Subject: Local Government and Industry Award Supporting Documents/(NYCDOT, AT&T,T-Mobile and Digi International, Inc)

Title: **New York City Traffic Safety Network (TSN)**

1 INTRODUCTION

The New York City Department of Transportation (NYC DOT) manages one of the most intricate urban transportation systems globally. The network extends across 6,300 miles of streets and highways, over 12,000 miles of sidewalks, roughly 800 bridges and tunnels, more than one million street signs, 14,000 signalized intersections, 315,000 streetlights, 350 million linear feet of pavement markings, 15,000 parking meters, 39 municipal parking garages, and the Staten Island Ferry, serving some 16 million riders each year. The agency's mission focuses on enabling the safe, equitable, and sustainable movement of people and goods through public-space enhancements that support thriving communities.

In 2020, NYC DOT upgraded its Intelligent Transportation System (ITS) communication network, transitioning from the outdated NYCWiN platform to the next generation **Traffic Safety Network (TSN).** Built on a virtual-private broadband overlay using AT&T FirstNet and T-Mobile, TSN now serves as NYC's largest municipal IoT communications network. As of last year (2024), the project goal to connect 14,000 traffic signals has been achieved and over 2,000 ITS field devices have been connected to the Traffic Management Center (TMC), enabling real-time traffic monitoring and advanced operations like adaptive signal control and Transit Signal Priority (TSP).

2 TRAFFIC SAFETY NETWORK (TSN)

New York City's streets are frequently operating at or beyond capacity. The dynamic conditions—including special events, roadwork, incidents, and weather disruptions—demand rapid response and adaptable traffic management. TSN addresses these needs with a resilient, secure, and low-latency communications backbone built from NYC DOT's NYCWiN experience.

TSN operates on AT&T FirstNet, a network core reserved for first responders and public safety agencies, and features Quality of Service (QoS) and preemption protocols that ensure traffic-control signals are always prioritized, even during network congestion. It integrates **dual** cellular carriers for seamless failover—reaching 99.99% uptime—even as routers automatically revert to the primary carrier once service restored. Communications are secured end-to-end via IPsec VPNs and device-locked SIM cards. Redundant network paths connect AT&T's mobile cores to both the primary TMC and a separate Disaster Recovery Center.

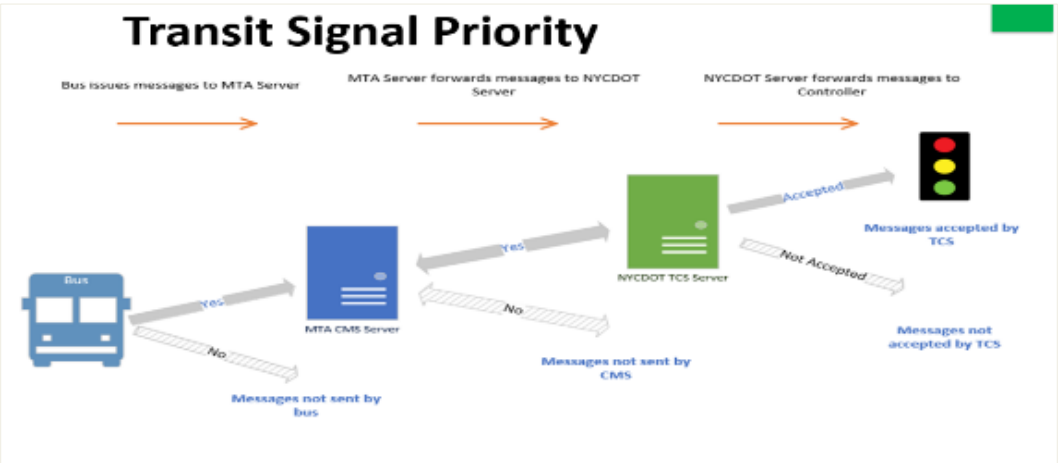
Key technical capabilities also include automatic device configuration for zero-touch deployment, secure encryption approved by NYC Cyber Command, and cellular radio fallback to neighboring towers if a primary site goes offline. Additionally, TSN routers feature embedded Wi-Fi/Bluetooth sniffing for anonymized travel-time data collection via MAC address probes between intersections—scalable and cost-effective with no additional field devices required. Currently the Wi-Fi/Bluetooth capability have been enabled in 2199 intersections in NYC.

