Cover Page

Project Name	Citywide Congestion Management Plan
Eligible Entity Applying to Receive Federal Funding	New York City Department of Transportation
Total Project Cost	$12,320,000
ATCMTD Request	$6,160,000
Are matching funds restricted to a specific project component?	No
State in which project is located	NY
Is the project currently programmed in the: • Transportation Improvement Program (TIP) • Statewide Transportation Improvement Program (STIP) • MPO Long Range Transportation Plan • State Long Range Transportation Plan	• No • No • Yes • Yes
Technologies proposed to be deployed	Sensors and cameras for High Occupancy Vehicle lanes on bridges, Transit Signal Priority technology for key bus routes, quiet delivery truck technology citywide

Submitted by in response to:

Notice of Funding Opportunity Number 693JJ317NF0001
"Advanced Transportation and Congestion Management Technologies Deployment Initiative"
ATCMTD Request: $6,160,000; Local Match: $6,160,000

Submitted to: U.S. Department of Transportation

By:
Commissioner Polly Trottenberg

June 12, 2017

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Project Description

1. Project Introduction

As part of the Citywide Congestion Management Plan (CCMP), New York City Department of Transportation (NYCDOT) requests $6,160,000 in Advanced Transportation and Congestion Management Technologies Deployment Initiative (ATCMTD) funds to develop and deploy technologies to reduce congestion in the five boroughs of NYC. Specifically, the project includes the following congestion mitigating technologies: launching Transit Signal Priority (TSP) on key bus routes, encouraging off hour deliveries (OHD) for trucks by employing noise-mitigating solutions on congested corridors citywide and installing High Occupancy Vehicle (HOV) cameras on East River bridges. To evaluate project success, goals include expansion of innovative data sets; analysis to evaluate the performance of our transportation network including crosswalks, bus and bike lanes; and implementation of systems to efficiently plan and operate streets and bridges to reduce costs, delay and crashes. Benefits include ability to monitor speeds, bus travel times, and bottlenecks, as well as origin and destination information for more efficient routing. Increasing reliability for bus service, shifting truck deliveries to improve traffic flow and promoting more efficient travel options will help NYCDOT efficiently and safely plan and operate its streets.

New York City is reaching record highs in the number of residents, jobs, and tourists, and these growth trends have clear impacts on the City's transportation network. In 2015, the City was home to more than 8.5 million residents and hosted 58.3 million tourists. Providing transportation options to efficiently and safely move millions of people every day presents significant challenges, which are exacerbated by congestion and the continued growth of commercial and home deliveries across the city. As the City attracts more visitors, workers, and residents, sidewalks and crosswalks are busier than ever and with more construction there is an increase in lane closures, impacting traffic flow. Speeds in the City, particularly Midtown Manhattan are slower, yet fewer cars overall are entering the core (Figures 1-2).

Taxi GPS TPEP Data - Average Manhattan CBD Travel Speed

		YEAR							
		2009	2010	2011	2012	2013	2014	2015	2016
MONTH	January	*	10.19	9.47	10.09	9.80	8.90	8.91	8.59
	February	*	9.71	9.24	9.77	9.34	8.83	8.25	8.39
	March	*	9.62	9.36	9.60	9.22	9.23	8.17	8.42
	April	*	9.62	9.28	9.35	9.03	8.82	8.14	8.05
	May	*	9.18	8.93	8.64	8.54	8.29	7.97	7.42
	June	*	9.18	8.89	8.74	8.48	8.16	7.96	7.31
	July	9.27	9.29	8.94	9.06	8.67	8.48	8.16	7.88
	August	9.50	9.46	9.19	9.41	9.00	8.77	8.37	8.13
	September	8.95	9.01	8.45	9.12	8.57	8.14	8.23	7.78
	October	9.24	9.17	8.87	9.35	8.74	8.18	8.04	8.05
	November	9.26	9.25	8.72	9.19	8.61	8.04	8.18	7.83
	December	8.85	8.62	8.66	9.16	8.81	8.18	8.23	8.01
Calendar Year		-	**9.35**	**8.99**	**9.28**	**8.90**	**8.51**	**8.21**	**8.01**
Fiscal Year		-	**9.38**	**9.16**	**9.09**	**9.14**	**8.72**	**8.27**	**8.12**

