New York City's
Connected Vehicle Pilot Deployment Project Operational Capability Showcase

ITS Joint Program Office

NYC Connected Vehicle Project
For Safer Transportation

U.S. Department of Transportation

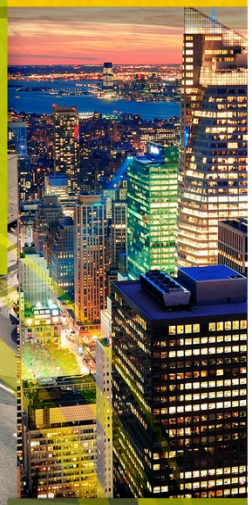
Today's Agenda

- Purpose of this webinar
  - Demonstrate the ***Operational Capability*** of CV safety technology in NYC
  - Share **challenges and lessons learned** in deploying CV technology in NYC

- Webinar Content
  - NYC CV Pilot Deployment Program and Project Overview and Goals
  - NYC CV Pilot Operational Capability Showcase
  - Q&A

- Webinar Protocol
  - Please mute your device during the entire webinar.
  - You are welcome to ask questions in the chatbox. Questions will be answered during the Q&A section at the end.

New York City



Operational Capability Showcase Host

Dr. Mohamad Talas
NYCDOT

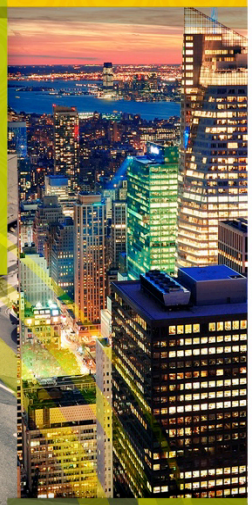
Presenters (Administration)

- **Dr. Mohamad Talas** – NYCDOT, CVPD Project Manager, Director of ITS Management and System Engineering
- **Ken Leonard** – USDOT, Director of ITS Joint Program Office (JPO)
- **Margaret Forgione** – NYCDOT, First Deputy Commissioner
- **Keith Kerman** – NYC DCAS, Chief Fleet Officer and Deputy Commissioner
- **Dr. Jonathan Walker** – USDOT, Chief of Policy, Architecture, and Knowledge Transfer

Presenters (Technical)

- **David Benevelli** – JHK Engineering (TransCore), CVPD System Engineering Lead
- **Dr. Kaan Ozbay** – NYU, Professor at the Dept of Civil and Urban Engineering (CUE) Director of the C2SMART Center
- **Eric Richardson** – NYC DCAS, Deputy Chief Fleet Management Officer
- **Keir Opie** – Cambridge Systematics, CVPD Performance Measurement Lead
- **Bob Rausch** – JHK Engineering (TransCore), CVPD System Deployment Lead
- **Dr. Arthur O'Connor** – USDOT, Sr. ITS/Operations Engineer Office of Program Management

New York City



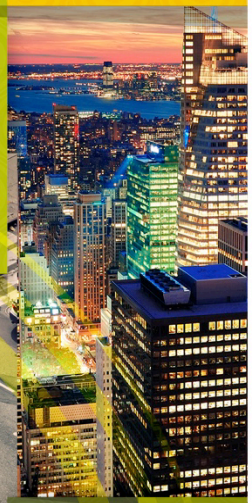
USDOT Connected Vehicle Pilot Program

Ken Leonard
USDOT


Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

New York City



NYCDOT Vision Zero and CV Program

Margaret Forgione
NYCDOT

NYCDOT CV Participation

VISION ZERO

"Traffic Death and Injury on City streets is not acceptable"

Source: USDOT

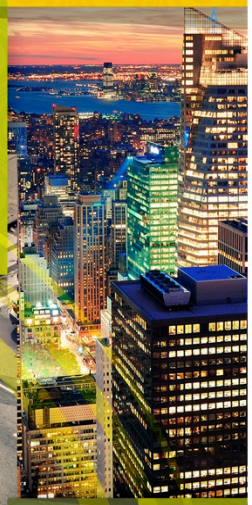
The NYC pilot will evaluate the **safety** benefits and challenges of implementing CV technology with a **significant number of vehicles** in the **dense urban environment.**

NYC Transportation Challenges


Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

New York City



NYC Fleet Management and DCAS Participation

Keith Kerman
NYC DCAS

NYC and US DOT Partnership

NYC Safe Fleet Transition

Safe Fleet Transition Plan

Tier 1	Tier 2 Best Practice Technologies	Tier 3 Exploratory Technologies
High vision truck cabs where competitively available and operationally feasible *§	**Pedestrian AEB for medium- and heavy-duty vehicles where available (Class 3-8) * §**	Alcohol touch ignition interlock §
Additional mirrors/lenses where applicable including Fresnel lenses *	Blind spot monitors	Cell phone physical or app-based lock box/ docking station ignition interlock §
Appropriate technologies and techniques to see behind vehicle, such as but not exclusive to backup cameras	Enhanced Seat Belt Reminder systems (ESBRs)	Seatbelt assurance ignition interlock systems §
Forward Collision Warning (FCW) and Pedestrian Collision Warning (PCW) for Class 1 and 2	Navigation systems	Surround cameras *
Automatic Emergency Braking (AEB) for light-duty vehicles (Class 1-2) with Advanced Pedestrian Monitoring as preferred option where available §	Power mirrors and heated mirrors *	Turning alarms *
Automatic headlights where available	Speed governors * §	**Universal design**
Enhanced truck rear underride guards *	**Connected vehicle, or vehicle-to-vehicle (V2V), communication technology**	**Rear Automatic Emergency Braking (AEB) for light-duty vehicles (Class 1-2) §**
Safety lights for work trucks, such as but not exclusive to side-visible turn signals and roadwork lights (amber)	**Broadband backup alarms +**	**Intelligent Speed Assistance (ISA) §**
Side underride guards * consistent with Local Law	**Rear Automatic Emergency Braking (AEB) for heavy-duty vehicles with air brakes * §**	Automatic Emergency Braking (AEB) for medium- and heavy-duty vehicles (Class 3-8) * §
Self-adjusting volume backup alarms +	**Forward Collision Warning (FCW) and Pedestrian Collision Warning (PCW) for Class 3 and above**	
Telematics to enable utilization, collision, speed, and safety reporting, among other uses	**External Cameras and Recording**	
Warning decals *	**Training where feasible in appropriate use of technologies**	

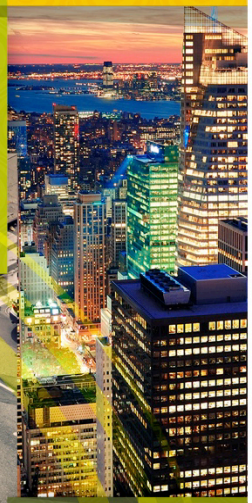
Note: Entries in **bold** are potential updates for 2018 (see explanations below)

* = Only apply to vehicles with gross vehicle weight rating of 10,000 lbs. or greater.


Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

New York City



USDOT CV Program Goals

Dr. Jonathan Walker
USDOT

CONNECTED VEHICLE PILOT DEPLOYMENT PROGRAM

PROGRAM GOALS

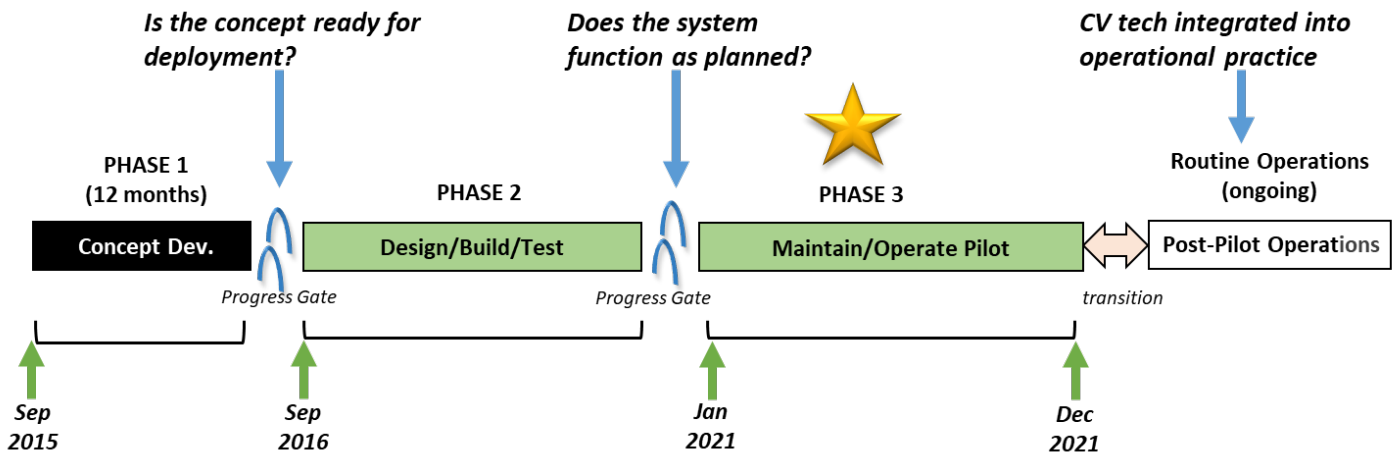
PILOT SITES

WYDOT

NYCDOT

Tampa (THEA)

NYCDOT SCHEDULE



CV Pilot Deployment Objectives

- Transition from research and development to practical sustainable deployment of CV infrastructure and applications
- Provide a roadmap for future deployers:
  - CV Pilots utilized the Systems Engineering Process to lead and inspire future developers of connected vehicles
  - CV Pilots produced a common documentation set for reference by future deployers
  - CV Pilots demonstrated their devices are interoperable

CV Pilots Interoperability Test

- Dates/Location:
  - June 25 – 28, 2018 at FHWA Turner-Fairbank Highway Research Center (TFHRC)
- Participating Organizations (63 attendees in total):
  - USDOT, technical support contractor (Noblis), Saxton Laboratory (STOL) contractor (Leidos)
  - New York City Pilot: NYCDOT and Transcore
  - Tampa Pilot: THEA, HNTB, Siemens, CUTR and Brandmotion
  - Wyoming Pilot: ICF and Neaera Consulting Group
  - OBU/RSU Vendors: Commsignia, Danlaw, Lear, Savari, Siemens and Sirius XM
  - Others: Certification (OmniAir), Independent Evaluator (TTI), Photographers (BAH)

