
# VIRGINIA AVENUE SMART CORRIDOR STUDY

## Final Report

October 2019

Aerotropolis ATLANTA Community Improvement Districts

MODERN MOBILITY partners

## ACKNOWLEDGEMENTS

This document serves as the Final Report for the Virginia Avenue Smart Corridor Study, led by the Aerotropolis Atlanta Community Improvement Districts (AACIDs).

The funding for the overall study was provided by the Atlanta Regional Commission's (ARC) Livable Communities Initiative (LCI) grant program with a local match provided by the AACIDs.

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# 1 OVERVIEW

## 1.1 Study Purpose

The Atlanta Regional Commission (ARC) awarded the Aerotropolis Atlanta Community Improvement Districts (AACIDs) a Livable Communities Initiative (LCI) grant to fund the Virginia Avenue Smart Corridor Study. The purpose of this study is to assess the potential of new and emerging transportation technologies and their ability to address safety, walkability, and mobility along the Virginia Avenue Smart Corridor. The recommendations included in this report are intended to be incorporated into the Scoping Study and ultimate Concept Report for the overall Virginia Avenue Corridor project that includes additional improvements, including a road diet, widening of sidewalks and bicycle facilities.

## 1.2 Study Area

The 2-mile Virginia Avenue Smart Corridor, from US 29/Main Street at the west terminus to South Central Avenue on the eastern terminus, is located just north of the Hartsfield-Jackson Atlanta International Airport (H-JAIA) and traverses the cities of College Park, East Point, and Hapeville. Figure 1, on the following page, illustrates the location of the Virginia Avenue Smart Corridor within the Atlanta region.

## 1.3 Study Milestones and Technical Reports

As illustrated in Figure 2 on the following page, the study included four milestones or phases. In addition to this *Final Report* documenting the entire study at a high level, detailed information on the existing conditions and needs assessment and best practices review is provided in the following two separate documents:

- Virginia Avenue Smart Corridor Study: Existing Conditions and Needs Assessment Technical Report, May 2019; and
- Virginia Avenue Smart Corridor Study: Best Practices and Trends in Emerging Technologies Technical Report, September 2019.

Details on the engagement and project prioritization process, recommended projects, implementation and phasing plan, and funding strategy are included in this *Final Report*.

*Figure 1: Location of Virginia Avenue Smart Corridor*


*Figure 2: Phases in the Study*

**Final Recommendations**

Finalize recommendations; funding strategy; implementation and action plan

**Preliminary Recommendations**

Finalize project prioritization framework; score, rank and prioritize projects

**Existing Conditions & Needs Assessment**

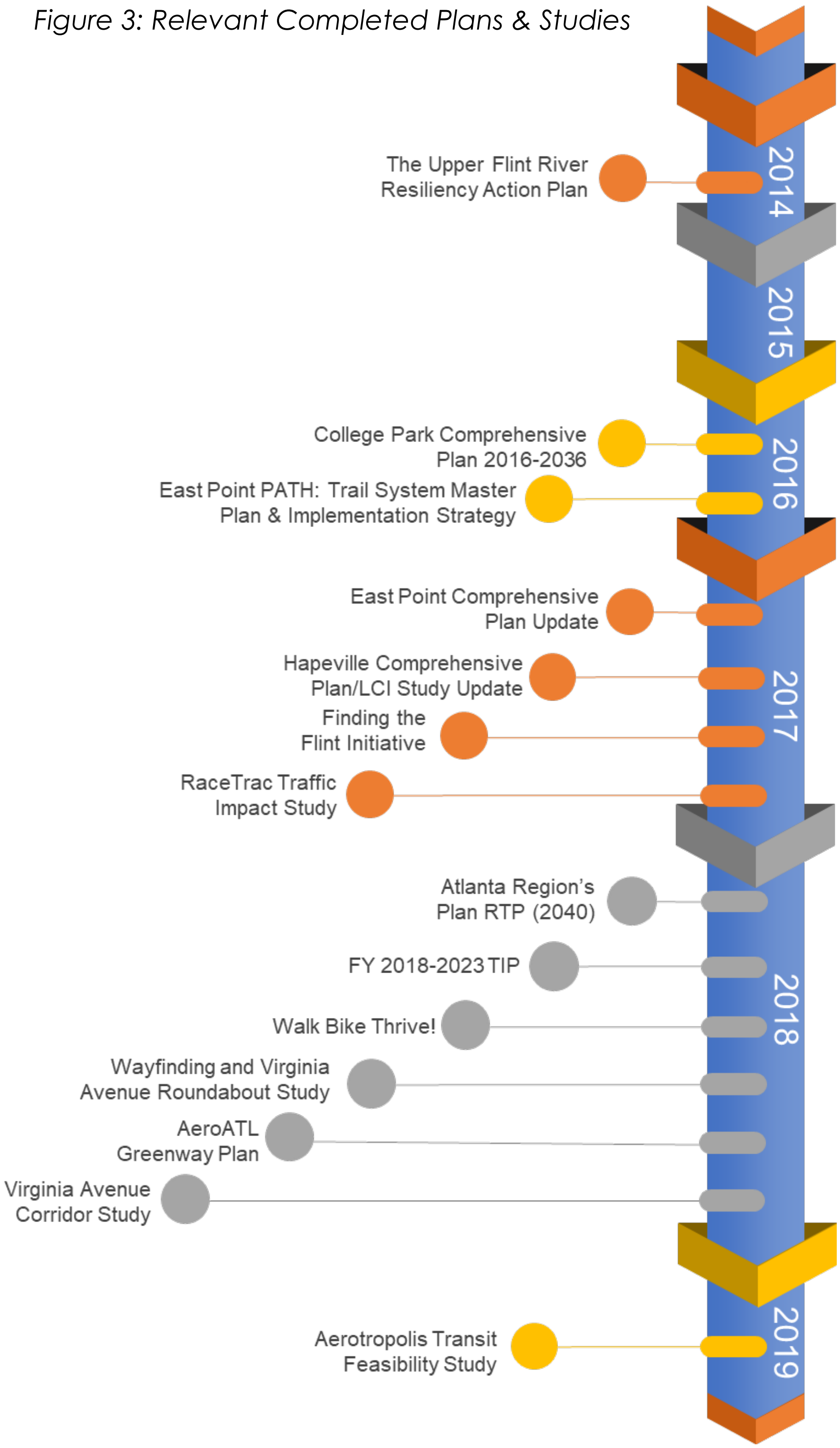
Existing conditions; needs and opportunities; best practices

**Project Initiation**

Data collection; update project prioritization framework; initial project types

# 2 RELEVANT PLANS AND STUDIES (SUMMARY)

*Figure 3: Relevant Completed Plans & Studies*

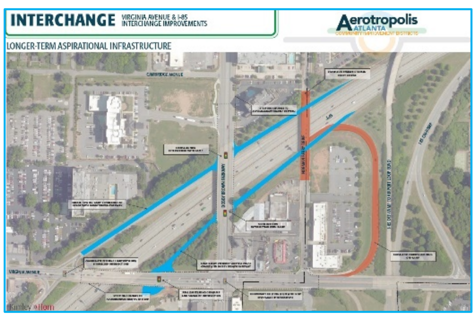



In recent years, Virginia Avenue has been included in a variety of larger plans and studies or examined as a stand-alone study or plan conducted by various agencies. Relevant plans and studies of the Virginia Avenue Corridor have been reviewed to learn from past analyses and to build upon previous planning efforts. Projects already planned along the Virginia Avenue corridor were listed for consensus by the Project Management Team (PMT) and will be further incorporated into the overall recommendations for the corridor as part of this study.

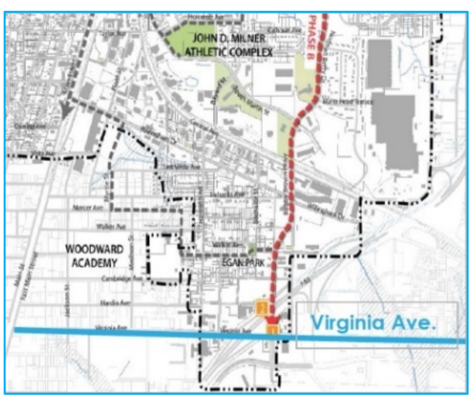
Several relevant studies and plans along or near the Virginia Avenue Corridor were reviewed and are listed in chronological order in Figure 3. Further detail on each is provided in the *Existing Conditions and Needs Analysis Technical Report*.

irginia Avenue
SMART CORRIDOR


Source: Virginia Ave Corridor Plan




Source: Virginia Ave Master Plan



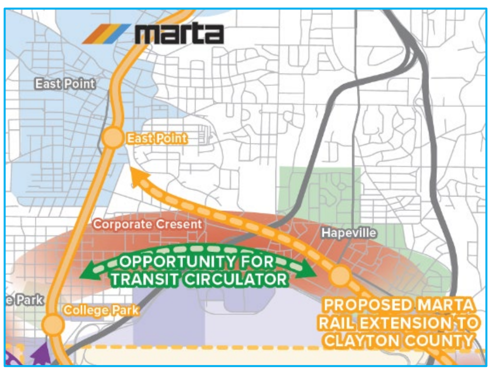

Source: City of East Point Trail System Master Plan

The following list summarizes the key findings of all the above studies as it relates to the Virginia Avenue Smart Corridor going forward.

- Road Diet: The recommendations included in the *Virginia Avenue Corridor Plan*, which include a road diet, bicycle lanes and widened and improved sidewalks, are expected to improve the overall walkability and biycle access for the Virginia Avenue Smart Corridor. These physical improvements will provide a platform for sidewalk and bicycle technologies to be implemented for pedestrian safety and comfort.
- I-85 Ramp Intersection Improvements: The recommendation included in the *Virginia Avenue Corridor Plan* to fully signalize the I-85 on- and off-ramp intersections at Virginia Avenue will provide an opportunity for smart technology implementation at the new signals. The action plan identified in the corridor study recommended that Year 1 include the interchange striping and signage design and striping installation. Year 2 includes the interchange signage installation. As part of the Virginia Avenue Smart Corridor Study, wayfinding technologies will be evaluated.
- Norman Berry Drive (including Bobby Brown Parkway Bridge) Trail: If implemented, the Norman Berry Drive trail (Trail #6) recommended in the *East Point PATH: Trail System Master Plan & Implementation Strategy* would result in a trailhead on the northern side of Virginia Avenue.
- Little Virginia Gateway: The purpose of Virginia Avenue Gateway Node identified in the *Hapeville Comprehensive Plan/LCI Study Update* is to create a welcoming gateway into Hapeville that showcases the office, hotel and mixed-use potential and provides a smooth transition and wayfinding into downtown Hapeville. This recommended gateway along "Little Virginia" on the eastern end of the Virginia Avenue Smart Corridor should be reflected in any recommendations.


Source: Finding the Flint


Source: AeroATL Greenway Plan

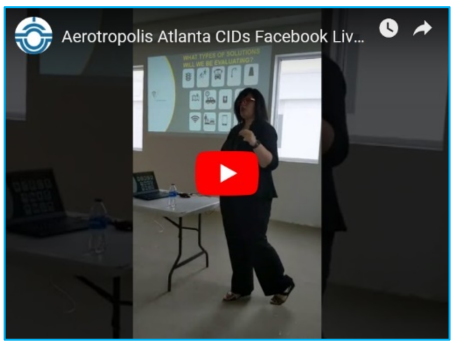



Source: Atlanta Region's Plan 2040 Regional Transportation Plan

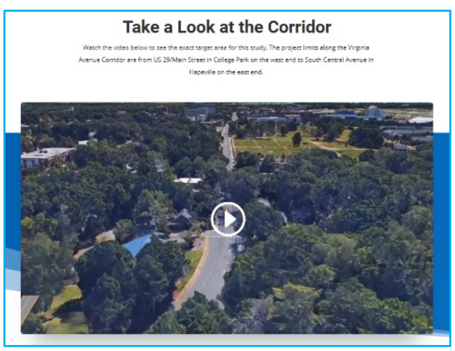
- Flint River: The Virginia Crossings area along Virginia Avenue east of International Boulevard across from the Delta Training Center has been identified as an area by *Finding the Flint* that currently has a parking lot covering the Flint River. As parking technologies are evaluated as part of the Virginia Avenue Smart Corridor, consideration should be given to providing parking options that do not cover the Flint River area in order to reserve room, as best as possible, for any future projects that may uncover the Flint River as part of a future trail system.
- Virginia Avenue Greenway: The AeroATL Greenway Plan has prioritized greenway trails along a portion of Virginia Avenue (HV-1 and HV-2 in the AeroATL Greenway Plan). The Virginia Avenue Smart Corridor also terminates at the East Main Street Connection greenway recommendation (CP-7 in the AeroATL Greenway Plan) in College Park. The exact location of the proposed greenway along Virginia Avenue, if known, will need to be coordinated with as part of the Virginia Avenue Smart Corridor prior to finalizing any project recommendations.
- Virginia Avenue Transit Circulator: The *Aerotropolis Transit Feasibility Study* has recommended a new MARTA line to Clayton County, and Virginia Avenue will likely to become a transit circulator between the two lines. As a result, transit technologies that will make transit more feasible or attractive should and will be evaluated as part of the Virginia Avenue Smart Corridor.

# 3 ENGAGEMENT


3-Sided Digital Billboard Notice for Public Meeting




Facebook Live Video of Public Meeting




Flyover Video of Corridor

The Study included a robust stakeholder and public outreach effort, ensuring the recommendations are supported by residents, employees and visitors to the area. During the 9-month study, the following public engagement efforts took place:

- 2 public meetings
- Project website[1]
- Social media, including Facebook Live videos of public meeting presentations
- Online and in-person survey to develop weighting scenario for project prioritization
- Google Earth Pro flyover video of corridor
- Articles and advertising of meetings in AACIDs e-newsletter
- Atlanta Business Chronicle article (see appendix)
- 3-sided digital billboard notice for public meeting

In addition, the study includes multiple public, private, and non-profit regional partners to implement a comprehensive smart corridor network of this magnitude. As part of the stakeholder engagement effort, the following took place:

- 4 Project Management Team (PMT) meetings
- 6 GDOT coordination meetings
- 2 MARTA coordination meetings
- 1 City of College Park Information Technology (IT) meeting
- 4-5 technology manufacturer and/or distributor vendor meetings

Further detail is provided below.

[1] https://aerocids.com/projects/the-smart-corridor/

## 3.1 In-Person Engagement

### *3.1.1 Project Management Team (PMT)*

The purpose of the Project Management Team (PMT) was to drive the vision of the study and engage all the cities that traverse the corridor, as well as the region's major stakeholders. Member agencies of the PMT included the following:

- AACIDs
- Atlanta Regional Commission
- City of College Park
- City of East Point
- City of Hapeville
- GDOT
- MARTA

The PMT met four times throughout the nine-month study, with each meeting focusing on the following milestones:

- **PMT #1 (January 10, 2019)**: Project kick-off, including draft project prioritization framework;
- **PMT #2 (April 17, 2019)**: Existing conditions and needs assessment;
- **PMT #3 (August 1, 2019)**: Review of findings from best practices and trends report, preliminary project prioritization results, and preliminary recommendations; and
- **PMT #4 (September 20, 2019)**: Final recommendations, including implementation and phasing plan, 100-day action plan, and funding strategy.

### *3.1.2 Public Meetings*

Two public meetings were held, as detailed below.

#### 3.1.2.1 Public Meeting #1 (March 14, 2019)

The purpose of the meeting was to introduce the study, present the preliminary menu of strategies for research and evaluation, and preliminary project prioritization framework.

- The meeting was held on the corridor at Virginia Crossings with approximately 38 people in attendance;
- A flyover video of the existing corridor was shown, along with display boards and two duplicate PowerPoint presentations were made, the second of which was

filmed on Facebook Live;

- An online survey link was distributed at the meeting, on the project website and on social media to gain feedback on what the public valued most when prioritizing projects (further detail on the survey results provided in section 7.2);
- Overall, the public was generally accepting of the Virginia Avenue Smart Corridor Study. Some attendees expressed concerns about safety and project costs and welcomed opportunities to implement lower cost projects with a high return on investment.

Public Meeting #2 held on August 15, 2019

#### 3.1.2.2 Public Meeting #2 (August 15, 2019)

The purpose of the meeting was to present and gain feedback on preliminary recommendations.

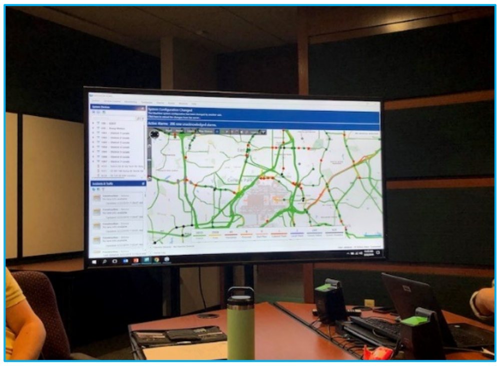
- The meeting was held on the corridor at Virginia Crossings with approximately 29 people in attendance;
- Display boards and two duplicate PowerPoint presentations were made, the first of which was filmed on Facebook Live;
- Overall, the general sentiment from those in attendance was that they were supportive of the study and were excited to see progress in the study. Attendees also provided information on potential funding mechanisms, including the hotel tax as well as grants for transportation projects that serve the disabled; and
- Public meeting notes, sign-in sheets, presentations and comment forms are included in the Appendix.

### *3.1.3 Stakeholders*

In addition to the PMT and general public, the study team also had one-on-one meetings with both GDOT and MARTA, as well as the City of College Park Information Technology (IT) Officer.

In addition to the PMT, the study team met with GDOT as follows:

- **GDOT Meeting #1 (February 20, 2019)**: Introduce study to rest of GDOT Planning, GDOT Operations and District 7, and determine if opportunities to leverage one another.
- **GDOT Meeting #2 (February 28, 2019)**: Brought Cities of College Park, East Point, and Hapeville in and continued the discussion with GDOT Operations and District 7 regarding the opportunity identified at the earlier



Meeting at GDOT TMC with Cities Discussing MaxTime/MaxView

meeting to upgrade the signal software to MaxTime/MaxView and install 4G LTE cellular radios at the intersections along Virginia Avenue from US 29/Main Street to South Central Avenue, as well as potentially to the rest of the Cities of College Park, East Point, and Hapeville.

- **GDOT Meeting #3 (March 22, 2019)**: Signal upgrade kick-off meeting with GDOT Operations and District 7 and Cities of College Park, East Point, and Hapeville, including signal locations, roles and responsibilities, and next steps.
- **GDOT Meeting #4 (June 28, 2019)**: Discussed technology strategies moving forward for evaluation and DSRC v. cellular pilot with GDOT Operations and Planning, as well as preliminary findings from best practices review.
- **GDOT Meeting #5 (July 8, 2019)**: Signal upgrade schedule update with GDOT Operations and District 7, including the Cities of College Park, East Point, and Hapeville.
- **GDOT Meeting #6 (October 9, 2019):** Summary of work completed regarding signal upgrades and timing.

In addition to the PMT, the study team met with MARTA as follows:

- **MARTA Meeting #1 (March 5, 2019)**: Introduced study to MARTA, including discussion of planned technology projects by MARTA and opportunities to leverage one another.

- **MARTA Meeting #2 (June 27, 2019)**: Discussed potential technologies for implementation on the MARTA bus system and opportunities to test out technologies on revenue and non-revenue service vehicles.

In addition to the agency stakeholders, the study team also had several one-on-one meetings with vendors to learn more about the technology applications.

## 3.2 Digital Engagement

### 3.2.1 Project Website and Social Media

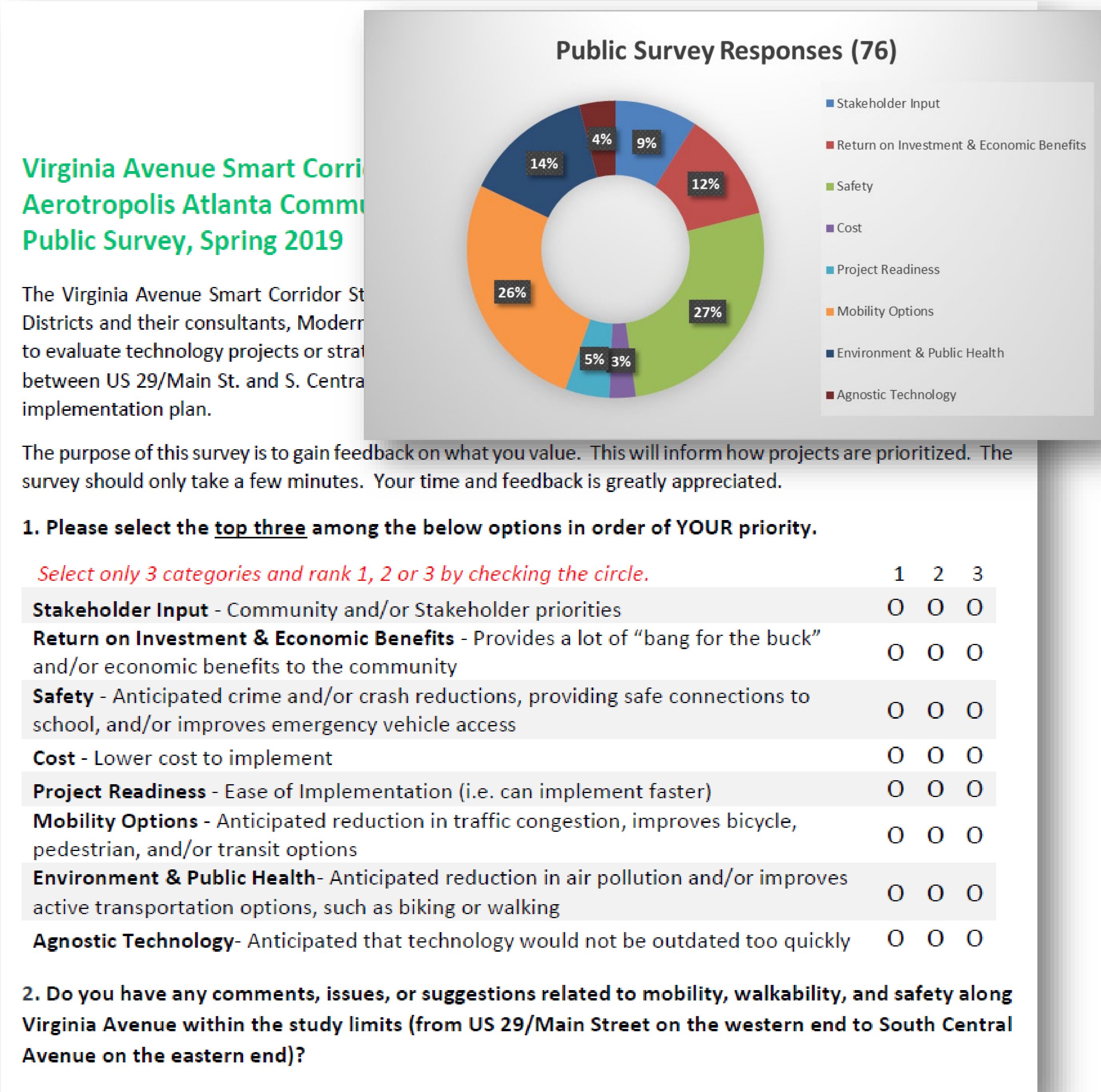
The AACIDs maintained the project website located at: https://aerocids.com/projects/the-smart-corridor/. In addition, project information was pushed out on AACIDs' social media channels, including Facebook and Twitter.


Project Website, Twitter, and Facebook Notices for Public Meetings

### 3.2.2 *Online Survey*

An online survey was conducted to gain feedback on what the general public valued when prioritizing projects. Figure 4 illustrates a sample of the survey instrument, along with the results of the 76 survey responses as it relates to what respondents valued.

*Figure 4: Online Survey and Findings*




**Virginia Avenue Smart Corri**
**Aerotropolis Atlanta Commu**
**Public Survey, Spring 2019**

The Virginia Avenue Smart Corridor St
Districts and their consultants, Modern
to evaluate technology projects or strat
between US 29/Main St. and S. Centra
implementation plan.

The purpose of this survey is to gain feedback on what you value. This will inform how projects are prioritized. The survey should only take a few minutes. Your time and feedback is greatly appreciated.

**1. Please select the top three among the below options in order of YOUR priority.**

| *Select only 3 categories and rank 1, 2 or 3 by checking the circle.* | 1 | 2 | 3 |
|---|---|---|---|
| **Stakeholder Input** - Community and/or Stakeholder priorities | O | O | O |
| **Return on Investment & Economic Benefits** - Provides a lot of "bang for the buck" and/or economic benefits to the community | O | O | O |
| **Safety** - Anticipated crime and/or crash reductions, providing safe connections to school, and/or improves emergency vehicle access | O | O | O |
| **Cost** - Lower cost to implement | O | O | O |
| **Project Readiness** - Ease of Implementation (i.e. can implement faster) | O | O | O |
| **Mobility Options** - Anticipated reduction in traffic congestion, improves bicycle, pedestrian, and/or transit options | O | O | O |
| **Environment & Public Health**- Anticipated reduction in air pollution and/or improves active transportation options, such as biking or walking | O | O | O |
| **Agnostic Technology**- Anticipated that technology would not be outdated too quickly | O | O | O |

**2. Do you have any comments, issues, or suggestions related to mobility, walkability, and safety along Virginia Avenue within the study limits (from US 29/Main Street on the western end to South Central Avenue on the eastern end)?**

# 4 EXISTING CONDITIONS (SUMMARY)

An inventory of existing conditions was conducted along the Virginia Avenue Smart Corridor, including the following:

- Roadway characteristics;
- Land use and demographics;
- Safety;
- Travel demand;
- Mobility options;
- Public parking;
- Wayfinding;
- Freight;
- Traffic signals;
- Public wi-fi; and
- Fiber capacity, electric grid and other relevant utilities.


