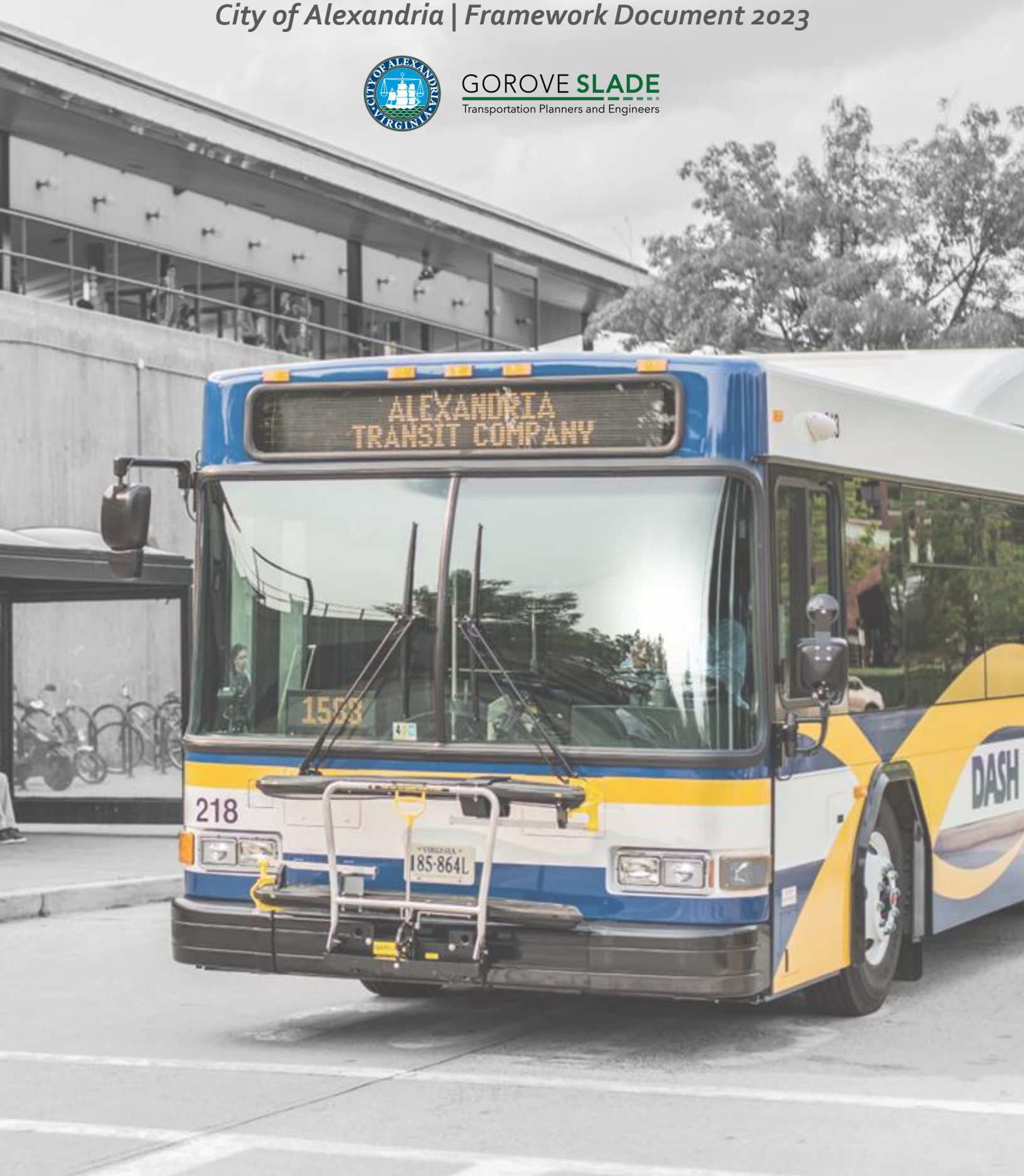
SMART MOBILITY

City of Alexandria | Framework Document 2023

GOROVE SLADE
Transportation Planners and Engineers



What is Smart Mobility?

Smart Mobility is the concept of applying information technologies to roads, traffic signals, transit vehicles, and other transportation infrastructure to help us better understand how our roadway network operates. This data can be leveraged to improve quality of life in Alexandria in a variety of ways – from managing traffic to improving transit to enhancing safety to optimizing parking to streamlining emergency management.

Strategy

When it comes to Smart Mobility, Alexandria is committed to a proactive, innovative approach. Implementation of this Framework will come from various sources and partnerships. It will involve an interdepartmental team of City staff tasked with streamlining existing Smart Mobility-related programs, researching and implementing new programs, and coordinating with external partners. In doing so, the City will lay the groundwork for application developers, vendors, and other technology creators to partner with Alexandria to advance its Smart Mobility goals.

Guiding Principles

Six Guiding Principles have been identified to inform the Smart Mobility Framework and ensure it serves the City's goals and principles.

Safety	Eliminate all traffic fatalities and severe injuries while increasing safe, healthy, equitable mobility for all.
Mobility	Improve accessibility and transportation options for residents and visitors of all abilities
Forward-looking	Proactively plan for emerging and future transportation technologies
Sustainability	Improve environmental quality and resiliency.
Traffic Management	Optimize traffic flow on City streets, improving travel times and reducing congestion.
Transparency	Use data and analytics to improve decision making and City services while broadening public access to information.

GOROVE SLADE
Transportation Planners and Engineers

| INFRASTRUCTURE

Alexandria is integrating **Intelligent Transportation Systems** (ITS) into its communications networks to ensure they're ready for the latest mobility technologies.

With a modernized and expanded fiber optics network, Alexandria's streets will become conduits of real-time communications – linking traffic signals, weather stations, and other devices with the Traffic Management Center. To date, the City has installed more than 145,000 feet of fiber-optic cable and 27 traffic cameras.

Combined with upgraded traffic signal management systems, closed circuit television systems, traffic signal cabinets, state of the art controllers, and smart detection, these updates will allow the City to better respond to delays and incidents, plan for special events, share critical alerts to better inform the public and support new mobility technologies. An upgraded transportation communication network is critical in enabling future technologies such as connected and autonomous vehicles.

An improved fiber optics network will allow the City to expand Municipal Broadband across Alexandria to support voice, video, and data transport among the City's public institutions, such as schools, libraries, public safety buildings. An additional goal of this initiative is to increase consumer choice in cable, voice, and broadband services and to increase data speeds.

Alexandria is also exploring ways to ready the City's roadway infrastructure for Inductive Charging of electric vehicles. Starting with a focus on Bus Rapid Transit corridors, the City will explore how to wirelessly charge vehicles while parked (static charging).

Alexandria is pursuing funding for a project to test Connected Vehicles in the Innovation District around Potomac Yard. This project will explore the benefits of using infrastructure to communicate with personal vehicles, buses, fleet vehicles, and more to improve safety and reduce congestion.

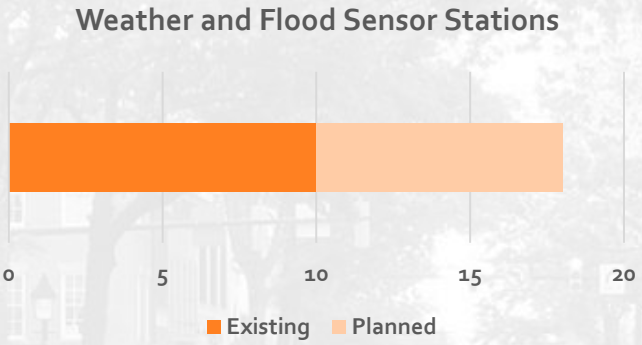
Alexandria is also retrofitting the City's streetlights with LED lights which last five (5) times longer than incandescent lights, reduce energy consumption by 90%, and burn brighter. Improved street lighting assists travelers in finding their way in the dark. The City expects to have converted 95% of the 10,000 streetlights to LED by the end of 2022.

| ROAD WEATHER

By implementing technology that tracks and measures road weather conditions, Alexandria will be equipped to better respond to severe weather events, such as snow, ice, high winds, and flooding.

