

# Connected Vehicle Pilot Deployment Program Phase 1

## Partnership Status Summary – New York City

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<b>16. Abstract</b> <p>This document describes the process and status of developing and implementing agreements, contracts and subcontracts among partner organizations in the New York City Connected Vehicle Pilot Deployment (NYC CVPD). Details include the work elements as they relate to several components of the Phase I documentation, including: the concept of operations; performance measures and targets; operational changes associated with the Pilot Deployment; governance framework and processes, and financial agreements. Led by the New York City Department of Transportation (NYCDOT) this document charts the progress of developing draft memorandum of understandings (MOU) and securing solid partnerships for the CVPD with the involved stakeholders and partner agencies.</p>					
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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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# Chapter 1. Introduction

The New York City (NYC) Connected Vehicle Pilot Deployment (CVPD) project is primarily focused on improving safety through the reduction of vehicle and pedestrian collisions, injuries, and fatalities. This is consistent with the City's focus and dedication of resources to achieve its Vision Zero goals.

The fundamental message of the 63 NYC Vision Zero initiatives, is that death and injury on NYC's streets is unacceptable. These tragedies happen in every community within NYC, to families from every walk of life – from the Upper West Side to the Woodside Side; from Park Slope to Edenwald. Everyone commuting on NYC streets is affected by collisions; however, most fatalities affect pedestrians – especially children and seniors. The goal of Vision Zero is to eliminate traffic deaths by 2024. The NYC CVPD project will focus on safety improvements for both motorists and non-motorists. In particular, collision risks increase during nighttime hours when vehicle speeds tend to be higher and it becomes more difficult for vehicle drivers to see pedestrians crossing the roadway.

As the safety statistics indicate, surface improvements on city streets alone will not eliminate the number of vehicle and pedestrian collisions, injuries, and fatalities. While no “Silver Bullet” will end all traffic fatalities, multiple supplemental tools are needed that can work together to attain Vision Zero's goal. The connected vehicle (CV) technology is one of these tools and it presents a systematic approach in alerting vehicles of unsafe roadway conditions, in an effort to prevent collisions with other vehicles, pedestrians, and bicyclists. It will provide numerous safety benefits that facilitate Vision Zero's goals and initiatives.

In addition to the safety benefits which are anticipated from the deployment of connected vehicles, more minor benefits and improvements can be expected in system mobility and travel time reliability, along with associated improvements in the environmental impacts related to congestions. The non-safety improvement objectives are, however, directly related to improved safety conditions and a reduction in the number and severity of collisions.

The NYC CVPD project area encompasses three distinct areas in the boroughs of Manhattan and Brooklyn. Figure 1-1 shows the general location of these areas within NYC. The first area includes a 4-mile segment of Franklin D. Roosevelt (FDR) Drive from 50<sup>th</sup> Street to 90<sup>th</sup> Street in the Upper East Side and East Harlem neighborhoods of Manhattan. The second area includes four one-way corridors of 1st Avenue, 2nd Avenue, and 5th Avenue from 14th Street to 67th Street and 6th Avenue from 14th Street to 59th Street in Midtown and Upper East Side neighborhoods of Manhattan. The third area covers a 1.6-mile segment of Flatbush Avenue in Brooklyn from Tillary Street on the north and Grand Army Plaza near Prospect Park to the south. While FDR Drive is a freeway without signalized intersections, the four avenues in Manhattan include 204 signalized intersections and Flatbush Avenue in Brooklyn includes 28 signalized intersections. These locations are shown in Figure 1-2, Figure 1-3, and Figure 1-4 below.



Source: NYCDOT, 2016

**Figure 1-1. New York City Connected Vehicle Pilot Deployment Overview Map**



Source: NYCDOT, 2016

**Figure 1-2. Franklin D. Roosevelt Drive Map**



Source: NYCDOT, 2016

**Figure 1-3. Manhattan Grid Map**



Source: NYCDOT, 2016

**Figure 1-4. Flatbush Avenue Map**

## 1.1 Purpose of the Report

This document describes the process NYC Department of Transportation (NYC DOT) went through to engage partners and garner support for the CVPD project; these efforts comprised Task 10 of CVPD Phase 1. The work objectives associated with Task 10 are to codify and provide definitive documentation of stakeholder agreements necessary for the successful deployment and operation of the pilot deployment. When possible, this includes an agreement on the main elements of the Concept of Operations (ConOps), performance measures and targets, operational changes associated with the Pilot Deployment, governance framework and processes, and financial agreements. This task work developed a summary understanding and vision of how partners will be engaged in the Phases 2 and 3 of the pilot program, which is documented in this report. Agreements will also include a vision of how these arrangements are expected to be altered or adapted in the post-deployment period to ensure a transition to permanent operational practice. It is understood that these partnerships and agreements are critical to the long term success of deployments for connected vehicle technology

This report is one of several planning documents for the New York City site of the Connected Vehicle Pilot Deployment Program, Phase 1 project funded by the United States Department of Transportation (USDOT). Other planning documents developed at the same time of this report include the Concept of Operations, the Security Management Operational Concept Plan, the Performance Measurement and Evaluation Support Plan, the Safety Management Plan, and the Human Use Approval plan. Further details on some of the issues discussed in this report can be found in these reports.

## 1.2 Organization of the Report

This report provides an overview of the New York City Connected Vehicle Pilot Deployment Phase 1 approach and the stakeholders involved in the program. The report details the approach to involving the stakeholders and steps through the engagement steps during Phase 1. This report provides a high-level description of the draft memorandum of understanding (MOU) initially sent to the stakeholders for their comments. Details for the governance and financial agreements as they are understood in Phase 1 are also presented.

The appendix provides more detailed information on the stakeholders and contacts and includes the initial letters of support for the Pilot.

# Chapter 2. Partnership Engagement

In 2014, New York City (NYC) began its Vision Zero program to reduce the number of fatalities and injuries resulting from traffic crashes. The Mayor's Office developed the Vision Zero action plan, which highlighted a set of initiatives for multiple city agencies to support the goal of improving street safety. One of the major ongoing initiatives has been the citywide speed limit reduction from 30 mph to 25 mph. According to the National Highway Transportation Safety Administration (NHTSA), speeding was a factor in more than one in four deaths. Also, human factors was the critical cause in about 94% of all crashes while vehicle-related factors only apply to about 2% of all crashes.

The Borough Pedestrian Safety Action Plans is another Vision Zero initiatives advancing Vision Zero's goal for all street users. The safety action plans have identified a priority list of streets based on historical accident frequencies, pedestrian fatalities, and severe injuries. Based on these findings, engineering and design modifications have been recommended for implementation. Despite these efforts, dangerous driving behavior still remains as the primary cause of pedestrian fatalities in crashes. In Manhattan, 73% of all fatalities involve pedestrians while this figure is only 14% nationwide. An average of 46 pedestrians are killed in Brooklyn each year, the highest of any borough. Pedestrian fatalities occur on local streets at a higher rate in Brooklyn than the rest of NYC, particularly at local street intersections<sup>[1]</sup>.