Figure 1

Motor Vehicles Entering the CBD

CBD Entries Daily (24 Hours)

Year	60th St Screenline 24 Hrs	Brooklyn Sector 24 Hrs	Queens Sector 24 Hrs	New Jersey Sector 24 Hrs	CBD Entries Total Vehicles 24-Hour Volumes		Pct. Change from Prior Yr
2011	348,872	177,105	137,840	100,369	764,186	2011	
2012	333,582	178,924	138,564	100,255	751,325	2012	- 1.7 %
2013	331,542	185,740	132,083	97,884	747,249	2013	- 0.5 %
2014	325,576	177,880	131,297	96,340	731,093	2014	- 2.2 %
2015	319,982	176,748	137,382	97,311	731,423	2015	0.0 %
2016	316,552	178,603	126,200	95,166	716,521	2016	- 2.0 %
					Pct. Chg. 2011-1016		- 6.2 %

Figure 2

The City's growth is straining our transportation system as never before. Up until now, New York City has largely been able to meet the travel demand generated by this growth with existing subway capacity and increased walking and biking. Between 2010 and 2016, citywide subway ridership increased 22 percent to 1.76 billion. Ridership is now 78 percent higher than during the system's nadir of 991 million riders in 1982. The number of frequent bike riders has risen 54 percent to 778,000 in the last five years, and pedestrian activity has increased dramatically. To support these shifts, the city has significantly expanded bus, bike and pedestrian facilities, and has done so in most cases without reducing overall vehicle throughput.
But overall, DOT believes that the City's extraordinary growth is likely the dominant factor leading to congestion and dropping traffic and bus speeds on the streets (Figure 3).

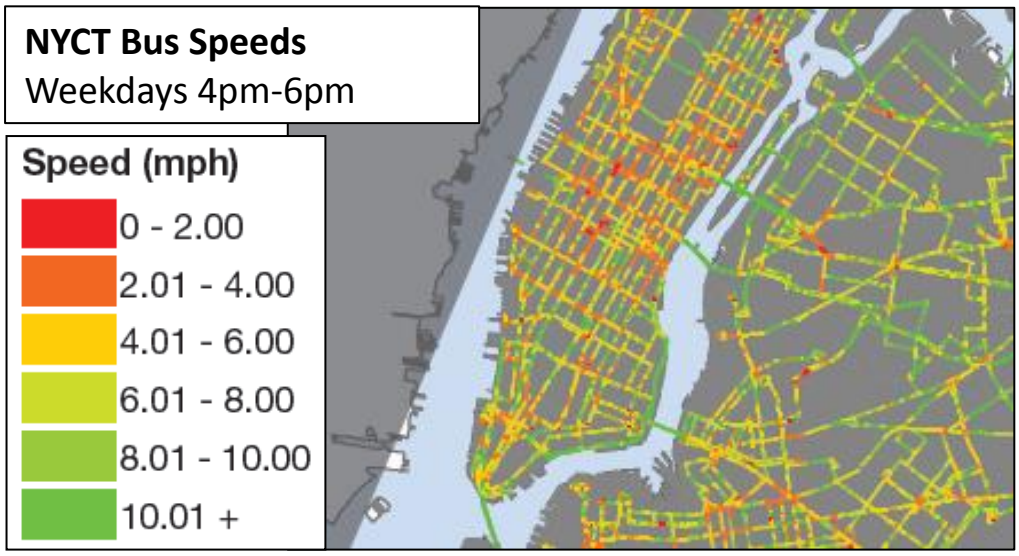

Figure 3

As a national leader in the use of data to monitor, manage, and evaluate multimodal transportation networks, NYCDOT is uniquely prepared to leverage ATCMTD funds to build on a long history of innovative data collection and analysis and use those tools to reduce congestion for all modes throughout NYC. NYCDOT has been collecting annual key screenlines since 1948, and has continuously sought to improve and expand both the data collected and the use of this data to plan for mobility improvements citywide. Midtown In Motion (MIM), NYCDOT's