Details on each is provided in the Virginia Avenue Smart Corridor Study: Existing Conditions and Needs Assessment Technical Report, May 2019.

Figure 5 provides a snapshot of existing characteristics and metrics along the Virginia Avenue Smart Corridor.

Figure 5: Existing Conditions Snapshot of Virginia Avenue

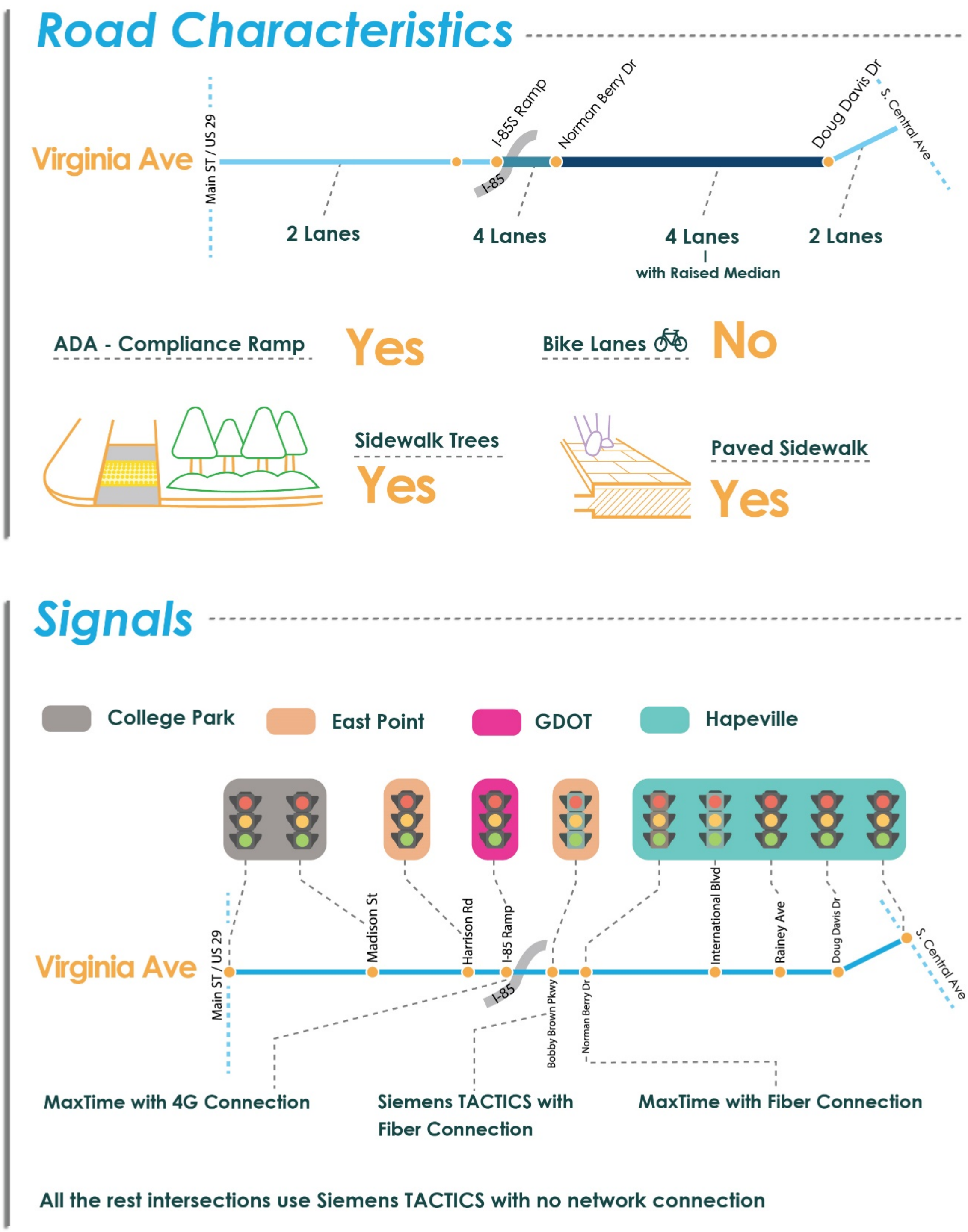


Figure 5: Existing Conditions Snapshot of Virginia Avenue (Cont'd)

## Mobility Options

marta

### Route 172

Every 45 Mins of Frequency;
28 Stops;
1,055 Daily Ridership for the entire Route;

**Driving**

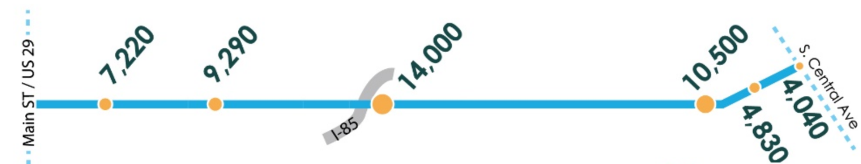
**Ride Sharing**

**Walking**

### Airport Shuttle

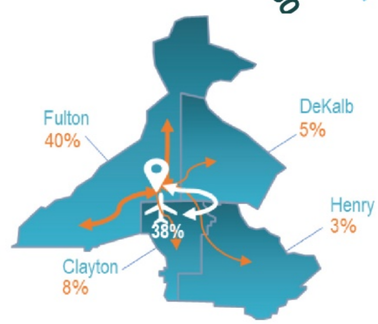
13 Hotels, each with their own shuttle service;
Every 20 to 30 Mins Frequency;
Service from 4am to 2am (2 hotels have 24/7 shuttle);
Mostly Connects the domestic terminal and ground transportation.

## Travel Demand



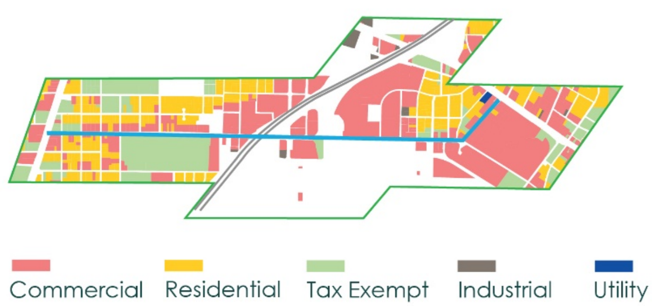

### Average Annual Daily Traffic 2017

Most trips along the Virginia Avenue corridor begin or end within Fulton County, followed second by the airport.




(Source: GDOT TADA)

## Land Use & Employment




**21,000** employees
along and near the corridor

**65,000** employees
at Hartsfield-Jacskon International Airport

(Source: ARC)

## Demographics

Minority — 44% / 56%

Poverty — 19% / 81%

Elderly — 7% / 93%

**Total Resident Population 6,289** (Source: ACS, EPA EJ Portal)

## Safety

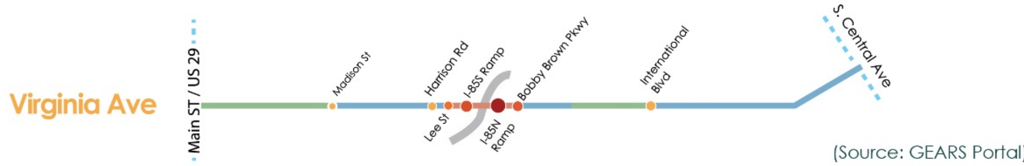
**588 Total Crashes** — 40 Injuries — 0 Fatilities

343 Front & Rear - End Crashes

239 Side Crashes

24 Truck-Involved

0 Pedestrian - Involved




Crash Rate: Low — Medium — High — Intersection with High Crashes

## Public Parking

| Parking Garage | Surface Parking Lot | Street Parking |
|---|---|---|
| No | Yes | No |

## Freight

Freight AADT Volume in 2017 (3%-11%)

340-470

(Source: GDOT TADA)

## Internet Access

20%-40% Households without Internet Access

Fiber Existence: No

Public WiFi Existence: Yes (Limited Coverage by Certain Hotels)

# 5 NEEDS AND OPPORTUNITIES (SUMMARY)

Based on the existing conditions analysis, it was determined that smart technology applications to be evaluated should primarily address pedestrian, transit, and vehicle safety and mobility. Freight applications were not evaluated due to the low percentage of trucks along the corridor.

Smart technology applications were evaluated that accomplish the following needs and opportunities.

## 5.1 Communications

- Install fiber along the entire 2-mile length of Virginia Avenue when the corridor construction is under way, as it is less expensive to install when the ground is already being dug up. Whether for direct access or to provide Wi-Fi to connect potential devices, fiber optic cable would be beneficial to advance technology options;
- Discuss potential utilization of dark (unused) fiber near Delta; and
- Coordinate with GDOT to leverage the opportunity to install 4G LTE cellular radios along the Virginia Avenue Smart Corridor as an interim solution.

Source: C2SMART

## 5.2 Traffic Signals

- Retrofit or replace older traffic signal installations to meet current standards;
- Install new traffic signal poles, traffic signal heads with back plates, flashing yellow arrow left turn phases, battery back-up, among other improvements, that will set benchmarks for the traffic signals along the corridor and assist with deployment of Smart Corridor enhancements;
- Add communication capabilities to traffic signals; and
- Upgrade traffic signal software in order to prepare to accommodate additional functionality related to connected vehicles and provide the ability to time remotely.

*Figure 6: Existing Traffic Signal Infrastructure*


Surface potholes, blurry crossing lines at the street crossing

## 5.3 Pedestrians

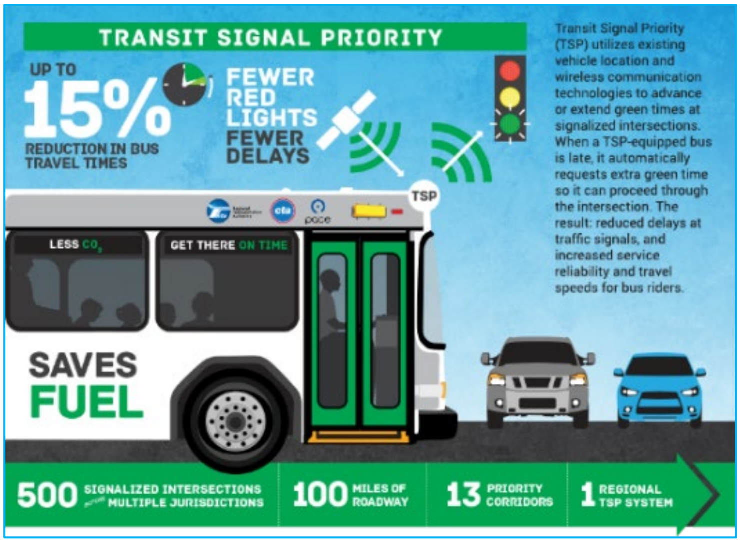
- Improve pedestrian safety, particularly as it relates to missing or inadequate crosswalks;
- Improve lighting along the corridor; and
- Leverage planned greenway along the corridor.

## 5.4 Bicyclists

- Improve bicyclist safety and mobility by evaluating technologies to compliment the planned bike lanes along the corridor.

## 5.5 Transit

- Evaluate technologies that make transit more competitive, such as transit signal priority;
- Work with MARTA to determine if there is an opportunity to switch out the buses on Route 172 along the Virginia




Source: Chicago Regional Transportation Authority

Avenue Smart Corridor with MARTA's new buses (expected to deploy in mid- to late 2019) that are equiped with transit signal priority transponders;

- Enhance bus rider experience by evaluating smart technology amenities at existing bus stops, including solar bus shelters and leveraging the City of College Park's plans underway to install smart trash receptacles; and
- Provide mobility for hotel visitors to get to local restaurants and shopping.

## 5.6 Personal Transport

- Facilitate safe operation and parking of scooters, should they become a mode of personal transport along the corridor.

## 5.7 Wayfinding

- Explore smart wayfinding solutions, particularly near the hotels and planned trail facilities, such as the Virginia Avenue greenway, Bobby Brown Parkway trail, and Norman Berry Drive trail, as well as along and near the "Little Virginia" gateway to Hapeville.

## 5.8 Parking

- Evaluate parking-related technologies, particularly near Virginia Crossings in case the Flint River is opened up in the future.

# 6 BEST PRACTICES IN NEW AND EMERGING TECHNOLOGIES (SUMMARY)

This *Best Practices and Trends in Emerging Technologies Technical Report* includes the following:

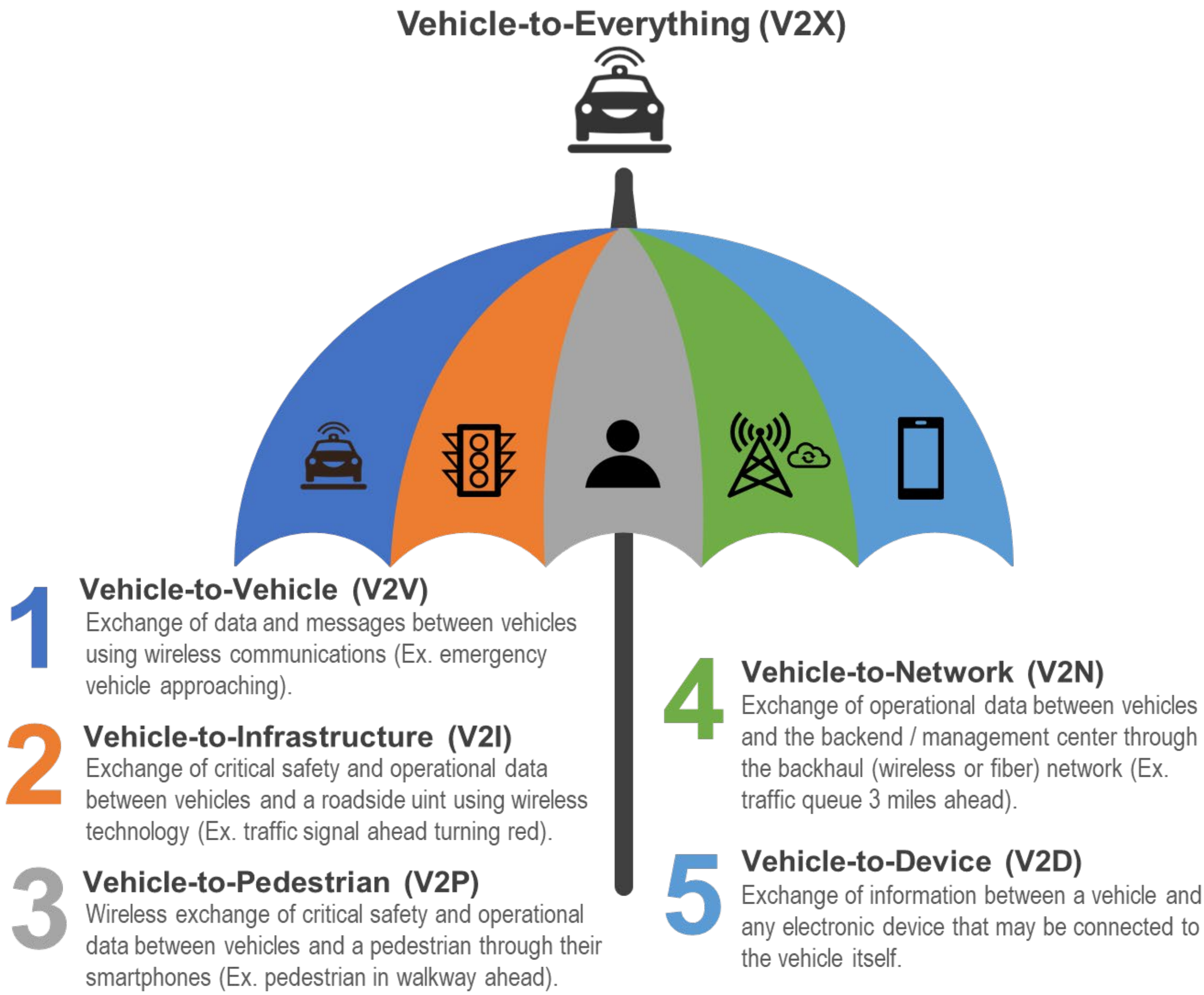
- An overview of communication concepts and technologies required for the various strategies to be implemented;
- Menu of technology applications related to safety, walkability, and mobility, including a brief description of the application, benefits, where it has been implemented, if applicable, any lessons learned, relative cost, and ease of implementation; and
- Conclusions related to which applications are recommended to proceed further with evaluating as part of the preliminary recommendations.

Below is a summary of key highlights from the best practices review. For more detail, refer to the *Virginia Avenue Smart Corridor Study: Best Practices and Trends in Emerging Technologies Technical Report*, September 2019.


## 6.1 Vehicle Communication Concepts

Figure 7 defines a variety of communication concepts, all of which fall under the umbrella of **Vehicle-to-Everything (V2X)**. V2X is where "everything" is anything relevant to the vehicle's safe and efficient operation.

*Figure 7: Overview of V2X*

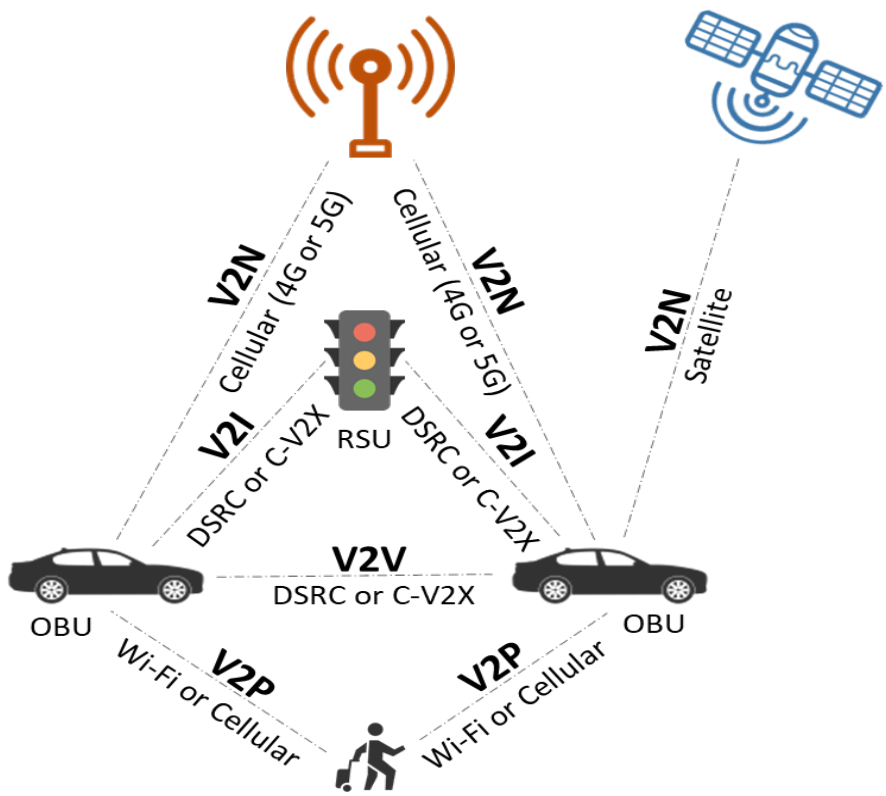



V2X systems can convey important information to the driver in regards to dangerous activities of nearby vehicles (**V2V**, vehicle-to-vehicle), presence of pedestrians and cyclists crossing the road (**V2P**, vehicle-to-pedestrian), traffic signal ahead is about to change to red (**V2I**, vehicle-to-infrastructure), and inclement weather, nearby accidents and road conditions ahead (**V2N**, vehicle-to-network).

V2X communications types, as shown in Figure 7, consists of two components: 1) direct (time-critical safety) communications and 2) indirect or broadcast (non-time-critical) communications.

Direct communications consist of V2V, V2P, and V2I, with no network involvement that enables better handling of latency (time) sensitive safety services, such as collision avoidance, blind spot warning, and others. As illustrated in Figure 8, vehicles communicate directly (exchanging safety related messages) with each other (V2V), through **On-Board Units (OBUs)** mounted on the vehicles; with the infrastructure (V2I), through direct communications between the OBU and a **Roadside Unit (RSU)** typically located on signal mast arms, traffic signal poles and other locations along the roadway; and with pedestrians (V2P) via their smartphones. Specific technologies, such as Dedicated Short-Range Communications (DSRC) or Cellular Vehicle-to-Everything (C-V2X) have been or are being developed and tested to address these types of safety applications and needs.[2]

*Figure 8: V2X Communication Types*




[2] Roadway to Vehicle Connectivity, Crown Castle, September 2018, https://www.atssa.com/Portals/0/Roadmap-to-Vehicle-Connectivity.pdf

Vehicles can also communicate indirectly with the network (V2N) or cloud to obtain more regional-based information. The broadcast component of V2X supports wide area communications, by leveraging the existing 4G LTE (or near-future 5G) cellular network as well as satellite systems. Latency-tolerant communications, such as the notification that an accident occurred a few miles ahead, can be broadcasted by a V2X server located at a Smart Data Center and/or Traffic Management Center (TMC) to vehicles, pedestrians, and infrastructure. The vehicles, pedestrians, and infrastructure send V2X messages to the V2X server.

## 6.2 Menu of Technology Applications

Figure 9 lists 33 technology applications that were evaluated as part of the best practices review, all which address safety, walkability, and/or mobility.

*Figure 9: Menu of Technology Applications Researched*

| | | Goals of Corridor Project | | |
|---|---|---|---|---|
| **No.** | **Project Types** | **Safety** | **Walkability** | **Mobility** |
| **TRAFFIC SIGNALS** | | | | |
| 1 | Signal priority (transit, bikes, peds) | ■ | ■ | ■ |
| 2 | Signal Pre-emption (emergency vehicles) | ■ | | ■ |
| 3 | Signal countdown digital signage | ■ | | ■ |
| 4 | Adaptive traffic control | ■ | | ■ |
| **BIKE AND/OR PEDESTRIAN TECHNOLOGY** | | | | |
| 5 | Cross alert systems for bike/pedestrians (motion sensor triggers light at crossing) | ■ | ■ | ■ |
| 6 | Flashing pedestrian beacons (along with refuge islands) | ■ | ■ | ■ |
| 7 | Bike traffic signal | ■ | | ■ |
| **STREET LIGHTING** | | | | |
| 8 | Solar/smart street light poles | ■ | ■ | |
| **PAVEMENT AND/OR SIDEWALKS** | | | | |
| 9 | Solar/smart pavement/sidewalks (ice, WiFi, maintenance, power, striping, EV) | ■ | ■ | |
| 10 | Roadside sensors to communicate roadway conditions (weather and maintenance) | ■ | | ■ |
| 11 | Smart dots in street centerlines (communicate maintenance issues) | ■ | | ■ |
| 12 | Technologies for extreme weather conditions | ■ | | ■ |
| **WAYFINDING** | | | | |
| 13 | Digital wayfinding signs/kiosks | | | ■ |
| 14 | Navigation assistance sensors for visually impaired (bus shelters, buses, crosswalks) | ■ | ■ | ■ |
| **TRANSIT** | | | | |
| 15 | Solar bus shelters (lighting, cooling/heating, WiFi, digital kiosk, etc.) | ■ | | ■ |
| 16 | Autonomous shuttle (6-12 passenger – first/last mile) | | | ■ |
| 17 | Mobility as a Service (Plan, ticket, and pay for all modes in one app) | | | ■ |
| 18 | Real-time transit data and systems coordination | | | ■ |
| 19 | Transit-Vehicle/Pedestrian Warning Applications (in transit vehicle) | ■ | ■ | ■ |
| 20 | Bus Stop Warning Applications (alerts nearby vehicles or pedestrians) | ■ | ■ | ■ |
| **PARKING** | | | | |
| 21 | Automated Parking Systems (garage or outdoor system) | ■ | | ■ |
| 22 | Parking availability app (including preferred parking for carshare) | | | ■ |
| 23 | Smart parking meters and other parking management systems | | | ■ |
| **ELECTRIC VEHICLE CHARGING** | | | | |
| 24 | Electric Vehicle (EV) charging stations | | | ■ |
| 25 | EV charging outlets in light polls along curb (EV driver pays for kw usage with app) | | | ■ |
| **VIDEO SURVEILLANCE** | | | | |
| 26 | Automated traffic monitoring/detection (vehicle class, traffic flow, incidents) | ■ | | ■ |
| 27 | Cameras/license plate readers (monitor traffic, parking enforcement and crime) | ■ | | ■ |
| 28 | Gunshot detection technology | ■ | | |
| **WI-FI** | | | | |
| 29 | Network connectivity and wireless communications opportunities (public wi-fi) | | | ■ |
| **CURBSIDE** | | | | |
| 30 | Flexible curbside management and associated technologies (loading vehicles, Lyft/Uber/TNC pick-up & drop offs, on-street parking, EV charging, etc.) | ■ | ■ | ■ |
| **PHONE APPS** | | | | |
| 31 | Construction related applications to ease impacts on neighborhoods/businesses, reroute vehicles during construction, and promote mode change | ■ | | ■ |
| 32 | V2I for real-time applications (also enabling V2V data collection) | ■ | | ■ |
| **DATA EXCHANGE** | | | | |
| 33 | Integrated data exchange, management and sharing to improve access and mobility (school buses, emergency services, etc.) | ■ | | ■ |

## 6.3 Conclusions

### 6.3.1 DSRC / 5G-NR C-V2X Deployment Considerations

For time-sensitive functions, satellite is not a viable communications solution. Since most technology applications being evaluated along the Virginia Avenue Smart Corridor are indeed time sensitive, DSRC or 5G-NR C-V2X communications solutions are recommended. 5G-NR refers to 5G New Radio, or the new radio spectrum.

