Connected Vehicle Pilot Deployment Program Phase 2

Comprehensive Installation Plan – New York City

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16. Abstract

This Comprehensive Installation Plan (CIP) describes the proposed acquisition and installation approach and schedule for the New York City (NYC) Connected Vehicle Pilot Deployment (CVPD). It identifies the type and number of devices, equipment, and software-based capabilities to be acquired, which includes the vehicles and in-vehicle equipment, roadside unit, mobile device, management center equipment and capabilities, and other supporting equipment and capabilities for the NYC CVPD system. The plan also addresses the installation approach, schedule, and needs for each respective subsystem. References to specifications and requirements will be provided for each device and equipment. Also, this document includes a plan for engaging and reaching out to potential vendors.

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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 fleets, taxi owners, UPS, MTA/NYCT, the NYC Sanitation Department, NY State Motor Truck Association, and Pedestrians for Accessible and Safe Streets (PASS) have expended considerable resources participating in the development of this Concept of Operations. 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 Comprehensive Installation Plan (CIP) covers detailed plans and tasks associated with the acquisition and installation of all in-vehicle Aftermarket Safety Devices (ASDs), Roadside Units (RSUs), Personal Information Devices (PIDs), Integrated Traffic Management Center (ITMC), and other equipment, software and supporting capabilities required to design, build, integrate and test the NYC Connected Vehicle System. The phrase “other equipment, software, and supporting capabilities” includes software development outside of connected vehicle/traveler application-specific development explicitly covered under Task 2-E (Application Development).

The specific devices will be determined at a stage after contract execution with the vendors. The New York City Department of Transportation (NYCDOT) has selected two ASD vendors based on their demonstration results held between May 17 and 24. NYCDOT entered into contract negotiations with the two vendors; Vendor 1 on July 19 and Vendor 2 on July 24. NYCDOT. The two ASD vendors are currently in the 2nd round of negotiations. The RSU procurement is scheduled to undergo a Re-bid in September. We can expect more information to document the CIP after Contract/Agreement execution with the vendors. The CIP will be updated and re-submitted as a draft with specific product detail, specifications, and designs as required.

NYCDOT will deliver a draft CIP to the USDOT for review. Once USDOT completes a review and provides comments, a revised CIP with an accompanying Comment Resolution Report will be submitted to USDOT. Based on USDOT review of the revised CIP, the City will deliver a final CIP.

The document is organized to meet the requirements of the USDOT System Engineering Process and ISO/IEC/IEEE 42010-2011 standard as required by USDOT's Notice of Funding Opportunity (NOFO) for Phases 2 and 3 of the CVPD Program.

1.1 IDENTIFYING INFORMATION

This document is identified as:

- Agency: New York City Department of Transportation
- Organization: Bureau of Traffic Operations
- Project Name: New York City (NYC) Connected Vehicle Pilot Deployment (CVPD)
- Title: Connected Vehicle Pilot Deployment Program Phase 2
- Subtitle: Comprehensive Installation Plan (CIP) - New York City
- Version: Final
- Date: 05/31/2018
- Status: FINAL
- FHWA Publication: FHWA-JPO-17-455

1.2 SUPPLEMENTARY INFORMATION

The key concept for the NYC CVPD project is to equip a large fleet of vehicles with CV technology in order to advance towards the Vision Zero goal of eliminating injuries and fatalities resulting from traffic crashes. To that end, the project approach is to acquire ASDs and RSUs that communicate over Dedicated Short Range Communications (DSRC) and applications to provide drivers with alerts of identifiable safety situations. Other existing and new infrastructure will be used to support the accumulation of data for performance measurement and ongoing operations of the system.

The ASDs and RSUs will communicate over DSRC using protocols covered by IEEE 802.11 and 1609 standards. They will utilize safety applications to provide drivers with alerts of identifiable safety situations. Also, they will connect with back-office applications to support information exchanges for data management and system operations.

The NYC CVPD project is one of three initial CV deployment projects that establish a base for growing a nationwide 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 provides 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 (NYCWiN). By deploying ASDs and RSUs, 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 regularly driving in the area.

The Smart Phone in Figure 1 is also referred to as the PID or Mobile Device. These terms are interchangeable.

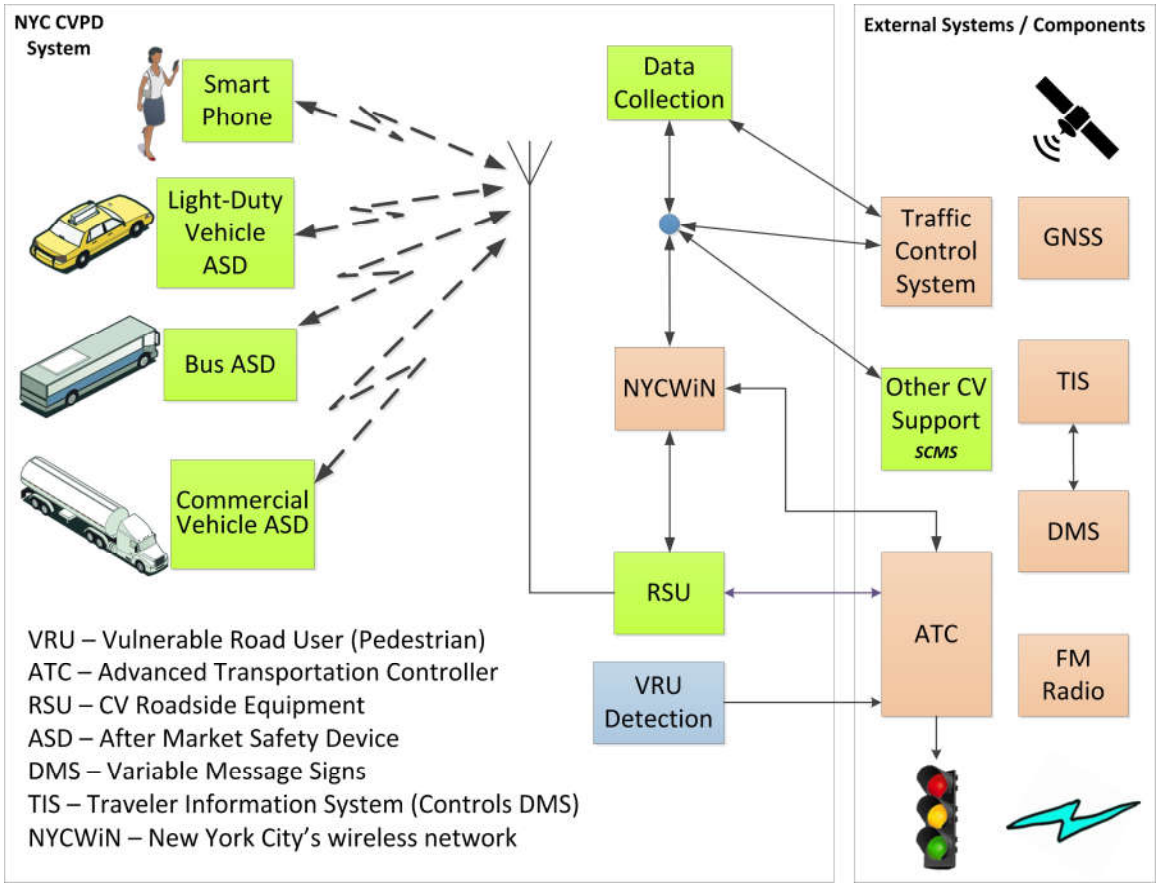


Figure 1. NYC CVPD System Concepts Diagram

The NYC CVPD project area encompasses three distinct areas in the boroughs of Manhattan and Brooklyn. Figures 2, 3, and 4 below display the general location of these areas within NYC. The following describes these deployment areas in terms of their roadway characteristics and crash history.

The first area includes a 4-mile segment of Franklin D. Roosevelt (FDR) Drive from 50th Street to 90th Street in the Upper East Side and East Harlem neighborhoods of Manhattan. There are seven entrance/ exit points within this area of FDR Drive. 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 the Midtown and Upper East Side neighborhoods of Manhattan. The segment lengths are 2.6 miles for 1st, 2nd, and 5th Avenues and 2.2 miles for 6th Avenue, respectively. 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 the figures below:

Source: NYCDOT

Figure 2. FDR Drive Map

Source: NYCDOT

Figure 3. Manhattan Grid Map

Source: NYCDOT

Figure 4. Flatbush Avenue Map

This project will also provide 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.

1.3 PURPOSE OF THE PLAN

The Comprehensive Installation Plan (CIP) incorporates the Comprehensive Acquisition Plan (CAP) and further identifies the types and number of equipment required to be configured and installed. The CIP addresses what and how the City will acquire and install the required products needed to successfully deploy the Connected Vehicle Program. NYCDOT is the acquirer that will inherit the NYC CVPD system upon completion of Phase 3. The procurement of devices and system design in Phase 2 has already started in September 2016 and is scheduled to be complete in April 2018. The plan documents the processes and procedures undertaken by the City to acquire and install the products and systems required to deploy the CV program.

NYCDOT has issued requests for proposal (RFP), and Request for Expression of Interest (RFEIP) to vendors for procuring the ASDs, RSUs, PIDs, and the Other Equipment. Two vendors have been identified for the ASD device procurement to develop the prototype and production devices for the NYC CVPD system. One vendor will be selected for each of the other subsystems.

NYC's system deployment is anticipated to be the largest CV technology deployment to date. Approximately 308 intersections will be instrumented with RSUs to communicate with up to 8,600 vehicles equipped with ASDs. These devices will monitor communications with other connected vehicles and the infrastructure and provide alerts to vehicle drivers/operators. Another 45 RSUs will be installed at locations on FDR, Flatbush Ave, and in Queens 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.

In addition to the acquisition and installation of the main vehicle and roadside equipment for the program, the Personal Information Device (PID), Traffic Management Center (TMC) equipment, and Other Equipment needed to supplement the Program are discussed in this document.

The CIP provides an overview of the supplier base and procurement methods, a high-level plan for inventory and configuration management, and a high-level initial installation schedule.

The CIP also addresses:

- Supplier(s)
- Inventory control method(s)
- Required configuration or pre-installation modifications
- Pre- and post-installation inspection procedures
- Detailed installation procedures
- QA/QC processes (with identified responsible parties)
- A preliminary, high-level installation schedule
- Hardware/software configuration control processes
- Spare parts/warranty contingency plans

1.4 REFERENCED DOCUMENTS

This document is one of several planning documents for the Connected Vehicle Pilot Deployment Program, Phase 2 project funded by the USDOT. Other planning documents developed under project Phases 1 and 2, which influence this CIP, include the following:

Table 1. References

LN	Document (Title, source, version, date, location)
1	Connected Vehicle Pilot Deployment Program Phase 1, Concept of Operations (ConOps) – New York City, April 8, 2016. FHWA-JPO-16-299.
2	Connected Vehicle Pilot Deployment Program Phase 2, System Architecture Document (SAD) – New York City, March 6, 2017. FHWA-JPO-17-451.
3	5.9 GHz DSRC AFTERMARKET SAFETY DEVICE (ASD) Merged Demo PROCUREMENT SPECIFICATION V2.3, November 2017, New York City Department of Transportation.
4	5.9 GHz DSRC ROADSIDE UNIT (RSU) PROCUREMENT SPECIFICATION V1.9, August 2017, New York City Department of Transportation.
5	PERSONAL INFORMATION DEVICE (PID)PROCUREMENT SPECIFICATION V1.7A, May 2016, New York City Department of Transportation.
6	Connected Vehicle Pilot Deployment Program Phase 2, System Design – New York City (Draft), September 11, 2017, FHWA-JPO-17-452.
7	Connected Vehicle Pilot Deployment Program Phase 2, Comprehensive Acquisition Plan (CAP) (Draft), December 21, 2017.

1.5 ORGANIZATION OF THE PLAN

The CIP identifies the type and number of devices, equipment, and software-based capabilities to be acquired and installed. The Plan contains sections for vehicles and in-vehicle equipment, roadside equipment, mobile devices, management center equipment/capabilities, and other equipment and supporting capabilities. This document provides an overview of the acquisition and installation approach that includes an assessment of time-to-procure and install relative to the overall deployment schedule. It also details method of procurement for the various subsystems required in the CV deployment. The CIP also addresses vendor outreach to engage and educate prospective vendors over time of changes to requirements, quantities, and delivery timelines.

Each component will have a specific path with regards to acquisition and installation. This plan will detail the processes to be undertaken to comply with city and state regulations, from the bidding stages, through the prototype stages until installation.

1.5.1. NYC CVPD Procurement Requirements

The procurement/acquisition requirements for the Connected Vehicle Program are categorized into six (6) parts: 1) Vehicle/In-vehicle units (ASDs), 2) Roadside Units (RSUs), 3) Mobile Devices or Personal Information Devices (PIDs), 4) Traffic Management Center (TMC), 5) Other Equipment, and 6) Installation Services. Each part is also referred to as a subsystem. Figure 5 below displays the 6 procurement categories and their main sub-categories:

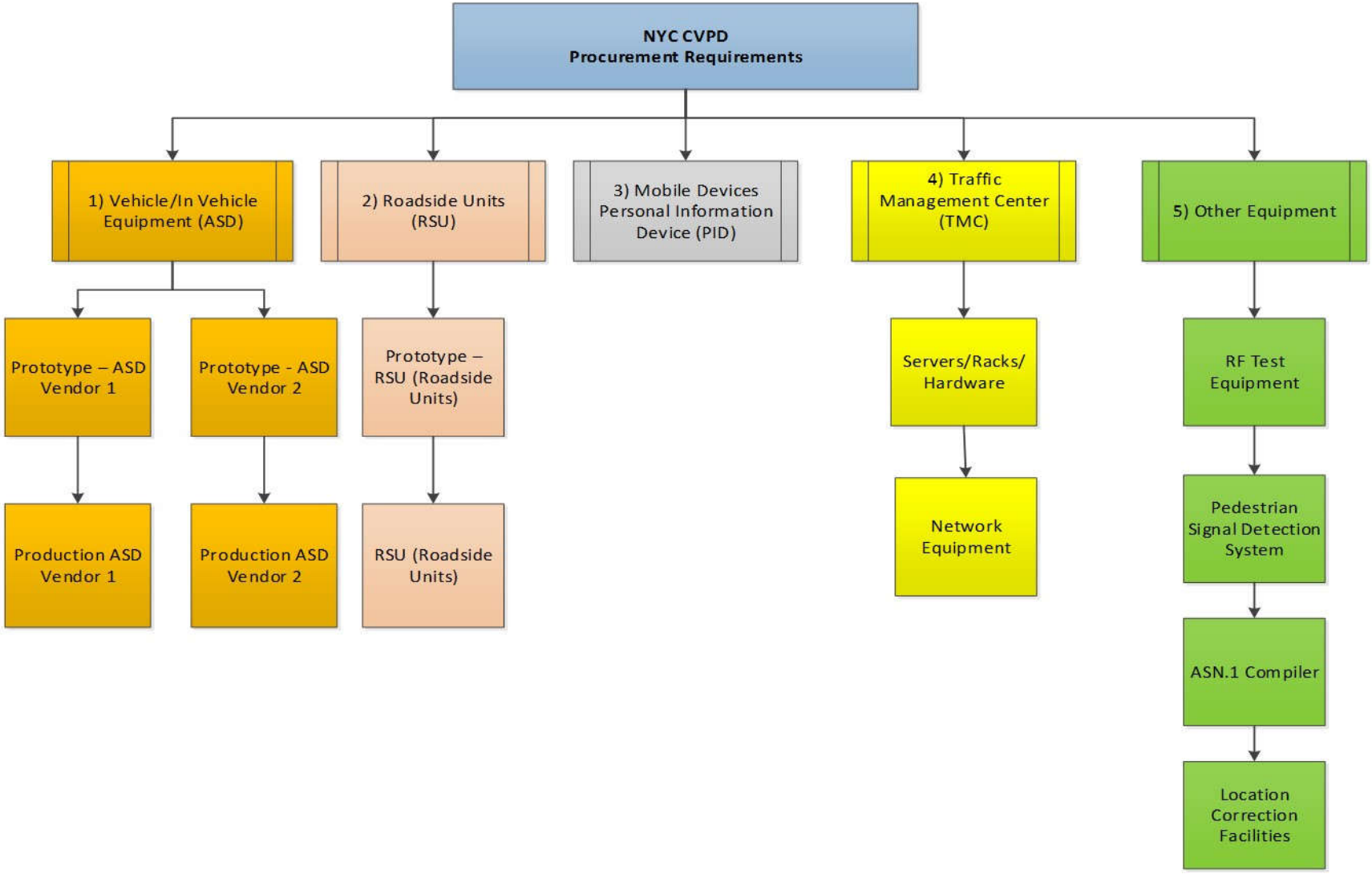


Figure 5. NYC CVPD Procurement Requirements

The acquisition quantities needed for each respective subsystem are determined by NYC CVPD program scope. All equipment quantities have been explored and determined to be essential for the successful deployment of the NYC CVPD program. The quantities required, along with the method of procurement that complies with the program and City requirements are shown below in Table 2: NYC CVPD Phase 2 Bill of Material (BOM).

Table 2. NYC CVPD Phase 2 Bill of Material (BOM)

Type	Name	Type	Qty	Method of Procurement	Vendor	Part Number
5.9 GHz ASD Specification Procurement						
1	ASDs - Vendor 1 (Prototype)	Device	100	RFEIP		
2	ASD Installation Kits - Vendor 1 (Prototype)	Device	100	RFEIP		
3	ASD - Vendor 2 (Prototype)	Device	100	RFEIP		
4	ASD Installation Kits - Vendor 2 (Prototype)	Device	100	RFEIP		
5	ASD - Vendor 1 (Production - Includes Spares)	Device	4200	RFEIP		
6	ASD Installation Kits - Vendor 1 (Production - Includes Spares)	Device	4200	RFEIP		
7	ASD - Vendor 2 (Production - Includes Spares)	Device	4200	RFEIP		
8	ASD Installation Kits - Vendor 2(Production - Includes Spares)	Device	4200	RFEIP		
9	Onsite Engineering Support Vendor 1 (Weekly)	Labor	8 weeks	RFEIP		
10	Onsite Engineering Support Vendor 2 (Weekly)	Labor	8 weeks	RFEIP		
11	ASD Vendor 1 Software/Source Code and development environment	SW	1	RFEIP		
12	ASD Vendor 2 Software/Source Code and development environment	SW	1	RFEIP		
5.9 GHz RSU Specification Procurement						
13	RSU Prototypes	Device	10	Competitive Sealed Bid (CSB)		
14	RSU Installation Kits - (Prototypes)	Device	10	CSB		
15	RSU (Production - Includes Spares)	Device	390	CSB		
16	RSU Installation Kits - (Production - Includes Spares)	Device	390	CSB		
17	Onsite Engineering Support Vendor 1 (Weekly)	Labor	8	CSB		
18	RSU Software Source Code and Development Environment	SW	1	CSB		
Mobile Device – Personal Information Device						
19	PID - Prototype	Device	10	CSB		
20	PID - Production	Device	90	CSB		

Type	Name	Type	Qty	Method of Procurement	Vendor	Part Number
TMC Equipment - CV Data Collection Server						
21	HPE ProLiant DL360 Gen9 Server	HW	2	In House - Buy Off A Master Agreement	CDW-G	DL360 Gen9
22	HPE MSA 2040 SAN Storage (21.6TB Capacity)	HW	1	In House - Buy Off A Master Agreement	CDW-G	MSA 2040 21.6tb
TMC Equipment - CV Network Integration Equipment						
23	Cisco ASR10001-X router rack mountable	HW	1	In House - Buy Off A Master Agreement	CDW-G	ASR1001X-2.5G K9
24	Cisco Upgrade from 2.5Gbps to 10Gbps License	SW	1	In House - Buy Off A Master Agreement	CDW-G	CON-SNT-SLASR1AM
25	Cisco SMARTnet extended service agreement	Service	1	In House - Buy Off A Master Agreement	CDW-G	CON-SNT-SLASR1AM
26	Cisco SFP-GE-T=SFP Transceiver Module	HW	2	In House - Buy Off A Master Agreement	CDW-G	GLC-TE
Other Equipment - Test Devices						
27	MS26890a or equal, Signal Analyzer includes one year warranty	HW	1	Competitive Sealed Bid (CSB)		MS26890A
28	MS2690A-008 or equal. 6GHz preamplifier includes one year warranty.	HW	1	CSB		MS2690A-008
29	MS26980A-020 or equal. Vector Signal Generator includes one year warranty	HW	1	CSB		MS26980A-020
30	MX269028A or equal. WLAN (802.11) Measurement Software, includes one year warranty.	SW	1	CSB		MX269028A
31	MX269028A or equal. WLAN signal generator includes one year warranty	HW	1	CSB		MX269028A
32	MX26900A or equal. Includes the standard software and V2X RF parametric test and V2X message check software and one year warranty.	SW	1	CSB		MX26900A
33	B0589A or equal. Carry case, includes one year warranty.	HW	1	CSB		B0589A
34	MS2690A-ES513 or equal. Five year repair and calibration when returned to the vendor.	Service	1	CSB		MS2690A-ES513
35	MS2720T or equal. Spectrum analyzer includes three year warranty.	HW	3	CSB		MS2720T
36	MS2720T-0709 or equal. Frequency range, 9khz-9GHz includes three year warranty.	HW	3	CSB		MS2720T-0709
37	MS2720T-0025 or equal. Interference analyzer includes three year warranty.	HW	3	CSB		MS2720T-0025
38	MS2720T-0431 or equal. Coverage mapping includes one three year warranty.	Service	3	CSB		MS2720T-0431

Type	Name	Type	Qty	Method of Procurement	Vendor	Part Number
39	MS2720T-0031 or equal. GPS receiver includes three year warranty.	HW	3	CSB)		MS2720T-0031
40	200-1528-R or equal. Magnet mount GPS antenna with SMA connector and 15' extension cable includes one year warranty.	HW	3	CSB		200-1528-R
41	2000-1748R or equal. Log periodic antenna 1-18GA GHz includes one year warranty.	HW	3	CSB		2000-1748R
42	MA2700A or equal. Mobile interference hunting system for the handheld spectrum analyzer.	HW	1	CSB		MA2700A
43	MX80007A-PL001 or equal. Mobile interference hunter software for the handheld spectrum.	SW	1	CSB		MX80007A-PL001
44	15NN50-1.5C or equal. Test port extension cable, armored, 1.5 meters, DC to 6 GHz, N(M) N(m), 50ohm.	HW	3	CSB		15NN50-1.5C
45	760-261-R or equal. Transit case.	HW	3	CSB		760-261-R
46	760-243-R or equal. Transit case for handheld equipment.	HW	3	CSB		760-243-R
47	3400-81718 or equal. Training class using the equipment to learn how to use the spectrum analyzer equipment and identity RF signal interference.	Training	1	CSB		3400-81718
48	MS2720T-0709-ES513 or equal. Five year repair and calibration when returned to the vendor.	Service	3	CSB		MS2720T-0709-ES513
49	MS27102A or equal. Remote spectrum monitor	HW	1	CSB		MS27102A
50	MS27102A-0706 or equal. Frequency range option 9khz-6 GHz.	HW	1	CSB		MS27102A-0706
51	MS27102A-0400 or equal. Vision monitor option enable.	HW	1	CSB		MS27102A-0400
52	40-187 or equal. AC/DC power supply, 1 meter 12 volt output cable.	HW	1	CSB		40-187
53	2000-1528R or equal magnet mount GPS antenna with SMA connector ad 15' extension cable includes one year warranty.	HW	1	CSB		2000-1528R
54	760-285-R or equal. Transit case for MS27102A.	HW	1	CSB B)		760-285-R
55	MS27102A-ES513 or equal. Five year repair and calibration when returned to the vendor.	Service	1	CSB		S27102A-ES513
Other Equipment - ASN.1 Java/Tool Compiler						
56	Project Start-up Kit License, OSS ASN.1/Java Tools (Compiler on Windows x86 64bit), ASN.1 studio (Supports BER, PER, and XML), Technical Support and Maintenance	SW	1	Micro Purchase	Garic Technology Inc	NA

Type	Name	Type	Qty	Method of Procurement	Vendor	Part Number
Other Equipment - Location Correction Facilities						
57	NTRIP Caster/RTCM Interface Software Package – NTRIP Caster and NTRIP Client	SW	1	CSB		
58	Integration and Training (NYC - Weeks)	Training	2	CSB		
59	Vendor Support - for vendor site NTRIP Clients connecting to NTRIP Caster (no travel)	Service	3	CSB		

Chapter 2. Acquisition Overview

2.1 ACQUISITION APPROACH

NYCDOT acquires needed products and services via different methods. Depending on the requisition value threshold, the City may be able to conduct in-house procurement. Acquisitions with requisition values exceeding $100,000 are turned over to the Department of Citywide Administrative Services (DCAS), the city authority on large procurement orders. With respect to the CV program acquisition needs, the City has identified 3 methods that will be utilized for the procurement of the various subsystems. These methods are selected based on policies and procedures dictated by City and State authorities, based on the best approach to ensure the items procured meet the required specifications. Figure 6 displays the method of procurement the City has selected for each subsystem.