3 CURRENT ITS APPLICATIONS SUPPORTED BY TSN

3.1 TRAFFIC SIGNAL MANAGEMENT AND OPTIMIZATION

3.1.1 Transit Signal Priority (TSP)

The TSN significantly enhances NYC DOT's ability to implement Transit Signal Priority by dynamically adjusting traffic signals for buses approaching intersections. Through real-time, highly reliable communication, signals can extend green phases or shorten red phases, enabling buses to proceed more smoothly along their routes. This capability reduces bus waiting times at intersections, leading to improved schedule adherence and overall transit reliability. Currently, this effective management covers 3,400 intersections across 134 bus routes, a scale achievable only due to TSN's extensive citywide coverage and its robust 99.99% reliability standard.



3.1.2 Adaptive Signal Control – Midtown in Motion

New York City's "Midtown in Motion" (MIM) adaptive signal control system leverages real-time traffic data - including EZ-Pass-based travel times, video feeds, and roadway sensors - to dynamically modulate signal timings across the Midtown Manhattan core. The TSN network is fundamental to MIM, providing secure, encrypted, and highly reliable (99.99%) wireless communication that transmits live congestion data to the Traffic Management Center (TMC) and conveys optimized signal timing commands back to controllers. This closed-loop, "operator-in-the-loop" configuration has yielded tangible benefits - most notably, travel speeds on key Midtown corridors have improved by around 10% during peak periods, supported by trajectory data and toll-tag sensor insights. By enabling rapid detection of gridlock and immediate timing adjustments, MIM exemplifies how TSN empowers data-driven, responsive congestion management in dense urban environments.

3.1.3 Remote Database Management for Traffic Signal Controllers

TSN facilitates the remote updating of traffic signal timing databases, vastly improving operational efficiency and reducing costs. Given the dynamic nature of NYC's traffic environment, signal timing changes occur frequently due to ongoing safety initiatives, intersection modifications, or environmental factors. With TSN, NYC DOT engineers at the TMC can swiftly and securely upload these updates to 14,000 signalized intersections, ensuring timely and accurate signal operations without the logistical challenges, expenses, or human errors associated with manual updates.

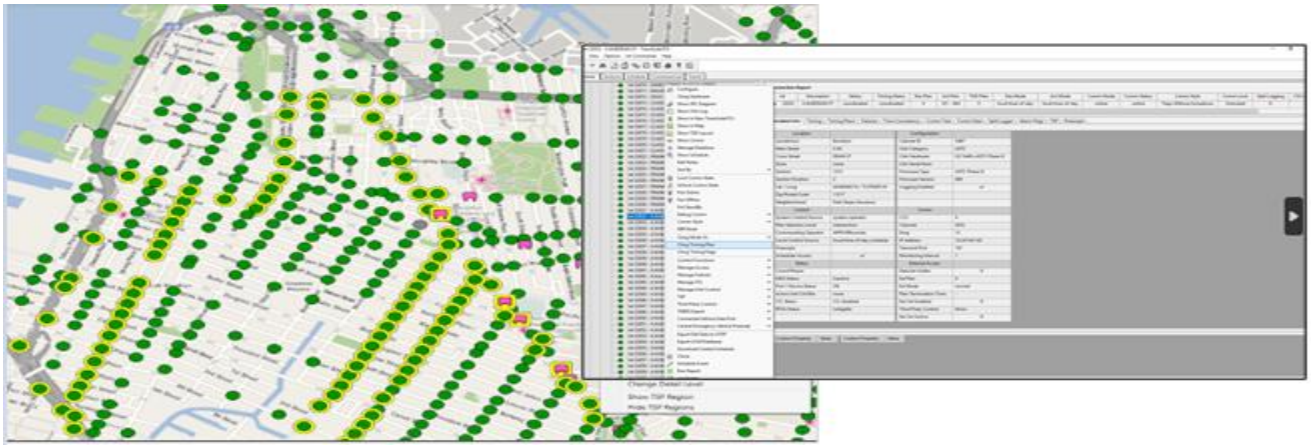
3.1.4 Real-Time Monitoring of Traffic Signal Controllers

