

# Connected Vehicle Pilot Deployment Program Phase 3

## Operational Capability Showcase Summary – New York City (NYCDOT)

[www.its.dot.gov/index.htm](http://www.its.dot.gov/index.htm)

**Final Report — November 16, 2021**

**FHWA-JPO-18-714**



U.S. Department of Transportation

Produced by New York City Department of Transportation (NYCDOT) CV Pilot Team  
U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology  
Intelligent Transportation Systems Joint Program Office (ITS JPO)

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## Technical Report Documentation Page

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<b>16. Abstract</b> This document describes the Operational Capability Showcase Summary (OCSS) for the New York City Department of Transportation (NYCDOT) Connected Vehicle Pilot Deployment (CVPD) Project. As part of USDOT Connected Vehicle (CV) Pilot Deployment program, NYCDOT held the Operational Capability Showcase (OCS) as a virtual event on July 20, 2021. While intended as an in-person media event to show the capabilities, intent, and value of the CV deployment, the showcase for NYC CV Pilot Deployment was held via webinar due to the COVID-19 pandemic. The OCSS provides a summary of the showcase event and highlights the engagement activities following the showcase event.			
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F2	11/16/2021	NYCDOT	Revised final
F2_Section508Compliant	12/16/2021	NYCDOT	Final 508-compliant

# Acknowledgements

The New York City Department of Transportation (NYCDOT) and its pilot deployment team thanks the many fleet owners dedicated to bringing connected vehicle technology to New York City. These stakeholder organizations demonstrate their commitment towards attaining Vision Zero's goals through their participation. The various NYCDOT vehicle fleets, NYC Department of Citywide Administrative Services (DCAS) vehicle fleets, MTA/NYCT, and Pedestrians for Accessible and Safe Streets (PASS) have expended considerable resources participating in the development of the overall Concept of Operations as well as this document.

Finally, the team wants to thank the USDOT for sponsoring this project and laying the foundation for future connected vehicle deployments.

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# 1. Introduction

## 1.1 Project Scope

NYC is implementing the CV technology as another tool in its quest for Vision Zero. It is anticipated that CV technology will demonstrate its potential in reducing the number of and severity of crashes in the deployment area through this project. New York City will assess the technology's impacts and potential for attaining the Vision Zero goal. Figure 1 in Section 1.2 provides a conceptual view of the system to be deployed. It also provides insight to whether a component exists or will be newly deployed within the project.

The NYC CVPD project is one of three initial CV deployment projects that establish a base for growing a nation-wide connected vehicle system. As such, its focus is on utilizing standards to build basic infrastructure in a manner that provides a foundation for future deployments of connected vehicle technology.

The NYC CVPD project allows for a real demonstration and evaluation of the benefits of the CV technology in a dense urban environment. NYC has deployed a robust infrastructure with advanced traffic controllers (ATC), an advanced adaptive traffic signal control system which currently uses travel times as part of its operational algorithms, an aggressive maintenance program, and a ubiquitous high speed wireless network (Traffic Safety Network (TSN)). By deploying Aftermarket Safety Devices (ASD) and Roadside Units (RSU), our team can bring the benefits of the CV paradigm to NYC's Vision Zero initiative and provide the opportunity to evaluate the benefits with a significant number of vehicles that are regularly driving in the area.

This project also provides the Federal Highway Administration (FHWA) the opportunity to showcase the benefits of CV technology without replacing the vehicle fleet – which is likely to be the situation for many years to come. At the same time, the NYC CVPD will be used to demonstrate the benefits to vulnerable road users who suffer the most from roadway fatalities in NYC. Hence, the purpose of the NYC CVP Operational Capability Showcase (OCS) is to highlight the benefits of CV and demonstrate the capabilities, intent, and value of deploying CV technology.