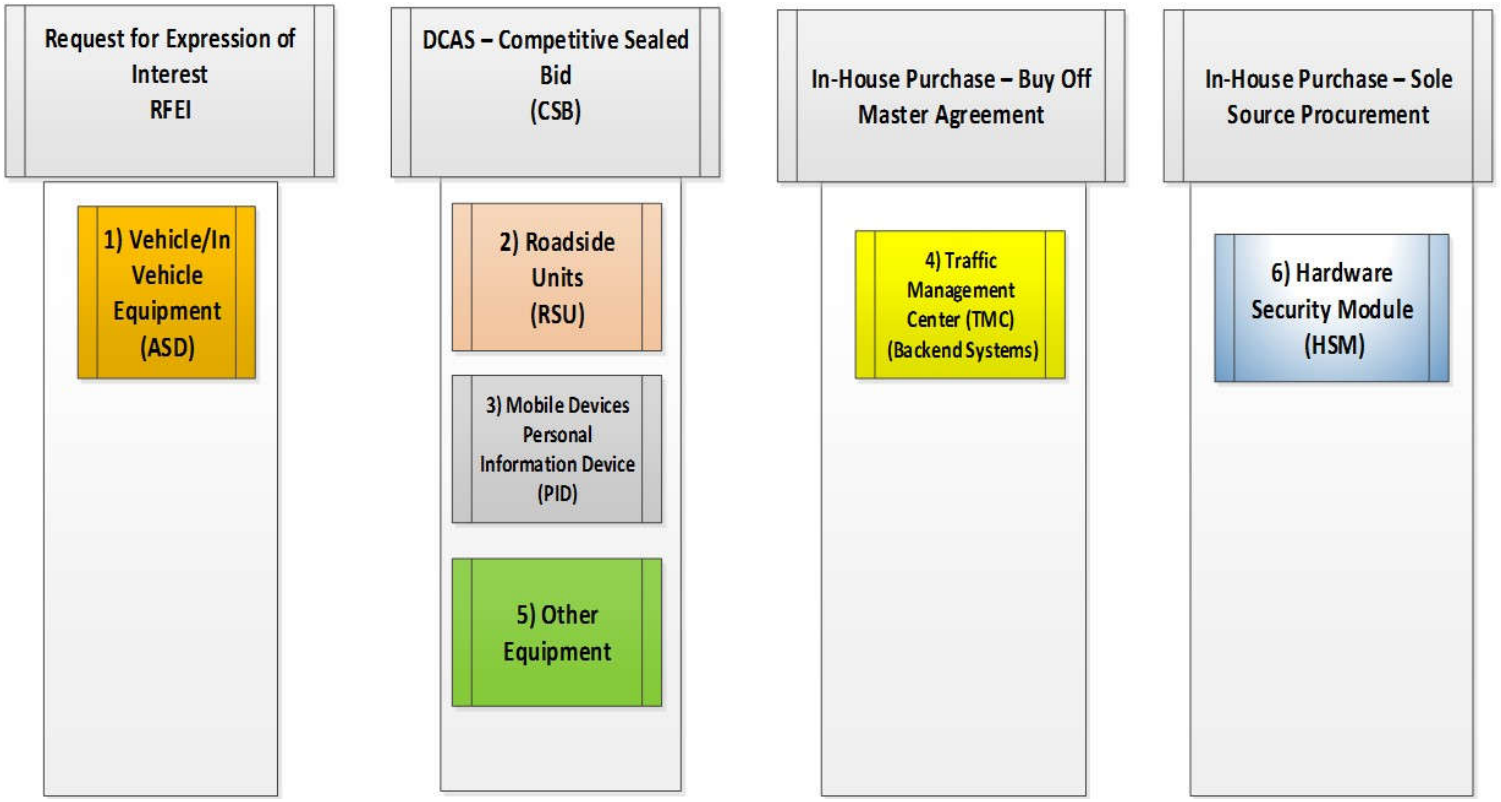


Figure 6. NYC CVPD Procurement Methods

2.1.1. NYCDOT In-House Procurement

The City conducts its own in-house procurement for purchase orders. These procurements are called in-house purchases. The city utilizes 4 kinds of procurement methods for in-house purchasing under $100,000 value; 1) Micro Purchase 2) Small Purchase, 3) Buy Off a Master Agreement, and In-House Purchase – Sole Source Procurement. These methods can be conducted to procure small purchase orders via an approved qualified list of vendors, and in some cases obtaining 3 vendor quotes to demonstrate competitive and fair price selection.

The 3rd method allows the city to procure requisitions with a value above $100,000 if the items being procured fall under a requirement to utilize a Master Agreement with a selected supplier. The majority of CV equipment does not fall under either method, but some CV support equipment will be procured under the Buy Off a Master Agreement contract.

Table 3. In-House Procurement Methods

LN	Procurement Method	Requisition Value	Description
1	Micro Purchase	<$20,000	Contact vendors by telephone or fax to ask for price quotes rather than advertise. Use vendors list and other sources to locate qualified vendors.
2	Small Purchases	$20,000 - $99,999	Invitations to bid are sent to a number of vendors who have been randomly selected from the City's Bidders' Lists
3	Buy Off a Master Agreement	>$100,000	For certain items the city may utilize this method, if a Master Agreement exists for certain items.
4	In-House Procurement	Any	For certain items that are only available from a sole source, the City may justify the purchase by executing a contract for the sole provider of the equipment.

2.1.2. Department of Citywide Administrative Services

DCAS will handle the acquisition of the most needed products because much of the product required by the CV Program will be valued over $100,000.

DCAS oversees the procurement processes of the DOT offices to maximize efficiency and ensure compliance with the City's Procurement Policy Board Rules, the City Charter, applicable laws and executive orders, and mayoral directives. The unit primarily manages the procurement of construction, service contracts, and procurement of goods contracts valued over $100,000. DCAS monitors scope development, vendor outreach, bid sales, bid-openings, responsiveness and responsibility determinations, vendor protests, contract registrations, contractor performance, and contract administration. With respect to the CVPD equipment acquisition, DCAS will determine the appropriate method of acquisition for each subsystem. DCAS is headquartered in the David N. Dinkins Municipal Building, located at 1 Centre Street in Manhattan, directly across the street from City Hall. Once DCAS completes the bid award, the City enters into a contractual agreement with the awarded vendor. Depending on the terms and conditions, the City will have the ability to extend or adjust the required quantities.

2.1.3. DCAS Procurement Methods

DCAS utilizes three different procurement methods to obtain needed services and goods. These methods vary and are distinguished by the total requisition value of the services/goods requested. DCAS will ultimately determine the appropriate method to proceed with for the Connected Vehicle Procurement. Depending on the characteristics and requirements of each CV subsystem, one of the following methods shown in Table 4 below will be considered.

Table 4. DCAS Procurement Methods

LN	Procurement Method	Requisition Value	Description
1	Competitive Sealed Bid (CSB)	>$100,000	A CSB is used to obtain bids when a procurement value is expected to exceed $100,000. All vendors on the appropriate bidders list are mailed invitations to bid and the procurements are publicly advertised in the City Record. Vendors submit bids that are opened in a public meeting and the contract is awarded to the qualified responsible vendor submitting the lowest responsive bid.
2	Request for Proposal (RFP)	>$100,000	RFPs are used to obtain professional services when price is not the most important factor. Vendors on a bidders list are emailed notices of solicitation and the procurements are publicly advertised. An evaluation committee chooses the best proposals and then negotiates with the top proposers before making a selection and awarding a contract.
3	Intergovernmental Procurements	>$100,000	DCAS may procure IT services or other items through the New York State Office of General Services (OGS) or other government entities. In such cases vendors selected by those entities are utilized

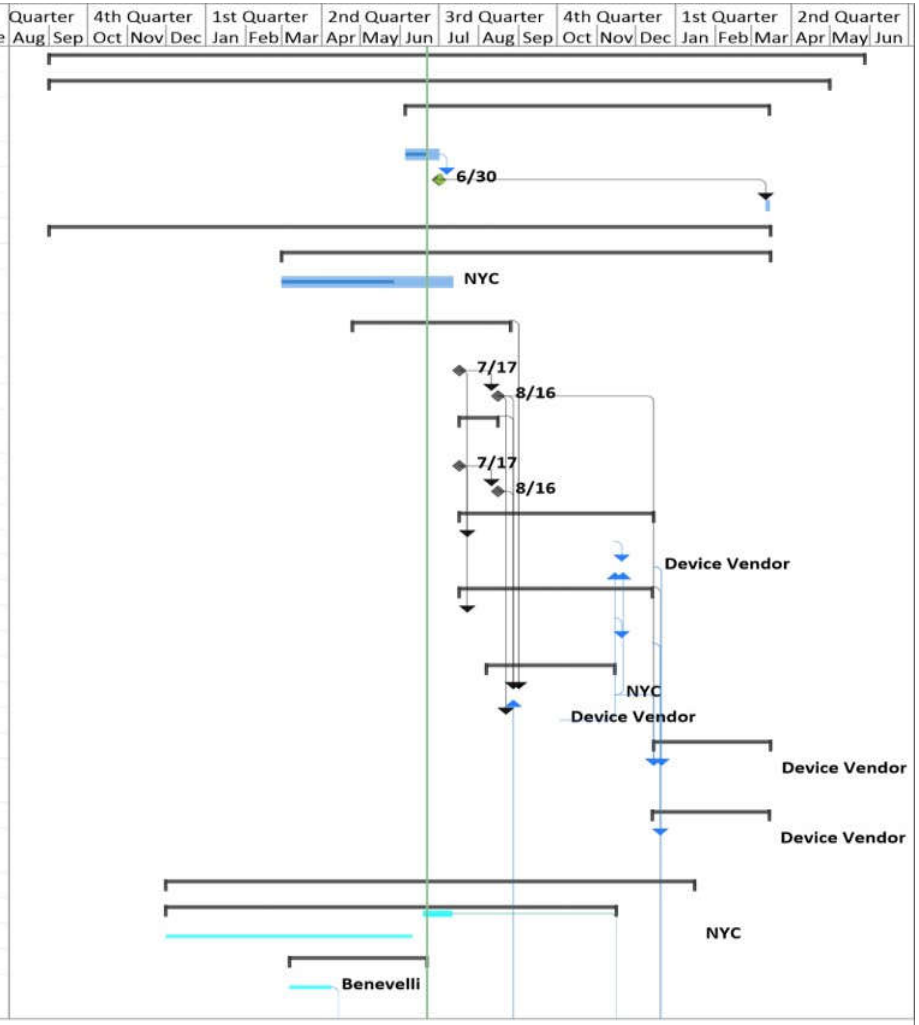
2.1.4. Request for Expression of Interest and Proposal (RFEIP)

The City has also selected an RFEIP option which is issued as a briefing document to stimulate and assess interest in providing equipment and services to NYCDOT (or the agency or the City) for the CV Pilot Deployment and to solicit useful information from interested parties for the supply of elements of the required systems. The responses to the RFEIP will be used by the City to begin negotiations with one or more vendors for the supply of certain CV Subsystems. This option will only be utilized for the ASD procurement. This option allows the city to review what the vendors have to offer before making a selection on a product or vendor and committing to a contract. Once RFEIP is complete, the City enters into a contractual agreement with the awarded vendor. Depending on the terms and conditions, the City will have the ability to extend or adjust the required quantities.

2.2 ACQUISITION AND INSTALLATION SCHEDULE

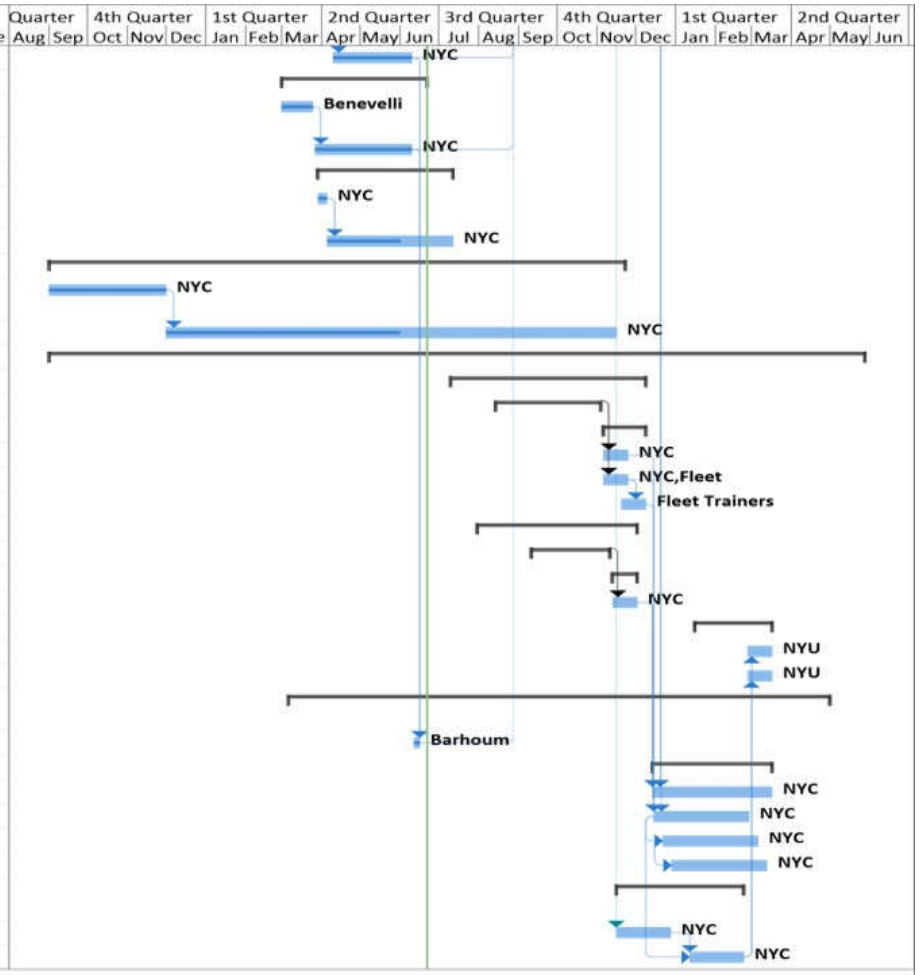
The expectation is that there will be substantially different acquisition schedules depending on the nature and type of equipment/capability being acquired. The majority of CV equipment required is not commercial off the shelf (COTS) ready and available product. Awarded bidders will have to build-to-order based on each item's specifications. Lead time varies with no typical estimated NYCDOT lead times available. Lead time is also a consideration for the selection of the vendor. However, such decisions are likely to affect the quantity of units which can be deployed depending on the cost estimates from the vendors. Figure 7 depicts the current Procurement and Installation Schedule.

ID	Task Name	Start	Finish	% Complete
67	**Phase 2**	**Thu 9/1/16**	**Sun 5/27/18**	**36%**
68	**Task 2A: Project Management**	**Thu 9/1/16**	**Mon 4/30/18**	**48%**
110	**SF-428(S) Submittal (60 Days Prior to Contract Year End)**	**Mon 6/5/17**	**Wed 3/14/18**	**57%**
111	Prepare Year 1 Report	Mon 6/5/17	Fri 6/30/17	65%
112	Submit Year 1 Report	Fri 6/30/17	Fri 6/30/17	0%
113	Add Year 2 Report to Phase 3 Schedu	Mon 3/12/18	Wed 3/14/18	0%
250	**Procurement**	**Thu 9/1/16**	**Thu 3/15/18**	**30%**
251	**ASD and RSU Procurement**	**Wed 3/1/17**	**Thu 3/15/18**	**5%**
252	Procure & Receive Sample ASD and RSU Devices	Wed 3/1/17	Tue 7/11/17	66%
253	**Procure & Receive Prototype ASD Devices (200)**	**Tue 4/25/17**	**Fri 8/25/17**	**0%**
254	ASD Vendors Selected	Mon 7/17/17	Mon 7/17/17	0%
260	Receive ASD Prototypes	Wed 8/16/17	Wed 8/16/17	0%
261	**Procure & Receive Prototype RSU Devices (10)**	**Mon 7/17/17**	**Wed 8/16/17**	**0%**
262	RSU Vendor Selected	Mon 7/17/17	Mon 7/17/17	0%
263	Receive RSU Prototypes	Wed 8/16/17	Wed 8/16/17	0%
264	**Procure Production ASDs from 2 Ver**	**Mon 7/17/17**	**Thu 12/14/17**	**0%**
265	ASD Vendor Registration	Mon 7/17/17	Tue 11/14/17	0%
267	Initial ASD Device Production	Tue 11/14/17	Thu 12/14/17	0%
268	**Procure Production RSUs**	**Mon 7/17/17**	**Thu 12/14/17**	**0%**
269	RSU Vendor Registration	Mon 7/17/17	Tue 11/14/17	0%
271	Initial RSU Production	Tue 11/14/17	Thu 12/14/17	0%
272	**Design & Prototype**	**Mon 8/7/17**	**Tue 11/14/17**	**0%**
276	Install and Test Prototype Devices	Mon 8/28/17	Tue 11/14/17	0%
277	Hardware Platform Verification	Wed 8/16/17	Mon 10/2/17	0%
278	**Device (ASD) Production & Delivery**	**Fri 12/15/17**	**Thu 3/15/18**	**0%**
279	ASD Device Delivery (Installation Occurs As Devices Provided)	Fri 12/15/17	Thu 3/15/18	0%
280	**Device (RSU) Production & Delivery**	**Thu 12/14/17**	**Wed 3/14/18**	**0%**
281	RSU Delivery (Installation Occurs As Devices Provided)	Thu 12/14/17	Wed 3/14/18	0%
282	**Ped Device and App Procurement (PID**	**Thu 12/1/16**	**Mon 1/15/18**	**45%**
283	**Procure Prototype PID Device(s)**	**Thu 12/1/16**	**Wed 11/15/17**	**13%**
286	Procure Production PID Devices	Thu 12/1/16	Mon 1/15/18	47%
297	**Network Equipment**	**Tue 3/7/17**	**Wed 6/21/17**	**100%**
298	Develop Specification and Procurement Method	Tue 3/7/17	Fri 4/7/17	100%



Phase 2&3 Schedule Working.mpp Page 1 Thu 6/22/17

ID	Task Name	Start	Finish	% Complete
299	Purchase and Receive	Mon 4/10/17	Fri 6/9/17	100%
302	**TMC Hardware & Licenses**	**Wed 3/1/17**	**Wed 6/21/17**	**100%**
303	Develop Specification and Procurement Method	Wed 3/1/17	Fri 3/24/17	100%
304	Purchase and Receive	Mon 3/27/17	Fri 6/9/17	100%
307	**Laptops**	**Wed 3/29/17**	**Tue 7/11/17**	**61%**
308	Develop Specification and Procurement Method	Wed 3/29/17	Tue 4/4/17	100%
309	Purchase and Receive	Wed 4/5/17	Tue 7/11/17	59%
314	**PED Detection Systems**	**Thu 9/1/16**	**Wed 11/22/17**	**60%**
315	Determine device specifications and procurement method	Thu 9/1/16	Wed 11/30/16	100%
316	Procure PED Detection Systems	Thu 12/1/16	Wed 11/15/17	52%
395	**Task 2F: Participant and Staff Training**	**Thu 9/1/16**	**Sun 5/27/18**	**26%**
428	**ASD Installation Training**	**Mon 7/10/17**	**Fri 12/8/17**	**0%**
433	**Prepare ASD Installer Training Mate**	**Mon 8/14/17**	**Fri 11/3/17**	**0%**
439	**Train ASD Installers**	**Mon 11/6/17**	**Fri 12/8/17**	**0%**
440	Train NYC Installers - ASD	Mon 11/6/17	Fri 11/24/17	0%
441	Train Installer Fleet Trainers	Mon 11/6/17	Fri 11/24/17	0%
442	Fleet Trainers Train Their Installer:	Mon 11/20/17	Fri 12/8/17	0%
443	**RSU Installation Training**	**Mon 7/31/17**	**Fri 12/1/17**	**0%**
448	**Prepare RSU Installer Training Mate**	**Mon 9/11/17**	**Fri 11/10/17**	**0%**
452	**Train RSU Installers**	**Mon 11/13/17**	**Fri 12/1/17**	**0%**
453	Train NYC Installers - RSU	Mon 11/13/17	Fri 12/1/17	0%
477	**Pedestrian Training & Device Distributi**	**Tue 1/16/18**	**Fri 3/16/18**	**0%**
479	Distribute PID	Mon 2/26/18	Fri 3/16/18	0%
480	Train Peds	Mon 2/26/18	Fri 3/16/18	0%
510	**Task 2H: Installation and Operational Readiness Testing**	**Mon 3/6/17**	**Mon 4/30/18**	**1%**
511	Install TMC Hardware, Network, Etc	Mon 6/12/17	Thu 6/15/17	100%
518	**Install, Integrate, Test & Tune ASD & R**	**Thu 12/14/17**	**Fri 3/16/18**	**0%**
519	Install RSUs	Thu 12/14/17	Fri 3/16/18	0%
520	Install ASDs (1st 80%)	Fri 12/15/17	Mon 2/26/18	0%
521	Integrate & Test (1st 80%)	Fri 12/22/17	Mon 3/5/18	0%
522	Tune & Test (1st 80%)	Fri 12/29/17	Mon 3/12/18	0%
523	**Pedestrian Configuration, Integration & Tuning**	**Thu 11/16/17**	**Thu 2/22/18**	**0%**
524	Final Ped App/Device Configuration	Thu 11/16/17	Wed 12/27/17	0%
525	Integrate, Test and Tune Ped App/De	Fri 1/12/18	Thu 2/22/18	0%



Phase 2&3 Schedule Working.mpp Page 2 Thu 6/22/17

Figure 7. Phase 2 Procurement and Installation Schedule

2.3 VENDOR OUTREACH PLAN

2.3.1. Vendors

The deployment of the New York City Connected Vehicle Pilot Deployment (NYC CVPD) products will be one of the first of its kind. All the CV products are customized and engineered to meet NYCWiN communication standards and NYC CVPD requirements. Many of the vendors in the V2X industry have been involved with the City since program inception. Table 5 lists the vendors that have participated in past demonstrations.

Table 5. V2X Vendors

LN	Vendor	LN	Vendor
1	5D Robotics	15	Genvict
2	Autotalks	16	General Motors GM
3	Battelle Memorial Institute	17	Kapsch TrafficCom North America
4	Brand Motion	18	Lear Connexus
5	Crash Avoidance Metrics Partnership (CAMP)	19	OmniAir Certification Services
6	Cohda Wireless America LLC	20	Q-Free
7	Commsignia	21	Qualcomm
8	Danlaw Inc	22	Savari Networks
9	Denso	23	SBE-California
10	Delphi	24	Schagrin-Consulting
11	Econolite Group, Inc	25	Siemens Industry, Inc Mobility Division – Intelligent Traffic Systems
12	eTrans Systems	26	Wave Mobile Solutions
13	Ford	27	FLIR Systems
14	Sirius XM	28	Ronnie Chowdhury - PID Development

2.3.2. Available Documents

The NYC CVPD team has produced a number of support documents during the first phase of this project. The vendors have been informed to review the Concept of Operations (ConOps), Security Management Operational Concept (SMOC), System Requirements Document (SRD), Performance Metrics and Evaluation document, and a System Architecture Document (SAD). These are all available online at the US DOT website or New York City Project site. The City is continuing to refine these documents and has incorporated these application requirements into the CV subsystems procurement specifications.

2.3.3. Pre Bid Conference

A pre-bid conference was held at the City offices in Manhattan on July 12, 2017. All prospective bidders were required to attend the pre-bid conference as a condition to submitting a bid on this contract. Questions submitted at least 5 business days prior to the pre-bid conference were to be addressed anonymously at the pre-bid meeting. Attendees to the pre-bid meeting were asked to document their questions raised orally during the pre-bid meeting.

2.3.4. Pre-Award Project Demonstration

For the ASD subsystems, a product demonstration will be required to show that the vendors' products meet the procurement specifications as outlined in each procurement specification document. The vendors will be required to demonstrate their products and technologies in a live environment prior to vendor selection by the City.

Selected responders will be offered the opportunity to demonstrate their product(s); we also encourage the vendors to demonstrate the effectiveness of the products or systems currently both under development or available for purchase. NYCDOT will make available a test location which may be used by the responders to demonstrate their current applications. All vendors are required to demonstrate several of their V2V and V2I applications as described in the Concept of Operations (ConOps) for the NYC project and the procurement specifications for the ASD (V2.1). The project has evolved since the initial ConOps such that the vendor needs to also review the current contents of the procurement document.

2.3.5. Prototype Phase

The ASD and RSU subsystems will undergo a Prototype Phase during which the City will work with the selected vendor to verify conformance to the requirements of the CV program as listed in each respective Procurement Specification.

2.3.6. Vendor Outreach Strategy

The NYC CVPD team will maintain weekly coordination and communication with all awarded vendors in order to ensure on time production and delivery. Multiple methods of communication will be undertaken to ensure timely delivery and quality assurance. These methods are listed below in Table 6.

Table 6. Vendor Outreach Strategy

Method	Stakeholders	Primary Purpose	Frequency
Conference Call	Vendors, NYCDOT	Schedule/delivery updates	Weekly
Physical Meeting: Vendor Location	Vendors, NYCDOT	Contractual, Quality, Inspection, Testing	TBD
Physical Meeting: Meetings at NYCDOT	Vendors, NYCDOT	Bidding, Contractual, Change Orders, Schedule	TBD
Vendor Site in NYC	Vendors, NYCDOT	Testing, Repair/Replacement, Warranty	As Needed

2.4 TANGIBLE PROPERTY REPORT (SF-428)

The CV program is funded by the US DOT. NYCDOT will comply with Federal Acquisition requirements and file an SF-428 each year 60 days prior to the award anniversary. The award for the CV program as stated in the Notice of Funding Opportunity Document (NOFO) is September 1, 2016. Tangible personal property is always depreciated over either a five- or seven-year period using straight-line amortization. Property may be provided by the awarding agency or acquired by the recipient with award funds. Federally-owned property consists of items that were furnished by the Federal government.

All Connected Vehicle products and equipment procured in this document are required to provide Federal awarding agencies with information concerning property in NYCDOT custody annually, at award closeout, or when the property is no longer needed. The SF-428 and its supplementary SF-428-A will be completed and submitted to the US DOT on an annual basis to comply with Federal Acquisition Regulations (FAR). Once there is a need for disposition instructions, at any time other than contract closeout, an SF-428-C

must be filed along with the SF-428 requesting US DOT instruction on how to proceed with the equipment disposition. At Award close-out, an SF-428-B will be filed for all federally provided/funded equipment on hand requesting final disposition instructions.

2.4.1. Federal Reporting Procedure and Schedule

All Connected Vehicle products and equipment procured in this document are required to provide Federal awarding agencies with information concerning property in NYCDOT custody annually, at Award closeout, or when the property is no longer needed. There are 3 separate SF-428 Attachments that will be filed with US DOT. The attachments to use will be subject to the nature and type of filing. Table 7 displays the schedule for filing the respective forms.

2.4.1.1. SF-428-A

The SF-428 and its supplementary SF-428-A will be completed and submitted to the US DOT on an annual basis to comply with FAR. The due date of submission is September 30th, which is the end of the Federal Fiscal year.

2.4.1.2. SF-428-B

At Award close-out, an SF-428-B attachment will be filed along with the standard SF-428 for all federally provided/funded equipment on hand requesting final disposition instructions.

2.4.1.3. SF-428-C

Once there is a need for disposition instructions, at any time other than Award/Contract closeout, an SF-428-C must be filed along with the SF-428 requesting US DOT instruction on how to proceed with the equipment disposition.

Table 7. Federal Tangible Property Filing Schedule (SF-428)

		Forms to be Filed			
Milestone Dates	**Date**	**SF-428**	**SF-428-A**	**SF-428-B**	**SF-428-C**
Notice of Funding Award (NOFO)	Sep 1, 2016				This attachment to be filed any time a disposition is requested on federally funded items during the duration of award/contract.
1st Annual Reporting of Tangible Property (60 days prior to anniversary)	July 1, 2017	√	√		
2nd Annual Reporting of Tangible Property (60 days prior to anniversary)	July 1, 2018	√	√		
3rd Annual Reporting of Tangible Property (60 days prior to anniversary)	July 1, 2019	√	√		
End of Phase 3 – Award Close-out	Oct 29, 2019	√		√	

Chapter 3. Installation Overview

3.1 SUPPLIER BASE

TMC network and storage equipment has been procured through a New York City Buy-Off-Master Agreement vehicle with CDW-G. ASD, RSU, PID, and all other CV procurements are still pending through other procurement vehicles. This section will be completed upon completion of the vendor selection and award process.

3.1.1. ASD Supplier Base

After completion of the vendor demonstration portion of the RFEIP May 17 to 24, 2017, three (3) vendors submitted technical and financial proposals. It is important to note that 6 vendors participated in the demonstration. These vendors were solicited out of a pool of known vendors. These proposals are currently being analyzed in preparation for award. The procurement of the ASDs is intended to be turnkey, meaning all ancillary and support items needed to install and operate the ASD must be provided by the awarded vendor. The 6 participating vendors listed in Table 8 below represent the ASD supplier base.

