"Transferring knowledge about the TSMO practice around the country"

USDOT ITS JPO: Virtual Community College Workshop Series



NOCoE Founding Partners

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS









U.S. Department of Transportation

Federal Highway Administration

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Transportation **S**ystems Management and Operations





What is a Paraprofessional



Paraprofessional -

An individual supporting a professional in fields such as education, engineering, healthcare, and law.

A paraprofessional may be required to demonstrate knowledge and skills through certification, education, and/or experience.

Paraprofessionals are normally under the responsible charge of a licensed professional and may be assigned levels of responsibility commensurate with their knowledge and skills.



What is a TSMO Paraprofessional



A TSMO paraprofessional is a position **supporting the management and operations** of transportation infrastructure.

A TSMO paraprofessional **may exert a high level of judgment** in the performance of their work.

TSMO paraprofessionals can **comprehend and apply knowledge** of basic engineering principles in the solution of broadly defined TSMO problems at a cursory level.

TSMO paraprofessionals provide traffic management center operations services and a variety TSMO field services.





https://transportationops.org/workforce



Connected Vehicles Technology Lessons Learned from Field Deployments



Blaine D Leonard, P.E. Transportation Technology Engineer Utah Department of Transportation

THE NARWHAL GROUP Jonny Turner Principal Electrical Engineer The Narwhal Group

Ralph Koeber Electrical Engineer The Narwhal Group



The **Connected Vehicle** system uses wireless technologies to exchange information with:

- Other vehicles (V2V),
- Roadside infrastructure (V2I), and
- Other travelers (peds, bikes, etc) (V2X)

to help the driver avoid hazards and drive more efficiently

INFORMATION BASED ON WHAT THE VEHICLE CAN "LEARN" BUT CAN'T SEE

Connected Vehicle V2X Options



Roadside Unit (RSU)

On-Board Unit (OBU)



DSRC (Dedicated Short Range Communication) Developed and evolved to meet specific needs 802.11 standards (like WiFi) Uses 5.9GHz Spectrum Very low latency (10-50 millisecond) 300-meter range

Tested, proven, broadly deployed, available Future Path to IEEE NGV

Connected Vehicle V2X Options



DSRC

802.11 standards Uses 5.9GHz spectrum Short-range, low-latency Broadly deployed Future Path: IEEE NGV



RSU

OBU



C-V2X (Cellular V2X)

Cellular 4G-LTE technology (not "5G") Built on 3GPP Release 14 (2017) and 15 (2018) Requesting access to 5.9GHz spectrum Short-range, low-latency Newer, not broadly tested yet Commercial availability emerging Not interoperable with DSRC



of Operations (draft) – 05-2020

SPaT Challenge Deployments

"Local Pilots of National Significance"

Challenge state and local public sector transportation Infrastructure Owners & Operators (IO&Os) to deploy DSRC infrastructure with SPaT broadcasts in at least one coordinated corridor or network (approximately 20 signalized intersections) in each state by January 2020.



www.transportationops.org/spatchallenge

20 Intersections in 50 states by 2020!



FCC Wireless Spectrum



Signal/ITS Technician (Electrician)

- Safety: traffic control, utilities, signal cabinet and tools
- Equipment Operation: safety, driving, and operation
- Electrical Theory: AC vs DC, volts, amps, resistance, power and Ohm's Law
- Traffic signal operation, electronics and interfaces
- Vehicle electrical system, operation and interfaces
- Field Measurements: volts, amps and resistance
- Radio Installation (mechanical skills): alignment, drilling, cutting, banding, dressing
- Cable Installation: junction box access, cable routing and pulling, terminations, cable testing and dressing
- Surge Suppression
 - Power over Ethernet



Information Technology (IT)

- Networking: wired and wireless, IP addressing subnetting, routing, IPV4 vs IPV6, port configuration, vlan, remote access
- Windows Command Line Environment: check IP, run ping commands
- Linux Command Line Environment: check and configure IP, folder navigation, file transfer, file editing (i.e., vi, nano, etc)
- Cabling Basics: cable distribution, fiber optic vs copper networks
- Real-time data handling
- Database management
- Packet capture (Wireshark)
- Firmware updates