## 1.2 System Overview

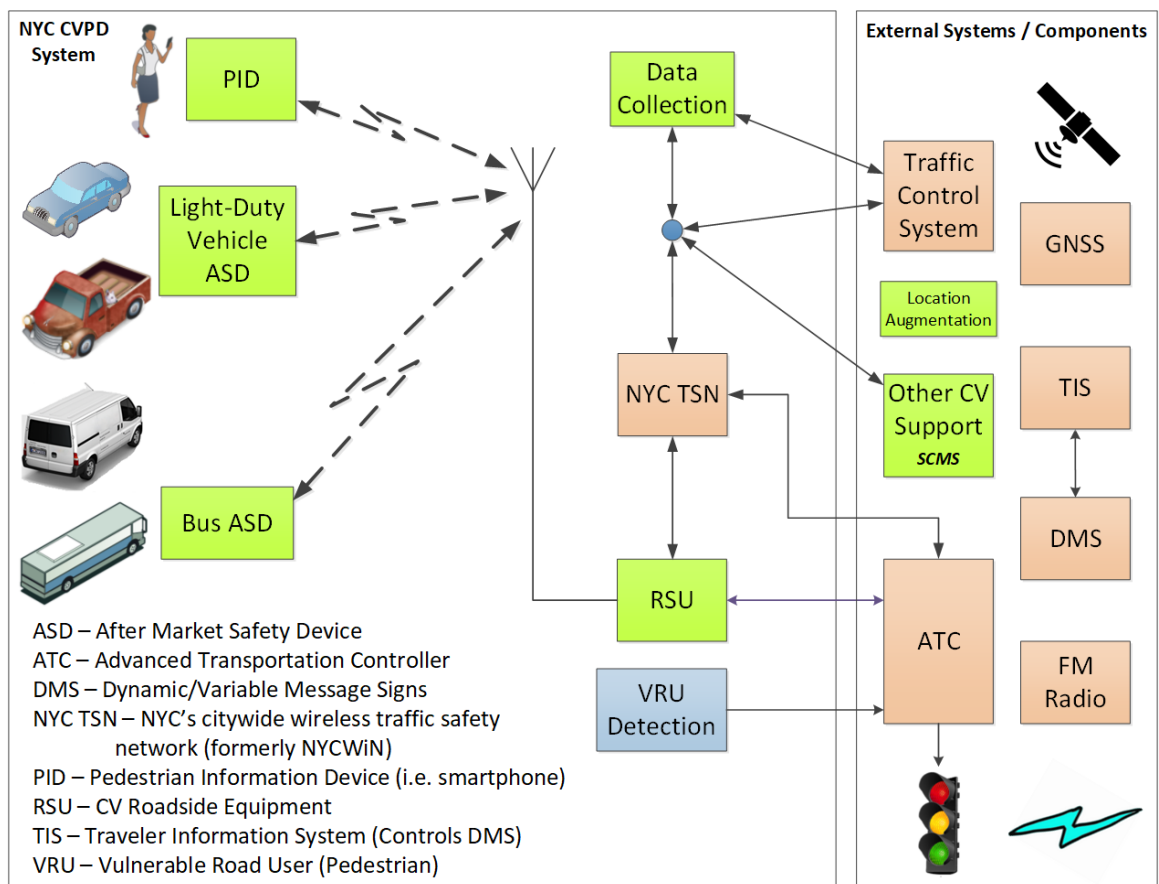
This project brings New York City (NYC) another step ahead towards reaching the Vision Zero goal of eliminating the injuries and fatalities due to traffic crashes. The project's concept is simple - it introduces CV technology and communications into the NYC travel environment by equipping several large vehicle fleets with the technology and equipping several areas with the corresponding connected vehicle infrastructure.

