Survey of U.S. Vehicle Infrastructure Integration (VII) Related Testbed Activities

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
1	**VII POC Testing Detroit, Palo Alto, Herndon** As part of the US DOT VII program, the US DOT is funding the VII development test environment (DTE) near Detroit, Michigan. Some development tests done in Herndon, and some field testing planned for California	US DOT/ BAH VII Coalition (VII-C partners include: General Motors, Chrysler, Toyota, BMW, Nissan, Volkswagen, Honda, Daimler, Ford) Road Commission of Oakland County	Mike Schagrin, US DOT 202-366-2180	ITS Applications: Traveler information Arterial Management Freeway Management Electronic Payments and Pricing Road Weather Management Day 1 Applications: Traveler Information Invehicle Signing Electronic Pay Ramp Metering Weather Information	DSRC WiMax: 28 sites Wireline: 21 sites 3G: 5 sites Canopy: 2 sites WiFi: 1 site	11/2006 thru ?	On-road testing scheduled to begin in 1/08	IEEE 1609.1-4 IEEE 802.11p SAE J2735	VII focused research
2	**DATA Use Analysis and Processing Project (DUAP):** -Evaluate Data Use, Analysis and Processing of VII-related data -Development of algorithms to use and process the VII data -Development of prototype applications and data management software using data from the Michigan VII test bed -Evaluation of how well the data and the algorithms function for a state and local transportation department - The Michigan VII test bed is located along I-96 Oakland County and in Auburn Hills	Michigan DOT & US DOT/Mixon/Hill, UMTRI	Greg Krueger ITS Program Manager Michigan DOT 517-373-9479 248-388-0729m Lee Mixon, Project Manager, Mixon/Hill 913-239-8400 Kyle Garrett, Technical Manager, Mixon/Hill 913-239-8400	ITS Applications: Arterial Management Freeway Management Transit Management Incident Management Day 1 Applications:	Data Analysis and Processing Activity	2/2007 thru 11/2008	A Concept of Operations was completed in 8/2007, System requirements are now being reviewed and development of a prototype design has begun	N/A	VII focused data analysis for DOT applications

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3	**Michigan VII Testbed:** **-** Michigan started deploying their VII Testbed two years ago. They are working primarily with car companies, tier 1 suppliers and telecommunications companies. - Michigan DOT is focused on operational aspects of back end DOT applications (maintenance, snow removal, etc.) - The Michigan VII test bed is located along I-96 Oakland County and in Auburn Hills	Michigan DOT/ HNTB	Greg Krueger ITS Program Manager Michigan DOT 517-373-9479 Jim Barbareso, HNTB, Project Manager 313-961-3330	ITS Applications: Day 1 Applications:	Deployment of 802.11 a/b/g (WiFi) with expansion to include DSRC radio equipment	Started 2005	Working on additional deployments	No	Potential applicability to future VII testbed work
4	**Highway/Metro Wireless Backbone (Wireless with Mobile Hotspots)** **Cisco wireless links on Smart Road:** **-** Setting up wireless networks for police, fire, transit - Vehicle 2 Roadside 802.11 a/b higher bandwidth apps., streaming video, not mission critical - Not addressing DSRC highspeed, low overhead, secure networks, mission critical - Throughput degradation over multiple hops - Characterizing throughput from vehicle to roadside - Characterizing handoff latency between mobile unit and roadside Access points - Optimizing handoff between mobile unit and roadside access points at varied speeds - Investigating antenna separation effect on collision/contention throughput - Investigating channel assignments effect on collision/contention throughput - Implementing Cisco Mobile IP - Characterizing the affect of LEAP encryption on handoff latency - Optimizing high bandwidth applications such as video across wireless networks - Implementing ObjectVideo Mpeg4 analytics with Cisco QOS controls	Cisco Systems/Virginia Tech Transportation Institute	Ashwin Amanna, Virginia Tech Transportation Institute 540-231-6349	ITS Applications: Emergency Management Day 1 Applications:	Vehicle-to-Roadside 802.11a/b higher bandwidth applications		Working on Final Report	N/A	Can potentially support VII applications, but not a replacement for them

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5	**Connected Vehicle Proving Center:** Working to broker research opportunities for VII POC testbed, automaker test vehicles, etc. The goal is to link wireless enabled roads, proving grounds and test tracks, independent bench test laboratories and traffic management centers with a centralized data processing, evaluation, and training center through the CVPC.	Connected Vehicle Trade Association (CVTA)/Connected Vehicle Proving Center (CVPC)	Scott McCormick 734-354-0546	ITS Applications: Day 1 Applications:	N/A	N/A	N/A	N/A	Future VII Applications Testing
6	**Probe Sampling Strategies for Traffic Monitoring Systems Based on Wireless Location Technologies (WLT):** - Tysons Corner Simulation VII testbed - WLT-based traffic monitoring systems are a form of probe-based monitoring that help approximate the average travel speed and travel time on a road by tracking a series of estimated positions for wireless devices (such as cellular phones) that are located in vehicles - Speeds for these devices can then be derived by looking at a series of position locations over time	Virginia Department of Transportation/ Old Dominion University University of Virginia	Michael Fontaine, Research Scientists, VDOT (434) 293-1980	ITS Applications: Traveler Information Arterial Management Day 1 Applications:	Based on Anonymous Cellular Telephone Data for Traffic Surveillance		Final report 1/2007	N/A	Defining minimal sample sizes for traffic monitoring Helpful for future VII work

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7	**Research Foundation to support Cooperative infrastructure/Vehicle Surface Transportation Control Management:** - Use vehicle route guidance information in combination with signal optimization programs to improve arterial management - This work involves development of modeling tools capable of capturing such networking and development of methods for beneficial integration	NSF/ University of Virginia	Brian Smith, Associate Professor, UVA (434) 243-8585	ITS Applications: Arterial Management Day 1 Applications:	N/A		Some preliminary analysis	Models idealized version of VII, ignoring privacy compliance	Idealized version of VII Incremental VII research
8	**Preparing to Use Vehicle Infrastructure Integration in Transportation Operations: Phase 1** **-** Development of a high resolution VII/traffic simulation environment using AIMSUN for traffic simulation, integrated with custom code that emulates VII functionality. Using this model, VII roadside units (RSUs) were “placed” based on guidance from the VII architecture and the extent of VII coverage was determined. A prototype traffic monitoring application was developed and evaluated for various penetration rates of VII equipped vehicles on an urban traffic network in the Tysons Corner area. - Based on current guidance in the VII Architecture, it was found that roughly 55% of the sections in the network would be within the direct range of an RSU. The accuracy and coverage analysis of the network illustrated that, based on the current VII architecture, around 60% of the network could be “covered” at low penetration rates. The error range for mean speed estimation was in range of 2.5 to 4 mph, even at very low VII penetration rates.	VDOT/University of Virginia	Cathy McGhee, Program Manager, VDOT (434) 293-1973 Brian Smith, Associate Professor, UVA 434-243-8585	ITS Applications: Crosscutting Infrastructure Assessment Day 1 Applications: Crosscutting Infrastructure Assessment	DSRC Simulation	7/2005 thru 8/2007	Final Report	Based on VII Arch. & stds.	VII focused research