After pedestrian fatalities in NYC reached an all-time low in 2011 with 249, it surged to 297 in 2013. Senior citizens over age of 65 comprise of 12% of the population in NYC but about 33% of all pedestrian fatalities. Also, the primary reason for collision-related deaths of children under 14 was from being struck by a vehicle. The New York City Connected Vehicle Pilot Deployment (NYC CVPD) is another tool that can be used to further the city's Vision Zero goals.

Ensuring lasting partnerships, from Concept of Operations (ConOps) to deployment, can confound project leaders in technology deployments such as the NYC CVPD. The NYC Department of Transportation's (NYC DOT) approach is to closely monitor partnering, so that all parties reach a consensus definition on what a successful outcome will be and formally agree that each wants in order to assist each other in achieving such outcomes. Most stakeholders involved in this pilot have established working relationships, which allows for open paths of communication.

Stakeholder engagement is an essential step in documenting the partnership in a negotiated agreement, or memorandum of understanding (MOU). MOUs must clearly define a path for continued partnering for Phase 2 and Phase 3 Pilot activities, including financial viability, ability to meet delivery and installation targets, specification adherence, and similar items. To promote success, engagement of partners occurred early in the formation of the project design and throughout Phase 1 of this pilot. The Phase 1 MOUs provide a document that details the support to the Pilot and clearly spell out what each stakeholder expects from the other in terms of service, outcomes, and reporting.

## 2.1 Project Team

The New York City Department of Transportation (NYCDOT) has staff with experience and expertise in the technologies and knowledge areas needed to complete the Phase 2 and 3 project tasks including device procurement, device installation, training, outreach, website development, and traffic engineering. The NYCDOT will supplement our outstanding staff with consultants with expertise in the transportation industry by leveraging our 25 year relationship with JHK Engineering, PC and other industry leaders. NYCDOT will be the prime contractor for the NYC CV Pilot project Phase 2 and 3. NYCDOT has integrated industry leading and locally well-known companies who possess the experience and track record of numerous CV and NYCDOT ITS successful project deliveries. This team consists of several partners who provided support throughout the first phase of this engagement. This partnering approach is one that the NYCDOT has used on many successful transportation projects. Table 2-1 provides an overview of project role for the key partners in this endeavor.

**Table 2-1. NYCDOT Team**

<b>Firm</b>	<b>Primary Project Role</b>
NYCDOT	Overall Project Leadership Project Management Lead Stakeholder Coordination Training Lead Outreach Leads Website Development Procurement Safety Management
JHK Engineering	Oversight for all Subcontractors and Tasks Site Delivery Lead System Engineering Lead Design Installation Planning Procurement Support Testing
Cambridge Systematics	Performance Measurement
KLD Engineering	Design Support Architecture Support NYC Infrastructure Integration
Security Innovations	Security Data Privacy
University Transportation Research Center (UTRC)	IRB Training Outreach Performance Measurement Support

## 2.2 Key Stakeholders

Early engagement of stakeholders began prior to the NYC CVPD proposal submittal to the United States Department of Transportation (USDOT) in the summer of 2015. Letters of support were included in the proposal, so that upon award, the NYC DOT quickly engaged each stakeholder in moving the project forward. Open paths of communications were established and two important stakeholder meetings occurred during Phase 1.

NYC DOT held an initial introductory meeting on October 27, 2015 with key stakeholders regarding the overall NYC CVPD project. The purpose of the meeting was to brief stakeholders on the connected vehicle (CV) applications, project goals, and timelines. A second round of stakeholder meetings were held with small groups of representatives of the NYC DOT fleet operations, Metropolitan Transportation Authority (MTA) fleet operations (for Manhattan), United Parcel Service (UPS) fleet operations (for Manhattan), the Taxi and Limousine Commission (for Manhattan), and Sanitation Operations (for Manhattan) in November and December 2015; these meetings included technical, operations, and legal personnel to address a wide range of issues including device installation, maintenance requirements, operating hours, operator selection, geographic coverage areas, stakeholder responsibilities, system operation, driver interface, and data collection activities.

A third meeting occurred on February 8, 2016 to present the draft ConOps for questions and discussion. Shortly after that the below stakeholders were engaged with draft MOUs:

- The City of New York Department of Sanitation
- The Metropolitan Transportation Authority
- The New York State Motor Truck Association
- The New York City Taxi and Limousine Commission
- United Parcel Service

The following sections present a description of each stakeholder and their role in the Pilot. Table 2-2, Table 2-3, and Table 2-4 show overviews of the anticipated connected vehicle applications each stakeholder will support.

The New York City CV Pilot Deployment will include the V2V safety applications listed in Table 2-2 on all vehicles. The deployment will also include the Vehicle-to-Infrastructure/Infrastructure-to-Vehicle (V2I/I2V) safety applications listed in Table 2-3.

**Table 2-2. V2V Safety Applications**

V2V Application	Purpose
Forward Collision Warning	Avoid rear-end crash
Emergency Electronic Brake Light	Avoid rear-end crash due to unobservable vehicle
Lane Change Warning/Assist	Avoid side-swipe crash
Blind Spot Warning	Avoid side-swipe crash
Intersection Movement Assist	Avoid crashes from cross traffic
Vehicle Turning Right in Front of Bus Warning	Avoid cut-off crash

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**Table 2-3. V2I/I2V Safety Applications**

V2I/I2V Application	Purpose
Speed Compliance Speed Compliance / Work Zone Curve Speed Compliance	To control speeds along arterials and locations such as work zones, curves, and selected school zones
Red Light Violation Warning	To avoid rear-end and right-angle crashes
Oversize Vehicle Compliance	To avoid vehicle-to-infrastructure crashes
Emergency Communications and Evacuation Information	To disseminate information for situations needing immediate changes in travel patterns

As the safety application address a variety of needs, it is important to understand where each safety application will serve those needs. All of the V2V safety applications will be loaded on each vehicle.

The City is also working with a number of pedestrian advocacy groups and will be deploying two V2I/I2V pedestrian applications shown in Table 2-4.

**Table 2-4. V2I/I2V Pedestrian Applications**

V2I/I2V Pedestrian Applications	Purpose
Pedestrian in Signalized Crosswalk	To avoid vehicle-to-pedestrian crashes by alerting drivers
Mobile Accessible Pedestrian Signal	To assist visually challenged individuals crossing intersections

## 2.2.1 The City of New York Department of Sanitation

The City of New York Department of Sanitation (DSNY) is authorized by the New York City Charter to operate vehicles for the function and operations in the City related to waste disposal. DSNY is the world's largest sanitation department, collecting more than 10,500 tons of residential and institutional garbage and 1,760 tons of recyclables every day. DSNY also clears litter, snow, and ice from some 6,000 miles of streets, removes debris from vacant lots and clears abandoned vehicles from City streets. To meet the challenge of keeping NYC clean, DSNY serves the City out of 59 districts, with resources that include: 2,230 collection trucks, 450 mechanical street sweepers, 275 specialized collection trucks, 365 salt/sand spreaders, 298 front end loaders, and 2,360 various other support vehicles<sup>[2]</sup>. Two hundred and fifty (250) sanitation vehicles will be equipped with CV technologies to support the applications shown in Table 2-2 and Table 2-3.