Leveraging TSN, NYC DOT Traffic Management Center engineers can proactively monitor signal controllers for any operational malfunctions. TSN provides continuous real-time communication, allowing quick detection and identification of problems such as controller failures, Timing-Plan/Database corruption, electrical faults,

and environmental disturbances. This significantly accelerates the response time for repairs, enhances safety, reduces downtime, and minimizes traffic disruptions. Moreover, in cases of widespread power outages or significant hardware failures, TSN facilitates rapid pinpointing of affected areas, enabling efficient coordination with emergency management teams and utility providers.

3.1.5 Immediate Deployment of Incident and Emergency Signal Patterns

During traffic incidents, planned construction activities, or emergency situations, TSN enables the NYC DOT Traffic Management Center (TMC) to swiftly alter signal timings. Real-time data transmission ensures that adjustments to adjacent and alternate routes can be executed immediately, optimizing traffic flow and reducing congestion impacts during disruptions. The rapid adaptability provided by TSN's high-speed and reliable communication is critical for minimizing delays and managing citywide traffic effectively during unforeseen events.



3.2 Incident and Emergency Management

3.2.1 Incident Detection and Rapid Response

TSN enables the NYC DOT to rapidly identify and respond to incidents through automated monitoring systems that compare real-time link travel times against historical averages. When speeds drop below predefined thresholds, TMC operators receive immediate alerts. Operators can then use integrated video surveillance, enabled by TSN's robust infrastructure, to verify the cause of slowdowns and coordinate appropriate response actions promptly, significantly reducing the incident's impact on traffic flow.

Link Alert Application.

The links below have had their speed(mph) decrease or remain below 50% from their historical values in the last 15 minutes.

Links with Ac tive Alerts

Timestamp	Incident ID	Link	Curr. Speed(mph)	Hist. Speed(mph)	Speed Decrease %	No. of Times Emailed
2025-05-02 10:54:03 -0400	05022510554620289	GWB E U/Lev Plaza - CBE E U/Lev Amsterdam Ave	11	25	55	1

3.2.2 Monitoring of Congestion Pricing Relief Zones and Approaches

NYC DOT employs TSN for comprehensive monitoring of congestion pricing zones and critical approaches, such as the East River bridges and exempt routes including FDR Drive and Westside Highway. By generating continuous, detailed reports every 30 minutes, TSN provides essential data to DOT staff for managing traffic flows, identifying congestion hotspots, and swiftly adjusting management strategies to maintain smooth traffic

movements around and within tolling areas.

Congestion Pricing Report										
Trip	Direction	Last Update	Trip Length (mi)	Trip Curr. TT (hh:mm:ss)	Trip Hist. TT (hh:mm:ss)	Trip % TT Difference	Trip TT Difference (hh:mm:ss)	Hist. Speed (mph)	Curr. Speed (mph)	Trip Statement
Queens Blvd/QBB - westbound - 39 St (qu) to QBB Lower Rd @ 59 St (ma)	westbound	2025-05-02 10:17	2.57	00:05:00	00:08:20	40	00:03:20	18.50	30.83	less
Queens Blvd/QBB - westbound - 39 St (qu) to QBB Lower Rd @ 60 St (ma)	westbound	2025-05-02 10:17	2.49	00:05:00	00:09:00	44	00:04:00	16.58	29.85	less
QBB Upper Level - westbound - Thompson Ave @ Van Dam St (qu) to E 62 ST (ma)	westbound	2025-05-02 10:17	2.13	00:14:00	00:10:20	-35	00:03:40	12.38	9.14	more

3.2.3 Construction Zone and Detour Route Monitoring

Utilizing Wi-Fi and Bluetooth data collected via the TSN network, NYC DOT effectively monitors construction zones and the accompanying detour routes. The real-time travel-time data allows DOT to quickly identify congestion and bottlenecks associated with construction activities. This information can then be rapidly disseminated to motorists via dynamic message signs and automated reporting platforms, helping to alleviate congestion and improving traffic management around construction sites. This proactive management significantly reduces traffic disruption and enhances safety for both motorists and construction personnel.