Video: https://youtu.be/0dja4B9qCSU

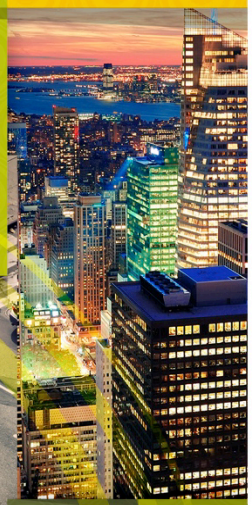

Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

New York City

NYCDOT CV Project Goals and Accomplishments

Dr. Mohamad Talas
NYCDOT



Project Objectives

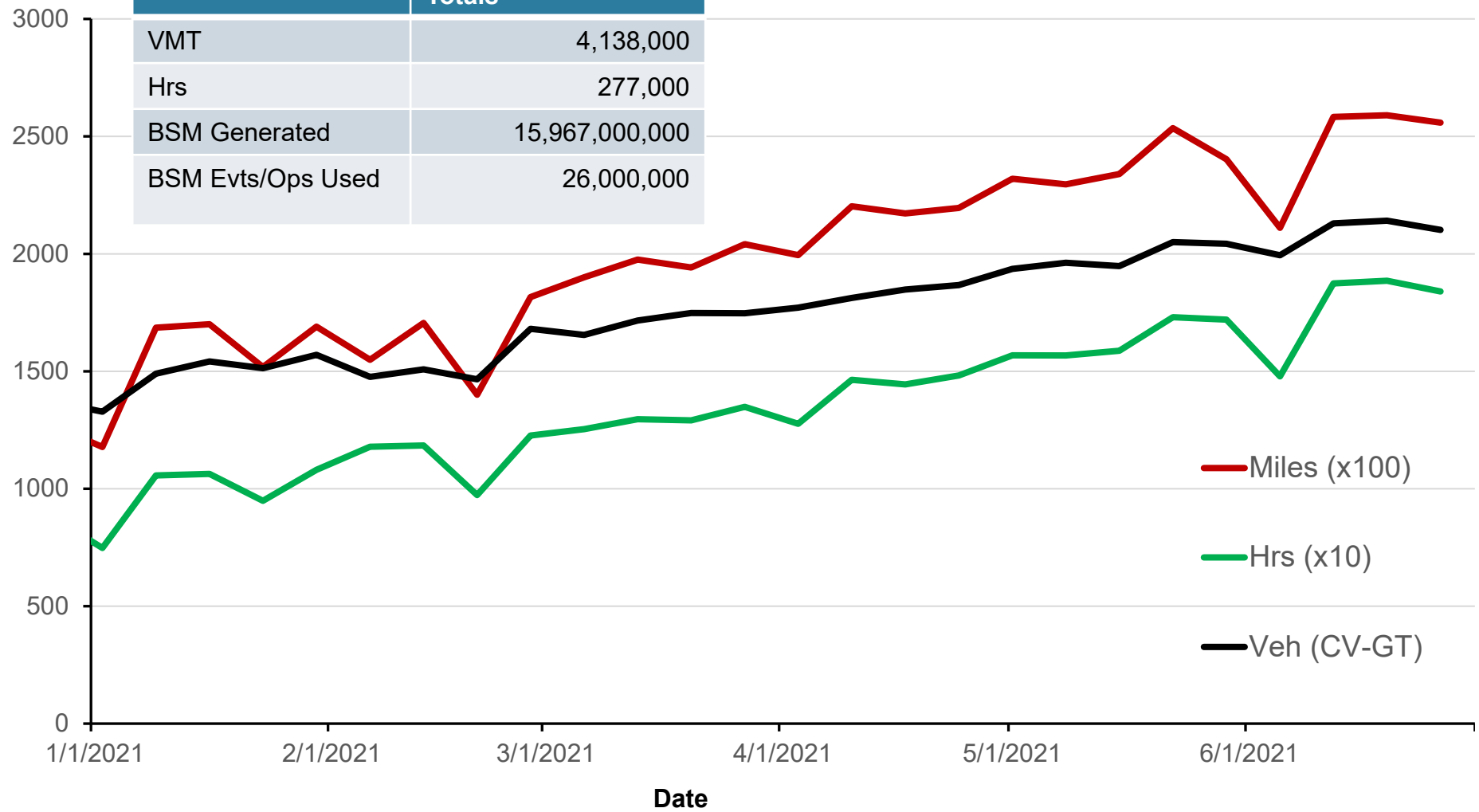
- Support the Vision Zero initiative by providing drivers with information regarding potential safety situations
- Provide the opportunity for selected NYC fleets to be early adopters of this safety-focused technology
- Create a CV technology deployment to inspire spreading the technology throughout North America
- Support the overall CV technology implementation by providing project experience, benefits, and feedback regarding the challenges and opportunities for implementing this technology in a **dense urban environment**

NYC CV Infrastructure

- Infrastructure: **450** Roadside Units (RSU)
- Vehicles: 2800+ increasing to **3000**
- Safety applications: **13**
- Operations applications: 8
- This is a ***large-scale*** deployment with ***challenges***:
  - Location accuracy – urban canyons
  - RSU density
  - Application arbitration/interference
  - DSRC media only – channel management
  - First full-scale security deployment
  - Security boundary expanded to include all ITS communications
- Utilize edge computing concepts to minimize bandwidth

Fleet Weekly Operations

Criteria	Jan 3 – May 29, 2021 Totals
VMT	4,138,000
Hrs	277,000
BSM Generated	15,967,000,000
BSM Evts/Ops Used	26,000,000



Project Accomplishments

- Infrastructure installation of RSU and OBU/ASD
- Proven operational concepts for managing CV devices
- Improved CV device operations with improvements in the areas of:
  - Location accuracy
  - Safety applications
  - Security operations
  - Communications
  - Spectrum utilization
- Extensive project deployment lessons are contributing to further standards evolution and procurement guidelines


Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

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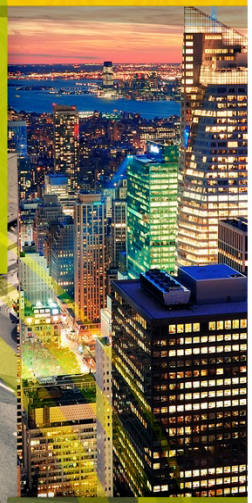


NYCDOT CV Safety Applications

David Benevelli
JHK Engineering

Manhattan South Crashes

Additional Information | About

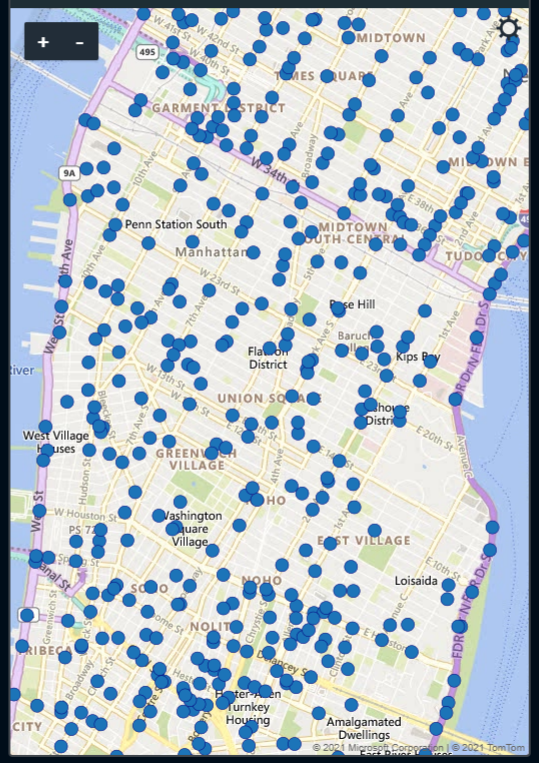
Patrol Borough: Citywide | Precinct: Manhattan South

NYPD TrafficStat

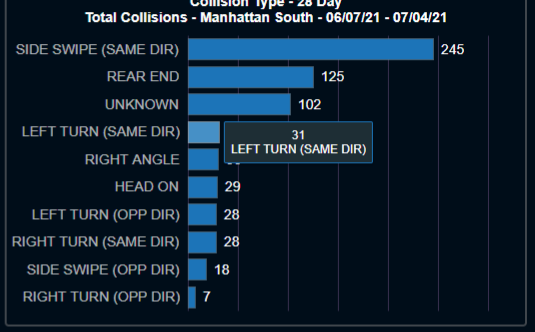
TrafficStat Book — Week of 06/28/21 - 07/04/21

	Week to Date			28 Day			Year to Date		
	2021	2020	% Chg	2021	2020	% Chg	2021	2020	% Chg
Total Collisions	117	125	-6.4 %	643	386	66.6 %	3,474	4,487	-22.6 %
Collisions w/ Injuries	42	49	-14.3 %	202	141	43.3 %	1,108	940	17.9 %
Total Injuries	45	60	-25.0 %	230	167	37.7 %	1,297	1,105	17.4 %
Occupant Injuries	27	31	-12.9 %	119	93	28.0 %	676	607	11.4 %
Pedestrian Injuries	9	7	28.6 %	46	17	170.6 %	298	246	21.1 %
Bicycle Injuries	9	22	-59.1 %	65	57	14.0 %	323	252	28.2 %
Fatalities									

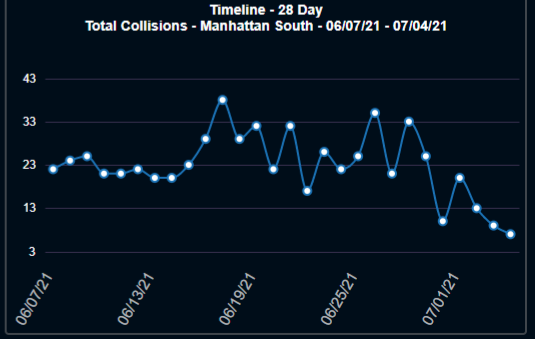
Incident Map



Sort: Collision Type | Chart Style: Bar



Timeline: Daily | Chart Style: Line



This page displays the NYPD's Traffic statistics as recorded in the TrafficStat book. TrafficStat periods run Monday through Sunday. All figures reflect statistics from the end of the most recent TrafficStat period. The data and information on this website is for informational purposes only.Only the first 5,000 records associated with any given field will be mapped, but all of the data will be available in the analytics panels. For best mapping services, select a specific Patrol Borough or Precinct.
The data presented on this page are preliminary and subject to change. Reasons for this may include re-classifications of deaths later determined to be unrelated to traffic collision, or delays in determining a death from traffic collision that occurred on a date subsequent to the actual crash. A comparison of current and previous year data may not be valid or statistically meaningful.
As of August of 2019 E-Bikes have been reclassified as bicycles rather than motor vehicles. E-Bike riders are therefore no longer counted as "Occupant Injuries" but as "Bicycle Injuries". This has had the effect of increasing "Bicycle Injuries" and decreasing "Occupant Injuries".