Table 8. ASD Supplier Base Table

LN	Vendor	Address
1	Lear Connexus	Lear Corporation 21557 Telegraph Rd. Southfield, MI 48033 www.Lear.com
2	Savari Networks	Savari Traffic Operation 2005 De La Cruz Blvd #111 Santa Clara, CA 95050 www.Savari.net
3	Danlaw, Inc.	41131 Vincenti Court Novi, MI 48375 www.danlawinc.com
4	Commsignia Inc.	122 Saratoga Ave. Suite 100 Santa Clara, CA 95051 www.commsignia.com
5	Laird Tech	Laird Technologies, Inc. 3481 Rider Trail South Earth City, MO 63045 www.lairdtech.com
6	Denso International America, Inc.	24777 Denso Drive PO BOX 5047, MC4200 Southfield, MI 48086-5047 www.densocorp-na.com

3.1.2. RSU Supplier Base

The RSU 5.9 GHz Procurement Specification bid was posted in early May 2017 with a May 23 opening date. The bid was postponed to June 21, 2017. A pre-bid conference was held on June 12, 2017 at 55 Water Street New York, NY to address any open questions and concerns. The procurement of the RSUs is intended to be turnkey, meaning all ancillary and support items needed to install and operate the ASD must be provided by the awarded vendor. The attending vendors to the pre-bid conference constitute the RSU Supplier Base are displayed in Table 9 below.

Table 9. RSU Supplier Base Table

LN	Vendor	Address
1	Lear Connexus	Lear Corporation 21557 Telegraph Rd. Southfield, MI 48033 www.Lear.com
2	Savari Networks	Savari Traffic Operation 2005 De La Cruz Blvd #111 Santa Clara, CA 95050 www.Savari.net
3	Cohda Wireless	Australia Headquarters 82-84 Melbourne Street, North Adelaide, SA 5006 Australia www.cohdawireless.com
4	Battelle Memorial Institute	505 King Ave. Columbus, Ohio 43201 www.battelle.org
5	Siemens Industry, Inc.	Mobility Division - Intelligent Traffic Systems 9225 Bee Cave Road Building B, Suite 101 Austin, TX 78733 www.siemens.com
6	Denso International, America, Inc.	Denso International, America, Inc. 24777 Denso Drive PO Box 5047, MC2414 Southfield, MI, 48086-5047 www.densocorp-na.com

3.1.3. Mobile Device (PID) Supplier Base

The supplier base for the acquisition of the PID device is not yet known. This section will be updated as more details become available.

3.1.4. Traffic Management Center (Back Office) Supplier Base

As discussed earlier in the document under Section 2 Acquisition Approach, NYCDOT In-House Procurement, the City will acquire TMC Storage and Network equipment as shown in Table 10 below under the approach of Buy Off a Master Agreement. The City currently has a Master Agreement with CDW-G to procure all IT needs without being required to solicit other vendors. In the interest of time and meeting the schedule, the City has opted for this method to meet these requirements.

Table 10. TMC Equipment Supplier Base

LN	Equipment	Vendor	Acquisition Date
1	CV Data Collection Server Equipment	CDW-G	June 7, 2017
2	CV Network Integration Equipment	CDW-G	June 7, 2017

3.1.5. Other Equipment

The following Other items shown in Table 11 will be procured in support of the NYC CV Program. These items have already either been procured or the procurement is currently under way. Their method of procurement depends on their overall value. The awarded vendor may not be the lowest bidder, in order to satisfy City requirements to award Small Businesses with the following classifications (Small Veteran Owned Business, Small Women Owned Business, etc.)

Table 11. Other Equipment Supplier Base

LN	Equipment	Method	Vendor	Acquisition Date
1	RF Testing Devices	CSB	Open	Open
2	ASN.1 Compiler	In-House Micro Purchase <$20,000	Garic Technology Inc.	June 1, 2017
3	Location Correction Facilities	Unknown	Open	Open
4	Pedestrian Detection System	CSB	Open	Open
5	Hardware Security Module (HSM)	In House Purchase, Sole Source	Green Hills ISS	Sep 27, 2017

3.2 PROCUREMENT METHOD

The various CV subsystems are currently in the procurement process. With the exception of TMC network and storage equipment, and the HSM, no vendors have been selected. The Hardware Security Module (HSM) has been determined to be a unique requirement that is only offered by Green Hills ISS, therefore the City has determined this to be a sole source procurement.

It has been determined by the City that the procurement method shown in Figure 8 will be used depending on the subsystem and value of award:

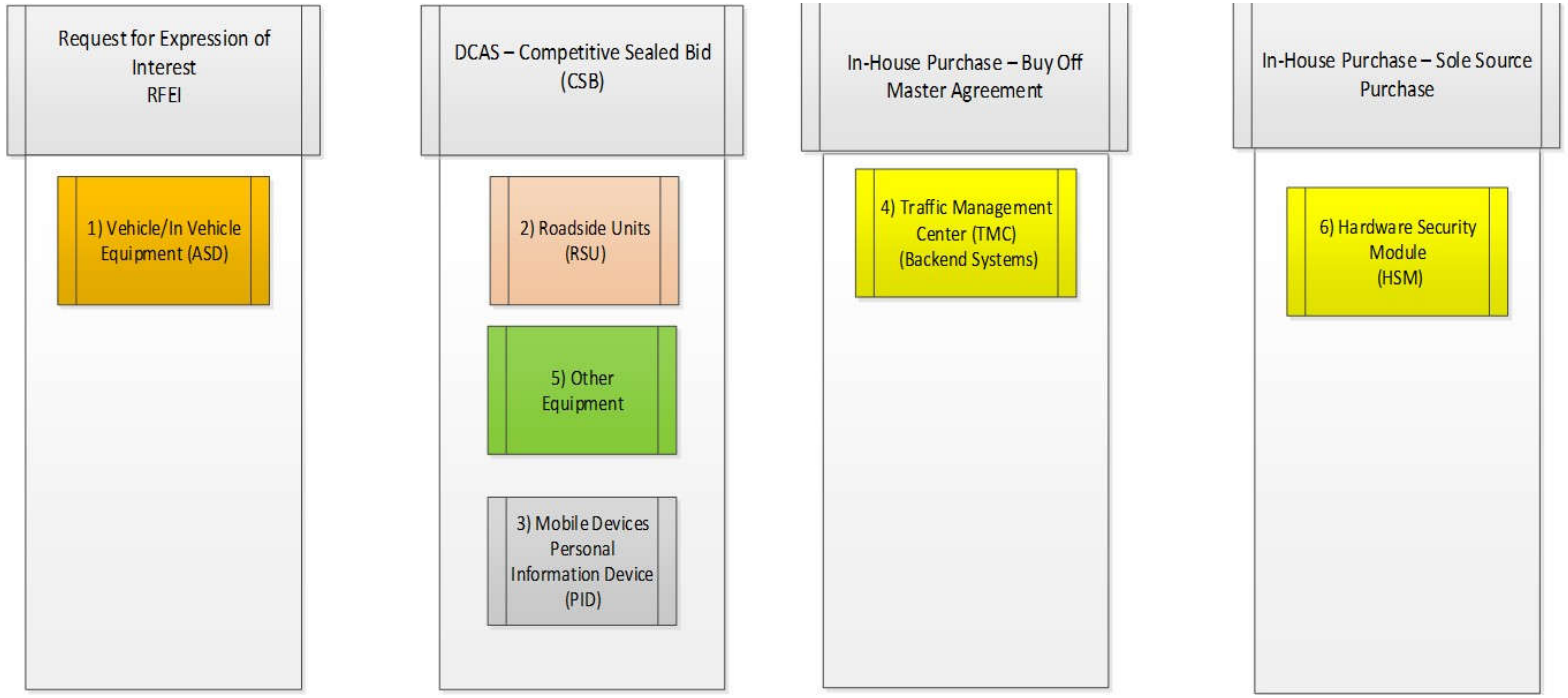


Figure 8. NYC CVPD Procurement Methods

3.3 INVENTORY MANAGEMENT

The NYC CVPD team will maintain a Master Inventory Spreadsheet to list, document, and retain received inventory from the awarded vendors. This spreadsheet will be managed and updated regularly by City Staff. In addition to the Master Inventory Spreadsheet, the following tools will be utilized:

1. Microsoft Word — used to produce deliverables, procedures, and other documentation.

2. Microsoft Excel — used to track checklists and schedules.

3. Microsoft Office Project — used to establish and monitor planned acquisition and receipt tasks in the project work plan.

3.3.1. Inventory Control

The purpose of the NYC CVPD Inventory Tracking Tool is to document products received for the NYC CVPD program in a manner that conforms to NYCDOT inventory tracking and documentation requirements. It is also a central tool to read, write, and modify information regarding equipment receipt as it becomes available. The Master Inventory Spreadsheet will be divided into 5 respective categories. Inventory will be tracked, input, and managed based on the 5 main categories. The document will reference any Purchase Order (PO) detail, and Invoicing documents. The Vendors will be required to provide all equipment as noted in the Procurement Specification with Part Number and Serial Number visible on both Devices and Packaging.

NYCDOT will receive and document all product receipts. Figure 9 displays the categories under which the inventory will be controlled.

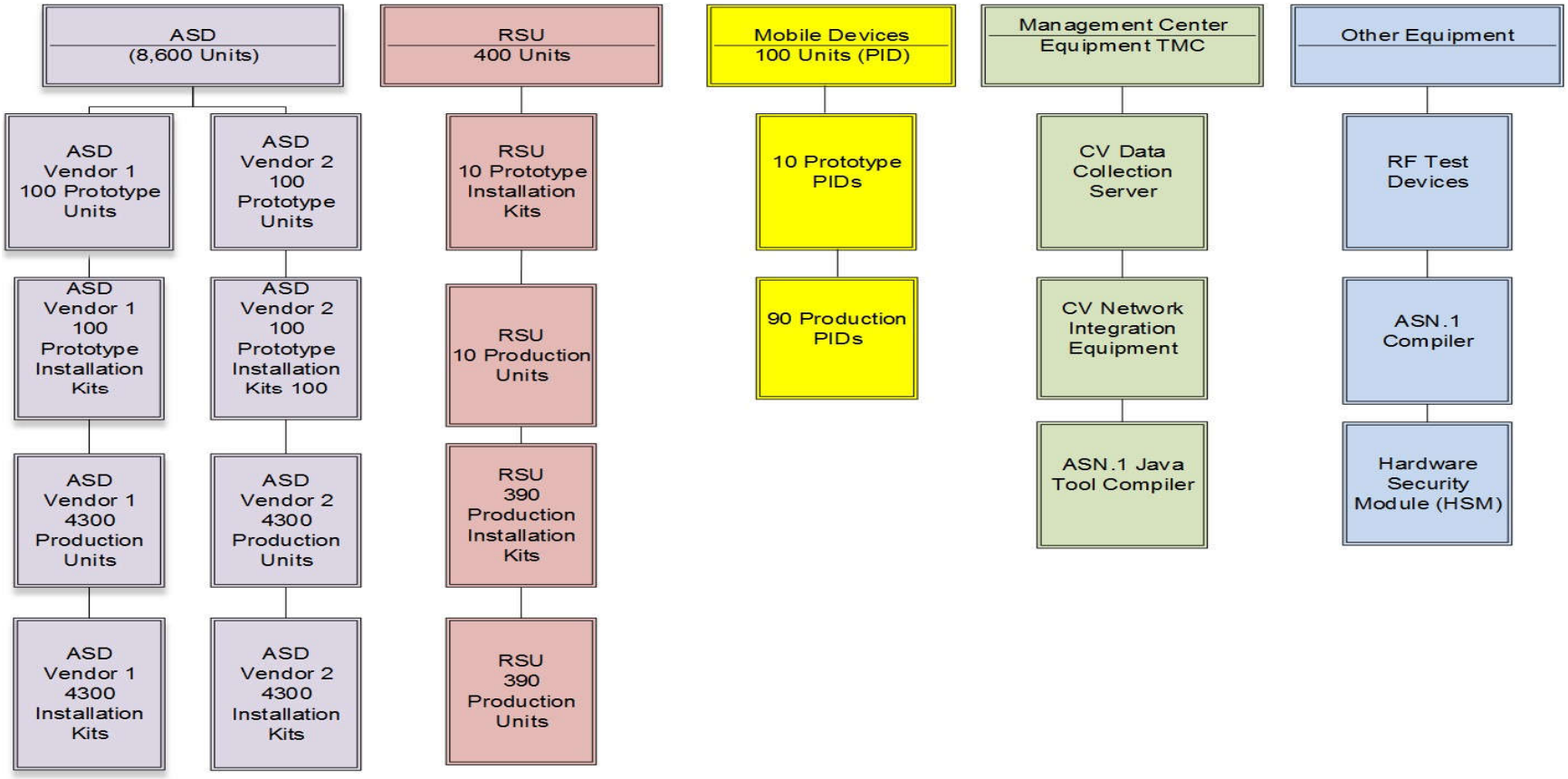


Figure 9. Inventory Tracking by Category

The master Inventory Spreadsheet will have specific fields updated that will help the City manage the CV inventory as it is received and installed. The following fields will need to be updated based on the availability of product, stakeholder readiness, and schedule requirements. Figure 10 displays the required fields to be updated in a conceptual diagram.

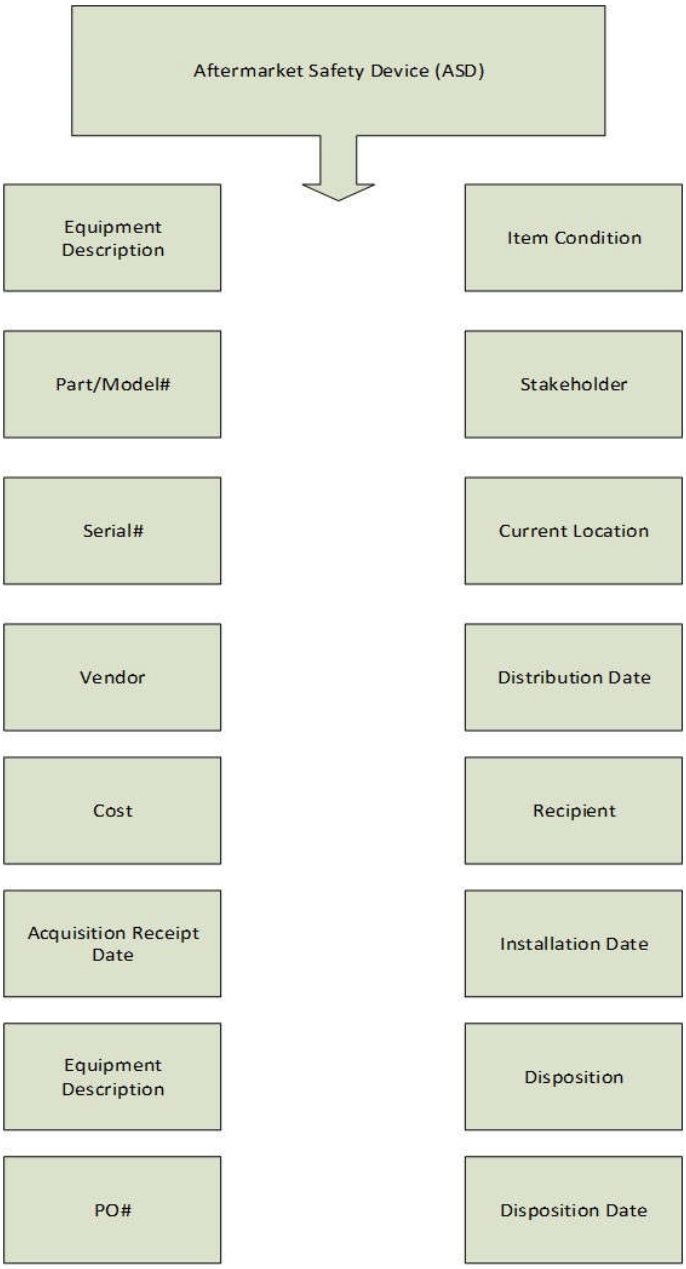


Figure 10. Master Inventory Tool Conceptual Diagram

The Master Inventory Spreadsheet is designed to provide all the required fields to manage the SF-428 Tangible Personal Property Reporting. Figures 11 and Figure 12 show how the City has aligned specific fields based on SF-428 federal reporting requirements and SF-428B/SF-428C supplementary reporting requirements.

	SF-428/ SF428A								
LN	Equipment Type/Description	Part/Model#	Serial#	Vendor	Cost	Federal Participation	Acquisition/Receipt Date	NYC DOT PO#	Contract Name

Source: NYCDOT, 2016

Figure 11. SF-428/SF-428A Reporting Requirements

SF428B/SF428C	
Disposition	Disposition Date

Source: NYCDOT, 2016

Figure 12. SF-428B/SF-428C Supplementary Reporting Requirements

3.3.2. Inventory Storage and Logistics

Items procured for the NYC CVPD program will need to be installed and deployed in various geographic sections of New York City depending on the form and purpose of the equipment. For example, RSUs will be deployed at fixed field locations, while ASDs will need to be installed in various fleet vehicles belonging to the participating stakeholders. The warehousing of equipment, parts, assets, etc. will be managed, coordinated, and secured by NYCDOT personnel, as well as the staging, storage, and inventory tracking of all necessary equipment for all phases of installation and maintenance as equipment arrives and is checked out of the warehouse facility.

Table 12 explains where the items will be delivered prior to distribution by the City for field installation or stakeholder vehicle installations.

Table 12. Equipment Delivery Locations

Equipment Type	Type	Delivery Location	Deployment Location
ASDs	HW	CV Container NYCDOT 45-02 37th Ave. Long Island City, NY 11101	Will be installed in DOT vehicles and distributed to stakeholders for in-vehicle installation in 8,000 participating vehicles.
RSUs	HW	CV Container NYCDOT 45-02 37th Ave. Long Island City, NY 11101	Will be installed by DOT personnel at 353 signalized and support sites in Midtown Manhattan, FDR, Flatbush, and designated RSU support sites
Mobile Device (PIDs)	HW	NYU Review Board	Pedestrians participating in the Pilot
Management Center Equipment CV Data Storage Collection	HW/SW	NYCDOT Traffic Management Center 28-11 Queens Plaza North Long Island City, NY 11101	NYCDOT Traffic Management Center 28-11 Queens Plaza North Long Island City, NY 11101
Management Center Equipment CV Network Integration Equipment	HW/SW	NYCDOT Traffic Management Center 28-11 Queens Plaza North Long Island City, NY 11101	NYCDOT Traffic Management Center 28-11 Queens Plaza North Long Island City, NY 11101
ASN.1 Java/Tool Compiler	SW	SW license delivery	TransCore ITS 192 Technology Parkway, Suite 500 Peachtree Corners, GA 30092

RF Testing Devices	HW	NYCDOT 34-02 Queens Blvd. Long Island City, NY 11101	NYCDOT 34-02 Queens Blvd. Long Island City, NY 11101
Location Correction Facilities	SW	SW license delivery	NYCDOT Traffic Management Center 28-11 Queens Plaza North Long Island City, NY 11101

The City will acquire all equipment for the program and proceed to store and distribute as the installation schedule requires. The City has designated a 40ft Cube Container at the NYCDOT location listed below as a warehouse location for the RSUs and ASDs that will be delivered to the City. The address is:

NYCDOT
45-02 37th Ave.,
Long Island City, NY 11101

The Location is secured by NYCDOT personnel who monitor entry and exit of the premises. NYCDOT personnel only have access. The location is a designated lot for NYCDOT vehicles, tools and equipment. The Container will also be secured with a padlock and keys distributed to key CV team personnel as shown in Figure 13.

Figure 13. CV Holding and Storage Location

This location will serve as the storage location for RSUs and ASDs. We intend to stage the delivery from the vendor based on their production schedule, which will be finalized after completing the prototype phase. Upon completion of the prototype phase, the vendor will deliver the items ordered to this location, where the City will verify receipt, log it into the inventory, and distribute to installers and/or stakeholders.

3.3.2.1. TMC Back Office Equipment

TMC Back Office equipment will be delivered directly to the TMC at the below address. This location is secured by electronic access control, and armed guards.

NYCDOT Traffic Management Center
28-11 Queens Plaza North
Long Island City, NY 11101

3.4 CONFIGURATION MANAGEMENT

The City will manage the configuration of the CV back office development source code developed during the design and prototype phase and throughout the entire System Development Life Cycle (SDLC). This methodology includes the evaluation, coordination, approval and implementation of any proposed changes to the baseline system. The baseline system will be developed during the prototype phase after vendors provide their respective source codes, and the City completes testing and tuning the devices for the NYC environment. The baseline for CV software will be assigned Version 1.0 upon completion of testing and approval. Any changes to the baseline consisting of any modification to the hardware or software components that are currently approved and installed would generate a configuration change request and a new version number.

In order to effectively support complete system configuration management, this plan identifies four distinctive CM processes to manage change for software and hardware Configuration Items. These carefully managed processes are described as follows:

3.4.1. Software Configuration Management

This process is used to manage and control changes in the evolution of a software system and the supporting documentation. The effective and efficient performance of this process is achieved by using automated tools to track all modifications to the software system. This will be done via a Change Request (CR) Form.

3.4.2. Hardware Configuration Management

This process is used for creating and maintaining a hardware baseline to ensure that components are capable of accepting and sustaining the operations of the NYC CVPD program. Once the baseline is established, any replacement component that is not currently approved as a standard baseline item is first evaluated for compliance before integration into the baseline system. This will be done via a Change Request (CR) Form.

3.4.3. Document Management

This process is used for creating and delivering documentation and specifications required for the design, procurement, installation, commissioning, and acceptance of hardware and/or software. This will be done via a Change Request (CR) Form.

3.4.4. Subsystem Testing

This process is required to ensure each subsystem/component is tested, properly configured and made available to the team at the required time. This will be done via a Change Request (CR) Form.

3.4.5. Change Control Board (CCB)

The City will implement a formal configuration management process. See Appendix C for NYC CVPD APPENDIX C . Change Request Form V1.0V1.0. A Change Control Board has been designated as shown in Table 13 to review, evaluate, and approve requested changes to the baseline.

Table 13. NYC CVPD Change Control Board

Name	Signature	Date
Nader Barhoum – Systems Engineer		
Robert Rausch – Site Lead		
Keith Patton/ Evgeniy Kudinov – Network Administrator		
Mohamad Talas – Program Manager		

3.4.6. Change Request (CR) Form

The City currently implements a formal configuration management process. This existing process will take effect after the CV Back Office software is baselined to version 1.0 upon completion of the system design, and completion of the prototype phase with the vendors. A CR Form is currently utilized to formalize the process. See Appendix C for NYC CVPD APPENDIX C . Change Request Form V1.0.

3.5 HIGH LEVEL EQUIPMENT INVENTORY

Only Back office HW equipment and SW License has been received to date. Weekly updates of the current inventory procured as shown in Table 14 will be updated to reflect the installation duration on the subsystems. It is standard practice by the City to visually verify receipt and condition of any procured goods and to maintain a log of all items received. This practice will continue utilizing the method and Master Inventory Tool described in Section 3 Inventory Control of this document.

Table 14. High Level Equipment Inventory

Equipment Type	Total Number Procured	Total Number Configured and Installed
Vehicle/In-Vehicle Item #1	X	X
Roadside Equipment Item #1	X	X
Mobile Device Item #1	X	X
Management Center CV Data Collection Equipment	104	X
Management Center CV Network Integration Equipment	5	X
ASN.1 Java/Tool Compiler	1	X

3.6 INSTALLATION SCHEDULE

See Section 2 Acquisition and Installation Schedule and Figure 7. Phase 2 Procurement and Installation Schedule, of this document.

3.7 INSTALLATION PLAN

Only logical and concept diagrams are available to submit at this time. The specific devices have not been determined as of yet, and this will occur upon vendor award, once the device specifications and prototype installation and testing is undertaken to develop the specific design of the NYC CVPD program.

3.7.1. Concept Design Diagram

The NYC CVPD Concept Design Diagram is displayed in Figure 14.

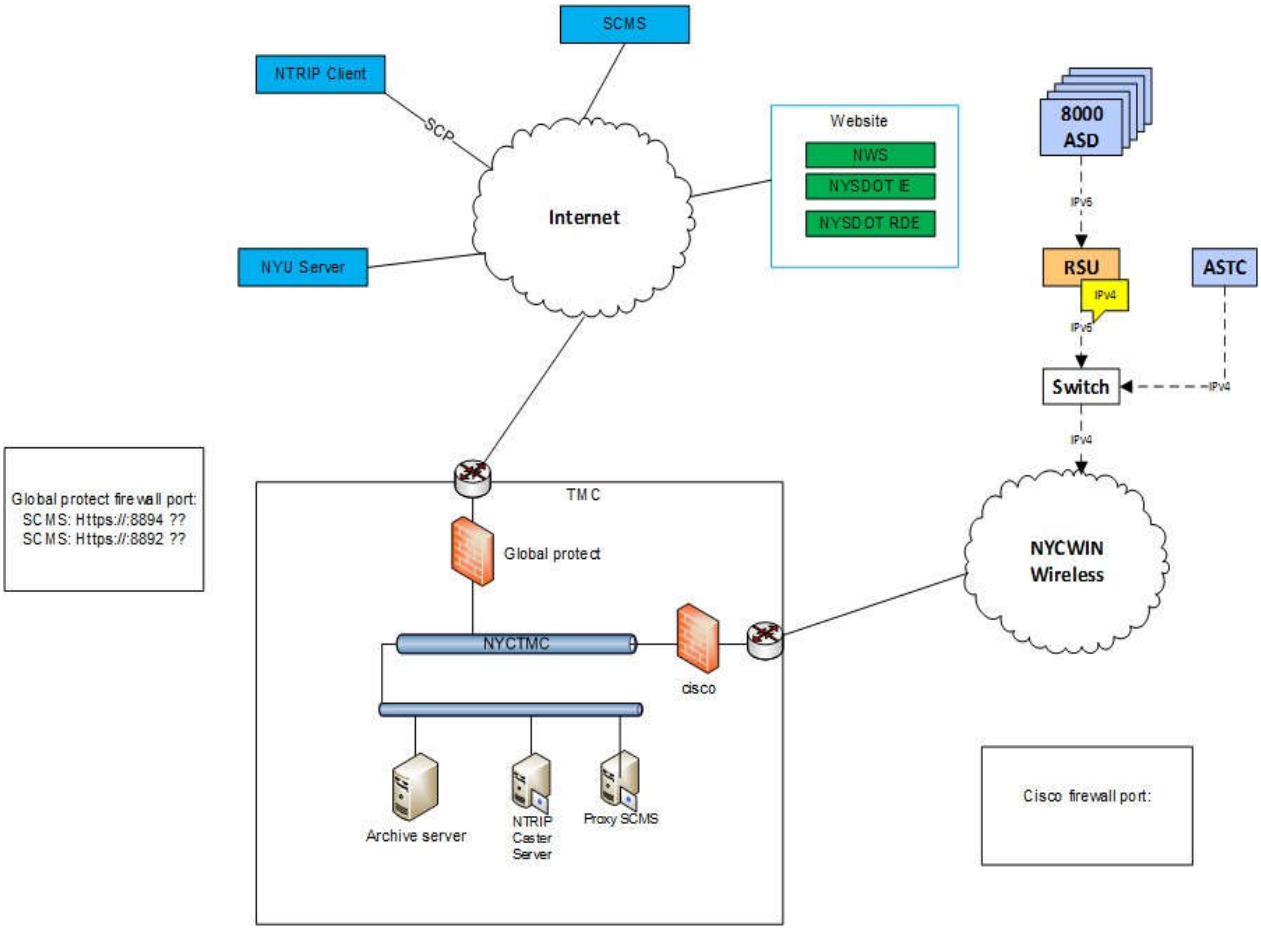


Figure 14. NYC CVPD Concept Design Diagram

3.7.2. Wiring, Fiber Optic Splicing (if applicable) and Interconnects

This information is not yet known; the document will be updated as more information becomes available.