monitoring system for the central business district, helps the City evaluate traffic flow on key corridors in Midtown Manhattan, and NYCDOT's partnership with the New York City Police Department and New York State Department of Transportation on the Joint Traffic Management Center use cameras and speed detection equipment to monitor traffic conditions in real time.

CCMP will build upon these efforts and purchase a new complete data set, to enable NYCDOT's Traffic Operations and Transportation Planning and Management divisions to support improved operations management and monitoring, evaluation, and planning efforts as well as inform the agency on how to best deploy congestion mitigation measures, including TSP, OHD and HOV. The new real-time and historical data allows NYCDOT to analyze complete travel paths, traveler attributes, origin-destination information, vehicle type, relative volume, travel times, trip length, speeds, delay costs, roadway and traffic event information, and planning time and buffer time metrics. This data will enable NYCDOT to utilize a rich dataset with the widest coverage available, arming the agency to improve the performance of the entire transportation network. This data will equip NYCDOT to plan safety projects and initiatives to monitor and improve the City's transportation network to alleviate congestion and reduce the number and severity of crashes for all modes throughout the City.

CCMP will focus on the following technologies to monitor and address congestion:

Transit Signal Priority Technology

TSP allows for improved reliability and performance on key corridors throughout NYC and encourages transit use, which reduces congestion. Smart traffic signals can detect when a bus is approaching, and adjust timing so the bus is more likely to encounter a green light. As a bus gets close to an intersection, it sends a wireless signal that is transmitted to the traffic signal controller, either directly or through a centralized TSP server. The controller then has the ability to maintain a green light longer for a bus to make it through the intersection, or to turn a red light green sooner if a bus is stopped at the red. Controls are put in place to make sure that the light never changes before pedestrians have enough time to safely cross, and that overall traffic flow is maintained (Figure 4). TSP makes small changes at each individual intersection, but over the course of a corridor bus speed and reliability can significantly improve. TSP has been implemented at approximately 370 intersections (about 3 percent of total signalized intersections) on seven routes in NYC and has reduced travel times by five to 20 percent.