3.3 Traffic Surveillance and Analytics

3.3.1 Expansion and Enhanced Utilization of Video Surveillance

The deployment of TSN has enabled a significant expansion of NYC DOT's video surveillance infrastructure, doubling the number of Closed-Circuit Television (CCTV) cameras from 450 to over 900. TSN's extensive network infrastructure allows these cameras to provide continuous, reliable high-speed video feeds, facilitating real-time traffic monitoring and incident verification across all five boroughs. This capability dramatically improves situational awareness, allowing the DOT to quickly detect, assess, and respond to traffic conditions and incidents.

3.3.2 Video Analytics – Edge-Based Intelligent Processing

NYC DOT currently uses the FLIR Cascade platform and VIPIP video modules to process traffic camera feeds within the Traffic Management Center (TMC), providing traffic volume data in real time. By integrating TSN's secure, encrypted, and reliable 99.99% connectivity, DOT plans to decentralize analytics - shifting processing to field-based "edge" equipment. AI-capable TSN-linked processors or other modern edge enabled units would perform vehicle/pedestrian detection, incident flagging, and anomaly recognition locally. Only the distilled metadata - such as event type, time stamp, geolocation, and short video clip - is sent back to the TMC via TSN. This dramatically reduces bandwidth use, enhances system responsiveness, and allows TMC operators to receive precise, timely alerts while preserving raw footage for forensic review only when needed. This edge based approach aligns with modern ITS best practices and future-proofs NYC's video analytics strategy.

3.4 Real-Time Data Collection and Dissemination

3.4.1 Real-Time Traffic Monitoring and Public Information Dissemination

The TSN supports internal operational management through real-time Wi-Fi-based travel-time data collection, processed centrally at the TMC. This capability enables DOT operators to continuously monitor traffic patterns and effectively manage daily operations. Additionally, the collected data is slated for public dissemination via the city owned Variable Message Signs and the Ral-Time Traveler Information (RTTI) website enhancing transparency and providing motorists with valuable travel-time information to improve journey planning and reduce congestion.

3.4.2 Route Choice and Origin-Destination Analysis

With the Wi-Fi and Bluetooth sniffing capability of the TSN routers, NYC DOT gains detailed insights into route choices and origin-destination patterns by analyzing travel times collected across multiple routes. This capability allows DOT engineers and planners to understand motorist behavior better, assess route efficiency, identify bottlenecks, and strategically plan traffic management interventions. This precise data-driven approach significantly enhances traffic flow optimization across the city.

ID	Time	Trip	Speed Limit (mph)	Length (ft)	Trip Time (min)	Trip Freeflow Time (min)
Fri May 02 2025 11:06:05 GMT-0400 (Eastern Daylight Time)						
1100	5/2/2025 11:04	BQE EB @ Wythe Ave - Jackson Ave @ Queens Blvd - Via McGuinnes	55	22104	18	9
1101	5/2/2025 11:04	BQE EB @ Wythe Ave - Jackson Ave @ Queens Blvd - Via LIE/Van Dam St	55	25584	12	10

3.5 Multimodal and Micromobility Analysis

3.5.1 Street Activity Data & Micromobility Monitoring

New York City DOT is piloting smart street-activity sensors - mounted on 12 light poles across Brooklyn, Bronx, Manhattan, and Queens - as part of its partnership with Viva City to count pedestrians, cyclists, scooters, vehicles, and near miss interactions in real time . Integrated into the TSN network, these devices securely and reliably transmit anonymized, edge-processed data - such as mode counts, travel speeds, turning movements, and path trajectories - to the Traffic Management Center (TMC). With TSN's robust 99.99% uptime and encrypted communications, DOT planners can analyze multi-modal usage trends continuously, bypassing labor-intensive manual counts. This system supports data-driven street redesigns - such as reallocating space on Lexington Avenue (where pedestrians account for 76% of users) and informing bike-lane adjustments - and aligns with broader Vision Zero and micromobility strategies. If the pilot demonstrates success, TSN's scalability will enable DOT to deploy sensors citywide to better forecast multimodal demand and proactively enhance street safety and equity.