## 2.2.2 The Metropolitan Transportation Authority

The MTA Bus Company was created in September 2004 to assume the operations of seven bus companies that operated under franchises granted by the New York City Department of Transportation. The takeover of the lines began in 2005 and was completed early in 2006. MTA Bus is

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responsible for both the local and express bus operations of the seven companies, consolidating operations, maintaining current buses, and purchasing new buses to replace the aging fleet currently in service. MTA Bus operates 47 local routes in the Bronx, Brooklyn, and Queens, and 35 express bus routes between Manhattan and the Bronx, Brooklyn, or Queens. It has a fleet of more than 1,200 buses, the 11th largest bus fleet in the United States and Canada<sup>[3]</sup>. One thousand two hundred and fifty MTA vehicles will be equipped with CV technologies to support the applications shown in Table 2-2 and Table 2-3.

### **2.2.3 The New York State Motor Truck Association**

The New York State Motor Truck Association (NYSMTA) is a non-profit trade association representing the interests of the motor truck industry and has over 800 member companies<sup>[4]</sup>. NYSMTA is an important stakeholder that will provide coordination support for the NYC CVPD.

### **2.2.4 The New York City Taxi and Limousine Commission**

New York City Taxi and Limousine Commission (TLC), created in 1971, is the agency responsible for licensing and regulating New York City's medallion (yellow) taxicabs, for-hire vehicles (community-based liveries and black cars), commuter vans, paratransit vehicles, and certain luxury limousines. The Commission's Board consists of nine members, eight of whom are unsalaried Commissioners. The salaried Chair/Commissioner presides over regularly scheduled public Commission meetings, and is the head of the agency, which maintains a staff of approximately 600 TLC employees assigned to various divisions and bureaus. TLC licenses and regulates over 50,000 vehicles and approximately 100,000 drivers, and performs safety and emissions inspections of the 13,637 medallion taxicabs three times each year, as well as biennial inspections of all TLC-licensed For-Hire vehicles, making it the most active taxi and limousine licensing regulatory agency in the United States<sup>[5]</sup>. Five thousand eight hundred and fifty TLC vehicles will be equipped with CV technologies to support the applications shown in Table 2-2 and Table 2-3. TLC will act as an important liaison to the fleet owners to secure participation in the NYC CVPD.

### **2.2.5 United Parcel Service**

United Parcel Service, Inc. is the world's largest package delivery company. The UPS Parcel Network is based on a hub and spoke model. UPS operates a private commercial vehicle fleet in the City<sup>[6]</sup>. Four hundred UPS vehicles will be equipped with CV technologies to support the applications shown in Table 2-2 and Table 2-3.

### **2.2.6 Pedestrians for Accessible and Safe Streets Coalition**

The Pedestrians for Accessible and Safe Streets (PASS) Coalition was founded by eleven organizations that represent people from across the disability spectrum - most of which focus on the needs of blind and visually impaired people in New York City. This coalition was established in order to ensure that all of New York City's streets are fully accessible to people who are blind or visually impaired, whether they are residents or visitors to the city. PASS currently is allied with over two dozen organizations<sup>[7]</sup>. Two applications shown in Table 2-4 will interface with the pedestrian aspects of the CVPD.

## 2.3 Initial Stakeholder Engagement

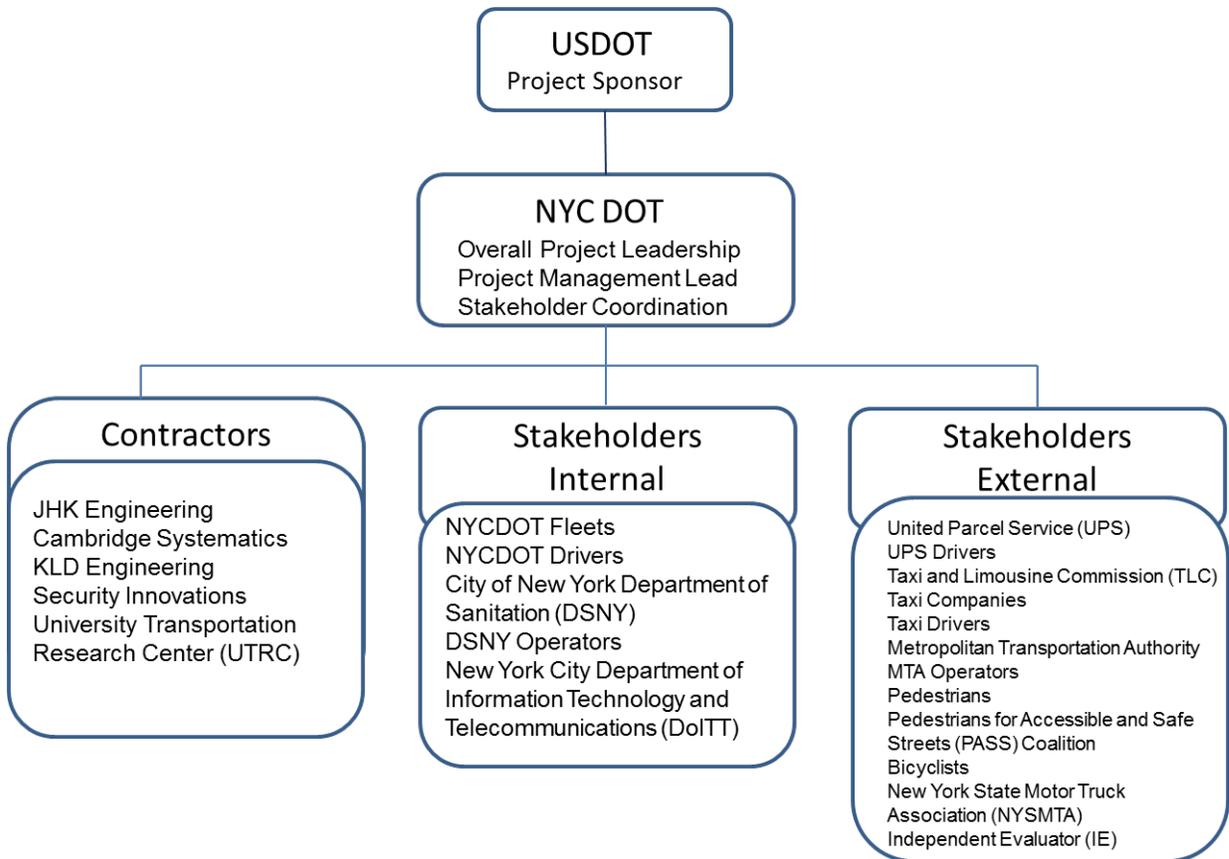
Mitigation of organizational risks were identified early by NYC DOT and letters of support from various stakeholders were included in the NYC proposal to the USDOT. As part of the proposal submittal, letters of support were secured from the NYC Taxi and Limousine Commission, NYC MTA Bus, New York State Truck Motor Association, United Parcel Service, and Verizon. These letters are contained in Appendix B. NYC DOT held an initial introductory meeting on October 27, 2015 with key stakeholders regarding the overall NYC CVPD project. The purpose of the meeting was to brief stakeholders on the connected vehicle applications, project goals, and timelines. A second round of stakeholder meetings were held with small groups of representatives of NYC DOT fleet operations, MTA fleet operations (for Manhattan), UPS fleet operations (for Manhattan), the Taxi and Limousine Commission (for Manhattan), and Sanitation Operations (for Manhattan) in November and December 2015; these meetings included technical, operations, and legal personnel to address a wide range of issues including device installation, maintenance requirements, operating hours, operator selection, geographic coverage areas, stakeholder responsibilities, system operation, driver interface, and data collection activities. When possible, representatives from NYC DOT's legal counsel attended these meetings and discussed risk mitigation and the MOU process with each stakeholder group.