By letting travelers and City staff know exactly where weather is impacting roadways, these sensors can keep the transportation network running safely and efficiently.

Alexandria is expanding its network of roadside flood and weather sensor stations. These stations detect and send alerts when weather conditions at the site warrant a road closure or other action.



By analyzing the data that the road weather sensor stations collect, the City will be able to proactively plan for extreme weather events, improving the timeliness of push notifications for residents and route planning for emergency responders.

| PUBLIC SAFETY

Alexandria is giving emergency responders the tools to travel quickly and safely to incidents.

Because every second matters for emergency responders, Alexandria is making sure response teams have up-to-the-minute information about road and incident site conditions.

The City will explore incident scene staging guidance, a technology that allows emergency responders to coordinate incident site staging and operations in real time.

Alexandria is exploring integrating its existing emergency vehicle Computer Aided Dispatch (CAD) system with real-time traffic data to improve on-scene arrival times.

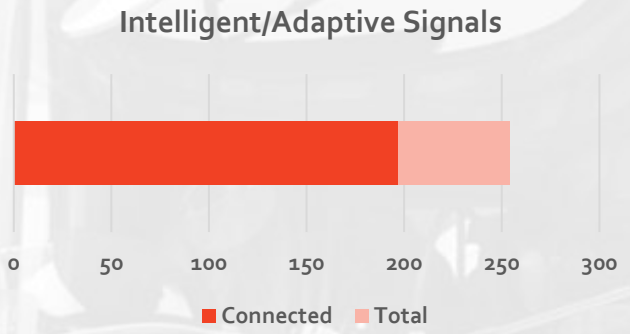
The City has made upgrades to its fleet of emergency vehicles with Emergency Vehicle Preemption equipment, which enables traffic signals to change in response to emergency vehicles responding to an emergency, improving response times.

The City has implemented Emergency Vehicle Preemption along Duke Street, Sanger Avenue, and Seminary Road and is exploring the addition of this technology along other corridors.

| TRAFFIC SIGNALS

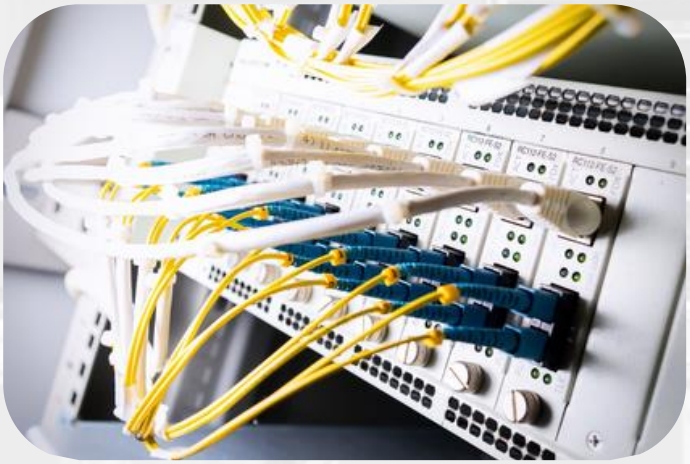
To manage traffic flow and move transit and emergency vehicles faster and safer, Alexandria is installing smart signals and preemption throughout the city.

Alexandria is rolling out intelligent traffic signals that respond and adapt to real-time vehicle location and movement data, optimizing traffic flow, decreasing delays, and reducing stops at various intersections throughout the city.



The new signals are equipped with technology to prioritize transit and emergency vehicles, allowing equipped vehicles to request preemption at intersections and bypass stopped vehicles or congestion.

The City is also exploring mobile accessible pedestrian signal systems that use GPS and other technologies to help people with limited or no eyesight cross signalized intersections safely.



| TRANSIT

From transit signal priority on major corridors to mobile fare payment and real-time arrival information, Alexandria is making transit faster, easier, and more reliable than ever.

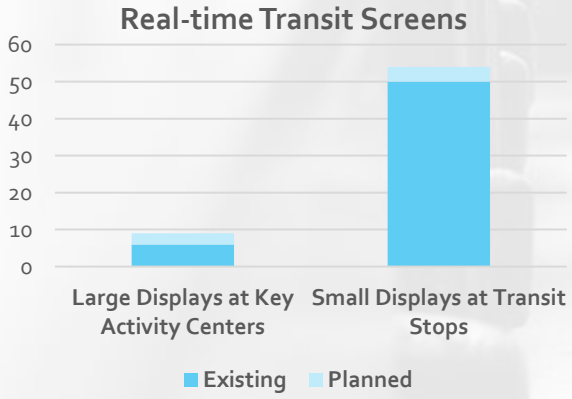
All new DASH buses come with automated passenger counters (APCs), allowing a better understanding of transit demand for future planning. DASH is also retrofitting existing buses to inlcude APCs

In addition to the DASH Tracker, Alexandria has begun providing third party apps like Moovit and the Transit app with real-time transit feed, so riders can see exactly where their bus is and when it will arrive.

The existing bus fleet will be equipped with transit signal priority (TSP) equipment as the City upgrades traffic signals with TSP on corridors throughout the City, starting with Beauregard Street, Duke Street, Seminary Road, Route 1, and Van Dorn Street.

5
transit signal priority corridors

Real-time transit arrival screens have been installed at key activity centers, various buildings, and bus stops across the city.



| MOBILITY ON DEMAND

From Capital Bikeshare to dockless bikes and scooters to ride-hailing services, Alexandria is partnering with shared, on-demand mobility providers to give residents and visitors more choices.

The recent growth of shared, on-demand mobility services gives Alexandria residents and visitors more transportation options and may reduce vehicle trips and parking demand.

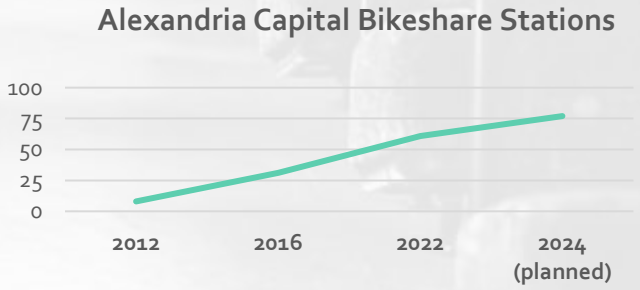
The City is looking to add Smart Mobility digital kiosks which provide real-time trip planning and wayfinding information with alternative transportation options.

In July 2022, the City switched to the Via booking platform for its paratransit program to better manage routing and provide online and app-based ride booking. This change will additionally provide better data for decision making.

Alexandria is looking into implementing more dedicated space for Pick-Up/Drop-Off zones for businesses such as restaurants utilizing mobile delivery apps.

In addition to ongoing car-sharing ride-hailing services, the City has implemented a dockless mobility program, permitting private dockless bicycle and scooter companies to operate in the City. The program continues to be monitored with data dashboards informing future decision making.

The City currently has 61 Capital Bikeshare (CaBi) stations with plans to install nine (16) more stations. The CaBi system supports unlocking pedal and electric-assist bikes (e-bikes) using the system's app or the Lyft app. Users can also track their usage or trip history in the CaBi app.



Ⓟ | PARKING

Through technology, curbside management, and improved City services, Alexandria is making parking more predictable and efficient.