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9	**VII Data Characteristics Task:** - Develop Trajectory Conversion Algorithm (TCA) software - Perform analytical assessment of VII probe - Develop VII algorithms to process this probe data into measure of interest - Simulation testbeds include: * St. Louis, Missouri * Camden, New Jersey * Van Ness Ave., San Francisco	US DOT/ Noblis	Mike Schagrin, US DOT 202-366-2180 Karl Wunderlich, Noblis 202-488-5707	ITS Applications: Traveler Information Freeway Management Arterial Management Day 1 Applications:	N/A	3/2006 thru 2/2008	Tests in all 3 testbeds complete 7/2007 Currently revising the process	Simulation of std. J2735	VII Program
10	**Ascertaining Viability of WiFi based Vehicle-to-Vehicle Network for Traffic Information Dissemination:** -Examine the characteristics of a vehicular ad hoc network and whether it can support effective traffic information dissemination - Assess bandwidth limitations of WiFi - Assess a simple data distribution algorithm - Simulated Southern New Jersey Testbed	NSF Career Award Programs Grant/Rutgers University	Samir Goel 732-878-0499 gsamir@cs.rutgers.edu Tomasz Imielinski Imielinski@cs.rutgers.edu	ITS Applications: Traveler Information Day 1 Applications:	GPS, static digital map and WiFi link (802.11 protocol or DSRC std.)		Final Report	Partial	Vehicle-to-Vehicle

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11	**ATIS Implementation and Integration throughout the I-90 Phase 2 Connector/ITS Test Bed Laboratory Transportation Network:** - A fleet of Global Positioning System—equipped vehicles shared real-time data about network travel times over a wireless network and had their path choices automatically updated accordingly - Researchers assessed the behavior of these 200 vehicles during the 3-month experiment and analyzed the kind of information that can be derived from the data archive that the vehicles created including real-time traffic-responsive path choice, travel times, compliance, and more - Planners, designers, and system operators can learn much about the way a system behaves and can sharpen their ability to create systems that work effectively and efficiently under all ranges of use Project features include: -Investigating wireless communications technologies to achieve cost-effective travel data collection from various modes -Instrumenting the transportation infrastructure and collecting travel data from commuters -Analyzing collected data and producing traveler information -Integrating the traveler information with transportation modes and transportation management centers - U.S. Route 4 ATIS testbed	New York State DOT Rensselaer County/Rensselaer Polytechnic Institute and North Carolina State University	Tim Conway NYS DOT Region 1 (518) 388-0381 Brian Menyuk NYS DOT (518) 388-0360/ Rensselaer Polytechnic Institute George List, North Carolina State University, Raleigh 919-515-7212 gflist@ncsu.edu	ITS Applications: Traveler Information Emergency Management Day 1 Applications: N/A	GPS, PDA with Sprint 3G card	10/30/2002 thru 3/31/2007	Developing Final Reports	N/A	Vehicle-to-Infrastructure En-Route Path Choice

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12	**Commercial Vehicle Infrastructure Integration Program:** **-** It is intended that the Department's CVII Program will develop, test and demonstrate commercial vehicle based data communication witht the VII roadside equipment (SE) Currently under development by USDOT. -Develop, test and demontrate the necessary and appropriate commercial vehicle on-board equipment and software for integration with the ongoing USDOT VII Initieative. - The Department and its partners desire to leverage the existing light vehicle based VII technology development to enhance commericial vehicle safety, security and mobility by partnering with one or more Entity to develop, test and demonstrate a prototype system that utilizes the VII architecture and sytem requirements as well as the SAE J1708 vehicle data bus and the standard message sets SAE J1587, SAE J1939 and SAE 2735. - 13-mile test site on the NYS Thruway Authority's Spring Valley Corridor - Development, testing and demonstration of commercial vehicle in-vehicle hardware and software to allow data message sets (DMS) to be wirelessly transmitted via DSRC provided by other sonsistent and compatible with the VII architecture and standards, including the 802.11p 5.9 GHz radio and IEEE standards - Testing of the communication of the commercial vehicle DMS to the VII 5.9 GHz roadside	New York State Department of Transportation	Al Hasenkopf, Senior Transportation Analyst, NYSDOT, 518-457-2600	ITS Applications: Commercial Vehicle Operations Day 1 Applications: Potential applications	DSRC	RFI	About 25 responders	VII Architecture & stds. DSRC, SAE J1708 vehicle data bus and the standard message sets, SAE J1587, SAE J1939 and SAE 2735.	VII focused research

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13	**World Congress VII Testbed:** A VII testbed is under development for the 2008 World Congress in New York City Between 20 - 22 5.9 GHz locations will be set up along I-495 North of the Long Island Expressway including some intersections in the Westburry area along Rte. 25 The VII applications will include invehicle signing, curve speed warning, transit priority, commercial vehicle operations, and school zone warning Between 10 - 12 5.9 GHz locations will also be established in Manhattan to demonstrate some traveler information applications	World VII Demo Committee: NYS DOT, NY City, US DOT, ITSA Members (equipment manufacturers, automakers and others)	Emilio Sosa, NYS DOT 631-952-6733 Mike Freitas, Connexsis	ITS Applications: Freeway Management Arterial Management Traveler Information Commercial Vehicle Operations Day 1 Applications:	DSRC CDM spread spectrum Ethernet over fibre Private cellular network similar to Japan??	Complete by WC	Completing communications Backbone Defining Applications	VII Arch. & Stds. starting point	VII Focused Demonstration Building upon VII Program
14	**VII California Testbed on US-101 and State Route 82 near Palo Alto:** Phase 1 VII Test Bed The first phase involved installing VII equipment in a few roadside installations, implementing a few select VII applications and then providing a successful demonstration at the ITS World Congress in November 2005. Four roadside units were installed that successfully communicated with five different vehicles. Demonstrations included: - a traveler information application that presented live 511 travel times and incidents in the vehicle - a mapping application that showed the status of VII-equipped vehicles in real time including vehicle speed, heading, wiper status, and headlight status	Metropolitan Transportation Commission (MTC) & Caltrans/PATH	Greg Larson, Chief, Office of Traffic Operations Research, Division of Research and Innovation, California Department of Transportation 916-657-4369 Melanie Crotty, Director, Traveler Coordination and Information, MTC 510-817-5880 Jim Misener, Transportation Safety Research Program Lead 510-665-3612 http://www.viicalifornia.org/	ITS Applications: Freeway Management Arterial Management Traveler Information Day 1 Applications:	Heterogeneous backlinks T1 Wireline 3G Modem WiMax (coming)	Yes, Completed 2005		IEEE 802.11p ("not completely") SAE J2735	VII focused research