## 2.4 Concept of Operations (ConOps) Stakeholder Engagement

As the project work began and the draft ConOps took form, NYC DOT again engaged the stakeholders in the development of the project. The draft ConOps were sent to each stakeholder and an in person meeting occurred on February 8, 2016 to step through the ConOps and respond to all questions the stakeholders had. Once this important step in the buy-in of the project concepts occurred, the ConOps document was finalized. The team received formal acceptance of the ConOps from the USDOT on April 15, 2016.

## 2.5 Program Reporting

For this program NYC DOT provides the strong project management resources and leadership to guide the program through the three phases. The project team and stakeholders are both aligned with NYC DOT to accomplish the programs goals and objectives. Figure 2-1 presents the overall structure and lines of communication for this CVPD. The graphic depicts the contractors – as defined in the project team section - reporting to the NYC DOT, the internal stakeholders that are part of the City government, and the external stakeholders. This reporting structure is discussed in more depth in the below governance section of this document.



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**Figure 2-1. CVPD Project Reporting**

# Chapter 3. Memorandums of Understanding

New York City Department of Transportation (NYC DOT)/ Division of Legal Affairs, with the input of the project team, drafted memorandums of understanding (MOU) for execution by stakeholders and partners of the pilot. The Division of Legal Affairs has had past dealings with most of the stakeholders, including recent technology deployments. These existing relationships and processes helped further the process for getting comments and having discussions on the content of the draft MOUs. Draft MOUs were developed in early May 2016 for the following stakeholders:

- The City of New York Department of Sanitation
- The Metropolitan Transportation Authority
- The New York State Motor Truck Association
- The New York City Taxi and Limousine Commission
- United Parcel Service

As of the delivery date of this report, the MOUs are still considered draft documents. The project team believes the MOUs will follow a tiered process so that during each Phase of the Pilot, MOUs will be revised to incorporate additional details as full design elements are determined.

## 3.1 Pilot Deployment Details

The below sections present five essential elements of the stakeholder agreements. Within each section we have included the language that currently exists in the draft MOUs provided to the stakeholders. As the New York City Connected Vehicle Pilot Deployment (NYC CVPD) moves to Phase 2 and Phase 3, agreements will be updated as new information is available. The five sections include: agreed-upon and main elements of the Concept of Operations (ConOps); performance measures and targets; operational changes; governance framework and processes; and financial agreements.

### 3.1.1 Concept of Operations

The draft ConOps took form with open communication paths and inputs from the stakeholders. Once a full draft document was developed, it was sent to each stakeholder and a day-long meeting was held on February 8<sup>th</sup> to step through the ConOps and respond to any questions the stakeholders had about the concept. Once this important step in the buy-in of the project concepts occurred, the ConOps document was finalized. The team received formal acceptance of the ConOps from the United States Department of Transportation (USDOT) on April 15, 2016.

The below text on the concept of operations, focusing on aftermarket safety devices (ASD), is included in each draft MOU with stakeholders:

*DOT will install the ASDs in about 8,000 vehicles that service the lower half of Manhattan including approximately 5,850 Taxis; 1,250 MTA buses; 400 UPS vehicles; and 250 Sanitation and other City fleet vehicles. The ASDs will collect and send data on vehicle actions and communications with other connected vehicles, cyclists, pedestrians and certain infrastructure. DOT will install approximately 230 roadside units (RSU) into existing DOT infrastructure to manage the operation of the ASDs and collect data recorded to measure the benefits of the system and verify its operational status. The roadside units will also transmit environmental, road geometry, traffic signal status, and traffic conditions information, which will be used by the ASD to provide alerts/warnings to vehicle drivers/operators.*

*The ASDs will record information (nominally at 1/10 second intervals) from all sources available during the time surrounding an event. The definition of an event will be configurable based on DOT's needs throughout the term of the MOU. Currently, events shall consist of certain short term driver behaviors such as hard breaks, steering turns or hard accelerations, and may include any alerts presented to the driver. The ASD collected data will be encrypted on the vehicle and transmitted securely to DOT where it will be anonymized by DOT servers. DOT servers will not permanently collect or store any raw data on individual vehicles or associate any information with specific drivers.*

*It is envisioned that cyclists and pedestrians will use similar technology as the ASDs in the form of a mobile applications (hosted on Smartphones or similar devices) that will broadcast data about their localized position and movement information on sidewalks and crosswalks, analyze their location information, and provide alerts to those users and to participating vehicles.*

*The alerts/warnings that will be provided to drivers/operators may consist of the following safety warnings: potential red light violation; approaching a school/work zone; excess speed; pedestrian in roadway; potential vehicle collision; excessive curve speed; over-height warning; and restricted route approach. In addition, the ASDs are envisioned to support a number of vehicle to vehicle ("V2V") safety applications that may provide the following: forward collision warning, emergency electronic brake light warning, blind spot warning, lane change warning/assist and intersection movement assist to avoid crashes. Such V2V warning are based on connected vehicle (CV) messages received from other vehicles outfitted with the CV technology.*

*The transmissions between the ASD and the roadside equipment (RSE) will be authenticated to establish a trust relationship for the data which can then be used to determine the appropriate alerts/warnings to be presented to the driver. The CV technology takes a privacy-by-design approach using random vehicle ID's and rotating security certificates such that the vehicles cannot be tracked through the network. Further, DOT has stated that CV data cannot be used for enforcement of the issuance of any violations.*

*DOT will also collect location and speed data from the ASD to develop travel times for the various roadway segments within the City. This data is used for traffic analysis to assist NYCDOT in optimizing the real time traffic signal timing. Any personally identifiable information or information that can be tracked to a specific vehicle is*

*encrypted on the vehicle and removed before it is permanently stored on any DOT server.*

### 3.1.2 Performance Measures and Targets

Under Task 5 work for the NYC CVPD the project team developed the Performance Measurement and Evaluation Support Plan<sup>[8]</sup>. The report documents the performance metrics that will be used to assess the success of the NYC CVPD project, the targets for improvement in those performance metrics, the data collection process, and the analytical processes that will be undertaken to show the impacts of the NYC CVPD project. In developing this plan, the project team developed a technical memorandum that specifically addressed and provided recommendations on the interrelationship of the performance measurement activities to the approach of project privacy issues.