Some development and deployment considerations include:

1. ***DSRC/C-V2X Radios***: When deploying wireless radios along a corridor, radios should be required to be fully tested, including interoperability testing, field testing and certification testing based on IEEE 802.11p/cellular, 1609.2/3/4 and SAE J2945.1 Standards. To minimize the risks associated with inadequate testing and to ensure the integrity and performance of a product, engineers will need interoperability and device certification tests.

2. ***V2X Pilot***: If the pilot testing occurs prior to 5G-NR C-V2X technology standards being finalized and products being commercially available, then we would recommend a DSRC-based V2X solution be considered for the pilot. If 5G-NR C-V2X is ready for deployment, then both technologies should be considered and tested assuming there is some sort of band sharing plan as discussed earlier to compare performance and determine which direction to go for full deployment. Of the 10 signalized intersections along the corridor, some of them could deploy DSRC and some could deploy 5G-NR C-V2X.

   Metrics should be developed for each intersection based on the connectivity and latency, among others, to determine the best communications fit for the selected use cases. The results of the pilot, including any lessons learned, would be shared with the rest of the Atlanta region to inform the decision on when its best to implement different communication devices depending upon which applications or use cases are being deployed and the type of area.

3. ***System Interoperability and Compatibility***: The USDOT has developed the Connected Vehicle Reference Implementation Architecture (CVRIA)[3] to facilitate and guide the design and implementation of connected vehicle and Smart City systems. To ensure maximum usage of systems and infrastructure, the Virginia Avenue Smart Corridor project should be compliant with the CVRIA Architecture and utilize an open-architecture and standards-based components during deployment to provide and promote interoperability with other Atlanta region Smart City initiatives.

4. ***GDOT Deployment Plans***: GDOT is also actively deploying connected vehicle technologies and upgrades to over 1,700 additional traffic signals and ramps throughout the Atlanta region based on DSRC communications. Any technology applications recommended along the Virginia Avenue Smart Corridor should be coordinated closely with GDOT to leverage existing and future opportunities.

## 6.4 Technology Applications Moved Forward for Further Consideration

As a result of the best practices review, the following technology applications and strategies moved forward for further consideration as part of the evaluation process. Further detail on each is provided in **Appendix A-2: Project Fact Sheets**.

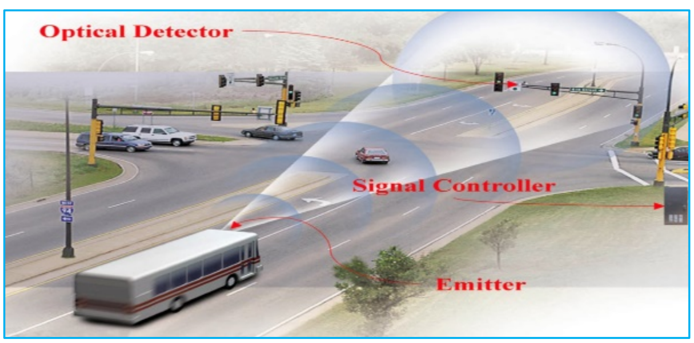



Image Source: Canadian Urban Transit Association

### *6.4.1 Transit Signal Priority*

Transit signal priority is an operational strategy to reduce the delay to transit vehicles at signalized intersections through communication between the transit vehicles and the traffic signals to time the signal in favor of the transit operations.

[3] U.S.DOT, Connected Vehicle Reference Implementation Architecture (CVRIA), https://local.iteris.com/cvria/, Accessed on May 2019

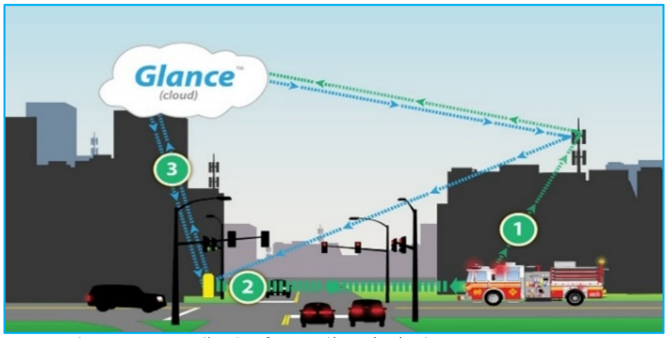


Image Source: Applied Information (AI) Blog


Image Source: Blasting News

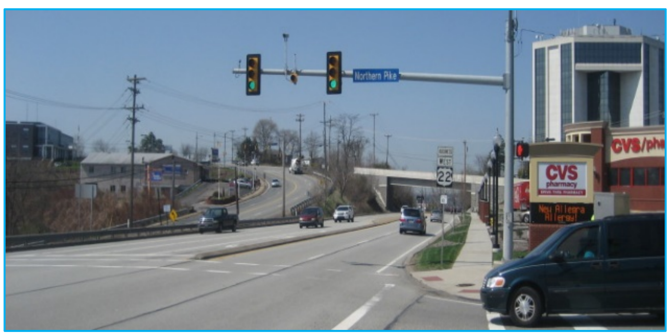


Image Source: Herbert, Rowland & Grubic, Inc.


Image Source: Bicycle Dutch

### *6.4.2 Emergency Vehicle Signal Pre-emption*

Traffic signal pre-emption is a system that allows the normal operation of traffic signals to be deferred for emergency vehicles. In other words, all vehicle approaches can be stopped for the emergency vehicle to get through the intersection.

### *6.4.3 Transit-Pedestrian Warning System*

Vehicle to Pedestrian (V2P) warning systems are used to detect pedestrians as well as bicycles, wheelchairs and other items in the area surrounding a bus. They include warning systems that send alerts to drivers, and to pedestrians via their smartphones.

### *6.4.4 CV - Based Adaptive Signal Control Technologies*

CV-based ASTC systems are expected to provide real-time spatial information necessary for evaluating traffic conditions on a road network. Communications between a connected vehicle and infrastructure enables the intersection controller to obtain much more detailed information of the surrounding vehicle status within the transmission range.

### *6.4.5 Bike Signal Detection*

Rectangular rapid flashing beacons (RRFB) and/or pedestrian hybrid beacons (PHB) with automated options for activation, such as motion and presence activated or video detection.

Virginia Avenue
SMART CORRIDOR


### 6.4.6 Solar Bench

Smart solar benches are new urban furniture pieces that will help cities, universities, retail, or business centers to create better, safer, and more user-friendly environments. They are powered by solar and it could offer functions such as charging, advertisement and information display.

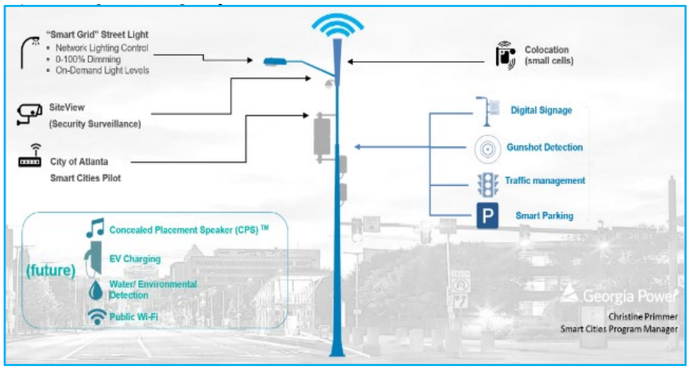



Image Source: Georgia Power

### 6.4.7 Smart Streetlighting

Smart streetlights have the potential to implement multiple technologies at one location, including sensors for on-demand lighting, audio systems for public alerts, accident and traffic monitoring, and potential electric car charging, security cameras, parking assistance, signal management, and public Wi-Fi access. Sensors and Road-Side Units are necessary for smart streetlights.


Image Source: West Michigan Strategic Alliance (WMSA)

### 6.4.8 EV Charging Stations

Electric vehicle (EV) charging stations are infrastructure for charging the battery of electric vehicles. At present, there are three levels of EV charging stations based on their ability to charge the car to sustain certain mileage ranges.

Image Source: The Ray, Smart Studs

### 6.4.9 Smart Dots (Studs) in Street Centerlines

In-pavement illuminated pedestrian crosswalks are crosswalks embedded with amber lights on both sides of the crosswalk and oriented to face oncoming traffic. The warning lights produces a bright, daytime-visible light focused directly in the driver's line of sight clearly indicating the curve, hazard, crosswalk, variable lane, or lane edge.

### 6.4.10 In-Pavement Illuminated Crosswalks


Image Source: LightGuard Systems

In-pavement illuminated pedestrian crosswalks are crosswalks that are embedded with amber lights on both sides of the crosswalk and oriented to face oncoming traffic.

### 6.4.11 Autonomous (Driverless) Shuttles


Image Source: WhatNow Atlanta

Autonomous shuttles are vehicles that move small numbers of passengers (6-15) approximately 1 mile on a set route, without a driver. Autonomous shuttles use detection systems based on a combination of sensors and deep learning programs to secure safety.

### 6.4.12 Solar Bus Shelters


Image Source: BBC News

Solar bus shelters are bus shelters powered by the sun to provide shelter, lighting, USB charger ports, digital transit maps, potentially air conditioning, and in some areas, free Wi-Fi.

### 6.4.13 Digital Wayfinding Kiosks


Image Source: Soofa Binocular

Digital wayfinding kiosks and IBM's artificial intelligence (AI) "conversation agent" robot are new means of providing wayfinding, with interactive digital screens and methods.

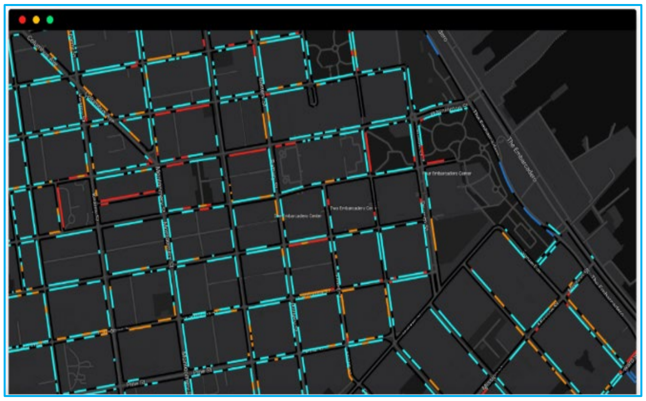


Image Source: COORD

## 6.4.14 Curbside Occupancy Sensors

Curbside occupancy sensors can be installed in the pavement along the curb to determine if the curb is occupied. Information can be displayed and sent to users and drivers through a web-based or mobile-based platform to give suggestions on real-time parking decisions.

Image Source: Nussbaum Parking

## 6.4.15 Automated Parking Systems

Automated parking systems (APS) serve to park automobiles automatically to lessen the surface area needed for parking vehicles and to maximize convenience and safety.


Image Source: BikePed Images

## 6.4.16 RRFB/PHB with Automated Options for Activation

A RRFB (Rectangular Rapid Flashing Beacon) or PHB (Pedestrian Hybrid Beacon) is a pedestrian-activated signal that uses flashing and solid lights to improve roadway crossing safety. When activated, the signal immediately flashes yellow to alert drivers before changing to a red stop light. When vehicles are stopped, pedestrians are given a Walk signal.

## 6.4.17 Parking Availability App

Real-time parking availability apps serve to inform drivers of available parking spaces based on street-level sensors that detect when a space becomes available.

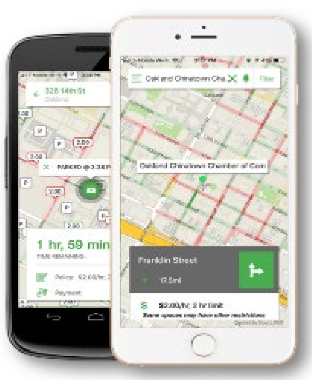



Image Source: Streetline

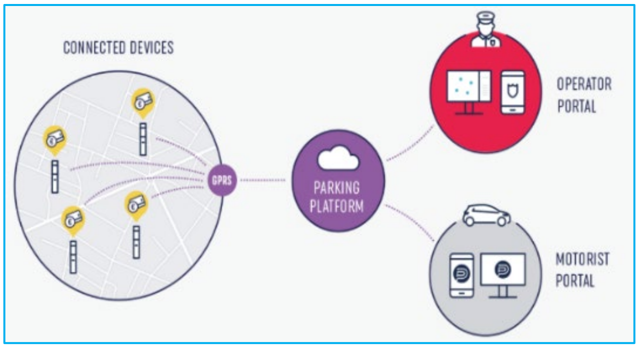



Image Source: IEM, Innovative Parking Solutions for Smart Cities


Image Source: Government Technology

Image Source: Karol Majek


Image Source: GIZMODO

### 6.4.18 Smart Parking Meters

Smart parking meters are automated parking systems that allow for a self-parking, paperless system aimed at making parking easier for cities and drivers. They work in conjunction with parking apps, street sensors and/or mounted cameras.

### 6.4.19 Cameras/License Plate Readers

Automatic license plate readers (ALPRs) are stationary units attached to poles along the street to monitor traffic, enforce parking, and monitor crime, in addition to other uses. They capture images of passing license plates, drivers and passengers with a location and a time stamp. The data is accessible by law enforcement.

### 6.4.20 Automated Traffic Monitoring/Object Detection

Traffic monitoring software is a technology that can be added to an existing camera surveillance system to monitor traffic flow and accidents in real time. The systems can also send out immediate alerts, which are visually verifiable.

### 6.4.21 Public Wi-Fi

Wi-Fi connectivity is foundational to Smart City and Corridor deployments. Lack of Internet access has implications for providing wide-spread services and addressing digital equity and inclusion.

### 6.4.22 Technology Applications Excluded from Further Evaluation

Table 1 lists technology applications that were not recommended to move forward for further evaluation and their reason for elimination.

*Table 1: Technology Applications Not Moved for Further Evaluation*

| Technology Application | Reason for Elimination |
|---|---|
| Gunshot detection sensors | High cost and unproven effectiveness to date |
| Solar pavement | High cost and maintenance requirements |
| Countdown pedestrian signals | Do not provide advanced warning to vehicles and not accessible to the visually impaired |
| Detector-based adaptive signal control technologies (ASCT) | Requires vehicle to drive over detector; high installation and maintenance cost |
| Roadside sensors | High cost; desired outcomes can be achieved with other technologies |
| Navigation assistance for the visually impaired | Devices worn by the visually impaired and do not require any infrastructure improvements |
| Artificial Intelligence (AI) Conversation Agent | Requires daily maintenance |

### 6.4.23 Other Considerations

The following strategies or technology applications are those that will require a much more robust coordination effort, due to data requirements and scope, between agencies.

- Extreme weather alert systems
- Mobility as a Service
- Real-time transit data and systems coordination
- Integrated system and data exchange

As a result, it is recommended that these four strategies be explored further by the AACIDs in coordination with regional stakeholders, as their scope extends well beyond the Virginia Avenue Smart Corridor.

**For further detail on the best practice review and findings, refer to the *Virginia Avenue Smart Corridor Study: Best Practices in New and Emerging Technologies Technical Report*, September 2019.**

# 7 PROJECT PRIORITIZATION PROCESS

## 7.1 Technology Application Screening

Prior to evaluating technology applications as part of the project prioritization process, some applications were screened out due to a variety of reasons, as indicated in the previous section. However, a total of 21 technology applications or strategies were carried forward for further evaluation, all of which received a project score. Figure 10 illustrates the screening of applications.

*Figure 10: Screening of Strategies*

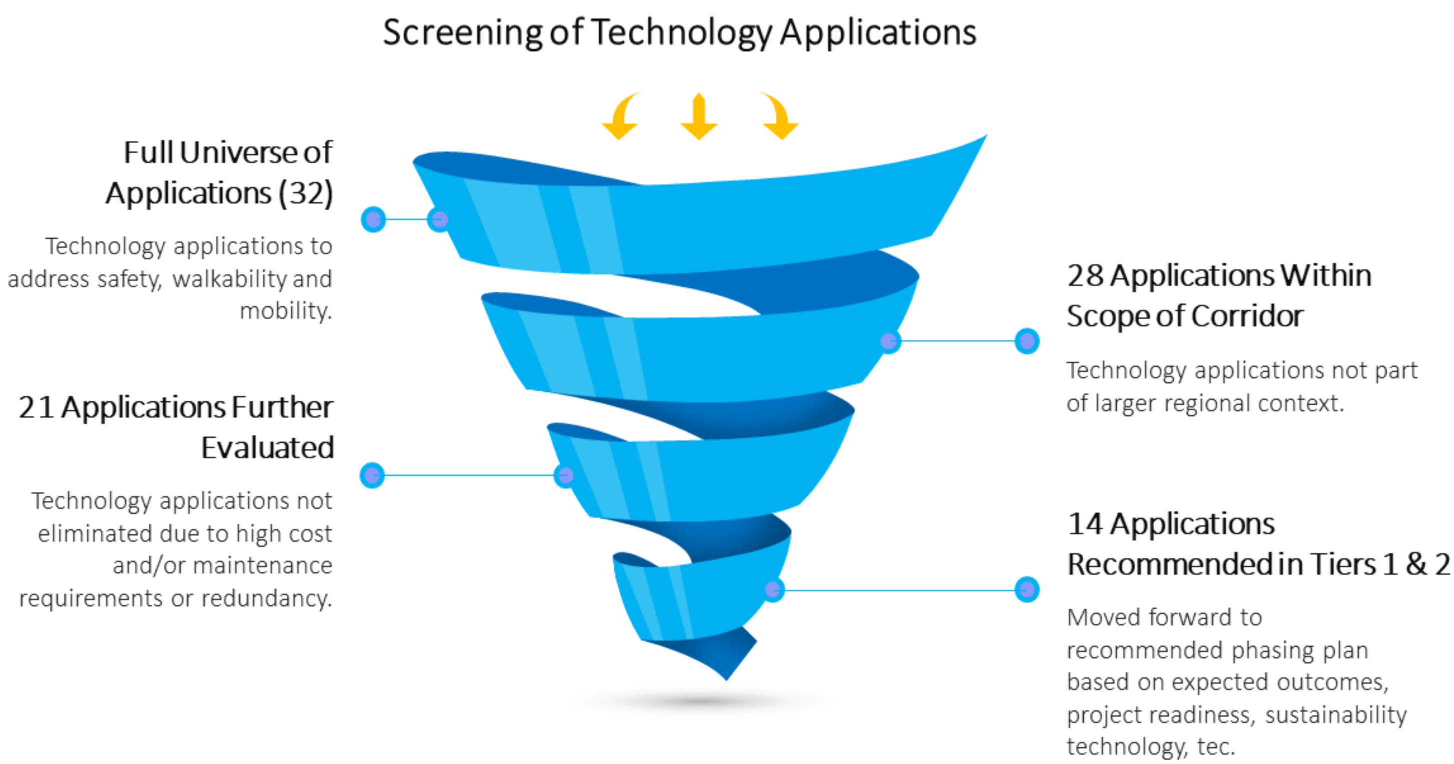



Figure 11 lists all 32 technology applications from the menu of strategies, categorized by whether they moved forward for further evaluation, and if so, if they are being recommended for implementation.

*Figure 11:Technology Applications by Screening Category*

### Outside Scope of the Corridor

01 Real-time Transit Data
02 Mobility as a Service
03 Integrated System and Data Exchange
04 Extreme Weather Alert Systems

### Eliminated from Further Consideration

01 Gunshot Detection Sensors
02 Solar Pavement
03 Countdown Pedestrian Signals
04 Detector-based Adaptive Signal Control Technologies
05 Roadside Sensors
06 Navigation Assistance for the Visually Impaired
07 Artificial Intelligence (AI) Conversation Agent

### Included in Tier 3 to Revisit Later

01 Parking Availability/Availability App
02 Smart Parking Meter(s)
03 EV Charging Station(s)
04 Automated Parking System(s)
05 Curbside Occupancy Sensors
06 Smart Dots (Studs) in Street Centerlines

### Recommended (Prioritized in Tier 1)

01 Transit Signal Priority
02 Emergency Vehicle Signal Pre-emption
03 Bike Signal Detection
04 Adaptive Signal Control Technology
05 In-Pavement Illuminated Crosswalks
06 Solar Bus Shelter(s)
07 RRFB/PHB with Automated Options for Activation
08 Transit - Pedestrian Warning System
09 Smart Streetlighting
10 Digital Wayfinding Kiosk(s)

### Recommended (Prioritized in Tier 2)

11 Public Wi-Fi
12 Camera/License Plate Readers
13 Driverless Shuttle
14 Automated Traffic Monitoring/Object Detection
15 Solar Bench(es)

## 7.2 Project Prioritization Framework

Figure 12 illustrates the project prioritization framework used to score and prioritize projects or technology applications.

*Figure 12: Project Prioritization Framework*


Six of the eight categories or themes (Stakeholder Input, Return on Investment & Economic Benefits, Safety, Project Readiness, Mobility Options, and Environment & Public Health) were already included as part of the AACIDs' project prioritization framework based on their Master Plan. The project prioritization framework was updated and tailored for the purpose of the Virginia Avenue Smart Corridor Study.

Within the existing categories or themes, the Project Readiness category was modified to include the following metrics specific to technology:

- **Project Readiness:** Projects that do not require a GDOT permit, have communications already in place to enable them, are MUTCD-compliant, (Manual on Uniform Traffic Control Devices) and/or can use GDOT's contract catalog to purchase equipment instead of through a procurement, receive a higher score.

Two new criteria were added, which include the following:

- **Cost:** Projects that are expected to cost less than others receive a higher score; and
- **Sustainable Technology:** Projects that communicate with most technologies, are multi-functional, have fewer maintenance requirements, and/or are not likely to be outdated within a few years, receive a higher score.

As mentioned earlier, an online survey was conducted to determine what citizens value most when prioritizing projects. They were asked to identify rank the top three categories or themes out of the eight indicated earlier in Figure 12. A weighting scenario was then calculated to factor the project scores to reflect the feedback from the public. A sensitivity analysis was conducted to determine how much of an impact different weighting scenarios would have on the tiering of projects. It was found that good projects consistently scored high, regardless of weighting scenario. Figure 13 illustrates the final weighting scenario used to score, rank and prioritize projects.

*Figure 13: Final Weighting Scenario to Score*

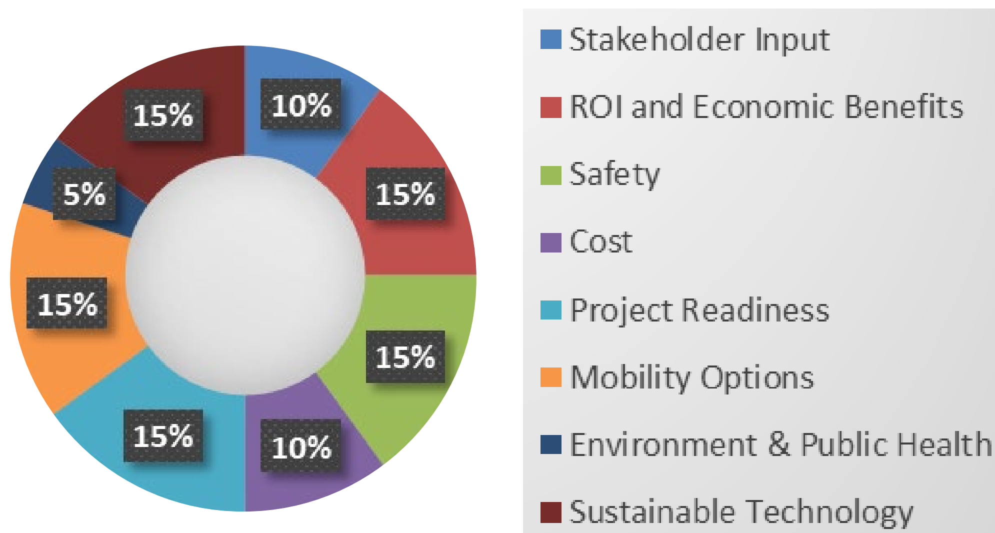



Table 2 indicates the weighting of the measures within each of the eight themes used to prioritize projects. Within each theme, there are one to four metrics used to evaluate how well a project meets the goal of the theme. All measures within a theme were weighted equally.

*Table 2: Weighting of Measures within Each Theme*

| Theme | Measures Within Theme | % Within Theme |
|---|---|---|
| Stakeholder Input | Based on Stakeholder Priorities | 100% |
| ROI & Economic Benefits | ROI Based on Jobs Created | 33% |
| | Aesthetics | 33% |
| | Economic Competitiveness | 33% |
| Safety | Anticipated Crash Reduction | 33% |
| | Anticipated Crime Reduction | 33% |
| | Safe Connections for Schools and/or Emergency Medical Services (EMS) | 33% |
| Cost | Relative Cost | 100% |
| Project Readiness | Telecommunications-Ready | 25% |
| | GDOT Permit Required | 25% |
| | MUTCD-Compliant | 25% |
| | Can Use GDOT's Contract Vehicle | 25% |
| Mobility Options | Improves Congestion | 25% |
| | Improves Bicycle Safety /Conditions | 25% |
| | Improves Pedestrian Safety/Conditions | 25% |
| | Improves Transit Safety/Conditions | 25% |
| Environment & Public Health | Anticipated Emissions Reduction | 50% |
| | Active Transportation | 50% |
| Sustainable Technology | Interoperability (communicates with most technologies) | 25% |
| | Multi-functional | 25% |
| | Low Maintenance (High = Best) | 25% |
| | Not likely to be outdated within a few years | 25% |

# 8 RECOMMENDATIONS

Once the project prioritization framework was finalized along with the best practices review, each of the 21 technology applications that moved forward for evaluation were input into the project prioritization framework.