It is important to understand the implications of the connected vehicle technology deployment in New York City. A small portion of the NYC roadway network has connected vehicle infrastructure installed



(450 Roadside Unit (RSU) locations). Vehicle-to-Infrastructure (V2I) applications such as Red-Light Violation Warning, Speed Compliance, and Curve Speed Compliance support connected vehicles operating in these areas. However, the geographic reach of the connected vehicle technology is much broader. Vehicles equipped with connected vehicle technology (i.e. ASDs) travel in this infrastructure equipped area *and throughout the City's transportation network*. Thus, the connected vehicle technology that supports Vehicle-to-Vehicle (V2V) applications can function anywhere two (2) equipped vehicles are within range of one another. Equipped vehicle encounters may occur on the surface streets, bridges crossing the rivers, at the airports, and on the City's higher speed facilities such as the FDR Drive and the Long Island Expressway. The large fleet size means that there will be many opportunities for the connected vehicle technology to perform over a large geographic area and diverse roadway environments.

Figure 1 depicts the NYC CVPD system and the boundary between the internal system and the external systems and components that interface with the NYC CVPD environment. The ASDs, RSUs, PIDs, data collection/processing system, NYC TSN, and VRU detection system are in the NYC CVPD system. The traffic control system (TCS), traffic controller (ATC), Global Navigation Satellite System (GNSS), Traveler Information System (TIS), Dynamic Message Signs (DMS), FM Radio, and other CV support systems including the Security Credential Management System (SCMS) are the external systems and components.



Source: NYCDOT, 2019

**Figure 1. NYC CVPD System Concept**

The existing system elements, critical to the operation of the pilot system, are illustrated with beige backgrounds. These existing elements include TCS, ATC, GNSS, TIS, DMS, FM radio, and supporting New York City's wireless network communications infrastructure (TSN). The new system elements which exist and will be reused, modified, or integrated into the NYC CVPD system contain green backgrounds. They comprise the ASDs in light-duty vehicle, bus, and commercial vehicle, RSUs, PIDs, data collection/processing system, and other CV support systems including the SCMS. The Vulnerable Road User (VRU) detection devices are shown with a blue background. They have been deployed to the system on a very limited basis. The firmware of the traffic controllers was modified by the vendor to provide the SPaT information to the RSU to support the V2I applications, and to the TCS to support the PID applications. In addition, the communications to the ATC have been upgraded to increase the security needed to support the Connected Vehicle applications.

NYC's initial system deployment is anticipated to be the largest CV technology deployment to date. 281 intersections in Manhattan and 28 intersections along Flatbush Avenue in Brooklyn have been instrumented with RSUs to communicate with up to 3,000 vehicles equipped with ASDs. These devices monitor communications with other connected vehicles and the infrastructure and provide alerts to vehicle drivers/operators. Other RSUs have been installed at locations to support system management functions such as providing security credentials, managing application and parameter configurations, and uploading logged information. These locations consist of fleet terminal facilities, airports, and river crossings (bridges and tunnels) where vehicles frequently travel. The City has installed 450 RSUs to support the connected vehicle infrastructure as indicated above.

### **1.3 Purpose of the Operational Capability Showcase**

The purpose of the OCS was to provide a media event that shows the capabilities, intent, and value of CV technology deployment. For NYC, the intent was to showcase the CV technology being deployed and operating in an urban environment and avoid being a structured demonstration such as the Operational Readiness Demonstration (ORD) in Phase 2.

However, the COVID-19 pandemic has been ongoing since early part of 2020 through 2021. Nonetheless, the project requirement is to hold the OCS no later than the first 12 months of Phase 3 which began on January 1, 2021. Hence, USDOT agreed to allow NYCDOT to hold a virtual OCS through the web in place of a face-to-face media gathering.

### **1.4 Purpose of the Operational Capability Summary**

The NYC CVPD Operational Capability Showcase Summary (OCSS) provides a summary of the showcase event and highlights the engagement activities following the showcase event. It describes the showcase activities and attendees, resources and material developed for the OCS, activities after the OCS, and lessons learned from the OCS.

