

Frequently Asked Questions

Overview

What is Vehicle Infrastructure Integration (VII)?

A voluntary research initiative between Federal and State Departments of Transportation U.S. vehicle manufacturers, and some local road authorities to define and test a secure communications system linking vehicles with each other and with road-side infrastructure to be used primarily for improving the safety and efficiency of the nation's road transportation system. This communications system may also be used for productivity and convenience applications to the extent they do not interfere with real-time safety applications. Research is intended to result in a system that can be deployed on a nation-wide basis and supported in all vehicles.

Why do we need VII?

Today, vehicle crashes result in more than 42,000 deaths per year and congestion costs are estimated at \$78 billion per year in urban areas across the nation.¹ VII has the potential to significantly reduce the continuing rise in these statistics. VII enables a leap forward in both safety and congestion management capabilities, and also has the ability to provide travelers with services that they want to make travel more convenient. When deployed, VII will enable a whole suite of "active safety" applications that are designed to increase drivers' situational awareness and ability to detect and respond to hazards. VII will also provide significantly better data for traffic management and traveler information than what is currently available. While some of these safety capabilities can be done through a combination of technologies on luxury vehicles, and a basic level a traffic data is available in most large cities today, VII promises a common, interoperable technology platform that can support a whole suite of applications — thus providing the economies of scale needed to make deployment affordable nationwide and in all vehicles.

What is being done to advance VII research and development?

The national VII program supported by U.S. Department of Transportation (U.S. DOT) and its partners is divided into three phases:

- Phase I — Operational testing including *SafeTrip-21*
- Phase II — Research in the areas of enabling technology, institutional issues, and applications to support deployment
- Phase III — Technology scanning to determine potential new technology horizons for VII

In December 2007, U.S. DOT announced *SafeTrip-21* — Safe and Efficient Travel through Innovation and Partnerships in the 21st Century. This multi-application field test of safety and congestion-reducing technologies will be launched at the Intelligent Transportation Systems World Congress in New York City from November 16-18, 2008, and then integrated into other test locations. *SafeTrip-21* builds upon research into the use of information, navigation, and communications technologies to prevent accidents and alleviate congestion by providing drivers with real-time safety warnings, traffic and transit information, and advanced navigational tools. *SafeTrip-21* will accelerate testing and deployment of these capabilities.

Phase II continues the foundational research necessary to determine the viability of a nationwide VII deployment decision. Significant work has been done in partnership with automakers, equipment suppliers, and State and local governments in assessing potential technology and applications. Concept testing is being conducted in Michigan, California, Virginia, Arizona, Florida, Minnesota, and New York. Privacy principles and related technical requirements have been developed. Study of other legal and institutional issues is underway, and work has begun to explore potential deployment scenarios and business models. Phase III will be an ongoing

¹ Texas Transportation Institute, 2007 Annual Urban Mobility Report

scanning activity to make sure that the VII initiative continues to plan for and use the best available technology over time. In addition, many states, universities and the private sector are conducting VII related research and testing.

What are the primary benefits of VII?

Roadway safety is the primary benefit. Significant benefits are also expected for operations and maintenance of the transportation network, including congestion mitigation, due to the real-time performance feedback that VII is expected to provide. In addition, there may be benefits for many other applications and industries that can make use of a high bandwidth data connection between vehicles and the infrastructure.

How will VII make driving safer?

VII will make driving safer by providing the driver and vehicle with information on the immediate status of the roadway and other vehicles in the area. As a simple example, VII may provide data in the vehicle on road signs and warnings, information on stopped vehicles ahead, or on traffic signals or signs that the vehicle may be in danger of violating. Eventually, if most vehicles on the roadway are equipped with VII technology, it will be possible for vehicles to exchange real-time information about their relative positions and trajectories, and to use this information to avoid or mitigate crashes.

How will VII improve mobility and help fight traffic congestion?

The VII system will provide up-to-the-minute data about traffic and roadway conditions on all equipped facilities. VII data will enable transportation managers to detect traffic congestion, incidents, ice, potholes, and other hazards. Transportation agencies can use this information to clear hazards more quickly, adjust traffic control devices (such as traffic lights, ramp meters, and lane control devices), and to provide detailed advisory messages to motorists, thereby reducing traffic delays and improving flow. VII data can also be used to improve transit and commercial vehicle fleet routing choices based on traffic conditions. When built out, the VII system has the potential for providing data with substantially better quality, coverage, and timeliness of delivery for traffic management applications than existing sources.