## 8.1 Project Prioritization Results

Based on the project prioritization themes and final weighting scenario, Table 3 lists the technology application recommendations by project score, rank, and priority tier recommendation. Priority Tier 3 are projects that should be revisited later based on needs, funding and partnership opportunities, and as the technology progresses.

*Table 3: Final Technology Application (Project) Rankings*

| Priority Tier | Rank | Technology Application |
|---|---|---|
| **1** | 1 | Transit Signal Priority |
| | 2 | Emergency Vehicle Signal Pre-emption |
| | 3 | Digital Wayfinding Kiosks |
| | 4 | Transit-pedestrian Warning System |
| | 4 | Bike Signal Detection |
| | 6 | In-Pavement Illuminated Crosswalks |
| | 7 | Solar Bus Shelters |
| | 8 | Smart Streetlighting |
| | 9 | CV-based Adaptive Signal Control Technologies |
| | 10 | RRFB and/or PHB with Automated Options for Activation |
| **2** | 11 | Public Wi-Fi |
| | 12 | Cameras/License Plate Readers |
| | 13 | Autonomous Shuttle |
| | 13 | Solar USB charging bench |
| | 15 | Parking Availability App |
| **3 (Revisit Later)** | 16 | Automated Traffic Monitoring/Object Detection |
| | 17 | Smart Parking Meters |
| | 18 | EV Charging Stations |
| | 19 | Automated Parking System |
| | 20 | Smart Dots in Street Centerlines |
| | 21 | Curbside Occupancy Sensors |

## 8.2 Communications infrastructure

### 8.2.1 Backhaul Communications (Fiber)

Backhaul communications is how the signals communicate back to the traffic management center (TMC). With the addition of 4G LTE cellular radios, the 10 signals along the Virginia Avenue Smart Corridor can now communicate the TMC.

Ultimately, it is recommended that as part of the overall corridor project, fiber be installed throughout the length of the corridor while the corridor is under construction. GDOT's trunk fiber at the ramp intersection of Virginia Avenue with I-85 can be accessed and everything can go back to the GDOT TMC (backhaul communications). However, this should be coordinated with GDOT to determine what should be done with all the data coming back to the TMC. Eventually, the City of College Park may consider tying the fiber in from Virginia Avenue to the City of College Park Municipal Complex where fiber already exists.

Installing fiber will increase the speed and reliability of communications. For example, if there is lightning, it is not an issue with fiber. Nor is there an issue if there is a regional emergency and everyone is on their cell phone. Fiber can also make it easier to install other applications going forward. Optics and network switches can be scaled up in the future with fiber.

In the meantime, 4G LTE cellular radios will provide backhaul communications.

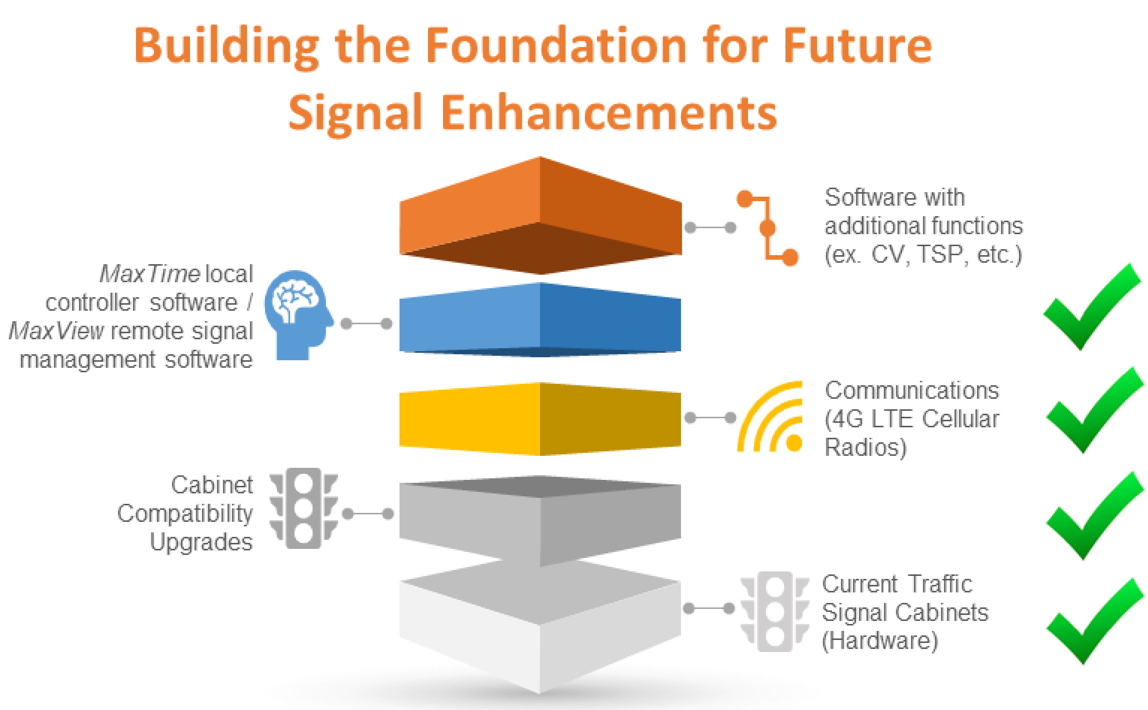
### 8.2.2 V2I Communications (4G LTE)

Early in the study, the team met with GDOT for an initial coordination meeting to learn about smart technology initiatives at the state level. It was during this meeting that GDOT indicated that they have a statewide license for Intelight's MaxTime and MaxView software that is used for smart signal timing and remote access through a web browser. Specifically, MaxTime is the local intersection software and MaxView is the advanced traffic management system (ATMS) software that is accessed through a web browser to remotely access signals and view analytics. GDOT intends to install this software on every state route in Georgia and has resources to install it on off-system routes as well.

GDOT offered the cities of College Park, East Point and Hapeville to not only convert the software and upgrade communication to 4G cellular radios along Virginia Avenue, but at no charge to the local cities. GDOT subsequently evaluated the hardware at each signal site along Virginia Avenue and upgraded two traffic control cabinets at no charge to the City of Hapeville. Furthermore, while the signal maintenance and timing will remain a responsibility of the individual cities, GDOT synchronized the initial timing and phasing plan for the corridor for more efficient flow of traffic. This effort was completed in August 2019, prior to completion of the study.

Installing the MaxTime software at the intersections, as well as 4G LTE cellular radios for communication, brings the existing signals up to current standards, allowing the signals to be better synchronized along the 2-mile corridor, and serves as an interim communications solution as it is cheaper and faster than installing fiber. Furthermore, as illustrated in Figure 14, it will make the signals compatible with future technology improvements, such as signal pre-emption and priority, connected vehicles, etc.

*Figure 14: Early Win - Installation of 4G LTE Cellular Radios and MaxTime/MaxView*



Now that the installation along Virginia Avenue is complete, installation throughout the entirety of the cities will take place over the next few months. It should be noted that the AACIDs have also coordinated additional meetings between GDOT and other cities in southern Fulton and Clayton Counties to explore the upgrade opportunities at additional signals. As a result, the City of South Fulton is also having the remainder of their signals upgraded to MaxTime along with 4G LTE cellular radios.

### 8.2.3 Communications (DSRC/5G-NR C-V2X) Pilot

In May 2019, ARC released a Call for Pilot Projects for their Transportation System Management and Operations (TSMO) Plan currently under way. The AACIDs and the Virginia Avenue Smart Corridor study team responded to the Call for Pilots with a DSRC/5G-NR C-V2X pilot project.

As part of this study, there has been extensive research to gain a better understanding on the differences between Dedicated Short-Range Communications (DSRC) and Cellular Vehicle-to-Everything (V2X) based on 5G-NR. The conclusions were that some technology applications may be better suited for DSRC and some for C-V2X (4G LTE or 5G-NR), while many can use either. Many people in the industry across the region, the nation and the world are struggling with which communications technology to proceed with (DSRC or ultimately 5G-NR). As a result, many agencies feel paralyzed until they have a better understanding of which communications solution they should use.

To assist with determining the best communications strategy for each technology application deployed and increase comfort levels, the study team proposed a DSRC/C-V2X (4G LTE and 5G-NR) pilot along the Virginia Avenue Smart Corridor. Of the ten signalized intersections along the corridor, some of them could deploy DSRC, some could deploy 5G-NR, and some could potentially deploy both (see Radio Frequency Interference discussion in the following section).

As a result of the coordination efforts and study recommendations, GDOT has already upgraded all ten signals along the corridor to include MaxView and MaxTime software and add 4G LTE cellular radios. As additional communication devices are installed, metrics could be developed for each intersection based on the connectivity and latency, among others, to determine the best communications fit for each use case or application. The results of the pilot, including any lessons learned, would be shared by the AACIDs with the rest of the Atlanta region to inform the decision to implement DSRC, 5G-NR or both going forward. Furthermore, the results would be of interest to the rest of the industry outside of Atlanta as well.

#### 8.2.3.1 5G-NR Timing Considerations

5G-NR Release 16 is expected in late 2019/early 2020, with full commercialization within the following year. As part of the current ARC Call for Projects, the AACIDs is requesting funds for this DSRC/5G-NR pilot. Decisions will be made by the ARC in Q1 and Q2 of 2020, at which time, 5G-NR Rel-16 should be released. By the time funding and contractors are in place to install 5G-NR Rel-16 at the intersections, 5G-NR Rel-16 should be fully commercialized or close to it. However, any delays in 5G-NR Rel-16 should be monitored closely to align with the pilot project.

#### 8.2.3.2 Radio Frequency Interference (RFI) Considerations

If cellular (4G LTE or 5G-NR) and DSRC radios are too close to one another in the same 5.9 Ghz band, there will be interference. As a result, if they are operating in the same 5.9 Ghz band, one must operate within the upper band and the other within the lower band. To operate within the same band, the Federal Communications Commission (FCC) must first grant permission to do so as they are not currently allowed in the same band. As part of the CV 1k+ Initiative, Applied Information has already applied for a permit with the FCC to operate within the same band.

In addition, prior to installation, a spectrum analysis of the corridor should be completed by walking the corridor and testing the area to see if there is anything that could potentially interfere with the DSRC radios.

#### 8.2.3.3 Performance Metrics

In addition to the timeframe for 5G-NR Rel-16 commercialization and Radio Frequency Interference considerations, Figure 15 indicates performance metrics that should be considered when evaluating the effectiveness of different communication devices for different use cases, or applications.

*Figure 15: Communication Device Performance Measures*

- Speed
- Latency (delay)
- Transmission range
- Maturity
- Reliability
- Initial cost
- Long-term cost
- Ease of implementation
- Advanced applications

In addition to the above metrics related to communications device performance, metrics related to the overall performance of the transportation system as a result of the applications installed should also be evaluated. As each traffic signal application is deployed, various performance metrics are available to compare the performance of the traffic system before and after the deployment.

GDOT is currently using Automated Traffic Signal Performance Measures (ATSPM) [4] and Regional Integrated Transportation Information System (RTIS) data to gather before and after data for any traffic signal timing optimization project. These tools replace the need for the traditional before and after studies. Now that GDOT has installed MaxTime at all 10 signals along the Virginia Avenue Smart Corridor, baseline data is being collected. A variety of performance metrics are collected, some of which include:

- Arrivals on red
- Approach volume
- Approach delay
- Pedestrian delay

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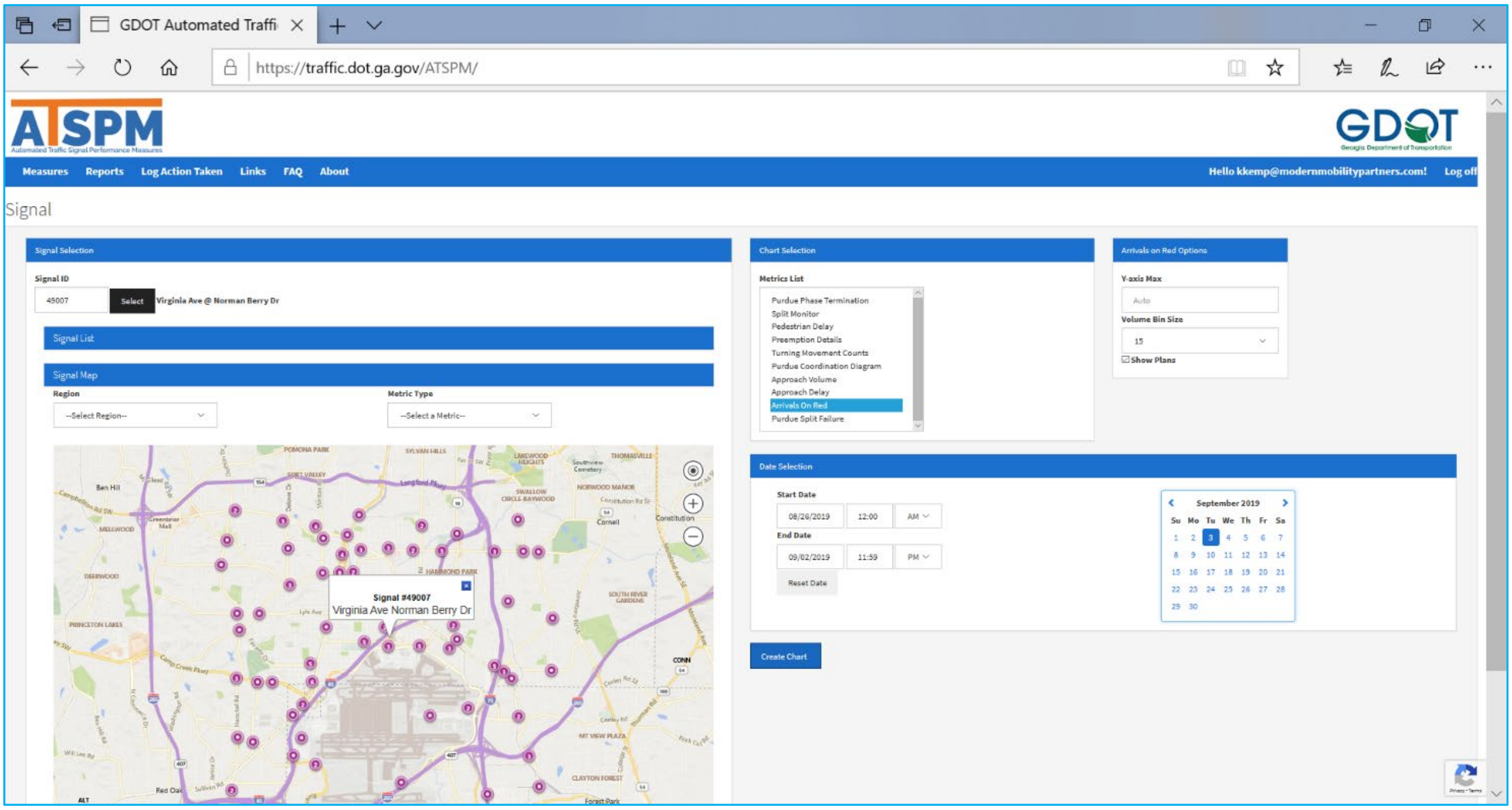
[4] Automated Traffic Signal Performance Measures (ATSPM), GDOT, https://traffic.dot.ga.gov/ATSPM/

*Figure 16: Automated Traffic Signal Performance Measures (ATSPM) Dashboard*




Once transit signal priority and emergency vehicle signal pre-emption are installed, pre-emption details are also available within the ATSPM.

It is anticipated that the funding for the installation of the communication devices will be included as part of the CV 1k+ Initiative (see section 9.2.1.5). The funding for the pilot itself would be focused on a study of before and after performance metrics and lessons learned to be shared with others. It is recommended that the AACIDs apply for funding for the pilot study as part of the current ARC TIP Solicitation that closes October 11, 2019. This is included in the 100-Day Action Plan.

# 9 IMPLEMENTATION PLAN

The implementation plan for the Virginia Avenue Smart Corridor Study includes the following elements:

- Funding strategy
- Overall phasing plan and considerations
- 100-day action plan

Further detail on each is provided below.

## 9.1 Funding Strategy

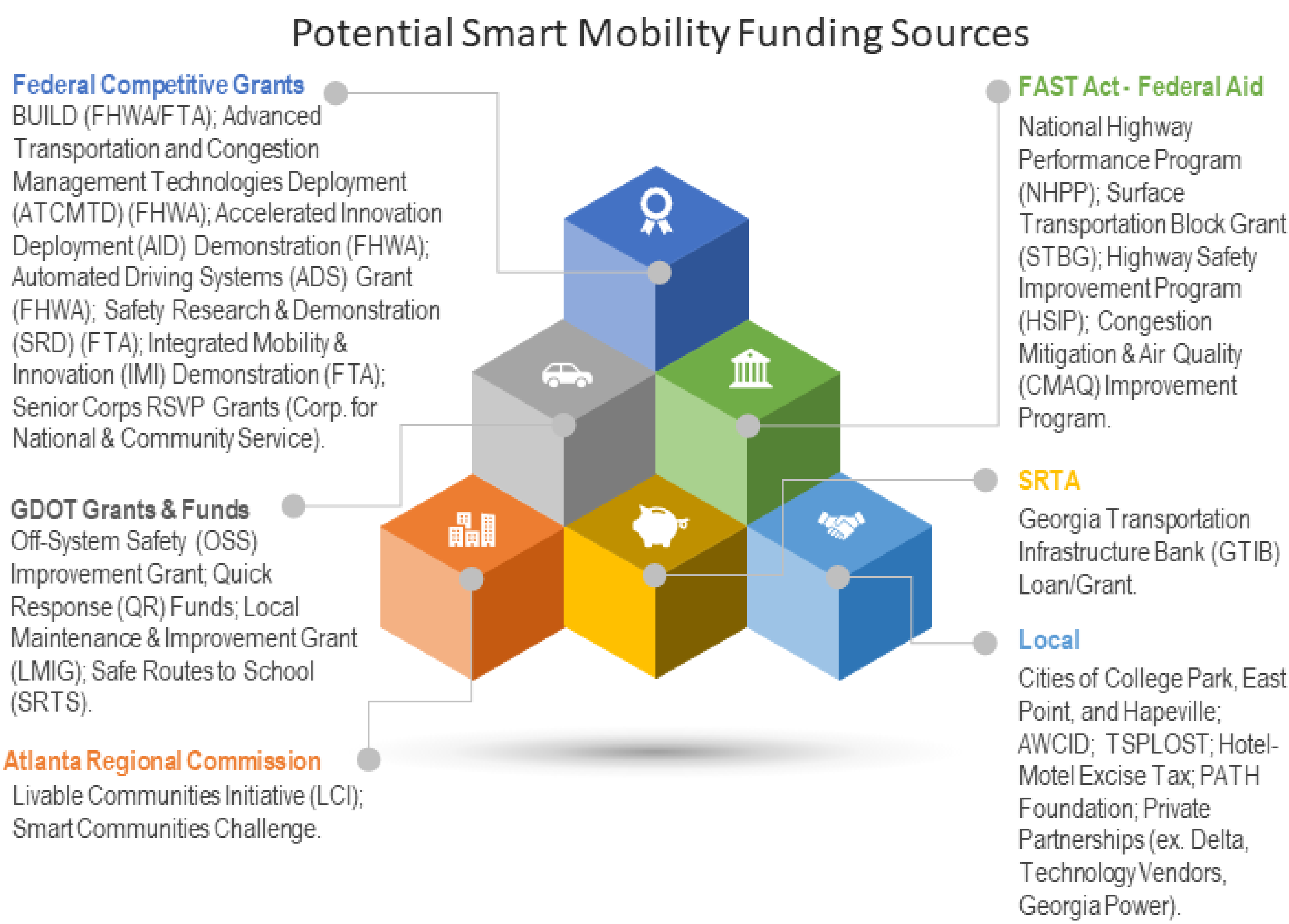
To develop the funding strategy, all 15 projects, or applications, included in Priority Tiers 1 and 2 were first reviewed to determine all the types of components included in the projects. All potential funding sources were then researched at the federal, state, regional, and local level, as well as consideration of private funding sources, and assigned as potential funding sources to each project or application. The funding strategy primarily focuses on capital expenses. Projects, or applications, were then bundled into packages based on funding cycles, project readiness, cost, etc. and included as part of an overall phasing plan. Figure 17 illustrates the overall approach to developing the funding strategy. Further detail on each step is provided below.

*Figure 17: Approach to Funding Strategy*

### 9.1.1 Full Universe of Potential Funding Sources

Figure 18 illustrates all potential funding sources to be considered for implementation of the recommended technology applications as part of the Virginia Avenue Smart Corridor Study.

*Figure 18: Potential Funding Sources*



Further detail on each is provided in the following tables:

- Table 4: Relevant Federal Funding Sources (FAST Act – Federal Aid)
- Table 5: Relevant Federal Funding Sources (Competitive Grants)
- Table 6: Relevant State Funding Sources
- Table 7: Relevant Regional/Local Funding Sources

*Table 4: Relevant Federal Aid Funding Sources*

| Grant | Agency | Description |
|---|---|---|
| **National Highway Performance Program (NHPP)** | FHWA | The NHPP supports the condition and performance of the National Highway System (NHS). The FAST Act provides specific NHPP eligibility for vehicle-to-infrastructure (V2I) communication equipment. The I-85 ramp intersections at Virginia Avenue are considered part of the NHS. |
| **Surface Transportation Block Grant (STBG)** | FHWA | STBG has the most flexible eligibilities among all Federal-aid highway programs. It can be used for use for projects to preserve or improve conditions and performance on any federal-aid highway, bridge projects on any public road, facilities for nonmotorized transportation, transit capital projects, and public bus terminals and facilities. |
| **Highway Safety Improvement Program (HSIP)** | FHWA | HSIP funding is for infrastructure safety-related projects and can be used on any public road, including those owned by local governments. In addition, the FAST Act includes Vehicle-to-Infrastructure (V2I) communication equipment as HSIP-eligible. |
| **Congestion Mitigation & Air Quality Program (CMAQ)** | FHWA | CMAQ is a funding source to help to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards. Since the Freight Cluster Plan study area is within the Atlanta non-attainment area, projects such as intersection and traffic signal improvements that can be shown to reduce congestion could be eligible. Additionally, the FAST Act made V2I communication equipment eligible as a CMAQ project type. CMAQ-funded projects must demonstrate a reduction in ozone precursor pollutants and/or particulate matter immediately upon implementation. The Atlanta Regional Commission (ARC) allocates approximately $29 million per year for the CMAQ program. |

*Table 5: Relevant Federal Competitive Grant Funding Sources*

| Grant | Agency | Description |
|---|---|---|
| Better Utilizing Investments to Leverage Development (**BUILD**) Transportation Discretionary Grant | FHWA/FTA | Annual competitive grant program to invest in road, rail, transit and port projects that will achieve national objectives and have significant local or regional impact. Project sponsors can be any public entity, including municipalities, counties, port authorities, tribal governments, MPOs, and others. Eligible capital projects include highway, bridge, or other road projects eligible under title 23, United States Code; public transportation projects eligible under chapter 53 of title 49, United States Code; passenger and freight rail transportation projects; port infrastructure investments (including inland port infrastructure and land ports of entry); and intermodal projects. The total BUILD Grant Program funding amount is $1.5 billion with projects in urban areas ranging from $5 million to $25 million. |
| Advanced Transportation and Congestion Management Technologies Deployment (**ATCMTD**) Program | FHWA | This is a competitive grant program for implementation and operation of advanced transportation technologies. Program purposes are to reduce costs and improve return on investments, deliver environmental benefits through increased mobility, improve transportation system operations, improve safety, improve collection and dissemination of real-time information, monitor transportation assets, deliver economic benefits, and accelerate deployment of connected/autonomous vehicle technologies. Eligible entities include states, local governments or other political subdivisions, transit agencies, large MPOs, multijurisdictional groups, and consortia of research or academic institutions. Up to $60 million per year is authorized for the ATCMTD program; up to $12 million per individual project; federal share up to 50% of project cost. |
| Accelerated Innovation Deployment (**AID**)[5] | FHWA | The AID program provides funding as an incentive to accelerate the use of innovation in highway transportation projects and may involve any phase of a highway transportation project between project planning and project delivery including planning, financing, operation, structures, materials, pavements, environment, and construction. The applicant must be ready to initiate within 12 months of applying for AID Demonstration funding. The FHWA expects approximately $10 million to be made available for AID Demonstration grants in each of fiscal years 2016 through 2020 through rolling applications. |
| Automated Driving System (**ADS**) Demonstration Grant[6] | FHWA | Provide grants to eligible entities to fund demonstration projects that test the safe integration of automated driving systems into the Nation's on-road transportation system. These grants aim to gather significant safety data to inform rulemaking, foster collaboration amongst state and local government and private partners, and to test the safe integration of ADS on our nation's roads. Up to $60,000,000 in Federal funding for all grant awards (total). |