4-week period ending July 4, 2021 Total: 643

CV Applications - 1

Vehicle-to-Vehicle (V2V) Safety Applications

▪ Forward Collision Warning	FCW
▪ Emergency Electronic Brake Light	EEBL
▪ Blind Spot Warning	BSW
▪ Lane Change Warning/Assist	LCA
▪ Intersection Movement Assist	IMA
▪ Vehicle Turning Right in Front of Bus Warning	VTRW

CV Applications - 2

Vehicle-to-Infrastructure (V2I) Safety Applications

- Red Light Violation Warning RLVW
- Speed **Compliance** SPDCOMP
- Curve Speed **Compliance** CSPDOMP
- Speed **Compliance**/Work Zone SPDCMPWZ
- Oversize Vehicle **Compliance** OVC
  - Prohibited Facilities (Parkways)
  - Over Height
- Emergency Communications and Evacuation Information *(Using the traveler information features)* EVACINFO

CV Applications - 3

Other Applications

- Pedestrian in Signalized Intersection Warning PEDINXWALK
- Mobile [Visually Impaired] Ped Signal System PED-SIG
- CV Data for Intelligent Traffic Signal System I-SIGCVDAT

Operations, Maintenance, and Performance Analysis

- RF Monitoring RFMON
- OTA Firmware Update FRMWUPD
- Parameter Up/Down Loading PARMLD
- Traffic data collection TDC
- *Event History Recording* *EVTRECORD*
- *Event History Up Load* *EVTCOLLECT*

To Meet USDOT Requirements for Benefit Analysis

CV Safety Applications Video

NEW YORK CITY DOT

NYC Connected Vehicle Pilot

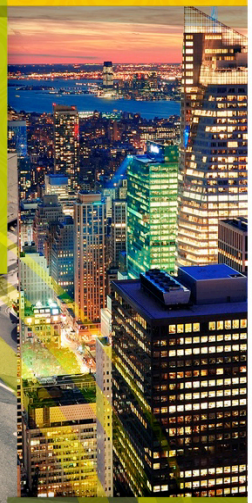
For Safer Transportation

www.cvp.nyc


Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

New York City



NYC CV Pedestrian Signal Application

Dr. Kaan Ozbay
NYU

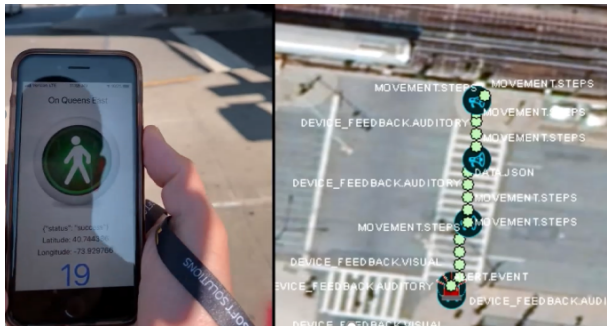
Pedestrian Signal Application

PED-SIG: Mobile Accessible Pedestrian Signal System

Advancing Social Equity with CVs

Assist visually impaired pedestrians in safely crossing the streets

- Equip 25+ pedestrians with a Personal Information Devices (PID)
- Field tests with predefined routes
- Obfuscate, encrypt, and transmit data to secure servers to protect privacy
- Learn the participants' experiences through the CV-equipped intersections

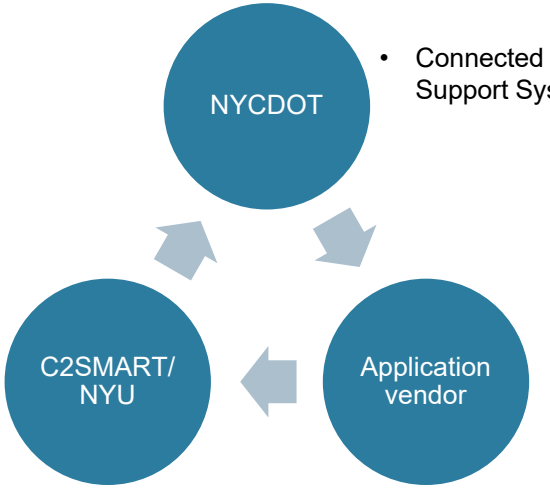


Pedestrian Information Device (PID)

Pedestrian Signal Application

Visually Challenged Pedestrian Application Context Diagram

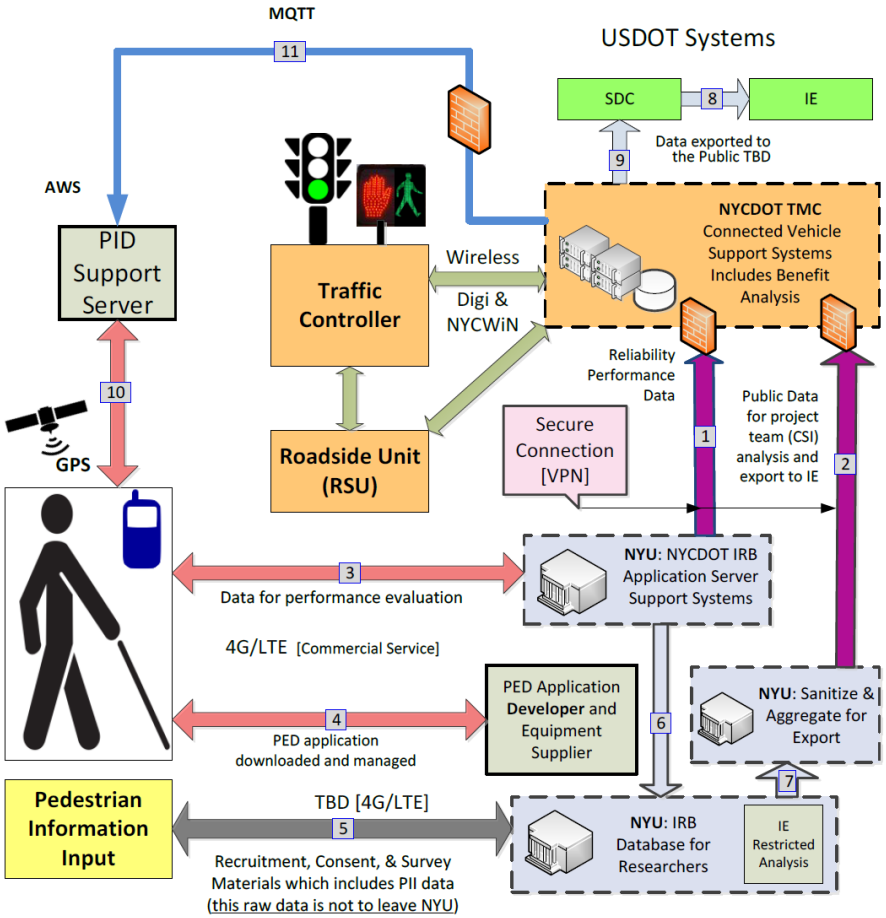
- Encrypt the collected data and transmit the encrypted data to a configured IP address through the broad-band carrier service



- Connected Vehicle Support System

- Participant coordination and support
- Transmit obfuscated data
- Database management
- Performance Evaluation

- Mobile application development and testing



Pedestrian Signal Application

Data necessary for the PED-SIG application:

- PID Operations Logs
- Field test observations
- Pre- and Post Experiment Survey

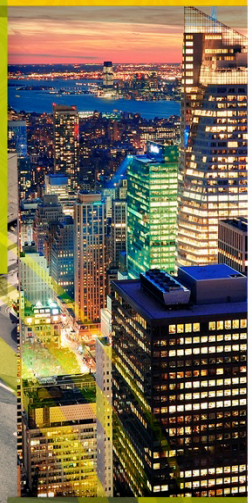
Challenges in testing the PED-SIG application in NYC urban environment

- **COVID-19 pandemic impacts:** New precautions will need to be taken. **Proposed solution:** Follow COVID-19 mitigation strategies required by local research sites
- **Smartphone-based issues:** For example, the digital compass needing recalibration when the phone is near a large metal object in the environment. **Proposed solution:** Designed routes with multiple batches of participants + field tests accompanied by IRB-certified NYU researchers to ensure safety

Aggregated Performance Measures for the PID / PED-SIG Application

- Pedestrian Crossing Speed and crossing Travel Time
- Pedestrian Crossing Waiting Time
- PID Compliance Rate
- Inadequate Crossing Time
- Pedestrian Crossing Violations
- Time to Step into the Crosswalk when Walk Phase is On
- Times Out of Crosswalk

New York City



NYC CV Stakeholder Participation

Eric Richardson
NYC DCAS

NYC Fleet Participating Agencies

- Department of Transportation (DOT)
- Parks Department (Parks)
- Department of Corrections (DOC)
- Department of Buildings (DOB)
- Dept. of Environmental Protection (DEP)
- Dept. of Homeless Services (DHS)
- Taxi and Limousine Commission (TLC)
- Human Resources Administration (HRA)
- Administration for Children's Services (ACS)
- Dept. of Design and Construction (DDC)
- Housing Preservation & Development (HPD)
- Office of Chief Medical Examiner (OCME)
- Dept. of Education (DOE)
- Dept. of Health and Mental Hygiene (DHMH)
- Office of Emergency Management (OEM)
- Dept. of Consumer Affairs (DCA)
- Dept. of Info. Tech. & Telecom. (DOITT)

Safe Fleet Transition Plan

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High vision truck cabs where competitively available and operationally feasible *§	**Pedestrian AEB for medium- and heavy-duty vehicles where available (Class 3-8) * §**	Alcohol touch ignition interlock §
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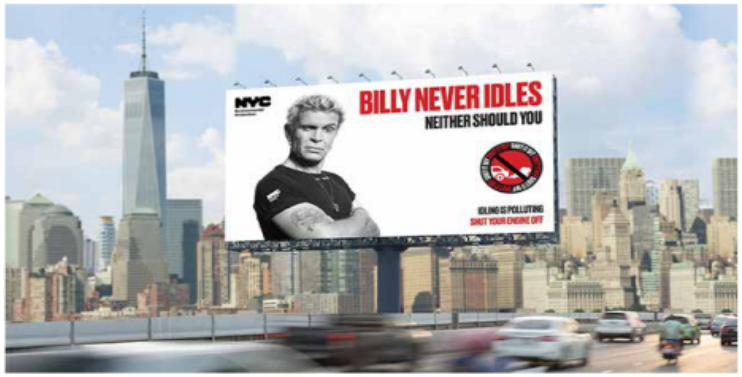
NYC in Real Time

telematics



NYC in real time

New York's new telematics command centre is not only transforming fleet management, it is also improving the delivery of direct services and enhancing core operations, writes NYC Chief Fleet Officer Keith Kerman.