3.7.3. Rack Mount Elevation of Communications Devices in the Control Center

Please refer to Section 7 TMC Installation Diagram(s), of this document.

3.7.4. Electrical and Power Interface Diagram(s)

Electrical and power interface diagram(s) which include grounding and transient voltage surge suppression) information is not yet known; the document will be updated as more information becomes available.

3.7.5. Infrastructure Hardware Mounting Details

This information is not yet known; the document will be updated as more information becomes available.

3.7.6. In-vehicle Hardware Mounting Details

Figure 15 below is a conceptual diagram depicting in-vehicle installation and the layout of the proposed ASD placement and connections to the battery fuse box, vehicle CAN Bus, DSRC radio and GPS antennas. Figure 16 depicts the DSRC antenna mounting on the vehicle. These diagrams are for illustration purposes only.

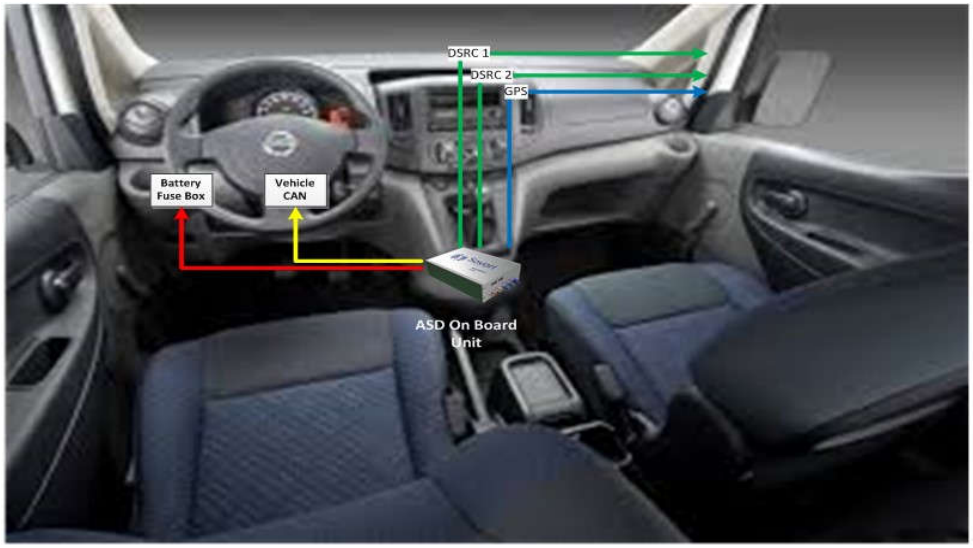


Figure 15. Conceptual In-Vehicle Installation

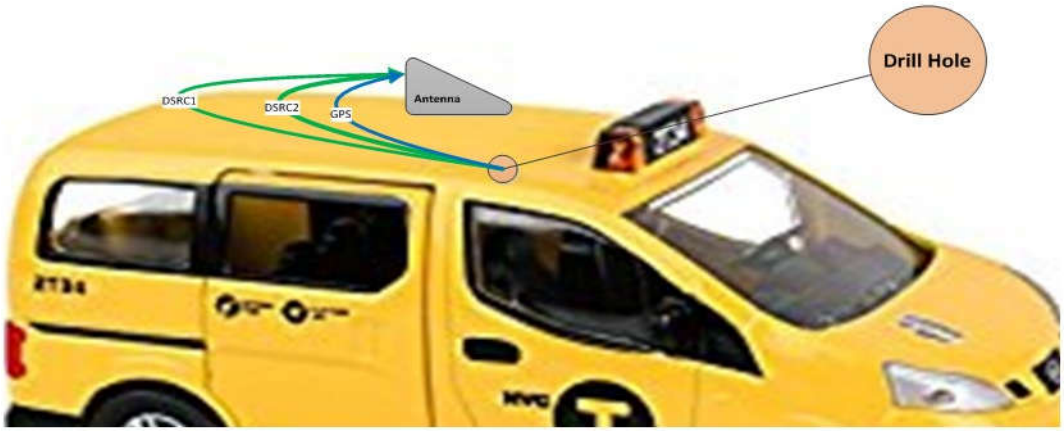


Figure 16. Antenna Installation Concept Diagram

3.7.7. In–Vehicle Installation Design

The City will develop Installation Guides during the Prototype Phase for the various type of Fleet Vehicles that will be participating. The stakeholders that have expressed interest in this pilot have different light/heavy vehicles, and different make/models. The City will likely have a different approach for installing ASD equipment in different vehicles. This will require some trial and testing during the prototype phase, in which the City can work with the ASD vendor and the various stakeholder installers in order to develop the best approach and required installation documentation and diagrams for each fleet.

3.7.7.1. NYCDOT Vehicles

The City will develop an Installation Guide for the participating NYCDOT Fleet vehicles. The Guide will take into consideration and adapt to the different make/models of each participating vehicle. The City will begin ASD installation and integration during the prototype phase to develop installation guides, and best practice prior to transferring knowledge and know-how to the other stakeholders.

3.7.7.2. NYC Taxi and Limousine Fleet

The City will develop an Installation Guide for the participating Taxi Fleet vehicles. The Guide will take into consideration and adapt to the different make/models of each participating vehicle.

3.7.7.3. NYC MTA Fleet

The City will develop an Installation Guide for the participating MTA Bus Fleet vehicles. The Guide will take into consideration and adapt to the different make/models of each participating vehicle. Buses are considered heavy vehicles and will therefore have a different approach for installation and integration of the ASD device.

3.7.7.4. NYC DSNY Fleet

The City will develop an Installation Guide for the participating New York City Department of Sanitation (DSNY) Fleet vehicles. The Guide will take into consideration and adapt to the different make/models of each participating vehicle. DSNY fleet vehicles are considered heavy vehicles and will therefore have a different approach for installation and integration of the ASD device.

3.7.7.5. UPS Fleet

The City will develop an Installation Guide for the participating New York City UPS Package Truck Fleet vehicles. The Guide will take into consideration and adapt to the different Make/Models of each participating vehicle. UPS Package Trucks are considered heavy vehicles, and will therefore have a different approach for installation and integration of the ASD device.

Chapter 4. Vehicle/In-Vehicle Equipment

4.1 AFTERMARKET SAFETY DEVICE (ASD)

The ASD is the main product that will be installed in the pilot vehicles participating in the NYC CVPD Project. This device may also be referred to as the Onboard Unit (OBU), which is to be considered identical for the purposes of this specification. OBU is a more generic term referring to equipment that is installed by the manufacturer as well as aftermarket devices. The total number of ASDs required is 8,600, which includes spares and replacements. Once contracts are executed with awarded vendors, the section will be updated with contracting methods for additional quantities based on the negotiated terms and conditions. Note that the installation kits quantity exceeds the device quantities to address life-cycle maintenance needs including vehicle replacements and knocked down devices. Also note that the procurement documents allow the City to alter the quantity purchased. The ASDs will be installed in both light and heavy duty vehicles. Any change or variation in the ASD will depend on the vendor's product offering and capability. The quantities of ASDs will be equipped in the fleets listed in Table 15.

Table 15. ASDs Required by Fleet

LN	Fleet	ASD Equipped Vehicles
1	NYC Taxi	5,850
2	NYCDOT	800
3	Department of Sanitation (DSNY)	250
4	UPS	400
5	MTA Buses	700
	Total	8,000

The ASD procurement consists of three major assemblies: 1) the ASD, 2) the Installation Kits, which include antennae and installation cables, and 3) software/firmware executing the required safety applications. It is anticipated that there will be more than one variation of installation kits to accommodate light vs heavy vehicles. Safety Applications software/firmware is expected to be the same for both light and heavy vehicles. Antenna cable length, connector type, and antenna type are possible variations which may be procured to better fit the different fleet vehicles. Table 16 below lists these acquisition items.

Table 16. ASD Acquisition Items

Item No.	Goods to Be Procured	Number to be Procured	Vendor
1	ASD Production Quantity (on approval)	8600	
2	ASD Installation Kits Production (on approval)	8600	
3	On-Site (NYC) Engineering Support Services Unit: week (optional)	8	
4	Laptops for ASD Configuration	12	
5	Software source code and development environment	LS	

4.1.1. Technical Description/Specification

4.1.1.1. Aftermarket Safety Device

Item 1 is the in-vehicle ASD. It is for automotive use and will be installed in light-duty vehicles, buses, and trucks of various types. These ASDs will be procured from 1 or 2 vendors following the RFEIP demonstration and bid evaluations. The required quantity is 8,600. The ASD will run a series of vehicle to vehicle (V2V), vehicle to infrastructure (V2I), and vehicle to pedestrian (V2P) safety applications.

4.1.1.1.1. V2V, V2I, V2P Safety Applications

The ASDs selected will be required to run V2V, V2I, and V2P applications. These applications are stated as components of this project in the Concept of Operations Document. The applications and their respective software code are considered primary and integral components of the ASD. The ASD procurement is considered turnkey. The applications required on the ASDs and their abbreviations are listed in Table 17.

Table 17. CV V2V, V2I, V2P Applications

Type	Application	Abbreviation
V2V	Forward Crash Warning	FCW
V2V	Emergency Electronic Brake Light	EEBL
V2V	Blind Spot Warning	BSW
V2V	Lane Change Warning	LCW
V2V	Intersection Movement Assist	IMA
V2V	Vehicle Turning Right in Front of a Bus Warning	VTRW
V2I	Speed Compliance	SPDCOMP
V2I	Curve Speed Compliance	CSPD-COMP
V2I	Speed Compliance / Work Zone	SPDCOMPWZ
V2I	Red Light Violation Warning	RLVW
V2I	Oversize Vehicle Compliance	OVC
V2I	Emergency Communications and Evacuation Information	EVACINFO
V2I	Pedestrian in Signalized Intersection Warning	PEDINXWALK
V2P	Mobile Accessible Pedestrian Signal System	PED-SIG

4.1.1.1.2. Conformance to Standards

The ASD procurement specification requires that the products selected meet the following standards:

- Institute of Electrical and Electronics Engineers (IEEE) 802.11p
- IEEE 1609 family
- Society of Automotive Engineers (SAE) J2735
- SAE J2945 family of standards
- SAE standards for automotive equipment as appropriate

4.1.1.1.3. ASD Specifications

A typical ASD on-board unit technical specification that details the components of the ASD unit is listed in Table 18 below.

Table 18. ASD Specification (Illustrative)

Item	Description
Processor	1 GHz dual core i.MX6
Memory	4GB DDR3 DRAM
Storage	Up to 32GB µSD Flash
	2-8GB eMMC
DSRC Radio	Two IEEE 802.11p 5GHz, 600mW, -94dB receiver sensitivity
GPS	U-blox. Tracking sensitivity -160 dBm
Ethernet	10/100 RJ-45 ports with Auto Uplink.
Console	RS-232 with micro USB connector
USB	1 USB 2.0 host ports
Power Supply	5-30V @15wW DC jack
Temperature	-40c to +85c
Standards Compliance	IEEE 802.11p, IEEE 1609.2, IEEE 1609.3, IEEE 1609.4, SAE J2735 (2016)
Security	SSL, Firewall, 1609.2
Physical	140mmX133mmX42mm.
RF Antenna Connectors	SMB Male FAKRA. Type C Blue GPS, Type Z Light Green DSRC0, Type Z Light Green DSRC1.
Power Consumption	• Mother Board: 3.6w (max)
	• DSRC Radio: 4.92w * 2 (max)
	• Total: 15.6w (max)
Audio	Built-in speaker, Audio mono line out and codec
CAN	1 CAN Connector
GPIO	4 GPIO Pins for custom applications
Ignition detect	For detection of Ignition ON/OFF
LED	Indicators for power, status and diagnostics

4.1.2. Ancillary Equipment

4.1.2.1. General Requirements

The vendor is required to furnish, deliver, and install all incidental accessories necessary to make the ASD and all of its elements complete and ready for operation. Items 2 – 5 in Table 16: ASD Acquisition Requirements are considered ancillary support equipment. The following ancillary equipment is being acquired for the in-vehicle equipment.

4.1.2.2. ASD Installation Kits

ASD Installation Kits are made up of the necessary support equipment to fully integrate and operate the ASD in the vehicles. Table 19 lists the installation kits and components to be procured (Illustration).

Table 19. ASD Installation Kit Components (Illustration)

LN	Item	Qty
1	GPS Antenna	
2	DSRC Radio Antenna	
3	OBDII/J1939/CAN port connector	
4	Radio/Antenna Connectors	
5	Mounting brackets	
6	Adhesives	
7	Audio Interface	

4.1.2.3. On-Site Engineering Services

In Table 16, Item 3 is designated for vendor provided on-site engineering services. Line item 3 will be purchased in lots of 1 week at a time. The vendor is requested to provide up to 8 weeks for on-site engineering support services in NYC. The 8 weeks will consist of a standard 40-hour week that can be adapted to the specific schedule needs of the installation process. The actual number of weeks purchased will depend on the needs of the contract and may be extended to a maximum of 12 weeks. The vendor shall provide the on-site services of a qualified engineer to assist the City and its consultants and subcontractors in tasks such as troubleshooting apparent problems and training. The vendor's engineer shall report to a location within NYC as specified by the City and work with the City staff and its consultants.

4.1.2.4. Software Source Code and Development Environment

The Vendor is required to provide the software source code to the City prior to acceptance of the equipment. Acceptance of the equipment and the start of the warranty shall occur only if the software source code and all required documentation have been provided, reviewed, approved, and accepted by the City. Note the Software Ownership requirements in the ASD Specification (Section 7.8).

4.1.3. Part Numbers and Quantities

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

4.1.4. Associated Software

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

4.1.5. Acquisition Method

4.1.5.1. RFEIP

The method of procurement utilized for the ASD acquisition is Request for Expressions of Interest and Proposal (RFEIP). The 5.9 GHz ASD specification is published in parallel with the RFEIP for the vendors to develop a cost estimate for the ASD, services, and location options.

The City selected this procurement method because the City is confronting a number of challenges, including GPS location accuracy due to urban canyons, the need for over-the-air (OTA) upgrades to the ASD from the RSU, and the need for transmitted V2V, V2I messages to be secured with a Security Credential Management System (SCMS). The City wants to ensure that the ASD specifications can be met by the bidders, and that the products available are not experimental.

With these concerns in mind, the City issued the RFEIP as a briefing document to stimulate and assess interest in providing equipment and services to NYCDT for the CVPD and to solicit useful information from interested parties for the supply of elements of this system. The responses to the RFEIP will be used by the City to begin negotiations with one or more vendors for the supply of the ASDs and installation kits.

The City expects that there may be some negotiations in the requirements during the contract negotiations and during the design phase. While we have required that the vendors bring such issues to our attention, some compromise may be required. There are concerns in several areas – current draw in the off state (stakeholders do not want any power used when the ignition switch is off) and location accuracy – but these will be dealt with later and may be part of the selection process.

The unique acquisition method of RFEIP for the ASDs was determined by the City because the most important factor in selecting a vendor is not the lowest bidder, but the technology and the ability of the product to meet the NYC CVPD program requirements.

The goals of the RFEIP are as follows:

- Goal 1 – To advertise the opportunity and establish an incentive that motivates aggressive pursuit of commercial development and delivery of the CV devices and applications. This project will be the largest CV project attempted by anyone to date.
- Goal 2 – To verify the deployment state of the equipment and applications identified above and to evaluate the vendor's readiness to deploy and develop the additional applications which are being customized for NYC.
- Goal 3 – To identify vendor commitment to interoperability.
- Goal 4 – To seek vendor insight into some of the challenges expected with the planned deployment in NYC. This includes such issues as location accuracy, DSRC message and channel saturation, and DSRC channel usage.
- Goal 5 – For NYCDOT to review the state of each vendor's commitment to and completion of equipment and applications which are commonly used for the CV safety applications.
- Goal 6 – To identify the vendor's proposed approaches to equipment certification such that the project can connect to and use the security credentials provided by the Security Credential Management System (SCMS) being developed by USDOT.
- Goal 7 – To gain a better understanding of the installation requirements, packaging options, the complexity of the application modifications, and help identify tuning parameters for the various applications.
- Goal 8 – To establish realistic project schedules for the procurement, installation, and testing of the ASDs and RSUs.

4.1.5.2. Vendor Demonstration

All responders were offered the opportunity to demonstrate their product(s) in a live demonstration in New York City during the period of May 17 – 24, 2017. Vendors were encouraged to demonstrate the effectiveness of the products or systems currently both under development or available for purchase. NYCDOT made available a test location which was the Aqueduct Racetrack parking lot used by the responders to demonstrate their current applications. All vendors were required to demonstrate several of their V2V and V2I applications as described in the ConOps for the NYC project and the procurement specifications for the ASD.

In addition to the safety applications indicated below, the vendor was required to perform a street drive on a route provided by the City immediately prior to the demonstration for each vendor. This route was within

the active project area – but was only revealed at the end of each vendor's demonstration. During the street drive, the vendor collected vehicle location information (note that this was to be the vehicle location after the application of all correction algorithms and adjustments for additional instrumentation) – not the GPS signal. The vendor submitted details regarding their approach to what was being done to improve the GPS location and timing information to meet the needs of the CV applications.

The vendors responding were invited to provide a demonstration and a response to the bid documents for review by NYCDOT which will serve as the basis for negotiations for the procurement of the ASDs. Responses included the following:

- A list of the applications and state of the technology you are prepared to demonstrate. This must also address the Security Management (use of certificates and 1609.2) that you support now, and/or your expected schedule for their inclusion in your ASD.
- Indicate the development schedule for the remaining applications that you currently do not support (e.g. data collection, OTA updates).
- The state of readiness for the safety applications as outlined in the ASD 5.9Ghx Procurement Specification

For the demonstration, vendors were required to provide the entire infrastructure and test environment necessary to support their demonstration. Some of these requirements include vehicles, RSUs, tripods, generators, brackets, cones, etc.

4.1.5.3. Bid Evaluation

The City used the evaluation criteria shown in Table 20, along with vendors' initial cost and schedule proposal to determine which vendors to award during the selection process. Vendors were required to demonstrate all the mandatory applications first, followed by any optional applications. Mandatory applications are considered necessary for the proposed NYC CVPD as designated in the CoOps document. Each demonstration criteria are given a weighted score, which will be taken under consideration during the evaluation process, and ultimately the vendor selection. The City is currently in the process of evaluating the proposals and demonstration results.

Table 20. Demonstration Evaluation Criteria

LN	Application Title	Acronym	Demo Requirements	Weighted Score
1	Location Accuracy Demonstration	LOC	M	10
2	Vehicle Turning Right in Front of Bus Warning	VTRW	M	5
3	Forward Collision Warning	FCW	M	5
4	Emergency Electronic Brake Light	EEBL	M	5
5	Blind Spot Warning	BSW	M	4
6	Lane Change Warning/Assist	LCA	O	5
7	Intersection Movement Assist	IMA	M	4
8	Red Light Violation Warning	RLVW	M	6
9	Speed Compliance	SPD-COMP	M	6
10	Curve Speed Compliance	CSPD-COM	M	6
11	Speed Compliance/Work Zone	SPDCOMPWZ	M	6
12	Oversize Vehicle Compliance	OVC	O	6
13	Prohibited Facilities (Parkways)		O	6
14	Over Height		O	6
15	Evacuation/emergency notification	EVACINFO	M	5
16	RF Monitoring	RFMON	M	3
17	OTA Firmware Update	FRMWUPD	O	3
18	Parameter Up/Down Loading	PARMLD	O	2
19	Traffic data collection	TDC	M	2

LN	Application Title	Acronym	Demo Requirements	Weighted Score
20	Event History Recording	EVTRECORD	O	2
21	Event History Up Load	EVTCOLLECT	O	2
22	ASD Software Operations Monitor	OPSMON	O	4
	PED Applications			
23	Pedestrian in Signalized Intersection Warning	PEDINXWALK	M	4
24	CV Data for Intelligent Traffic Signal System	I-SIGCVDAT	O	4
	M = Mandatory for the demonstration			
	O = Optional for the demonstration			

4.1.5.4. Vendor Selection

The City has determined that the best approach for the ASD acquisition is to select two vendors after review of all the submitted proposals and completion of the vendor demonstrations. The goal is to select 2 vendors each supplying ½ of the ASDs for the project and to demonstrate interoperability between the vendors as well as interoperability with the RSU infrastructure.

The selection process will entail weighing the cost and schedule proposals from the vendors that have demonstrated their technologies with the highest scores from the demonstration criteria. The City will then select 1 or 2 vendors as it seems fit.

4.1.6. Prototypes

The City will acquire the ASDs in a series of three delivery stages from the successful vendor(s). The initial delivery stage will be of 100 prototype units for evaluation in the NYC environment. A second delivery will consist of 1000 production units followed by a delivery of the remainder of the production units. The intent is to have two different vendors each providing half of the required 8600 devices. The acquisition quantities are staged to provide the City with flexibility to adjust device production to the higher performing vendor should it become necessary. This approach is a risk mitigation strategy for the project.

The City will conduct tests on the prototype units to assess the unit's fulfillment of the project requirements. During the prototype phase, the City will work with the vendors to verify conformance to the requirements of the ASD specification, and demonstrate their solutions to the project's technical challenges including support for the following:

- Tunable applications (to compensate for the NYC driving environment)
- Over-the-air (OTA) software updates
- OTA tuning of the applications
- Data collection (evaluation and operation)
- Security system implementation (use of SCMS)
- Software stability
- Support for IPv4 and IPv6
- Location determination accuracy
- Hardware stability for the mobile environment including environmental (temperature, humidity, shock, vibration) and electrical (power interruption, surges, ESD)

During this phase, the vendor(s) may be required to make minor hardware modifications to the ASD design (with no change in cost) based upon City review. The ASD prototypes will be used by NYCDOT to verify the vendor's quality (and hardware operation). ASD vendors are required to supply production units

with SCMS-POC routed enrollment and pseudonym certificates. Vendors are required to satisfy USDOT SCMS EE requirements to obtain the Certificates

The prototype ASDs and their respective Installation Kits shall be used to develop installation procedures. The vendor's staff will work with the fleet installers (i.e. service providers) to resolve any installation issues and prepare for the production installation activities. This will be used for the training program for the service providers. Note that because different service providers are likely to be used for each of the vehicle fleets, the installation kits will be scheduled for the following anticipated mix of vehicles:

- 60 for the Taxis and other light vehicles
- 10 for the Buses
- 10 for the Sanitation Vehicles
- 10 for the DOT fleet
- 10 for the UPS fleet

4.1.7. Potential Vendors

After completion of the Vendor demonstration portion of the RFEIP May 17 to 24, 2017, three (3) vendors submitted technical and financial proposals after completion of the demonstration. It is important to note, that 6 vendors participated in the demonstration. These vendors were solicited out of a pool of known vendors. These proposals are currently being analyzed in preparation for award. The procurement of the ASDs is intended to be turnkey, meaning all ancillary and support items needed to install and operate the ASD must be provided by the awarded vendor. The 6 participating vendors that representing the ASD supplier base are listed in Table 8, Section 3 of this document.

4.1.8. Acquisition Schedule

This vendor-specific information is not yet available. See Figure 7 of this document for the Phase 2 Procurement and Installation Schedule.

4.2 VEHICLE/IN-VEHICLE ITEM #1 INSTALLATION INFORMATION

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

4.2.1. Supplier(s)

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

4.2.2. Inventory Control Method

Please refer to Section 3 Inventory Storage and Logistics of this document.

4.2.3. Configuration(s)

Please refer to Section 3 Configuration Management of this document.

4.2.4. Installation Diagram(s)

Figure 17: ASD Context Diagram displays ASD integration into the vehicle. A detailed installation diagram is not yet known, pending vendor selection and award.

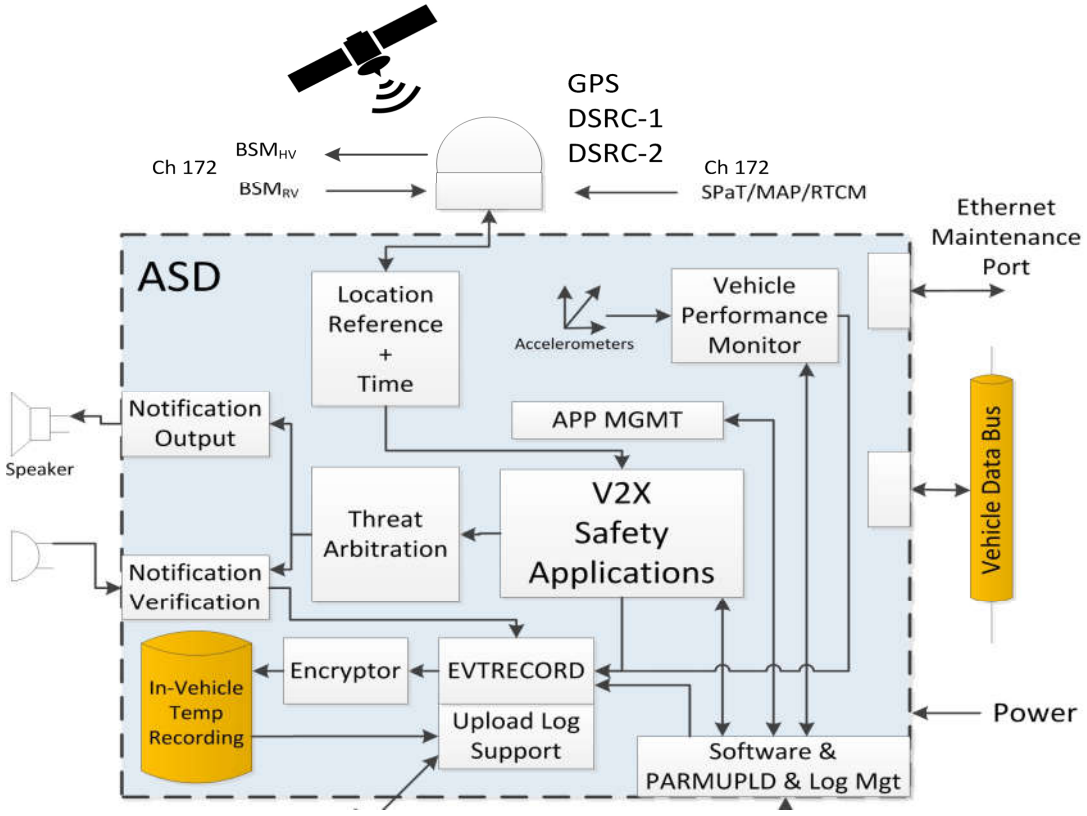


Figure 17. ASD Context Diagram

4.2.5. Installation Procedures

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends to develop pre-installation, installation, post-installation procedures, Quality Assurance/Quality Control, HW and SW Configuration Control Process, Installation Schedule, and Sparing Strategy and Contingency Plan with the selected vendor during the Prototype phase scheduled in Q3.