5 https://www.fhwa.dot.gov/innovation/grants/edc4_aiddemo_factsheet.pdf

66 https://www.transportation.gov/av/grants

*Table 5: Relevant Federal Competitive Grant Funding Sources (Cont'd)*

| Grant | Agency | Description |
|---|---|---|
| **Safety Road Demonstration (SRD) Grant**[1] | FTA | The Safety Research and Demonstration (SRD) Program is part of a larger safety research effort at the U.S. Department of Transportation that provides technical and financial support for transit agencies to pursue innovative approaches to eliminate or mitigate safety hazards. The SRD program focuses on demonstration of technologies and safer designs. Maximum federal share is 80%. The funding available for the last funding cycle in 2017 was a total of $7 million. |
| **IMI Grant**[1] | FTA | FTA's Integrated Mobility Innovation (IMI) Program funds projects that demonstrate innovative and effective practices, partnerships and technologies to enhance public transportation effectiveness, increase efficiency, expand quality, promote safety and improve the traveler experience. FTA's IMI 2019 funding opportunity provided $15 million for demonstration projects focused on three areas of interest: Mobility on Demand, Strategic Transit Automation Research and Mobility Payment Integration. |
| **Senior Corps RSVP Grant**[1] | CNCS | The mission of the Corporation for National and Community Service (CNCS) is to improve lives, strengthen communities, and foster civic engagement through service and volunteering. Healthy futures are one of the goals of the RSVP grant, which includes assisting with meeting health needs within communities including: access to care, aging in place, and childhood obesity. Activities may include supporting the ability of adults who are homebound or older adults and individuals with disabilities, to live independently and assisting individuals with access to food resources. Awards range from $40,000 to $470,000. |

*Table 6: Relevant State Funding Sources*

| Grant | Agency | Description |
|---|---|---|
| GDOT Off-System Safety (OSS) | GDOT | To reduce the severity and frequency of crashes on off system routes, GDOT implemented the OSS program in 2005 in the State Traffic Operations Office. The OSS program is now administered by the Local Grants Office. As part of this program, funds are dispersed through the federal safety program in order to enhance safety on local routes through low-cost countermeasures such as striping and sign replacement as well as rumble strips and raised pavement marker installations. All work must be completed within existing rights of way; no additional pavement may be added. If local governments are interested in receiving funds through the OSS program, they should, by January of the current fiscal year, contact the State Aid Coordinator for the district in which they are located.[7] |
| GDOT Quick Response (QR) Program | GDOT | The QR Program, which is administered by the Local Grants Office, allows the Department a mechanism to quickly identify, approve and construct small traffic operational projects through their seven District Offices around the state. This process allows each District Engineer the ability to quickly identify a needed project, solicit a minimum of (3) bids and then award the project to the lowest bidder. Projects up to $200,000. |
| GDOT Local Maintenance & Improvement Grant (LMIG) | GDOT | LMIG funds can be used for a variety of projects, including but not limited to intersection improvements; signal installation or improvements; patching, leveling and resurfacing a paved roadway; Preliminary Engineering (including engineering work for R/W plans and Utility plans); roadway signs and striping; sidewalk adjacent (within right of way) to a public roadway or street; turn lanes; utility adjustments or replacement, etc. According to GDOT's LMIG Formula Funding Amounts[8], a total of $658,600 is available in FY '20 LMIG funds for the Cities of College Park, East Point, and Hapeville in total. A 30% match is required. |
| **Safe Routes to School (SRTS)** | GDOT | Georgia has a Safe Routes to School (SRTS) program intended to improve the health and well-being of children in grades K-8—including those with disabilities—by making it safe, convenient and fun to walk or bike to school. A school must be actively engaged in non‐infrastructure activities (e.g. SRTS Plan, Education, Encouragement and/or Enforcement activities) and enrolled in the Georgia SRTS Resource Center. Projects must be infrastructure projects within the public right of way, within a 2‐mile radius of a school with grades K‐8. Eligible projects types are sidewalk improvements, traffic calming and speed reduction improvements, pedestrian and bicycle crossing improvements, on‐street bicycle facilities, off‐street bicycle and pedestrian facilities, secure bicycle parking facilities, and traffic diversion improvements. Other project types may also be eligible if they meet the objectives of reducing speeds and improving pedestrian and bicycle safety and access. Applications are limited to $500,000 and there is no match required for this federal funding source. |

[7] http://www.dot.ga.gov/PS/Local
[8] FY '20 LMIG Formula Funding Amounts, http://www.dot.ga.gov/PartnerSmart/Local/LMIGReportsForms/Formula%20Amounts.pdf

Table 6: Relevant State Funding Sources (Cont'd)

| Grant | Agency | Description |
|---|---|---|
| **Georgia Transportation Infrastructure Bank (GTIB) Loan or Grant[9]** | State Road and Tollway Authority (SRTA) | GTIB is a grant and low-interest loan program for highly competitive transportation projects that have enhanced mobility and driven economic development in local communities throughout Georgia. Eligible costs are costs related to preliminary engineering, traffic and revenue studies, environmental studies, right of way acquisition, legal and financial services associated with the development of the qualified project, construction, construction management, facilities, and other costs necessary for the qualified project. Eligible projects are currently restricted to those roadway projects that satisfy the requirements of being motor-fuel tax eligible; as set forth in O.C.G.A. §32-1-1et seq. GTIB interest rates currently range between 1.41 and 2.44%, depending on loan repayment term (5-, 10-, 15-, and 20-year terms). Historically, grant funding is more competitive than loan funding. **The 2019 application cycle is currently open. Applications will be accepted from August 15, 2019 through October 15, 2019.** Awards are expected to be announced in February 2020. Up to $25 million will be awarded. |

[9] Georgia Transportation Infrastructure Bank, SRTA, https://www.srta.ga.gov/gtib/

*Table 7: Relevant Regional/Local Funding Sources*

| Grant | Agency | Description |
|---|---|---|
| **Livable Communities Initiative (LCI)**[10] | ARC | The ARC's Livable Centers Initiative (LCI) is a grant program that incentivizes local jurisdictions to re-envision their communities as vibrant, walkable places that offer increased mobility options, encourage healthy lifestyles and provide improved access to jobs and services. The ARC board has allocated $314 million through 2030 to fund transportation projects resulting from completed LCI studies. The LCI program is funded with federal transportation dollars. The grants cover 80 percent of the cost of each study or transportation project, with the recipient making a 20 percent match. The Virginia Avenue Smart Corridor Study was funded with LCI dollars. Coordination with ARC should take place to determine if additional LCI dollars are available for implementation of LCI study recommendations. |
| **Community Development Assistance Program (CDAP)**[11] | ARC | In 2018, the ARC launched a technical assistance program with the goal of helping cities, counties, and nonprofit organizations find solutions to land use and transportation planning issues. It offers both grants and technical assistance. In addition to maximizing ARC resources directed towards communities, CDAP is also a partnership with external agencies looking to tackle similar issues. In 2019, ARC will be partnering with Georgia Conservancy, Georgia Power, Georgia State, Georgia Tech, Southface and the Urban Land Institute. There are four types of technical assistance offered through CDAP, one of which includes implementation. Implementation includes strategic assistance to implement high-priority action items identified in adopted plans. Smart Communities is also one of the focus areas. The last funding application cycle was in coordination with the LCI program (LCI and/or CDAP) in January/March 2019 and it is conducted annually. A 20% match is required for both LCI and CDAP grants. The AACIDs should meet with ARC to determine the likelihood of using CDAP funds for actual deployment of smart technologies. |
| **Smart Communities Challenge**[12] | ARC/ GaTech/ Georgia Power | The program is organized by the Georgia Institute of Technology in partnership with ARC, Association County Commissioners of Georgia (ACCG), Georgia Municipal Association (GMA), Georgia Chamber of Commerce, Georgia Centers for Innovation, Georgia Department of Community Affairs (DCA), Metro Atlanta Chamber, and Technology Association of Georgia (TAG), and supported by Georgia Power. Georgia Smart has conducted two annual cycles of awarding four applicants each in the areas of smart mobility and smart resilience. Each of the four winning teams receive direct grant funding of up to $50,000, as well as additional funds for research and technical assistance with a required local match. Georgia Tech and its partners will then work with the winning teams throughout the year on implementing their proposals, creating four testbeds of smart community development. |

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[10] Livable Communities Initiative (LCI), Atlanta Regional Commission, https://atlantaregional.org/community-development/livable-centers-initiative

[11] LCI & CDAP Assistance Application Guidebook, 2019, Atlanta Regional Commission, http://smartcities.ipat.gatech.edu/sites/default/files/lci-cdap-asst-appl-guidebook-v4.pdf

[12] Smart Communities Challenge, https://atlantaregional.org/news/community-preparedness/georgia-smart-communities-challenge/.

*Table 7: Relevant Regional/Local Funding Sources (Cont'd)*

| Grant | Agency | Description |
|---|---|---|
| **Airport West CID** | AACIDs | The Airport West CID, as part of the Aerotropolis Atlanta CIDs, can use assessment revenue for a range of beautification, public safety, and infrastructure projects, including technology-related projects. This funding can be used to leverage additional grants and to provide matching funds for state and federally funded projects. |
| **Fulton County T-SPLOST** | Fulton County | Local taxes, such as Special Purpose Local Option Sales Taxes, or SPLOSTs, are important local funding sources and may be used for matching funds on state or federally funded projects. A TSPLOST is specifically slated for transportation projects. While single-county TSPLOST can only be levied for up to five years at a time, they can be re-initiated with voter approval under a new referendum. Approved by Fulton County voters in 2016, the Fulton County TSPLOST is a 0.75-cent sales tax for transportation purposes in Fulton County, outside the City of Atlanta. Each city is responsible for managing and implementing its approved project list. The funds can be used only for transportation improvements. The Fulton County TSPLOST started in 2017 and will end in 2022 or when the maximum amount of $655 million is reached. |
| **Hotel-Motel Excise Tax** | Cities of College Park, East Point, Hapeville | Above and beyond Fulton County's 7% hotel-motel excise tax, the Cities of College Park, East Point, and Hapeville all have an additional 1% hotel-motel excise tax totaling 8%.[13] There are 16 hotels located on or near the Virginia Avenue Smart Corridor and as such, the hotel-motel excise tax could be a potential local funding source. |

[13] FY2017 Hotel/Motel Excise Tax Report Jurisdiction Tax Rate and Authorization Paragraph Updated: February 2019, https://www.dca.ga.gov/sites/default/files/fy2017_hmt_-_rate_and_authorization_2_18_2019.pdf.

### 9.1.2 *Assignment of Potential Funding Sources to Each Recommended Project*

Figure 19 illustrates each element within each phase of the smart corridor by potential funding source based on eligibility.

*Figure 19: Potential Funding Source by Smart Corridor Element*

| SMART CORRIDOR TECHNOLOGY APPLICATIONS | FEDERAL | | | | | | | STATE | | | | | LOCAL | | | | | | PUBLIC PRIVATE PARTNERSHIP (P3) POTENTIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Competitive Grants | | | | | | | GDOT | | | | GRTA/SRTA | ARC (above and beyond Federal Aid) | | | Fulton County | Cities of College Park, East Point, and/or Hapeville (depending on location) | | |
| Projects | BUILD Transportation Grant (FHWA/FTA)[3] | Accelerated Innovation Deployment (AID) Demo (FHWA)[2] | Automated Driving System (ADS) Grant (FHWA) | Advanced Transportation and Congestion Management Technologies Deployment Grant (FHWA) | Safety Research and Demonstration (SRD) Program (FTA) | Integrated Mobility Innovation (IMI) Demonstration Program (FTA) | Senior Corps RSVP Grants (Corp. for National and Community Service) | Off-System Safety (OSS) Improvement Grant | Local Maintenance and Improvement Grant (LMIG) | Safe Routes to School (SRTS) | Quick Response (QR) Funds | Georgia Transportation Infrastructure Bank (GTIB) Grant/Loan Program | Livable Communities Initiative (LCI) Grant (for Implementation) | Community Development Assistance Program (CDAP) | Smart Communities Challenge (ARC/GA Tech/GA Power)[2] | TSPLOST | Hotel-Motel Excise Tax | |
| Digital Wayfinding Kiosk(s) | Yes | No | No | No | No | No | No | No | No | No | No | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Transit Signal Priority | Yes | No | No | Yes | No | No | No | No | Yes | No | Yes | Yes | Yes | Yes | No | Yes | Yes | No |
| Emergency Vehicle Signal Pre-emption | Yes | No | No | Yes | No | No | No | Yes | Yes | No | Yes | Yes | Yes | Yes | No | Yes | Yes | No |
| Bike Signal Detection | Yes | Yes | No | Yes | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| In-Pavement Illuminated Crosswalks | Yes | Yes | No | Yes | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| RRFB with Automated Options for Crossing (PHB as part of Phase 3) | Yes | Yes | No | Yes | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Transit-Pedestrian Warning System | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Solar USB Bench(es) | Yes | No | No | No | No | No | Yes | No | No | No | No | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Driverless Shuttle | Yes | Yes | Yes | Yes | No | Yes | Yes | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adaptive Signal Control Technology | Yes | No | No | Yes | No | No | No | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No |
| Solar Bus Shelter(s) | Yes | No | No | No | No | No | Yes | No | No | No | No | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Smart Streetlighting | Yes | Yes | No | Yes | No | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Public Wi-Fi | Yes | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Camera/License Plate Readers | Yes | No | No | Yes | No | No | No | No | Yes | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Automated Traffic Monitoring/Object Detection | Yes | Yes | No | Yes | No | No | No | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No |

**Notes:**

1 At I-85 Ramp Intersections Only (assuming ramp intersections included on NHS; needs verification)

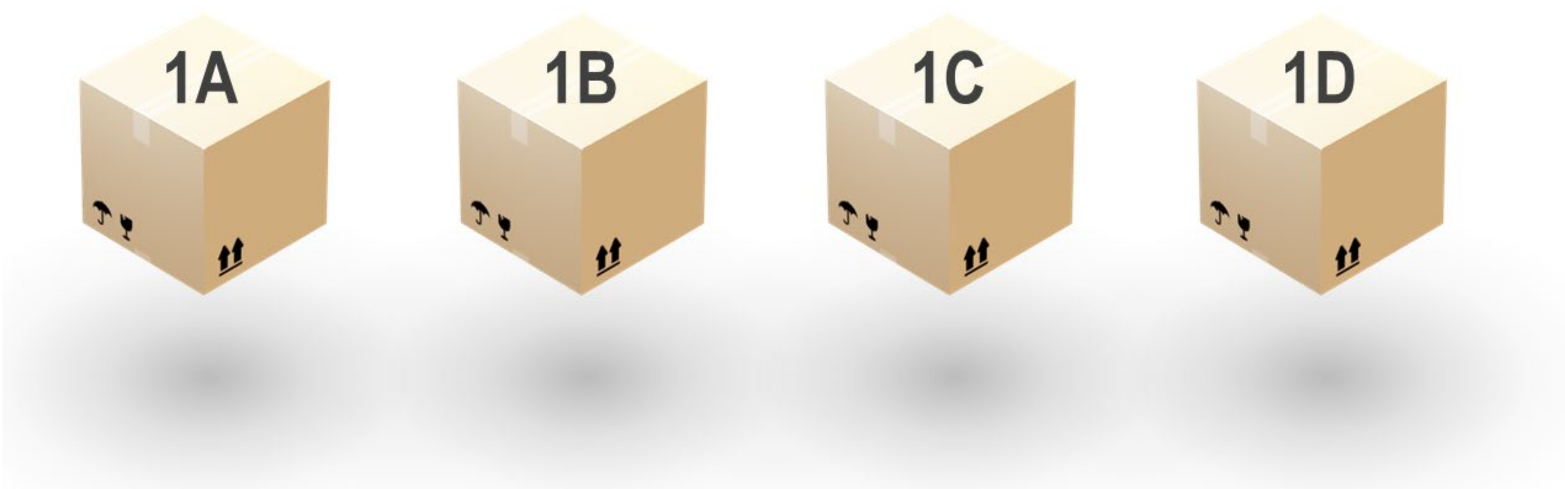
2 Since program is for pilots or significant innovation, only assumed newer technologies would be eligible

3 Assumed any projects eligible for a BUILD grant would be submitted as part of an overall program

### 9.1.3 Packaging of Technology Applications (Projects)

Figure 20 illustrates the bundling of each of the projects, or applications, into packages as they aligned with regional initiatives and/or funding cycles. Further detail on each of the packages, or bundles, is included in Section 9.2.3.

*Figure 20: Packaging of Technology Applications (Projects)*




**Package 1A:**
Upgrade Signals with 4G LTE Routers and Install MaxTime/MaxView Software at All 10 Traffic Signals

**Package 1B:**
Digital Wayfinding Kiosks (near hotels)

**Package 1C:**
CV1k+ Initiative – Install DSRC/CV2X Routers, Transit Signal Priority, and Emergency Vehicle Signal Pre-emption at All 10 Traffic Signals

**Package 1D:**
GTIB Grant Application – Pilot 1-2 In-Pavement LED Illuminated Crosswalks (near hotels), 1-2 RRFP with Automated Options (near Woodward Academy), 1-2 Bike Signal Detection, Solar USB Charging Benches, Transit Pedestrian Warning System

## 9.2 Overall Phasing Plan

### 9.2.1 Considerations

The following were considered when developing the overall phasing plan recommendations:

- Overall corridor project construction timeline and funding application cycles
- Concept of Operations as part of Scoping Study
- Fiber Network Design
- Order of magnitude project cost
- CV 1k initiative (DSRC and C-V2X cellular radios)
- GDOT permitting requirements
- MUTCD compliance
- GDOT contract catalog availability and procurement requirements

Further detail is provided below.

#### 9.2.1.1 Overall Corridor Construction

The overall corridor reconstruction project includes a road diet for Virginia Avenue in some places, including removing the median on the eastern end of the corridor, widening the sidewalks, and adding bike lanes. A Scoping Study must be completed by the AACIDs, which includes but is not limited to a detailed traffic analysis and project cost estimate, prior to applying for Preliminary Engineering (PE) funds.

The Atlanta Regional Commission (ARC) Transportation Improvement Program (TIP) Project Solicitation funding cycle is currently open. The AACIDs is applying for funding for the Scoping Study (included in the 100-day action plan). ARC typically opens TIP Project Solicitations every two years. As a result, PE funds won't be applied for until late 2021 with funding available in 2022. Construction is estimated to begin in late 2025 with completion estimated for late 2027.

Since construction will not begin for six years, some projects are being recommended for installation before construction of the overall corridor, or at least as pilot projects at fewer locations to test technologies. However, it should be noted that some projects, such as in-pavement illuminated crosswalks, will likely be ripped out as part of the overall corridor reconstruction in six years. Since these will be tested at 1-2 locations, they can be installed along the length of the corridor as part of the overall corridor reconstruction and should be included in the Scoping Study.

#### 9.2.1.2 Concept of Operations

As part of the Scoping Study, a Concept of Operations will be conducted. Adaptive signal control technologies should be included in the Concept of Operations. As a result, adaptive signal control is being recommended for installation as part of the overall corridor reconstruction to allow time for it to be addressed in the Concept of Operations.

#### 9.2.1.3 Fiber Network Design

To increase speeds and reliability of communications, fiber installation is recommended as part of the overall corridor reconstruction. Due to the cost of fiber and the efficiencies of installing fiber while the corridor is already under construction, fiber installation is not recommended until the entire corridor is under construction and should be included in the Scoping Study. The fiber network design will be developed as part of Preliminary Engineering.

#### 9.2.1.4 Project Cost

Only lower cost applications are recommended for installation prior to corridor reconstruction. In addition, applications that can be implemented at no cost to the AACIDs or cities, such as digital wayfinding kiosks, are recommended for earlier implementation since the cost to install and maintain is covered by advertising fees.

#### 9.2.1.5 CV 1k Initiative

The Atlanta Regional Connected Vehicle Program (CV 1k+) is the first wide-scale, functional deployment of connected-vehicle technology in the United States. Implementing the technologies at over 1,700 signals, the project will be the first in the nation that will incorporate all current methods of communication available for connected vehicles - with the capability to upgrade to new technologies as they become available and/or necessary for new applications. The strategy also provides the Atlanta Region and Georgia with a connected vehicle deployment which can be scaled statewide.

The Atlanta Regional Connected Vehicle Program (CV 1k+) will serve as a magnet and incubator for automakers and their suppliers, mobile network operators, semiconductor manufacturers, and other intelligent transportation technology companies to come to Georgia and test products and new applications in a real-world environment. The program deployment also provides a desirable testing environment including diverse topography, four seasons of weather, dense seasonal vegetation, city center, and suburban construction interferences.

A core program objective is to meet the needs for the earliest rollout of connected vehicle technologies based on C-V2X: Ford's commitment to installing C-V2X in the model year 2022 vehicle fleet. Other examples of existing connected vehicle models include the include the use of DSRC in Cadillac CTS sedans, beginning in the 2017 model year.

In order to successfully implement the program for both C-V2X and DSRC, an experimental license from the FCC is required that permits C-V2X and DSRC to operate in the 5.9 GHz band.

###### 9.2.1.5.1 Program Overview and Needed Capabilities

The planned deployment provides a real-world implementation of the three radio technologies at the center of the connected vehicle framework:

1. **C-V2X (Cellular Vehicle-to-Everything)** – The connected vehicle short-range radio technology selected by the Ford Motor Company for installation in all Ford vehicles, starting in the model year 2022. Other vehicle manufacturers are also examining this technology.

2. **DSRC (Dedicated Short-Range Communication)** – The connected vehicle short-range radio technology identified by GDOT for deployment on the RTOP (Regional Traffic Operations Program) corridors. Beginning with the 2017 model year, the Cadillac CTS sedan currently uses DSRC technology. Other vehicle manufacturers are also examining this technology.

3. **C-V2N** (**Cellular Vehicle-to-Network**) – The connected vehicle long-range radio technology that uses existing 4G LTE networks, supporting long-range communications with intersections and other traffic equipment.

These technologies support innovative transportation applications. "Day One" applications focus on improving safety, managing congestion and supporting air quality goals. Day one applications are subject to approval of local governments, with all data shared with GDOT and other entities as approved in agreements (examples):

- Emergency Vehicle Preemption Capability (requires in-vehicle radios)
- Transit Bus Priority Capability (requires in-vehicle radios)
- Freight/Delivery Vehicle Priority Capability (requires in-vehicle radios)
- Red Light Running Warning (via smartphone app)
- Preparation for Signal Turning to Green Message (via smartphone app)
- Emergency Vehicle Proximity Warning Capability (via smartphone app)
- Other illustrative capabilities (Wrong Way Alerts, School Bus Warning, Work Zones) (via smartphone app)

All ten traffic signals along Virginia Avenue have been recommended and included in the first phase of deployment, expected in Spring 2020.

#### 9.2.1.6 GDOT Permitting Requirements

As a state agency, GDOT has permitting authority for roadways designated as State Routes. Traditional permits include encroachment and traffic signal. For consistency throughout the State and where the Georgia Legislature has passed governing laws, GDOT has permitting authority on non- state routes. An example is permitting of red-light running cameras. Table 6 lists each of the recommended applications and whether a GDOT permit will be required, as determined by GDOT District 7. Projects that are not expected to require a GDOT permit may be implemented faster than those that do.

*Table 8: GDOT Permitting Requirements*[14]

| ID | Technology Application | GDOT Permit Required |
|---|---|---|
| 1 | Transit Signal Priority | Yes |
| 2 | Emergency Vehicle Signal Pre-emption | Yes |
| 3 | Adaptive Signal Control Technologies | No |
| 4 | Transit-pedestrian Warning System | No |
| 5 | Bike Signal Detection | Yes |
| 6 | RRFB and/or PHB with Automated Options for Activation | Yes |
| 7 | Smart Streetlighting | No |
| 8 | EV Charging Stations | Yes |
| 9 | Smart Dots in Street Centerlines | Yes |
| 10 | Autonomous Shuttle | No |

[14] Provided/confirmed by GDOT Office of Traffic Operations and District 7, August 2019.

Table 9: GDOT Permitting Requirements (Cont'd)

| ID | Technology Application | Yes |
|---|---|---|
| 11 | Solar Bus Shelters | Yes |
| 12 | Digital Wayfinding Kiosks | No |
| 13 | Solar USB charging bench | Yes |
| 14 | Automated Parking System | No |
| 15 | Curbside Occupancy Sensors | No |
| 16 | Parking Availability App | No |
| 17 | Smart Parking Meters | No |
| 18 | Cameras/License Plate Readers | Yes |
| 19 | Automated Traffic Monitoring/Object Detection | Yes |
| 20 | Public Wi-Fi | Yes |
| 21 | In-Pavement Illuminated Crosswalks | Yes |

#### 9.2.1.7 MUTCD Compliance

The Manual on Uniform Traffic Control Devices (MUTCD) sets minimum standards and provides guidance to ensure uniformity of traffic control devices across the nation. Setting uniform standards reduces crashes and congestion, improves the efficiency of the surface transportation system, and helps to reduce the cost of traffic control devices through standardization. Non-compliance with the MUTCD can ultimately result in the loss of federal-aid funds and significantly increase tort liability for state and local municipalities. Table 9 indicates which of the recommended applications as part of the Virginia Avenue Smart Corridor Study are MUTCD-compliant. For those applications that are not MUTCD-compliant, design exceptions may be considered but often take longer for approval.