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15	**VII California Testbed on US-101 and State Route 82 near Palo Alto:** **Proposed Phase 2 VII Test Bed** The goal of the next phase of the VII test bed will be to increase the number of roadside installations and the number of VII-equipped vehicles to enable a realistic evaluation of the viability of VII as a tool for system management and improved traffic safety. The proposed contract amendment would support up to 40 roadside installations over the next year along the project corridor and test the following VII applications: - Traveler Information, which processes data collected from the VII-equipped vehicles and sends 511 information directly into the vehicles - Signal Violation Warning, which warns vehicles if they are driving too fast as they approach a traffic signal that is about to turn red - Curve Overspeed Warning, which warns vehicles if they are driving too fast as they approach a sharp curve - Toll Collection, which electronically collects tolls from vehicles as they pass roadside installations - Adaptive Ramp Metering, which uses traffic flow data collected from VII-equipped vehicles to automatically adjust metering rates at freeway on ramps	MTC & Caltrans/California PATH, University of Virginia	Greg Larson, Chief, Office of Traffic Operations Research, Division of Research and Innovation, California Department of Transportation 916-657-4369 Melanie Crotty, Director, Traveler Coordination and Information, MTC (510) 817-5880 Jim Misener, Transportation Safety Research Program Lead 510-665-3612 Brian Smith, Associate Professor, UVA (434) 243-8585 http://www.viicalifornia.org/	ITS Applications: Emergency Management Freeway Management Arterial Management Traveler Information Day 1 Applications: Traveler Information Ramp Metering Electronic Pay Curve Speed Warning Signal Violation	DSRC, GPS		Current status: US DOT, Caltrans and MTC are coordinating the POC participants on creating a California Development Test Environment elements of the POC.	Some VII program testing planned for California testbed, integration into common backhaul network	VII focused research

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16	**GPS Mobile Probes: A Field Experiment:** - The experiment will test a novel traffic monitoring system designed to collect velocity and position data from GPS-enabled Nokia N95 cellular phones - Provides proof of concept for traffic-flow reconstruction from probe vehicle measurements - 100 vehicles carrying the GPS-equipped Nokia N95 will drive along a 10-mile stretch of I-880 between Hayward and Fremone, CA	California Center for Innovative Transportation Caltrans Nokia University of California at Berkeley	Alexandre Bayen Department of Civil and Environment Engineering, University of California at Berkeley 510-642-2468 Quinn Jacobson Technology Incubation Group, Nokia 650-521-3243 JD Margulici California Center for Innovative Transportation 510-642-5929	ITS Applications: Freeway Management Arterial Management Day 1 Applications:	GPS, Cell Phones	Current	Test planned conducted February 8, 2008	N/A	Traffic flow study

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17	**Development and Evaluation of Selected Mobility Applications for VII:** Design, test and evaluate three innovative ways of using wireless communications capability for VII to improve mobility: - Collect probe vehicle data to characterize local freeway traffic speed and density, then use that information to generate reference speed advisories to individual drivers to help dissipate shock waves and improve throughput - Use the same type of probe vehicle data to generate reference speed and gap adjustment commands to cooperative adaptive cruise control systems, to enable them to also dissipate shock waves and increase throughput, while improving driver acceptance - Use vehicle-vehicle communication between heavy trucks to enable them to operate in close-formation automated platoons, increasing lane capacity and reducing aerodynamic drag - Microscopic simulation and track testing (Crows Landing, CA)	US DOT-FHWA & California PATH Cooperative Agreement	Bob Ferlis, Technical Director for Operations R&D, TFHRC 202-493-3268 Steven Shladover, Research Engineer, PATH 510-665-3514 510-499-8155m	ITS Applications: Driver Assistance Freeway Management Commercial Vehicle Operations Day 1 Applications: Beyond Day 1	3 DSRC V-V Units (trucks) Cellular Telephone Modems providing traffic information to passenger cars	10/2007 thru 10/2010	Preparing for Project Kickoff	Starting point VII stds.	VII Future Applications Vehicle-to-Vehicle
18	**Next Generation of Smart Traffic Signals:** - Assess whether a self-adaptive traffic control system can be an effective approach for large scale adoption of adaptive traffic control systems - Develop and test a next generation traffic adaptive control system that is self-learning; eliminating the need for traffic signal operators to collect the data needed to set control parameters - Simulation analysis and limited field testing will be conducted; VII-enabled enhancements will be developed and tested	US DOT-FHWA & University of Arizona ATLAS Center Cooperative Agreement	Raj Ghaman, Team Leader, TFHRC 202-493-3270 Pitu Merchandani 520-621-6551	ITS Applications: Arterial Management Day 1 Applications: Beyond Day 1	N/A	10/2007 thru 10/2010	Preparing for Project Kickoff	N/A	Minor Relevance Assessment of Adaptive Control working within VII environment

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19	**Intelligent Multi-Sensor Measurements to Enhance Vehicle Navigation and Safety Systems:** - Assess improvements in both lane detection systems and vehicle positioning to achieve near 100% availability - Develop an accurate, robust, and reliable vehicle positioning system capable of high-update rate lane-level measurements for future vehicle navigation and safety systems - Integrated sensor fusion approach including lane departure warning (LDW) cameras, MEMS inertial sensors from vehicle ESC system, LIDARS for collision avoidance, and High Accuracy Nationwide Differential GPS (HA-NDGPS) - The system will be tested on test track vehicles (Auburn NCAT test track)	US DOT-FHWA & Auburn University Cooperative Agreement	Dave Gibson, Highway Research Engineer 202-493-3271 David M. Bevly, Assistant Professor, Department of Mechanical Engineering, Auburn University 334-844-3446	ITS Applications: Freeway Management Arterial Management Day 1 Applications: Beyond Day 1	Location: High Accuracy Nationwide Differential GPS (HA-NDGPS) Infrastructure Sensors: Lane Departure Warning (LDW) Cameras Vehicle Sensors: MEMS inertial sensors from vehicle ESC system, LIDARS	10/2007 thru 10/2010	Preparing for Project Kickoff	No	Strictly sensor testing
20	**Intersection Control for Autonomous Vehicles:** - Investigate how intersection control mechanisms can leverage autonomous vehicles to improve safety and efficiency - Study the impacts of an intersection control “space-time reservation” system for autonomous vehicles. Through V2I communications, vehicles request and receive time slots for intersection traversal. Vehicle automation allows accurate delivery of vehicles at reserved time slots. This concept will be studied through simulation, physical robots, and a full size vehicle.	US DOT-FHWA & University of Texas at Austin Cooperative Agreement	Gene McHale, Team Leader, TFHRC 202-493-3275	ITS Applications: Arterial Management Day 1 Applications: Beyond Day 1	DSRC	10/2007 thru 10/2010	Preparing for Project Kickoff	Starting point VII stds. Expand as needed to conduct research	Future VII