Author
Keith Kerman

Above: In February 2020, Mayor de Blasio and rocker Billy Idol announced a campaign to reduce idling: Billy Never Idles.
Top right: NYC fleet units are everywhere in the city.

The alert came in the morning of April 1, 2021. A van belonging to the NYC Department of Education was missing and may have been stolen.

Once missing for a full day or more, the prospects of recovering a stolen City vehicle have historically been slim. No longer.

Immediately, a team from the Department of Citywide Administrative Services (DCAS), which runs the City vehicle fleet, the Department of Education (DOE), and the New York City Police Department (NYPD) worked together to track the missing vehicle online, follow it in person, arrest the perpetrators, and recover the vehicle.

The recovery was made possible through NYC's new Fleet Office of Real Time Tracking (FORT), a command centre for more than 23,000 City vehicles and school buses that have been fitted with telematics tracking devices. It is the largest public vehicle telematics programme in the US and a model for efforts in public and private fleets for safety, efficiency, and fleet operations.

FORT is transforming fleet management in the City through the provision of new ways to track vehicle utilisation, safety, fuel economy, driving behaviours, crashes, and maintenance. While implemented by DCAS, FORT is also an exciting new tool for improving delivery of direct services and enhancing core operations.

Advancing the safety agenda

New York City's Vision Zero Safety plan was the initial impetus for the FORT. The City of New York has made enormous strides in reducing crashes involving fleet units. Despite

telematics

this, fleet units are involved in more than 4,700 crashes a year. The City paid out more than US $140 million (£99 million) last year in personal injury claims tied to fleet crashes. Some involved major injury or loss of life, which it is Vision Zero's goal to prevent.

DCAS proposed the installation of live tracking on all fleet units to monitor and improve safe driving behaviours with the aim of preventing crashes. The FORT monitors speeding, seatbelt use, hard acceleration and braking, and harsh cornering. When an employee is speeding, a real-time alert goes out to their agency. A Vehicle Safety Index was developed to scorecard the safety behaviour of each specific vehicle and each agency and compare them to each other.

Through the Safety Index, DCAS is monitoring daily and historic data on a per mile basis to assess the success of its training, technology, and other safety measures.

'Ensuring that agency fleet managers and senior executives have a set of regular reporting that can easily explain serious and specific issues, the frequency of these events, and how agencies compare internally is an important part of spreading a fleet safety culture to all city drivers,' explains Eric Richardson, Deputy Chief Fleet Manager at DCAS. 'We want our drivers to be the model of safe driving, and these safety scorecards allow us to confirm we are making progress.'

While the goal is crash avoidance, the telematics system has also improved crash management. When a vehicle is in a crash based on a G-force event, an automated potential collision alert goes out. This provides initial crash data – location, speed, and which part of the vehicle was impacted – instantly alerts the agency, and serves as the initial record for the crash. These records are independent of driver assessments and can help the City defend claims and pursue affirmative litigation where private vehicles hit City units.

In some cases, potential collision alerts are due to road conditions. These can be reported to the NYC Department of Transportation for investigation. Depending on the type of collision and the G-force, there may even be alerts when vehicles are hit while parked. The instantaneous nature of alerts allows the City to quickly follow up with emergency services if required and check with the driver.

In major crashes, the telematics system can reproduce the core of black box information. Retrieving event data recorder data has proved difficult, costly, and time-consuming. Telematics can more easily provide granular speed, turning, braking force, and airbag data.

Analysis of telematics data is also informing the City's ongoing in-person and online training efforts. DCAS is refocusing training on trends in the data and showing the data to drivers during the training sessions.

Telematics for sustainability

In the City budget, the FORT was expected to pay for itself through crash savings. But safety isn't the only way FORT can reduce costs. Mayoral Executive Order 41 of 2019 implemented the mandate for telematics in City on-road vehicles. This order also calls for the City to implement an 80% daily-use fleet target and reduce fleet size by at least 1,000 vehicles. The City achieved the fleet reduction ahead of the June 30 2021 deadline.

The FORT is also helping the City with its sustainability goals. In the NYC Green Fleet Plan, NYC committed to reducing vehicle fuel use and emissions by 50% by 2025. The FORT provided new information about the fuel economy of City vehicles, the efficiency of electric vehicles, and provided new ways to report and understand wasteful vehicle idling.

When a new vehicle is purchased, it has an EPA fuel economy rating. Using telematics, NYC studied the actual fuel economy of each model of vehicle and compared it to the sticker rating. In the DCAS report, it found that hybrids in actual use – of which there are 5,500 – were even more efficient than expected when compared to conventional vehicles. Less happily, the system revealed that NYC has work to do to reduce vehicle idling. For the first time, agencies now get reports on idling over three minutes, which is against the law in New York City. In February 2020, Mayor de Blasio and rocker Billy Idol announced a campaign to reduce idling: Billy Never Idles. Telematics is now the City's main tool to follow Billy's lead.

The City is also transitioning its fleet to EVs and is studying actual battery range and functioning and plans a report on EV operations similar to the fuel economy study.

Preventing misuse of City vehicles

The City of New York has 80,000 full or part-time fleet operators, so misuse of City vehicles does happen. However, telematics has supplied a powerful tool to reduce these events and identify staff using vehicles improperly.

Each day, fleet managers get a daily report about vehicle usage, which identifies speeding and crashes and also lists every vehicle used overnight or that left city limits. The City always has the pulse of its vehicles now with live telematics, regular reporting, and FORT.

Improving safety and vehicle maintenance

Vehicle tracking can also help keep people, especially children, safe. NYC Local Law 32 of 2019 requires the City to place tracking units on school buses to ensure the location of the over 10,000 contracted school buses. DCAS worked closely with the NYC DOE to install units on 10,751 school buses operated by 37 companies. In addition, DCAS provides the DOE with a full set of fleet management reports and alerts.

'Working through the Fleet Office of Real Time Tracking (FORT) and DOE Office

NYC Fleet Show: CV on Display

NYC Parks

32nd ANNUAL EQUIPMENT & VEHICLE SHOW

Rescheduled Date:
Wednesday, September 22,
9am to 2pm
Rain Date: Friday, September 24

Flushing Meadows Corona Park,
Queens, by the Unisphere

This show highlights vendors who support NYC's Clean Fleet and Vision Zero initiatives, as well as daily operations. We will have vendors offering a wide array of products to improve vehicle safety including cameras, truck side guards, systems to track and manage fleets, and systems to avoid or mitigate collisions. The show also highlights vehicles and equipment with alternative fuels and emissions reducing technologies, along with the latest in light and heavy-duty vehicles, trucks, horticultural equipment, tools, fleet services, and more.

Free to all exhibitors and attendees.

RSVP forms will be available soon at
https://www1.nyc.gov/site/dcas/agencies/fleet-news.page

Accessibility Questions?
Contact DCAS Accessibility at 212-386-0256, or accessibility@dcas.nyc.gov by Wednesday, September 15.

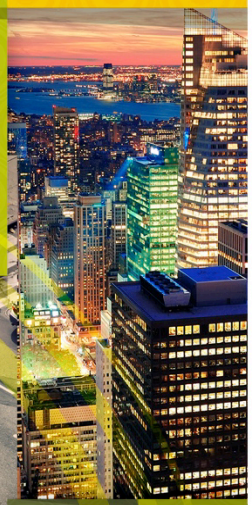
NYC Fleet

NYC DCAS
Citywide Administrative Services

#ONENYC

VISION ZERO
nyc.gov/visionzero

New York City



NYC CV Performance Measurement

Keir Opie
Cambridge Systematics

Performance Measurement Program

- **Safety is Job #1.**
  - Once alerts are activated in a vehicle, they won't be silenced.
- User Needs related to Performance Measurement
  - ***Maintain privacy of users throughout pilot and data collection***
  - ***No enforcement***
  - ***No driver evaluation***
- Consider impacts of CV data combined with data from other sources.
- Approach to collecting the performance information.
- Approach to using data collection bins of performance information.
- Control Group vs. Treatment Group

Performance Measures

FHWA-JPO-16-302

Connected Vehicle Pilot Deployment Program Phase 2

Performance Measurement and Evaluation Support Plan – New York City

www.its.dot.gov/index.htm
FINAL REPORT — January 13, 2020
Updated: March 31, 2021