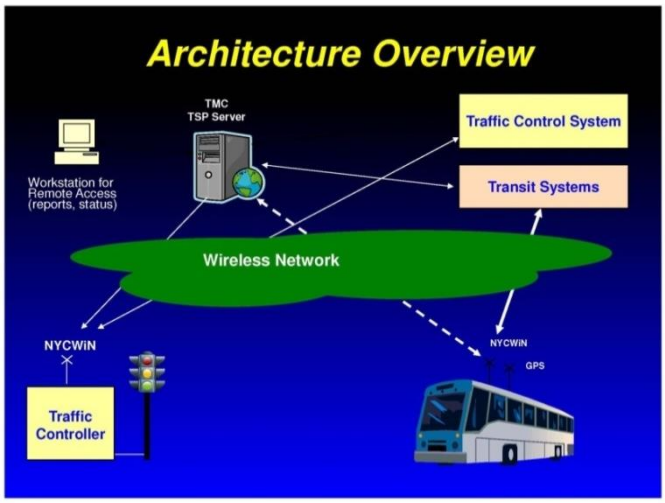

Figure 4

Off Hour Delivery Technology

Another component of CCMP includes reducing peak hour deliveries in the most congested parts of NYC, specifically Midtown Manhattan. NYCDOT will identify and deploy low noise transportation technology and unassisted delivery technology to facilitate and encourage more off hour deliveries in our dense, urban environment. This initiative is supported by the Mayor's OneNYC Plan 2015 and NYCDOT's Strategic Plan 2016. Noise related to transportation and delivery processes is a barrier to implementing more off hour deliveries due to resident concerns associated with noise mitigation. Low noise engines, quiet refrigeration systems, quiet cargo handling equipment and other truck accessories are some of the strategies that can be implemented to reduce noise impacts. Staffing costs for receivers can also present challenges for businesses interested in implementing OHD. The use of electronic doormen, virtual delivery cages, and other security technologies can support unassisted deliveries. These technologies will incentivize the adoption of OHD by shippers and receivers.

HOV Lane Occupancy Verification Technology

Beyond addressing bus and truck congestion, NYCDOT is preparing to integrate a quarter of a million displaced daily transit riders into surface transportation. The Canarsie Tunnel, which carries the L subway line under the East River between Brooklyn and Manhattan will be closed to repair Superstorm Sandy-related damage starting in 2019, requiring 225,000 daily subway commuters to find other travel options (Figure 5). Travel on this corridor, between Brooklyn and Manhattan is limited to the ferry, three bridges and one tunnel. Some of these commuters will shift to other subway options that have also experienced increases in ridership, but there is no parallel transit route to the L train, leaving commuters with less efficient daily travel options.

Figure 5

As a result, NYCDOT is exploring HOV restrictions over the East River bridges to enable high-volume replacement bus service that can serve as an acceptable alternative. While many of the entry points of these bridges are from city streets, some connect to limited-access highways where vehicles will be entering the bridge approaches at higher speed. The ATCMTD funds would aid NYCDOT in testing technological solutions to address the significant changes in travel demand through the use of vehicle occupancy sensor technology, which enables open-road verification and enforcement of HOV restrictions. Other US Cities have implemented camera-based technologies of this kind, and NYCDOT's intention would be to conduct a test of camera technology and its accuracy at key locations. A concept of operations diagram for this technology is depicted in Figure 6. Note that NYCDOT would only seek to implement cameras,

test their accuracy and collect data under this grant funding, not develop a violations processing infrastructure.

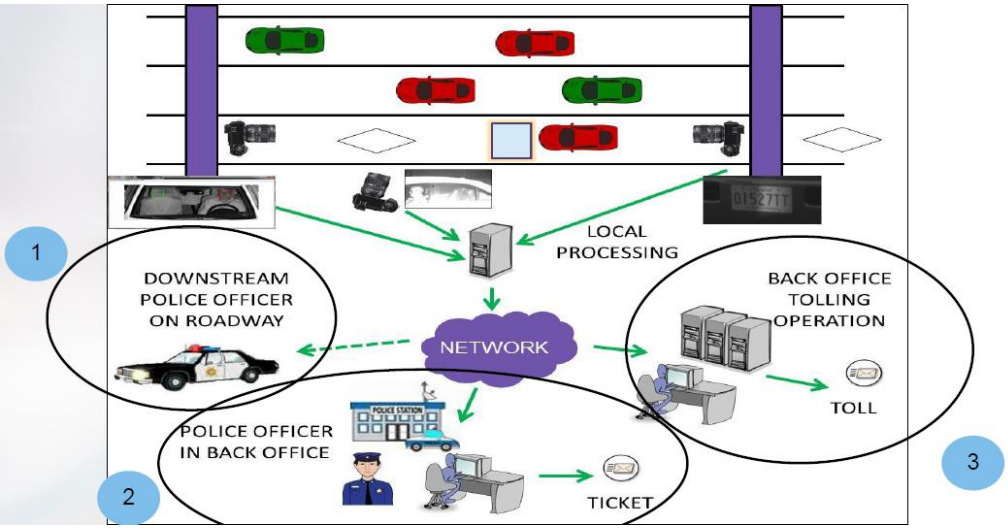

Figure 6

Integration with NYC and Other Initiatives

The CCMP project will directly support the following initiatives and programs:

- Vision Zero
- MTA/NYCDOT L-Train Construction Mitigation
- MTA/NYCDOT Select Bus Service Operations
- NYC Freight Plan
- New York Metropolitan Transportation Council's Long Range Transportation Plan and travel demand processes
- Performance measurement and reporting for MAP-21 and FAST Act
- Roadway State of Good Repair (SOGR) monitoring
- In-house and capital project planning, design and construction
- Overall traffic operations, system monitoring and management
- USDOT Strategic Plan goals
- New York State Department of Transportation planning objectives

2. Goals and Objectives of Proposed Deployment

The proposed deployment of CCMP will support NYCDOT's core mission, which is to provide for the safe, efficient, and environmentally responsible movement of people and goods in the City of New York and to maintain and enhance the transportation infrastructure crucial to the economic vitality and quality of life of its primary customers, NYC residents.

To meet the needs of the city and NYCDOT, CCMP will:

- Provide complete, accurate and reliable real-time count, curbside utilization, travel time and origin-destination data
- Seamlessly interface with NYCDOT's current ITS infrastructure and Traffic Management Center systems

- Provide coverage at critical intersections, corridors, and screenlines throughout NYC
- Alleviate congestion and streamline traffic flow throughout the five boroughs
- Monitor and improve the operational performance and efficiency for all modes of the transportation network
- Reduce the number and severity of traffic crashes and increase safety for all modes
- Deliver economic benefits by reducing delays, improving system performance, and providing for the efficient and reliable movement of goods and services

2.1. Goals and Objectives of the Proposed Deployment

Proposed Deployment(s)	Objectives	Goals
Transit Signal Priority (TSP)	• Analyze the feasibility and quantify potential benefits of TSP for selected bus routes through use of micro simulation modeling • Design and develop the framework necessary for field implementation of TSP • Improve or maintain Level of Service (LOS) for all other road users while simultaneously minimizing bus delays	• Improve the overall mobility by reducing bus transit travel time • Improve reliability of bus service and on-time performance • Improve the overall intersection traffic operation (delays, speed, air quality, etc.), specifically during peak weekday commuter hours • Encourage use of transit • Improve transit operations and service quality • Improve mobility • Reduce mobile-source emissions and fuel consumption rates
Off Hour Deliveries (OHD)	• Reduce noise impacts for truck deliveries • Facilitate unassisted truck deliveries	• Reduce traffic congestion and transportation related emissions by expanding the off hour deliveries program • Reduce delivery costs and improve delivery times for transporters, shippers and receivers (businesses) through OHD
High Occupancy Vehicle (HOV)	• Test the accuracy of vehicle occupancy camera technology in a constrained, high-volume roadway setting	• Enable fast, high-volume interborough bus service through the use of HOV lanes that reduce overall traffic volume • Encourage carpooling and transit use • Reduce highway congestion at bridge interface points

3. Proposed Deployment Components

Transit Signal Priority

Objective: Improve performance of bus service through the application of Transit Signal Priority on key corridors.

Challenges: NYCDOT and MTA are embarking on an ambitious program to provide TSP to 6,000 buses in New York City. A key component of the project is New York City's dedicated broadband wireless infrastructure (NYCWiN), which was created by the city's Department of Information Technology and Telecommunications to support public safety and operations. Because NYCWiN supports the implementation of TSP without any additional hardware or infrastructure changes, this approach is particularly cost-effective and attractive for widespread implementation of TSP in New York.