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21	**Reliable Range of Individual Travel Time Information in Vehicular Ad Hoc Networks:** Using mobile ad hoc networks for traffic management Baltimore-Washington Parkway testbed (simulated) - Data analysis and reliability - Independent of technical issues other than protocols	University of Maryland	Hyoungsoo Kim, Univ. MD 301-405-6550 hsookim@umd.edu Dave Lovell, Univ. MD 301-405-7995 lovell@eng.umd.edu	ITS Applications: Freeway Management Arterial Management Day 1 Applications: N/A	Wireless LAN, GPS		Final Report 11/2006	N/A	Vehicle-to-Vehicle Insight into performance of V-2-V systems in urban area
22	**Investigation of Communications Considerations in the Simulation of VII-Enabled Applications:** **-** Develop and evaluate cooperative control strategies, with a focus on cooperative control strategies for route guidance and signal timing **-** A crucial component of this analysis is the underlying communications architecture that will support these cooperative control systems. The wireless network is a hybrid ad hoc network, with combinations of vehicle to roadside and vehicle to vehicle networking. The ultimate success of the cooperative control systems rests on the ability of this complex wireless network to deliver the needed data with low latency.	The Center for Intelligent Systems Research (CISR) of the George Washington University, the University of Virginia (UVA), and Scalable Networks Technologies, Inc. Earmark	Azim Eskandarian, George Washington University 703-726-8362 Cathy McGhee, Program Manager, VDOT (434) 293-1973 Brian Smith, Associate Professor, UVA (434) 243-8585 Jeremy Blum, Penn State	ITS Applications: Traveler Information Arterial Management Day 1 Applications: Traveler information Corridor Management	DSRC Simulation	5/2007 thru 10/2008	Qualnet has been modified to 802.11p Developing interface with Aimsum	Based on VII Arch. & stds. (IEEE 802.11p) Willing to implement additional standards	VII Simulation Some overlap with UVA NSF work Taking advantage of the other UVA VII work noted in this spreadsheet

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23	**Arizona E-VII Program Summary** Maricopa County REACT arterial incident response trucks and Arizona DOT ALERT freeway service patrol trucks will be used for the proof-of-concept test and demonstrations. Prototype applications will be developed using VII technologies for traffic signal preemption and priority, ramp meter preemption (queue flushing), and mobile incident warning. In addition to using the VII technology for preempting the signal for the incident responder, the VII RSE will also be used to broadcast warning messages to other VII-enabled vehicles that an emergency response vehicle is approaching – vastly improving the safety of an intersection during preemption. In the mobile incident warning prototype application, the on-board unit of the incident response vehicle will function as an RSE to warn on-coming VII-enabled vehicles of the hazard once the incident responder arrives on-site. In addition, the incident response vehicle may upload incident details (number of lanes blocked, location, special response needs, etc.) to the VII network for dissemination to other incident responders through other RSEs further away from the incident site.	Maricopa County DOT & Arizona DOT/University of Arizona	Faisal Saleem, Maricopa County DOT, VII Program Manager 602-506-1241 Doug Gettman, Project Manager Kimley-Horn 602-906-1332 520-977-5753m	ITS Applications: Arterial Management Incident Management Traveler Information Day 1 Applications: Traveler Information Beyond Day 1	DSRC Vehicle-to-Vehicle and Vehicle-to-Infrastructure	5/2007 thru 8/2009	Working on ConOps for Applications	Yes	New VII approach to non-VII applications Vehicle-to-Vehicle and Vehicle-to-Infrastructure

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24	**Simulation Study of a Bus Signal Priority Strategy Based on GPS/AVL and Wireless Communications:** The vision of the VII (Vehicle Infrastructure Integration, is to deploy a nationwide network that enables communications between vehicles and roadside infrastructure for various transportation operations and applications. Signal priority requests for transit or emergency vehicles can potentially be sent to the signal controller through the vehicle-to-infrastructure communication architecture described in VII. Communication with the roadside unit (e.g., traffic controller) for signal priority may be established using the existing 802.11x WLAN on the bus or the DSRC (Dedicated Short Range Communication) 802.11p protocol currently under development for wireless access to and from the vehicular environment. Work in next phase will oncentrate first on the more readily available protocols. However the system will be designed so that it can be ported to the new 802.11p protocol when it becomes more readily available. - Twin Cities Metro Area	Center for Transportation Studies and the Intelligent Transportation Systems Institute University of Minnesota	Chen-Fu Liao, Center for Transportation Studies and the Intelligent Transportation Systems Institute University of Minnesota Ph: 612-626-1697 Gary A. Davis, Department of Civil Engineering University of Minnesota Ph: 612-625-2598	ITS Applications: Transit Management Day 1 Applications:	802.11x WLAN GPS/AVL proposed expansion to DSRC		Proposed Phase II work	VII Architecture & stds. based	VII focus Proposed Phase ll work may be similar to work in Arizona

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25	**Denver Testbed:** VII Tacticle deployments The objective of the Denver E-470 test is to present and prove Multi Lane Free Flow (MLFF / ORT) high performance tolling and enforcement based on Kapsch TrafficCom's 5.9 DSRC technology. The installation is an end-to-end solution consisting of Road Side Equipment (RSE), a Road Side Cabinet (RSC) and a Server unit. RSE includes the transceiver for 5.9 GHz DSRC communication with On Board Unit`s (OBU) installed in vehicles participating at the test, the Lane Cameras (for front and rear pictures) with illumination units, overview Cameras with external IR-Flashes and the Laser Unit`s. The RSC includes the Traffic Laser Controller, Camera Controller, Transceiver Controller, Station Controller and other sub components. Due to the scenario selected the performance of the commercial E-470 installation will be easily comparable with the 5.9 MLFF solution of Kapsch. The Kapsch solution will enable a tactical/reverse deployment of the 5.9 DSRC technology because 1) It will provide the DOTs with a pragmatic, step by step roll-out model for VII that reduces complexity 2) it will provide the badly needed funds for upgrading the road infrastructure by leveraging tolling as mega-application and combining it with a few selected "stage one" applications - instead of relying on the government to finance the program for all the many safety applications by itself.	E-470 Public Highway Authority Kapsch TrafficCom, System Developer Independent Test & Verification, OmniAir Consortium, Inc.	Ed DeLozier, E-470 Executive Director EDeLozier@e-470.com Tugrul Güner, Project Manager, Kapsch TrafficCom Phone +43 (0)50 811 2210 Timothy McGuckin, Executive Director OmniAir Consortium, Inc. T 202-756-0012 M 202-276-8483	ITS Applications: Freeway Management Day 1 Applications: Electronic Pay	DSRC		January-February - system installation at E-470 (comprising the components of the toll system) March-April (perhaps into May) - system performance testing by Kapsch May-July - OmniAir independent testing and verification	DSRC	DSRC focused work