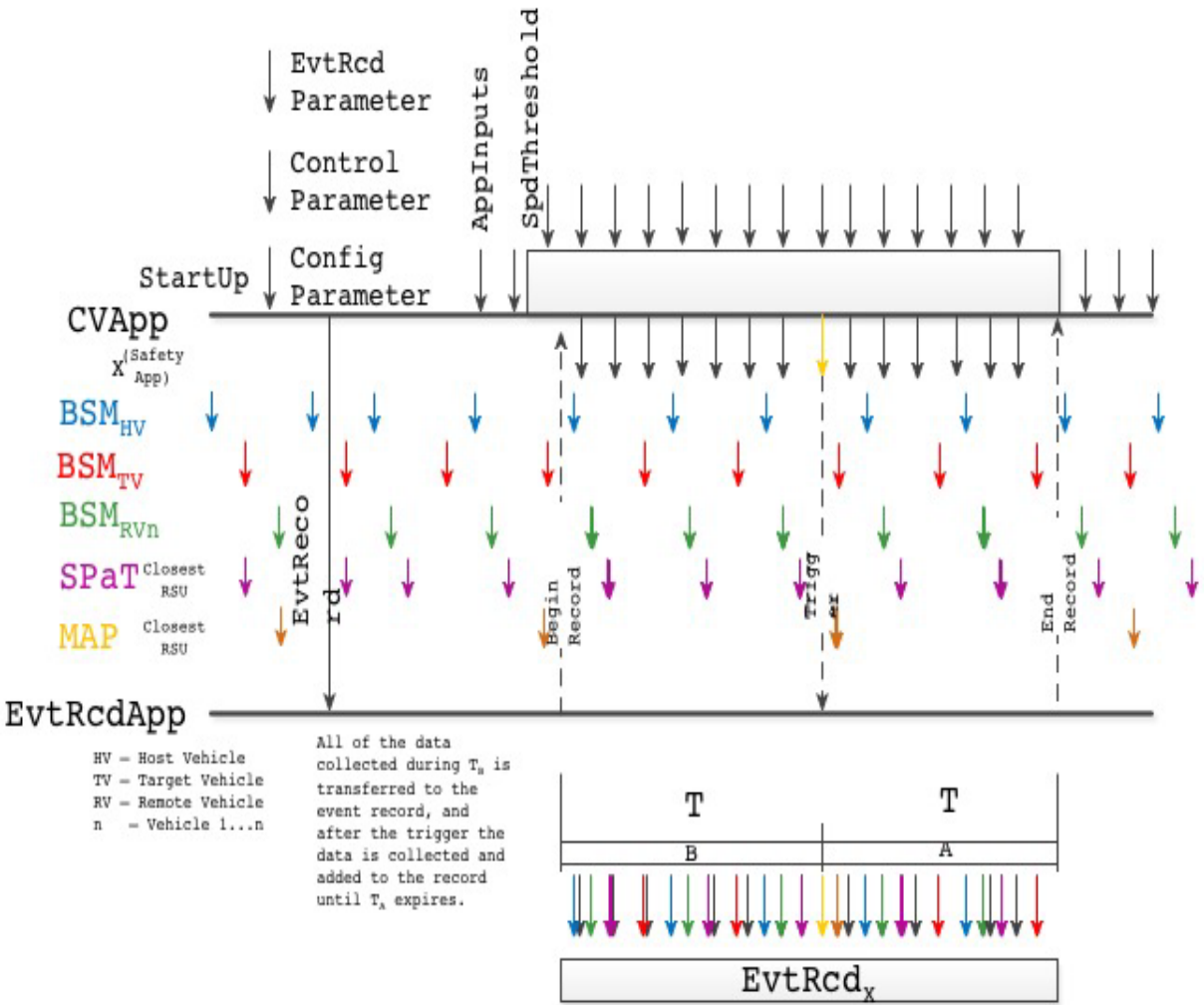
FHWA-JPO-16-302

U.S. Department of Transportation

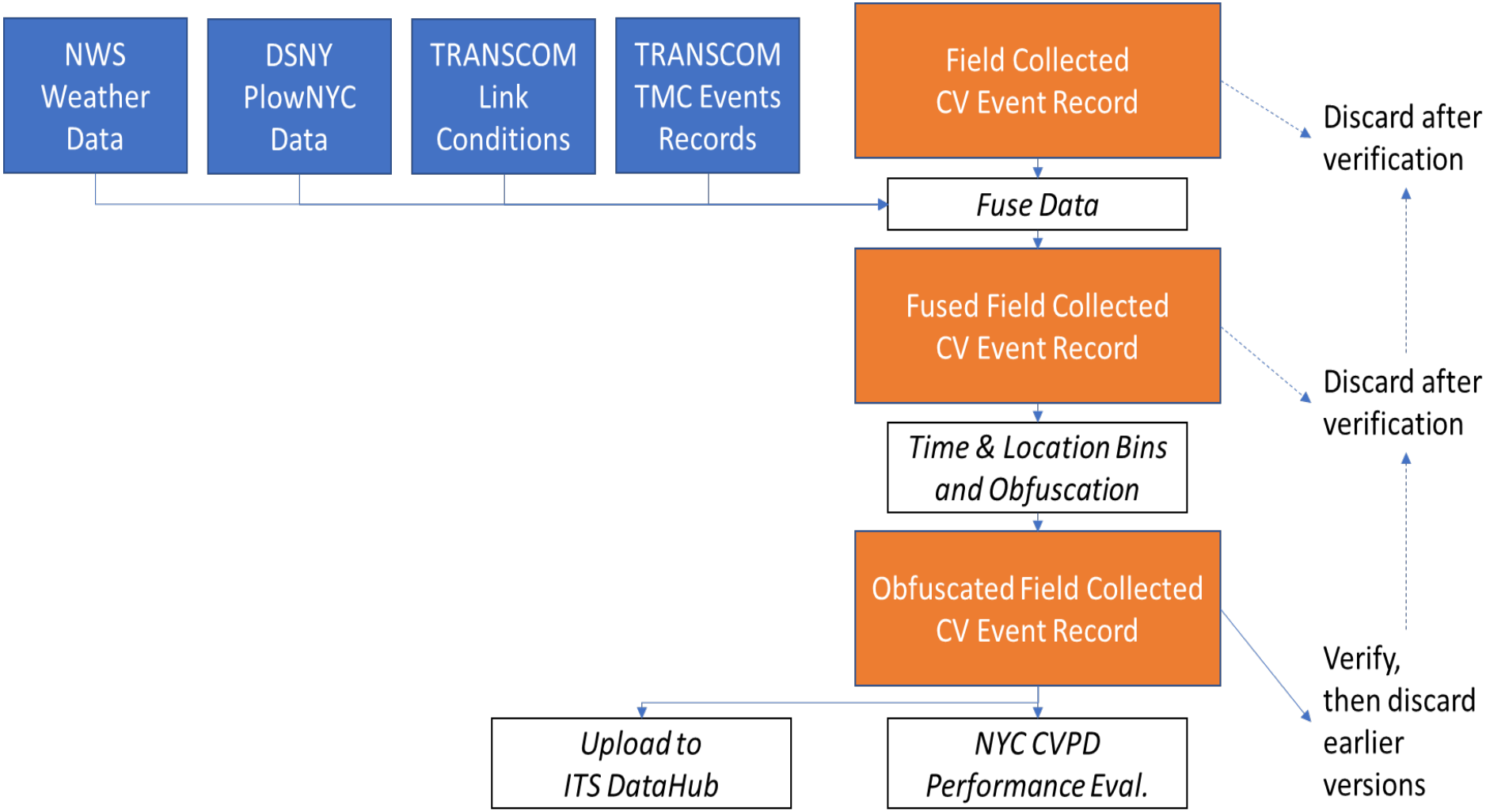
User Need	Category	NYCDOT Needs	CV Application	No.	Performance Measure Metrics	Question for Evaluation
Manage Speeds	Safety, Mobility	Discourage Spot Speeding	Speed Compliance	1	1a. Number of stops (average and distribution measures) 1b. Speeds (average and distribution measures) 1c. Emissions 1d. Reduction in speed limit violations 1e. Speed variation 1f. Vehicle throughput (average and distribution measures) 1g. Driver actions and/or impact on actions in response to issued warnings	Does speed limit adherence increase and speed variability decrease within the vehicle fleet on a given study roadway segment for a given time period (cycle length basis) from the Before period to the Pilot period, and from control group to the treatment group? Is this accompanied by an overall increase, decrease or no change in average segment speed?
Manage Speeds	Safety	Improve Truck safety	Curve Speed Compliance	2	2a. Speed related crash counts, by severity 2b. Vehicle speeds at curve entry 2c. Lateral acceleration in the curve 2d. Driver actions and/or impact on actions in response to issued warnings 2e. Number of curve speed violations at each instrumented location	Do the number of curve speed violations on each applicable studied roadway segment decrease from the Before period to the Pilot period, and from control group to the treatment group?
Manage Speeds	Safety	Improve Work Zone Safety	Speed Compliance / Work Zone	3	3a. Speed in work zone (average and distribution measures) 3b. Speed variation (distribution) at work zone 3c. Number of vehicle speed limit violations in variable speed zone areas 3d. Driver actions and/or impact on actions in response to issued warnings	Do the number of work-zone speed violations on each applicable studied roadway type decrease from the Before period to the Pilot period, and from control group to the treatment group?
Reduce Vehicle to Vehicle Crashes	Safety	Reduce Vehicle to Vehicle Accidents	FCW EEBL BSW LCW IMA	4	4a. Fatality crash counts 4b. Injury crash counts 4c. Property damage only crash counts 4d. Time to Collision (vehicle to vehicle)	Do the number of reportable crashes decrease from the Before period to the Pilot period, and from control group to the treatment group?
Reduce Vehicle to Vehicle Crashes	Safety	Reduce Accidents at High Incident Intersections	Red Light Violation Warning	5	5a. Red light violation counts 5b. Time To Collision (vehicle to cross vehicle path) at the intersection 5c. Driver actions and/or impact on actions in response to issued warnings	Do the number and severity of red-light violations at each studied intersection decrease from the Before period to the Pilot period, and from control group to the treatment group?
Reduce Vehicle to Vehicle Crashes	Safety	Reduce Bus Incidents, Improve Safety	Vehicle Turning Right in Front of Bus Warning	6	6a. Right-turning related conflicts 6b. Time to collision (vehicle to bus) 6c. Number of warnings generated 6d. Driver actions and/or impact on actions in response to issued warnings	Do the number of bus / right turn vehicle crashes decrease from the Before period to the Pilot period, and from control group to the treatment group?
Reduce Vehicle to Pedestrian Crashes	Safety	Improve Pedestrian Safety on Heavily Traveled Bus Routes	Pedestrian in Signalized Crosswalk Warning	7	7a. Pedestrian related crash counts, by severity 7b. Number of warnings generated 7c. Pedestrian-related conflicts/hard braking events 7d. Time to collision (vehicle to pedestrian) 7e. Driver actions and/or impact on actions in response to issued warnings	Do the number of pedestrian related crashes decrease from the Before period to the Pilot period, and from control group to the treatment group?
Reduce Vehicle to Pedestrian Crashes	Safety	Improve Safety of Visually and Audibly-impaired pedestrians	Mobile Accessible Pedestrian Signal System (PED-SIG)	8	8a. Qualitative Operator Feedback 8b. Pedestrian Crossing Speed and Crossing Travel Time 8c. Times Out of Crosswalk 8d. Waiting time at intersection for crossing	Does the mobile app improve participants' perceived safety when crossing signalize intersection?
Reduce Vehicle to Infrastructure Crashes	Safety	Address Bridge Low Clearance Issues/Enforce Truck Route Restriction	Oversized Vehicle Compliance	9	9a. Number of Warnings generated 9b. Number of truck route violations	Do the number of low clearance violations decrease from the Before period to the Pilot period, and from control group to the treatment group?
Inform Drivers of Serious Incidents	Mobility	Inform Drivers	Emergency Communications and Evacuation Information	10	Number of vehicles receiving information when generated	Do CV vehicles receive the information warnings when generated?
Provide Mobility Information	Mobility	Replace Legacy Measurements	Intelligent Traffic Signal System Connected Vehicle Data (I-SIGCVDATA)	11	11a. Segment speed (average and distribution measures) from CV compared to legacy detection systems 11b. Travel time (average and distribution measures) from CV compared to legacy detection systems	Do the CV based mobility metrics compare favorably to legacy detection systems or provide better information?
Manage System Operations	System Operations	Ensure Operations of the CV Deployment	NA	12	System performance statistics (system activity, down time, radio frequency monitoring range on ASD's and RSU's, number of event warnings by app)	Does the system operate reliably?

