Catching up with Connected & Automated Vehicle Advances in NJ

NJDOT's Smart and Connected Corridor Program

April 21, 2021





In coordination with County and Municipal Traffic Engineers Association







Today's Overview

Technical Program

- Connected Vehicle Technology: A Next Step for Intelligent Transportation Systems Programs
- CAV Planning and Preparation
- NJCTII Pilot Project
- Equipment and System Demonstration
- Mainstreaming CV Programmatic Activities and Projects
- Final Question & Answer

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As we go along, please enter your questions in the Q&A (Not Chat)

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CONNECTED VEHICLE TECHNOLOGY: A NEXT STEP FOR INTELLIGENT TRANSPORTATION SYSTEMS PROGRAMS



Connected Vehicle Technology



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What is it?

- Equipment, applications, or systems that use Vehicle to Everything (V2X) communications
- V2X communications communication broadcasts and peer to peer exchanges to sense what other travelers are seeing
- Allows two equipped devices to "see" each other and exchange critical information
- Equipment and applications maybe on the roadside, vehicles and on personal devices

Connected Vehicle Technology



Why is it important?

- Improve ability to communicate with travelers about safety risk
 - Weather
 - Incidents
 - Work zones
 - Intersection safety

Improve traffic signal control and systems management

- Signal coordination
- Eco-driving
- Many more...



Connected Vehicle Technology







CAV PLANNING AND PREPARATION





NJDOT CONNECTIVITY - PLANNING INITIATIVES

- P77 Cabinets
- Connected Vehicle Hardware Standard Drawings
- Connectivity ConOps
- NJTAP CAV Working Group/ Strategic Plan
- CAV Backend Systems





Planning for Design – Connected Vehicles P-77 Cabinets

P-77 Cabinet Features:

- Extra space for ITS/CV devices
- Access for additional conduits



Planning for Design – Connected Vehicles CV Standard Drawings

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Roadside Unit (RSU) Features:

- Can be placed on traffic signal pole, or midblock detector pole
- Many CV safety applications available for use
- Standard Details and specifications being fine tuned as design projects progress

SYSTEMS ENGINEERING FOR STATEWIDE CONNECTIVITY

- Understand CV applications that each regional stakeholder desires to implement
- List of Stakeholders for Project:
 - NJDOT (several departments)
 - PANYNJ
 - MPO's
 - State representatives for local police, fire and EMS
 - Trucking industry
 - FHWA Regional Office
 - Cities of Newark and Trenton
 - 8 statewide Transportation Management Associations

SELECTED CV APPLICATIONS





NJTAP CAV WORKING GROUP/COORDINATION • NJDOT was part of the New Jersey Transportation Agency Partnership (NJTAP) CAV Working Group

- NJDOT led the CAV Working Group had coordination among key transportation agencies within New Jersey:
 - Delaware River Port Authority (DRPA)
 - New Jersey Turnpike Authority (NJTA)
 - NJ Transit
 - Port Authority of New York and New Jersey (PANYNJ)
 - South Jersey Transportation Authority (SJTA)
 - American Council of Engineering Companies (ACEC NJ)



Executive

Committee

NJTAP

Seven Working Groups: 1) New Jersey Department of Environmental

Protection Regulations



NJTAP CAV STRATEGIC PLAN

- NJTAP CAV Working Group Developed CAV Strategic Plan.
- Plan Covers
 - Purpose/Vision for CAVs in New Jersey
 - Ongoing CAV Initiatives (Nationally, Regionally, Locally)
 - Needs/Challenges associated with CAVs in New Jersey
 - Goals of CAVs for New Jersey
 - Strategies for NJTAP Agencies to successfully prepare for/deploy CAVs





chrowledgements: Prepared in cooperation with the American Council of Engineering Companies (ACEC), Delaware River Port unbothy (DBPA), New Jersey Department of Transportation (NUDOT), New Jersey Turngike Authority (NUTA), New Jersey ranzh (NUT), Port Authority of New York and New Jersey (PANYNI) and Souch Jersey Transportation Authority (SITA). nouliant support provided by Jacoba Engineering Group through contracts to NUDOT.

sictaimer: The contents of this report are based on the research, discussions and coordination completed by the individual nembers of the New Jarsey Transportation Agencies Partnership (NLTAP) Connected and Automated Vehicle (CUV) Working rough. The contents on the nexessiry if yearches the official views or policies of the supporting agencies. This report does not onstitute a standard, specification, or regulation.