Alexandria has migrated its visitor permit parking program online, making it easier and less time consuming for visitors to the City to register their vehicles and obtain a parking permit. The City will explore the feasibility of similarly migrating the residential permit parking program online in the future.

The City is increasing its use of Automated License Plate Readers (ALPRs), allowing parking enforcement officers to streamline ticketing, and manage citations via autonomous vehicle mounted units. In addition, ALPRs are used by APD to capture and analyze license plates against known databases for enforcement.

18
Automated License Plate Readers

Alexandria has begun replacing traditional multi-space, pay and display parking meters with multi-space, pay-by-plate meters, making parking enforcement easier.

At selected garages, the City will install parking guidance systems that tell customers whether there are spaces available in the facility.

Smarking is a tool that facilitates "Smart Parking". It allows us to track live capacity at various parking facilities and better plan for events, holidays, and daily parking needs. In the future it could also support smarter curb management practices for deliveries and quick stops."

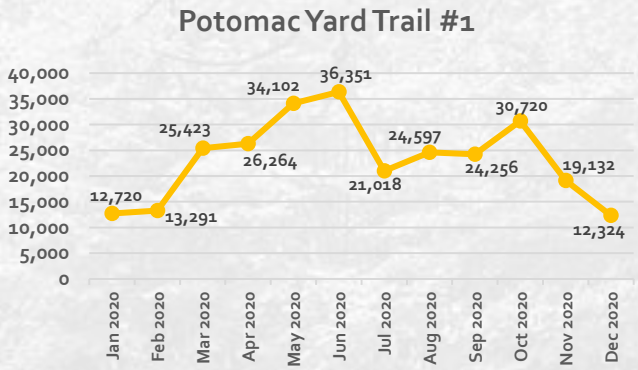
| PERFORMANCE MONITORING

By modeling, studying, and analyzing data from sensors, video, and other sources, Alexandria can better understand travel patterns and determine how to manage traffic.

Alexandria will analyze data from Bluetooth devices, cellular devices, on-street sensors, and video equipment to make sure streets are functioning safely and efficiently.

The City is utilizing technology that both monitors traffic conditions and tallies vehicular, bicycle, and pedestrian movements at intersections.

Alexandria has seven (7) automated bicycle and pedestrian counters set up throughout the City, providing data that helps City staff better understand local and regional transportation trends and plan accordingly. This data is also publicly available for the public to consult, download, improve, and analyze.



The City utilizes big data to analyze traffic movement and travel patterns. Through on-demand mobility analytics platforms, City staff can leverage anonymized, location-based service (LBS) data from Bluetooth enabled devices for in-depth traffic analyses.

Alexandria is partnering with the Virginia Tech Transportation Institute to evaluate potential tools for improving safety and design of local intersections. These tools can quantify near misses between cars and vulnerable road users and inform changes to streets, curbs, and signals. This partnership can serve as a model for future opportunities to collaborate for academic research.

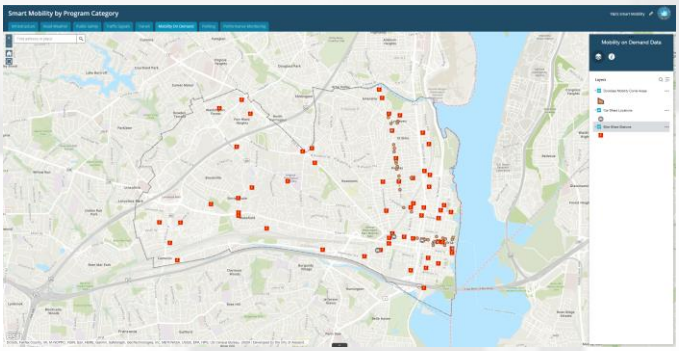
ⓘ | INFORMATION MANAGEMENT

With a data-driven mobility approach, Alexandria is committed to sharing its data with local and regional stakeholders, while also making sure information is handled responsibly and securely.

Alexandria's Traffic Management Center will be equipped to receive upgrades, allowing it to manage on-street traffic equipment, monitor overall system status, configure devices remotely, and analyze data.

To allow regional cooperation on mobility and safety, the City will participate in secure data exchanges with nearby jurisdictions, state agencies, and private companies.

For example, Alexandria has joined the WAZE for Cities Program, providing the City access to real-time information on incidents and slow-downs and providing drivers access to advance notice on construction, crashes, and road closures.



The City will expand the number of automated interactive maps available to staff and the public. These maps provide agencies and residents with access to easy-to-use searchable maps targeted to specific exploration and discover needs. The existing Smart Mobility Viewer includes layers related to road weather, public safety, traffic signals, transit, mobility on demand, parking, and performance monitoring. The City is additionally building out a Vision Zero Viewer to display crash and accident information.

The City of Alexandria makes its geospatial data available for free in multiple ways through its GIS Open Data Portal. Using these existing methods for distributing geospatial data, the City will make new data sets available to staff and the public when possible.

$ | FUNDING

Alexandria is committed to implementing Smart Mobility principles and programs in the short-, medium-, and long-term by seeking both traditional and innovative sources of project funding.

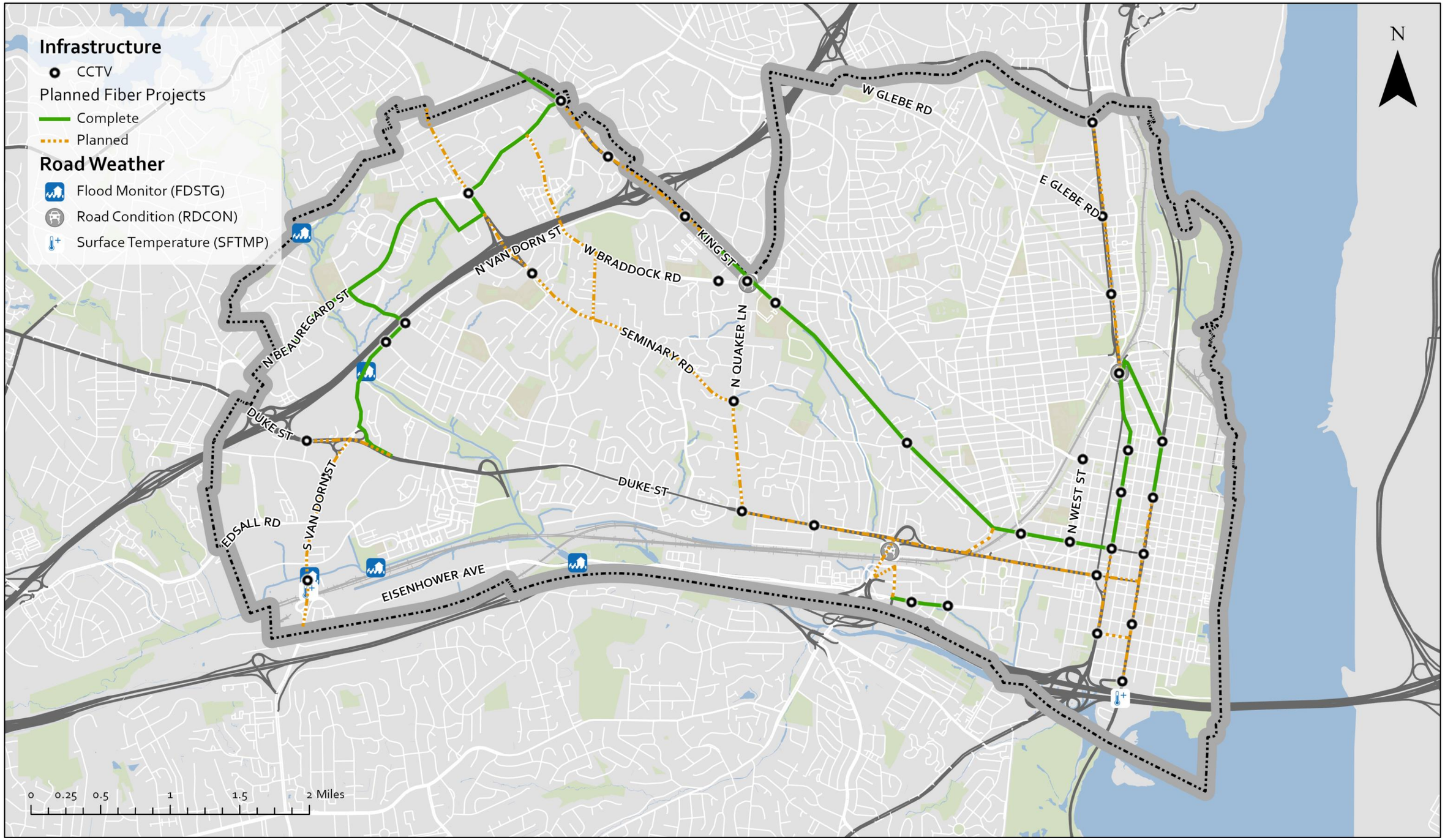
Alexandria currently funds many of its projects through regional, state, and federal grants in addition to the City's operating funds. Notable sources of grant funding include the Northern Virginia Transportation Authority (NVTA), the Virginia Department of Rail and Public Transportation (DRPT), and the Federal Highway Administration (FHWA).