4.2.5.1. Pre-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends to develop pre-installation procedures/checklist with the selected vendor during the Prototype phase scheduled in Q3.

4.2.5.2. Installation Procedures

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends to develop installation procedures/checklist with the selected vendor during the Prototype phase scheduled in Q3.

4.2.5.3. Post-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends to develop post-installation procedures/checklist with the selected vendor during the Prototype phase scheduled in Q3.

4.2.6. Quality Assurance/Quality Control Process

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends to develop Quality Assurance and Quality Control Processes with the selected vendor during the Prototype phase scheduled in Q3.

4.2.7. Installation Schedule

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends to develop a detailed installation schedule with the selected vendor during the Prototype phase scheduled in Q3.

4.2.8. HW and SW Configuration Control Process

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends to develop a Configuration Control Process with the selected vendor during the Prototype phase scheduled in Q3.

4.2.9. Sparing Strategy, Warranty and Contingency Plan

4.2.9.1. Sparing Strategy

The ASD procurement specification requires a total number of 8,600 units to be supplied by the vendors. This amount is to cover 8,000 participating vehicles, and 600 spare units.

4.2.9.2. Warranty

The purchasing of the ASDs shall be for turnkey units – with all software, hardware, certifications, and 36-month warranty. The 36-month warranty shall start at the successful completion of the site acceptance test and the 60-day initial period of operation. The 3-year warranty is to cover the equipment for the term of the Program.

4.2.9.3. Contingency Plan

The City requires the ASD vendors to allow for continued procurement, above and beyond the required 8,600 ASD units under the same pricing and terms and conditions negotiated.

Chapter 5. Roadside Equipment (RSU)

5.1 ROADSIDE EQUIPMENT ITEM #1 ACQUISITION INFORMATION

The DSRC RSU, for roadside use, serves as the point of communications between the infrastructure and the vehicles and other mobile devices; it will also communicate with the traffic controller as necessary to obtain the information necessary or to provide input to the traffic controller located at signalized intersections. The RSU will be used in the vehicle communication safety pilot and must be capable of both transmitting and receiving signals to vehicle and other mobile devices from the roadside infrastructure using DSRC radios, using the 5.9 Gigahertz (GHz) band approved for DSRC use by the Federal Communications Commission (FCC), and implement the appropriate Institute of Electrical and Electronics engineers (IEEE) and Society of Automotive Engineers (SAE) standards (IEEE 802.11p, IEEE 1609 family, and SAE J2735). Figure 18: RSU High Level Design below depicts the high-level design of the RSU in the NYC CVPD Program.

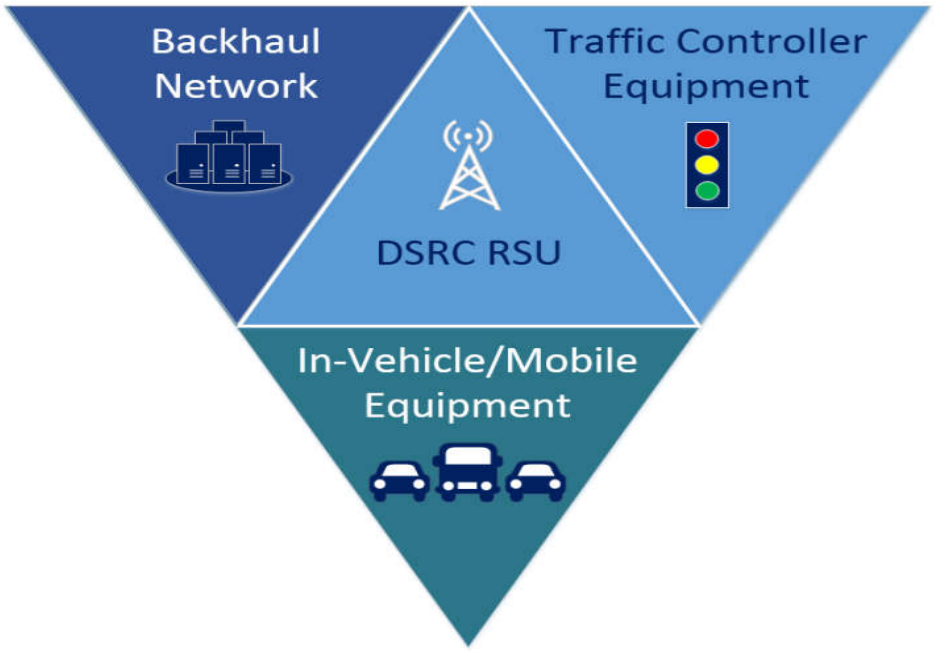


Figure 18. RSU High-Level Design

The purchasing of the RSUs is for turnkey units – with all software, hardware, certifications, and 36-month warranty being delivered to NYCDOT ready for installation. The warranty includes all hardware and software supplied under this contract including installation kits.

The equipment listed in Table 21 will be acquired in order to install the RSUs. No vendor has been selected as of this time; the table is an illustrative account of what is expected to be acquired.

Table 21. Proposed RSU Bid Items (Illustrative)

Item No.	Goods to Be Procured	Quantity	Vendor	Part Number
1	Prototype - RSU Production Quantity	10		
2	Prototype - RSU Installation Kits Production	10		
3	RSU Production Quantity (on approval)	390		
4	RSU Installation Kits Production (on approval)	390		
5	On-Site (NYC) Engineering Support Services Unit: week (optional)	8		
6	Software source code and development environment	LS		

5.1.1. Technical Description/Specification

Item one is the RSU units to be procured for mounting at the 353 city locations. The intent is to award one vendor for all 400 units which includes the 353 Project Area locations and spares. Once contracts are executed with awarded vendors, the section will be updated with contracting methods for additional quantities based on the negotiated terms and conditions. Note that the installation kits quantity exceeds the device quantities to address life-cycle maintenance needs including vehicle replacements and knocked down devices. Also note that the procurement documents allow the City to alter the quantity purchased. Each DSRC device shall obtain its time and position from the Global Navigation Satellite System (GNSS) per the requirements of J2945/1. The RSUs will run additional (V2I) vehicle to infrastructure, (I2V) infrastructure to vehicle safety applications.

RSU Procurement specifications require that RSUs meet the following requirements:

- The RSU shall broadcast SPaT and MAP data to the vehicles deployed along the NYC CVPD corridors as per J2735.
- The RSU shall broadcast the roadway's clearance height and restrictions.
- The RSU shall broadcast the roadway geometry for the speed zone, curve speed warning, and vehicle restrictions.
- The RSU shall be able to receive the PSM from surrounding pedestrians and determine when pedestrians are in specific crosswalks.
- The RSU shall receive PSMs from the PIDs/Mobile Devices per J2945/9. (future)
- The RSU shall transmit pedestrian detections in response to PSMs from the crosswalk. (future)
- The RSU shall decode pedestrians' request for crossing. (future)
- The RSU shall indicate pedestrian presence in the roadway as measured by pedestrian detection devices.

5.1.1.1.1. V2I Safety Applications

The RSUs selected will be required to run V2V, V2I, and V2P applications. These applications are included as components of this project in the Concept of Operations Document. The current plan is for the MAP, TIM, and RTCM messages to be assembled and signed by the TMC and sent to the RSU for periodic broadcast. The RSU will be responsible for developing the Signal Phase and Timing (SPaT) message from data provided by the traffic controller; the RSU is also responsible for the data collection activities with respect to the BSM and RF levels noted in our design documents.

The applications required on the RSUs and their abbreviations are listed in Table 22 below.

Table 22. CV V21, I2V Applications

Type	Application	Abbreviation
V2I	Speed Compliance	SPDCOMP
V2I	Curve Speed Compliance	CSPD-COMP
V2I	Speed Compliance / Work Zone	SPDCOMPWZ
V2I	Red Light Violation Warning	RLVW
V2I	Oversize Vehicle Compliance	OVC
V2I	Emergency Communications and Evacuation Information	EVACINFO
V2I	Pedestrian in Signalized Intersection Warning	PEDINXWALK

5.1.1.1.2. Conformance to Standards

The RSU procurement specification requires that the products selected meet the following standards:

- Institute of Electrical and Electronics Engineers (IEEE) 802.11p
- IEEE 1609 family
- Society of Automotive Engineers (SAE) J2735
- SAE J2945 family of standards
- SAE standards for automotive equipment as appropriate
- NEMA standards for Traffic Control Equipment (Environmental, including but not limited to shock, vibration, EDS, temperature, humidity, power interruption, and power input.)

5.1.1.1.3. RSU Specifications

The RSU unit is a rectangular shaped unit with a similar size of a car GPS unit. Its components may vary from brand to brand, but all RSUs should have the same concept and functionality as dictated by IEEE802.11p, IEEE1609, SAE J2735, and J2945 standards. A typical RSU technical specification is listed in Table 23 below.

Table 23. Sample RSU Technical Specification

LN	Item	Type
1	Processor	1 GHz, iMX6 Dual Core
2	Memory	1 GB DDR DRAM
3	Storage	4 GB Flash (Up to 16 GB)
4	DSRC Interfaces	Dual Radio Support
5	GPS	U-Blox Traking Sensitivity -160dBM
6	HSM	Infineon SLI 97
7	Power Rating	IEEE 802.3 at PoE
8	Power Consumption	< 10W
9	Temperature	-35C to +75C
10	Dimensions	8” (L) x 8 ½” (H) x 2 ¾” (D)
11	Antenna Connectors	N-Type Male (DSRC) and SMA (GPS)
12	LED	Power, Status and Diag
13	Standards Compliance	USDOT RSU v4.1 Specification
14	FCC Compliance	FCC Part 15B/IC ICES-003 Class A
15	Traffic Controller Compatibility	Compatible with NTCIP compliant traffic controllers

5.1.2. Ancillary Equipment

5.1.2.1. General Requirements

The vendor is required to furnish, deliver, and install all incidental accessories necessary to make the RSU and all of its elements complete and ready for operation. The ancillary equipment in Table 24 is being acquired for the RSUs:

Table 24. RSU Installation Kit Components

LN	Item	Qty	Vendor	Part No.
1	RSU Installation Mounting Kit: Pole mounting kit PoE (Power over Ethernet) Controller Kit (Prototype)	10		
2	Installation Mounting Kit: Pole mounting kit PoE (Power over Ethernet) Controller Kit (Production)	390		
3	On-site (NYC) Engineering Services – RSU Equipment	8 (weeks)		

5.1.2.2. RSU Installation Mounting Kit (Prototype)

Item 1 is the RSU Installation Kits for the initial prototype phase. These (10) RSU Installation Kits shall be supplied along with the 10 prototype RSUs and include all accessories including mounting brackets to complete the field installation. These kits will be tested along with the RSUs to make sure all required items are available for proper installation and operation. Following the Prototype Phase, Item 2 will be the production Installation Mounting Kit. These will constitute the remaining 390 units. The kits may include Ethernet cables, connectors, PoE inserter, and power supply for the PoE, and any necessary lightning protection. The kits are made up of the necessary support equipment to fully integrate and operate the RSU at their designated mounting location.

5.1.2.3. On-Site Engineering Services

Item 3 is for vendor provided on-site engineering services, and Line item 3 will be purchased in lots of 1 week at a time. The vendor is requested to provide up to 8 weeks for on-site engineering support services in NYC. The actual number of weeks purchased will depend on the needs of the contract and may be extended to a maximum of 12 weeks. The vendor shall provide the on-site services of a qualified engineer to assist the City and its consultants and subcontractors in tasks such as troubleshooting apparent problems and training. The vendor's engineer shall report to a location within NYC as specified by the City and work with the City staff and its consultants.

5.1.3. Part Numbers and Quantities

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

5.1.4. Associated Software

5.1.4.1. Software Source Code and Development Environment

The Vendor is required to provide the software source code to the City prior to acceptance of the equipment. Acceptance of the equipment and the start of the warranty shall occur only if the software source code and all required documentation have been provided, reviewed, approved, and accepted by the City. The RSU vendor is required to provide a software development kit listed in Table 25 to the City for testing the system required applications.

Table 25. RSU Software Development Kit

LN	Item	Qty	Vendor	Part
1	Software Development Kit (SDK): Available for rapid deployment and testing of connected vehicle applications. Sample applications are available through Comprehensive Programmers Guide	1		

It is important to note that some of the vendors have taken exception to the requirement for providing the source code due to their investment in proprietary intellectual property. This will be part of the final negotiations with the City.

5.1.5. Acquisition Method

The RSU procurement method is via the Competitive Sealed Bid (CSB) method. This method allows the City to bid out the required specification and to select the lowest bidder. One vendor will be selected based on lowest bid, provided they meet all the specifications set forth in the 5.9 GHz DSRC Roadside Unit Procurement Specification. A prototype phase is required to ensure that the RSU meets the required standards.

5.1.5.1. Prototype Phase

The awarded vendor is required to develop ten (10) prototype RSUs initially along with all required kits for a complete installation. The ten (10) RSU prototypes will be used to verify the vendor's quality (software and hardware operation) and support the software development of the Back Office CV support systems including SCMS interfaces, data collection, data analysis, OTA software updates, and OTA parameter changes.

Ten Prototype RSU Installation Kits shall also be supplied which shall include all accessories including mounting brackets to complete the field installation. This shall include, but not be limited to, Ethernet cable, connectors, PoE inserter, power supply for the PoE if required (note the cabinet does not have a 48 VDC supply) and any necessary lightning protection. The RSU power supply shall derive its power from a 120 VAC source within the controller cabinet which already includes an RFI filter, surge protection, and circuit breaker.

The RSU vendor supply program is expected to undergo a prototype phase during which the City will work with the vendor to ensure conformance to the requirements, and demonstrate various aspects of the technical challenges including support for the following:

- Tunable applications (to compensate for the NYC driving environment)
- Over-the-air (OTA) software updates
- OTA tuning of the applications
- Data collection (evaluation and operation)
- Security system implementation (use of SCMS)
- Software stability
- Support for IPv4 and IPv6
- Location determination accuracy
- Hardware stability for the roadside environment including environmental (temperature, humidity, shock, vibration) and electrical (power interruption, surges, ESD)

During the prototype evaluation phase (or before), the RSU prototypes shall also be subjected to certification for standards conformance for the RF portion of device including messages which will invoke the appropriate SAE standards, IEEE standards, NEMA standards, and NTCIP standards (e.g. J2735, J2945/x, 802.11p, 1609.x, NEMA TS2 environmental). RSU vendors are required to supply production units with SCMS-POC routed enrollment and pseudonym certificates. Vendors are required to satisfy US DOT SCMS EE requirements to obtain the Certificates.

Once the prototypes have been proven, the City may release the production quantity. Note that this will be optional – i.e. there is no assurance that the production quantity will be released when the City awards the contract. Further, the vendor will be required to provide timely submittals, design documents, and message proposals for review as they proceed. During the prototype design and development, the vendor shall be required to provide timely submittals, design documents, and message proposals for review as they proceed. These documents will be reviewed by NYCDOT and its subcontractors, and USDOT and its consultants to ensure conformance to the overall requirements of the project and the requirements documents.

5.1.6. Potential Vendors

The potential vendors solicited for the RSU acquisition are listed in Table 8: Potential ASD Vendors. Many of these vendors have participated in an earlier RFEI (Request for Expression of Interest) at the City's request earlier in July 2016. Potential vendors listed in the table are considered primary players in the V2X industry. Only the vendors that responded to the RFP and participated in the demonstration are evaluated further. Table 26 below lists the vendors solicited for the RSU procurement.

Table 26. RSU Bidders

LN	Company/Vendor	Address	Proposal Submitted	Demonstration Participation
1	Battelle Memorial Institute	505 King Avenue Columbus, Ohio 43201		
2	Cohda Wireless America LLC	28125 Cabot Drive Suite 100 Novi, MI 48377		
3	Commsignia	2995 Woodside Road #620492 Woodside, CA 94062		
4	eTrans Systems	2751 Prosperity Avenue Suite 320 Fairfax, VA 22031		
5	Savari Networks	34505 Twelve Mile Road Suite 170 Farmington Hills, MI 48331		
6	Wave Mobile Solutions	2200 North Glassell Street Orange, CA 92865-2702		
7	Kapsch Trafficom North America	8201 Greensboro Drive Suite 1002 McLean, VA 22102		
8	Lear Connexus	21557 Telegraph Road Southfield, MI 48033		
9	Q-Free	103 Watson Road Chesapeake, VA 23320		

5.1.7. Acquisition Schedule

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

5.2 ROADSIDE EQUIPMENT ITEM #1 INSTALLATION INFORMATION

5.2.1. Supplier(s)

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

5.2.2. Inventory Control Method

Please see Section 3, Inventory Control, of this document.

5.2.3. Configuration(s)

Please refer to Section 3, Configuration Management of this document.

5.2.4. Installation Diagram(s)

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

5.2.5. Installation Procedures

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends on developing pre-installation, installation, post-installation procedures, Quality Assurance/Quality Control, HW and SW Configuration Control Process, Installation Schedule, and Sparing Strategy and Contingency Plan with the selected vendor during the Prototype phase scheduled in Q3.

5.2.5.1. Pre-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends on developing pre-installation, with the selected vendor during the Prototype phase scheduled in Q3.

5.2.5.2. Installation Procedures

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends on developing installation, with the selected vendor during the Prototype phase scheduled in Q3.

5.2.5.3. Post-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends on developing post-installation procedures, with the selected vendor during the Prototype phase scheduled in Q3.

5.2.6. Quality Assurance/Quality Control Process

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends on developing Quality Assurance/Quality Control, with the selected vendor during the Prototype phase scheduled in Q3.

5.2.7. Installation Schedule

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made. However, the City intends on developing a detailed installation schedule with the selected vendor during the Prototype phase scheduled in Q3.

5.2.8. HW and SW Configuration Control Process

Please refer to Section 3, Configuration Management of this document.

5.2.9. Sparing Strategy, Warranty and Contingency Plan

5.2.9.1. Sparing Strategy

The RSU procurement specification requires a total number of 400 units to be supplied by the vendor. This amount is to cover 353 designated Field sites and 47 spare units.

5.2.9.2. Warranty

The purchasing of the RSUs shall be for turnkey units – with all software, hardware, certifications, and 36-month warranty. The 36-month warranty shall start at the successful completion of the site acceptance test and the 60-day initial period of operation. The 3-year warranty is to cover the equipment for the term of the Program.

5.2.9.3. Contingency Plan

The City requires the awarded RSU vendor to allow for continued procurement, above and beyond the required 400 RSU units under the same pricing and terms and conditions negotiated.

Chapter 6. Mobile Devices

6.2 MOBILE DEVICE ITEM #1 (PID) ACQUISITION INFORMATION

Pedestrians are the people that walk along the sidewalks and cross the roadways. This includes visually impaired and audibly impaired persons. This project is intended to serve the visually impaired pedestrian and is intended to allow such pedestrians to orient themselves, determine their location, and determine the status of the pedestrian signals for their crosswalk of interest. To meet this requirement a portable "smart device" or PIDs with at least two communication interfaces, both "normal" cellular communication for access to the internet via the wide area network (WAN) and dedicated short-range communication (DSRC) for communicating with the Connected Vehicle (CV) Roadside Unit (RSU) is being acquired.

The pedestrians participating in the NYC CVPD Program carry a PID which receives the DSRC communications (signal, phasing, and timing (SPaT) and map data (MAP) messages) and is able to communicate with the Back Office equipment over a wide area service such as 4G/LTE or equivalent. The PID acquisition items are listed in Table 27 (Illustrative).

Table 27. NYC CVPD PID Acquisition Items (Illustration)

LN	Type	Method of Procurement	Qty	Vendor	Part No.
1	PID	Competitive Sealed Bid (CSB	100		
2	PID Applications	CSB	1		

6.2.1. Technical Description/Specification

6.2.1.1. Personal Information Device (PID)

All PIDs shall have a unique serial number, which is permanently readable internally and on the unit (i.e. stored on non-volatile storage on the device in such a way that it cannot be changed once the device is in operational mode) so that it can be retrieved and added to selected data when required by the application. The serial numbers include an obviously readable date of manufacture, the vendor's ID, and the subassembly or assembly ID.

The PIDs are equipped with the application for assisting the visually-challenged pedestrian in crossing the street. The DSRC radios shall operate in a 5.9 Gigahertz (GHz) band approved for DSRC use by the FCC and implement the appropriate IEEE and SAE standards (e.g. IEEE 802.11p, IEEE 1609 family, SAE J2735, and SAE J2945/x).

The PID shall be able to receive DSRC broadcasts from the traffic controller and other sources within the DSRC spectrum at 5.9 Gigahertz (GHz) approved by the Federal Communications Commission (FCC). All the messages of interest to the PID will be transmitted on Channel 172 (safety channel). The PID shall also include a user interface and alternative internet access via commercial service. The commercial service connection shall be used for collecting the usage and performance data. Note that all

intersections equipped with an RSU within the project area (~370) shall be broadcasting the Signal Phase and Timing (SPaT) and geometric information (MAP) message.

6.2.1.2. PID Standards

The PID meets the requirements set forth in the following standards:

- Institute of Electrical and Electronics Engineers (IEEE) 802.11p
- IEEE 1609 family of standards
- Society of Automotive Engineers (SAE) J2735
- SAE J2945 family of standards

The equipment, materials, and installation shall conform to the applicable requirements of the Underwriters Laboratories Incorporated (UL), the Electronic Industries Association (EIA), the National Electrical Code (NEC), National Electrical Safety Council (NESC), the American Society of Testing and Materials (ASTM), the Insulated Power Cable Engineers Associates (IPCEA), Illumination Engineers Society (IES), the Institute of Transportation Engineers (ITE), the American National Standards Institute (ANSI), the Rural Electrification Administration (REA), and the National Electronic Manufacturers Association (NEMA).

6.2.1.3. PID Hardware

A sample PID specification is listed in the below Table 28: PID HW Specification.

Table 28. PID HW Specification

Requirement No.	Requirement Name/Description
1	PID Hardware
1.1	• Cellular and DSRC capabilities
1.2	• Built-in 3-axis accelerometer
1.3	• Built-in 3-axis gyroscope
1.4	• GPS
1.5	• Standard Ethernet Interface
2	The PID have one or more optional non-DSRC radios of the following types:
2.1	• 3G Cellular
2.2	• 4G/LTE Cellular
2.3	• A display for use as a Human Machine Interface (HMI) (i.e. touchscreen, color LCD)
2.4	• A speaker capable of playing recorded or synthesized human speech for use as an HMI.
3	The PID's battery life shall be five (5) days.
4	The PID shall contain a removable lithium-ion battery that is capable of being charged via a separate capable and power adapter (120V).
5	The PID shall be either wearable or mountable via clip.

6.2.2. Mobile Device (PID) Ancillary Equipment

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.2.3. Mobile Device (PID) Part Numbers and Quantities

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.2.4. Mobile Device (PID) Associated Software

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.2.5. Mobile Device (PID) Acquisition Method

The PID procurement method is via the Competitive Sealed Bid (CSB) method. This method allows the City to bid out the required specification and to select the lowest bidder. One vendor will be selected based on lowest bid, provided they meet all the specifications set forth in the PERSONAL INFORMATION DEVICE (PID) PROCUREMENT SPECIFICATION Version 1.3. A prototype phase is required however to ensure that the PID meets the required standards. Therefore, the bidders will have to demonstrate their products' capabilities prior to selection.

NYU is the Independent Review Board (IRB) for NYCDOT and responsible for all analysis of the PID applications and maintaining the records and for soliciting participants in cooperation with the Pedestrians for Accessible and Safe Streets (PASS) and other groups.

6.2.5.1. Vendor Demonstration

Prior to the award of the contract, the selected vendor is required to demonstrate the operation of the PID, its application, and collection of the performance data shown in Table 29: PED-SIG Application Performance Data. During this phase, the vendor is required to make minor modifications to the PID design based on City review. The ten (10) PID prototypes will be used to verify the vendor's quality (Software and Hardware operation), applications, and develop the software for the back-office CV support systems including SCMS interfaces, data collection, data analysis, Over-the-air (OTA) software updates, and OTA parameter changes.

Table 29. PED-SIG Application Performance Data

LN	PED-SIG Application Performance Data
1	Number of pedestrian crossing violation reductions
2	Visually-impaired pedestrian-related crash counts, by severity
3	Conflicts with visually-impaired pedestrians
4	Time to collision (vehicle to pedestrian)
5	Waiting time at intersection for crossing

6.2.6. Mobile Device (PID) Potential Vendors

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.2.7. Acquisition Schedule

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.3 MOBILE DEVICE ITEM #1 INSTALLATION INFORMATION

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.3.1. Supplier(s)

This information is not yet known, the document will be updated as more information becomes available once vendor selection is made.

6.3.2. Inventory Control Method

Refer to Section 3 Inventory Control of this document.

6.3.3. Configuration(s)

Refer to Section 3 Configuration Management of this document.

6.3.4. Installation Diagram(s)

Not Applicable. No installation required.

6.3.5. PID Installation Procedures

The Mobile Device or PID is not a device that will require any installation services. It may, however, require initializing and updating, much like a phone application. Information about this device is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.3.5.1. Pre-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.3.5.2. Installation Procedures

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.3.5.3. Post-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.3.6. Quality Assurance/Quality Control Process

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.3.7. Installation Schedule

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

6.3.8. HW and SW Configuration Control Process

Please refer to Section 3, Configuration Management of this document.

6.3.9. Sparing Strategy, Warranty and Contingency Plan

6.3.9.1. Sparing Strategy

The PID procurement specification requires a total number of 100 units to be supplied by the vendors. This amount is to cover 100 participating pedestrians. Any additional units will be negotiated in a new procurement with the vendor.

6.3.9.2. Warranty

The purchasing of the PIDs shall be for turnkey units – with all software, hardware, certifications, and 36-month warranty. The 36-month warranty shall start at the successful completion of the site acceptance test and the 60-day initial period of operation. The 3-year warranty is to cover the equipment for the term of the Program.

6.3.9.3. Contingency Plan

The City requires the awarded Mobile Device (PID) vendors to allow for continued procurement above and beyond the required 100 PID units under the same pricing and terms and conditions negotiated.

Chapter 7. Management Center Equipment

7.2 CV DATA COLLECTION SERVER

In order to fully integrate the CV field components with the backend system at the Traffic Management Center (TMC), additional equipment is required at the TMC backend office. This equipment is required to process and store the various data received and stored from the various field locations. All the CV subsystem collected data will ultimately feed back to the TMC for analysis. Table 30 lists the equipment acquired for the TMC.

