to the transit trip maker will be determined by the sophistication of the mobile device. The display would inform the user of the basic trip plan, and the congestion level on major expressway segments of this route to the airport.



- Ability to accommodate other SAFE Trip-21 applications/Capability to incorporate other US DOT activities – Because it is an enabling technology, the Vehicle Probe Project is intended specifically for the testing of a variety of ITS applications such as sophisticated usage of travel time data for diversion of corridor traffic (i.e. load balancing of parallel facilities), automated incident detection and travel time prediction. It is also intended for testing the estimation of various performance measures that are essential for evaluating operational effectiveness. – The ability of USDOT to readily contract through the University of Maryland, as well as the structure of the Coalition’s contracts with INRIX and its program support consulting team, will facilitate the incorporation of other USDOT activities into the project.

The I-95 Corridor Coalition would be pleased to work with the Volpe Center in the testing of other applications proposed under the SAFE TRIP-21 program. We are aware of your interest, and the interest of some of our member agencies, in Smart Work Zone concepts. We propose to work with you, and one of our member agencies, the North Carolina DOT, in the testing of Smart Work Zone concepts, as described below.

#### More Efficient and Safer Work Zones

The Coalition proposes to work with the Volpe Center and the North Carolina DOT to test whether providing advance information about travel times and speeds in work zone areas can improve the efficiency and safety of work zone operations. Two tests are proposed.

One project would occur in a more congested urbanized area. That test could assess whether providing information on travel times through the work zone areas, through upstream DMS, through the State’s 511 system, and through commercial radio broadcasts, will divert traffic from the work zone area and lead to more efficient work zone operations.

The other project would occur in a more rural setting. That test could assess whether providing information on work zone area queues and speeds, primarily through upstream DMS, can reduce speeds approaching work zone areas, thus leading to safer operations. In addition, the test and evaluation could assess whether providing information on current speeds through the work zone area can help enforcement agencies more cost-effectively deploy enforcement resources by enabling them to focus on situations deemed to be most hazardous.

In conducting these tests, the Coalition and North Carolina DOT would be happy to work with the Volpe Center and the vendor of the iCone product. Through conversations with the vendor, we are aware that the concept of testing applications using the product was submitted in response to the SAFE TRIP-21 solicitation. Our understanding is that the Volpe Center would otherwise contract with the vendor to acquire the needed hardware, software and services. We propose to provide the staffing resources necessary to work with the Volpe Center, the vendor, evaluation consultants and the North Carolina DOT to advance



deployment of the project and its evaluation. We will also assist with technology transfer activities to help ensure our members are informed about the project and its results.

### **Test Site Facilities**

No other candidate test site in America is based upon the myriad of public and private sector facilities, equipment and institutional arrangements as the I-95 corridor.

Over a dozen traffic operations center function in the core project area of North Carolina to New Jersey, and the number of centers at least doubles when the full Coalition region of Florida to Maine is considered. Several agencies provide their sensor data to INRIX which combines it with its GPS vehicle fleet data received from more than a dozen private contracts and real-time internet data connections. MATOC in the Washington, DC region and TRANSCOM in the New York City region offer multi-agency operational coordination capabilities that have developed over years of collaboration and negotiation.

This test site is unique in several ways:

Communications Systems and Facilities: The I-95 corridor is so vast that all additional application activities will occur without any specific roadside or traditional VII/ITS infrastructure being deployed. Through INRIX, MATOC, and TRANSCOM, the wide area sensor and communication infrastructure needed to support the proposed mobility applications are readily available.

Data: The Coalition will have available an archive of the traffic flow data provided by the Vehicle Probe Project to support evaluation of the proposed mobility applications.

Institutional Arrangements: Importantly, the Coalition has the teams already under contract to develop, deliver and operate the multi-state web site. Through a simple transfer of funding to the Maryland State Highway Administration and the University of Maryland, the INRIX/PBS&J and Telvent teams can be tasked to perform the various projects. As described in other sections of the proposal, the capabilities of the teams include the resources to support test panels and communications and outreach experts.

### **Sustaining the Test Site**

One of the unique and attractive features of the Coalition test site is that it does not involve public infrastructure. All of the data collection and fusion is done by INRIX as an integral part of its business. The Coalition, acting on behalf of its member agencies, is an INRIX customer. In order to maintain customer satisfaction, and perhaps to generate additional revenue through additional premium service offerings, INRIX will be motivated to continue to sustain and improve its data collection/fusion infrastructure.

The I-95 Corridor Coalition has agreed to acquire data from INRIX, on behalf of its member agencies, for a three-year period that commenced earlier this year. The accuracy of the data is being independently evaluated. The Coalition contract (with the University of Maryland acting



as host), however, has a ten-year life. After the Coalition's purposes have been met at the conclusion of the three-year demonstration/test, the contract will remain available for the Coalition and its member agencies to add funding to it to continue to acquire data from INRIX, thus providing for "sustaining the test site" for continued data acquisition for another seven years.