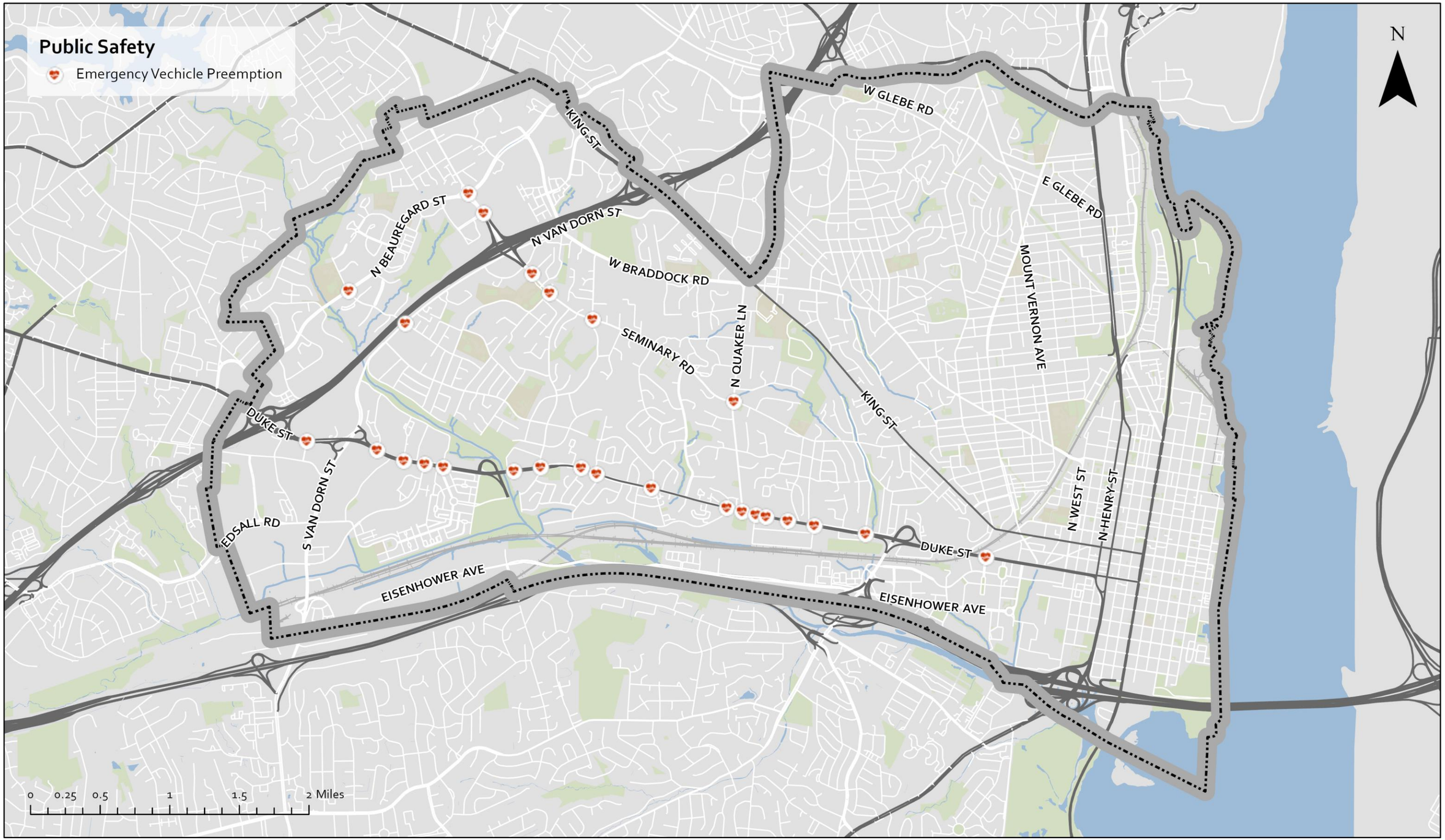
To allow for greater private sector participation in the delivery of public sector projects, services, and infrastructure, the City now has an Assistant City Manager to focus on public-private partnerships (P3s).

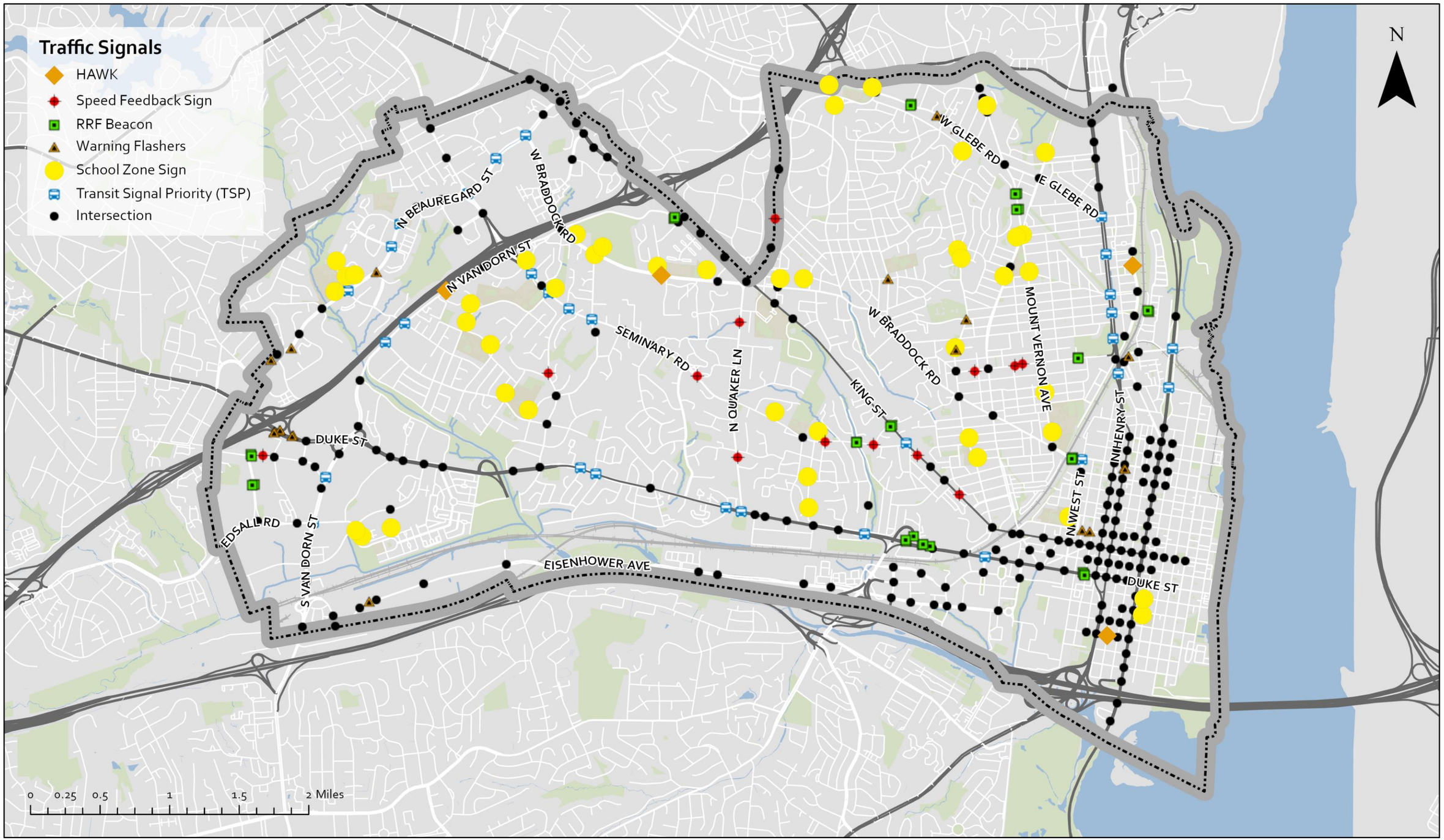
Notable projects delivered through public-private partnerships include the construction of public parking garages with private development, the Potomac Yard Metrorail station, and the first design-build of a municipal bus facility in Virginia.

