V2IDC TWG 2 (Research) Conference Call

June 1, 2016

Attendees:

1. Bill Gouse, SAE
2. Greg Larson, Caltrans
3. Yang Cheng, Traffic Operations and Safety (TOPS) Lab at UW-Madison
4. Danjue Chen, Traffic Operations and Safety (TOPS) Lab at UW-Madison
5. Huynjun Park, UVA
6. Jianming Ma, TX DOT
7. Josh Hassol, Volpe
8. Alan Korn, Meritor WABCO
9. Tim Sanidimas, IA DOT
10. Bob Sheehan, ITS JPO
11. Tom Timcho, WSP | Parsons Brinckerhoff
12. Skip Yeakel, Volvo

Status of Progress on Issues

1. Issue 1: V2X Applications – Activities are underway.
2. Issue 3: V2I Data Collection – Still needs to get kicked off.
3. Issue 6: V2I Outreach Coordination – Activities are underway.
4. Issue 7: Benefits/Cost of V2IDC – Activities are underway.

Problem statements will be sent to Rob Bertini, Greg Larson, and Pat Zelinski for review before being sent to TRB for consideration in NCHRP 20-102: Impacts of Connected Vehicles and Automated Vehicles on State and Local Transportation Agencies. The problem statement titles are as follow, and the complete text of each is available in the subsequent pages of this document.

1. Cost-Effectiveness Assessment of Vehicle to Infrastructure Applications
2. Cooperative Vehicle-Infrastructure Situational Awareness System
3. How to Prepare TIM Responders for a Connected Vehicle/Automated Vehicle World
4. Readiness Assessment of CV Applications in the OSADP

PROBLEM TITLE

Cost-Effectiveness Assessment of Vehicle to Infrastructure Applications

II. RESEARCH PROBLEM STATEMENT

Connected Vehicle (AV) technologies offer potential to significantly improve safety and efficiency of travel. Vehicle-to-infrastructure (V2I) applications in particular can reduce fatalities and injuries at traffic signals and other critical areas such as work zones and curves. There is very limited deployment of CV-enabled vehicles and/or infrastructure. This means that benefits must be estimated using simulation models or forecasts rather than by direct observation. This research will assess current tools and benefits estimation frameworks and approaches and identify any gaps in methodology, process, or information. The project will then develop the methodology, tools, or processes to fill those gaps.

III. OBJECTIVE

The objective of this research is to provide agencies with tools for large-scale assessment regarding the cost effectiveness of V2I applications. Without demonstrated cost-benefit of CV technology, agencies have limited incentive to invest in unproven technology and lack the information needed to compare the likely return from V2I expenditures with other transportation investment opportunities.

IV. RESEARCH PROPOSED

The research team will review literature in V2I applications benefits estimation to include the AASHTO footprint analysis, the NHTSA V2V readiness report, the USDOT tools, and related academic research. The team will identify gaps in these approaches and propose a plan to fill those gaps with new tool development, research, and data collection. This work should build on lessons learned from CVPD projects in Wyoming, New York, and Florida. The research team will focus on the four high-priority V2I application areas identified by the V2I Coalition: (1) work zones, (2) curve warning, (3) traffic signals, and (4) queue warning. To a lesser extent they should consider positive synergies among these applications both in terms of cost savings and increased net benefits to safety and mobility and the ability of the field deployments to handle other secondary applications. In particular, technology investments in contrast to more straightforward infrastructure projects generate network impacts that are difficult to quantify. The research team will apply the benefits estimation approach to a variety of deployment scenarios, and in particular evaluate the effects of penetration level of equipped vehicles and geographic locations. At least six alternative locations and deployment organizational types will be considered ranging from isolated rural to dense urban environments (rural agency, suburban agency, urban agency, State agency, multi-state coalition, regional coalition). The scenarios should illustrate the effect on cost effectiveness of 1) different levels of market penetration among the vehicle fleet, 2) different levels of RSE deployment density, and 3) different levels of development density. The assessment will identify where V2I applications perform best. It should also identify when V2I reach break-even returns based on market penetration among vehicles and on the density of deployment of RSEs. The team will then summarize the findings and recommendations for the best plan of action towards implementation of further deployment.

V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding: $400,000.
Research Period: 15 months.

VI. URGENCY AND PAYOFF POTENTIAL

Agencies need evidence that investment in CV V2I technologies will be cost-effective use of their resources. Thus, the research is considered quite urgent given the timeline of typical procurement processes, the expectation of rapid deployment of required equipment in vehicles in the near future, and need to address institutional issues related to project definition and funding. V2I applications can be transformative in the ability of public agencies to provide a broad range of public benefits at reduced cost but limited public funds also call for evidence of the expected return on investment.

VII. RELATIONSHIP TO NCHRP STRATEGIC RESEARCH GOALS, STRATEGIC PRIORITIES, and/or TRB STRATEGIC, CRITICAL, AND EMERGING ISSUES

This research is an important component of the AASHTO AV/CV research roadmap.