### **Evaluation Support**

Data evaluation, collection and storage (archiving) are key elements of the Vehicle Probe Project. Data evaluation will be conducted by the University of Maryland on a continuous basis for the three years of data acquisition that are currently planned. This is an essential activity, since the contractor's payments are prorated as a function of the percent of roadway coverage that meets the accuracy required by the contract. A data sampling plan has been developed based on an alternative automated evaluation technique utilizing Bluetooth-enabled consumer electronic devices as sources of anonymous probe data. Ground truth data utilizing the Bluetooth technology as well as traditional floating car data was initiated in July of 2008, and continues on a rotating basis to the various states involved in the core network. The initial validation report is expected in October of 2008 and will include the evaluation of Inrix data against ground truth data collected in Northern Virginia, Maryland and Delaware in July through September of 2008. Ongoing validation will continue for the life of the vehicle probe project. The sampling plan encompasses the six core states. The accuracy of the Inrix data will be assessed for both the approximate 2000 miles of freeway and the 1000 miles of arterial data. Although official results have not been released at this time, the preliminary comparisons with ground truth data appear encouraging. This exercise not only is the first of its kind due to the scale of the vehicle probe project, but also demonstrates the utility of the new Bluetooth based data collection as a highly accurate and flexible method for obtaining high quality travel time data.



## MANAGEMENT APPROACH

The University of Maryland’s I-95 Corridor Coalition team is comprised of key staff from the University of Maryland, INRIX/PBS&J/EnterInfo team and the Telvent program support consulting team that includes KMJ Consulting, and Mr. Matthew Coogan. The sections below provide information on individual project schedules, technical and cost control, configuration management approach and staffing and qualifications.

### **Individual Project Schedules**

Project schedule information is presented below. Time to develop system requirements and designs, and to develop, integrate and test systems, has been provided for, followed by at least a 10-month test and evaluation period for each project.

Task	2008		2009												2010	
	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
<b>Evaluation of Long-Distance Trip Planning Using Real-Time Travel Time Data</b>																
System Development																
Testing & Rollout																
Operation/Evaluation																
<b>Displaying Travel Time in Public Areas</b>																
System Development																
Testing & Rollout																
Operation/Evaluation																
<b>Providing Travel Time Information to Airport Users</b>																
Requirements & Design																
Development & Delivery																
Evaluation Support																
<b>More Efficient and Safer Work Zones</b>																
Dependent on schedule of North Carolina DOT and Supplier																

Deliverables will include requirements and design documents, test plans and reports, and new /enhanced software, consistent with the terms of the contracts between the University of Maryland and the INRIX/PBS&J and Telvent teams.

### **Technical and Cost Control**

It will be the responsibility of the Principal Investigator to maintain positive technical and cost control. This will be achieved using various techniques throughout the life of the project, but it starts with the creation of a Project Management Plan within 10 days from notice to proceed. At a minimum, the Plan will include:

- Major tasks to be completed;



- Resources required and assigned to complete each task;
- Expected cost to complete each task;
- Anticipated starting and ending dates for each task; and
- Submittal schedule for deliverables.

This plan is the basis of all key project activities and it requires all members to acknowledge and agree to them. Locking down clearly defined, traceable and testable system requirements is the next step to mitigating technical and cost issues, as the requirements are the driving force behind the entire project. Once agreed to and “baselined” they can only be changed by going through the Change Control Board, which is designed to consider all options and consequences when change requests are made.

### **Configuration/ Change Management**

The Change Control Board (CCB), staffed by the principal investigator, representatives of Coalition member agencies directly affected, and the system development leads for each project, will be the mechanism to process and manage changes. Once a product baseline configuration has been established, all changes will then be controlled and documented. The I-95 Corridor Coalition will use this process to document and manage any changes related to the graphical user interface of the websites and displays, the introduction of new data sets, geographic expansion and additional functionality that may be added over the life of the project.