The major concern expressed by all of the stakeholders was the potential that any data collected could be used for driver evaluation and/or enforcement or that such data could be subpoenaed or the subject of a freedom of information act (FOIA) request for any and all records available that could then be merged with other records (e.g., police accident reports) and used in legal proceedings, disciplinary proceedings, or insurance negotiations.

Until there are clear rules governing the collection and use of such data, most stakeholders do not want to participate if there is a chance that this data can be subpoenaed or FOIA requested where it can be merged with other databases to incriminate an individual or vehicle.

The NYC CVPD is a deployment project focused on improving safety through the reduction in crashes and pedestrian injuries/fatalities. The data collected for the NYC CVPD is therefore focused on measuring these types of benefits. Within each draft MOU the following statement of the privacy of data was included to address the stakeholder's concerns:

*The CV technology takes a privacy-by-design approach using random vehicle ID's and rotating security certificates such that the vehicles cannot be tracked through the network. Further, DOT has stated that CV data cannot be used for enforcement of the issuance of any violations.*

### 3.1.3 Operational Changes Associated with the Pilot Deployment

From the stakeholder's perspective, the NYC CVPD operational conditions will be nearly unnoticed. When fully deployed, vehicle drivers will hear audible messages in support of the nine applications. A training program will be implemented so that drivers are aware of the technological advancement the Pilot brings to the vehicle. Passive data collection points will be established to gather data from the vehicles throughout the day. It is expected that minimal daily operational changes will be needed by the drivers (stakeholders). The below text is included in the draft MOUs as statements of operational conditions:

*DOT will provide resources to install or have installed and will be responsible for the maintenance of the ASDs in the vehicles. Replacement of lost, stolen, or vandalized ASDs will be the responsibility of PARTICIPANT. ASDs will provide drivers with audible warnings or alerts and it is the responsibility of PARTICIPANT to alert DOT of any suspected equipment malfunction. The ASDs are the property of DOT and may not be removed from the vehicles without prior written consent from DOT. Any removed ASDs shall be returned to DOT.*

### 3.1.4 Governance Framework and Processes

NYC DOT was awarded a contract by the FHWA to implement this Pilot Program. The Pilot is well-aligned with Mayor Bill de Blasio's Vision Zero initiative, and as such has upper-management support at the highest levels of City government. NYC DOT has brought forward strong project management resources to this effort to further establish the governance approach throughout the pilot. The administration, maintenance, and policy supporting the pilot will be led by NYC DOT. NYC DOT Legal Council is leading the development and execution of MOUs with the stakeholders.

The primary objective of the governance process is to promote consistency and shared stakeholder expectations, empower stakeholders so that they are contributors to the success of the pilot, and establish procedural processes for review and evaluation of the pilot. NYC DOT has taken the lead in all governance processes including risk management, quality control, procurement, and project implementation. NYC DOT will have responsibility for the infrastructure aspects of the system and the various stakeholders will assume responsibility for the installation of vehicle equipment, with some oversight (specification, equipment, and training) from the NYC DOT. Agreements will identify paths for problem resolution. The Project Team, as part of Task 10, will periodically analyze what went right, what went wrong, and what are the lessons learned for the future across all of the agreements and negotiations.

Table 2-1 provides an overview of the responsibilities of each of the project team members. Table 3-1 provides an overview of the Stakeholder roles

The draft MOUs document the stakeholders' agreement and support of their participation in the NYC CVPD. As comments are received and details better defined, the MOUs will be finalized, although they are not at that stage currently. There is no anticipated timeline for finalizing the MOUs as the team believes a stepwise process is best and time is needed to determine each stakeholder's needs for a comprehensive and agreed upon MOU.

**Table 3-1. Stakeholder Roles**

<b>Firm</b>	<b>Primary Project Role</b>
NYCDOT Fleets	Provide vehicles Provide drivers
DSNY	Provide vehicles Provide drivers Train drivers Install devices
DoITT	Support NYCDOT on IT related needs DSRC license registration
UPS	Provide vehicles Provide drivers Train drivers Install devices
TLC	Liaison between NYCDOT and Taxi Companies

Firm	Primary Project Role
Taxi Companies and Drivers	Provide vehicles Provide drivers Train drivers Install devices
MTA	Provide vehicles Provide drivers Train drivers Install devices
Pedestrians	Participate in project Attend training
PASS Coalition	Support project activities and communication with disabled community
IE	Independently validate performance measures to validate study results.

### 3.1.5 Risk Assessment

Potential risks may arise in terms of project cost, schedule disruption, and public relations, all areas that can impact stakeholder engagement. During the Phase 1 Concept Development, the project team identified eleven program risks and have detailed these in the Comprehensive Deployment Plan document. In addition the team has identified a set of risks for Phase 2 development and recognize that risk identification and monitoring is an on-going activity. Risks that have been identified specific the partnerships and stakeholders include concerns over the collection of data and the privacy of that data.

Each of our stakeholders has a vested interest to improve the safety of their operations and reduce the costs associated with crashes. Through a series of meetings, NYC DOT assembled a list of their needs which included a consistent theme expressed by both vehicle owners and operators/drivers for their need for privacy. The project team took a preemptive approach to identifying this risk and addressing it in each stakeholder meeting and by including the text in the memorandums of understanding. Two statements in the Concept portion of the draft MOUs attempt to address this concern. The first statement deals with storing data, and the draft MOU states *“DOT servers will not permanently collect or store any raw data on individual vehicles or associate any information with specific drivers.”* The second statement deals with enforcement, and each draft MOU has the statement *“DOT has stated that CV data cannot be used for enforcement of the issuance of any violations.”*

In addition, the below stakeholder specific risk was brought forward in the Comprehensive Deployment Plan:

- Continued support from the stakeholders is paramount to this project. We will continue to increase the participation throughout the initial phases of the project.
  - **Mitigation:** We will continue to increase the participation throughout the initial phases of the project. We will stand by the privacy provisions of our data collection and are now launching a “sales” campaign with the stakeholder community to “sell” the benefits of this technology and the value of the opportunity to be early adopters at no cost to them!

As the program moves into Phase 2 a continued emphasis on risk assessment and mitigation will continue including stakeholder, institution, and financial risk identification and mitigation.

### 3.1.6 Financial Agreements

It is anticipated that stakeholder agreements will adopt “continuous improvement” frameworks to the agreement process so that all partners are tracking performance and regularly conferring on ways to improve it. Phase 1 of the NYC CVPD did not get far enough along the path of full design to determine the definitive financial agreements needed for a fully deployed Pilot. The stakeholders’ expectation is that the equipment and installation will be at no cost to them, and be supplied by NYC DOT. There are several elements that have been discussed, but not resolved during Phase 1 needed to fully define the financial agreements with various stakeholders. The risks and concerns for the financial agreements moving forward are summarized below.