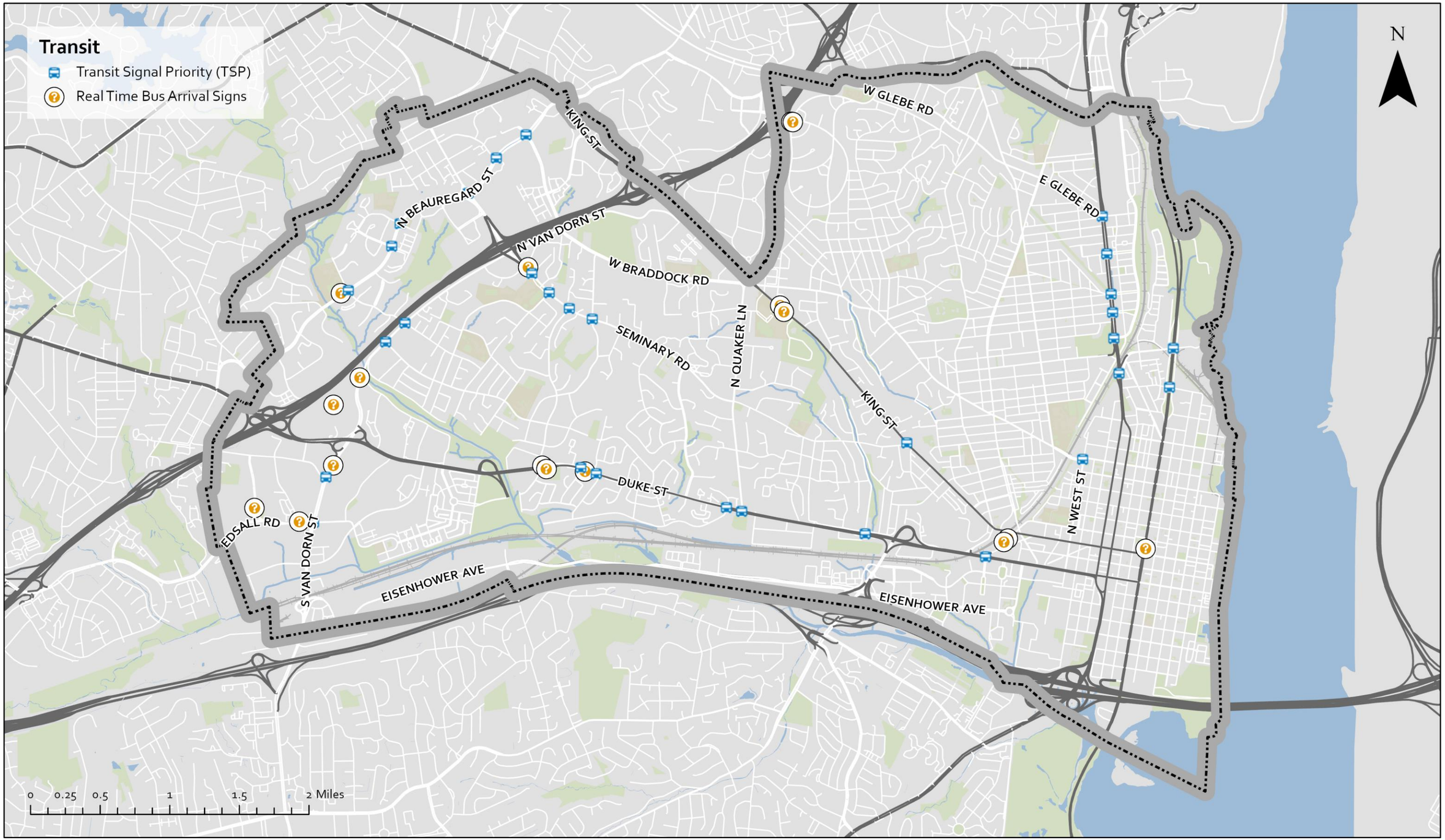
Program Maps

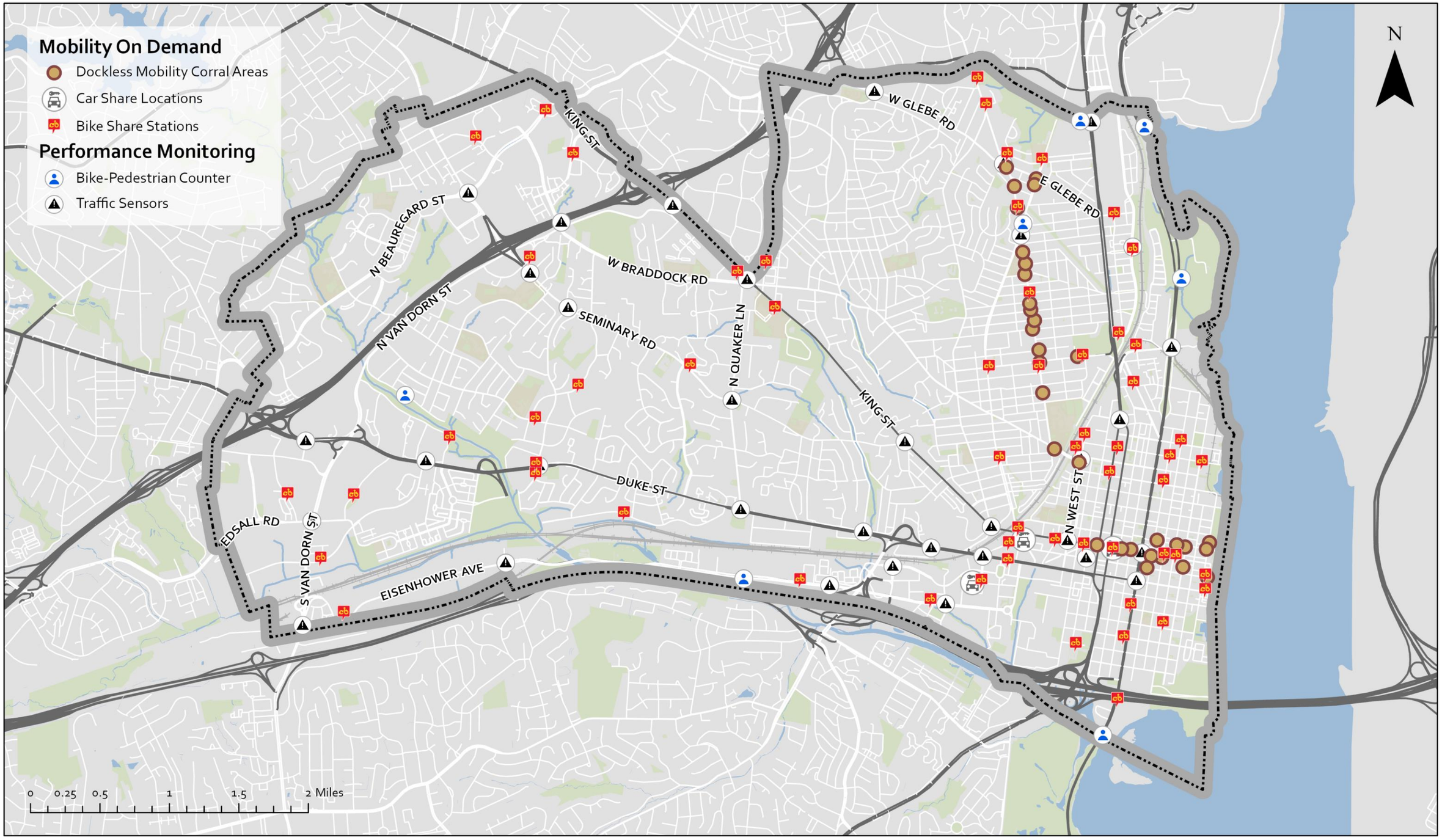
These maps show the location of selected Smart Mobility programs.




Public Safety
Emergency Vechicle Preemption
N
KING ST
W GLEBE RD
E GLEBE RD
N BEAUREGARD ST
N VAN DORN ST
W BRADDOCK RD
SEMINARY RD
N QUAKER LN
MOUNT VERNON AVE
KING ST
DUKE ST
S VAN DORN ST
EDSALL RD
EISENHOWER AVE
DUKE ST
N WEST ST
N HENRY ST
EISENHOWER AVE
0 0.25 0.5 1 1.5 2 Miles


Traffic Signals
HAWK
Speed Feedback Sign
RRF Beacon
Warning Flashers
School Zone Sign
Transit Signal Priority (TSP)
Intersection
N
N BEAUREGARD ST
W BRADDOCK RD
N VAN DORN ST
SEMINARY RD
N QUAKER LN
KING ST
W GLEBE RD
E GLEBE RD
W BRADDOCK RD
MOUNT VERNON AVE
N HENRY ST
N WEST ST
DUKE ST
EDSALL RD
S VAN DORN ST
EISENHOWER AVE
DUKE ST
0 0.25 0.5 1 1.5 2 Miles


Transit
Transit Signal Priority (TSP)
Real Time Bus Arrival Signs
N
KING ST
W GLEBE RD
E GLEBE RD
N BEAUREGARD ST
N VAN DORN ST
W BRADDOCK RD
SEMINARY RD
N QUAKER LN
KING ST
DUKE ST
N WEST ST
EDSALL RD
S VAN DORN ST
EISENHOWER AVE
EISENHOWER AVE
0 0.25 0.5 1 1.5 2 Miles


Mobility On Demand
Dockless Mobility Corral Areas
Car Share Locations
Bike Share Stations
Performance Monitoring
Bike-Pedestrian Counter
Traffic Sensors
N
KING ST
W GLEBE RD
E GLEBE RD
N BEAUREGARD ST
N VAN DORN ST
W BRADDOCK RD
SEMINARY RD
N QUAKER LN
KING ST
DUKE ST
N WEST ST
EDSALL RD
S VAN DORN ST
EISENHOWER AVE
0 0.25 0.5 1 1.5 2 Miles

Program Progress Chart

This chart lists progress made on each of the [x] programs in the Smart Mobility Framework. For more details about individual programs, please visit [website].

Progress Key

- Not started
- Initiated
- Moderate progress
- Significant progress
- Complete

	PROGRAM / ACTION	LEAD DEPARTMENT	FUNDING SOURCE	IMPLEMENT YEAR	TIME FRAME	PROGRESS
	1. INFRASTRUCTURE					
1.1	Upgrade roadside lighting to LED	T&ES	CIP	2021-25	Short	
1.2	Upgrade, expand fiber optics communications network	T&ES	CMAQ, SmartScale	2021-25	Short	
1.3	Upgrade traffic signal cabinets, controllers, and detection systems	T&ES	SmartScale, CIP	2025-29	Medium	