NJDOT CAV STRATEGIC PLAN

- Initially planned for 2020
- Proposed to take place in 2021
- Provides a DOT-wide introduction to CAV
 - Education of CAV for all units
 - High level buy-in for moving forward
 - Opens discussion for advancing CAV at DOT





New Jersey Connected Technology Integration and Implementation (NJCTII) Pilot Project





NJCTII PROJECT SCOPE

- Preliminary Investigation Phase Determine requirements for successful deployment of RSUs for SPaT, MAP, TIM, BSM
- Lab Testing Phase Successfully develop simulated field network setup in a lab environment to test RSUs, OBUs, and Signal Controllers
- Field Deployment Phase Successfully install, integrate and activate RSUs at signalized intersections onto the NJDOT communications network



NJCTII PROJECT CV APPLICATIONS

- Signal Phasing and Timing (SPaT) provides traffic signal phases, current state of all lanes at signalized intersection, as well as any preemption or priority
- MAP message set providing intersection geometry data
- TIM Traveler Information Messages
- BSM Basic Safety Messages







NJCTII OEM VENDORS

- Road Side Units (RSU)
 - Siemens (DSRC & CV2X)
 - Commsignia (Dual Band)
 - Danlaw
 - Blyncsy Intersect
 - Traffic Cast BlueTOAD Spectra (DSRC & CV2X)
- On-Board Units
 - Commsignia (DSRC & Dual Band)
 - Danlaw
- Traffic Signal Systems
 - Naztec 2070LN
 - Econolite Cobalt
 - Trafficware Commander ATC
 - SCATS (Signal Software)
- Network Hardware/Software
 - Cisco





NJCTII MATRIX



LEGEND				
	Tested, Confirmed Compatible			
	Compatibility Testing Pending			
	Not Compatible			
	Not Applicable			

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ADAPTIVE SIGNAL INTEGRATION

 As a part of the project, NJDOT is also testing SPaT/MAP broadcasts on adaptive traffic signal systems





FCC COORDINATION

- NJDOT required to register DSRC equipment with the FCC
- FCC Notice of Proposed Rule Making (NPRM)
 - In December 2019 FCC issued NPRM announcing temporary freeze on acceptance of applications for certain portions of the dedicated 5.9 GHz Band
- Experimental CV2X License from FCC

NJCTII CONNECTIVITY

- NJDOT is closely coordinating with the Office of Information Technology (OIT) to evaluate network requirements for integration
- Current deployments will all be on corridors with direct fiber connections
- OIT helped configure simulated field network in the lab



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NJCTII TESTING

- NJCTII project will assist NJDOT determine testing requirements and specifications.
- NJCTII will evaluate commercial applications for OBUs to test SPaT/MAP
- Potential Corridors
 - RT 22
 - RT 9
 - RT 1



EQUIPMENT AND SYSTEM DEMONSTRATION



Driving intelligence to the edge







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Edge Applications

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- Graphical UI client enabling administrator to program the dataflow engine
- Easy drag-and-drop interface enabling visual programming
- Displays real-time values to aid in creation and debugging process
- Plugin for Visual Studio





MAINSTREAMING CV AT NJDOT -PROGRAMMATIC ACTIVITIES AND PROJECTS



PROGRAMMATIC DEVELOPMENT OF ENABLING

Standards & Specifications

- DSRC VS C-V2X
- Requirement for OmniAir Certification
- Compatible with SCMS certificates
- Supports Provider Service Identifiers (PSID)
- SCMS production Certificate Provisioned (pre-baked) by RSU vendor

Testing procedures

- Level-A: Demonstrate individual devices at each site are fully operational for BSM, MAP & TIM transmission without Cisco Edge Intelligence platform
- Level-B: Demonstrate individual devices at each site are fully operational for BSM, SPaT & MAP & TIM transmission with & without Cisco Edge Intelligence platform

ITS((

 Level-C: Demonstrate integration of BSM, TIM, SPaT & MAP with Cisco Edge Intelligence Software from the designated control central server through DOT Network

Security Credential Management System (SCMS)