Technical writing

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Engineering / Computer Science

- File Editing: configuration files
- Security Certificate Management System (SCMS)
- RF Theory: transmit, receive, dBm, interference, dual radio impacts (not like COTS radio links)
- Hardware design
- Programming
- Device testing
- Configuration files
- Understanding of applications
- SNMP
- MIBs
- Encoding/Decoding
- Next-level support from manufacturers
- Data Analysis
- Technical writing



On the Job Training (OJT) – To round things out

- Alphabet Soup: DSRC, CV2X, OBU, RSU, Dual Unit, BSM, MAP, SPaT, TIM, FCC, Spectrum, Frequency, Channels, PSID, IEEE 1609, SAE J2735, J2945, 3GPP, NTCIP
- GIS: MAP Generation
- System monitoring analysis
- Custom Applications: ISD Message Creator, TIM Message Creator, Message Validator
- Proficiency with: VPN, SSH, Telnet, RDP, SCP



Lessons Learned

- We have found that the implementation of this technology requires professionals from all of these areas
- This rapidly changing technology and their deployments have proven to give consistent challenges and growth to those that have chosen to do this work
- Ideal candidates have IT or Engineering background that are willing to work on the side of a busy road, 20' in the air, in extreme environments (which electricians, signal and ITS techs do regularly)
- This work provides a great sense of accomplishment and satisfaction













Connected Intersection MAP Messages

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President, A	they Creek Consultants			
i -				
leeter@acc	consultants.org			





SPaT Message:

- From the Signal Controller
- Current Signal Status for each approach (signal group)
- Expected time of next signal phase change
- Whether pedestrian cross walks are activated
- Others







Key Skills / Resource Familiarity

- FHWA Mapping Tool: Available on-line
- GIS Tools and Software
- Online Mapping Resources: Google Maps, Bing Maps
- Data Collection Tools: LIDAR, UAVs, Traditional surveying equipment, handheld GPS
- Data Formats / Languages: XML, KML, JSON
- Location Correction: Approaches and Data Sources







Work Zone Technology Innovations

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Why make Works Zones "Smart"?

Introduction of ITS (Intelligent Transportation Systems) into the work zone provides:

- Improved communication for motorists
- Reduce driver distraction
- Increase mobility
- Worker Safety Measures



The future of Work Zone Innovations

- Solution-Based Work Zone Technology
- Digitally Connecting Work Zones





Examples of Innovations in Work Zone Safety





Vehicle Queue Warning Systems



- Used to alert motorists of slow or stopped traffic before they reach the back of

before they happen



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Dynamic Merge Systems

- Early Merge: Light traffic; encourage aggressive drivers to merge into the open lane sooner than they would
- Late Merge: Effective for higher volumes of traffic where the congestion and backups are expected





Helps to dynamically manage traffic







Portable Traffic Signals

Many states use portable traffic signals to support work zone safety and mobility - but the market is getting smarter!







Variable Speed Limit Systems

Allow DOTs to dynamically reduce speed during active construction and when workers are present







Use beacons to actively show to the motorist that work is going on





Connected Arrow Boards







Digital Mapping of Work Zones

Use Work Zone Location Sensors to digitally map the GPS location, where work zone begins and ends, and direction of travel

Data can be absorbed by traffic service providers to give improved guidance to approaching motorists



zone

Source: VER-MAC





So <u>who</u> does this work?

Use of Smart Work Zone (ITS) technology requires a unique skill set that is not developed through most standard college programs -

- Transportation Engineering Principles
- Systems Operations and Maintenance
- Computer Science / Basic Programing
- Electrical Technician
- Knowledge of Sensors
- Understanding of Communications Protocols
- Cyber Security
- Big Data

Solving Transportation needs with data analytics and technology





Thank you!



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