Approach: TSP in New York City uses in-vehicle GPS tracking devices and other on-bus TSP software to detect a bus's location. The bus then sends a TSP request to the NYCDOT Traffic Management Center (TMC), relayed through MTA's Bus Command Center. The TMC uses the New York City Wireless Network (NYCWiN) to communicate with the traffic signal controllers (Figure 7). In order to create a safe and efficient intersection with TSP, significant traffic analysis is required. Analysis will be conducted utilizing both macroscopic and microscopic modeling software. The former will be used to identify existing capacity problems, evaluate mitigation measures to alleviate these problems, and optimize signal timings and offsets. All analyses of TSP operations will be evaluated at the microscopic level to measure traffic performance and visualize operations. TSP operational benefits are dynamic in nature and sensitive to changes in traffic characteristics such as volumes, signal timing and phasing, new pedestrian phases, intersection geometry, bus schedules and frequencies. Thus, optimal results can be maintained over time by fine tuning TSP parameters based on periodic reassessments.

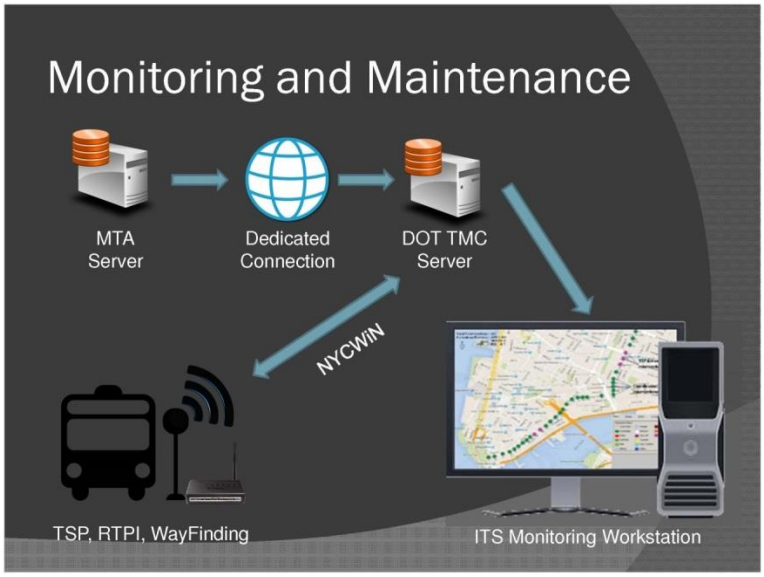

Figure 7

Off Hour Deliveries Program Expansion
Objective: Implement low-noise and unassisted delivery technology to encourage and incentivize the shift of truck related deliveries to the off peak hours, thereby reducing traffic congestion and emissions, as well as reducing delivery costs and improving goods delivery times.

Challenges: NYCDOT seeks to reduce the impact of the trucks on congestion. In NYC, trucks carry approximately 91 percent of goods. Daily freight trips are estimated to have increased steadily in the city, growing by 5.7 percent between 2010 and 2013. Moreover, trucking industry partners have advised NYCDOT that they have experienced a 30 percent increase in parcel deliveries to sections of Manhattan since 2010. This increased truck traffic puts additional demands on already congested streets. The added congestion results in increased emissions, delayed delivery of goods, and added costs for shippers and receivers. Two major concerns that arise in implementing OHD are noise concerns for community residents and the need for additional staff for businesses. Utilizing technology solutions to address both will facilitate broader implementation of OHD.

Approach: OHD will scale up work that NYCDOT has previously developed through an OHD Pilot (2009/2010), during which 400 business shifted deliveries to the off peak hours. Benefits of the pilot program included financial benefits for shippers (lower delivery, reduced parking fines) and receivers (reductions in inventory costs, improved reliability of deliveries, and lower shipping costs). In addition, there were reductions in transportation emissions by trucks having shorter and more direct routes, faster speeds, and less time stuck in traffic. NYCDOT would seek additional OHD participation from shippers and receivers in the most congested areas of the city. NYCDOT would use this grant to develop and distribute an incentives program, which would include a customized scheme to provide financial incentives for receivers and transporters to acquire technology that could facilitate unassisted deliveries, such as electronic doormen, quiet pallet jacks and virtual delivery cages.