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26	**Vehicle Integration Applications for Improving Surface Transportation Weather Services:** This effort focuses on conducting applied research aimed at acquiring, analyzing, and processing VII-enabled data, with the ultimate goal of improving the capacity to diagnose and forecast roadway conditions, generating roadway-specific alerts and warnings, and enabling the development of new weather-related tools and technologies that will support the decisions of surface transportation stakeholders. A key element of this effort will be the development of a Weather Data Translator (WDT) demonstration system that will be capable of ingesting, parsing, processing and archiving vehicle-based probe data from VII testbed(s), along with relevant supplemental weather and road condition data. The system will generate quality checked derived observations for use by Clarus, as well as other systems or applications. Such derived observations should prove to be extremely useful in assessing specific aspects of road conditions and related road weather.	USDOT FHWA Road Weather Management Program	Kevin Petty National Center for Atmospheric Research 303-497-2705	ITS Applications: Road Weather Management Traveler information	Data Analysis and Processing Activity	2/1/08 - 6/1/09	Incipient phase	N/A	VII Research and Development: gain an understanding of how to effectively utilize weather-related VII-enable data elements

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27	**Development of a Prototype Vehicle-Infrastructure Integration System for Real-Time Traffic Management and Control:** While the Vehicle-Infrastructure (VII) concept has been in existence for a decade, its operational model and implementation strategy remain unclear. What is clear is that the VII infrastructure, if designed to meet its full expectations, must be able to support such applications as incident management, congestion mitigation, air pollution management, driving assistance, and disaster evacuation. However, fully realizing this vision involves meeting challenges beyond just establishing communication links among VII components. New operational algorithms and higher-layer network protocols must be developed in view of the heterogeneous devices, contexts, and wireless technologies that are involved, and the specific missions that must be achieved. Given the expected large scale of the VII system and ever increasing metropolitan areas, the traditional centralized operational concepts have become too costly to implement, maintain, and protect from threats. This research will develop a prototype hierarchical VII system with distributed decision making and reliable distributed networking that adequately accommodates future sophisticated VII applications.	National Transportation Center Morgan State University http://www.eng.morgan.edu/~ntc/ Clemson University Department of Civil Engineering Clemson University	Ronnie Chowdhury Depatment of Civil, Clemson University (864) 656-3313 Anthony Saka National Transportation Center, Morgan State University (443) 885- 3666	ITS Applications: Freeway Management Arterial Management Day 1 Applications:	Wireless Network	Start Date: September 1, 2007 End Date: October 31, 2008 Status: Active			Vehicle-Infrastructure Integration Distributed Wireless Network Distributed Decision Making Traffic Operational Algorithms

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
28	NSF/USDOT Partnership for Exploratory Research - ICSST: Timely and Effective Dissemination of Traveler Information in Rural Areas The Department of Electrical and Computer Engineering at Montana State University collaborated with WTI in a project that explored alternative technical and structural approaches to effectively disseminating traveler information in rural areas. Researchers used a systems engineering approach to incorporate technologies and methodologies from diverse disciplines. Peer to-peer, ad hoc communications between vehicles and between vehicles and roadside sensors, using recent advances in wireless technologies such as DSRC and ad hoc networking protocols are being explored to serve as a surrogate for extensive fixed communication and information infrastructure. Human factors and inputs from private and public sector stakeholders are being used to further shape the system design. Emerging technologies such as smart antennas are being evaluated using requirements-based criteria and an end-to end system design. Researchers used modeling and simulation techniques to conduct performance assessments and technology trade-off studies. Yellowstone National Park was selected as a representative example of a remote area where communications infrastructure is limited and numerous information intensive activities ranging from public safety to tourist services are taking place. With the cooperation of park staff, researchers are building a model of the Yellowstone area including topography, demographics, vehicle flows and other data and then examining how ad hoc networking can be used as a surrogate for more conventional communications infrastructure to meet application demands in a timely way. One of the objectives of this research is to design a prototype that might be deployed in a rural area for a field trial. The results of this research will direct future investments in communications and information technology infrastructure that will suit the particular demands of rural and sparsely populated areas. The approach provides a high benefit to cost ratio that meets the structural requirements of large portions of the less populated regions of the country. The benefits go beyond improvements in safety and efficiency, as the infrastructure also supports a broad range of traveler information services that are of value to businesses that rely on transportation, such as fleet management, as well as the broader tourist industry. The development of the communications and information infrastructure in remote areas will also benefit the economic development efforts of rural and Native American communities	National Science Foundation/ USDOT	Richard Wolff Montana State University, College of Electrical and Computer Engineering (406) 994-7172; rwolff@ece.montana.edu	ITS Applications: Traveler Information Day 1 Applications:	Wireless DSRC	N/A	Complete	Yes	Rural Applications Vehicle-infrastructure Simulation

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
29	**Blackfeet Automated Accident Reporting System** The objective of this project was to improve accident reporting through the application of advanced technology to increase the accuracy and completeness of accident reporting. This project will provide a system to improve the current system of accident reporting by addressing several issues; the inaccuracy of data, the incompleteness of the data and the potential errors associated with transcribing and communicating the data. The basis of the improvement is the use of mobile computing systems to collect the data at the accident scene and using Global Positioning System (GPS) units to identify the accident locations with greater precision than can be done manually. The advantages of the improvement will be superior accident report data and improved accuracy in the resulting reports. There are two major pieces to the system: the mobile data collection portion and the fixed data upload and database interface portion. The initial platform for the mobile product will be PocketPC based Personal Data Assistants (PDA's) coupled with GPS units. However, the goal is to have software products that can operate on a wide-variety of PDA or laptop computing systems. The fixed product will be designed to operate on current computing systems as necessary, including Microsoft Windows and/or Unix/Linux platforms. It will be designed to interoperate with the current database mechanisms supported by local and State of Montana agencies for accident reporting needed, but limited by the time constraints of the project. The mobile platform software will provide a user interface that mimics the current paper reporting system to as great a degree as possible to maximize user acceptance and to minimize the likelihood of errors. The system will be designed to detect and correct errors, or to require that correct data be entered and to make the process easier and faster. The interface with the data upload software will provide the user with an opportunity to perform validity checking on the report data. As necessary the software will be interconnected with other applications on the mobile platform.	Robin Kline USDOT/Research and Innovative Technologies Administration, Office of Research, Development, & Technology 400 Seventh St SW Room 2440 Washington DC 20590-0001 202-366-2732 robin.kline@dot.gov	Steve Albert, Director, Western Transportation Institute, College of Engineering - Montana State University; (406) 994-6114	ITS Applications: Emergency Management Day 1 Applications:	GPS, wireless	N/A	Complete	Yes	Rural Data Accuracy advanced technology to increase the accuracy and completeness of accident reporting Global Positioning System (GPS)