- Ensures Integrity
- Ensures Authenticity
- Ensures Privacy

https://www.ghsiss.com/v2x/njdot/



Smart & Connected Corridor (Route 1/295) Contract#1

Route-1

Total 36 Intersections Total 27 Midblock Locations 5 WWD sites

<u>Route-295</u>

Total 11 ITS Sites (CSS,DMS) 6 WWD sites

> Total RSUs for project: 78 Application: SPaT, MAP, TIM & BSM



Route U.S 322 & Route U.S 40/322 ATS, C#1

Total 27 Intersection Total 21 Midblock Location Total 47 RSU's Application: SPaT, MAP, TIM & BSM

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Route 73, Haddonfield Road to Delaware River, ATS, C#2 Total 4 Intersection Total 5 Midblock Location Total 9 RSUs Application: SPaT, MAP, TIM & BSM

ITS ()NJ





Projects Under Design

Number	Project Name	Route	MP Start	MP End	Number of Signalized Intersections
1	Route 38, Rt 70 to Union Mill Road ATS C#1	38	0	12.16	20
2	Route 73, Haddonfield Rd to Delaware River ATS C#2	73	32.1	34.49	4
3	Route 18, Paulus Blvd to Rt 287 SB Ramp ATS C#2	18	40.91	47.92	11
4	Route 29, Route 295 to Sullivan Way ATS C#1	29	0	6.68	4
5	Route 1&9, Rt 35 to North Street ATS C#1	1	36.35	55.81	33
6	Route 23, Route 80 to CR694 ATS C#1	23	5.53	16.94	18
7	Route 1T and Route 440 ATS C#1	1T	0.93	4.25	8
8	Route 1T and Route 440 ATS C#1	440	24.22	26.1	8
9	Route 40, CR 606 to Atlantic Ave, Interchange, Rt. 50, Rt. 40 to Cedar St., ATS C#1	40	45.89	47.84	6
10	Route 40, CR 606 to Atlantic Ave, Interchange, Rt. 50, Rt. 40 to Cedar St., ATS C#1	40	62.98	64.32	3
11	Route 40, CR 606 to Atlantic Ave, Interchange, Rt. 50, Rt. 40 to Cedar St., ATS C#1	50	18.62	21.6	3



Projects under Planning

Number	Project Name		MP Start	MP End
1	Rt 287, Route 95 to Old New Brunswick Road	287	0.2	7.7
2	Rt 287, Old New Brunswick Road to Foothill Road		7.7	15
3	Route 195, Route 295 to Route 9	195	0	25.9
4	Rt 295, Essex Avenue to CR 537 (Marne Highway)		26.4	41.5
5	Rt 76, CR 659 to Rt 676	76	0	2

Questions?

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PDH QUESTIONS - ROUND 1- PLEASE ANSWER IN CHAT



Q1. What types of travel applications can a Signal Phase and Timing Message support? (Check all that apply)	Q2. What is a Basic Safety Message?
	1. A message or a packet of data that contains information about vehicle position, heading, speed, and other
A. Transit Signal Priority	information relating to a vehicle's state and predicted path.
B. Intersection Movement Assist	2. A message on a roadside sign indicating safety information
C. Road weather alerts D. Eco-driving	3. A message to 911 or law enforcement about vehicle location
	4. A message received by a vehicle about congestion ahead
Q3 What are some of the primary reasons for NJ DOT to consider research and deployment for	Q4. What are some of the ongoing concerns about CV technology for DOT?
connected technology!	a) Technology changes. What if the technology on the
I. Provide more timely in-vehicle alerts about road	roadside is not compatible with devices/technologies used in cars?
II. Improve traffic safety by reducing intersection- related crashes and wrong way driving III. Track vehicles through New Jersey IV. Identify speeders on NJ corridors	b) Lack of vendors for the technology
	c) Timing of investment. Chicken or the egg – What comes
	tirst – intrastructure deployment or critical mass of connected devices on the road
	d) Interoperability with other jurisdictions and State DOTs.

PDH QUESTIONS - ROUND 2- PLEASE ANSWER IN CHAT



Q5. What do each of the following connectivity terms stand for V2V, V2I, V2X and what is an example of use of each?

- V2V = Vehicle to Vehicle, ex. Forward collision warning
- V2I = Vehicle to Infrastructure, ex. Red light warning, wrong way driving
- v2X = Vehicle to Everything, ex. Pedestrian alerts

Q6. How do various connected devices trust each other's messages?

Through the security credential management system or the SCMS. The SCMS provides the security infrastructure to issue and manage the security certificates that form the basis of trust for V2V and V2I communication.

Thank you!

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