CV Event Records

- Data from ASD/OBU to time period surrounding a warning issued
- Detailed information:
  - Identifies exact time and precise location
  - Records detailed vehicle trajectory and movement
- Data retention keeps data from event until it can be transmitted to the TMC

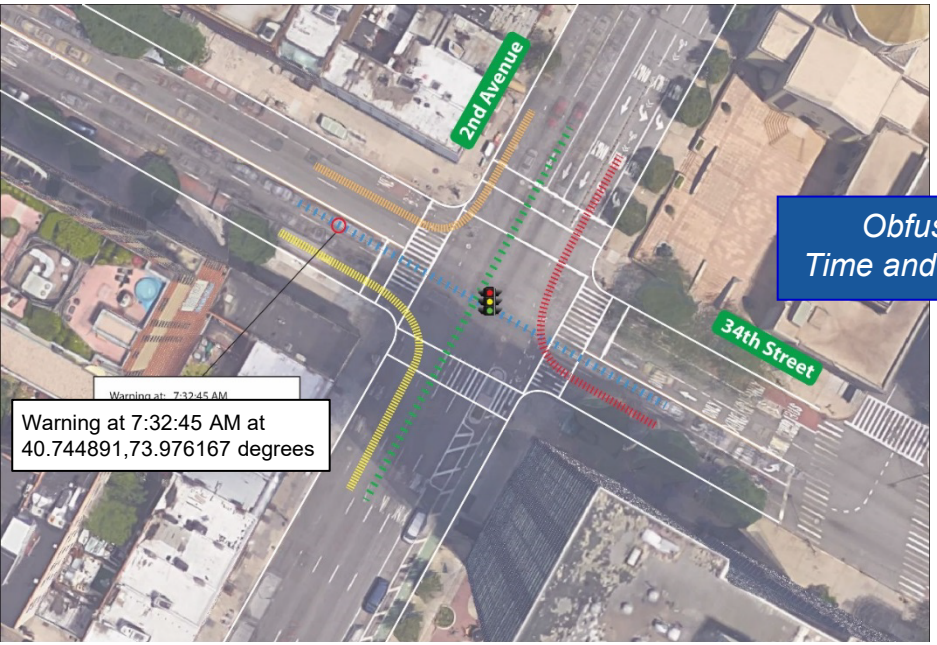


CV Event Obfuscation Process



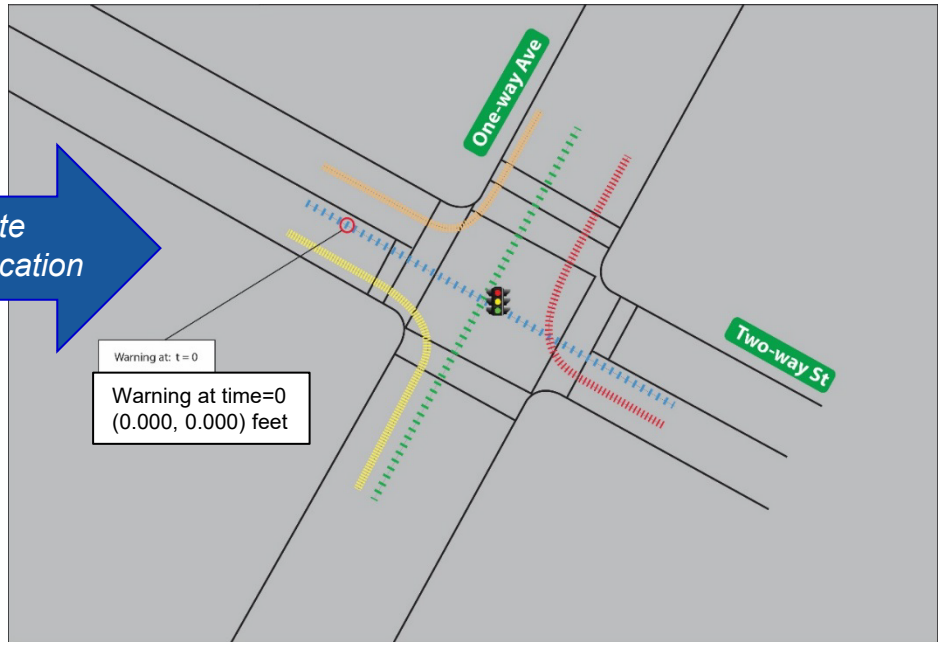
ASD Event Log Obfuscation

Raw ASD Action Log Data

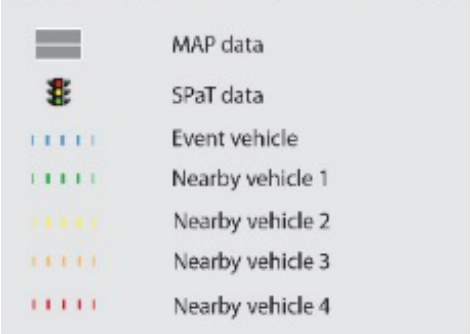


Obfuscate Time and Location

Obfuscated ASD Action Log Data



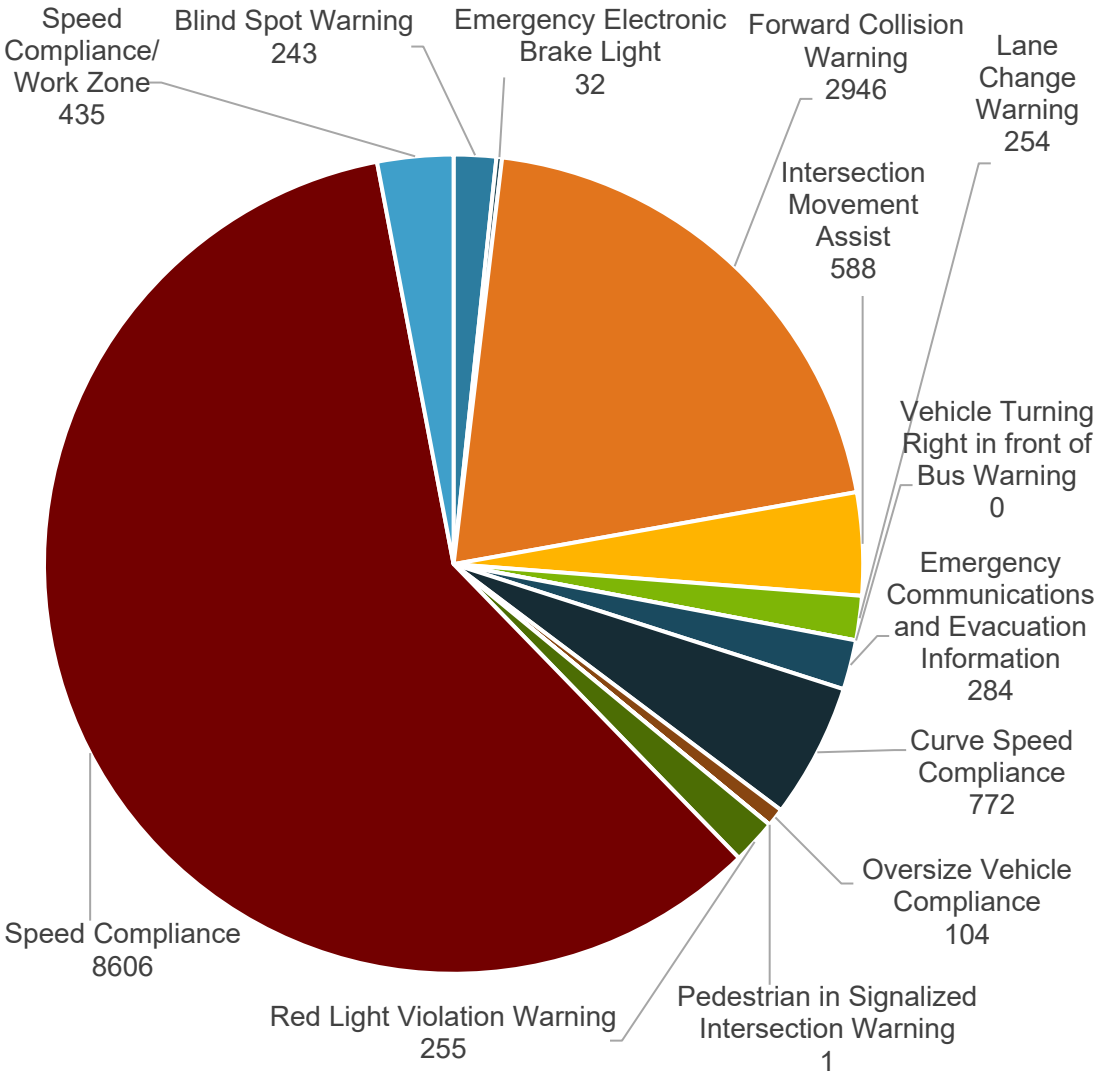
- Obfuscation process to scrub precise time and location data
  - Relative details retained
- Non-obfuscated data will be destroyed following the obfuscation process