## 1.5 Organization of the Report

This OCSS consists of the following sections:

- 2 – Operational Capability Showcase Overview
- 3 – Operational Capability Showcase Attendees
- 4 – Operational Capability Showcase Activities
- 5 – Resources Developed for the Operational Capability Showcase
- 6 – Post-Operational Capability Showcase Activities
- 7 – Lessons Learned
- 8 – References
- 9 – Acronyms
- Appendix A – Operational Capability Showcase Invitation
- Appendix B - Operational Capability Showcase Questions and Answers

## 2. Operational Capability Showcase Overview

### 2.1 Objective of the OCS

The purpose of the OCS is to provide a media event that shows the capabilities, intent, and value of CV technology deployment. For NYC, the intent is to showcase the CV technology being deployed and operating in an urban environment and avoid being a structured demonstration such as the Operational Readiness Demonstration (ORD) in Phase 2.

However, the COVID-19 pandemic has been ongoing since early part of 2020 through 2021. Nonetheless, the project requirement is to hold the OCS no later than the first 12 months of Phase 3 which began on January 1, 2021. Hence, USDOT agreed to allow NYCDOT to hold a virtual OCS through the web in place of a face-to-face media gathering.

### 2.2 Outcome of the OCS

The virtual OCS demonstrated the operational capability and performance of the CV safety technology in NYC. It also shared challenges and lessons learned in deploying CV technology in NYC. The attendees were able to see the impact of NYC CV pilot deployment's emphasis and focus on safety goals and benefits. Also, they were able to understand how the NYC CV pilot deployment could evolve into a sustainable infrastructure to support USDOT's goals for CV interoperability and standardization. The lessons learned presented during the virtual NYC OCS could be shared with the general public to help and encourage current and future CV deployers in other parts of the country and the world. The audience also was able to learn where to find additional resources describing the project, its performance, and continued operations.

Throughout the virtual OCS, the audience was able to ask questions. The questions were answered by the presenters and the administrator of the virtual showcase event at the end of the presentation. After the virtual showcase, the NYC team compiled the OCS Q&A document which is referenced in Section 5.3 and provided in Appendix B. In addition, the Q&A document has been posted on the USDOT ITS JPO CV Pilots website: <https://www.its.dot.gov/pilots/index.htm>.

### 3. Operational Capability Showcase Attendees

USDOT's ITS Joint Program Office (JPO) and ITS America (ITSA) sent out the announcement and the registration landing page for the virtual NYC CV Pilot Deployment OCS: <https://nycoperationalcapabilityshowcase.eventbrite.com>. Screenshots from the website with the event description are in Appendix A of this OCSS document.

While an official number of attendees was not captured, a total of 525 registrants signed up to attend the virtual OCS on the above link. They consisted of individuals from the following types of organizations:

- Private sector
  - Device vendors
  - Engineering/consulting companies
  - Motor companies/vehicle manufacturers
  - Nonprofit/Non-government organizations (NGO)
  - Original Equipment Manufacturers (OEM)
- Public sector
  - Federal (i.e. USDOT/FHWA)
  - State departments of transportation (DOT)
  - Local municipalities
- Universities and research institutions

# 4. Operational Capability Showcase Activities

## 4.1 Presentation Activity

The NYC OCS was held virtually on July 20, 2021 from 1:30 to 2:30pm Eastern Time (ET). NYCDOT coordinated with Intelligent Transportation Society of America (ITS America) and Institute of Transportation Engineers (ITE) to host the live, virtual NYC OCS and provide the external link listed in Chapter 3 for registered attendees to join.

The virtual NYC showcase event followed the timeline and agenda shown in Table 1 below.