VIII. RELATED RESEARCH

No current NCHRP 20-102 project is developing a benefits estimation approach. This research should extend from current FHWA/USDOT sponsored work on benefits estimation, NCHRP 03-103, NCHRP 20-102 (08), and other methodologies developed and available in the literature.

IX. PERSON(S) DEVELOPING THE PROBLEM

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X. PROCESS USED TO DEVELOP PROBLEM STATEMENT

This RPS was developed by Dr. Gettman and members of the V2I Coalition Working Group 2 (Research) and was reviewed by Greg Larson and Rob Bertini.

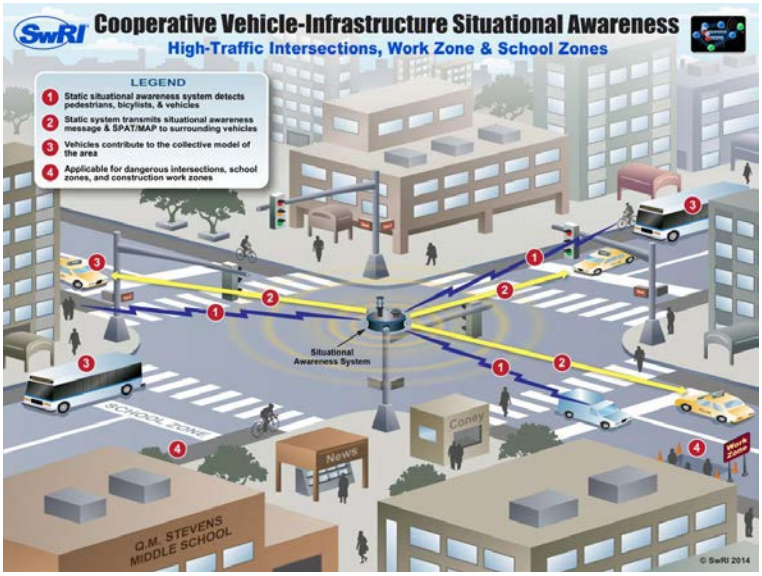
XI. DATE AND SUBMITTED BY

June 23, 2016; Submitted by Dr. Douglas Gettman on behalf of the V2I Coalition Working Group 2

Cooperative Vehicle-Infrastructure Situational Awareness System

Despite advances in enforcement, public awareness strategies and improved infrastructure (e.g. dedicated bicycle lanes), vulnerable road user safety remains a serious issue. Automakers are implementing technology that utilizes the vehicle's sensors to warn the driver of the presence of pedestrians and bicyclists; however, the sensors are often occluded from directly sensing the vulnerable road user due to buildings, other vehicles, and intersection geometries. Additionally, infrastructure-based sensing can be more robust, utilizing higher-end sensors and processors than can be accommodated on a vehicle.

An increasing number of vehicles will be outfitted with DSRC in years to come which will enable vehicles to communicate with each other and an intelligent infrastructure. Current research in communication with vehicles and infrastructure to improve intersection safety has been primarily focused on sending information regarding signal phase and timing as well as the intersection geometry to the vehicle to assist in collision avoidance at intersections. This has also included very rudimentary pedestrian detection and warning systems which to date have not worked well due to the sensors inability to accurately detect and classify pedestrians. How can we take advantage of this to further improve safety for vulnerable road users? It is relatively straightforward to envision the development of the next generation of cooperative vehicle-infrastructure situational awareness as illustrated in the following figure:



The problem of the vulnerable road user is a significant one that cannot simply be solved by sensors on a vehicle platform, as they simply do not have the "sight lines" to detect all possible conflicts – the infrastructure needs to also be providing information. This concept merges advanced detection techniques with Connected Vehicle technology to demonstrate advanced vulnerable road user detection. We propose to study the feasibility of combining intelligent sensors and connected infrastructure to improve situational awareness for connected (and potentially automated) vehicles in intersections and other highly dynamic environments.

Project subject cluster: Institutional and Policy Project

TITLE: How to Prepare TIM Responders for a Connected Vehicle / Automated Vehicle World

Problem Statement

From the time Traffic Incident Management programs were initiated until now, the roles of emergency responders have remained largely the same because the transportation system has remained largely the same. Today a revolution in vehicle technology is taking place and is being led by the private sector. Vehicles with connected technologies are on the roads today, and, every year, technology is taking over a larger part of the driving task. Even before we reach the implementation of fully automated vehicles, there are changes taking place that will impact incident response.

Auto companies have been designing these technologies for many years. The public sector and academia have gotten involved more recently. The focus of the CV/AV work has been from the driver's perspective with the general thinking that these CV/AV technologies will make driving safer. However, what will happen when a crash occurs? Will responders need to respond differently? Will the severity of crashes increase because when the technology fails, it will fail catastrophically? Will new players be involved in incident response? Will all crashes be treated like crime scenes until the cause of the crash is identified? Are there new or changing risks to responders?