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
30	**Roadside Animal Detection System Test bed -** The objective is to evaluate different types of animal detection systems with regard to system reliability, and operation and maintenance aspects. Phase 1 of the FHWA is designing and implementing the backbone of the “Roadside Animal Detection Systems” (RADS) test-bed in a controlled access environment, facilitating integration of animal detection systems. Selected animal detection systems will be installed in the test-bed. Design, implement, operate and maintain the RADS test-bed communication system has been implemented by utilizing a systems engineering approach.	Mike Bousliman Montana Department of Transportation, Maintenance Division P.O. Box 201001 Helena, MT 59620-1001 406-444-6159 mbousliman@mt.gov	Marcel Huijser Western Transportation Institute P.O. Box 174250 Bozeman, MT 59717 406-543-2377 mhuijser@coe.montana.edu	ITS Applications: Freeway Management Traveler Information Arterial Management Emergency Management Day 1 Applications:	microwave, break-the-beam and infrared devices	N/A	Complete	Yes	Rural National ITS architecture standards

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
31	**An Integrated PDA/GPS System to Collect Standardized Road Kill Data** The objective of this project is to conduct a pilot study of field-rugged PDA/GPS units that will enable transportation agencies, natural resource management agencies, and other interested parties to easily collect spatially accurate animal road kill data. The researchers at WTI are developing the "Roadkill Observation Collection System" (ROCS), integrating customized software with a field-rugged instrument for the collection, integration, and analysis of standardized, spatially-accurate animal-vehicle collision data. This project demonstrates how a Personal Data Assistant (PDA) in combination with a Global Positioning System (GPS) and customized software is an efficient, cost-effective tool to collect spatially accurate and standardized animal-vehicle collision data. The goal of this project is to apply the data collection components of the ROCS in a variety of settings and organizations to obtain feedback and adapt the system to ensure stability, ease of use, and applicability of standardized, and spatially precise collection of animal-vehicle collision data. Ultimately, both DOT management and maintenance personnel could be outfitted with this hardware and software to record field data. With accurate, standardized data, transportation agencies will be better able to conduct analyses in order to apply mitigation measures such as wildlife warning signs or wildlife fencing and crossing structures to reduce animal-vehicle collisions and increase driver safety.	Kim Vaughn Washington Department of Transportation P.O. Box 12560 Yakima, WA 98909-2560 509-577-1881 VaughnK@wsdot.wa.gov	Douglas Galarus WTI P.O. Box 174250 Bozeman, MT 59717-4250 406-994-5268 dgalarus@coe.montana.edu	ITS Applications: Freeway Management Traveler Information Arterial Management Emergency Management Day 1 Applications:	wireless	Within one year	Current	Yes	Rural Standardized data collection, global positioning systems (GPS)

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
32	**Cold Regions Laboratory, Lewistown Montana** The vision of this laboratory is to improve transportation maintenance, operations and safety with cold-regions research through the collaboration of academia, industry and government. The Lewistown Cold Region Rural Transportation Research Testbed will be constructed along portions of old runways at the Lewistown Aiport in central Montana. The site will include a backbone of communications, power, and data networking capabilities, all of which are necessary to collect, store, and disseminate data during research. The multidimensional research capability that the site offers can greatly enhance researchers' understanding of the many interrelated issues associated with the transportation environment. The site offers a safe environment to test innovative products without creating a nuisance or endangering the traveling public. This laboratory will be used on projects to: Conduct multidimensional rural transportation research in a cold environment Test products and their effects on roadway infrastructure, vehicles, and the surrounding environment Evaluate de-icing and anti-icing protocols in the field Demonstrate and test technologies aimed to reduce animal-vehicle crashes Study new and improved materials used to build and maintain infrastructure Study the effects of winter driver training for commercial vehicle operators	Robin Kline USDOT/Research and Innovative Technologies Administration, Office of Research, Development, & Technology 400 Seventh St SW Room 2440 Washington DC 20590-0001 202-366-2732 robin.kline@dot.gov	Eli Cuelho Western Transportation Institute P.O. Box 174250 MSU Bozeman Bozeman, Montana 59717-4250 (406) 994-7886 elic@coe.montana.edu	ITS Applications: Freeway Management Traveler Information Arterial Management Emergency Management Day 1 Applications:	microwave, break-the-beam and infrared devices	Long term	Current	Yes	rural Demonstrate and test technologies multidimensional rural transportation research

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
33	**Redding Responder** The Responder System integrates hardware, software, and communications to provide incident responders, particularly those in remote rural areas, with a structured, easy to use means for collection and digital communication of incident information. The Responder pilot deployment has been developed with an emphasis on ease of use and usability. The WTI Project Team will assist Caltrans in developing a business case to determine whether and how to proceed with full deployment. WTI will evaluate hardware to reduce the size of equipment and to “harden” the system for use in extreme heat and cold. Software will be finalized to accommodate hardware updates and to increase usability and robustness of the system. The system will then be installed in vehicles for testing by several crews over one to two months during a time period in which incidents and usage are most likely to occur. The system will be evaluated under real use situations with criteria including ease of use, usefulness and reliability.	Jeff Kiser Caltrans District 2 1490 George Drive Redding, CA 96003-1460 530-225-3210 Jeff_Kiser@dot.ca.gov	Douglas Galarus WTI P.O. Box 174250 Bozeman, MT 59717-4250 406-994-5268 dgalarus@coe.montana.edu	ITS Applications: Freeway Management Traveler Information Arterial Management Emergency Management Day 1 Applications:	wireless	Within one year	Current	Yes	rural data communication, incident management

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
34	**Greater Yellowstone Rural VII Demonstration and Test-bed:** - Road-Weather Case Study/Demonstration: The first demonstration project will address the ability for the roadside infrastructure (Road-Weather Information Systems) to communicate road-weather information and to pass, or hand-off, that information to other vehicles before those vehicles encounter road-weather problems. - Corridor Animal -Vehicle Collision Warning and Avoidance Demonstration: The second demonstration project will focus on warning motorists of potential animal collisions. - Western States Emergency Medical Services Network VII: Working with our partners, the Critical Illness and Trauma Foundation and the Western States EMS Network, WTI will expand the VII research and demonstration effort to the western United States and a potential fleet of 5000 vehicles.		Steve Albert, Director, Western Transportation Institute, College of Engineering - Montana State University; (406) 994-6114	ITS Applications: Road Weather Management Emergency Management Driver Assistance Day 1 Applications	Wireless communications between road and vehicle, microwave, break-the-beam and infrared devices		Planned	Yes	rural vehicle to Infrastructure