**Table 1. NYC CV Pilot Operational Capability Showcase Agenda**

#	Subject	Duration	Description	Speaker
1	Welcome and Introduction	7 min	Master of Ceremonies: Mohamad Talas introduces the speakers	<ul style="list-style-type: none"> <li>• Mr. Ken Leonard – USDOT Director of ITS Joint Program Office (JPO)</li> <li>• Ms. Margaret Forgione – NYCDOT First Deputy Commissioner</li> <li>• Mr. Keith Kerman – NYC DCAS Chief Fleet Officer and Deputy Commissioner</li> </ul>
2	Interoperability	7 min	<ul style="list-style-type: none"> <li>• USDOT CV interoperability video</li> <li>• CVP Project Coordination Goals (Documentation consistency, common system engineering approaches, etc.)</li> </ul>	Dr. Jonathan Walker – Chief of Policy, Architecture, and Knowledge Transfer, USDOT ITS JPO
3	Project Overview and Accomplishments	14 min	<ul style="list-style-type: none"> <li>• Goals</li> <li>• Safety applications               <ul style="list-style-type: none"> <li>○ V2V, V2I, PED App</li> </ul> </li> <li>• NYC CV safety application/driver training video</li> </ul>	<ul style="list-style-type: none"> <li>• Dr. Mohamad Talas – Director of ITS Management and System Engineering, NYCDOT Traffic Operation</li> </ul>

#### 4. Operational Capability Showcase Activities

			<ul style="list-style-type: none"> <li>• PED-SIG application challenges</li> </ul>	<ul style="list-style-type: none"> <li>• Mr. David Benevelli – Associate Vice President, JHK</li> <li>• Dr. Kaan Ozbay – Professor at the Department of Civil and Urban Engineering (CUE) and Director of the C2SMART Center, NYU Tandon School of Engineering</li> </ul>
4	Stakeholder Outreach	3 min	Stakeholder outreach coordination	Mr. Eric Richardson – Deputy Chief Fleet Management Officer, NYC DCAS
5	Performance Measurement to Date	4 min	<ul style="list-style-type: none"> <li>• Safety</li> <li>• Mobility</li> </ul>	Mr. Keir Opie – Director of Simulation and Traffic Analysis   Principal, Cambridge Systematics
6	Additional Resources	3 min	<ul style="list-style-type: none"> <li>• NYC CV Pilot web site</li> <li>• Publicly available data: <ul style="list-style-type: none"> <li>○ ITS DataHub</li> <li>○ Data Dashboard</li> </ul> </li> </ul>	Mr. Keir Opie – Director of Simulation and Traffic Analysis   Principal, Cambridge Systematics
7	Conclusion and Next Steps	5 min	<ul style="list-style-type: none"> <li>• Lessons Learned</li> <li>• Urban Environment</li> <li>• Scale</li> <li>• Operations/Maintenance</li> <li>• Fleet Management</li> <li>• Security Scaling</li> <li>• Safety Application Performance</li> </ul>	Mr. Bob Rausch – Vice President, JHK
8	Next Steps	2 min	<ul style="list-style-type: none"> <li>• Program Success</li> <li>• Urban Environment Model experience</li> <li>• Next Steps</li> </ul>	Dr. Arthur O'Connor – Sr. ITS/Operations Engineer, USDOT/FHWA Office of Program Management
	Q&A	15 min		

## 4.2 Demonstration Elements

Because the NYC OCS was not an in-person event, no demonstration occurred during the OCS. Hence, the virtual NYC CV Pilot showcase did not involve any ribbon-cutting event or on-road demonstration with vehicles in the field. Instead, videos noted in Section 5.2 were used to describe the operation of the CV safety applications and provide the viewer with an understanding of the driver experience.

# 5. Resources Developed for the Operational Capability Showcase

## 5.1 Presentation

The final slides for the virtual NYC OCS presentation are posted on the ITS JPO web page for NYC CV Phase 3: [https://www.its.dot.gov/pilots/phase3\\_webinars.htm](https://www.its.dot.gov/pilots/phase3_webinars.htm).

## 5.2 Videos

The following videos were shown during the NYC CV Pilot OCS:

- USDOT CV pilot interoperability testing video: <https://youtu.be/0dja4B9qCSU>
- NYC CV safety applications video: <https://www.cvp.nyc/cv-safety-apps#128>

While USDOT CV pilot interoperability testing video can be viewed by the general public, the NYC CV safety applications video is not available for viewing by the general public.