There are many unanswered questions and, to date, the TIM community has not been involved in these conversations. The Intelligent Transportation Society of America (ITSA) and the Transportation Safety Advancement Group (TSAG) have initiated the *Connected Responder: Public Safety and Emergency Response Community Connected Vehicle Interest, Context, and Business Case Development* project to educate responders about, and make the business case for, CV. There is also a significant need to reverse the conversation and include responders in discussions about TIM needs in the coming CV/AV world.

Task Outline

This project will begin with developing a summary of CV/AV research and determining if emergency responders are involved in the research. This project will also include an investigation of how traffic incidents might change in a more connected transportation system and what the needs of traffic incident responders would be. Lastly, this project will create a process to ensure traffic incident responders are included in the CV/AV research agenda moving forward.

(1) Prepare summary of ongoing CV/AV research and determine if the work includes considerations for traffic incident response / responders.

(2) Investigate how traffic incidents might change as transportation system becomes more connected (number of incidents, severity, liability, etc.) – consider 5, 10, 20 years in the future.
    - This work should incorporate any considerations developed by the FHWA TIM Vision Work Group.

(3) Based on predicted incident trends, consider how traffic incident response will change – new roles for responders, new agencies / organizations / companies involved in response, etc.
    - Work on this task will coordinate closely with work on the ITSA/TSAG project *Connected Responder: Public Safety and Emergency Response Community Connected Vehicle Interest, Context, and Business Case Development*.

(4) Develop a plan to ensure traffic incident responders are included in continued development of the CV/AV research agenda and projects.

Deliverables

For each task, a report will be prepared that summarizes findings or provides a plan, as appropriate.

Resources

Approximately 2 person years over one year, with expertise in traffic incident response combined with knowledge of CV/AV technologies. $250 K

Urgency

High urgency because of the need to ensure the issues/ requirements of the traffic incident responder community are considered at the earliest stages of development (preferably) and implementation CV/AV technologies.

PROBLEM TITLE

Readiness Assessment of CV Applications in the OSADP

II. RESEARCH PROBLEM STATEMENT

USDOT has funded a great deal of work to develop prototype Connected Vehicle applications. A wide variety of these prototypes are now available for public re-use on the OSADP (Open Source Application Development Portal). State and Local DOTs that wish to re-use these applications and integrate their capabilities into other existing systems need guidance on the readiness of these applications for deployment; in particular to more realistically evaluate the costs of integration of these tools with other DOT systems, software, and databases.

III. OBJECTIVE

The objective of this research is to provide agencies guidance on the readiness of OSADP applications for re-use.

IV. RESEARCH PROPOSED

The research team will review all applications on the OSADP intended for use in deployment of CV applications. Research tools and other applications for assessment of benefits or costs estimation are not necessary to review. The team will identify and consolidate into a single report the basic software structure, language, operating system, use of third-party tools/libraries/dependencies, databases, input files, and other characteristics of each package. Based on expertise and experience in developing similar types of software, the team will identify any potential observable issues in the software architecture and related components. The report will have sections that are digestible by non-software professionals with basic knowledge of information technology terms and concepts and more detailed analytical discussion of more complex software technology issues and details. The assessment will be objective and not biased towards the perceived superiority of any particular language, operating system, or technology except where the open market would clearly determine that a particular technique, tool, or technology selection would require significant effort by a DOT to adjust its current standards and allowable exceptions to re-use. The guidance will identify any gaps in the suite of tools on the OSADP that DOTs will have to fill to bring any particular application or suite of applications into a deployable state.

V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding: $100,000.
Research Period: 6 months.

VI. URGENCY AND PAYOFF POTENTIAL

Agencies need guidance on how much effort it will take to re-use any prototype applications developed by USDOT on the OSADP for their own IT environments and use of existing traffic management systems and related software, databases, and web technologies. Thus, the research is considered reasonably urgent given the timeline of typical procurement processes, the expectation of rapid deployment, and need to address institutional issues related to project

definition and funding estimates of V2I applications. V2I applications can be transformative in the ability of public agencies to provide a broad range of public benefits and re-use of applications through the OSADP is likely to help reduce agency costs.

VII. RELATIONSHIP TO NCHRP STRATEGIC RESEARCH GOALS, STRATEGIC PRIORITIES, and/or TRB STRATEGIC, CRITICAL, AND EMERGING ISSUES

This research is an important component of cost estimation of DOT deployment of CV applications.

VIII. RELATED RESEARCH

No current NCHRP 20-102 project is evaluating OSADP application readiness. This is a niche task of primary interest to State and Local DOTs that have near-term interests to deploy CV applications.

IX. PERSON(S) DEVELOPING THE PROBLEM

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X. PROCESS USED TO DEVELOP PROBLEM STATEMENT

This RPS was developed by Dr. Gettman and members of the V2I Coalition Working Group 2 (Research) and was reviewed by Greg Larson and Rob Bertini.

XI. DATE AND SUBMITTED BY

June 28, 2016; Submitted by Dr. Douglas Gettman on behalf of the V2I Coalition Working Group 2