Table 30. TMC Equipment Requirements

LN	QTY	Part #	Description	Vendor
1	2	DL360 Gen9	HPE ProLiant DL360 Gen9 Server	CDW-G
2	1	MSA 2040 21.6tb	HPE MSA 2040 SAN Storage (21.6TB Capacity)	CDW-G

7.2.1. Technical Description/Specification

7.2.1.1. HPE ProLiant DL360 Gen9 Server

The HPE ProLiant DL360 Gen9 Server shown in Figure 19 delivers a 1U chassis with up to two processors, delivering an optimal unit that combines high-performance, low energy consumption, improved uptime, and increased density. The configuration acquired is based on CV program needs and capacity planning.

Figure 19. HPE ProLiant DL360 Gen9 Server

Table 31 is the configuration that was developed specifically for CV Program needs.

Table 31. HPE ProLiant DL 360 Server Configuration

Quantity	Part#	Description
1	755258-B21	HP DL360 Gen9 8SFF CTO Server
1	755258-B21 ABA	U.S. - English localization
1	818178-L21	HPE DL360 Gen9 E5-2650v4 FIO Kit
1	818178-B21	HPE DL360 Gen9 E5-2650v4 Kit
1	818178-B21 0D1	Factory integrated
8	805351-B21	HPE 32GB 2Rx4 PC4-2400T-R Kit
8	805351-B21 0D1	Factory integrated
8	781516-B21	HP 600GB 12G SAS 10K 2.5in SC ENT HDD
8	781516-B21 0D1	Factory integrated
1	764644-B21	HP DL360 Gen9 2P FH PCIe Slot CPU2 Kit
1	764644-B21 0D1	Factory integrated
1	700759-B21	HP FlexFabric 10Gb 2P 533FLR-T Adptr
1	700759-B21 0D1	Factory integrated
1	749974-B21	HP Smart Array P440ar/2G FIO Controller
1	726911-B21	HP H241 Smart HBA
1	726911-B21 0D1	Factory integrated
1	734807-B21	HP 1U SFF Easy Install Rail Kit
1	734807-B21 0D1	Factory integrated
2	720479-B21	HPE 800W FS Plat Ht Plg Pwr Supply Kit
2	720479-B21 0D1	Factory integrated
1	BD505A	HPE iLO Adv incl 3yr TSU 1-Svr Lic
1	BD505A 0D1	Factory integrated
1	U7AQ5E	HPE 5Y FC 24x7 DL360 Gen9 SVC
1	AC111A	HPE Door/dock Small Delivery SVC
2	748921-B21	MS WS12 R2 Std ROK E/F/I/G/S SW
1	841182-B21	MS SQL14 Std 4 Core FIO Npi en SW

7.2.1.2. HPE MSA 2040 SAN Storage (21.6TB Capacity)

The HPE MSA 2040 shown in Figure 20 is an Energy Star Certified entry level storage array designed to meet the needs of the data coming in from the various CV Program subsystems. The configuration acquired is based on CV program needs and capacity planning.

Figure 20. HPE MSA2040 SAN Storage Device

Table 32 is the configuration that was developed specifically for CV Program needs.

Table 32. HPE MSA2040 SAN Storage Device Configuration

Qty	Part No.	Description
1	M0S99A	HPE MSA 2040 ES SAN Dual Ctl 21.6TB Bndl
8	J9281B	HPE X242 10G SFP+ to SFP+ 1m DAC Cable
1	AG467A	HPE Door/dock Medium Delivery SVC
1	U2MQ5E	HPE 5Y FC 24x7 wCDMR MSA2kG3Arrys SVC

7.2.2. Ancillary Equipment

The equipment will be installed on existing racks at the Traffic Management Center (TMC). Ancillary Equipment will not be acquired to install and/or operate.

7.2.3. Part Numbers and Quantities

Table 33 below displays the TMC equipment and their associated Part # and serial #s.

Table 33. CV Data Collection Server Inventory Detail

LN	Equipment Type/Description	Part/Model Number	Serial Number	Vendor
1	HPE ProLiant DL360 Gen9 - Xeon E5-2667V3 3.2 GHz - 32 GB - 0 GB	800081-S01	MXQ715027G	CDW-G
2	HPE ProLiant DL360 Gen9 - Xeon E5-2667V3 3.2 GHz - 32 GB - 0 GB	800081-S01	MXQ715027L	CDW-G
3	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV65203ZV	CDW-G
4	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV652040Z	CDW-G
5	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV652040R	CDW-G
6	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV652040Y	CDW-G
7	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV652040V	CDW-G
8	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV6520410	CDW-G
9	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV6520413	CDW-G
10	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV6520400	CDW-G
11	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV6520408	CDW-G
12	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV6520409	CDW-G
13	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV6520412	CDW-G
14	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV652040W	CDW-G
15	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV652040X	CDW-G
16	HPE DIMM 288-pin 16 GB DDR4 SDRAM	726719-B21	2CV6520411	CDW-G
17	Intel Xeon E5-2667V3 / 3.2 GHz processor	755408-B21	2Y47144XJ3	CDW-G
18	Intel Xeon E5-2667V3 / 3.2 GHz processor	755408-B21	2Z47144XJ4	CDW-G
19	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH17008K1AJ	CDW-G
20	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K1AZ	CDW-G
21	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K1IT	CDW-G
22	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K1B5	CDW-G
23	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K1H2	CDW-G

LN	Equipment Type/Description	Part/Model Number	Serial Number	Vendor
24	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K1FZ	CDW-G
25	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K18U	CDW-G
26	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K1B6	CDW-G
27	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K1B8	CDW-G
28	HPE Enterprise - hard drive - 900 GB - SAS 12Gb/s	785069-B21	PH1708K1CE	CDW-G
29	HP Integrated Lights-Out Advanced License 1 Year	E6U59ABE	software	CDW-G
30	HP Integrated Lights-Out Advanced License 1 Year	E6U59ABE	software	CDW-G
31	StarTech.com 1-Port 10G Ethernet NIC - PCI Express - Intel Chip	ST10000SPEXI	16365700325	CDW-G
32	StarTech.com 1-Port 10G Ethernet NIC - PCI Express - Intel Chip	ST10000SPEXI	16365700323	CDW-G
33	HPE Foundation Care Next Business Day Service	U7AQ2E	service	CDW-G
34	HPE Foundation Care Next Business Day Service	U7AQ2E	service	CDW-G
35	HPE Modular Smart Array 2042 SAS Dual Controller SFF Storage	Q0F08A	7CE703M660/7 CE703M674	CDW-G
36	HPE Foundation Care Next Business Day Service	H1DH0E	service	CDW-G
37	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z0ZJ	CDW-G
38	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z03K	CDW-G
39	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z01F	CDW-G
40	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z046	CDW-G
41	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z016	CDW-G
42	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z04E	CDW-G
43	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z05A	CDW-G
44	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z045	CDW-G
45	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z04U	CDW-G
46	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z043	CDW-G
47	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z00X	CDW-G
48	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z104	CDW-G
49	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z01A	CDW-G
50	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z01G	CDW-G
51	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z04H	CDW-G
52	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z04C	CDW-G
53	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z00W	CDW-G
54	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z04F	CDW-G
55	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z044	CDW-G
56	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z03V	CDW-G
57	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z04R	CDW-G
58	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z01E	CDW-G
59	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z04B	CDW-G
60	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z040	CDW-G
61	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z047	CDW-G
62	HPE Midline - hard drive - 4 TB - SAS 12Gb/s	K2Q82A	THN707Z04G	CDW-G

LN	Equipment Type/Description	Part/Model Number	Serial Number	Vendor
63	QNAP TS-EC1680U-R2 - NAS server - 0 GB	TS-EC1680U-I3-8G-R2-US	Q172I03963	CDW-G
64	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840ZF9V	CDW-G
65	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840ZEHI	CDW-G
66	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	A840YY3C	CDW-G
67	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840YYGZ	CDW-G
68	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840Q50A	CDW-G
69	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840Z3TG	CDW-G
70	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840Q1M4	CDW-G
71	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840P86J	CDW-G
72	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840P8E2	CDW-G
73	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840Q6YN	CDW-G
74	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840YYJ1	CDW-G
75	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840ZADT	CDW-G
76	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840P423	CDW-G
77	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840Z8AX	CDW-G
78	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840Z84D	CDW-G
79	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840ZAW2	CDW-G
80	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840ZAHR	CDW-G
81	Seagate Archive HDD 8 TB Internal HDD	ST8000AS0002	Z840Q4YY	CDW-G
82	HPE Smart Array P431/2GB with FBWC - storage controller	698531-B21	MXQ71406GK	CDW-G
83	HPE SAS external cable 6.6 ft	716197-B21	5C571701BF	CDW-G
84	HPE SAS external cable 6.6 ft	716197-B21	5C571606Q3	CDW-G
85	Microsoft Windows server 2016 standard license	9EM-00254	software	CDW-G
86	Microsoft Windows server 2016 standard license	9EM-00254	software	CDW-G
87	Microsoft Windows server 2016 standard license	9EM-00254	software	CDW-G
88	Microsoft Windows server 2016 standard license	9EM-00254	software	CDW-G
89	Microsoft Windows server 2016 standard license	9EM-00254	software	CDW-G
90	Microsoft Windows server 2016 standard license	9EM-00254	software	CDW-G
91	Microsoft Windows server 2016 standard license	9EM-00254	software	CDW-G
92	Microsoft Windows server 2016 standard license	9EM-00254	software	CDW-G
93	Microsoft SQL server 2016 standard license- 1 server	22810837	software	CDW-G
94	Microsoft SQL server 2016 standard license- 1 user cal	359-06362	software	CDW-G
95	Microsoft SQL server 2016 standard license- 1 user cal	359-06362	software	CDW-G
96	Microsoft SQL server 2016 standard license- 1 user cal	359-06362	software	CDW-G
97	Microsoft SQL server 2016 standard license- 1 user cal	359-06362	software	CDW-G
98	Microsoft SQL server 2016 standard license- 1 user cal	359-06362	software	CDW-G
99	Microsoft SQL server 2016 standard license- 1 user cal	359-06362	software	CDW-G

7.2.4. Associated Software

There are several categories of software to be acquired for the CV server and these are the base operating environment COTS products (i.e. operating system, Java Virtual Machine, database), the CV back-office applications, and the COTS tools (e.g. ASN.1 compiler, run-time libraries). The CV back-office applications are expected to be developed for the project and subject to the Software Ownership concepts presented in the ASD Specification (Section 7.8). The other software categories are governed by their respective licenses.

7.2.5. Acquisition Method

As discussed earlier in the document under Acquisition Approach Section 2 NYCDOT In-House Procurement, the City acquired these items under the approach of “Buy off a Master Agreement”. The City currently has a Master Agreement in place with CDW-G to procure all IT needs without being required to solicit other vendors. In the interest of time and meeting the schedule, the City has opted for this method to meet these requirements.

7.2.6. Potential Vendors

As discussed earlier in the document under Acquisition Approach Section 2 NYCDOT In-House Procurement, the City has already acquired these items under the approach of “Buy Off a Master Agreement”. The City currently has a Master Agreement in place with CDW-G to procure all IT needs without being required to solicit other vendors. In the interest of time and meeting the schedule the City has opted for this method to meet these requirements.

7.2.7. Acquisition Schedule

The NYC CV Data Collection Equipment was ordered and received on June 7th, 2017.

7.3 CV NETWORK INTEGRATION EQUIPMENT

In order to fully integrate the CV field components with the backend system at the TMC, additional equipment is required at the backend office at the TMC. This equipment is required to process and store the various data received and stored from the various field locations. All the CV subsystem collected data will ultimately feed back to the TMC for analysis. Table 34 lists the network equipment required for the TMC.

Table 34. CV Network Integration Equipment Requirements

LN	Qty	Part #	Description	Type
1	1	ASR1001-X	Cisco ASR10001-X router rack mountable	Main
2	1	FLSA-1X-2.5-10G	Cisco Upgrade from 2.5Gbps to 10Gbps License	Ancillary
3	1	CON-SNT-ASR1001X	Cisco SMARTnet extended service agreement	Ancillary
4	2	SFP-GE-T	Cisco SFP-GE-T=SFP Transceiver Module	Ancillary

7.3.1. Technical Description/Specification

7.3.1.1. Cisco ASR1001-X Router Rack Mountable

The Cisco ASR 1001-X Router shown in Figure 21 is a 1-rack-unit (1RU) platform targeted towards the low to medium Enterprise and Managed Service Provider use cases. Its compact form factor has a built-in Route Processor, Embedded Services Processor (ESP) and Shared Port Adapter (SIP) Interface processor.

Figure 21. Cisco ASR1001-X Router Rack-Mountable

The ASR 1001-X Router technical description and specification is listed in Table 35 below:

Table 35. Cisco ASR 1001-X Router Rack Mountable Specifications

Technical Description	ASR 1001-X Specifications
Release Date:	12-JUN-2013
Redundant Power Supply:	Yes; Dual AC or DC
Number of SPA Interface Processors (SIPs) Supported:	Integrated
Operating Temperature:	32 to 104 F (0 to 40 C)
Embedded Services Processor Slots:	Integrated
Airflow:	Front to Back
Integrated Daughter Card:	8 x Channelized T1/ E1 Ports
Number of SFP Built-In GE Ports:	6
Network Interface Modules (NIMs):	1
Weight:	23.30 lb (10.59 kg)
Operating Humidity (Short-Term):	5 to 90% (non-condensing)
Number of SFP Built-in 10GE Ports:	2
ESP Bandwidth:	2.5 to 20 Gbps
External USB Flash Memory:	1-GB USB flash-memory support
Crypto Performance:	Up to 1.8 Gbps

Technical Description	ASR 1001-X Specifications
Operating Altitude:	-500 to 10,000 feet (-152 to 3028 m)
Route Processor Slots:	Integrated
Operating Humidity:	10 to 85% (non-condensing)
Forwarding Rate:	Up to 7.5 Mpps
Storage Temperature:	-40 to 150 F (-40 to 70 C)
Scalability:	2.5 Gbps to 20 Gbps
Built-in Gigabit Ethernet Ports: :	4
Redundancy:	Yes: Software
ESP Support:	Cisco ASR 1000 Series 2.5-Gbps ESP (default). Upgradable through a software-activated feature license to 5,10, or 20 Gbps
Targeted For:	High-end branch office, enterprise WAN or Internet edge, managed services
Dimensions (H x W x D):	1.71 x 17.3 x 18.5 in.
Operating Temperature (Short-Term):	32 to 122 F (0 to 50 C)
Default Memory:	8-GB DRAM shared across route processor, ESP, and SIP
Shared Port Adapter Slots:	1
Storage Humidity:	5 to 95% (non-condensing)
Rack Units:	1 RU

7.3.2. Ancillary Equipment

7.3.2.1. Cisco Upgrade from 2.5Gbps to 10Gbps License (FLSA-1X-2.5-10G)

The FLSA-1X-2.5-10G is an upgrade license key from the 2.5Gbps to 10Gbps software associated with the acquisition of line item 2 from Table 35: CV Network Integration Equipment Requirements. This upgrade is required for the acquisition of the ASR1001-X. Table 36 is the upgrade license product details:

Table 36. FLSA-1X-2.5-10G Cisco Upgrade from 2.5Gbps to 10Gbps License Specification

Product Detail	License Specification
Product Name	2.5G to 10GBPS Upgrade License for ASR 1001-x
Manufacturer Part Number	FLSA1-1X-2.5-10G
Product Type	Hardware Licensing
License Information	
License Type	Upgrade License
Product Supported	Cisco ASR 1001-X Router
Product Information	
Distribution Media Type	Electronic

7.3.2.2. Cisco SMARTnet Extended Service Agreement (CON-SNT-ASR1001X)

This item is for an extended service agreement with Cisco for the ASR1001-X Router. The router comes with a 1 year warranty. The SMARTnet extended service agreement provides the City with support and service availability from Cisco Professionals 8hs/day, 7days/week via phone. Cisco SMARTnet Service connects its customers directly to the Cisco Technical Assistance Center (TAC), staffed by Cisco professionals certified in a broad range of Cisco technologies for troubleshooting and assistance.

7.3.2.3. Cisco Transceiver Module SFP-GE-T=SFP

The SFP-GE-T= is a 1000BASE-T SFP transceiver module for Category 5 copper wire, extended operating temperature range. The main features of this item are listed below in Table 37.

Table 37. Cisco Transceiver Module SFP-GE-T=SFP

Type	Specification
Slot	SFP (mini-GBIC) transceiver module
Datalink Protocol	Gigabit Ethernet
Cabling	1000Base-T up to 328 ft
Interface	RJ-45, Female, Ethernet 1000Base-T
Data Transfer Rate	1 Gbps
Compliance Standards	FCC CFR21 Part 1040, IEC 60825-1, Laser Class 1, NEBS level 3
Service and Warranty	1 year

7.3.3. Part Numbers and Quantities

Table 38 below displays the TMC Network equipment acquired for the NYC CVPD Program.

Table 38. TMC Network Equipment Inventory

LN	Equipment Type/Description	Part/Model No.	Serial No.	Vendor
1	Cisco ASR 1001-x- router -rack mountable-with Cisco 1000 series Emb	ASR1001X-2.5G K9	FXS2110Q3ZZ	CDW-G
2	Cisco SMARTnet extended service agreement	CON-SNT-SLASR1AM	Software	CDW-G
3	Cisco SMARTnet extended service agreement	CON-SNT-ASR105GK	Software	CDW-G
4	SPF (mini-GBIC) transceiver module-Gigabit Ethernet	GLC-TE	AVC211623JU	CDW-G
5	SPF (mini-GBIC) transceiver module-Gigabit Ethernet	GLC-TE	AVC211623JT	CDW-G

7.3.4. Associated Software

The Cisco hardware contains original Cisco OEM software acquired as a HW/SW single solution. No additional software is associated with these items.

7.3.5. Acquisition Method

As discussed earlier in the document under Acquisition Approach Section 2 NYCDOT In-House Procurement, the City acquired these items under the approach of Buy Off a Master Agreement. The City currently has a Master Agreement in place with CDW-G to procure all IT needs without being required to solicit other vendors. In the interest of time and meeting the schedule, the City has opted for this method to meet these requirements.

7.3.6. Potential Vendors

Only CDW-G was considered for this procurement as it meets all specification requirements and schedule delivery needs. CDW has an existing master agreement with NYCDOT that allows for the direct procurement of all IT needs.

7.3.7. Acquisition Schedule

These items have been procured and received from CDW-G on June 7, 2017.

7.4 HARDWARE SECURITY MODULE (HSM)

The HSM is a rack-mountable appliance that will be installed at the TMC to expand TMC operations with direct-to-vehicle messaging over latest V2X network technology. Traveler Information, MAP, and other infrastructure messages are inspected and digitally signed to prevent hacking so TMC messages can be trusted. The HSM authenticates incoming messages and signs certificates for outgoing messages to and from the TMC. The HSM inspects and formats TMC messages for acceptance by V2X networked devices. Installed RSUs and ASDs do not require any additional components.

7.4.1. Technical Description/Specification

The HSM, also known as the TMC Authority, provides complete support for IEEE 1609.2 algorithms and protocols including SAE J2735, and J2945/x. It also provides FIPS 140-2 Level 3 protection for V2X signing keys. The TMC Authority checks and digitally signs traffic management center messages for instant verification and acceptance, compliant with IEEE 1609.2 standards and cryptography. Data is secured inside and out with FIPS 140-2 Level 3 protection of keys and TLS v1.2 tunnels to TMC servers. High availability network failover is standard, including redundant power supplies and storage; the TMC Authority maintains trusted reliable operation, even in untrusted environments.

Green Hills ISS is the provider for this equipment, integration services, and support for 3 years. The 3 years of maintenance and support start with the effective date of contract, which is upon the signing of the contract/agreement on September 19, 2017. Maintenance and Support from Green Hills ISS includes the following:

Table 39. HSM Maintenance and Support Items

Support Item	Type
Support Hours	Business Hours
Hotline support for Severity issues 1and 2 levels	Business Hours
Phone/Email Support	Yes
Product Updates and Upgrades	Yes
Unlimited Support Requests	Yes
Maximum Customer Contacts	5
Patch Distribution	Yes
Automatic Priority Escalation	Yes
Documented Reporting of Critical Issues	Yes
Monthly Status Meetings	Yes

7.4.2. Ancillary Equipment

No ancillary equipment is required for the HSM product.

7.4.3. Part Numbers and Quantities

Table 40 lists the part numbers and quantities for various components of the HSM. Because the HSM parts have not been delivered, the part numbers and quantities cannot be determined at this time. The part numbers will be verified and included in this document upon delivery of the HSM equipment.

Table 40. Hardware Security Module (HSM) Components

LN	QTY	Part Number	Description
1	2		DLM TMC Authority Appliances for HA and Redundancy
2	1		Integration Services (NRE)
3	1		On Board Security integration work of Aerolink into TMC Authority
4	1		3 Year Subscription

7.4.4. Associated Software

No additional software is associated with the HSM components listed in Table 39 above.

7.4.5. Acquisition Method

As discussed in Section 2 NYCDOT In-House Procurement of this document, the City will purchase these items under the approach of “Buy off a Master Agreement”. However, this product is not available through City’s existing CDW-G. Therefore, the HSM was procured directly from the sole source vendor Green Hills ISS.

7.4.6. Potential Vendors

Only Green Hills ISS was considered for this procurement as a sole source provider.

7.4.7. Acquisition Schedule

The purchase for the HSM was completed and signed on September 19, 2017 with an expected delivery and integration of the HSM into the TMC 10 weeks after receipt of order. At this time, the HSM equipment has not been delivered to NYCDOT.

7.5 CV DATA COLLECTION SERVER AND NETWORK INTEGRATION EQUIPMENT INSTALLATION

7.5.1. Supplier(s)

As discussed earlier in the document under Acquisition Approach Section 2 NYCDOT In-House Procurement, the City has already acquired these items under the approach of “Buy off a Master Agreement”. The City currently has a Master Agreement in place with CDW-G to procure all IT needs without being required to solicit other vendors. In the interest of time and meeting the schedule the City has opted for this method to meet these requirements

7.5.2. Inventory Control Method

The CV data collection server and network integration equipment installation will follow the inventory control method described in Section 3 Inventory Control of this document.

7.5.3. Configuration(s)

The CV data collection server and network integration equipment installation will follow the configuration described in Section 3 Configuration Management of this document.

7.5.4. TMC Installation Diagram(s)

Figure 22 displays the method of installation on existing TMC Racks.

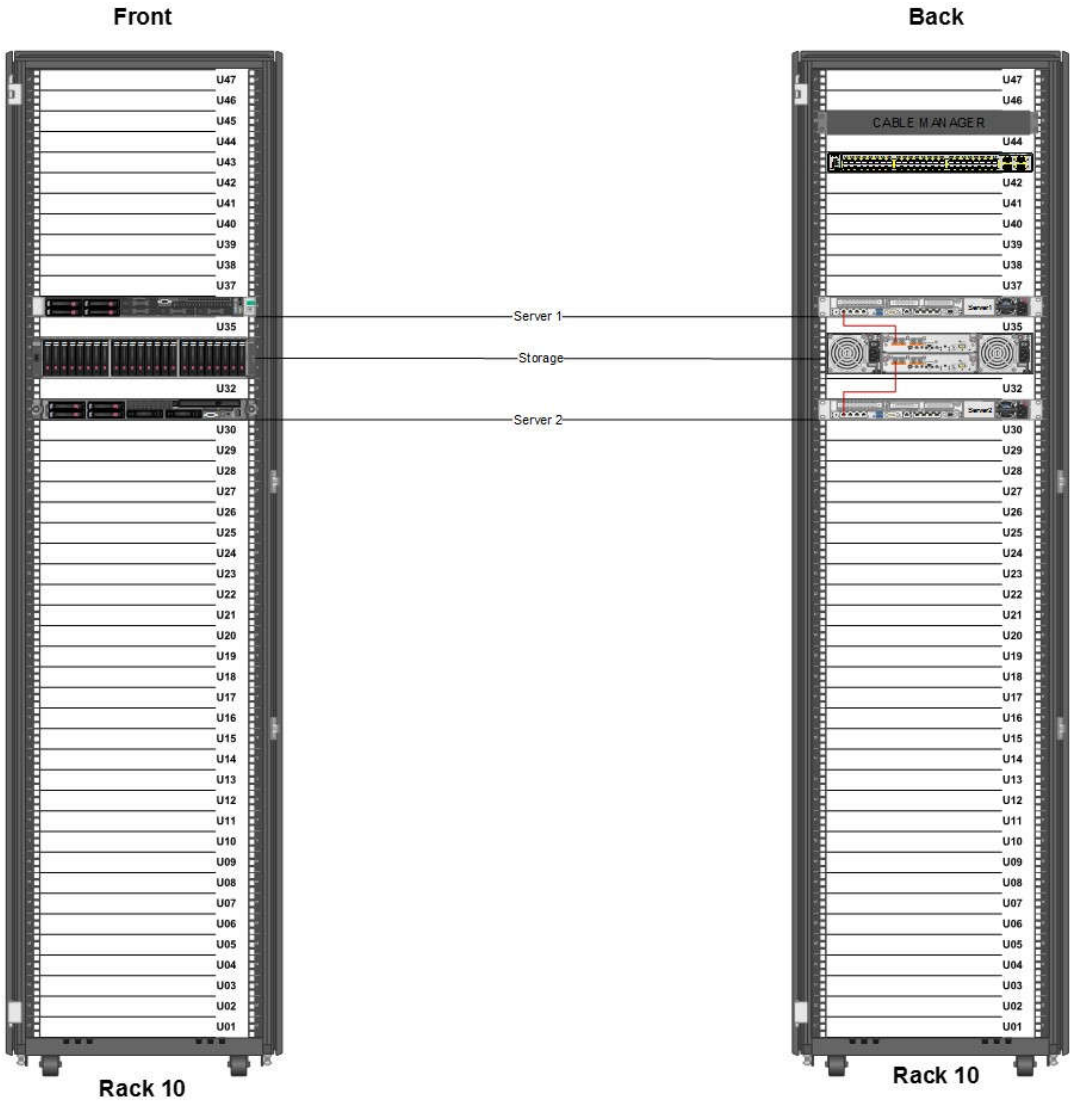


Figure 22. Rack Diagram

7.5.5. Installation Procedures

7.5.5.1. Pre-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

7.5.5.2. Installation Procedures

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

7.5.5.3. Post-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available once vendor selection is made.

7.5.6. Quality Assurance/Quality Control Process

This information is not yet known; the document will be updated as more information becomes available.

7.5.7. Installation Schedule

Please refer to Figure 7 Phase 2 Procurement and Installation Schedule.

7.5.8. HW and SW Configuration Control Process

Please refer to Section 3 Configuration Management.

7.5.9. Sparing Strategy, Warranty and Contingency Plan

Warranty provisions are governed by the Terms and Conditions in the Master Agreement in place between NYCDOT and CDW-G.

Chapter 8. Other Equipment

8.2 RADIO FREQUENCY (RF) TESTING DEVICES

The City will procure RF test equipment that has a range up to 6 GHz as required for the intended CV 5.9 GHz DSRC range. Under this acquisition the vendor will provide RF signal analyzers, with associated preamplifiers, vector signal generators, software, carrying cases, and selected training. These items will be used to monitor the 5.9 GHz spectrum remotely via a lab tester, and in some cases during installation of RSUs at locations. It is expected that some interference may be discovered, so portable devices will be needed as well.