*Table 10: MUTCD-Compliant Technology Applications*

| ID | Technology Application | MUTCD - Compliant |
|---|---|---|
| 1 | Transit Signal Priority | Yes |
| 2 | Emergency Vehicle Signal Pre-emption | Yes |
| 3 | Adaptive Signal Control Technologies | Yes |
| 4 | Transit-pedestrian Warning System | No |
| 5 | Bike Signal Detection | No |
| 6 | RRFB and/or PHB with Automated Options for Activation | Yes |
| 7 | Smart Streetlighting | NA |
| 8 | EV Charging Stations | NA |
| 9 | Smart Dots in Street Centerlines | No |
| 10 | Autonomous Shuttle | No |
| 11 | Solar Bus Shelters | NA |
| 12 | Digital Wayfinding Kiosks | NA |
| 13 | Solar USB charging bench | NA |
| 14 | Automated Parking System | No |
| 15 | Curbside Occupancy Sensors | NA |
| 16 | Parking Availability App | NA |
| 17 | Smart Parking Meters | NA |
| 18 | Cameras/License Plate Readers | NA |
| 19 | Automated Traffic Monitoring/Object Detection | NA |
| 20 | Public Wi-Fi | NA |
| 21 | In-Pavement Illuminated Crosswalks | No |

#### 9.2.1.8 GDOT Contract Catalog and Procurement Requirements

GDOT maintains a contract catalog that is available for local municipalities and organizations to purchase traffic operations equipment. This provides the locals a cost savings due to the nature of the contract versus a one-time/stand-alone purchase. Additional benefits are the consistency in equipment deployed and integration. By utilizing the GDOT contract catalog for those applications that are included in the catalog (see Table 10), the AACIDs can bypass the procurement process which will allow for faster deployment.

*Table 11: GDOT Contract Catalog Options*[15]

| ID | Technology Application | Can Use GDOT's Contract Vehicle |
|---|---|---|
| 1 | Transit Signal Priority | Yes |
| 2 | Emergency Vehicle Signal Pre-emption | Yes |
| 3 | Adaptive Signal Control Technologies | No |
| 4 | Transit-pedestrian Warning System | No |
| 5 | Bike Signal Detection | Yes |
| 6 | RRFB and/or PHB with Automated Options for Activation | Yes |
| 7 | Smart Streetlighting | No |
| 8 | EV Charging Stations | No |
| 9 | Smart Dots in Street Centerlines | No |
| 10 | Autonomous Shuttle | No |
| 11 | Solar Bus Shelters | No |
| 12 | Digital Wayfinding Kiosks | No |
| 13 | Solar USB charging bench | No |
| 14 | Automated Parking System | No |
| 15 | Curbside Occupancy Sensors | No |
| 16 | Parking Availability App | No |
| 17 | Smart Parking Meters | No |
| 18 | Cameras/License Plate Readers | Yes |
| 19 | Automated Traffic Monitoring/Object Detection | No |
| 20 | Public Wi-Fi | No |
| 21 | In-Pavement Illuminated Crosswalks | No |

For those technology applications that will be deployed using vendors outside the GDOT contract catalogue, the following items should be considered when procuring and selecting vendors:

- Is the on-board unit (if applicable) one that can be used with multiple vendors (i.e. MARTA desires one OBU per bus)?
- Is equipment backwards compatible?
- Is equipment based on an open architecture so it can communicate with the TMC?
- Is it web-based?
- How much bandwidth is required?

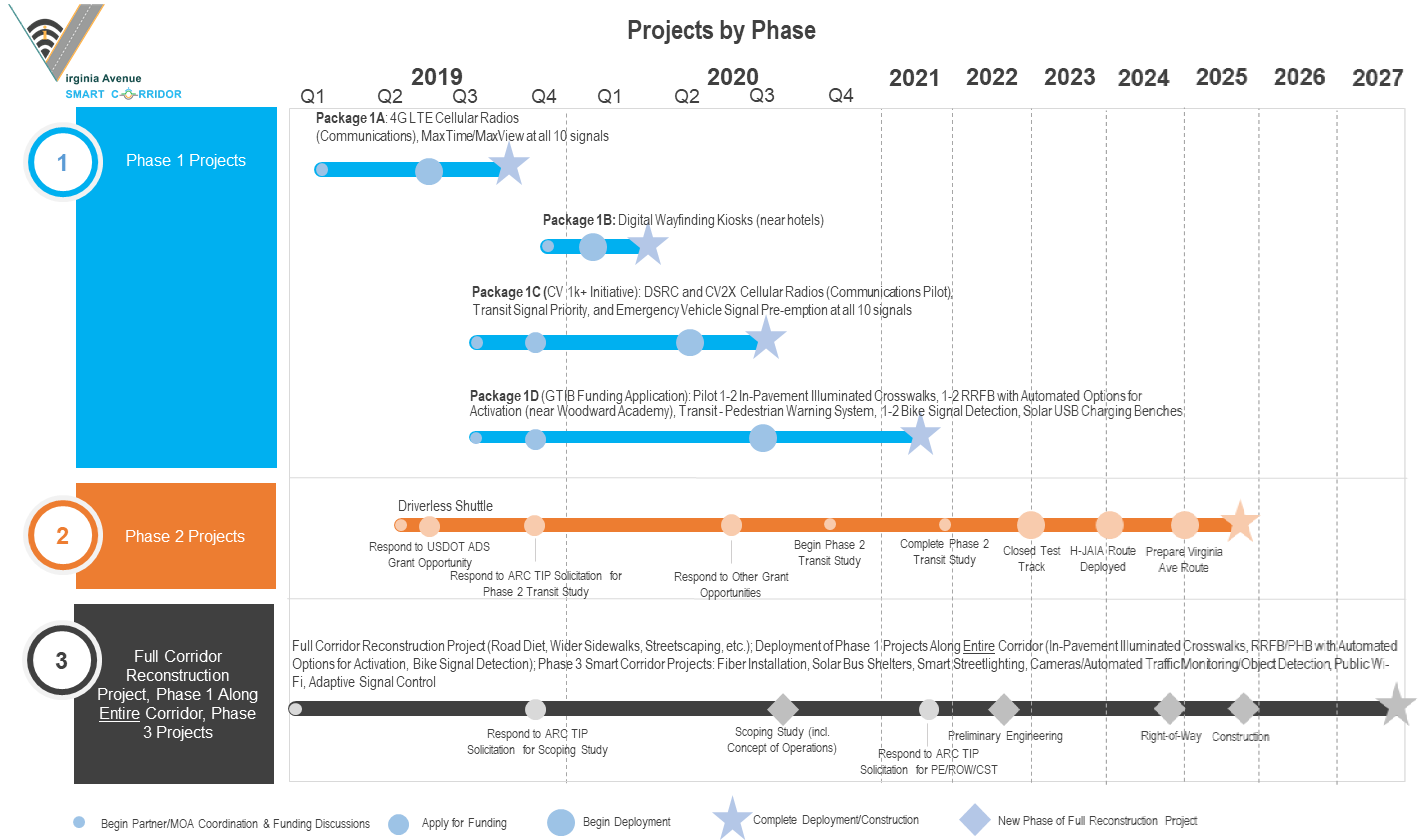
[15] Provided by GDOT Office of Traffic Operations, August 2019.

- Are there over-the-air software updates so equipment can be updated when standards change?
- Is equipment compliant with national standards so they are interoperable?
  - National Transportation Communications for ITS Protocol (NTCIP)
  - Society of Automotive Engineers (SAE) International for connected vehicle communications
  - CV Reference Implementation Architecture
- Does the vendor have relevant experience?

### *9.2.2 Overall Phasing Plan*

As a result of the considerations list above, an overall phasing plan was developed for the corridor. Figure 21 illustrates the overall phasing plan for the Virginia Avenue Smart Corridor, focusing on the smart corridor project recommendations. Further detail for each phase is provided in the following sections.

*Figure 21: Overall Phasing Plan*



### 9.2.3 *Phase 1*

#### 9.2.3.1 Package 1A: 4G LTE Cellular Radios and MaxTime/MaxView Software

As indicated earlier, this early recommendation has already been implemented as part of the study. The recommendation was identified in the first few months of the study. As a result of continuous coordination and partnerships with the study team, AACIDs, the Cities of College Park, East Point, and Hapeville, GDOT was able to install 4G LTE cellular radios at all ten signals along the corridor in order to provide communications between signals and back to the GDOT TMC. Furthermore, GDOT installed MaxTime software on all ten signals and subsequently retimed the signals along the corridor to better synchronize the signals and improve traffic flow. This effort, at GDOT's cost, was completed in August 2019, just prior to the completion of this study.

Since GDOT only owns one of the 10 signals along the corridor, the Cities of College Park, East Point, and Hapeville will be responsible for future signal timing and maintenance of their respective signals. As a result, GDOT through their contractor, Intelight, is providing free training to City staff on MaxTime and MaxView. The 3-day training is being hosted at the AACIDs has been scheduled for October 1-3, 2019. Should City staff not be able to attend this training, other training opportunities are available in the future as they are offered periodically by Intelight.

#### 9.2.3.2 Package 1B: Digital Wayfinding Kiosks

Digital wayfinding kiosks are recommended in proximity of the hotels on the eastern end of the Virginia Avenue Smart Corridor. Since the digital wayfinding kiosks, such as those provided by Soofa, are available at no cost to the AACIDs or Cities, it is recommended that the AACIDs proceed with piloting 1-2 locations in 2020. The cost to install and maintain the digital wayfinding kiosks is covered by advertising.

#### 9.2.3.3 Package 1C: CV 1k+ Initiative and Signal Priority and Pre-emption

During the Summer of 2019, the AACIDs submitted a list of intersections to be included in the CV 1k+ Initiative, including all ten intersections along Virginia Avenue. It is anticipated that the CV 1k+ Initiative will begin deployment in Spring 2020 with those that have made funding commitments, including but not limited to the AACIDs. As illustrated in Figure 22, 4G LTE cellular radios were already installed along Virginia Avenue providing communications between the signals and back to the GDOT traffic management center. As part of the CV 1k+ Initiative, additional communications will be installed, as well as transit signal priority and emergency vehicle signal pre-emption as part of the Day 1 capabilities of the initiative.

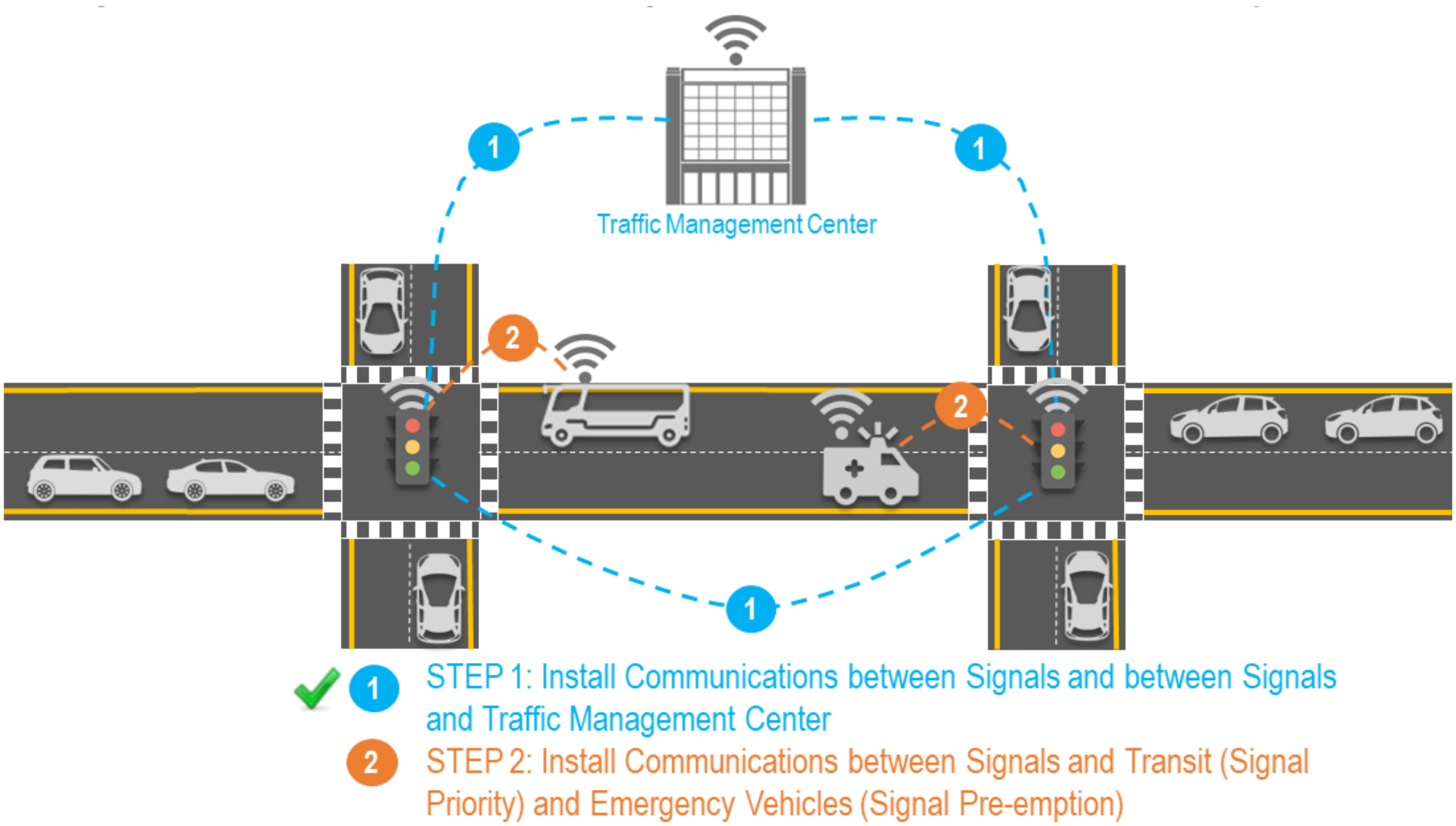
Below are some considerations for transit signal priority:

- MARTA has expressed a desire for only one OBU per transit vehicle; as a result, the AACIDs should coordinate with the rest of the region on vendor selection and resulting OBUs.
- MARTA Bus Route 172 follows the majority of Virginia Avenue; however, the same bus does not serve Route 172 every day; it is one of over 30 buses out of the Hamilton Garage that services Virginia Avenue; as a result, in order to make sure the bus driving Route 172 gets signal priority along Virginia Avenue every day, over 30 OBUs will need to be purchased, one for each bus. Or, a pilot could be conducted first where one OBU is purchased which will ensure that the bus with the OBU will run along Virginia Avenue at least a few times within a 3-month period.

Figure 22: Signal Priority & Pre-emption

#### 9.2.3.4 Package 1D: GTIB Funding Application

The Georgia Transportation Infrastructure Bank (GTIB) grant and



loan program is currently accepting funding applications through October 15, 2019. It is recommended that the AACIDs submit a funding application to include the following element as a pilot since some of these elements could be dug up later as part of the overall corridor reconstruction that is expected to begin in six years:

- **In-pavement LED illuminated crosswalks:** 1-2 locations near the hotels on the eastern end of the corridor. Estimated capital cost is $12,000+ per location. This price includes 10 in-roadway warning lights, 2 signs, A/C power and push button activation. Automated activation or solar power increases the cost significantly.
- **Rectangular Rapid Flashing Beacons (RRFB) with Automated Activation**: 1-2 locations near the hotels on the eastern end of the corridor and near Woodward Academy on the western end of the corridor. Estimated capital cost is $4,500 to $52,000 per location, averaging $22,300 per location.[16]
- **Bike Signal Detection**: 1-2 locations near the hotels on the eastern end of the corridor and near Woodward Academy on the western end of the corridor. Estimated capital cost is $2,000 – 20,000 per location.
- **Solar USB Charging Benches**: 1-2 locations near the hotels on the eastern end of the corridor and near Woodward Academy on the western end of the corridor (potentially north side of Virginia Avenue at Jackson Street MARTA bus stop). Estimated capital cost is $3,000 per location.
- **Transit-pedestrian warning system** – 1 intersection with 1 OBU near the hotels on the eastern end of the corridor which would require sensors be installed along the roadway leading up to the intersection and OBUs for the buses. In order to provide warning to pedestrian of approaching buses, a new mobile app would need to be designed or a current app with need to be customized. It should also be noted that if the OBU requires any training of bus drivers, there will need to be coordination by MARTA with the union. Estimated capital cost is $6,000 per OBU.

Assuming two locations each for in-pavement LED illuminated crosswalks, RRFBs, bike signal detection, and solar USB charging benches, and one location for transit-pedestrian warning systems,

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16 http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=54

the total estimated capital cost for equipment is expected to be in the range of $125,000 to $150,000. This does not include any design that may be needed, or maintenance. It is recommended that the AACIDs apply for at least $200,000 in funds as part of the GTIB funding cycle to cover any unexpected costs since these are new pilots. Should GTIB funds not cover the entirety of the necessary project costs, the AACIDs should also consider GDOT OSS funding and contact GDOT prior to December 31, 2019 to inform them of their interest in OSS funding.

### *9.2.4 Phase 2*

Phase 2 includes some form of a driverless shuttle or bus. The recent ADS grant application was not successful as the ADS grant program ended up awarding only half their available funds at this time with a focus on existing test beds. However, a second phase of the AACIDs transit study will be conducted soon if the AACIDs is successful at gaining funding through the current ARC TIP Solicitation. As part of the transit study, further analysis should be conducted as it relates to a driverless shuttle or bus along Virginia Avenue, particularly near the hotels on the eastern end.

### *9.2.5 Phase 3*

Phase 3 includes the overall corridor reconstruction project with construction estimated to begin in 2026 and completed in 2028. As part of the overall corridor reconstruction, the following smart corridor elements are recommended along the length of the 2-mile corridor:

- Fiber installation along entire two-mile corridor
- Public Wi-Fi along entire corridor
- In-pavement LED illuminated crosswalks (with automated activation and potentially solar powered) at all crosswalks along corridor
- Bike signal detection at all intersections
- Transit-pedestrian warning systems at all intersections the MARTA bus route traverses (up to where Virginia Avenue turns into "Little Virginia")
- Solar USB charging benches at all bus stops that do not include solar bus shelters
- Solar bus shelters at high ridership bus stops with crosswalks
- Digital wayfinding kiosks if determined more needed above the 1-2 purchases as part of Phase 1D
- Smart street lighting along the entire corridor

- Cameras with object detection at intersections near hotels and Woodward Academy
- Adaptive signal control at all ten signalized intersections
- All of the above smart corridor elements should be included in the Scoping Study, Concept of Operations, ITS Plan, and Data Management Plan going forward. Further detail is included in Section 9.3.

**100-Day**
Action Plan

## 9.3 100-Day Action Plan (2019)

The Virginia Avenue Smart Corridor Study will be completed on September 30, 2019. The 100-Day Action Plan is for the October 1 – January 8, 2020 time period. Figure 23 lists action items to be conducted by the AACIDs within the first 100 days.

*Figure 23: 100-Day Action Plan*

## 100-Day Action Plan

- [x] **Upgrade 10 Traffic Signals with Telecommunications and Synchronize.**
Install 4G LTE routers and MaxTime/MaxView software and re-time signals.

- [x] **Host MaxTime/MaxView Training for Cities.**
Host training for Cities of College Park, East Point, and Hapeville (scheduled for 10/1/19 – 10/3/19).

- [x] **Apply for Funding for Overall Corridor Scoping Study and DSRC / C-V2X Communications Pilot Study.**
Respond to ARC TIP Solicitation (applications due 10/11/19) to fund Scoping Study, including Concept of Operations, and Telecommunications Pilot Study (performance measures study; not equipment)..

- [ ] **Apply for Funding for Phase 1D Projects.**
Respond to Georgia Transportation Infrastructure Bank (GTIB) Grant/Loan Program (applications due 10/15/19) to fund implementation of in-pavement LED illuminated crosswalks, rectangular rapid flashing beacons, transit pedestrian warning systems, bike signal detection, and solar USB charging benches at 1-2 locations (pilot).

- [ ] **Coordinate with Partners on Phase 1C Projects as part of CV 1k+ Initiative.**
Coordinate funding commitments, roles, and responsibilities and GDOT permits for 2020 deployment of Dedicated Short-Range Communications and cellular radios, transit signal priority, and emergency vehicle signal pre-emption.

- [ ] **Call/Meet with GDOT D7 to Discuss Permitting Process for Phase 1D Projects.**
GDOT permits are required for the following projects within Phase 1D: In-pavement LED illuminated crosswalks, rectangular rapid flashing beacons, bike signal detection, solar USB charging benches.

- [ ] **Call/Meet with GDOT Operations to Discuss Process for Utilizing Contract Catalog for Eligible Phase 1D Projects.**
The following projects within Phase 1D are included in GDOT's contract catalog: rectangular rapid flashing beacons and bike signal detection.

- [ ] **Call/Meet with GDOT D7 State Aid Coordinator to Discuss OSS Funding.**
Locals are required to contact District Aid Coordinator by the end of the year (12/31/19) in order to potentially access OSS funds for current fiscal year (by 6/30/20). May be needed to supplement GTIB funding or as a back-up plan.

- [ ] **Meet with Vendor(s) and City of Hapeville for Phase 1B Project (Digital Wayfinding Kiosks).**
Determine timeline for implementation, including any City permitting requirements (none required by GDOT), roles and responsibilities.

- [ ] **Determine Interoperability of On-Board Units.**
Meet with vendor(s) for CV 1k+ Initiative to determine if on-board unit for transit signal priority can also be used for transit pedestrian warning systems.

### 9.3.1 *Scoping Study Considerations*

#### 9.3.1.1 Concept Report

The smart corridor elements outlined in Section 9.2.5 should be included in the Scoping Study and ultimate Concept Report. The list assumes DSRC radios and 5G-NR C-V2X, along with transit signal priority and emergency vehicle signal pre-emption, have already been implemented along the entire corridor as part of the Phase 1C recommendations by the time the Concept Report is complete and that the installations will not be impacted by corridor reconstruction.

#### 9.3.1.2 Concept of Operations

As part of the Scoping Study, a Concept of Operations should also be developed as an appendix. A Concept of Operations details the process to be followed in implementing a system. It defines the roles and responsibilities of the stakeholders throughout the process and offers a clear path to realize the goal.

The Concept of Operations should include:

- Statement of the goals and objectives of the system
- Strategies, policies, and constraints affecting the system
- Activities and interactions of the participants, stakeholders and organizations
- Statement of responsibilities
- Operational processes for implementing the system
- Operational description from a user perspective
- Operational needs that will drive the system requirements during design
- System overview, including a high-level description, interfaces, system capabilities (functions)
- Operational and support environments, including facilities, equipment, hardware, software, personnel, operational procedures, and support needs to operate the deployed system
- Operational scenarios
- Process for initiating, developing and ultimately retiring the system

As part of the Concept of Operations, a Memorandum of Understanding (MOU) or Memorandum of Agreement (MOA) between the AACIDs, the Cities, GDOT and/or MARTA should be developed that will outline the following roles and responsibilities:

- Who will lead and/or participate in the Concept of

Operations?

- Who will pay for capital, operations and maintenance costs?
- Who is going to install the OBUs on vehicles and how many test vehicles will be needed?
- Who will be responsible for landscaping and maintenance?
- Where is the line of demarcation for responsibilities for the fiber? Is it up to the signal cabinet?
- Who is going to be doing maintenance and on what portions of the system?
- Will there be a third party maintenance provider whereas the AACIDs would manage a contract along the corridor and the Cities would pay into it? It could include the fiber along the corridor in addition to the intersections for the fiber, devices, network equipment, maintenance, etc.
- Who will monitor any cameras?
- Who will be responsible for data?

The AACIDs will need to obtain GDOT approval on the Concept Report and corresponding Concept of Operations. This will then generate a project identification (PI) number for the corridor project.

#### 9.3.1.3 Conceptual Network Design

A high-level Network Design should also be developed as part of the Scoping Study with more detail during PE. This would include a general idea of the devices and technologies along the corridor connected to a fiber network that connects back to the GDOT TMC over fiber.

#### 9.3.1.4 Alternative Delivery Methods

Traditional project delivery methods include conducting Preliminary Engineering (PE), right-of-way (ROW) (if applicable), and Construction (CST) in sequential order. Alternative delivery methods may be considered, such as Design Build, which allow for streamlined delivery which could also remove the requirement to follow GDOT's Plan Development Process (PDP). All phasing discussed in this final report is based on traditional delivery methods and does not assume Design Build. However, it is recommended that alternative delivery mechanisms be considered during the Scoping Study to determine if there may be cost-effective ways to streamline the delivery schedule.

## 9.4 Next Steps

To keep up the success of the Virginia Avenue Smart Corridor, the Cities of College Park, East Point, and Hapeville should each designate a point of contact for the AACIDs to continue coordination. The 100-Day Action Plan included in this report should be used as a checklist by the AACIDs for the remainder of 2019. Going forward, it is recommended that the AACIDs meet quarterly with the designees from the Cities to ensure continued momentum.

# 10 APPENDIX

## 10.1 Appendix A: Public Engagement

Public meeting notes, sign-in sheets, presentations and comment forms for both public meetings held on March 14, 2019 and August 15, 2019 are included in Appendix A-1.