1.4	Increase coverage of closed-circuit television (CCTV)	T&ES	SmartScale/CMAQ	2025-29	Medium	
1.5	Develop architecture that supports Connected and Autonomous Vehicles (CAV)	T&ES	-	-	Long	
	2. ROAD WEATHER					
2.1	Expand number of environmental sensor stations	T&ES	CIP	2021-25	Short	
2.2	Integrate road weather data with emergency response routing support	T&ES, ITS	-	2021-25	Short	
2.3	Implement road weather motorist alerts	T&ES	-	-	-	
	3. PUBLIC SAFETY					
3.1	Implement incident scene staging guidance for emergency responders	AFD	-	2029+	Long	
3.2	Integrate real-time data with emergency response routing support	AFD	-	2029+	Long	
3.3	Install emergency vehicle preemption equipment on fleet vehicles	AFD	NVTA	2021-25	Short	
	4. TRAFFIC SIGNALS					
4.1	Install intelligent/adaptive and traffic responsive traffic signals system	T&ES	SmartScale	2021-29	Medium	
4.2	Install transit and emergency signal priority equipment on signals	T&ES	NVTA, SmartScale	2021-25	Short	
4.3	Implement mobile accessible pedestrian signal systems	T&ES	-	-	-	
	5. TRANSIT					
5.1	Install bike/pedestrian detection systems on buses	DASH	DRPT	2021-25	Short	
5.2	Install transit signal priority equipment on buses	DASH	NVTA, SmartScale	2021-25	Short	
5.3	Install real-time arrival screens at bus stops and in buildings	DASH	DRPT, SmartScale	2021-25	Short	
5.4	Automate collection of bus boarding and alighting data	DASH	CMAQ	2021-25	Short	
5.5	Upgrade to real-time transit feed from static feed	DASH	NVTA	2021-25	Short	
5.6	Update bus scheduling software	DASH	DRPT	2021-25	Short	
5.7	Implement real-time SMS texting for bus arrivals	DASH	NVTA	2021-25	Short	
5.8	Upgrade bus CAD/AVL systems	DASH	DRPT	2025-29	Medium	
	6. MOBILITY ON DEMAND					
6.1	Expand the City's Capital Bikeshare program	T&ES	CMAQ, Developers	2025-29	Medium	
6.2	Implement Pick-up/Drop-off zones for commercial deliveries	T&ES, ITS	City Operating Funds	2021-25	Short	
6.3	Manage the Dockless Mobility Program	T&ES	Permit Fees	2021-25	Short	
6.4	Implement Paratransit On-Demand	T&ES	City Operating Funds	2021-25	Short	
6.5	Pilot Smart Mobility kiosks	T&ES	P3	-	Short	