- Through various discussions with stakeholders NYC DOT has implied there is no cost to the participants in this Pilot. NYC DOT will be paying for the equipment and the installation for participants. Full costs and details cannot be defined until the system requirements, equipment purchases, and installation procedures and costs are understood.
- There is an important unknown cost of the Pilot as the USDOT will be the “owner” of the CVPD equipment that has been installed into the participant’s vehicle and the end of the project retrieval of the equipment is not yet defined. Direction from the USDOT will be needed in order to define the financial agreement with each stakeholder.
- There is an important unknown cost to participating in the Pilot related to the “up time” of the CVPD equipment. Specifically, if CVPD equipment is in need of repair, the time that repair takes place is lost time for the revenue generation of that vehicle. More information will be needed to address this concern in the financial agreements.

# Chapter 4. Conclusions

The NYC Department of Transportation (NYC DOT) has engaged the stakeholders and partners supporting the CVPD project since before the initial proposals were submitted to the FHWA in the spring of 2015. Upon award of the Pilot, NYC DOT began a process of educating the stakeholders on what the pilot program consisted of and how each partner would fit in and participate in the program. All stakeholders have been engaged, interested, and supportive of the program.

Through this early engagement NYC DOT has had strong support for the program. The status of securing memorandum of understanding is currently in draft form. The project team believed a series of MOUs will be secured through all three Phases of the CV Pilots. With each Phase of the pilot, additional tiers of MOUs will be developed with the additional details developed at that time. With the success of this pilot program these partnerships and agreements will further assist in the long term success of deployments for connected vehicle technology and help to realize the Vision Zero goals for the City.

# References

#	Document
1	Pedestrian Safety Action Plan Vision Zero Brooklyn, <a href="http://www.nyc.gov/html/dot/downloads/pdf/ped-safety-action-plan-brooklyn.pdf">www.nyc.gov/html/dot/downloads/pdf/ped-safety-action-plan-brooklyn.pdf</a> , 2015, accessed August 4, 2016
2	Website <a href="http://www1.nyc.gov/assets/dsny/about/inside-dsny.shtml">http://www1.nyc.gov/assets/dsny/about/inside-dsny.shtml</a> , accessed August 4, 2016
3	Website <a href="http://web.mta.info/busco/about.htm">http://web.mta.info/busco/about.htm</a> , accessed August 4, 2016
4	Website <a href="http://www.nytrucks.org/what-we-do/">www.nytrucks.org/what-we-do/</a> , accessed August 4, 2016
5	Website <a href="http://www.nyc.gov/html/tlc/html/about/about.shtml">www.nyc.gov/html/tlc/html/about/about.shtml</a> , accessed August 4, 2016
6	Adapted from website <a href="https://en.wikipedia.org/wiki/United_Parcel_Service">https://en.wikipedia.org/wiki/United_Parcel_Service</a> , accessed August 4, 2016
7	Website <a href="http://www.passcoalition.org">www.passcoalition.org</a> , accessed August 4, 2016
8	Connected Vehicle Pilot Deployment Program Phase 1, Performance Measurement and Evaluation Support Plan – New York City (FHWA-JPO-16-302)

## APPENDIX A. List of Acronyms

Acronym / Abbreviation	Definition
3G	Third Generation
3P	Third Party
4G	Fourth Generation
A	Adjacent
ACL	Access Control List
APDU	Application Protocol Data Unit
API	Application Programming Interface
ASD	Aftermarket Safety Device
ASN.1	Abstract Syntax Notation.1
ASTC	Advanced Solid-state Traffic Controller (NYC standard traffic signal controller device)
ATC	Advance Traffic Controller (see ASTC)
ATIS	Advanced Traveler Information System
BAA	Basic Agency Agreement
BSM	Basic Safety Message
C	Continental
C2C	Center to Center
C2F	Center to Field
CA	Certificate Authority
CAMP	Crash Avoidance Metrics Partnership
ConOps	Concept of Operations
CRL	Certificate Revocation List
CV	Connected Vehicle
CVPD	Connected Vehicle Pilot Deployment
CVRIA	Connected Vehicle Reference Implementation Architecture
DD	Data Distribution
DNS	Domain Name System
DSNY	New York City Department of Sanitation
DOT	Department of Transportation

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Intelligent Transportation Systems Joint Program Office

APPENDIX A. List of Acronyms

<b>Acronym / Abbreviation</b>	<b>Definition</b>
DSRC	Dedicated Short Range Communications
EVSD	Enhance Vehicle Situation Data
Gbps	Gigabits per second
GHz	Gigahertz
GID	Geographic Intersection Description
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
H	Historic
HMI	Human Machine Interface
HTTPS	Hypertext Transfer Protocol (Secured)
I2V	Infrastructure to Vehicle
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
ISD	Intersection Situation Data
ITS	Intelligent Transportation System
JPO	Joint Program office
KSI	Killed or Severally Injured
L	Local
MAP	Map Data Message (a DSRC message)
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MTA	Metropolitan Transportation Authority
N	Now (context: temporal data distribution)
N	National (context: geographical data distribution)
NHTSA	National Highway Traffic Safety Administration
NYC	New York City
NYCDOT	New York City Department of Transportation
NYCWiN	New York City Wireless Network
O and M	Operations and Maintenance
OBE	On-Board Equipment
OCCM	Office of Construction Mitigation and Coordination

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APPENDIX A. List of Acronyms

<b>Acronym / Abbreviation</b>	<b>Definition</b>
ODE	Operational Data Environment
OEM	Office of Emergency Management
OER	Office of Emergency Response
ORDS	Object Registration and Recovery Service
OST-R	Office of the Assistant Secretary of Transportation for Research and Technology
P2P	Peer-to-Peer
PDU	Protocol Data Unit
PDU	Protocol Data Unit
PID	Personal Information Device (e.g., SmartPhone)
PII	Personally Identifiable Information
PKI	Public Key Infrastructure
POC	Proof of Concept
R	Recent (context: time domain)
R	Regional (context: geographic domain)
RA	Registration Authority
RDE	Research Data Exchange
RF	Radio Frequency
RSE	Roadside Equipment
S	Static
SAE	Society of Automotive Engineers International
SCM	Security and Credential Management
SCMS	Security Credential Management System/Service
SDC	Situation Data Clearinghouse
SDW	Situation Data Warehouse
SET-IT	System Engineering Tool – Intelligent Transportation
SM	Service Monitor
SMS	Service Monitor System
SPaT	Signal Phase and Timing (a DSRC message)
SPMD	Safety Pilot Model Deployment
SSL	Secure Sockets Layer
TBD	To Be Determined

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APPENDIX A. List of Acronyms

<b>Acronym / Abbreviation</b>	<b>Definition</b>
TCP	Transmission Control Protocol
TIC	<Region> Transportation Information Center
TLC	New York City Taxi and Limousine Commission
TMC	Traffic Management Center
TPAC	Third Party Application Center
TSD	Traveler Situation Data
UDP	User Datagram Protocol
UPS	United Parcel Service
USDOT	United States Department of Transportation
V2I (I2V)	Vehicle-to-Infrastructure (Infrastructure-to-Vehicle)
V2V	Vehicle-to-Vehicle
VRU	Vulnerable Road User
WAID	Wide Area Information Distributor
WAVE	Wireless Access in Vehicular Environments
Wi-Fi	Wireless Fidelity (short to mid-range wireless network)
WiMAX	Worldwide Interoperability for Microwave Access
WSA	WAVE Service Advertisement
WSM	WAVE Short Messages
WSMP	WAVE Short Message Protocol
XML	eXtensible Markup Language