8.2.1. Technical Description/Specification

The RF test equipment required for the NYDC CVPD program is listed in Table 41. Each item and description are further described in the following sections.

Table 41. RF Test Equipment

LN	Description	Part Number	Qty
1	MS27102A	Remote Spectrum Monitor, IP67 Rated	1
2	MS2720T	Portable Spectrum Master	3
3	MS2690A	Signal Analyzer Bench/Lab Tester	1
4	3400-81718	RF Signal Interference Training. Three-day, hands-on, instructor-led training course covering the fundamentals of spectrum analysis and RF signal interference analysis	1
5	MX280007A-PL001	Software Interference Hunter. Mobile Interference Hunter™ software license	1
6	XXXXX	Full Software support: V2x RF Parametric Test and V2x Message Check Solution software	1

8.2.1.1. MS 27102A Remote Spectrum Analyzer

This is a Remote Spectrum Monitor - wide temperature rated; it can be connected to 3G/4G or NYCWiN for communications or, it can store a log internally of what it sees and transmits to a base station or be downloaded locally (can monitor 1 channel – configurable). This would be used if there was suspected an intermittent source of interference in a specific channel at a specific location or area. Technicians would configure the channel, place in the area and wire to a controller cabinet or some other cabinet; connect to 24 VDC (small power supply) and wire to NYCWiN or something else and track what happens overnight or more – plot. A tracker device would then be used to find the actual source.

Figure 23. MS27102A Remote Spectrum Analyzer

See Table 42 below for technical description and specifications developed for the MS27102A.

Table 42. MS27102A Technical Description and Specification

LN	Part Number	Description	Qty
1	MS27102A	Remote Spectrum Monitor, IP67	1
2	MS27102A-0706	Option 706, Frequency Range 9kHz to 6 GHz	1
3	MS27102A-0400	Option 400, Vision Monitor Enabled	1
4	40-187-R	AC/DC Power Supply, 1 meter 12 volt output cable	1
5	2000-1528-R	Magnet Mount GPS Antenna (active 3-5V) with SMA Available 75.00 75.00 connector and 4.6 m (15 ft) extension cable Supplied with 1 year warranty coverage.	1
6	760-285-R	Transit Case (For Model MS27102A)	1
7	MS27102A-ES513	5 Year Extended Service - Return to Vendor Repair and Standard Calibration	1

8.2.1.2. MS2720T Portable Spectrum Master

The MS2720T shown in Figure 24 is a Handheld Spectrum Analyzer for field interference and spectrum analysis. This device includes software which supports their interference hunter and may include training for operation and interference hunting. The interference tracking would be used initially to evaluate all of the subject area and specifically the RSU locations. Its interference tracking feature will save NYCDOT time and money if we need to solve communications problems during installation and operation.

T

Figure 24. MS2720T Portable Spectrum Analyzer

See Table 43 for technical description and specifications developed for the MS2720T.

Table 43. MS2720T Technical Description and Specification

LN	Part Number	Description	Qty
1	MS2720T	Spectrum Master. Supplied with 3 year warranty coverage	3
2	MS2720T-0709	Frequency Range 9 kHz to 9 GHz. Supplied with 3 year warranty coverage.	1
3	MS2720T-0025	Interference Analyzer supplied with 3 year warranty coverage	1
4	MS2720T-0431	Coverage Mapping supplied with 3 year warranty coverage	1
5	MS2720T-0031	GPS Receiver supplied with 3 year warranty coverage	1
6	2000-1528-R	Magnet Mount GPS Antenna (active 3-5V) with SMA connector and 4.6 m (15 ft) extension cable supplied with 1 year of warranty coverage	1
7	2000-1748-R	Log Periodic Antenna, 1 to 18 GHz, N(f), 6 dBi, typical supplied with 1 year of warranty coverage	1
8	MA2700A	Interference Hunter Handheld Direction Finding System	1
9	15NN50-1.5C	Test Port Extension Cable, Armored, 1.5 meters, DC to 6 GHz, N(m) - N(m), 50 Ohm	1
10	760-261-R	Transit Case, MA2700A	1
11	760-243-R	Transit Case	1
12	MS2720T-0709-ES513	Five year Return-to-Vendor Repair and Z540 Calibration	1

8.2.1.3. MS2690A Signal Analyzer Lab/Bench Tester

This device as shown in Figure 25 below is a bench tester for the DSRC RSU and OBU and can handle all aspects of the radio verification. This is what was used in the testing of the RSU and OBU in the open lab alliance, except the top frequency is only 6 GHz in line with the 5.9 GHz DSRC frequency needs. During deployment and operations, it will be added to the ITS test lab so NYCDOT can verify all of the RSUs and OBUs upon receipt.

Figure 25. MS2690A Signal Analyzer Lab/Bench Tester

See Table 44 below for technical description and specifications developed for the MS2690A.

Table 44. MS2690A Technical Description and Specification

LN	Part Number	Description	Qty
1	MS2690A	SIGNAL ANALYZER. Supplied with 1 year warranty coverage	1
2	MS2690A-008	6GHz PREAMPLIFIER. Supplied with 1 year warranty coverage	1
3	MS2690A-020	VECTOR SIGNAL GENERATOR. Supplied with 1 year warranty coverage	1
4	MX269028A	WLAN (802.11) Measurement Software. Supplied with 1 year warranty coverage	1
5	MX269911A	WLAN IQproducer. Supplied with 1 year warranty coverage	1
6	MX269000A	Standard Software. Supplied with 1 year warranty	1
7	B0589A	Carrying Case. Supplied with 1 year warranty coverage	1
8	MS2690A-ES513	5-Year Return to Vendor Repair and Standard Calibration	1

The RF equipment ordered is configured to best fit the needs of the City with regards to the NYC CVPD program. All the ancillary/components of the major devices are listed in Technical Description/Specification of this document. The only additional non-equipment item acquired is the Interference Analysis Certification/Training.

8.2.1.4. Interference Analysis Certification Training (Item number: 3400-81718)

The only ancillary line item to be considered is a training course for RF Signal Interference Analysis Training. This item, 3400-81718, is to be acquired in order to provide the City RSU installers with the necessary training to conduct RF interference analysis once they encounter interference at installation locations in the city. It is a 3 day instructor led hands on course offered by various RF Signal vendors.

8.2.2. Ancillary Equipment

Sections 8 Technical Description/Specification, Ancillary Equipment and Part Numbers and Quantities of this document provide a full list of Main and ancillary support equipment needed to operate the device.

8.2.3. Part Numbers and Quantities

See Item Technical Description/Specification for projected quantities and part numbers. Serial numbers are not available as this equipment has not been delivered yet.

8.2.4. Associated Software

There will be two (2) required software elements to be acquired in connection to the RF Test equipment. The software required is listed in Table 45.

Table 45. RF Test Equipment Software Requirements

LN	Description	Part Number	Qty
1	MX280007A-PL001	Software Interference Hunter. Mobile Interference Hunter™ software license	1
2	XXXXX	V2x RF Parametric Test and V2x Message Check Solution software	1

8.2.4.1. Software Interference Hunter MX280007A-PL001

The software mobile interference hunting system automates the interference hunting process. Multiple measurements are automatically taken and processed using the MX280007A software. Using mapping software resident on a Windows laptop/tablet, a handheld spectrum analyzer and an omnidirectional antenna, directions and voice prompts are provided in this system to guide the driver to the source of interference. The Mobile Interference Hunter software uses a “min hold” algorithm which captures the interfering signal while eliminating the LTE traffic signal from measurement consideration.

8.2.4.2. V2x RF Parametric Test and V2x Message Check Solution software

The City will acquire a full software and support package for V2x RF Parametric Test and V2x Message Check Solution software. This software is considered COTS and will integrate DSRC technology and the 802.11p standard testing capability in the signal and spectrum analyzer equipment. V2X Message Viewer is a V2X Message checking tool, which reduces the burden of setting up the environment for objective V2X message checking with the Signal Analyzer. It currently supports US and Japanese standards, and in the near future, will support the European standard as well.

8.2.5. Acquisition Method

The acquisition method for the RF Test Devices is via the Competitive Sealed Bid (CSB) method. This method allows the City to bid out the required specification and to select the lowest bidder. One vendor will be selected based on lowest bid, provided they meet all the bid specification requirements.

8.2.6. Potential Vendors

The bid will be published by DCAS and open to the public. Anritsu Products was considered as an OEM and a quotation was obtained for budgetary and technical analysis only.

8.2.7. Acquisition Schedule

This information is not yet known; the document will be updated as more information becomes available.

8.3 RF TEST DEVICES INSTALLATION INFORMATION

No installation is required, this section is not applicable.

8.3.1. Supplier(s)

This information is not yet known; the document will be updated as more information becomes available

8.3.2. Inventory Control Method

Please refer to Section 3 Inventory Control of this document.

8.3.3. Configuration(s)

Please refer to Section 3 Configuration Management of this document.

8.3.4. Installation Diagram(s)

Not Applicable

8.3.5. Installation Procedures

The RF Test devices do not require installation. The RF testing devices are standalone equipment that will be used to test RF signal propagation, and signal interference during the prototype installation and testing phase. This document will be updated with more detailed information as the CV team receives the equipment and puts it to use during prototype installations.

8.3.5.1. Pre-Installation Procedures/Checklist

The RF Test devices do not require installation; therefore, this section is not applicable.

8.3.5.2. Installation Procedures

The RF Test devices do not require installation; therefore, this section is not applicable.

8.3.5.3. Post-Installation Procedures/Checklist

The RF Test devices do not require installation; therefore, this section is not applicable.

8.3.6. Quality Assurance/Quality Control Process

This information is not yet known; the document will be updated as more information becomes available

8.3.7. Installation Schedule

The RF Test Devices do not require installation; therefore, this section is not applicable.

8.3.8. HW and SW Configuration Control Process

Not Applicable

8.3.9. Sparing Strategy, Warranty and Contingency Plan

8.3.9.1. Sparing Strategy

These items are RF Test devices and are considered Capital Assets supporting the installation and integration of the field equipment. The City does not foresee a need for a sparing strategy.

8.3.9.2. Warranty

The purchasing of the RF Test Equipment will require provisions for 3 year warranty periods on all signal analyzers, and spectrum analyzers.

8.3.9.3. Contingency Plan

The City is requiring an extended 5 year service agreement to be provided by the vendor to cover the repairing and calibration of the equipment at the OEM location.

8.4 ASN.1 COMPILER

The City acquired an OSS ASN.1 /Java Tools Compiler on Windows x64bit) Rights of use fee for two years, supporting BER, PER, XML as part of the NYC CVPD Program. This software is provided via a license key. The ASN.1 is a computer language designed by the CCITT/ITU (Telecommunication Standardization Sector of the International Telecommunications Union) for the specification of data types and values, especially in communication protocols.

ASN.1 is typically used to define the protocol data units (PDUs) of communication protocols. To map a PDU into a concrete sequence of octets, the ASN.1 standard offers several encoding rules. There are two main encoding rules:

- Basic encoding rules (BER): The basic encoding rules prefixes each component of the PDU by an identifying tag and the data length. These encoding rules are very simple but space consuming and are mostly used for the encoding in old standards.
- Packed encoding rules (PER): The packed encoding rules encode the values in a very compact format and often use the minimum number of bits required. These encoding rules are very complex and are mostly used in recent standards.

The ASN.1 compiler supports both these encoding rules (and its variants like CER and DER) and generates datatypes, values, encoding, and decoding functions for a specific programming language (C or Java) according to the definitions in the ASN.1 file supplied by the user.

8.4.1. Technical Description/Specification

The ASN.1 Compiler software components required for the NYDC CVPD program is listed below in Table 46. Each item and description is further described in the following sections.

Table 46. ASN 1 Compiler Components

LN	Part Number	Description	Qty
1	XXXX	Project Start-up Kit License	1
2	XXXX	OSS ASN.1/Java Tools (Compiler on Windows x86 64bit)	included
3	XXXX	ASN.1 studio (Supports BER, PER, and XML)	Included
4	XXXX	Technical Support and Maintenance	included

The City acquired this software initially as a Project Startup License kit. This allows the City to use the software for development, testing, and demonstration purposes only for a single defined project. With acquisition complete, the City upgraded to a full license, with a 2-year right of use.

8.4.2. Ancillary Equipment

The ASN.1 Compiler Tool is a software license kit that does not include any ancillary equipment.

8.4.3. Part Numbers and Quantities

The ASN.1 Compiler Tool is a software license kit. Part# and serial# are not applicable to this acquisition. A license key was provided as part of the acquisition.

8.4.4. Associated Software

The ASN.1 Compiler Tool is a software license kit; therefore, this section is N/A.

The version is ASN.1 Studio Version 8.1.1 Copyright (C) 2017 OSS Nokalva, Inc. All rights reserved.

This product is licensed for use by "NYC Department of Transportation, Long Island City, New York - Two-year Project Start-up, Expiring May 10, 2019", License "17309", only for project "Connected Vehicle Pilot Deployment Program", on platform(s)"Windows X64 on AMD64".

8.4.5. Acquisition Method

The ASN.1 Compiler Tool was acquired via a micro purchase <$20,000, conducted in house by the NYCDOT procurement department.

8.4.6. Potential Vendors

Since the value was estimated less than $20,000, this was considered a micro purchase. The City solicited approved and qualified NYCDOT vendors for quotations, as part of In-House Purchasing. The award was made to Garic Technology Inc, to satisfy State requirements to award Minority and Women-owned Business Enterprise (M/WBE).

8.4.7. Acquisition Schedule

The OSS ASN.1 /Java Tools Compiler on Windows x64bit) Right of use fee for two years, supporting BER, PER, XML was received on June 1, 2017. The timing of this acquisition is in line with anticipated Installation activities in Q3, and Q4 2017.

8.5 ASN.1 JAVA/TOOL COMPILER INSTALLATION INFORMATION

8.5.1. Supplier(s)

The acquisition of this item was made from Garic Technology Inc. The OEM software provider is OSS Nokalva. The award was made to Garic Technology Inc, to satisfy State requirements to award Minority and Women-owned Business Enterprise (M/WBE).

8.5.2. Inventory Control Method

Please refer to Section 3 Inventory Control of this document.

8.5.3. Configuration(s)

Please refer to Section 3 Configuration Management of this document.

8.5.4. Installation Diagram(s)

This is a software license and does not require installation.

8.5.5. Installation Procedures

This is a software license and does not require installation; it requires download and configuration only.

8.5.5.1. Pre-Installation Procedures/Checklist

Please see Installation Procedures below.

8.5.5.2. Installation Procedures

Once the award was made, and the license key was obtained, City TMC staff followed the download/ installation procedure for the ASN.1/Java Tools on 64-bit Windows platform. The download/installation procedure is displayed in Table 46 below.

Table 47. ASN 1 Compiler Installation Procedure

LN	Download/Installation Procedure	Description
1	Go to: https://depot.oss.com	Login using your company email address as your username and select "Request a new password". You will receive an email with instructions to create a personal password. After successful access, we ask that you update your profile with the ASN.1 Standards and Encoding Rules you will use.
2	Agree to License Terms and Download	Select "Download Products" to open the screen of ASN.1 Product you are purchasing. Select the 7.0.0.1 disk icon to open the license agreement. The download will not proceed until the "I Agree" button is chosen. After downloading, select "Return to product page" to open the installation instructions and to access the online documentation.
3	Temporary 30-day license key "ossinfo": A zip file containing a binary license key is attached to this email. This temporary key will allow use of the program and the application you develop through June 10, 2017. After receipt of the license fee payment, a new license key will be delivered allowing use of the program and your application through the two-year license term.	Save the file as "ossinfo" (lowercase, no extension) to a directory of your choosing on your Windows 64-bit machine(s), then run the downloaded 7.0.0.1 installation executable. Reference the install instructions link on the download page for complete installation details and getting started information.
4	Confirm the installation:	When you have downloaded and installed the products, please confirm by email reply that you have the files and that the installation has gone smoothly. If you have any trouble, please email or call us immediately, day or night. Our technical support is free of charge and we are always here to serve - 24 hours a day, 7 days a week. For help with installation, email or call:customerservice@oss.com, 1-315-896-2610 For technical support, email or call: support@oss.com, 1-732-302-9669

8.5.5.3. Post-Installation Procedures/Checklist

The ASN.1 Compiler tool does not require any post installation procedures/checklists. The license acquired is valid for two years, at which time it is renewable through a follow up procurement.

8.5.6. Quality Assurance/Quality Control Process

Not Applicable

8.5.7. Installation Schedule

The ASN.1 Java/Tool Compiler was acquired on June 7, 2017.

8.5.8. HW and SW Configuration Control Process

Please refer to Section 3 Configuration Management of this document.

8.5.9. Sparing Strategy, Warranty and Contingency Plan

Not Applicable

8.6 LOCATION CORRECTION FACILITIES

In order to improve location accuracy for the DSRC devices being deployed under the CV project, NYCDOT is soliciting quotations for software, facilities, and integration/training services to provide location corrections using the DSRC Radio Technical Commission for Maritime (RTCM) messages defined in SAE J2735. The RTCM content will be obtained by the back-office system and broadcast to mobile devices (i.e. ASD) using the J2735 RTCM message over DSRC.

8.6.1. Technical Description/Specification

Network Transport of RTCM data over IP (NTRIP), or NTRIP Caster, is a protocol used to transport RTK correction data over the Internet. The correction data is moved in a way similar to that of streaming audio. Essentially a client connects to some device serving the stream and requests a copy of that data. Transporting RTK correction data over the Internet is an alternative to using radios to transport the data. The following line items in Table 48 are being solicited from select vendors.

Table 48. NTRIP Caster Solicitation

LN	Description	Measure	Qty	Vendor/Part Number
1	NTRIP Caster/RTCM Interface Software Package – NTRIP Caster and NTRIP Client	LS	1	
2	Integration and Training (NYC)	Week	2	
3	Vendor Support - for vendor site NTRIP Clients connecting to NTRIP Caster (no travel)	Vendor	3	

Line item #1 is an NTRIP Caster software application capable of gathering, filtering, and encoding as well as sending corrections data with multiple common types of differential corrections to the various end user NTRIP client devices (RSUs, and ASDs), in the industry standard formats defined by RTCM and by the SAE J2735 message set documents. The 3 components of this line item are described in the sections below.

8.6.1.1. NTRIP Client

The NTRIP Client functions as a TCP/IP client on the rover side. It initiates a connection to the Caster, asking for data on a certain stream.

8.6.1.2. NTRIP Server

The NTRIP server functions as a TCP/IP client on the base station side. It initiates a connection to the Caster, asking to upload data for a certain stream. NTRIP Servers are typically GNSS reference stations of various quality levels with a thin layer of software to connect to and push data out to a Caster over an internet connection

8.6.1.3. NTRIP Caster

The NTRIP Caster functions as a TCP/IP server and listens for connections, and will forward data from one NTRIP Server to many NTRIP Clients. The clients in this case are the ASDs and RSUs. An NTRIP Caster takes data from one or more data stream sources (Base Stations referred to as NTRIP Servers) and provides this data to one or more end users, the NTRIP Clients.

8.6.2. Ancillary Equipment

In order to fully test and integrate the NTRIP Caster, Client, and Server into the TMC, the vendors are requested to provide 2 weeks of training and integration support at the TMC.

8.6.3. Part Numbers and Quantities

This information is not yet known; the document will be updated as more information becomes available.

8.6.4. Associated Software

The Location Correction Facilities procured is a software package, therefore this section is Not Applicable.

8.6.5. Acquisition Method

This information is not yet known; the document will be updated as more information becomes available.

8.6.6. Potential Vendors

Currently there are two vendors being considered for this acquisition, ITSWare and Trimble.

8.6.7. Acquisition Schedule

This information is not yet known; the document will be updated as more information becomes available.

8.7 LOCATION CORRECTION FACILITIES INSTALLATION INFORMATION

This information is not yet known; the document will be updated as more information becomes available.

8.7.1. Supplier(s)

This information is not yet known; the document will be updated as more information becomes available.

8.7.2. Inventory Control Method

Please refer to Section 3 Inventory Control of this document.

8.7.3. Configuration(s)

Please refer to Section 3 Configuration Management of this document.

8.7.4. Installation Diagram(s)

This information is not yet known; the document will be updated as more information becomes available.

8.7.5. Installation Procedures

This information is not yet known; the document will be updated as more information becomes available.

8.7.5.1. Pre-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available.

8.7.5.2. Installation Procedures

This information is not yet known; the document will be updated as more information becomes available.

8.7.5.3. Post-Installation Procedures/Checklist

This information is not yet known; the document will be updated as more information becomes available.

8.7.6. Quality Assurance/Quality Control Process

This information is not yet known; the document will be updated as more information becomes available.

8.7.7. Installation Schedule

This information is not yet known; the document will be updated as more information becomes available.

8.7.8. HW and SW Configuration Control Process

This information is not yet known; the document will be updated as more information becomes available

8.7.9. Sparing Strategy, Warranty and Contingency Plan

This information is not yet known; the document will be updated as more information becomes available.

Chapter 9. Bill of Materials

Table 49 below lists the items and material included in the NYC CVPD Bill of Material (BOM).

Table 49. NYC CVPD Phase 2 BOM

Type	Name	Type	Qty	Method of Procurement	Vendor	Part Number
5.9 GHz ASD Specification Procurement						
1	ASDs - Vendor 1 (Prototype)	Device	100	RFEIP		
2	ASD Installation Kits - Vendor 1 (Prototype)	Device	100	RFEIP		
3	ASD - Vendor 2 (Prototype)	Device	100	RFEIP		
4	ASD Installation Kits - Vendor 2 (Prototype)	Device	100	RFEIP		
5	ASD - Vendor 1 (Production - Includes Spares)	Device	4200	RFEIP		
6	ASD Installation Kits - Vendor 1 (Production - Includes Spares)	Device	4300	RFEIP		
7	ASD - Vendor 2 (Production - Includes Spares)	Device	4300	RFEIP		
8	ASD Installation Kits - Vendor 2(Production - Includes Spares)	Device	4300	RFEIP		
9	Onsite Engineering Support Vendor 1 (Weekly)	Labor	8	RFEIP		
10	Onsite Engineering Support Vendor 2 (Weekly)	Labor	8	RFEIP		
11	ASD Vendor 1 Software/Source Code and development environment	SW	1	RFEIP		
12	ASD Vendor 2 Software/Source Code and development environment	SW	1	RFEIP		
5.9 GHz RSU Specification Procurement						
13	RSU Prototypes	Device	10	Competitive Sealed Bid (CSB)		
14	RSU Installation Kits - (Prototypes)	Device	10	Competitive Sealed Bid (CSB)		
15	RSU (Production - Includes Spares)	Device	390	Competitive Sealed Bid (CSB)		
16	RSU Installation Kits -(Production - Includes Spares)	Device	390	Competitive Sealed Bid (CSB)		
17	Onsite Engineering Support Vendor 1 (Weekly)	Labor	8	Competitive Sealed Bid (CSB)		
18	RSU Software Source Code and Development Environment	SW	1	Competitive Sealed Bid (CSB)		
Mobile Device - PID						
19	PID - Prototype	Device	10	Competitive Sealed Bid (CSB)		
20	PID - Production	Device	90	Competitive Sealed Bid (CSB)		

Type	Name	Type	Qty	Method of Procurement	Vendor	Part Number
TMC Equipment - CV Data Collection Server						
21	HPE ProLiant DL360 Gen9 Server	HW	2	In House - Buy Off A Master Agreement	CDW-G	DL360 Gen9
22	HPE MSA 2040 SAN Storage (21.6TB Capacity)	HW	1	In House - Buy Off A Master Agreement	CDW-G	MSA 2040 21.6tb
TMC Equipment - CV Network Integration Equipment						
23	Cisco ASR10001-X router rack mountable	HW	1	In House - Buy Off A Master Agreement	CDW-G	ASR1001X-2.5G K9
24	Cisco Upgrade from 2.5Gbps to 10Gbps License	SW	1	In House - Buy Off A Master Agreement	CDW-G	CON-SNT-SLASR1AM
25	Cisco SMARTnet extended service agreement	Service	1	In House - Buy Off A Master Agreement	CDW-G	CON-SNT-SLASR1AM
26	Cisco SFP-GE-T=SFP Transceiver Module	HW	2	In House - Buy Off A Master Agreement	CDW-G	GLC-TE
Other Equipment - Test Devices						
27	MS26890a or equal, Signal Analyzer includes 1 year warranty	HW	1	Competitive Sealed Bid (CSB)		MS26890A
28	MS2690A-008 or equal. 6GHz preamplifier, includes one year warranty.	HW	1	Competitive Sealed Bid (CSB)		MS2690A-008
29	MS26980A-020 or equal. Vector Signal Generator includes one year warranty	HW	1	Competitive Sealed Bid (CSB)		MS26980A-020
30	MX269028A or equal.WLAN (802.11) Measurement Software, includes one year warranty.	SW	1	Competitive Sealed Bid (CSB)		MX269028A
31	MX269028A or equal. WLAN signal generator includes one year warranty	HW	1	Competitive Sealed Bid (CSB)		MX269028A
32	MX26900A or equal. Includes the standard software and V2X RF parametric test and V2X message check software ad one year warranty.	SW	1	Competitive Sealed Bid (CSB)		MX26900A
33	B0589A or equal. Carry case, includes one year warranty.	HW	1	Competitive Sealed Bid (CSB)		B0589A
34	MS2690A-ES513 or equal. 5 year repair ad calibration when returned to the vendor.	Service	1	Competitive Sealed Bid (CSB)		MS2690A-ES513
35	MS2720T or equal. Spectrum analyzer includes three year warranty	HW	3	Competitive Sealed Bid (CSB)		MS2720T
36	MS2720T-0709 or equal. Frequency range, 9khz-9GHz, includes three year warranty	HW	3	Competitive Sealed Bid (CSB)		MS2720T-0709
37	MS2720T-0025 or equal. Interference analyzer include three year warranty	HW	3	Competitive Sealed Bid (CSB)		MS2720T-0025
38	MS2720T-0431 or equal. Coverage mapping includes one three year	Service	3	Competitive Sealed Bid (CSB)		MS2720T-0431

Type	Name	Type	Qty	Method of Procurement	Vendor	Part Number
	warranty					
39	MS2720T-0031 or equal. GPS receiver include three year warranty.	HW	3	Competitive Sealed Bid (CSB)		MS2720T-0031
40	200-1528-R or equal. Magnet mount GPS antenna with SMA connector and 15' extension cable, includes one year warranty	HW	3	Competitive Sealed Bid (CSB)		200-1528-R
41	2000-1748R or equal. Log periodic antenna 1-18GA GHz, includes one year warranty	HW	3	Competitive Sealed Bid (CSB)		2000-1748R
42	MA2700A or equal. Mobile interference hunting system for the handheld spectrum analyzer.	HW	1	Competitive Sealed Bid (CSB)		MA2700A
43	MX80007A-PL001 or equal. Mobile interference hunter software for the handheld spectrum.	SW	1	Competitive Sealed Bid (CSB)		MX80007A-PL001
44	15NN50-1.5C or equal. Test port extension cable, armored, 1.5 meters, DC to 6 GHz, N(M) N(m), 50ohm.	HW	3	Competitive Sealed Bid (CSB)		15NN50-1.5C
45	760-261-R or equal. Transit case.	HW	3	Competitive Sealed Bid (CSB)		760-261-R
46	760-243-R or equal. Transit case for handheld equipment.	HW	3	Competitive Sealed Bid (CSB)		760-243-R
47	3400-81718 or equal. Training class using the equipment to learn how to use the spectrum analyzer equipment and identity RF signal interference.	Training	1	Competitive Sealed Bid (CSB)		3400-81718
48	MS2720T-0709-ES513 or equal. 5 year repair and calibration when returned to the vendor.	Service	3	Competitive Sealed Bid (CSB)		MS2720T-0709-ES513
49	MS27102A or equal. Remote spectrum monitor	HW	1	Competitive Sealed Bid (CSB)		MS27102A
50	MS27102A-0706 or equal. Frequency range option 9khz-6 GHz.	HW	1	Competitive Sealed Bid (CSB)		MS27102A-0706
51	MS27102A-0400 or equal. Vision monitor option enable.	HW	1	Competitive Sealed Bid (CSB)		MS27102A-0400
52	40-187 or equal. AC/DC power supply, 1 meter 12 volt output cable.	HW	1	Competitive Sealed Bid (CSB)		40-187
53	2000-1528R or equal.magnet mount GPS antenna with SMA connector ad 15' extension cable, includes one year warranty.	HW	1	Competitive Sealed Bid (CSB)		2000-1528R
54	760-285-R or equal. Transit case for MS27102A.	HW	1	Competitive Sealed Bid (CSB)		760-285-R
55	MS27102A-ES513 or equal. 5 year repair and calibration when returned to the vendor.	Service	1	Competitive Sealed Bid (CSB)		MS27102A-ES513
Other Equipment - ASN.1 Java/Tool Compiler						
56	Project Start-up Kit License, OSS ASN.1/Java Tools (Compiler on Windows x86 64bit), ASN.1 studio	SW	1	Micro Purchase	Garic Technology Inc	NA

Type	Name	Type	Qty	Method of Procurement	Vendor	Part Number
	(Supports BER, PER, and XML), Technical Support and Maintenance					
Other Equipment - Location Correction Facilities						
57	NTRIP Caster/RTCM Interface Software Package – NTRIP Caster and NTRIP Client	SW	1	Competitive Sealed Bid (CSB)		
58	Integration and Training (NYC - Weeks)	Training	2	Competitive Sealed Bid (CSB)		
59	Vendor Support - for vendor site NTRIP Clients connecting to NTRIP Caster (no travel)	Service	3	Competitive Sealed Bid (CSB)		

References

Table 50 lists the references used to develop this Comprehensive Acquisition Plan.