### 10.1.1 March 14, 2019 Public Meeting

# Public Meeting Notes

**Date:** March 14, 2019

**Time:** 5:00 PM – 7:00 PM

**Location:** Virginia Crossing Building, 1001 Virginia Ave., Suite 300, Hapeville, GA 30354

**Subject:** Virginia Avenue Smart Corridor Project, Public Meeting #1

**AACIDs Members Present:**

- Kirsten Mote, AACIDs
- Charlie Vaughn, AACIDs
- Gerald McDowell, AACIDs
- Jon Antoine, AACIDs

**Team Members Present:**

- Keli Kemp, Modern Mobility Partners
- Jennifer Zhan, Modern Mobility Partners
- Jian Pang, Modern Mobility Partners
- Chuck Bailey, KCI
- Holly Painter, KCI

**Number in Attendance:** 37 (excluding staff and team members)

**Attachments:** Sign-in Sheets, Presentation

**Agenda:**

1. 5:00-5:30: Public meeting started promptly at 5 PM with multiple people showing up and asking questions about the project. Attendees looked at boards, asked questions of staff, and answered online survey.
2. 5:30-5:45: Presentation – Consultant team Project Manager, Keli Kemp of Modern Mobility Partners, started presentation promptly at 5:30 PM. Gerald McDowell, AACIDs, gave a brief overview for the AACIDs and on the project location and description.
    a. Audience questions from the presentation:

        Q: Is the cemetery portion of the roadway considered one of the high traffic areas? If not, it should be.

            A: There are fewer traffic volumes along the western portion of the Virginia Avenue corridor. However, it's also only two lanes compared to the four lanes on the eastern portion. Traffic will be evaluated as part of the development and evaluation of solutions.

Q: Relative to the area along the corridor near Woodward Academy (Madison Street) with school traffic - if the lanes are narrowed for streetscaping, will this affect the ability for school buses to use the corridor?

A: Kirsten Mote with AACIDs indicated that prior to moving forward with a project that includes lane width reductions, any impacts on school bus traffic would be investigated further.

Q: The right-of-way on the west side has constraints if expanding out. Will this take out property?

A: Kirsten Mote with AACIDs mentioned they first would look at moving the utility poles which is a challenge in and of itself.

Q: Is cost going to be considered as part of the recommendations?

A: Keli Kemp with Modern Mobility Partners indicated that cost would indeed be considered as part of the evaluation and recommendations. After the online survey results are reviewed, we will have a better idea of what the community values when prioritizing projects. However, return on investment is one of the evaluation criteria.

3. 5:45-6:15: Attendees looked at boards, asked questions of staff, and answered online survey.
4. 6:15-6:30: Presentation - Keli started a second run of the same presentation as earlier as scheduled. Charlie Vaughn, AACIDs, recorded this one on Facebook Live. Kirsten gave a brief overview for the AACIDs and the project location and description.
   a. Audience questions from the presentation:

Q: What is agnostic technology?

A: Kirsten and Keli explained that the team is going to prioritize technology that is interoperable with other technologies and isn't expected to be outdated shortly before it's implemented.

Q: What is the total cost of the project? What is the cost to implement the project?

A: Keli indicated that once projects are evaluated, the relative order of magnitude cost will be calculated and included in the overall project recommendations. Preliminary recommendations will be presented to the public in July, at which time, early high-level cost information should be available.

Q: The hotel/motel tax for the three different cities (College Park, Hapeville, East Point) could be a possible funding source to supplement the cost of project implementation.

A: Keli indicated that the team will consider the hotel/motel tax as a potential revenue stream for project implementation.

5. 6:30-7:00: Attendees looked at boards, asked questions of staff, and answered the online survey. The meeting ended at 7 PM.

Virginia Avenue
SMART CORRIDOR

# PUBLIC MEETING SIGN IN SHEET

| NAME | EMAIL ADDRESS | NAME | EMAIL ADDRESS |
|---|---|---|---|
| Jonathan Liddell | jliddell@us.ibm.com | Mike Vinciguerra | mike@treesatlanta.org |
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| Angela Johnson | angela.johnson@gt.com | | |
| Reggie Wilkins | reginaldwilkins5@yahoo.com | | |

Virginia Avenue
SMART CORRIDOR

# PUBLIC MEETING SIGN IN SHEET

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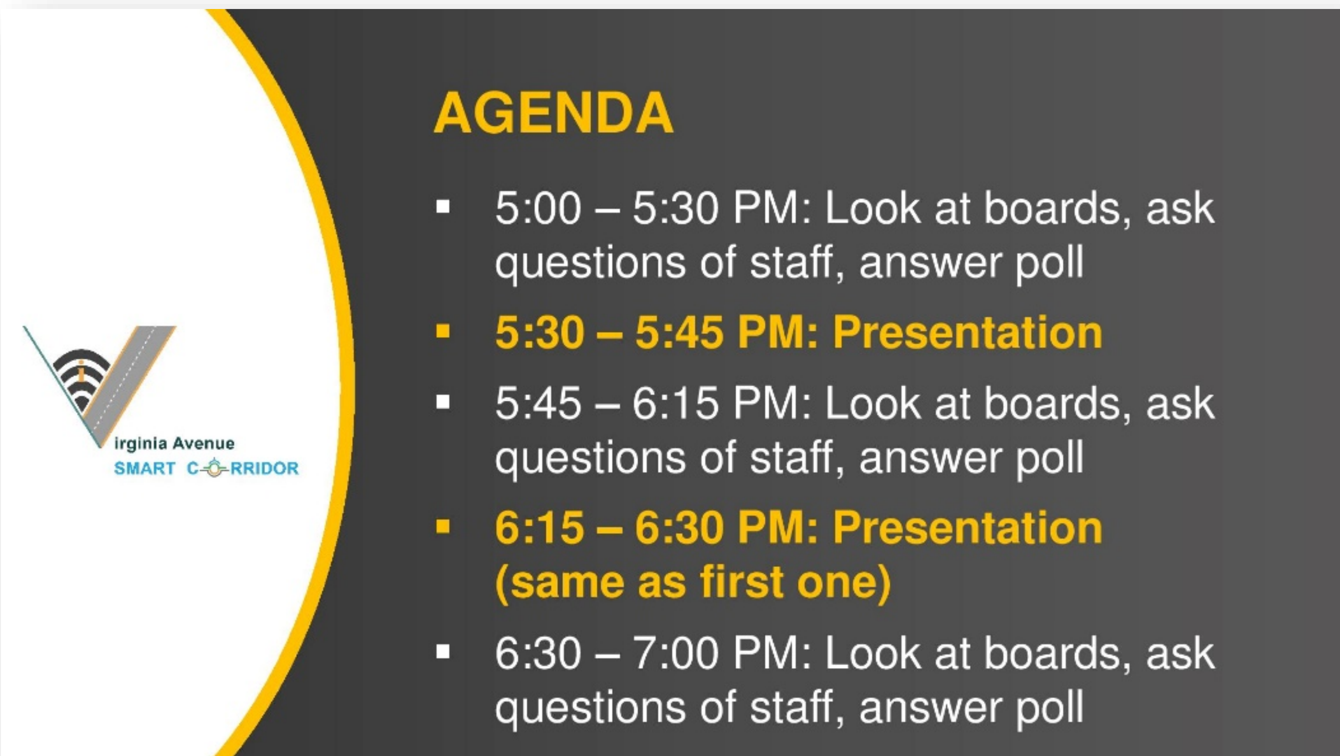
irginia Avenue
SMART C RRIDOR
PUBLIC MEETING
March 14, 2019
Aerotropolis
ATLANTA
MODERN MOBILITY
partners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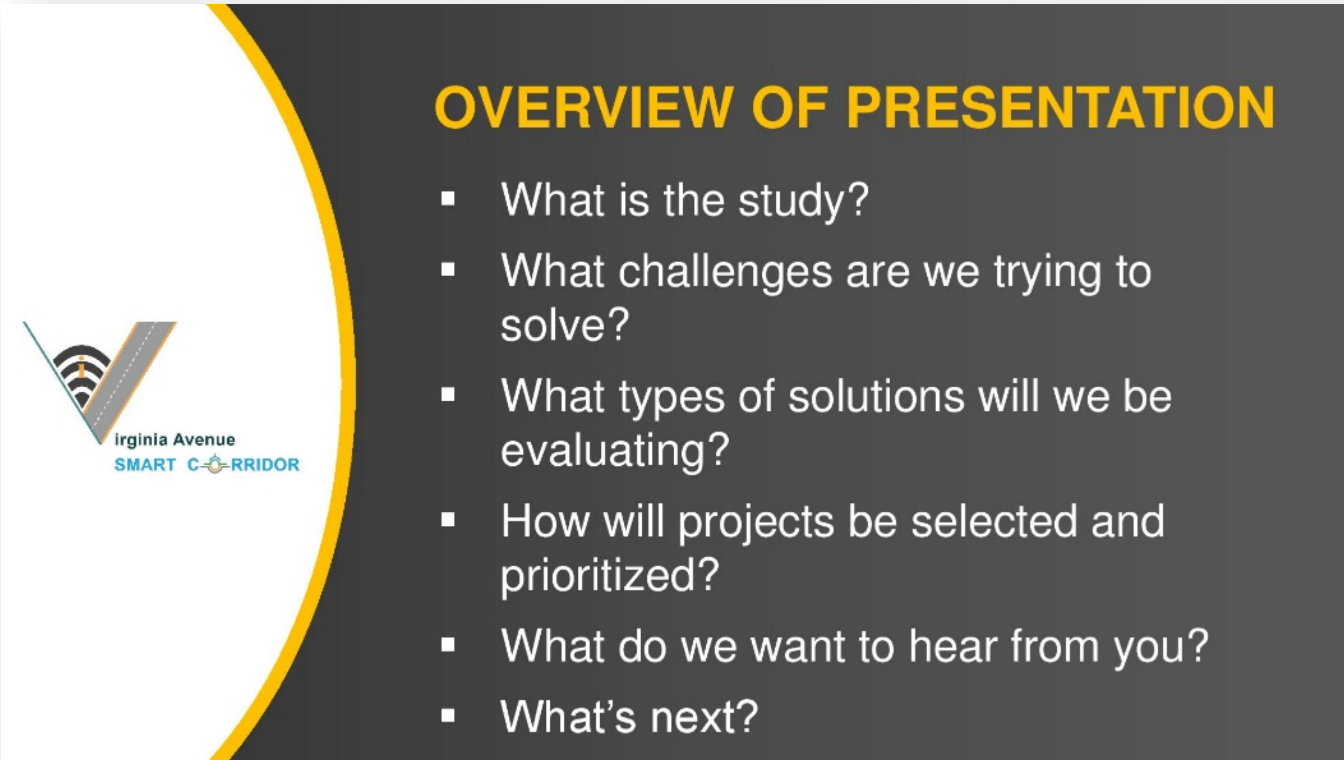
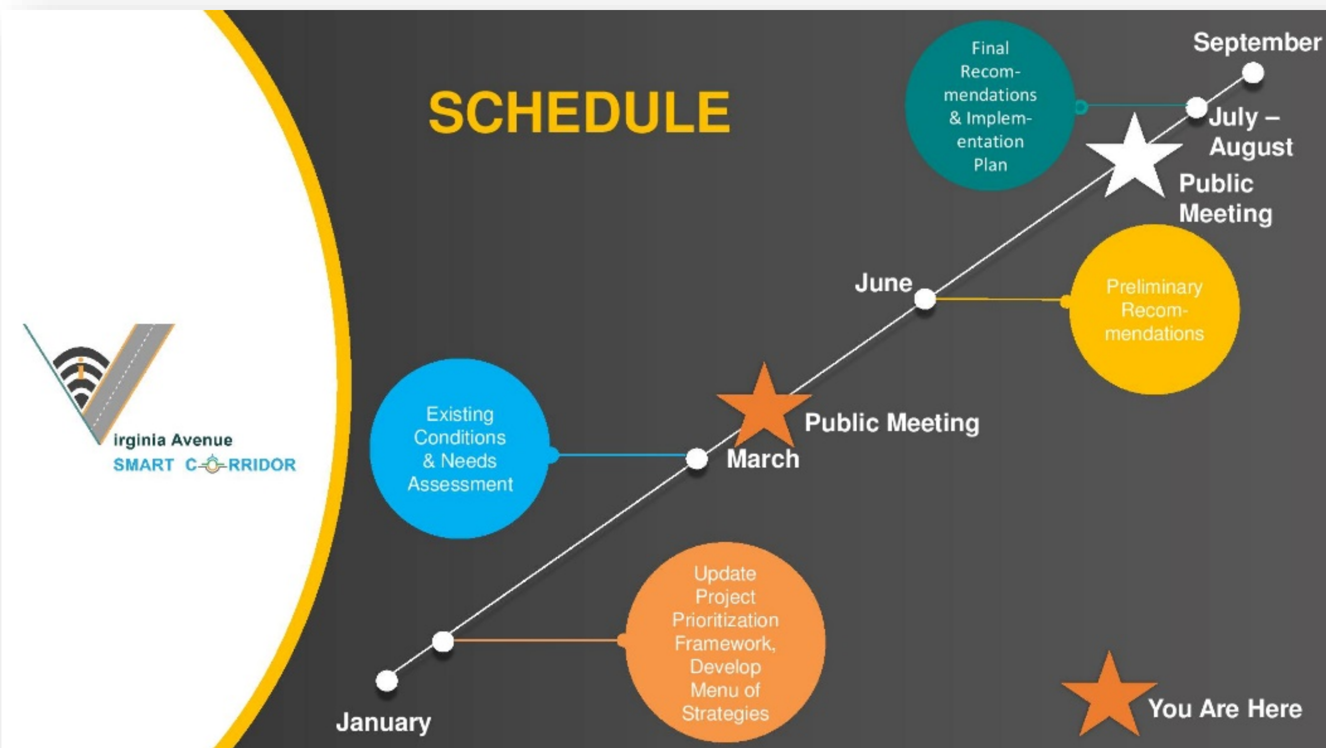
AGENDA
5:00 – 5:30 PM: Look at boards, ask questions of staff, answer poll
5:30 – 5:45 PM: Presentation
5:45 – 6:15 PM: Look at boards, ask questions of staff, answer poll
6:15 – 6:30 PM: Presentation (same as first one)
6:30 – 7:00 PM: Look at boards, ask questions of staff, answer poll


irginia Avenue
SMART CORRIDOR
OVERVIEW OF PRESENTATION
What is the study?
What challenges are we trying to solve?
What types of solutions will we be evaluating?
How will projects be selected and prioritized?
What do we want to hear from you?
What's next?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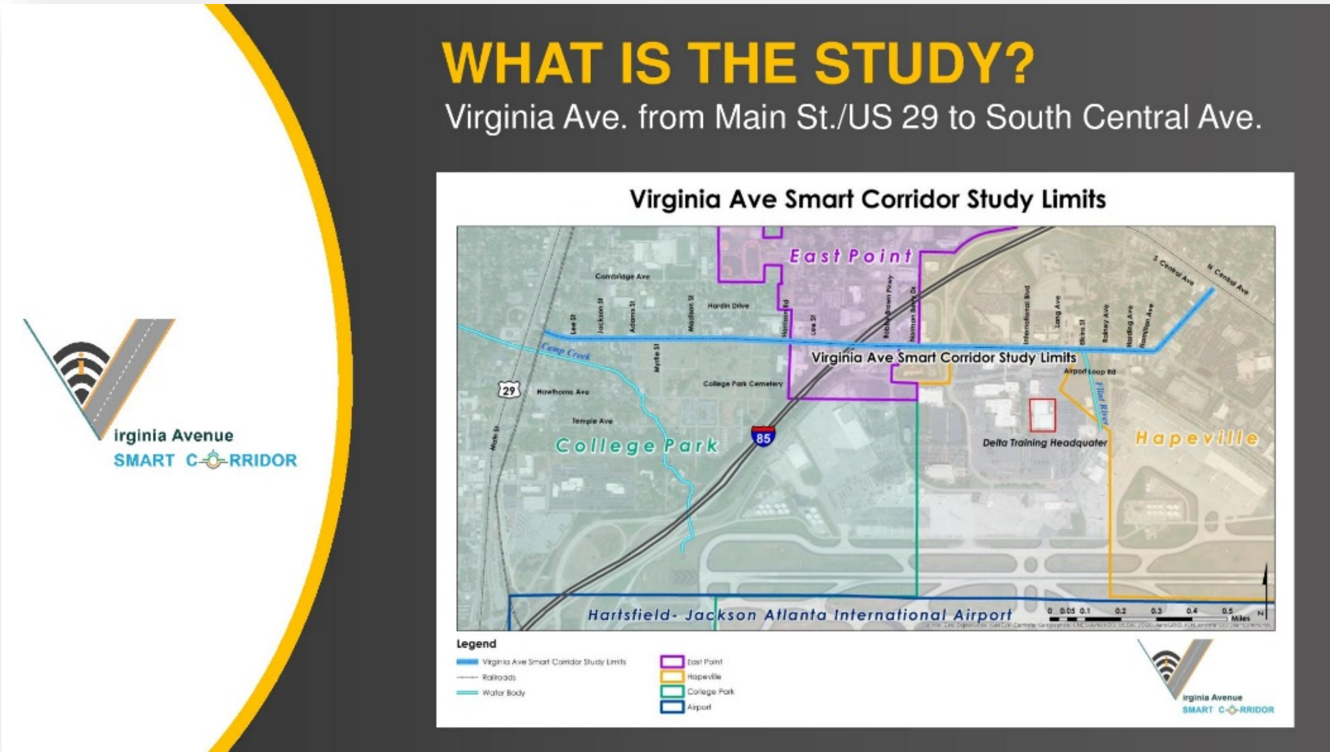
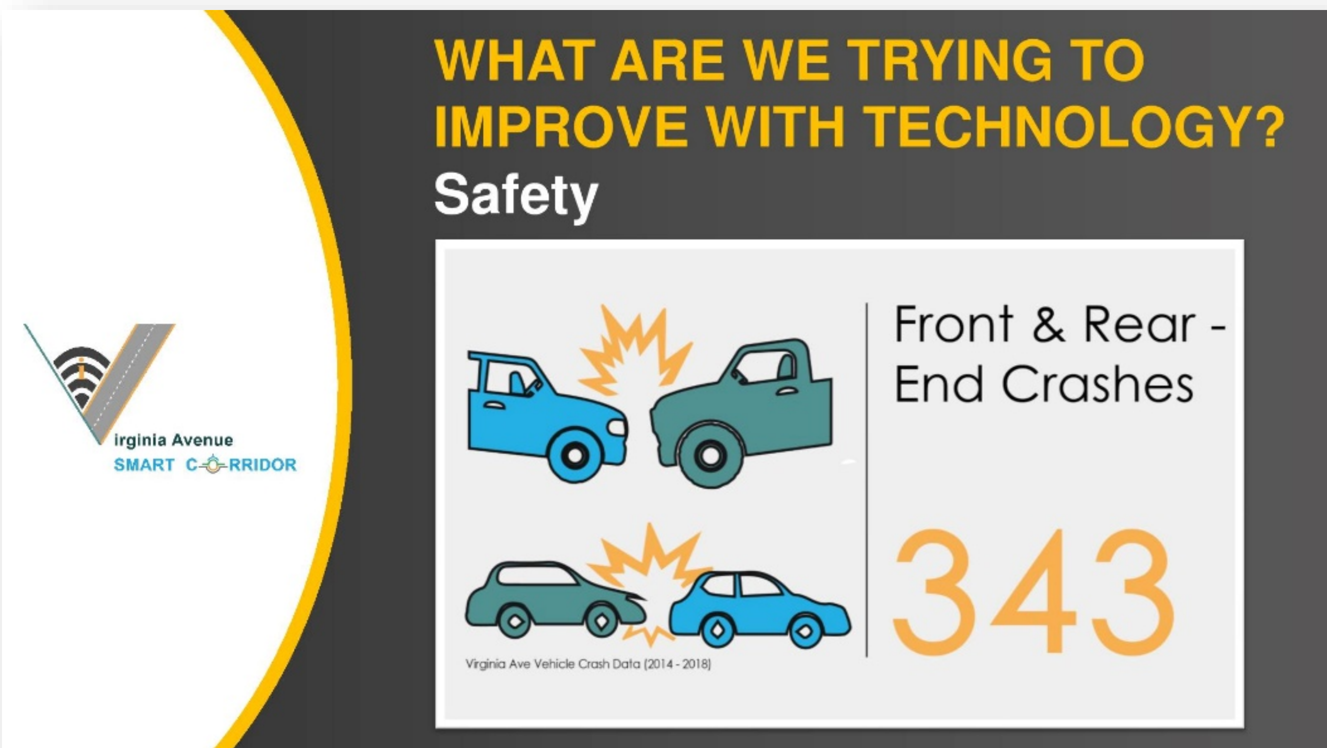
SMART CORRIDOR
SCHEDULE
Final Recom-mendations & Implem-entation Plan
September
July – August
Public Meeting
June
Preliminary Recom-mendations
Existing Conditions & Needs Assessment
Public Meeting
March
Update Project Prioritization Framework, Develop Menu of Strategies
January
You Are Here


WHAT IS THE STUDY?
Virginia Ave. from Main St./US 29 to South Central Ave.
Virginia Ave Smart Corridor Study Limits
East Point
Virginia Ave Smart Corridor Study Limits
College Park
Hapeville
Delta Training Headquater
Hartsfield- Jackson Atlanta International Airport
Legend
irginia Avenue
SMART C-O-RRIDOR


WHAT ARE WE TRYING TO IMPROVE WITH TECHNOLOGY?
Safety
Walkability
Mobility
irginia Avenue
SMART C-O-RRIDOR


WHAT ARE WE TRYING TO IMPROVE WITH TECHNOLOGY?
Safety
Total Crashes
Including crashes on Virginia Ave. and crashes within the 105-feet buffer of its intersection with other streets.
588
Virginia Ave Vehicle Crash Data (2014 - 2018): Including crashes on Virginia Ave. and crashes within the 105-feet buffer of its intersection with other streets.
irginia Avenue
SMART C RRIDOR


WHAT ARE WE TRYING TO IMPROVE WITH TECHNOLOGY?
Safety
Front & Rear - End Crashes
343
Virginia Ave Vehicle Crash Data (2014 - 2018)
irginia Avenue
SMART C RRIDOR


WHAT ARE WE TRYING TO
IMPROVE WITH TECHNOLOGY?
Safety
Left & Right -
Side Crashes
239
Virginia Ave Vehicle Crash Data (2014 - 2018)
irginia Avenue
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WHAT ARE WE TRYING TO
IMPROVE WITH TECHNOLOGY?
Safety
Trucks
Involved
24
Virginia Ave Vehicle Crash Data (2014 - 2018)
irginia Avenue
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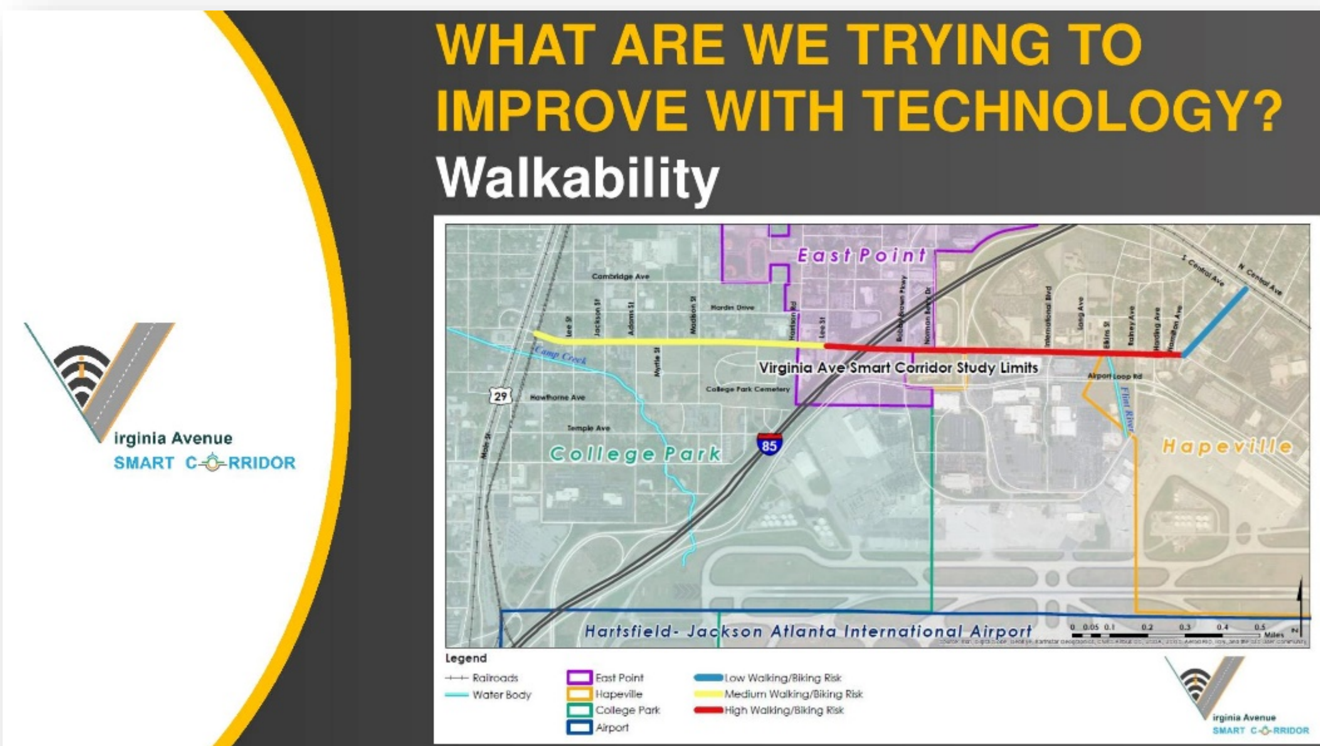
Virginia Avenue
SMART CORRIDOR
WHAT ARE WE TRYING TO IMPROVE WITH TECHNOLOGY?
Safety
Fatalities
0
Injuries
140
Virginia Ave Vehicle Crash Data (2014 - 2018)