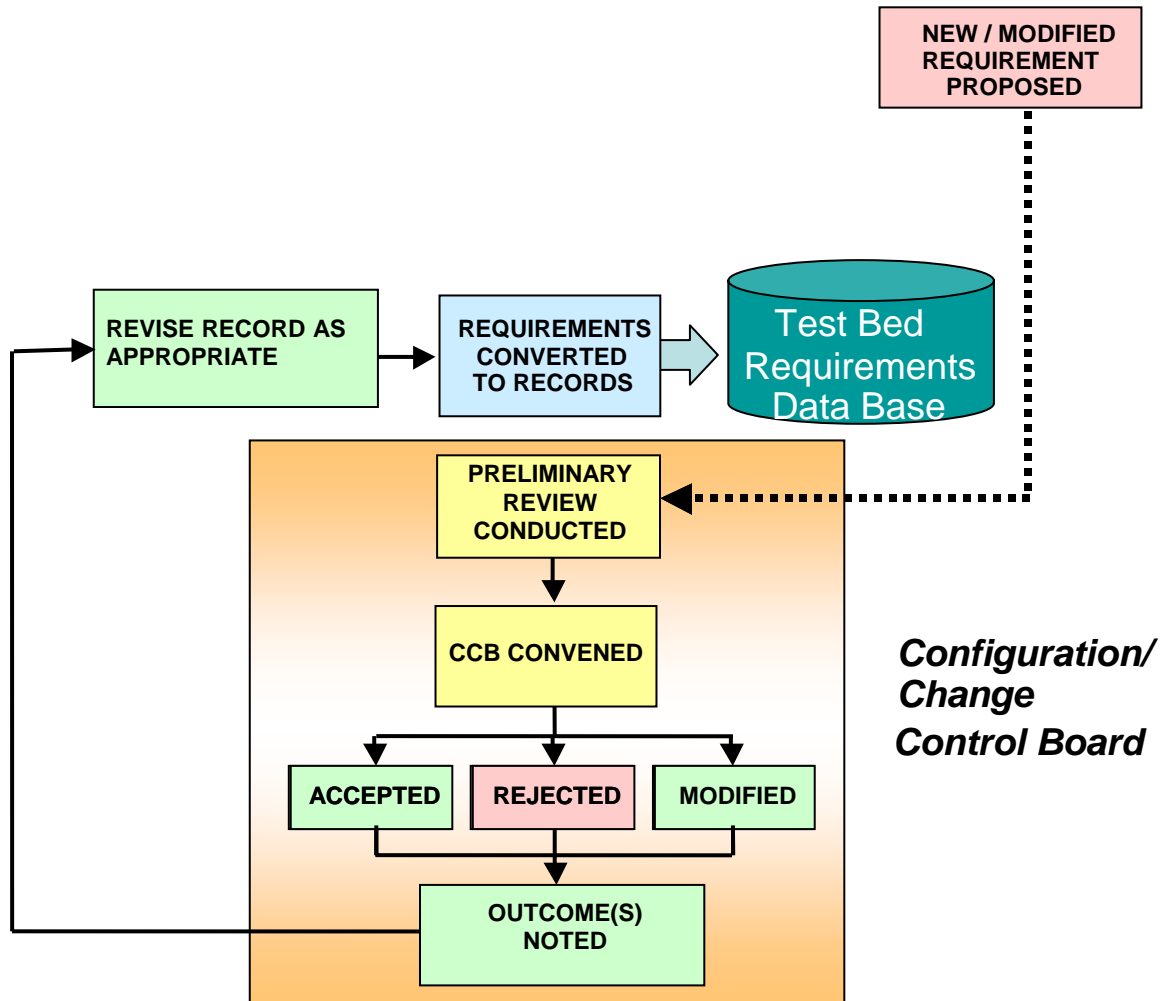
The objective of the change control element of configuration management is to maintain consistency and traceability of the design requirements, physical configuration, and changes made to documentation. This objective can be met if the following is adhered to:

- Identify the need for a change and initiate a change proposal for a project by describing the change(s) that needs to be considered and the justification for the change(s);
- Evaluate and document the impact the change if approved/disapproved;
- Provide a recommendation of how the change should be considered;
- Provide a recommendation of how the change will be implemented and verified;
- Identify any procedures, documents, and instructions required for incorporating the approved change in the product and its related product configuration information;
- Verify change incorporation and continued consistency with the product configuration information that need to be updated as a result of the change and propose a schedule for completion and verification;
- Identify and document approvals and implementing variances from the baselined product requirements;
- All change processing, including decisions must be documented and maintained as a CM Item; and
- Publish notification of Change Approval/Disapproval to all affected parties



The configuration change management process model shown in Figure 2 illustrates the typical flow of the change control process. It is capable of addressing permanent changes (Requests for Change) to provide a new product configuration, as well as temporary departures (Requests for Variance) from the approved configuration that allow the delivery of a non-conforming unit.

The CCB will be one of the tools to help control technical, and related cost, issues.



**Figure 2: Configuration/Change Management Process**

### Teaming/ Key Project Personnel

The “team” for this project is a collection of the I-95 Corridor Coalition’s member agencies, including the DOTs from North Carolina to New Jersey, the University of Maryland, the Vehicle Probe Data project team, led by INRIX as the primary data provider and PBS&J as the lead consultant, and the Coalition’s program support consulting team, led by Telvent with KMJ Consulting and Mr. Matthew Coogan as subconsultants. Collectively, these entities are a



geographically diverse and knowledgeable team of ITS, transportation and website development professionals focused on delivery of unique products to the larger membership of the Coalition (from Florida to Maine) and to the traveling public. Each team member has either financial, contractual or policy driven goals binding them to the I-95 Corridor Coalition, the Vehicle Probe Data project and, ultimately, the development of the products propose herein. If the project were to lose any particular individual over its lifespan, the loss would not be significantly felt due to the significant resources available to the team, and the project would continue as planned.

### **Deliverables/ Progress Reporting**

The team will develop and submit monthly progress reports which will document progress achieved during the month, as well as work planned for the month subsequent. The day to day operations of the project will be updated in these monthly reports, making transparent all work done to date. Work will be compared against documented milestones. Any unresolved issues that develop will be addressed in the progress report.

### **Key Milestones**

- Key Milestones for this project were documented above under Schedule.