Table 50. References

No.	Document
1	Connected Vehicle Pilot Deployment Program Phase 1, Concept of Operations (ConOps) – New York City, April 8, 2016. FHWA-JPO-16-299.
2	Connected Vehicle Pilot Deployment Program Phase 2, System Architecture Document (SAD) – New York City, March 6, 2017. FHWA-JPO-17-451.
3	5.9 GHz DSRC AFTERMARKET SAFETY DEVICE (ASD) Merged Demo PROCUREMENT SPECIFICATION V2.3, November 2017, New York City Department of Transportation.
4	5.9 GHz DSRC ROADSIDE UNIT (RSU) PROCUREMENT SPECIFICATION V1.9, August 2017, New York City Department of Transportation.
5	PERSONAL INFORMATION DEVICE (PID)PROCUREMENT SPECIFICATION V1.7A, May 2016, , New York City Department of Transportation.
6	Connected Vehicle Pilot Deployment Program Phase 2, System Design – New York City (Draft), September 11, 2017, FHWA-JPO-17-452.
7	Connected Vehicle Pilot Deployment Program Phase 2, Comprehensive Acquisition Plan (CAP) (Draft), December 21, 2017.

APPENDIX A. List of Acronyms

Table 51 defines selected project-specific acronyms used throughout this Comprehensive Installation Plan.

Table 51. List of Acronyms

Acronym/ Abbreviation	Definition
AO	Agreement Officer
AOR	Agreement Officer Representative
ASD	Aftermarket Safety Devices
ASN.1	Abstract Syntax Notation One
ASTC	Advanced Solid-state Traffic Controller
ATC	Advanced Traffic Controller
BSM	Basic Safety Message
CAN	Controller Area Network
CAMP	Crash Avoidance Metrics Partnership
ConOps	Concept of Operations
CV	Connected Vehicle
CVPD	Connected Vehicle Pilot Deployment
CVRIA	Connected Vehicle Reference Implementation Architecture
DSNY	City of New York Department of Sanitation
DSRC	Dedicated Short Range Communications
FHWA	Federal Highway Administration
FOIA	Freedom of Information Act
GHz	Gigahertz
I2V	Infrastructure-to-Vehicle
IE	Independent Evaluator
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
IRB	Institutional Review Board
ISO	International Organization for Standardization
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
LTS	Location and Time Service
MAP	Map Data Message
MTA	Metropolitan Transportation Authority
NTCIP	National Transportation Communications for Intelligent Transportation System Protocol

Acronym/ Abbreviation	Definition
NYC	New York City
NYC DoITT	New York City Department of Information Technology and Telecommunications
NYCDOT	New York City Department of Transportation
NYCWiN	New York City Wireless Network
OandM	Operation and Maintenance
OBE	On-Board Equipment
OBU	On-Board Unit
ODE	Operational Data Environment
OEM	Original Equipment Manufacturer
OTA	Over-the-Air
PASS	Pedestrians for Accessible and Safe Streets
PED	Pedestrian
PID	Personal Information Device
PII	Personally Identifiable Information
RDE	Research Data Exchange
RFID	Radio Frequency Identification
RFQ	Request for Quote
RSE	Roadside Equipment
RSU	Roadside Unit
SAD	Systems Architecture Document
SAE	Society of Automotive Engineers International
SCMS	Security Credential Management System
SET-IT	Systems Engineering Tool for Intelligent Transportation
SPaT	Signal Phase and Timing
SyRS	System Requirements Specification
TCS	Traffic Control System
THEA	Tampa-Hillsborough Expressway Authority
TIM	Traveler Information Message
TLC	Taxi and Limousine Commission
TMC	Traffic Management Center
TTI	Texas Transportation Institute
UPS	United Parcel Service
USDOT	United States Department of Transportation
V2I	Vehicle-to-Infrastructure
V2P	Vehicle-to-Pedestrian
V2V	Vehicle-to-Vehicle
XML	Extensible Markup Language

APPENDIX B. Glossary

Term	Definition
Access Control	Refers to mechanisms and policies that restrict access to computer resources. An access control list (ACL), for example, specifies what operations different users can perform on specific files and directories.
Administrator	These are the operators that set control parameters, implement system policies, monitor system configuration, and make changes to the system as needed.
Aggregation	The process of combining data elements of similar format into a single data element that is a statistical representation of the original elements.
Analysis	The process of studying a system by partitioning the system into parts (functions, components, or objects) and determining how the parts relate to each other.
Anonymity	Lacking individuality, distinction, and "recognizability" within message exchanges.
Anonymous Certificate	A certificate which contains a pseudonym of the System User instead of his real identity in the subject of the certificate and thus prevents other System Users from identifying the certificate owner when the certificate is used to sign or encrypt a message in the connected vehicle program. The real identity of the anonymous certificates can be traced by Authorized System Operators by using the services of Registration Authority and Certification Authority.
APDU	Application Protocol Data Unit. This is a defined data structure that is transferred at a peer level between two applications.
Application	One or more pieces of software designed to perform some specific function; it is a configuration of interacting Engineering Objects. A computer software program with an interface, enabling people to use a computer as a tool to accomplish a specific task.
Application User	A user who interfaces with Application Layer software for a desired function or feature.
Assumption	A judgment about unknown factors and the future which is made in analyzing alternative courses of action.
Authenticate	The process of ensuring that an APDU originated from a source identified within the message
Authentication	The process of determining the identity of a user that is attempting to access a network.
Authenticate-ability	The ability of the receiver of information to authenticate the sender's identity or trustworthiness to send data within the domain. If required, this can be accomplished by verifying the incoming message has been digitally 'signed' by the sender.
Authenticity	The quality of being genuine or authentic; which is to have the origin supported by unquestionable evidence; authenticated; verified. This includes whether the software or hardware came from an authorized source.
Authorization	The process of determining what types of activities or access are permitted on a network. Usually used in the context of authentication: once you have authenticated a user, they may be authorized to have access to a specific service.
Available	Ready or able to be used
Backup	The ability of one System Element replacing another System Element's functionality upon the failure of that System Element.
Bad Actor	A role played by a user or another system that provides false or misleading data, operates in such a fashion as to impede other users, operates outside of its authorized scope.

Term	Definition
Boundaries	The area of management and control for a System or Object. It could be by latitude/longitude or by county or by regional jurisdictions.
Broadcast	A flow where the initiator sends information on a predefined communications channel using a protocol that enables others who know how to listen to that channel to receive the information. One-to-many communication, with no dialog.
Cardinality	The characterization of the relationship between the number of sender(s) and receiver(s) of a data exchange. (e.g. broadcast (one-to-many) unicast (one to one))
Center	An entity that provides application, management, administrative, and support functions from a fixed location not in proximity to the road network. The terms "back office" and "center" are used interchangeably. Center is a traditionally a transportation-focused term, evoking management centers to support transportation needs, while back office generally refers to commercial applications. From the perspective of this ConOps Specification these are considered the same.
Concept of Operations (ConOps)	A user-oriented document that describes a system's operational characteristics from the end user's viewpoint.
Confidentiality	The property of being unable to read PDU contents by any listener that is not the intended receiver
Configurable Parameter	Non-static data that can be adjustable and updated when needed.
Configuration	Data that is used to customize the operational environment for a System Element or System User, or the System as a whole
Configure	The process of selecting from a set of option(s) or alternative values in order to create a specific operational environment.
Constraint	An externally imposed limitation on system requirements, design, or implementation or on the process used to develop or modify a system. A constraint is a factor that lies outside – but has a direct impact on – a system design effort. Constraints may relate to laws and regulations or technological, socio-political, financial, or operational factors.
Contract	In project management, a legally binding document agreed upon by the customer and the hardware or software developer or supplier; includes the technical, organizational, cost, and/or scheduling requirements of a project.
Control	To exercise influence over.
Coverage Area	A geographic jurisdiction within which the System provides services.
Cyber Address	The cyber or network address of a Unified Implementation of the Reference Architecture object.
Data Consumer	A user or system that is receiving or using data from another user or system. Any Unified Implementation of the Reference Architecture object that registers with and subsequently requests and receives delivery of data from a data warehouse.
Data Provider	Any Unified Implementation of the Reference Architecture object that registers with and subsequently deposits data into a data warehouse A System User that is supplying or transmitting data to another user or system. A data provider is likely to be an aggregator of data.
Data Warehouse	A data storage facility that supports the input (deposit) and retrieval (delivery) of clearly defined data objects. This can be design and implemented in a variety of ways, including publish/subscribe and a traditional query based database.
Decrypt	To decode or decipher data that has previously been encoded in such a way to secure its contents from unauthorized access. See Encryption.
Deployment Benefits	This term refers to the measures of effectiveness used by the NYCDOT and the Independent Evaluator on a periodic basis to assess the benefits realized from the utilization of connected vehicle technology and applications within the project's deployment areas.

Term	Definition
Digital Certificate or Signature	A digital certificate is an electronic "identification card" that establishes your credentials when doing business or other transactions on the Web. It is issued by a certification authority. It contains your name, a serial number, expiration dates, a copy of the certificate holder's public key (used for encrypting messages and digital signatures), and the digital signature of the certificate-issuing authority so that a recipient can verify that the certificate is real. Note: From the SysAdmin, Audit, Network, Security Institute - www.sans.org website.
DNS (Domain Name System)	The internet protocol for mapping host names, domain names and aliases to IP addresses.
Encryption	Scrambling data in such a way that it can only be unscrambled through the application of the correct cryptographic key.
End-User	The ultimate user of a product or service, especially of a computer system, application, or network.
Environment	The circumstances, objects, and conditions that surround a system to be built; includes technical, political, commercial, cultural, organizational, and physical influences as well as standards and policies that govern what a system must do or how it will do it.
Extensibility	The ability to add or modify functionality or features with little or no design changes.
Field	These are intelligent infrastructure distributed near or along the transportation network which perform surveillance (e.g. traffic detectors, cameras), traffic control (e.g. signal controllers), information provision (e.g. Dynamic Message Signs (DMS)) and local transaction (e.g., tolling, parking) functions. Typically, their operation is governed by transportation management functions running in back offices. Field also includes RSU and other non-DSRC wireless communications infrastructure that provides communications between Mobile elements and fixed infrastructure.
Forwarding	The process of forward sending data onto another entity (system user) without modifying or storing the data for any substantial length of time.
Functionality	The capabilities of the various computational, user interfaces, input, output, data management, and other features provided by a product.
Geo-Fence	An electronic set of geo reference points that form a bounded geographic region.
Geo-Referencing	The process of scaling, rotating, translating and de-skewing the image to match a particular size and position. To define something in terms of its physical location in space.
Hardware	Hardware refers to the physical parts of a computer and related devices. Internal hardware devices include motherboards, hard drives, and memory. External hardware devices include monitors, keyboards, mice, printers, and scanners.
Now (N)	Transient Data that is hyper current (relevant at the time of reporting for applications that require sub-second response).
Adjacent (A)	Data that is hyper local (relevant to a geographic area within ~1 minute travel distance)
Recent (R)	Transient Data that is current (relevant at the time of reporting for applications that do not require sub-second response).
Local (L)	Data that is local (relevant to a geographic area within 10 minute travel distance)
Historic (H)	Transient Data that is historical (relevant at the time of reporting for an indefinite interval).
Regional (R)	Data that is regional in scope (relevant to a geographic area greater than 10 minute travel distance).
National (N)	Data that is national in scope.
Continental (C)	Data that is continental in scope.
Static (S)	Data that is permanent (relevant at the time of reporting for an indefinite interval).
Identity Certificate	A certificate that uses a digital signature to bind a public key with an identity - information such as the name of a person or an organization, their address, and so forth. The certificate can be used to verify that a public key belongs to an individual.

Term	Definition
Integrity	To maintain a system that is secure, complete and conforming to an acceptable conduct without being vulnerable and corruptible. The property of being certain that a message's contents are the same at the receiver as at the sender.
Interconnect	The communications link between two architectural objects.
Internet	An interconnected system of networks that connects computers around the world via the TCP/IP protocol.
Issuance	For Anonymous Certificates: Blocks of certificates for a System User which are generated by the Certificate Authority (CA) with mappings between the System User's real identity and the pseudo-identity in the certificates are maintained by the Registration Authority (RA). For Identity Certificates: Blocks of certificates for a System User which are generated by the Certificate Authority (CA) with information such as the name of a person or an organization, their address, etc., maintained by the Registration Authority (RA). Both certificates are installed in the System User equipment by online (through a communication channel with encrypted communications) or offline (mechanisms such as USB download) mechanisms.
Jurisdictional Scope	The power, right, or authority to interpret and apply the law within the limits or territory which authority may be exercised.
Link	A Link is the locus of relations among Nodes. It provides interconnections between Nodes for communication and coordination. It may be implemented by a wired connection or with some radio frequency (RF) or optical communications media. Links implement the primary function of transporting data. Links connect to Nodes at a Port.
Hardware	Hardware refers to the physical parts of a computer and related devices. Internal hardware devices include motherboards, hard drives, and memory. External hardware devices include monitors, keyboards, mice, printers, and scanners.
Now (N)	Transient Data that is hyper current (relevant at the time of reporting for applications that require sub-second response).
Adjacent (A)	Data that is hyper local (relevant to a geographic area within ~1 minute travel distance)
Recent (R)	Transient Data that is current (relevant at the time of reporting for applications that do not require sub-second response).
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Identity Certificate	A certificate that uses a digital signature to bind a public key with an identity - information such as the name of a person or an organization, their address, and so forth. The certificate can be used to verify that a public key belongs to an individual.
Integrity	To maintain a system that is secure, complete and conforming to an acceptable conduct without being vulnerable and corruptible. The property of being certain that a message's contents are the same at the receiver as at the sender.
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Jurisdictional Scope	The power, right, or authority to interpret and apply the law within the limits or territory which authority may be exercised.
Link	A Link is the locus of relations among Nodes. It provides interconnections between Nodes for communication and coordination. It may be implemented by a wired connection or with some radio frequency (RF) or optical communications media. Links implement the primary function of transporting data. Links connect to Nodes at a Port.
Logical Security	Safeguards that include user identification and password access, authentication, access rights and authority levels.
Misbehaving User	A user who exhibits misbehavior.
Misbehavior	The act of providing false or misleading data, operating in such a fashion as to impede other users, or to operate outside of their authorized scope. This includes suspicions behavior as in wrong message types or frequencies, invalid logins and unauthorized access, or incorrect signed or encrypted messages. etc.; either purposeful or unintended
Misbehavior Information	Includes Misbehavior Reports from System Users, as well as other improper System User acts, such as sending wrong message types, invalid logins, unauthorized access, incorrectly signed messages and other inappropriate System User behavior.
Misbehavior Report	Data from a System User identifying suspicious behavior from another System User that can be characterized as misbehavior.
Mobile	These are vehicle types (private/personal, trucks, transit, emergency, commercial, maintenance, and construction vehicles) as well as non-vehicle-based platforms including portable personal devices (smartphones, PDAs, tablets, etc.) used by travelers (vehicle operators, passengers, cyclists, pedestrians, etc.) to provide and receive transportation information
Non-repudiation	The property whereby a PDU is constructed in such a way that the PDU sender cannot effectively deny having been the sender of that PDU; and the PDU receiver cannot effectively deny having received a particular PDU.
On-Board Equipment (OBE)	Computer modules display and a DSRC radio, that is installed and embedded into vehicles which provide an interface to vehicular sensors, as well as a wireless communication interface to the roadside and back office environment.
Operational Data Environment	The ODE consists of several different USDOT developed smart data routers brokering processed data between various data sources, including the Unified Implementation of the Reference Architecture, and a variety of data users (e.g. RDE, TMCs). As a smart data router, the ODE routes data from disparate data sources to software applications (including CV applications) that have placed data subscription requests to the ODE. The ODE also performs necessary security / credential checks and, as needed, data valuation, aggregation, integration and propagation functions.
Operators	These are the day-to-day users of the System that monitor the health of the system components, adjust parameters to improve performance, and collect and report statistics of the overall system.
Permission	Authorization granted to do something. From the System's perspective, permissions are granted to System Users and Operators determining what actions they are allowed to take when interacting with the System.

Term	Definition
Persistent Connection	A connection between two networked devices that remains open after the initial request is completed, to handle multiple requests thereafter. This reduces resource overhead of re-establishing connections for each message sent and received. This is opposite of Session-oriented Connection.
Physical Security	Safeguards to deny access to unauthorized personnel (including attackers or even accidental intruders) from physically accessing a building, facility, resource, or stored information. This can range from simply a locked door to badge entry. with armed security guards
Priority	A rank order of status, activities, or tasks. Priority is particularly important when resources are limited.
Privacy	The ability of an individual to seclude information about themselves, and thereby reveal information about themselves selectively.
Process	A series of actions, changes, or functions bringing about a result.
Protocol Data Unit (PDU)	A defined data structure that is transferred at a peer level between corresponding software entities functioning at the same layer in the OSI standard model which are operating on different computing platforms that are interconnected via communications media .
Public Key	In cryptography, a public key is a value provided by some designated authority as an encryption key that, combined with a private key derived from the public key, can be used to effectively encrypt messages and digitally sign them. The use of combined public and private keys is known as asymmetric cryptography. A system for using public keys is called a public key infrastructure (PKI).
Regional (R)	Data that is regional (relevant to a geographic area within ~30 minute travel distance)
Registry	A repository for maintaining data requester's information including the type of data they are subscribing to, their address, etc.
Reliability	Providing consistent and dependable system output or results.
Repackage Data	Data that is broken down for aggregation, parsing or sampling.
Requirement	(A) A condition or capability needed by a user to solve a problem or achieve an objective. (B) A condition or capability that must be met or possessed by a system component to satisfy a contract, standard, specification, or other formally imposed document. (C) A documented representation of a condition or capability as in definition (A) or (B). (IEEE Std 610.12-1990)
Research Data Exchange	A web-based data resource provided by the USDOT ITS-JPO's Real-Time Data Capture and Management (DCM) program which collects, manages, and provides archived and real-time multi-source and multi-modal data to support the development and testing of ITS applications.
Scalability	The capable of being easily grown, expanded or upgraded upon demand without requiring a redesign.
Scenario	A step-by-step description of a series of events that may occur concurrently or sequentially.
Secure Storage	Encrypted or protected data that requires a user or a process to authenticate itself before accessing to the data. Secure storage persists when the power is turned off.
Secure Transmission	To protect the transfer of confidential or sensitive data usually by encryption, Secure Sockets Layer (SSL), Hypertext Transfer Protocol Secure (HTTPS) or similar secure communications.
Secure/Securely	Referring to storage, which consists of both logical and physical safeguards
Session-oriented Connection	A connection between two networked devices that is established intermittently and to handle few requests thereafter. The connection is meant to be temporary lasting for minutes, hours, but likely not more than a day before it is closed. This is opposite of Persistent Connection.
Software	Software is a general term that describes computer programs. Terms such as software programs, applications, scripts, and instruction sets all fall under the category of computer software.

Term	Definition
States	A distinct system setting in which the same user input will produce different results than it would in other settings. The System as a whole is always in one state. A state is typically commanded or placed in that state by an operator. States are Installation, Operational, Maintenance, Training, and Standby.
Status	Anomalies, actions, intermittent and other conditions used to inform the System Operator for reparation or maintenance.
Subsystem	An integrated set of components that accomplish a clearly distinguishable set of functions with similar or related uses.
Synchronization	the act or results of occurrence or operating at the same time or rate
System	(A) A collection of interacting elements organized to accomplish a specified function or set of functions within a specified environment. Typically, the System Elements within the System are operationally self- contained but are interconnected and collaborate to meet the needs of the System and its Users. (B) A group of people, objects, and procedures constituted to achieve defined objectives of some operational role by performing specified functions. A complete system includes all of the associated equipment, facilities, material, computer programs, firmware, technical documentation, services, and personnel required for operations and support to the degree necessary for self-sufficient use in its intended environment.
System Element	(A) A collection of interacting components organized to accomplish a specified function or set of functions within a specified environment. (B) An object and procedures constituted to achieve defined objectives of some operational role by performing specified functions. A complete system element includes all of the associated equipment, facilities, material, computer programs, firmware, technical documentation, services, and personnel required for operations and support to the degree necessary for self-sufficient use in its intended environment. An integrated set of components that accomplish a clearly distinguishable set of functions with similar or related uses.
System Need	A capability that is identified and supported within the System to accomplish a specific goal or solve a problem
System Performance	This term refers to the measures of effectiveness used by NYCDOT traffic management operations staff on a periodic basis to manage the on-going operation of the system.
System Personnel	This represents the staff that operates and maintains the System. In addition to network managers and operations personnel, System Personnel includes the Administrators, Operators, Maintainers, Developers, Deployment teams, and Testers.
System Requirements Specification (SyRS)	A structured collection of information that embodies the requirements of the system.
System User	System Users refers to Mobile, Field, and Center Systems.
Testers	These users verify the System's operation when any changes are made to its operating hardware or software.
Time	A measurable period during which an action, process or condition occurs.
Time synchronization	Calibration adjustment of date, hour, minutes and seconds for keeping the same time within a system.
Time-of-Day	Current hours, minutes and seconds within a day.
Traceability	The identification and documentation of derivation paths (upward) and allocation or flow down paths (downward) of work products in the work product hierarchy. Important kinds of traceability include: to or from external sources to or from system requirements; to or from system requirements to or from lowest level requirements; to or from requirements to or from design; to or from design to or from implementation; to or from implementation to test; and to or from requirements to test.
Transition	A passage from one state, stage, subject, or place to another
Trust Credentials	A user's authentication information which determines permissions and/or allowed actions with a system and other users.

Term	Definition
Unicast	The sending of a message to a single network destination identified by a unique address.
User	An individual who uses a computer, program, network, and related services of a hardware and/or software system, usually associated with granting that individual with an account and permissions.
User Need	A capability that is identified to accomplish a specific goal or solve a problem that is to be supported by the system.
Valid	When data values within a message are acceptable and logical (e.g., numbers fall within a range, numeric data are all digits).
Validate	To establish or confirm the correctness of the structure, format and/or contents of a data object.

APPENDIX C. Change Request Form V1.0

NYC CVPD Program

NYCDOT

Configuration Control

Change Request

Change Request No.	
Details	
Date	
Requested By	

1. Change Control Process Tracking Sheet

(<to be filled by Change Requestor)

Change Request #	
Name	
Requested By	
Date	

	Start Date	End Date
Required Timing of the change		
Change request generated		
Evaluation by NYCDOT CVPD Team		
Review by NYCDOT CVPD Team		
Forwarded to Change Control Board		
Accepted / Rejected by the Board		
Implementation of Change		
Signoff of Change Request – Systems Engineer		
Sign off Change Request – IT Administrator		
Completed Change Request		

2. Details of the Request for Change

<Section 2 through 4 to be filled by the requestor.>

Date:		
Requestor:		
Details of requested change:		
Requested Timing for the change:		
Name of the Software Package on which change is requested (If applicable) :		
Current Version Number of the Software:		

3. Justification for the Change and Benefits

1	
2	
3	
4	
5	

4. Impacts of the change on the Program

Scope	
Schedule	
Quality	
Cost	
Revenue	
Risk	
Contracts	
Others	

Will the proposed change result in a:

Major Release of the software:	☐
Minor Release of the software:	☐
Fix:	☐
Is Roll Back Possible:	☐

RECOMMENDATION:		
May be Accepted	☐	
May be Accepted after modifications suggested	☐	
May be asked to resubmit with required additional information	☐	
May be rejected	☐	
Reviewed By:		
Date:		

5. Change Control Board

Date	
Time	
Modifications required	
Accepted	☐
Accepted after modifications suggested above	☐
May be asked to resubmit with required additional information	☐
Rejected	☐

Name	Signature	Date
Nader Barhoum – Systems Engineer		
Bob Rausch – Site Lead		
Keith Patton/		
Evgeniy Kudinov – Network Administrator		
Mohamad Talas – Program Manager		

6. Change Implementation Tracking

Date of implementation: **Time :**		
Actions Taken ::		
Implemented By :		
Full name of the software with the New Version number		

6.1 Documents Amended

Document Name	Amended on	Amended by

Change Implementation Completed on:	

6.2 Signoff

Signature		
Name		
Date		

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ITS Joint Program Office-HOIT
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Washington, DC 20590

Toll-Free “Help Line” 866-367-7487
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FHWA-JPO-17-455

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