	PROGRAM / ACTION	LEAD DEPARTMENT	FUNDING SOURCE	IMPLE-MENT YEAR	TIME FRAME	PROGRESS
Ⓟ	**7. PARKING**					
7.1	Continue, expand use of handheld enforcement devices	T&ES, APD	CMAQ, RSTP	2021-25	Short	●●●○
7.2	Continue, expand use of automated license plate readers	T&ES	City Operating Funds	2021-25	Short	●●●○
7.3	Continue pay-by-phone parking in commercial areas	T&ES	Fee based	2021-25	Short	●●●●
7.4	Continue, expand pay-by-phone parking in residential areas	T&ES	Fee based	2021-25	Short	●●●○
7.5	Continue and expand pay-by-plate parking at multi-space meters	T&ES	-	2021-25	Short	●●●○
7.6	Streamline residential parking permit issuance	T&ES	Fee based	2021-25	Short	●●○○
7.7	Streamline visitor parking permit issuance	T&ES	Fee based	2021-25	Short	●●○○
7.8	Implement real-time variable rate parking meters	T&ES	-	2021-25	Short	○○○○
7.9	Implement electric vehicle charging station management	T&ES	-	2021-25	Short	●●○○
7.10	Install parking garage guidance systems	T&ES	Grant funded	2021-25	Short	●●○○
7.11	Implement near real-time parking information systems	T&ES	City Operating Funds	2021-25	Short	●●○○
7.12	Install parking sensors	T&ES	-	-	-	○○○○
	8. PERFORMANCE MONITORING					
8.1	Exchange data with connected vehicles and navigation apps	T&ES	-	2025-29	Long	●●●○
8.2	Implement video data collection	T&ES	City Operating Funds	2025-29	Medium	●○○○
8.3	Implement sensor data collection	T&ES	-	2021-29	Medium	●●●●
8.4	Implement cellular data collection	T&ES	City Operating Funds	2021-25	Short	●●○○
	9. INFORMATION MANAGEMENT					
9.1	Upgrade Traffic Management Center (TMC)	T&ES, ITS	SmartScale	2025-29	Medium	○○○○
9.2	Facilitate data exchange	ITS	-	-	Short	●●●○
9.3	Facilitate data and alerts distribution	ITS	-	-	Short	●○○○
9.4	Creation of automated Interactive Maps	T&ES, ITS	-	-	Short	●●●○
9.5	Facilitate secure inter-device communications	ITS	-	-	Medium	○○○○
9.6	Integrate real-time data into decision-making model	T&ES, ITS	-	-	Short	●○○○

Agency Acronyms

AFD Alexandria Fire Department
APD Alexandria Police Department
DASH Driving Alexandria Safely Home (Alexandria Transit Company)
ITS Information Technology Services
T&ES Transportation & Environmental Services

Funding Acronyms

CIP Capital Improvement Program
CMAQ Congestion Mitigation and Air Quality Improvement Program
DRPT Virginia Department of Rail and Public Transportation
NVTA Northern Virginia Transportation Authority
RSTP Regional Surface Transportation Program
P3 Public Private Partnership

Program Description Chart

This chart provides more detail about individual programs in the Framework, describing how they benefit residents and visitors and highlighting which Guiding Principles they address.

PROGRAM / ACTION		DESCRIPTION	BENEFIT	GUIDING PRINCIPLES: Safety	Mobility	Forward-looking	Sustainability	Traffic Management	Transparency
1. INFRASTRUCTURE									
1.1	Upgrade roadside lighting to LED	Upgrade existing high pressure sodium streetlights to LED lights	Allows for more energy efficient usage of lighting	●		●	●		
1.2	Upgrade, expand fiber optics communications network	Links traffic signals, weather stations, and other devices with the Traffic Management Center (TMC), allowing real-time data and analysis and decision-making; provides infrastructure required for Municipal Broadband	Provides dynamic communications backbone, allowing TMC to better understand travel patterns, and congestion; provides infrastructure to pursue opportunities to increase consumer choice in cable, voice, and broadband services to provide consumer options and increased data speeds, as well as infrastructure for Municipal Broadband	●	●	●		●	
1.3	Upgrade traffic signal cabinets, controllers, and detection systems	Provides required technology to support advanced infrastructure such as intelligent/adaptive traffic signal systems, connected vehicles, and transit/emergency vehicle signal priority systems	Enables more advanced signal operations, including for transit and emergency vehicles	●	●	●		●	
1.4	Increase coverage of closed-circuit television (CCTV)	Provides real-time traffic condition information for operational decision-making and traveler information; may be accessed by emergency services for improved situational awareness and response	Delivers contextual, useful travel information to transportation and safety officials	●	●	●		●	
1.5	Develop architecture that supports Connected and Autonomous Vehicles (CAV)	Connected and automated features on vehicles are on roads today. Fully connected and autonomous vehicles will be more prevalent in the near future, and it is necessary to ensure critical roadway and communications infrastructure can accommodate CAVs	Enables strategies to plan for future infrastructure to accommodate CAVs		●	●	●	●	●
2. ROAD WEATHER									
2.1	Expand number of environmental sensor stations	Fixed roadway location with one or more sensors measuring atmospheric, pavement/soil, and/or water level conditions	Allows decision makers to understand and analyze problem areas for flooding and other weather concerns, enables real-time alerts to motorists and residents	●	●	●			
2.2	Integrate road weather data with emergency response routing support	Uses environmental data from sensors to produce warnings or advisories for emergency response vehicles or dispatchers	Allows emergency responders to track road weather conditions in real time, allowing routing changes if necessary	●		●			
2.3	Implement road weather motorist alerts	Uses road weather data from sensors to produce warnings or advisories for individual motorists	Allows motorists to track road weather conditions in real time, allowing routing changes if necessary	●	●	●		●	
3. PUBLIC SAFETY									
3.1	Implement incident scene staging guidance for emergency responders	Provides situational awareness and coordination among emergency responders at all points of dispatch, travel, arrival, and departure from incident scenes	Allows real-time communication among emergency responders to coordinate more efficient staging and travel to incident sites	●		●		●	
3.2	Integrate real-time data with emergency response routing support	Integrate existing emergency vehicle Computer Aided Dispatch (CAD) and routing decision software with real-time data to improve reliability and on-scene arrival times	Allows emergency responders to determine routes to incident sites using real-time information	●		●		●	
3.3	Install emergency vehicle preemption equipment on fleet vehicles	Uses emergency vehicle to infrastructure communications to allow an emergency vehicle to request preemption at intersections	Allows emergency vehicles to change traffic signal while responding to an emergency call, improving response times	●		●		●	
4. TRAFFIC SIGNALS									
4.1	Install intelligent/adaptive and traffic responsive traffic signals system	Uses location and movement information from near real-time data to improve traffic signal control system operations	Enables more efficient signal operations; Allow real-time adjustments to signals along major traffic corridors	●		●		●	
4.2	Install transit and emergency signal priority equipment on signals	Signals allow transit and emergency vehicles to request priority/preemption at intersections	Enables more efficient movement of transit and emergency vehicles	●	●	●	●	●	
4.3	Implement mobile accessible pedestrian signal systems	Uses GPS and other technologies to help people with limited or no eyesight to cross signalized intersections safely	Increases mobility and accessibility to people with limited or no eyesight	●	●	●			
5. TRANSIT									
5.1	Install bike/pedestrian detection systems on buses	Uses smart sensors to provide real-time visual and audible alerts when pedestrians or cyclists are in bus blind spots	Reduces the risk of bus collisions with bicycles or pedestrians	●		●			
5.2	Install transit signal priority equipment on buses	Uses transit vehicle to infrastructure communications to allow a transit vehicle to request priority at intersections	Allows transit vehicles to bypass congestion and offer more reliable service		●	●	●	●	
5.3	Install real-time arrival screens at bus stops and in buildings	Electronic screens display real-time arrival countdowns of nearby transit lines	Allows riders to plan and choose a travel mode quickly and on the spot		●	●	●		●
5.4	Automate collection of bus boarding and alighting data	Near real-time collection of transit boarding and alighting data	Gives transit planners better information about route usage or crowding, allowing service adjustments to meet demand		●	●	●	●	●
5.5	Upgrade to real-time transit feed from static feed	Allows real-time updates of transit vehicle location data, which can be disseminated to customers via third party apps	Allows transit riders to see exactly where their bus is and when it will arrive, improving the accuracy and reducing uncertainty while traveling by transit		●	●	●	●	●
5.6	Update bus scheduling software	Upgrade bus scheduling software to more dynamic, capable program	Allows transit planners to more efficiently plan and service bus routes		●	●	●	●	
5.7	Implement real-time SMS texting for bus arrivals	Allows transit riders to send a text from a transit stop to learn when the next bus will arrive	Provides transit riders without smartphones the ability to receive real-time transit arrival information		●	●	●		
5.8	Upgrade bus CAD/AVL systems	Performs bus vehicle diagnostics through upgrades to existing Computer Aided Dispatch (CAD) and Automated Vehicle Location (AVL) systems on buses	Allows more efficient predictive and preventative maintenance of bus fleet	●	●	●	●		●