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
35	**MANETS for Rural Public Safety** The overall objective of this project is to enhance or develop a routing protocol for Mobile Ad-hoc Networks and conduct proof-of-concept demonstration of Mobile Ad-hoc Networks, as a method for enhancing wireless communications for law enforcement agencies in remote, rural locations. Mobile ad hoc networks (MANETs) provide the potential for addressing these pressing needs. A MANET is a network of computers that can automatically start communicating when they are close enough to one another to be in wireless range. A team from the Western Transportation Institute and the Departments of Electrical and Computer Engineering and Computer Science at Montana State University, and the Hot Springs County Wyoming Sheriff's Department have initiated a project to develop a routing protocol for Mobile Ad-hoc Networks and field test a MANET, in partnership with the U.S. Department of Homeland Security (DHS). The DHS SAFECOM program funds research into emerging technologies that can help public safety agencies communicate with each other and coordinate services. Through this project, researchers will develop a standardized routing protocol in response to the requirements of law enforcement agencies in Hot Springs County, Wyoming, with the expectation that the protocol will be applicable to agencies in similar rural locations.	Luke Klein-Berndt, OIC Program Mgr Department of Homeland Security 245 Murray Lane, SW Washington, DC 20528 Luke.Klein-Berndt@dhs.gov	Douglas Galarus WTI P.O. Box 174250 Bozeman, MT 59717-4250 406-994-5268 dgalarus@coe.montana.edu	ITS Applications: Emergency Management Day 1 Applications	Wireless communication, mobile ad-hoc networks, routing protocols	Within one year	Current	Yes	rural VII data simulation

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
36	**FHWA Pooled Fund Animal-Vehicle Crash Mitigation using advanced technology demonstrations** The objective of this demonstration is to evaluate an animal detection system in a real-world environment with regard to system reliability, and operation and maintenance aspects. For this project WTI, in partnership with Oregon DOT and 15 other states, is evaluating a animal detection system that detects large animals (e.g., deer, elk, moose) along US-191 in Montana/ Yellowstone National Park. When an animal is detected, signs are activated that warn drivers that large animals may be on or near the road at that time.	Felix Martinez Oregon Department of Transportation 200 Hawthorne SE Suite B-240 Salem, OR 97301 503-986-2848 felix.c.martinez@odot.state.or.us	Marcel Huijser Western Transportation Institute P.O. Box 174250 Bozeman, MT 59717 406-543-2377 mhuijser@coe.montana.edu	ITS Applications: Freeway Management Traveler Information Arterial Management Day 1 Applications:	microwave, break-the-beam and infrared devices	N/A	Complete	Yes	rural Vehicle to Infrastructure Animal detection system

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
37	**Ant Colony Optimization for Transportation Optimization Problems** The overall objective of this project is to formalize, test and enhance propagation estimate techniques used to select the optimal placement of communications infrastructure using artificial intelligence. WTI leads numerous research projects to improve transportation in rural areas. A typical challenge in locations is the absence of seamless or reliable communication, due to the difficulty of effectively placing infrastructure in remote areas or rugged terrain. WTI has conducted preliminary research into the use of an optimization technique called “Ant Colony Optimization,” to investigate whether it can be applied to select optimal placement of communications infrastructure along a roadside. The initial research has included computational analysis, integration of digital elevation models, and development of a working algorithm. Ant Colony Optimization (ACO) is an artificial intelligence algorithm and is a form of “Swarm Intelligence.” Ant Colony Optimization algorithms mimic the behavior of ants searching for food. Ants deposit pheromones on the paths they follow when searching for food. The ants that find food survive and retrace their paths back to their homes, making the pheromone deposited along trails leading to food even stronger. Other ants follow pheromone-laden trails leading to food, and ultimately the shortest paths to food are found by the collective ant colony. Similarly, ACO explores potential paths to solutions of problems and increases the weights of paths leading to good solutions. Ultimately, ACO algorithms converge to near-optimal solutions for very complex problems, such as the infrastructure placement problem. This project will allow the researchers of the Systems Engineering Group to build on the previous research through enhancement of the estimation techniques and algorithm, generation of test cases based on real locations and equipment, and identification of other applications for the techniques used in the research.	Robin Kline USDOT/Research and Innovative Technologies Administration, Office of Research, Development, & Technology 400 Seventh St SW Room 2440 Washington DC 20590-0001 202-366-2732 robin.kline@dot.gov	Douglas Galarus WTI P.O. Box 174250 Bozeman, MT 59717-4250 406-994-5268 dgalarus@coe.montana.edu	ITS Applications: Day 1 Applications:	radio	Within one year	Current	Yes	rural communications networks; communications infrastructure placement

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38	**Northern California Rural VII Case Study-** The intent of the Rural Fleet Application Case Study was to recommend applications and consider implications of Vehicle-Highway Cooperative Systems in a rural environment. The research developed the plan for applying advanced technology solutions that will assist fleet operations and would ultimately increase safety and improve operations of the transportation system in northern California. The study area for this project consists of Caltrans Districts 1 and 2, which make up the California portion of the California Oregon Advanced Transportation Systems (COATS) project. The research examined principally applications for the two-lane rural highway (non-interstate) system. This project provides a foundation for testing and deployment of Vehicle-Highway Cooperative Systems concepts in northern California. As it is difficult to initiate or influence the deployment of technologies on light duty passengers vehicles, the opportunities for research, development, testing and potential deployment lie in partnering with a fleet owner/operator and in developing infrastructure systems that complement emerging in-vehicle technologies. Examples of fleets include trucking, transit, law enforcement, and emergency vehicles as well as vehicles that operate and maintain utilities like power, communications, or transportation facilities. The vision for this Rural Fleet Application Case Study was to define a VII System that can evolve as the roadside and vehicle safety systems are implemented, communication coverage increases, fleet technology improvements migrate to a rural environment, and fleet managers understand the application of technology to their specific needs. This project will outline VII for spot application and information assistance. WTI will work with Caltrans and other stakeholders to identify technologies that exchange information between the vehicle and roadside infrastructure and may provide some level of assisted vehicle control. Researchers will review technologies that can be implemented in the near term, are beneficial in the rural environment, and can be implemented in a fleet of vehicles.	Matt Hanson Caltrans New Technology and Research 1227 O Street, P.O. Box 942873 Sacramento, CA 94273-0001 916-654-8171 Matt_Hanson@dot.ca.gov	Michael Kelly, WTI 406-994-7377 mkelly@coe.montana.edu	ITS Applications: Freeway Management Commercial Vehicle Management Day 1 Applications:	DSRC	N/A	Completed	Yes	Rural Intelligent Vehicle Highway Systems, Advanced Rural Transportation Systems