What kind of convenience applications may be possible with VII?

The VII communications network, if deployed, will allow a vehicle owner to opt into a service that provides vehicle diagnostic information in real time to the vehicle manufacturer or maintenance provider. This will allow improved diagnostics of the vehicle performance, and possibly remote repair or upgrades of software in the vehicle. VII could also be used for downloading high content materials (such as movies) into traveling vehicles, providing location specific services and parking information, and enabling users to conduct payment transactions from their vehicles.

What other applications might be possible with VII?

VII is being designed with an open architecture that will enable numerous applications that are consistent with the program scope and goals. VII applications fall into three main categories: 1) those designed to enhance safety, 2) those designed to improve mobility and the efficiency of road operations, and 3) those designed to enhance productivity and convenience for road users. Within these three categories, well over a 100 applications have been conceived of so far, and most experts believe that this is actually a small percentage of the number of applications that would be designed for VII, if deployed.

Who is involved with VII?

The National VII Coalition includes representatives from the U.S. Department of Transportation, several state departments of transportation, and light vehicle manufacturers. In addition, representatives from the American Association of State Highway and Transportation Officials; Institute of Transportation Engineers; Intelligent Transportation Society of America; International Bridge, Tunnel and Turnpike Association; and National Association of Counties are also

represented on the Coalition.

Who else might become involved?

As the VII research program moves from concept development and testing into applications development and deployment, other stakeholders will be important for its success. Active engagement with potential developers and users of VII applications will be necessary, as well as engagement with potential network deployers and interest groups. The VII Coalition has already begun active engagement with privacy advocacy groups to ensure that user privacy is actively protected through the VII system.

Data Access and Privacy

What happens to the vehicle data that is collected by Vehicle Infrastructure Integration (VII)?

All data collected by or through VII will be handled in accordance with established laws and privacy policies developed for a National VII Program. We expect there to be two general categories of data: anonymous data that is untraceable to a particular vehicle and that will be aggregated and generally available for the operation of the transportation network, and data that will be identified with a particular vehicle or owner for such purposes as providing diagnostic information and facilitating electronic payments. Such personal information will be encrypted, and will only be collected, used, and disseminated in accordance with an agreement between the vehicle owner and the service provider, which in turn will be subject to privacy protection laws and regulations. A Privacy Principles Framework document has been developed and is available in the VII website Library.

Will the system be able to track vehicles?

No, VII will ensure anonymity by design and policy; the system will not have the ability to track user activity. VII will support verification without identification — the system will use anonymous digital certificates to verify that information is being sent from a valid source.

What about services that require personal information?

These services will only be provided to customers who opt-in. In these cases, privacy is maintained by secure, end-to-end transactions between a mobile user and a remote service provider. These service providers would be subject to privacy laws and regulations that require them to protect the privacy of individuals — personal information cannot be shared without a customer's permission. Law enforcement officials would have to seek a court order before accessing personal data without the permission of the person who owns the vehicle.

Will VII support law enforcement and surveillance purposes?

No. Because VII will not be able to track individual vehicles, it will not support speed enforcement or other law enforcement actions. In the case of optional services that do require identifying information, law enforcement officials would have to seek a court order before accessing personal data without the permission of the person who owns the vehicle.

System Design

What kinds of communication will the Vehicle Infrastructure Integration (VII) network support?

The VII system will support wireless communications:

- Between vehicles — to enable safety applications aimed at preventing vehicle-to-vehicle crashes
- Between vehicles and an infrastructure element, such as a traffic signal or toll plaza — to enable transactions with that device, such as potential violation warnings or payment transactions

- Between vehicles and roadside equipment connected to a network — to enable traveler information and other services that require information from the system as a whole.

What technical capabilities will the VII System support?