	PROGRAM / ACTION	DESCRIPTION	BENEFIT	Safety	Mobility	Forward-looking	Sustainability	Traffic Management	Transparency
6. MOBILITY ON DEMAND									
6.1	Expand the City's Capital Bikeshare program and add e-bike with mobile unlocking	Allows users to borrow a bike from a dock and return it to another dock within the system	Provides one-way trips of shared bicycles; provides last-mile transportation solution		●		●	●	
6.2	Implement Pick-up/Drop-off zones for commercial deliveries and improved curbside management	Allows commerical drivers dedicated space for pick and drop off for deliveries	Allows for easier curbside access to businesses which utilize delivery or pickup services		●	●		●	
6.3	Manage the Dockless Mobility Program	Allows users to borrow a bike or scooter by unlocking via smartphone app and returning it anywhere within the provider's service area (i.e., not in a dock)	Allows one-way trips on shared bicycles or scooters with more origin/destination flexibility than docked systems; provides last-mile transportation solution		●	●	●	●	
6.4	Implement Paratransit On-Demand	Allows residents and visitors to the City to schedule near real-time trip requests for paratransit trips that require specialized transportation services for riders who require special accommodations	Enables near real-time trip requests for riders eligible to receive ADA paratransit services		●	●		●	
6.5	Pilot Smart Mobility kiosks	Provides real-time trip planning and wayfinding information for multi-modal transportation options at digital kiosks locations throughout the City	Enables users to have real-time access to alternative modes of transportation provided within the City		●	●	●	●	
7. PARKING									
7.1	Continue, expand use of handheld enforcement devices	Allows parking enforcement officers to streamline ticketing, manage citations, and improve enforcement	Allows more effective enforcement of parking regulations	●		●			●
7.2	Continue, expand use of automated license plate readers	Allows parking enforcement officers to streamline ticketing, manage citations via autonomous vehicle mounted units, and improve enforcement; used by APD to capture and analyze license plates against known databases for enforcement	Allows more effective enforcement of parking regulations; used by APD for public safety	●		●			●
7.3	Continue pay-by-phone parking in commercial areas	Allows users to pay for parking using a mobile device	Provides ease and flexibility in parking payment		●	●			●
7.4	Continue, expand pay-by-phone parking in residential areas	Allows users to pay for parking in residential areas using a mobile device	Provides ease and flexibility in parking payment		●	●			●
7.5	Continue and expand pay-by-plate parking at multi-space meters	Allows users to pay for parking by entering their license plate number into a ticket machine	Provides ease and flexibility in parking payment		●	●			●
7.6	Streamline residential parking permit issuance	Online process to register and produce virtual residential parking permits	Provides ease and flexibility in obtaining residential parking permits		●	●			
7.7	Streamline visitor parking permit issuance	Online process to register and produce residential visitor parking permits	Provides ease and flexibility in obtaining residential visitor parking permits		●	●			●
7.8	Implement real-time variable rate parking meters	Parking meters that respond to demand by adjusting rates	Reduces the need for vehicles to circle looking for parking by dynamically adjusting prices based on demand, ensuring a certain proportion of spaces are always vacant		●	●		●	
7.9	Implement electric vehicle charging station management	Provides an exchange of information between vehicle and charging station to manage the charging operation	Helps ensure effective electric vehicle charging		●	●	●	●	
7.10	Install parking garage guidance systems	Monitors individual parking spaces and overall parking facility capacity, directing users via digital signage	Helps motorists determine whether a garage has open spaces before entering facility		●	●		●	●
7.11	Implement near real-time parking information systems	Provides users with real-time location, availability, type (e.g., street or garage), and price of parking	Helps motorists find available parking more quickly, reducing the Vehicle Miles Travelled (VMT)		●	●	●	●	●
7.12	Install parking sensors	Uses smart sensors and intelligent software to optimize use of urban parking facilities and eliminate congestion caused by motorists searching for parking	Helps motorists find parking more quickly		●	●		●	●
8. PERFORMANCE MONITORING									
8.1	Exchange data with connected vehicles and navigation apps	Uses real-time connected vehicle and navigation app data to aid in understanding congestion, travel times, and delays and to optimize traffic signal operation in real-time	Optimize transportation network operation		●	●		●	●
8.2	Implement video data collection	Uses video to collect and classify data to aid understanding of transportation networks	Delivers contextual, useful travel information to transportation officials; used to better understand travel patterns in the city		●	●			●
8.3	Implement sensor data collection	Uses sensors to collect and classify data to aid understanding of transportation networks	Delivers contextual, useful travel information to transportation officials; used to better understand travel patterns in the city		●	●			●
8.4	Implement cellular data collection	Uses cellular networks to collect data from passing devices to aid understanding of travel times and congestion	Delivers contextual, useful travel information to transportation officials; used to better understand travel patterns in the city		●	●			●
9. INFORMATION MANAGEMENT									
9.1	Upgrade Traffic Management Center (TMC)	Allows TMC to manage on-street traffic equipment, monitor overall system status, configure devices remotely, and analyze and share data	Allows transportation officials to better manage traffic flow		●	●		●	●
9.2	Facilitate data exchange	Facilitates exchange of information between jurisdictions	Allows decisions to be made based on regional transportation needs and patterns		●	●			●
9.3	Facilitate data and alerts distribution	Manages distribution of data to City agencies, residents, and stakeholders and protects data from unauthorized access	Provides open, transparent access to data for use and examination by stakeholders in the City			●			●
9.4	Creation of automated Interactive Maps	Provides access to data for examination and analysis via interactive dynamic maps	Provides agencies and residents with access to easy-to-use searchable maps targeted to specific exploration and discover needs		●	●			●
9.5	Facilitate secure inter-device communications	Facilitates trusted communications between mobile devices and other mobile devices or roadside devices and protects data from unauthorized access	Ensures data transmitted over mobile devices is protected and secure			●			●
9.6	Integrate real-time data into decision-making model	Automated decision making, automated information dissemination to the City and the public, and the ability to aggregate information about individual incidents to inform decisions	Allows better understanding of incident patterns, enabling more contextual, informed decisions	●		●		●	●