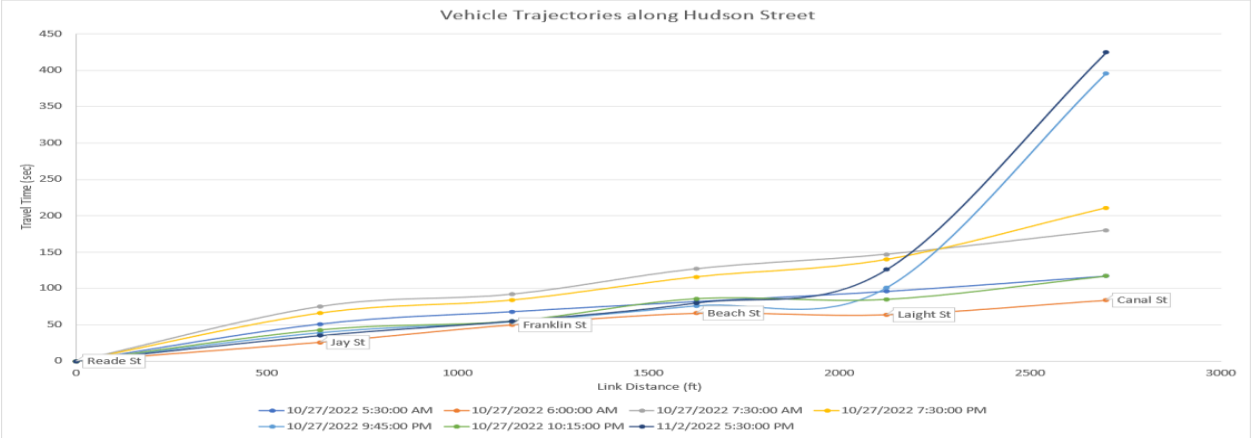
3.5.2 Connected Vehicle / Roadside Unit Integration

NYC DOT's Connected Vehicle Pilot across Manhattan and Brooklyn - covering major corridors nyc.gov. TSN routers, with modular Ethernet ports, provide secure, encrypted, and highly reliable backhaul connectivity for these RSUs. This integration enables Vehicle-to-Infrastructure (V2I) applications such as Red-Light Violation Warning, Speed Compliance alerts, Pedestrian-In-Crosswalk detection, and Intersection Movement Assist. By

utilizing TSN's 99.99% uptime and IPsec VPN, RSUs can exchange Basic Safety Messages (BSMs), SPaT, and MAP data with the Traffic Management Center and On-Board Units (OBUs) in the field seamlessly. The TSN also supports over-the-air software updates, certificate management via SCMS, and real-time telemetry, while preparing the infrastructure for future 5G-based RSUs. This edge-to-center architecture enhances crash prevention and enables proactive fleet safety alerts.

3.5.3 Emerging Applications

TSN's ability to collect detailed Wi-Fi and Bluetooth data enables NYC DOT to analyze vehicle trajectories comprehensively. By tracking the real-time movements of individual vehicles, DOT can accurately identify locations of frequent delays and persistent bottlenecks within corridors or across the broader network. This trajectory data can be visualized in conjunction with traffic signal timing diagrams, significantly aiding in evaluating and optimizing signal timing plans. Such precise analysis improves strategic planning efforts, reduces congestion, and enhances overall traffic flow and efficiency across the city's transportation network.



4 CONCLUSION

The Traffic Safety Network represents a strategic overhaul of NYC's transportation communications infrastructure. By deploying a secure, redundant & dual carriers, and IoT-enabled broadband network tailored for public safety, NYC DOT has established a cost effective, scalable and efficient backbone that underpins:

- Transit efficiency via signal priority
- Adaptive traffic control to reduce congestion
- Enhanced emergency response
- Data-driven travel-time monitoring
- Automated field device management
- Incident Response and traffic monitoring
- Improved cyclist and pedestrian safety
- Dual Carrier ensuring 99.99 % communication uptime
- All supported applications adhering to all ITS NTCIP standards

As TSN continues to evolve, emerging applications such as connected vehicle integration, deep-learning signal optimization, and comprehensive micro-mobility sensing promise to further elevate the safety, sustainability, and resilience of New York City's streets.