## 5.3 Questions and Answers

After the virtual showcase, the NYC team compiled the OCS Q&A document, which is provided in Appendix B. In addition, the Q&A document has been posted on the USDOT ITS JPO CV Pilots website: <https://www.its.dot.gov/pilots/index.htm>.



# 6. Post-Operational Capability Showcase Activities

## 6.1 Engagement by the Media

At the time of this writing, no media articles have been produced after the NYC CV Pilot OCS. However, with many attendees from a variety of industries and sectors across the world as listed in Chapter 3, the NYC team may garner interests from local, state, and/or industry media in the future. Throughout Phase 3 of the CV Pilot, NYCDOT has been and continues to update its CV Pilot website: <https://www.cvp.nyc>.

## 6.2 Continued Engagement

The 508-compliant version of the NYC Operational Capability Showcase (OCS) presentation was transmitted to USDOT. After the virtual OCS event, USDOT posted the presentation slides on its ITS JPO NYC CV Phase 3 web page: [https://www.its.dot.gov/pilots/phase3\\_webinars.htm](https://www.its.dot.gov/pilots/phase3_webinars.htm). This will allow for continued engagement with the public, especially for those who have demonstrated keen interest in the NYC CV Pilot. In addition, the final 508-compliant version of this Operational Capability Showcase Plan (OCSP) will soon be posted on USDOT ITS JPO CV Pilots website as well.

## 7. Lessons Learned

The following lessons learned were presented during the virtual NYC CV Pilot OCS:

- Location accuracy remains a challenge in the urban canyon environment. Urban location accuracy requires more than GPS.
- Grade separation is a challenge in dealing with elevation element of location accuracy. Elevation is an essential component of the safety applications in the urban environment.
- The number of FCW and SPDCOMP events dominate the data collected and tend to skew any analysis of events spanning multiple types.
- Breadcrumb were essential to analyzing anomalies and operational issues.
- O&M data collected confirms RF data reception ranges impact OBU & RSU device loading due to device density.
- Need to collect additional data: until we began analyzing events, we couldn't determine that there is additional information that would make analysis easier. For example, for RLVW, adding the specific intersection identification triggering the alert in the event header would make analysis easier. Also, when analyzing BSMs, the MAP/SPaT/TIM being heard would impact interpretation of driver behavior.

The above lessons learned have also been captured in the NYC CV Pilot Lessons Learned Logbook.

## 8. References

Table 2 below lists the references used for this OCSS document.

**Table 2. References**

#	Document (Title, source, version, date, location)
1	Galgano, S., Talas, M., Benevelli, D., Rausch, R., Sim, S., Opie, K., Jensen, M., Stanley, C., Connected Vehicle Pilot Deployment Program Phase 1, Concept of Operations (ConOps) - New York City, April 8, 2016 FHWA-JPO-16-299.
2	Connected Vehicle technology is coming to the streets of New York City! This technology holds the potential to make our streets safer and smarter. <a href="https://www.cvp.nyc">https://www.cvp.nyc</a>

## 9. Acronyms

Table 3 below provides a list of the acronyms used in this OCSS document.

**Table 3. Acronym List**

Acronym/Abbreviation	Definition
AO	Agreement Officer
AOR	Agreement Officer Representative
ASD	Aftermarket Safety Devices
ASTC	Advanced Solid-state Traffic Controller
ATC	Advanced Traffic Controller
BSM	Basic Safety Message
ConOps	Concept of Operations
C-V2X	Cellular vehicle to everything
CV	Connected Vehicle
CVPD	Connected Vehicle Pilot Deployment
DSRC	Dedicated Short Range Communications
FCW	Forward Collision Warning
FHWA	Federal Highway Administration
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
I2V	Infrastructure-to-Vehicle
IE	Independent Evaluator
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
ITSA	Intelligent Transportation Society of America
MTA	Metropolitan Transportation Authority
NGO	Non-governmental Organization
NYC	New York City
NYCDOT	New York City Department of Transportation
OBU	Onboard Unit

