Traffic Signal Systems and Connected Vehicles
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TEAM EFFORT:

Travel Safely: DSRC / SPaT Translation @ 85 Intersections
Connected Vehicles and V2X Applications / Research (C-V2N)

CAV Platform and Smartphone Application in Place!
Free to download and ready to expand for Alabama

Connected Vehicle Hardware – RADIO WARS
Cellular, DSRC (FHWA / USDOT), C-V2N (Qualcomm), C-V2X, 5G
Roadside Units (RSUs) at the Intersection On-Board Units (OBU’s) in the Vehicle

West Central Region Connected Vehicle Pilot Deployment
Tony English – Connected Vehicle Technical Lead
12 students 0600-0915, 18 Months Security. The below is his house!

WyDOT I-80 FHWA Freeway Deployment of DSRC
76 Radios over 402 Miles; Six Phases of Deployment; Truck Antennas

Travel Safely: Applied Information – Glance
SPaT and BSM Platform for Data Collection

Travel Safely: Real-Time Signal Info to Drivers
Countdown to green, red light warning, bikes, preempt, schools

Applied Information’s TravelSafely System
This system uses DSRC, C-V2X, C-V2N, and other forthcoming technology

Video Demonstration of SPaT and BSM Safety – 2018
SPaT Broadcasting and Red Light Warning https://youtu.be/E70cRk65JN
USDOT List of CAV Applications
More than 50 uses have been identified

Already have 17 included generic applications
- Up/Down display of signal timing
- Red-light running at traffic signals
- Bus/transit priority
- Intelligent school zones
- Emergency vehicle preemption
- Emergency vehicle notification
- Motorist – Cyclist communication
- Motorist – Pedestrian communication
- Work zone warning
- Curve warning/increase speed
- Rear end collision warning
- Wrong way detection
- Emergency vehicle preemption
- Weather Warnings
- Congestion Ahead Warning
- Railroad crossing active ahead
- Event management area management

Proposed Application #1: Freight Preemption (2019-2020)
Improving Reliability for JIT/JIS Manufacturing

Idea
- Use connected cellular preemption for freight CMVs
- Only use when needed based upon schedule and/or route conditions

Benefits
- Enhance travel time reliability to improve manufacturing performance
- Reduce overall travel time and emissions
- Increase safety of CMVs at intersections

Proposed Application #2: Signal BSM Logic (2019-2021)
Use Basic Safety Messages to Call/Extend Signal Phases

Idea
- Develop controller logic to use CAV BSMs to call/extend phases
- Use vehicle trajectory information to anticipate vehicle movements

Benefits
- Reduce delay at intersections; consider vehicles on all approaches
- Increase safety by protecting the dilemma zone
- Expands detection coverage; reduce future detection maintenance

Trajectory Based Signal Control from BSM 2030?
Completely New Logic! Radars → Virtual BSM Pilot
http://youtu.be/dy323KI6rrM

Trajectory Based Control Data - Connected Vehicles / Virtual Basic Safety Messages
Campus Drive (SW/RB/NE) @ Peter Byrge Boulevard (NW/SB/SW) - Tuscaloosa, AL

External BSM Control: A REALLY Simple Logic to Start
Three cars at Speed < 2.0mph is the switch criteria
http://youtu.be/Un5dES5eoWs

Trajectory Based Control Data - 3 Stopped Vehicles to Switch

West Central Region Connected Vehicle Pilot Deployment
REALLY EXCITING! First Trajectory Radar BSM Control
Econolite Sky, 4x Radars to Place Virtual BSM Calls (November 2019)

First Glimpse of Trajectory Data – One Approach, vBSM
Econolite Sky, 4x Radars to Place Virtual BSM Calls (January 2020)

Putting It All Together: C-V2N, SPaT, BSM, vBSM, Sky
Combining Data to Generate Trajectory Data (February 2020)

FHWA ATCMTD $16M (2019-2022) ALABAMA
Partnering with ALDOT, IDOT, TCRF for Smart & Connected Communities

ACTION: 32 Miles Fiber, >140 DSRC/CAV, >110 SPM
Machine Learning for Congestion and Incident Detection on 50+ Cameras
ITSA Connected Vehicle Deployments: UA & ALDOT!
Only TWO University Deployments – Operational and Planned

CONCLUSION: High-Res Data, DSRC, Machine Learning, etc.
Powerful New Ways to Monitor, Operate, and Optimize Traffic

Team Effort! UA, UTCA, CAPS, ATI, ALDOT, TDOT, RTOP

West Central Region Connected Vehicle Pilot Deployment