## APPENDIX B. NYC CVPD Stakeholders

Representative	Agency
Mohamad Talas	Director, ITS Project Management and TMC New York City Department of Transportation.
John Ornas	Director of Electrical Operations Traffic and Street Lighting at New York City Department of Transportation
Michael Marsico	Assistant Commissioner Bureau of Parking at NYCDOT
Franco Esposito	Senior Counsel New York City Department of Transportation
Conan Freud	Associate Deputy Commissioner for Fleet Services, NYCDOT Fleet
Cordell Schachter	Chief Technology Officer, NYCDOT
Quemuel Arroyo	Policy Analyst, NYCD DOT PASS

External Stakeholders	Contact
MTA NYCT	Sunil Nair Senior Director, Bus Customer Information Systems, MTA Metropolitan Transportation Authority 2 Broadway, 27th Floor New York, New York 10004 Phone: (646) 252-1043, Cell: (917) 991-0200
NYC Taxi and Limousine Commission	Rodney Stiles Director of Research and Evaluation 33 Beaver Street, 22nd Floor New York, New York 10004 Phone: (212) 676-1183, Cell: (616) 753-1204 Email: <a href="mailto:rodney.stiles@tlc.nyc.gov">rodney.stiles@tlc.nyc.gov</a>
City of New York Department of Sanitation	Rocco DiRico Deputy Commissioner, Bureau of Support Services New York City Department of Sanitation Phone: (718) 334-8911 Email: <a href="mailto:rdirico@dsny.nyc.gov">rdirico@dsny.nyc.gov</a>
New York State Motor Truck Association	Kendra Hems, President New York State Motor Truck Association (NYSMTA) 7 Corporate Drive Clifton Park, New York 12065 Phone: (518) 458-9696 Email: <a href="mailto:khems@nytrucks.org">khems@nytrucks.org</a>

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APPENDIX B. NYC CVPD Stakeholders

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<b>External Stakeholders</b>	<b>Contact</b>
United Parcel Service	Jerome Ferguson Senior Project Manager 670 Winters Avenue, Office A-151 Paramus, New Jersey 07960 Phone: (201) 828-6684, Cell: (732) 236-5373 Email: <a href="mailto:jeromeferguson@ups.com">jeromeferguson@ups.com</a>
NYCDOITT	Frank Aghili Associate Commissioner Wireless Technology NYC Information Technology and Telecommunications 15 MetroTech Center, 18th Floor Brooklyn, New York 11201 Phone: (718) 403-8540, Cell: (347) 436-5856 Email: <a href="mailto:faghili@doitt.nyc.gov">faghili@doitt.nyc.gov</a>
University Transportation Research Center UTRC (CUNY, NYU)*	Dr. Camille Kamga The City College of New York 160 Convent Avenue New York, New York 10031 Phone: (212) 650-8087, Cell: (718) 916-0676 Email: <a href="mailto:ckamga@utrc2.org">ckamga@utrc2.org</a>

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## **APPENDIX C. Letters of Support from Stakeholders at the Proposal Stage (Spring 2015)**

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U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology  
Intelligent Transportation Systems Joint Program Office



Meera Joshi  
Commissioner  
tlccommissioner@tlc.nyc.gov

33 Beaver Street  
22nd Floor  
New York, NY 10004

+1 212 676 1003 tel  
+1 212 676 1100 fax

March 13, 2015

Commissioner Polly Trottenberg  
New York City Department of Transportation  
55 Water Street, 9<sup>th</sup> Floor  
New York, NY 10041

Subject: Advancing Vision Zero through the USDOT's Connected Vehicle Program

Dear Commissioner Trottenberg:

The New York City Taxi and Limousine Commission is a partner agency with NYCDOT in Mayor de Blasio's Vision Zero initiative to eliminate traffic deaths by 2024. As such, the TLC is excited to support the NYCDOT's efforts to participate in the USDOT's Connected Vehicle (CV) Pilot Deployment Program which we believe will further enhance the City's Vision Zero Initiative.

Under NYCDOT's leadership, we believe the CV Pilot Deployment Program provides the City an opportunity to increase the number and visibility of hands-on Vision Zero projects. We will work closely with the NYCDOT-led CV Pilot Deployment Team where feasible in deploying and making operational after-market safety devices (ASD) in the TLC's agency vehicle fleet of approximately 120 vehicles and in facilitating NYCDOT's extension of the pilot to TLC's licensees operating vehicles for hire, a fleet of approximately 70,000 vehicles.

In summary, NYCDOT has the support of and participation from the TLC to establish a substantial demonstration project to validate the benefits of CV Applications and technology and advance the City's Vision Zero program.