High Occupancy Vehicle Verification
Objective: Implement and test vehicle occupancy verification cameras at key locations.

Challenges: NYCDOT is working in partnership with Metropolitan Transportation Authority (MTA) to mitigate the effects of the closure of the L subway line between Brooklyn and Manhattan for resiliency repairs. The closure is expected to take 15 months starting in early 2019, and force 225,000 subway commuters to find a different commute option. Most likely shuttle bus service will be primarily concentrated on the Williamsburg Bridge, the nearest bridge to the L subway line, and if these buses were to operate in mixed traffic, they would experience significant delay. Unreliable service would stimulate some shift to less efficient modes, further exacerbating congestion.

To ensure fast, reliable operation of high-volume bus service between Manhattan and Brooklyn, NYCDOT is exploring HOV restrictions on the Williamsburg Bridge, as well as other nearby

crossings. In order to enforce HOV restrictions, NYCDOT will work with the New York Police Department (NYPD) to station officers at key locations to check vehicle occupancy and enforce against violators. Where bridge connections are made from major highways, this approach is logistically difficult. Other US cities have tested and adopted camera technologies to verify and enforce against motorists carrying fewer than the minimum required passengers for HOV lane access. NYCDOT seeks to test technologies of this type, but acknowledges the unique challenges that arise from operating in the heavily-congested, under-engineered roadway environment of New York City and its bridge crossings.

Approach: NYCDOT will follow agency procurement guidelines to ascertain viable technological solutions from eligible vendors, and procure material for camera installations at key locations. NYCDOT staff will consult with other jurisdictions who have implemented similar technologies on how to structure tests of the accuracy at installation locations. NYCDOT will then collect vehicle occupancy data using the cameras as well as through manual counts and evaluate the accuracy of camera technology. After piloting the technology, NYCDOT will issue a monitoring report summarizing the results of the test and including a recommendation on future applicability.

4. Benefits of the Proposed Deployment

Following development and deployment of these technologies, the supplemental data is crucial to evaluating performance. Under current conditions, many counts and travel data collection surveys that are performed at key locations across the city are only deployed one-to-two weeks at a time, once or twice a year, or on a project-by-project basis. As a result, there is no information on the traffic flow characteristics at other times and NYCDOT must draw conclusions from such data for planning, operations, and monitoring purposes. Having a sustainable, consistent source of data is critical. Detection equipment deployed under the proposed system will have uniform technology specifications and counting procedures. The resulting data will be consistent in format and will be seamlessly integrated into NYCDOT's current data flows. In addition, variation due to count contractor personnel and count methods will be eliminated.

A reliable set of continuous, renewable, real-time and historical data will provide insights into the spatial and temporal fluctuations of traffic activity, greatly benefit a number of citywide initiatives, and provide a basis for performance monitoring. The new dataset for CCMP will also allow NYCDOT to analyze an unprecedented amount of continuous, real-time information on traffic flows to support innovative programing and applications that improve mobility and system efficiency.

Transit Signal Priority Benefits:
Improving bus service reliability and on-time performance will encourage increased transit usage, public safety and improve air quality. TSP enables buses to move out of traffic congestion and minimize customer delay.

Off Hour Delivery Benefits:
OHD promotes less loading and double parking, which alleviates congestion in the daytime hours. Carriers/shippers benefit from faster and more reliable travel times, reductions in delivery

costs, reductions in parking fines, and less stress on delivery crews. Receivers benefit from large increases in the reliability of deliveries, reductions in inventory costs, and lower shipping costs. Also, low-noise delivery practices and technologies will reduce disruption during night time deliveries. OHD reduces vehicular emissions produced by trucks due to shorter routes with less congestion, faster speeds, and no stop-and-go traffic.