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
39	**Minnesota in-Vehicle Signing Project:** Minnesota is planning a test of an interim in-vehicle signing application that will use OBE and RSE only. The test will determine if real-time safety information can be transmitted from a stand-alone roadside device to a driver via an after market product within vehicle. The test will also evaluate the effectiveness of in-vehicle signing for work, school and speed zones, in addition to curve and intersection collision warnings.	Minnesota DOT	Ray Starr 651-234-7006 Matt Gjersvik 651-234-7064	ITS Applications: Traveler Information Day 1 applications: -In Vehicle Signing	Most likely DSRC radio with a localized secure data network.	Present - through 9/30/09	Draft phase I federal work order submitted. RFPs for phase I project management and evaluation in progress	VII Architecture & stds. Based, however only the vehicle to roadside element is being tested. There will be no connection to the VII national network or vehicle to vehicle communication.	Will eventually test if In-Vehicle Signing is an effective day one application. Deployment may be fitted to eventually tie into the proposed VII national network
40	**Simulation Study of a Bus Signal Priority Strategy Based on GPS/AVL and Wireless Communications:** The vision of the VII (Vehicle Infrastructure Integration, is to deploy a nationwide network that enables communications between vehicles and roadside infrastructure for various transportation operations and applications. Signal priority requests for transit or emergency vehicles can potentially be sent to the signal controller through the vehicle-to-infrastructure communication architecture described in VII. Communication with the roadside unit (e.g., traffic controller) for signal priority may be established using the existing 802.11x WLAN on the bus or the DSRC (Dedicated Short Range Communication) 802.11p protocol currently under development for wireless access to and from the vehicular environment. Work in next phase will oncentrate first on the more readily available protocols. However the system will be designed so that it can be ported to the new 802.11p protocol when it becomes more readily available. - Twin Cities Metro Area	Center for Transportation Studies and the Intelligent Transportation Systems Institute University of Minnesota	Chen-Fu Liao, Center for Transportation Studies and the Intelligent Transportation Systems Institute University of Minnesota Ph: 612-626-1697 Gary A. Davis, Department of Civil Engineering University of Minnesota Ph: 612-625-2598	ITS Applications: Transit Management Day 1 Applications:	802.11x WLAN GPS/AVL proposed expansion to DSRC		Proposed Phase II work	VII Architecture & stds. based	VII focus Proposed Phase ll work may be similar to work in Arizona

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
41	We have an in-progress contract with Ford for a "Vehicles as Sensors" project. It is retrieving data from some fleet vehicles using cellular communications and integrating the resulting data into the CARS database which feeds Minnesota's 511 system. Future work may include adding additional communication approaches and providing a means to provide the traveler information back into the vehicles.		Ray Starr [Ray.Starr@dot.state.mn.us]						

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
42	**Embedded Distributed Simulation for Transportation System Management:** This research explores the question: "can ad hoc distributed simulations incorporating real-time information be effective in rapidly producing reliable forecasts of future system states for use in system management and optimization?" Ad hoc distributed simulations offer significant technical and economic advantages over conventional approaches such as global, centralized simulations. In the context of transportation systems, this research foucuses on an autonomously reconfigurable, continuously operating, dynamically extensible, real-time, embedded simulation environment that is distributed across in-vehicle computer systems, roadside computers, and traffic management centers. Autonomous predictive models such as in-vehicle agent-based simulations join the system as their vehicle begins a trip, obtain information from sensor networks and information systems, perform predictive functions on behalf of their clients, share their projections with other simulations as needed, and exit the system when their vehicle reaches its destination. Local V2R/V2V test bed near the campus of Georgia Tech.	National Science Foundation/ Georgia Tech. http://nsf-efri.ce.gatech.edu/	Scott F. Midkiff, Ph.D. Program Director National Science Foundation Telephone: 703-292-8339 Email: smidkiff@nsf.gov Michael Hunter Principal Investiagtor Assistant Professor Georgia Institute of Technology School of Civil and Environmental Engineering 790 Atlantic Drive, NW Atlanta, Georgia 30332 (404) 385-1243 michael.hunter@ce.gatech.edu	ITS Applications: Freeway Management Arterial Management Day 1 Applications:	802.11 DSRC (5.9 GHz band) & alternative short-range communication system	4 year project beginning Fall 2007 Projected completion date 8/31/2011		N/A	Vehicle-to-Vehicle and Vehicle-to-Roadside Focused Research
43									
44									
	Responses from 5.9 GHz licensees that have related VII work								
	Installed 3 Highway Advisory Radio Towers, 2 more coming in 2008 Lake County Passage Program	Lake County, Illinois	Anthony Khawaja 847-377-7000,7400	ITS Applications: Traveler Information Day 1 Applications:	HAR				

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
	RFP for Next Gen. Toll Readers **Possible that someone could propose 5.9 GHz**	MTA Bridges and Tunnels, New York	Bob Redding 646-483-3581	ITS Applications: Electronic Payment and Pricing Day 1 Applications:	Possibly DSRC	RFP			
	CVISN: in-house software, anonymous tracking **Maintenance Vehicles:** snowplows (chemical rates, blade up, blade down), striping **Incident Response:** Record location of incidents in data management system and track time to clear for performance management.	Washington State DOT		ITS Applications: Incident Management Commercial Vehicle Operations Roadway Operations & Maintenance Road Weather Management Day 1 Applications:	GPS, 800 MHz (data and voice sidebands), Microwave Backhaul				
	Collecting data for Chrysler headlights on, wipers on	FDOT	Mike Smith George Gilhooley 407-547-2997	ITS Applications: N/A Day 1 Applications: N/A	802.11 b				
	Florida 4.9 - 5.9 GHz testbed (public safety focus) some 5.9, but not for ITS, yet!!	Pinellas County, Florida	Pam Montanari, Pinellas County Emergency Communications 727-582-2509	ITS Applications: N/A Day 1 Applications: N/A	4.9 & 5.9 GHz				
Miscellaneous Contacts for Information on Related Work									
	VII Test Beds (GM, Ford, DaimlerChrysler, Nissan, Motorola)	may be complete - OTBE	Sarah Hiple was not aware of any follow on activity						
	See Arizona work above	Larry Head 520-621-2264							
	No NHTSA Heavy Truck Activities	Tim Johnson 202-366-3505							
	FMCSA	Jeff Seacrist 202-385-2367							
	No VII or V2V related work associated with the Darpa Urban Challenge Sensor work may be of value	Dick Bishop richardbishop@mindspring.com							
	TFHRC	Jim Arnold							

	Research/Project Title & Description	Sponsoring Organization/ Researchers	Point of Contact	Key Applications	Communications Media	Time Frame	Status (current/ planned)	VII Arch. & Stds. Compliance	Assessment: Relevance to VII Program
	VII Coalition	Jim Wright 651-234-7710 jim.wright@dot.state.mn.us							
	SHARP II - No VII related activities	Bill Hyman 202-334-1914							
	No Studies on VII	Rich Cunard 202-334-2963							
	We have an in-progress contract with Ford for a "Vehicles as Sensors" project. It is retrieving data from some fleet vehicles using cellular communications and integrating the resulting data into the CARS database which feeds Minnesota's 511 system. Future work may include adding additional communication approaches and providing a means to provide the traveler information back into the vehicles.	Ray Starr [Ray.Starr@dot.state.mn.us]							
	Utah - No work	Bryan Chamberlain [bchamberlain@utah.gov]							