CV Events by Type

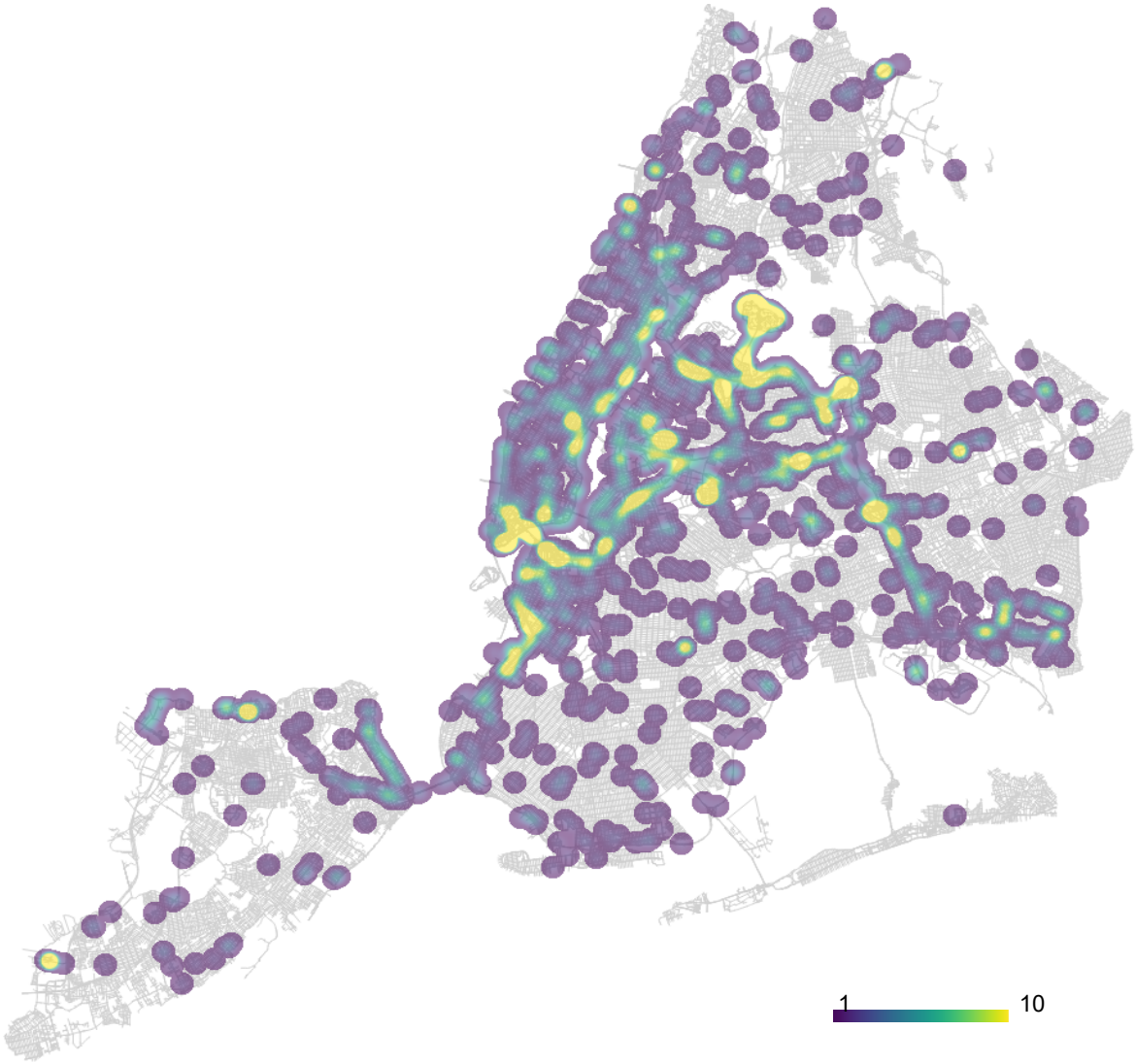
MAY 2021

- 14,520 Total Fleet Events
- 2640 Installed Vehicles
- May VMT: 957,000 (Est)
- May Hrs: 66,000 (Est)
- Includes Both Silent and Active Alerts
- Notes:
  - Disregards early ASD firmware versions
  - Disregards Test Vehicle Events
  - Includes Events passing error tests
  - Includes Treatment and Control Vehicles