To support the basic safety, mobility, and convenience applications envisioned through VII, the system must:

- Facilitate very accurate positioning for mobile devices (GPS plus corrections)
- Generate basic vehicle-to-vehicle safety messages (heartbeats)
- Distribute anonymous “probe” sensor data collected by mobile devices on vehicles
- Deliver geographically focused advisory messages to mobile devices
- Provide a secure communications infrastructure for transactional services
- Support communications session continuity between infrastructure access points (road-side equipment)

Additional technical requirements are described in the Concept of Operations and National System Requirements documents, available on the Library page of the VII Coalition website.

What wireless communications will be used?

Research to date has focused on Dedicated Short Range Communications (DSRC) technology, which utilizes 75MHz of radio spectrum around the 5.9GHz band that was dedicated by the Federal Communications Commission for vehicle safety purposes. DSRC provides the secure, low latency, and high availability requirements necessary for active safety transactions. Other communication technology may be used in combination with DSRC to support certain network-based mobility applications and augment data sources until a full VII network is established. The U.S. Department of Transportation (U.S. DOT) is conducting periodic technology scanning to evaluate and assess the potential impacts of new and alternative communications capabilities.

What communication standards will apply?

- ITS Standards related to VII are: IEEE 1609 Family of Trial-Use Standards for Wireless Access in Vehicular Environments (WAVE),
- IEEE 802.11p Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part II: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification, and
- SAE J2735 Dedicated Short Range Communications (DSRC) Message Set Dictionary.

A fact sheet is available on the IEEE 1609 Family of Trial-Use Standards for Wireless Access in Vehicular Environments (WAVE). http://www.standards.its.dot.gov/fact_sheet.asp?f=80

A second fact sheet is available for the SAE J2735 Dedicated Short Range Communications (DSRC) Message Set Dictionary. http://www.standards.its.dot.gov/fact_sheet.asp?f=71

IEEE also provides information on the status of the IEEE 802.11p standard. http://grouper.ieee.org/groups/802/11/Reports/tgp_update.htm

Is there a system architecture for VII?

A VII concept architecture is currently being testing through a proof-of-concept test. This architecture has been designed to support a suite of safety and mobility applications, protect personal privacy, and be scalable up to 200 million mobile users. This concept architecture is subject to change following testing and early demonstration activities. More information about the VII concept architecture is available in the Concept of Operations and National System Requirements documents, available on the Library page of the VII Coalition website.

What is the Proof-of-Concept test?

In order to operationally test the VII concept, U.S. DOT and its partners are conducting VII Proof-of-Concept (POC) testing. Test environments have been established in California and Michigan. Testing includes both a System Integration Test, and an Applications Integration Test. Testing is expected to be completed by mid-2008. However, it is expected that test environments will be maintained following POC completion and may expand to other locations.

The System Integration and Test is expected to demonstrate the technical viability of the VII system concept. Specifically, it is intended to test the capabilities of the 5.9GHz DSRC communications standards, test the VII System architecture to show the ability to simultaneously provide for a diverse set of system user groups, test the VII system management and security capabilities; specifically vehicle and road-side equipment management, and finally, demonstrate that the VII system provides technical solutions to address policy concerns: anonymity, privacy, and security.

The Applications Integration and Test is expected to demonstrate that the VII system can meet basic objectives to prove the viability of VII-enabled applications. Specifically, it is intended to test the safety and mobility functions, demonstrate support for private/commercial services, and concurrent operation/prioritization of public and private applications.

Deployment

Where will Vehicle Infrastructure Integration (VII) be deployed?

The vision is for VII to be deployed nation-wide eventually. However, the VII network is likely to be deployed incrementally with applications for specific purposes being implemented in limited geographic areas initially and expanding over time.

When will VII it be deployed?

A deployment schedule has not been determined. Infrastructure testing, research and demonstration activities are expected to continue through at least 2010.

How much will be added to the cost of a new vehicle to equip it with VII?

This is not clear at this time, although based on the cost of similar hardware today, the cost is expected to be relatively modest.

How much will it cost to build the infrastructure and how will it be paid for?

The build-out of a national infrastructure, including the communications back-haul, is expected to cost between \$5 and \$8. In addition, it is expected that it will cost approximately \$100 million/year to operate, maintain, and govern a National VII Program, once deployed. The VII program is currently undertaking business and legal studies to help frame a deployment and operating plan for VII. Both deployment and operations are expected to involve public-private partnerships.