Integrating Connected Vehicle Technologies in Support of Traffic Incident Management

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Introduction and Definitions

Traffic Incident Management (TIM)
The planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible.

Effective TIM reduces the duration and impacts of traffic incidents and improves the safety of motorists, crash victims and emergency responders.
Introduction and Definitions

Connected Vehicles (CV)
Broadly defined as those technologies that provide safe, interoperable, networked wireless communications among/between vehicles (V2V), the roadside infrastructure (V2I), and users’ personal communications devices (V2X).
CV Applications Background/Overview

• Five-year focus on application research, prototyping, demonstration and assessment
• Over three dozen application concepts developed
• Formal assessments to measure safety, mobility and environmental impacts
• Field demonstration assessments supplemented by estimation of future impacts using analytical methods
• USDOT Wave 1 CV Pilots incorporate multiple concepts
USDOT Wave 1 CV Pilots

Tampa Hillsborough Expressway Authority – crash/incident avoidance and expressway/arterial mobility

I-80 Wyoming – primary/secondary weather related incident reduction with focus on freight

New York – urban arterial signalized intersection safety focus, crash reduction
CV-TIM “Connection” and Wheel of Opportunity

A paradigm shift: crash survival to crash avoidance and incident prevention

Data for enhanced decision support and incident prediction

Enhancing awareness of incidents and maximizing mobility around/through incident scenes

Applications to enhance incident response and promote safe, quick clearance

SAFETY

DATA

RESPONSE

MOBILITY

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Safety V2I-TIM Applications (incident prevention)

Curve Speed Warning (CSW) – alerts provided to the vehicle/driver approaching a curve at an unsafe speed

Spot Weather Impact Warning (SWIW) - warnings of hazardous weather conditions relayed from management center and other weather prediction sources to roadside equipment, which are then re-broadcasted to impacted vehicles

Reduced Speed/Work Zone Warning (RSWZ) - utilizes roadside equipment to broadcast alerts to drivers warning them to reduce speed, change lanes, or come to a stop within work zones
Safety V2V-TIM Applications (incident prevention) 

Emergency Electronic Brake Lights (EEBL) – drivers are alerted to hard braking downstream traffic giving them heightened awareness of situations developing ahead

Forward Collision Warning (FCW) – alerts of a direct and imminent threat ahead are presented to the driver in order to help avoid or mitigate the severity of rear-end crashes

Blind Spot/Lane Change Warning (BSW/LCW) – drivers are alerted of the presence of same-direction traffic in an adjacent lane to help avoid unsafe lane change crashes

Do Not Pass Warning (DNPW) - alerts are given to drivers to help avoid a head-on crash resulting from passing maneuvers
Data CV-TIM Applications

Vehicles as data collectors and communicators

• “Big data”: Volume, Variety, Velocity, Veracity
• Context-aware decision making for response resource allocation, on-scene TIM actions
• Enhanced, real-time weather data integration
• Ability to “learn” from historical incidents to tailor real-time actions
• Data integration and analytics for predicting when, where, and under what conditions incidents are most likely to occur
• Robust, real-time performance measurement, reinforcing the TIM business case and substantiating ongoing programs and investment
Data CV-TIM Applications

“Heads-up” of important emerging research…

National Cooperative Highway Research Program Project 17-75
Leveraging Big Data to Improve Traffic Incident Management

Research objective: develop guidelines for TIM agencies that illuminate the concepts, opportunities, data sources, challenges, and options associated with the practical use and application of big data to advance TIM state-of-the-practice.
Mobility CV-TIM Applications

Significantly enhancing motorists’ awareness of incidents and maximizing mobility around/through incident scenes

Motorist Advisories and Warnings (MAW) - data from downstream vehicles provide information/warnings to upstream motorists

Intelligent Traffic Signal System (I-SIG) - An overarching system optimization application accommodating signal priority, preemption and pedestrian movements

Dynamic Speed Harmonization (SPD-HARM) - recommends target speeds in response to congestion, incidents, and road conditions to maximize throughput and reduce crashes

Queue Warning (Q-WARN) – provides drivers with timely existing and impending queues from incidents and work zones

Enhancing safe, quick incident clearance.

Emergency Vehicle Preemption (PREEMPT) – Preempts traffic signal operations to facilitate mobility of emergency vehicles

Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG) – provides input to responder vehicle routing, staging and secondary dispatch decisions

Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE) – warns on-scene responders/workers of vehicles with trajectories or speeds that pose a high risk to their safety. It also warns drivers passing an incident zone if they need to slow down, stop, or change lanes.

Emergency Communications and Evacuation (EVAC) - addresses needs of evacuees with and without special needs or their own transportation

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Integrating CV and TIM: Phase 1

Immediate/Short-Term (now-2020)

- Engagement of emergency responders
  - Needs identification
  - CV development
- Promotion of “what’s possible”
- Take advantage of ongoing TIM responder and manager training
- Stay current in CV continued research, apply CV pilot lessons learned
Integrating CV and TIM: Phase 2

Medium-Term (2020-2025)

• Migrate concepts to prototypes and in-field testing
• Embrace CV “big data” and use for meaningful TIM performance measurement
• Include emergency responders in addressing CV institutional issues and setting policy
• Recognize emergency responders are practical problem solvers and need proof of how CV technology can benefit them—what’s in it for me?
Integrating CV and TIM: Phase 3

Long-Term (2025+)

- Ensure that “back-end” data analytics consider needs of emergency responders in improving situational awareness and decision support
- Reliance on CV/data likely to require more aggressive maintenance of CV infrastructure
- Continued training on the use of CV as an incident response tool

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Conclusion

• There is strong potential for CV technology to dramatically and positively impact traffic incident management

• Recognize the important role of TIM/emergency responders play in transportation operations—not likely to diminish in the future

• The success of CV for TIM is dependent upon engaging emergency responders now

• Ongoing TIM responder training is an opportunity to promote and enhance awareness of potential

• Continue and expand CV pilot deployments and use evaluation results to fine-tune technology and applications
QUESTIONS?
THANK YOU FOR YOUR INTEREST!

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