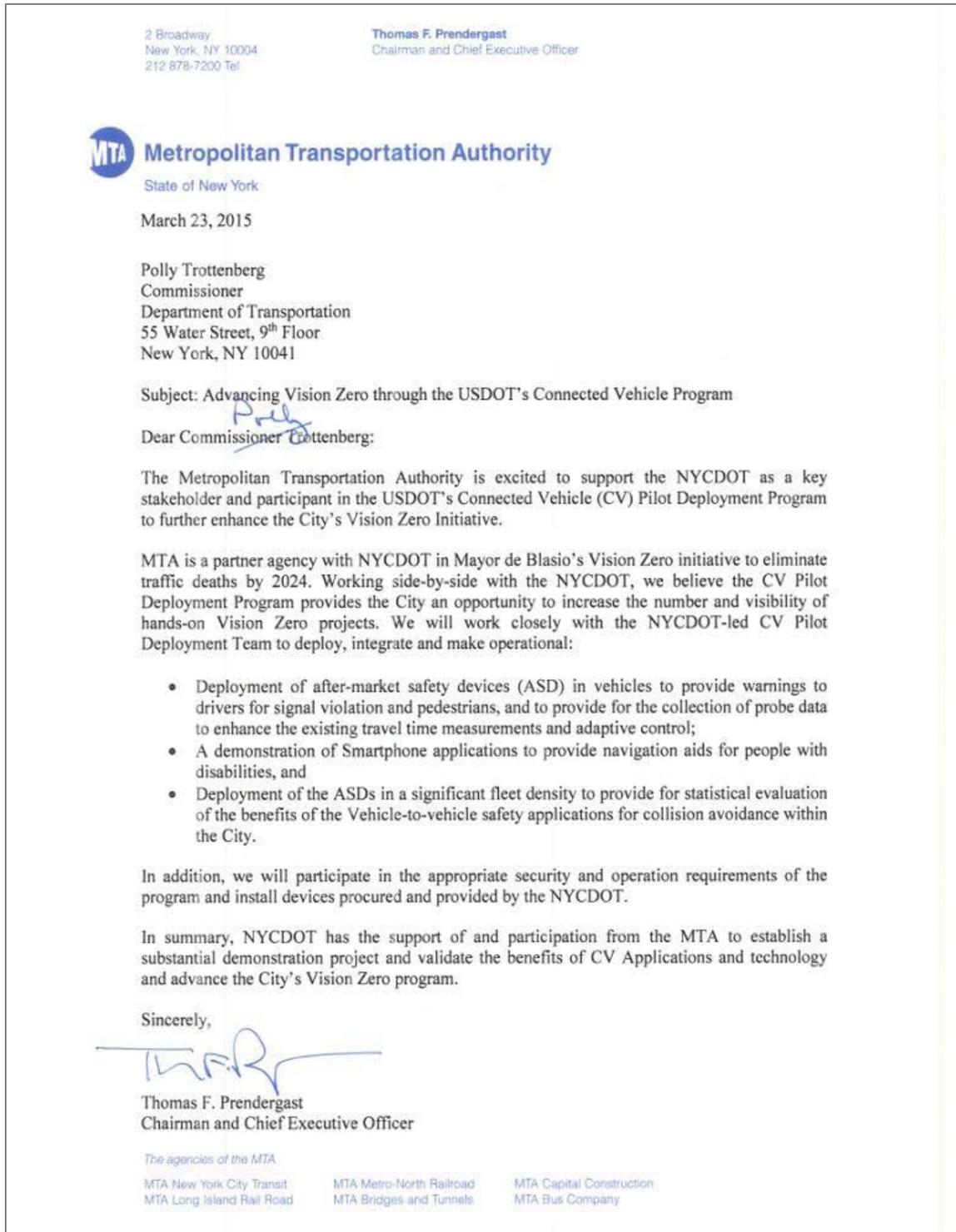
Sincerely,

A handwritten signature in black ink that reads "Meera Joshi".

Meera Joshi  
Commissioner/Chair

NYCDOT Proposal for Connected Vehicle Pilot Deployment Program, Solicitation No. DTFH6115R00003,  
Volume I – Technical Proposal, March 27, 2016

U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology  
Intelligent Transportation Systems Joint Program Office



NYCDOT Proposal for Connected Vehicle Pilot Deployment Program, Solicitation No. DTFH6115R00003, Volume I – Technical Proposal, March 27, 2016

U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology  
Intelligent Transportation Systems Joint Program Office



Kendra Hems  
President

March 13, 2015

NYC Department of Transportation  
Polly Trottenberg, Commissioner  
55 Water Street, 9th Floor  
New York, NY 10041

Subject: Advancing Vision Zero through the USDOT's Connected Vehicle Program

Dear Commissioner Trottenberg:

The New York State Motor Truck Association (NYSMTA) is excited to support the NYCDOT as a key stakeholder and participant in the USDOT's Connected Vehicle (CV) Pilot Deployment Program to further enhance the City's Vision Zero Initiative.

Working side-by-side with the NYCDOT, we believe the CV Pilot Deployment Program provides the City an opportunity to increase the number and visibility of hands-on safety projects which is a cornerstone Vision Zero initiative. The goals of NYSMTA are well aligned with the City's Vision Zero initiative which seeks to reduce the deaths of pedestrians and make the City's streets safer for all modes of transportation.

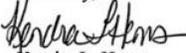
As an organization NYSMTA makes safety a top priority. Not only does the association coordinate several programs to provide safety training to trucking companies and their drivers, NYSMTA also conducts programs to educate the public on the unique operating characteristics of large trucks. Through the "Trucks Eye View" program NYSMTA, in partnership with NYCDOT, has educated over 4,000 pedestrians and bicyclists on how to stay safe in the vicinity of large trucks. As a member of the Vision Zero Task Force, NYSMTA is committed to continuing to work with NYCDOT to make New York's streets safer for all users.

We will work closely with the NYCDOT-led CV Pilot Deployment Team to deploy, integrate and make operational:

- Deployment of after-market safety devices (ASD) to provide warnings for signal violation and pedestrians, and to provide for the collection of probe data to enhance the existing travel time measurements and adaptive control
- A demonstration of Smartphone applications to provide navigation aids for the handicapped
- Deployment of the ASDs in a significant fleet density to provide for statistical evaluation of the benefits of the Vehicle-to-vehicle safety applications for collision avoidance within the City

In addition, we will participate in the appropriate security and operation requirements of the program and install devices procured and provided by the NYCDOT.

In summary, NYCDOT has the support of and participation from NYSMTA to establish a substantial demonstration project and validate the benefits of CV Applications and technology and advance the City's Vision Zero program.

Sincerely,  
  
Kendra L. Hems

**NEW YORK STATE MOTOR TRUCK ASSOCIATION**

828 Washington Avenue • Albany, NY 12203 • (518) 458-9696 • (518) 458-2525 fax • www.nytrucks.org

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March 24, 2015

To: Commissioner Polly Trottenberg – NYCDOT  
55 Water St, 9th Floor  
NY, NY 10041  
Fr: Jerome Ferguson  
Director of Autonomous Systems  
United Parcel Service

Subject: Advancing Vision Zero through the USDOT's Connected Vehicle Program

Dear Commissioner Trottenberg,

United Parcel Service is excited to support the NYCDOT as a key stakeholder and participant in the USDOT's Connected Vehicle (CV) Pilot Deployment Program to further enhance the City's Vision Zero Initiative.

Working side-by-side with the NYCDOT, we believe the CV Pilot Deployment Program provides the City an opportunity to increase the number and visibility of hands-on safety projects which is a cornerstone Vision Zero initiative. The goals of United Parcel Service are well aligned with the City's Vision Zero initiative which seeks reduce the deaths of pedestrians and make the City's streets safer for all modes of transportation. We will work closely with the NYCDOT-led CV Pilot Deployment Team to deploy, integrate and make operational:

- Deployment of after-market safety devices (ASD) to provide warnings for signal violation and pedestrians, and to provide for the collection of probe data to enhance the existing travel time measurements and adaptive control
- A demonstration of Smartphone applications to provide navigation aids for the handicapped
- Deployment of the ASDs in a significant fleet density to provide for statistical evaluation of the benefits of the Vehicle-to-vehicle safety applications for collision avoidance within the City

We plan to participate in Phase I-Planning, Analysis, Design at this time and look forward to approving Phase II at some point in the near future.

We will participate in the appropriate security and operation requirements of the program and, after additional evaluation as part of potential Phase II approval, install devices procured and provided by the NYCDOT.

In summary, NYCDOT has the support of and participation from United Parcel Service to establish a substantial demonstration project and validate the benefits of CV Applications and technology and advance the City's Vision Zero program.

Sincerely,

Jerome Ferguson  
Director of Autonomous Systems  
March 24, 2015

Ec: Stacey Hodge  
Mohamad Talas

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U.S. Department of Transportation  
ITS Joint Program Office-HOIT  
1200 New Jersey Avenue, SE  
Washington, DC 20590

Toll-Free "Help Line" 866-367-7487  
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