HOV Vehicle Occupancy Verification Benefits: If camera technology proves viable in the NYC environment, the near-term applicability would be to allow for verification of occupancy in HOV lanes during the L subway line closure. This would result in the reduction of congestion on East River bridges and the adjacent street network, as well as the prioritization of more efficient travel modes such as bus service and carpooling. Over the longer term, HOV lane restrictions could potentially be implemented after the end of the L line construction closure, and facilitated through the development of a full electronic enforcement infrastructure built around camera-based enforcement. Such an outcome would offer the benefit of long-term congestion reduction as well as reduced police enforcement costs.

5. Proposed Deployment Plan

TSP Technology

In-vehicle GPS tracking devices will be installed in buses and activated in signals along major outerborough routes with high ridership. Priority bus routes for TSP deployment could include South Brooklyn Crosstown – B82, South Bronx Crosstown- BX6, and Woodhaven Blvd – Q52/53.

OHD Technology

NYCDOT proposes to add 900 new participants to the OHD program during the course of 24 months. The deployment plan would include an updated marketing strategy, a recognition/ incentives program as well as noise monitoring and low noise technology program.

HOV Vehicle Occupancy Technology

NYCDOT will procure and install camera technology for vehicle occupancy verification at key locations on East River bridges. Using these cameras, NYCDOT will collect vehicle occupancy data and evaluate the accuracy of camera technology. At the conclusion of the pilot, NYCDOT will issue a monitoring report summarizing the results of the test and including a recommendation on future applicability.

New York City Department of Transportation

NYCDOT will enter into the agreement with FHWA. NYCDOT has extensive experience in Federal grant administration and in the planning, design and engineering of capital and ITS-related projects. The agency has professional licensed and certified planners, engineers, and construction managers and staff that are able to manage projects and/or manager consultants providing staff support and technical assistance through existing engineering service agreements. Assistance with grant administration will be provided by the Division of Finance, Contracts and Program Management, which has extensive experience administering grants and complying with all requirements. NYCDOT has an annual operating budget of over $900 million and has

significant financial controls. NYCDOT's staff of over 5,000 employees oversees and manages a five year $10 billion capital program.
The project is consistent with the metropolitan planning process of the local Metropolitan Planning Organization (MPO) – the New York Metropolitan Transportation Council (NYMTC. All project elements are consistent with the NYMTC long range Regional Transportation Plan (RTP). NYCDOT which is a voting member of the NYMTC is committed to adding all ATCMTD-funded project elements into the Transportation Improvement Program (TIP)/State Transportation Improvement Program (STIP) within one month upon confirmation that the project has been awarded ATCMTD funds.

Staffing

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Internal NYCDOT Stakeholders
Commissioner's Office / Policy
Regional and Strategic Planning
Traffic Engineering and Planning
Research, Implementation and Safety
Bicycle and Pedestrian Programs
Transit Development
Capital Program Management
Parking Operations, Planning and Analysis
Signals and Street Lighting
Borough Engineering
Roadway Repair and Maintenance

External Stakeholders
US DOT
NYMTC
NYSDOT Region 11
MTA
Freight Industry Partners

Funding Description

Data	Equipment			Total Cost
HOV	Sensors and Cameras			$1,750,000
TSP	GPS Tracking Devices and Software			$4,770,000
OHD	Low noise technology, unassisted delivery technology			$3,000,000
Total Equipment				$9,520,000
Data Collection, Planning, System Development, Engineering, Deployment and Integration, Testing and Administration				$2,800,000
Total Cost				**$12,320,000**
Federal ATCMTD Portion				$6,160,000 (50%)
Local Match				$6,160,000 (50%)

Schedule

Months from Award	Task
1-12	Grant authorizations, equipment procurement
12-24	Equipment installation, system checks and integration
24-36	Initial data gathering, data integrity checks and system refinements

Notes:

1. A kick-off meeting will be scheduled within one month following award announcement.
2. Progress reports will be submitted monthly following award announcement.
3. A comprehensive status update report will be produced annually (at months 12, 24 and 36) following award announcement.
4. A series of coordination meetings with the US DOT team will be proposed for the project duration.