FCW Events

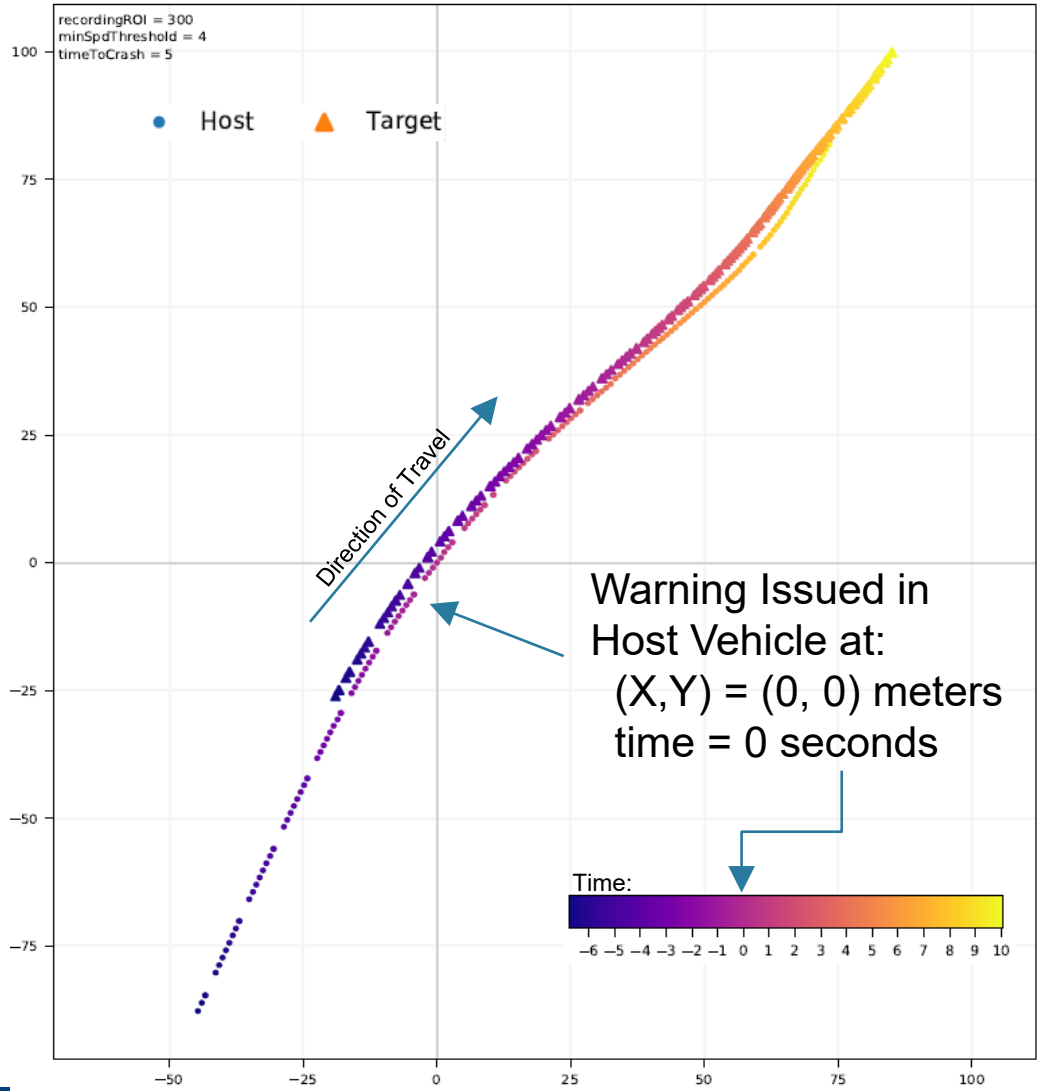
- May 2021 E

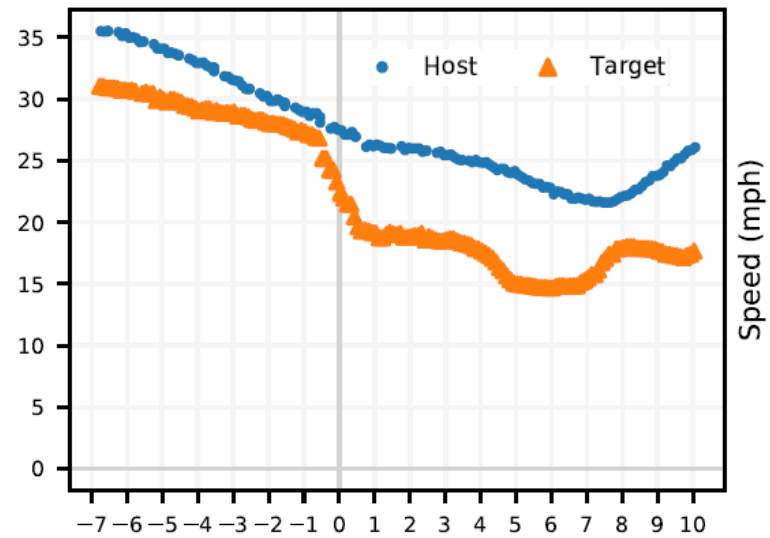


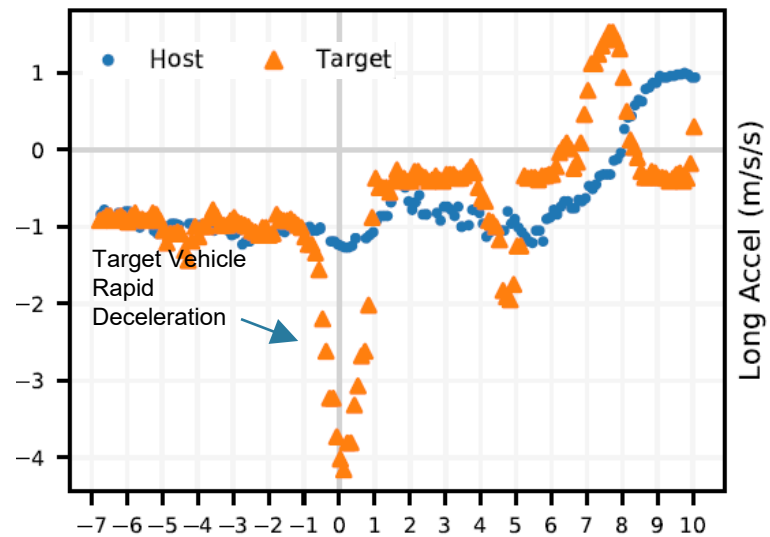
SPDCOMP Events

- May 2021 Events
- V2I areas only

Obfuscated Event Analysis Sample: EEBL Warning

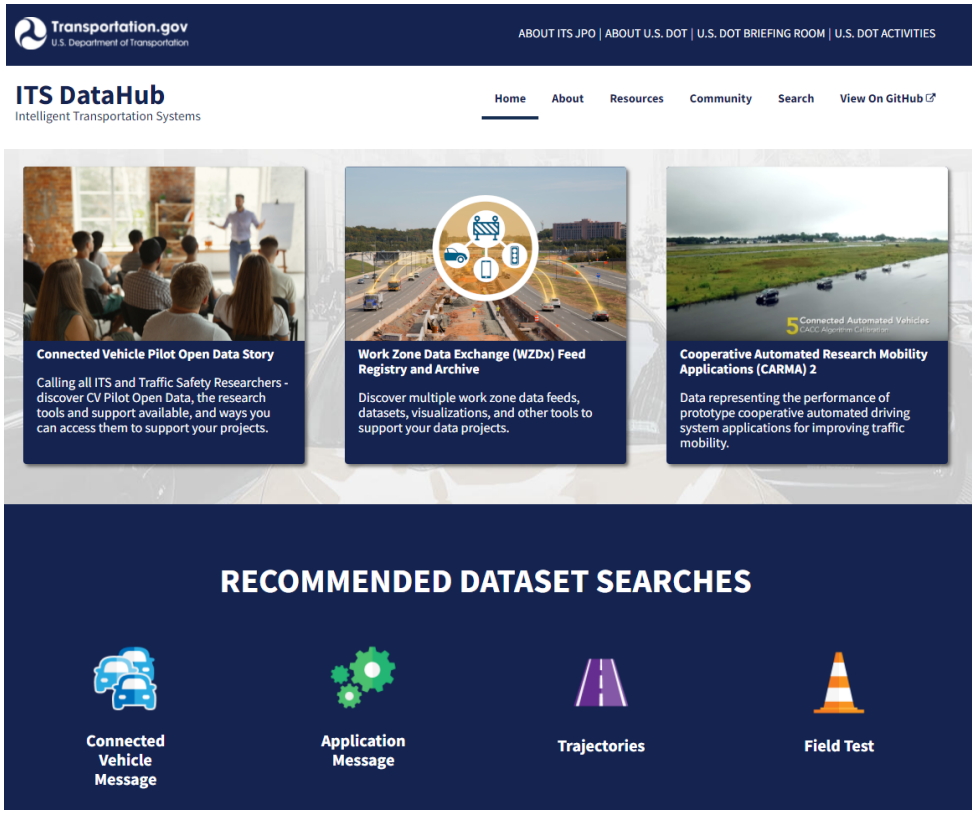




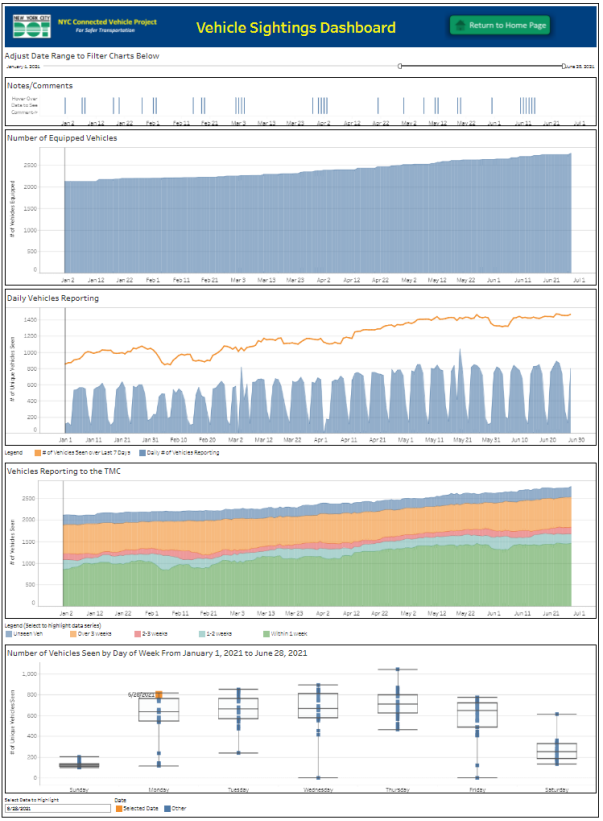


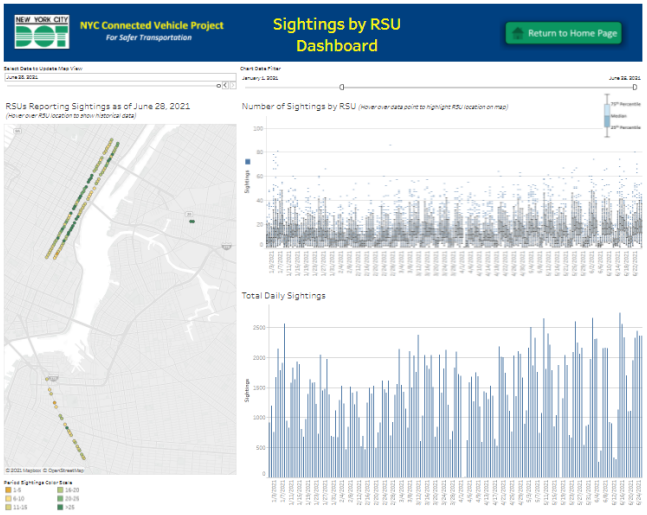
Obfuscated Event Data at ITS DataHub

- https://www.its.dot.gov/data
- https://data.transportation.gov/stories/s/Connected-Vehicle-Pilot-Sandbox/hr8h-ufhq#new-york-city-dot-(nycdot)-pilot
- https://data.transportation.gov/stories/s/Connected-Vehicle-Pilot-Sandbox/hr8h-ufhq#cv-pilot-data-sandbox
- Event data in the Sandbox updates weekly



System Operations Dashboards





NYC DOT Website: CVP.NYC

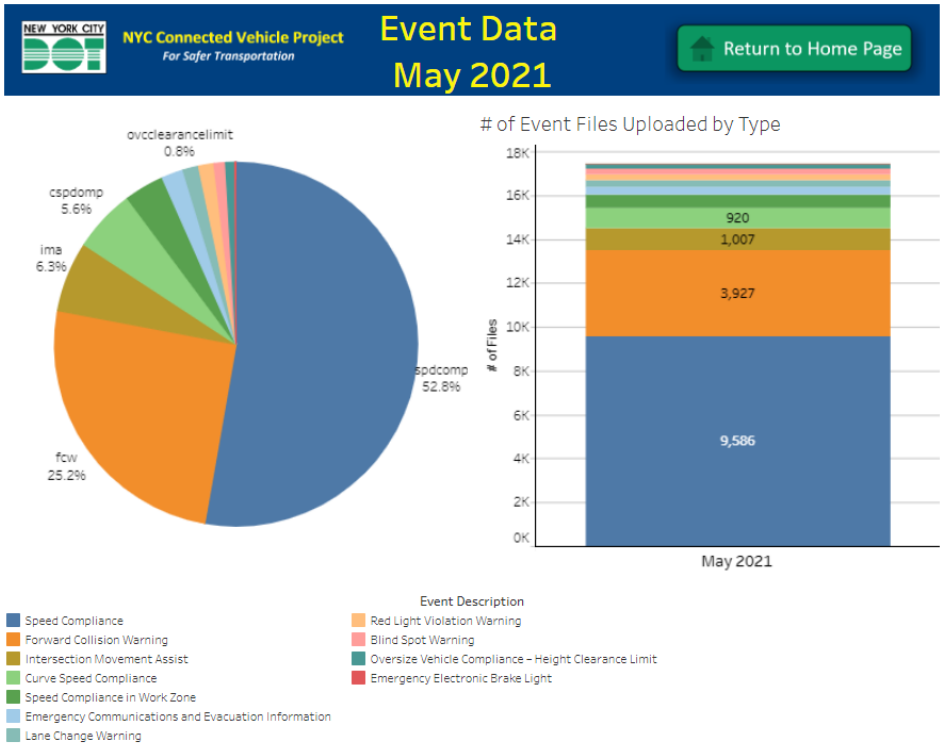
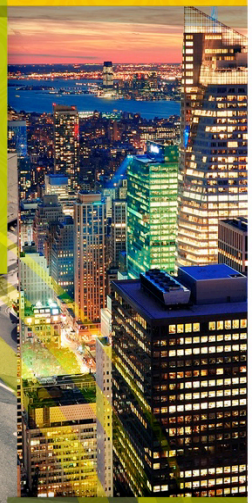



Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

New York City



NYC CV Project Lessons

Bob Rausch
JHK Engineering

Challenges - *Everywhere*

- Stakeholder privacy concerns vs. USDOT desire for broad evaluation data
- Stakeholder requirements to avoid distracting **"cockpit"** displays
- Density of Roadside DSRC Transponders (RSU)
  - ~76 M for short blocks ***DSRC – Nominal 300M***
  - ~200 M for the long blocks (between avenues)
- Bandwidth limitations of the wireless backhaul (RSU to TMC)
- Ongoing maintenance and support (in-vehicle and infrastructure) of the large-scale deployment (3,000 Vehicles and 450 RSUs)

****Security Credential Management System***

- SCMS* for all applications & DSRC Over-the-air (OTA) certificate distribution
- OTA [DSRC] data collection – bandwidth limited
- OTA [DSRC] software updates
- OTA [DSRC] parameter management
- Location accuracy in the urban canyons *(both relative V2V and absolute V2I)*

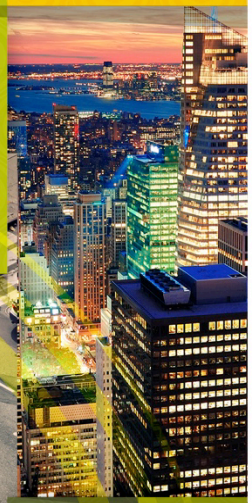
Lessons Learned

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


Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

New York City



NYC ITS Sub Regional Architecture

Dr. Arthur O'Connor
USDOT

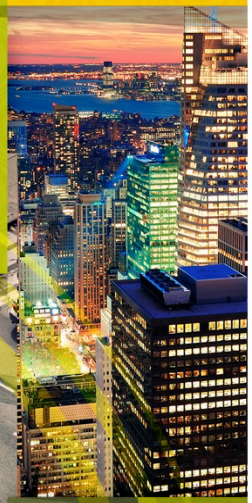
NYC Sub Regional Architecture

- NYC CV Pilot program successes
- NYC CV Pilot's relationship to the ITS Sub Regional Architecture
- Urban environment model experience
- Next steps


Photo Courtesy of: MTA New York City Transit

Photo Courtesy: MTA New York City Transit

New York City



NYC CV Team Members

Dr. Mohamad Talas
NYCDOT

NYC CV Team Members

- USDOT Team
- NYCDOT Team
- NYC DCAS Team
- NYC Fleet
- Consulting Team
  - JHK Engineering (TransCore)
  - Cambridge Systematics
  - KLD Engineering
  - University Transportation Research Center (UTRC)
  - New York University (NYU)


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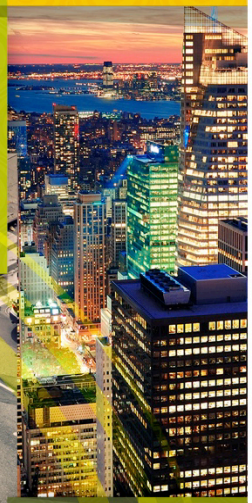
Photo Courtesy: MTA New York City Transit

New York City



Questions?

Dr. Mohamad Talas
NYCDOT

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Join us for the *Getting Ready for Deployment* Series

- Discover more about the CV Pilot Sites
- Learn the Essential Steps to CV Deployment
- Engage in Technical Discussion

Website: http://www.its.dot.gov/pilots

Twitter: @ITSJPODirector

Facebook: https://www.facebook.com/USDOTResearch

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  MTalas@dot.nyc.gov

CV Pilot Sites Document Repository

http://www.its.dot.gov/pilots/cv_pubs.htm

Please visit the CV pilots website for the recording and the briefing material of the previous webinars:
http://www.its.dot.gov/pilots/technical_assistance_events.htm