## 9. Acronyms

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OCS	Operational Capability Showcase
OCSP	Operational Capability Showcase Plan
OCSS	Operational Capability Showcase Summary
OEM	Original Equipment Manufacturer
OTA	Over-the-Air
PASS	Pedestrians for Accessible and Safe Streets
PED	Pedestrian
PID	Pedestrian Information Device
RF	Radio Frequency
RSU	Roadside Unit
SCMS	Security Credential Management System
SDC	Secure Data Commons
SPaT	Signal Phase and Timing
SPDCOMP	Speed Compliance
TCS	Traffic Control System
TIM	Traveler Information Message
TIS	Traveler Information System
TSN	Traffic Safety Network
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
VRU	Vulnerable Road User
USDOT	United States Department of Transportation

# Appendix A. Operational Capability Showcase Invitation

The screenshot shows the Eventbrite interface. At the top, there is a navigation bar with the Eventbrite logo, a search icon, and links for 'Browse Even', 'Organize', 'Help', 'Create an event', and 'Sign In'. Below the navigation bar, a grey banner states 'This event has ended.' The event title is 'New York City Connected Vehicle Pilot Operational Capability Showcase' by ITS America, with 290 followers and a 'Follow' button. The event is listed as 'Free'. At the bottom of the event card, there are buttons for 'Sales Ended' and 'Details'.



#### Date and time

Tue, July 20, 2021  
1:30 PM – 2:30 PM EDT  
[Add to calendar](#)



#### Location

Online event



#### **New York City Connected Vehicle Pilot Operational Capability Showcase** **About this event**

The New York City Department of Transportation (NYC DOT) Connected Vehicle (CV) Pilot will host an Operational Capability Showcase on Tuesday, July 20. The webinar will present the accomplishments of the NYC DOT CV pilot deployment project and detail how the pilot system performs.

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Intelligent Transportation System Joint Program Office

## Overview

Webinar attendees will be able to see how the deployed vehicle-to-vehicle and vehicle-to-infrastructure applications operate in NYC's urban environment, and they will learn about the pilot deployment's emphasis on safety goals and benefits. Attendees will also learn more about aftermarket safety device communications along with how the devices communicate with other roadside units that are deployed in the field. Additional resources about the project objective, performance, and continued operations will be shared during the webinar. For more information on the NYC DOT CV Pilot and to view their videos, please visit: [https://www.its.dot.gov/pilots/pilots\\_nycdot.htm](https://www.its.dot.gov/pilots/pilots_nycdot.htm)

## Speakers

### U.S. DOT

- Ken Leonard, Director of Intelligent Transportations Systems (ITS) Joint Program Office (JPO)
- Jonathan Walker, ITS JPO Chief of Policy, Architecture, and Knowledge Transfer
- Arthur O'Connor, Sr. ITS/Operations Engineer, Office of Program Management

### NYC DOT

- Margaret Forgione, First Deputy Commissioner
- Mohamad Talas, Director of ITS Management and System Engineering

### New York University

- Kaan Ozbay, Professor at the Department of Civil and Urban Engineering and Director of the C2SMART Center

### NYC Department of Citywide Administrative Services

- Keith Kerman, Chief Fleet Officer and Deputy Commissioner
- Eric Richardson, Deputy Chief Fleet Management Officer

### JHK Engineering (TransCore)

- Robert Rausch, Vice President
- David Benevelli, Associate Vice President

### Cambridge Systematics

- Keir Opie, Director of Simulation and Traffic Analysis (Principal)

Source: ITS America, 2021

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# Appendix B. Operational Capability Showcase Questions and Answers

The Operational Capability Showcase Questions and Answers document can be found on the CV Pilots website:

[https://www.its.dot.gov/pilots/pdf/NycCvpdOcsWebinarQuestionsAndAnswers\\_20210720.pdf](https://www.its.dot.gov/pilots/pdf/NycCvpdOcsWebinarQuestionsAndAnswers_20210720.pdf)



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