Virginia Avenue
SMART CORRIDOR
WHAT ARE WE TRYING TO IMPROVE WITH TECHNOLOGY?
Walkability
East Point
Virginia Ave Smart Corridor Study Limits
College Park
Hapeville
Hartsfield- Jackson Atlanta International Airport
Legend
Railroads
Water Body
East Point
Hapeville
College Park
Airport
Low Walking/Biking Risk
Medium Walking/Biking Risk
High Walking/Biking Risk


WHAT ARE WE TRYING TO IMPROVE WITH TECHNOLOGY?
Mobility
irginia Avenue
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WHAT TYPES OF SOLUTIONS WILL WE BE EVALUATING?
Signals
Bikes/ Pedestrians
Transit
Street Lights
Pavement/ Sidewalks
Wayfinding
Parking
EV Charging
Video Surveillance
Wi-Fi
Curbside
Apps
Data Exchange
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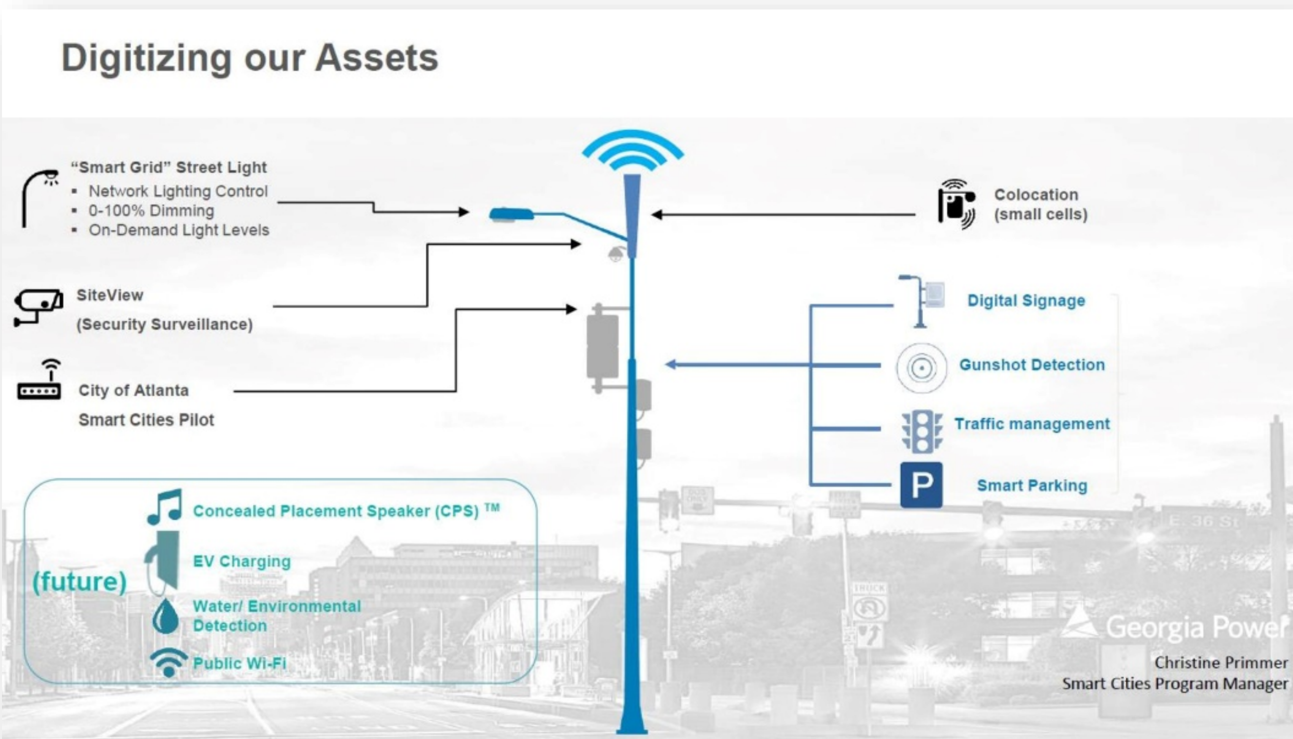
Digitizing our Assets
"Smart Grid" Street Light
Network Lighting Control
0-100% Dimming
On-Demand Light Levels
SiteView
(Security Surveillance)
City of Atlanta
Smart Cities Pilot
Colocation
(small cells)
Digital Signage
Gunshot Detection
Traffic management
Smart Parking
(future)
Concealed Placement Speaker (CPS) TM
EV Charging
Water/ Environmental Detection
Public Wi-Fi
Georgia Power
Christine Primmer
Smart Cities Program Manager


HOW WILL PROJECTS BE SELECTED AND PRIORITIZED?
Stakeholder Input
Community and/or stakeholder priorities
Return on Investment & Economic Benefits
Jobs created, aesthetics, economic competitiveness
Safety
Anticipated crash and/or crime reduction, safe connections for schools and/or EMS.
Cost
Relatively lower cost projects which could be low-hanging fruit
Project Readiness
Ease of implementation; right-of-way.
Mobility Options
Congestion, improves transit, bike, and/or pedestrian amenities and/or service
Environment & Public Health
Anticipated emissions reduction, active transportation
Agnostic Technology
Communicates with most technologies; not likely to be outdated within a few years
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WHAT DO WE WANT TO HEAR FROM YOU?
What are some needs, challenges, and opportunities along the corridor?
What do you value?
What is most important to you?
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WHAT'S NEXT?
Determine existing needs and opportunities
Evaluate potential solutions
Develop preliminary recommendations
Conduct public meeting in July
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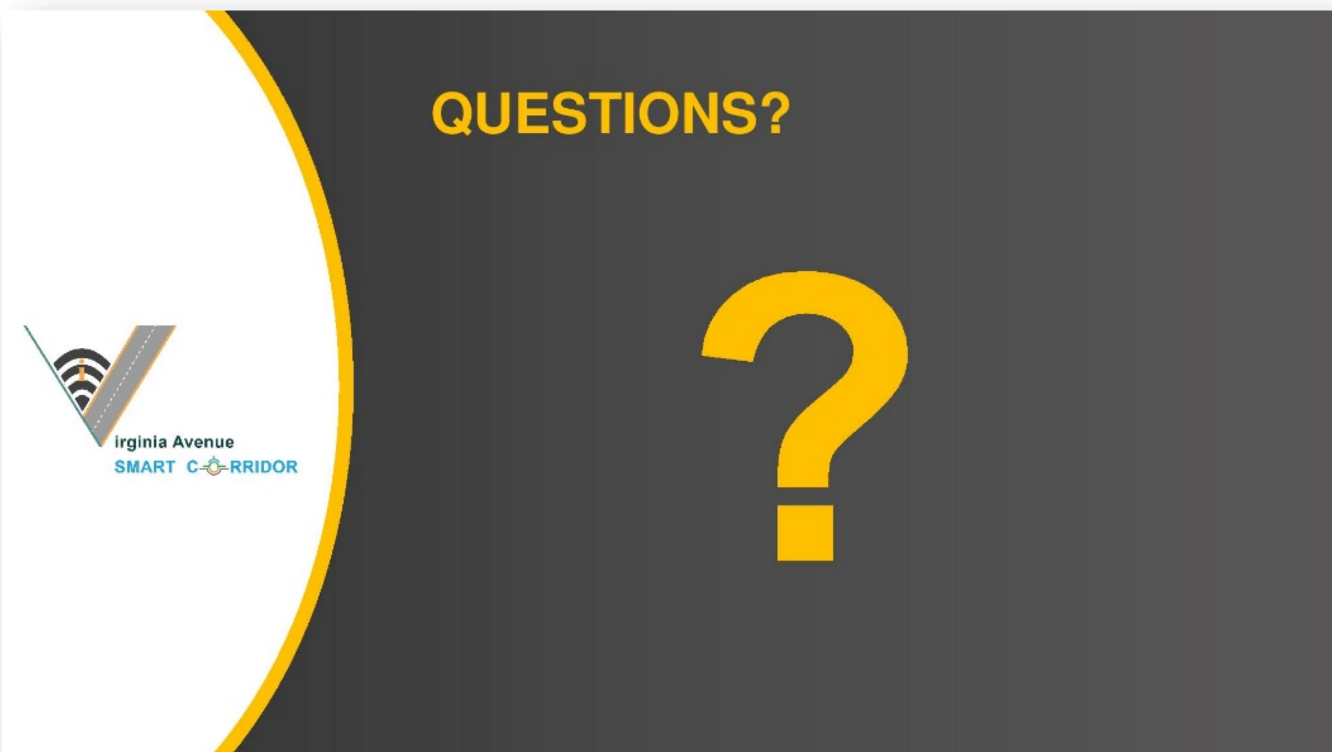
QUESTIONS?
?
Virginia Avenue
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PLEASE FILL OUT THE SURVEY
Instructions for answering survey online (anonymous):
Type in link on your smartphone:
www.surveymonkey.com/r/VAAve
Or, scan this QR code:
If you don't have a smart phone, please ask for a paper version.


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CONTACT INFORMATION
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Aerotropolis Atlanta CIDs
Program Director
Phone: 404-349-2211 x106
Email: kmote@aerocids.com
#aerocids

### 10.1.2 August 15, 2019 Public Meeting

# Public Meeting Notes

**Date:** August 15, 2019

**Time:** 5:00 PM – 7:00 PM

**Location:** Virginia Crossing Building, 1001 Virginia Ave., Hapeville, GA 30354

**Subject:** Virginia Avenue Smart Corridor Project, Public Meeting #2

**AACIDs Members Present:**

- Kirsten Mote, AACIDs
- Charlie Vaughn, AACIDs
- Gerald McDowell, AACIDs
- Jon Antoine, AACIDs

**Team Members Present:**

- Keli Kemp, Modern Mobility Partners
- Chuck Bailey, KCI
- Holly Painter, KCI

**Number In Attendance:** 29 (excluding staff and team members)

**Attachments:** Sign-in Sheets, Presentation

**Agenda:**

1. 5:00-5:20 PM: Public meeting started promptly at 5 PM with multiple people showing up and asking questions about the project. Attendees looked at boards and asked questions of staff.
2. 5:20-5:50 PM: Presentation – Consultant team Project Manager, Keli Kemp of Modern Mobility Partners, started presentation at 5:20 PM. Kirsten Mote, AACIDs, gave a brief introduction.
    a. Audience questions from the presentation:

        **Q:** If you go with cameras, who would monitor them?

        **A:** This is something we still need to determine, however, when it comes to the cameras, law enforcement should have access them. There's potential for a future video integration center but we would need have to have a Memorandum of Understanding (MOU) with the cities, as the corridor traverses' multiple jurisdictions.

        **Q:** Does this plan have any stakeholders yet to implement any of the recommendations?

**A:** GDOT has already installed the 4G LTE cellular radios at the traffic signals along the corridor as a result of this study, as well as the MaxTime software at each signal that lays the foundation for future improvements. GDOT did this at their cost. The cities are all partners in this study and its recommendations, but the next phase is to develop a funding strategy. MARTA has been at the table as well.

**Q:** City of Hapeville Council Member Travis Horsley indicated that the City has TSPLOST and hotel tax dollars that might be a potential funding source.

**A:** We will include that as a potential source in our funding strategy.

**Q:** In the study, did you look at people with disabilities in the area?

**A:** Although it's difficult to isolate disabled populations at the corridor level, we did evaluate the demographics along the corridor including age of population. We also researched technologies to improve mobility for the disabled, including those for the visually impaired. What was found through the research is that other than the typical audio crosswalks that are becoming standard and will be included in future crosswalk improvements, most of the technologies used to improve mobility for the visually impaired is all done in the smart phone.

**Q:** I work with the elderly and disabled, and my son is visually impaired. There may be potential grant funding available through the Corporation for National and Community Service and the USDOT.

**A:** Please send us the information and we will be sure to research further and include in the funding strategy.

**Q:** Will Virginia Avenue be the only smart corridor in the area, or will there be other ones in the future?

**A:** Yes, we expect that there will be other smart corridors in the future and many, but not all, of the recommendations from this study will be transferrable to other smart corridors.

**Q:** For this corridor study, what's the furthest point studied? And are there plans to extend it further west?

**A:** The Virginia Avenue Smart Corridor study begins at US 29/Main Street to the west and at S. Central Avenue to the east. MMP: US29/Main Street. The AACIDs has been meeting with each of the cities and there is potential to expand beyond Main Street.

**Q:** Are there communities around the region/country that have incorporated these recommendations?

**A:** The City of Atlanta has installed mid-block flashing beacons, as well as the City of Marietta. The Best Practices Report on New and Emerging Trends and Technologies indicates other cities the technologies have been used throughout the U.S. and beyond.

3. 5:50-7:00 PM: Attendees looked at boards and asked questions of staff.

Virginia Avenue SMART CORRIDOR

# PUBLIC MEETING SIGN IN SHEET

| NAME | EMAIL ADDRESS |
|---|---|
| KEN ALLEN | EKENDALLALLEN@AOL.COM |
| Will Reed | wbreed@atlantaga.gov |
| Nick Anderson | nanderson@gacommuteoptions.com |
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| Joe Henderson | JoeKHenderson89@gmail.com |
| Travis Horsley | thorsley@hapeville.org |
| ROBERT GOLDEN | regolden@gmail.com |
| Victoria Blount | vblount1@gmail.com |
| Jordan Blount | jordantblount@gmail.com |
| Councilman Ambrose Clay | clayoncouncil@mac.com |
| Kevin Brown | kevinbrown213@gmail.com |
| Jacob Zoske | |
| Bianca Motley Broom | bianca.motley@gmail.com |
| Andrea Malloy | andrea@joinaero.com |
| Thomas Wilkes | twilkes@e-globaltransportationlogistics.com |
| Jim Kegley | jkegley@10thandmonroe.com |
| Andrew Smith | andrew.smith@greshamsmith.com |
| | |

Virginia Avenue
SMART CORRIDOR

# PUBLIC MEETING SIGN IN SHEET

| NAME | EMAIL ADDRESS |
|---|---|
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| Vicki Hueber | V.JHUEBER@GMAIL.COM |
| Ryan Taylor | ryanctaylor@kw.com |
| Kelly Yamanouchi | kyamanouchi@ajc.com |
| Mike Vinciquerra | Trees Atlanta |
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Virginia Avenue SMART CORRIDOR

# PUBLIC MEETING SIGN IN SHEET

| NAME | EMAIL ADDRESS |
|---|---|
| STACEY DUNSON | SLDUNSON@GMAIL.COM |
| Roby Blount | blountre@comcast.net |
| Gil Pirano | |
| Tiffany Layden | tlayden@generationinfocus.com |
| Shareeka Johnson | sjohnson@parkeastacademy.com |
| STEVE BOWEN | STEVE@1024ATL.COM |
| George Bush (AKA Gerald) | Washington, DC |
| Kirsten | |
| Charlie | |
| Keli | |
| Holly | |
| Jon | |
| Chuck | |
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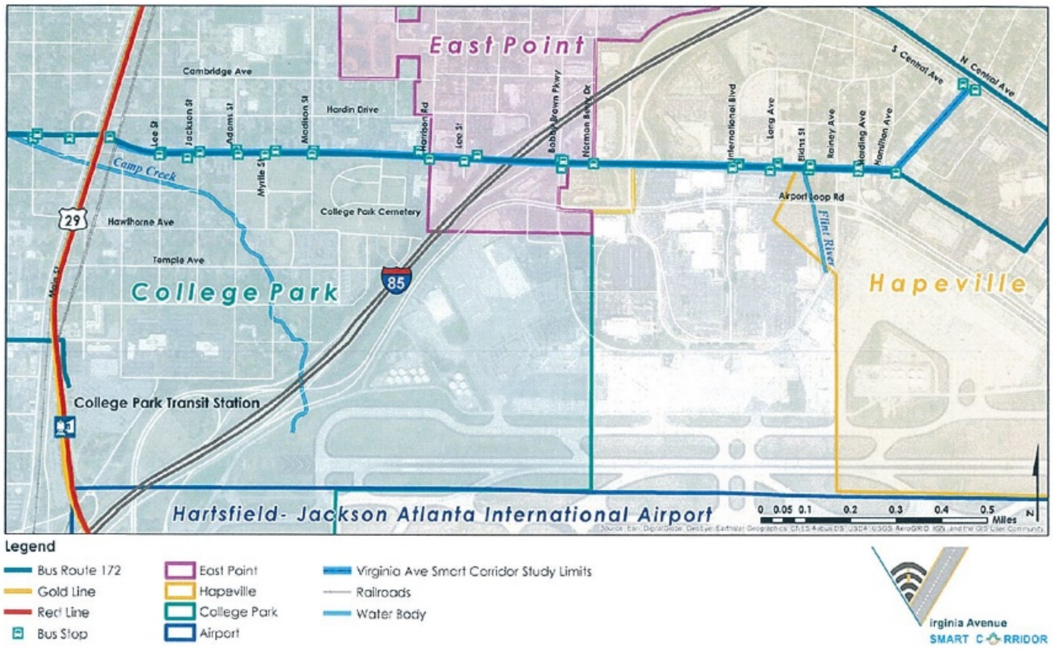


## Virginia Avenue SMART Corridor – Comment Card

**Public Meeting on 8/15/19**

*PLEASE PRINT*

Name Jordan Blount

Email Address jordantblount@gmail.com

Comments I just wanted to say thanks for this project. I think all of these potential options are going to improve the value of the three cities and definitely makes me happy for this upcoming area.

How did you hear about this meeting?

*3800 Camp Creek Pkwy SW, Building 1400, Suite 132*
*Atlanta, GA 30331*
*https://aerocids.com/projects/the-smart-corridor/*

*Call: 404-349-2211*
*Email: info@aerocids.com*


## *Virginia Avenue SMART Corridor – Comment Card*

**Public Meeting on 8/15/19**

*PLEASE PRINT*

Name Robin Blount

Email Address blountre@comcast.net

Comments The largest group of individuals are those with disabilities, especially as the population ages. There is funding for seniors and individuals with disabilities. Please look at best practice communities who have received these grants and at the national TA Center thru U.S. DOT

How did you hear about this meeting?

3800 Camp Creek Pkwy SW, Building 1400, Suite 132
Atlanta, GA 30331
https://aerocids.com/projects/the-smart-corridor/

Call: 404-349-2211
Email: info@aerocids.com


Public Meeting #2
August 15, 2019
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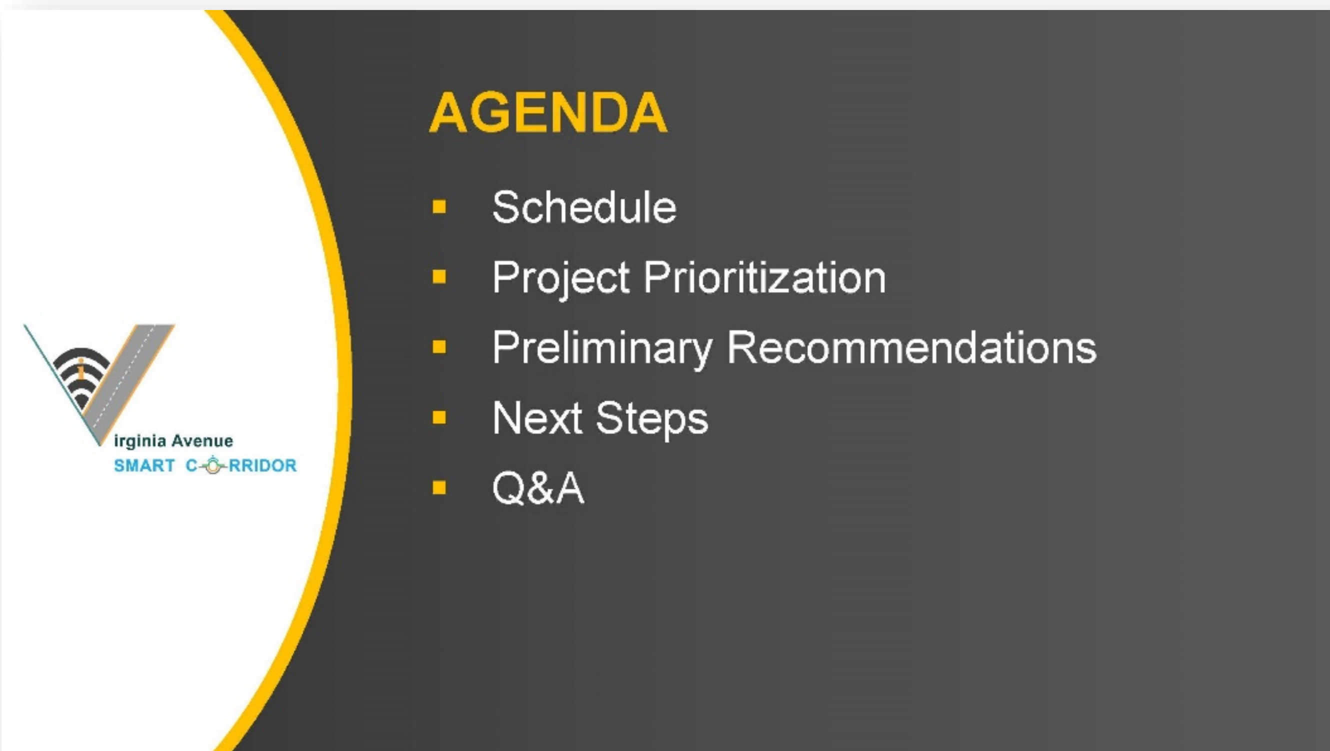
Aerotropolis
ATLANTA
Community Improvement Districts
MODERN MOBILITY
partners


AGENDA
Schedule
Project Prioritization
Preliminary Recommendations
Next Steps
Q&A
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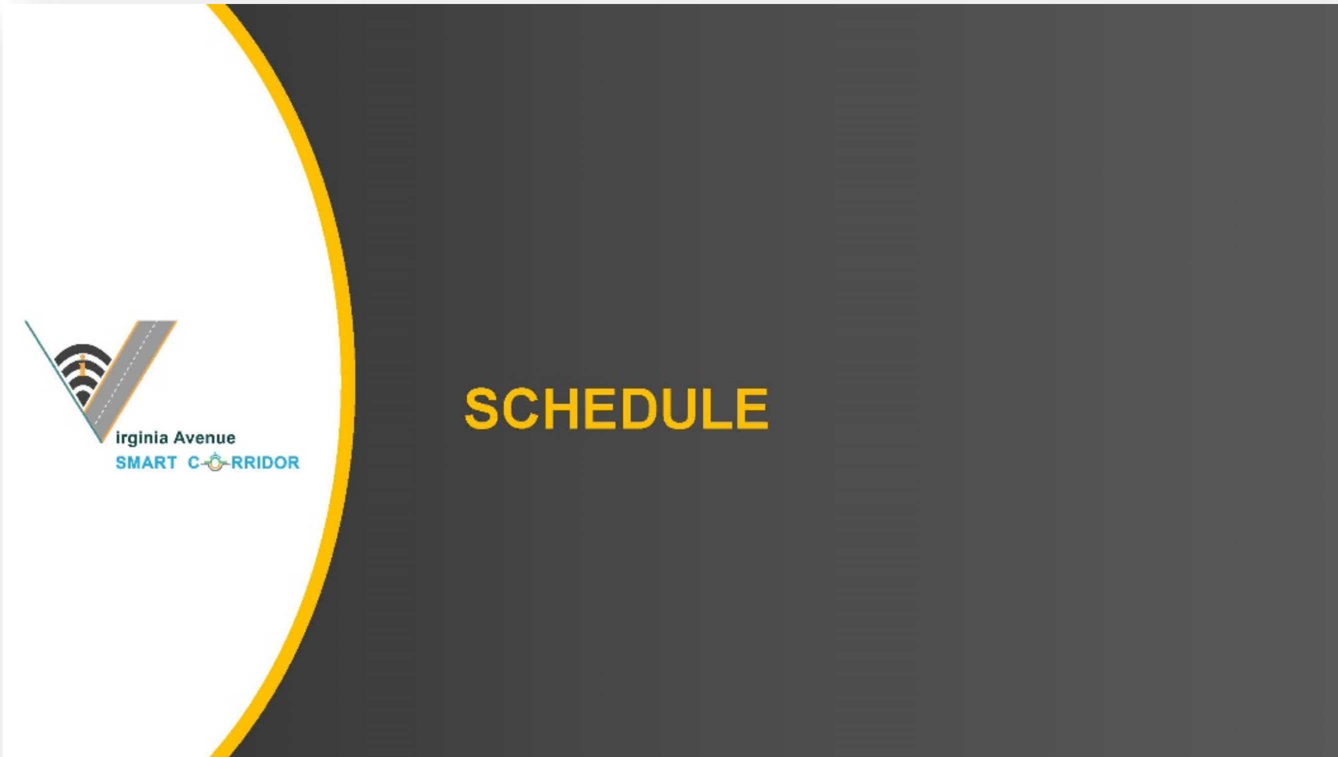
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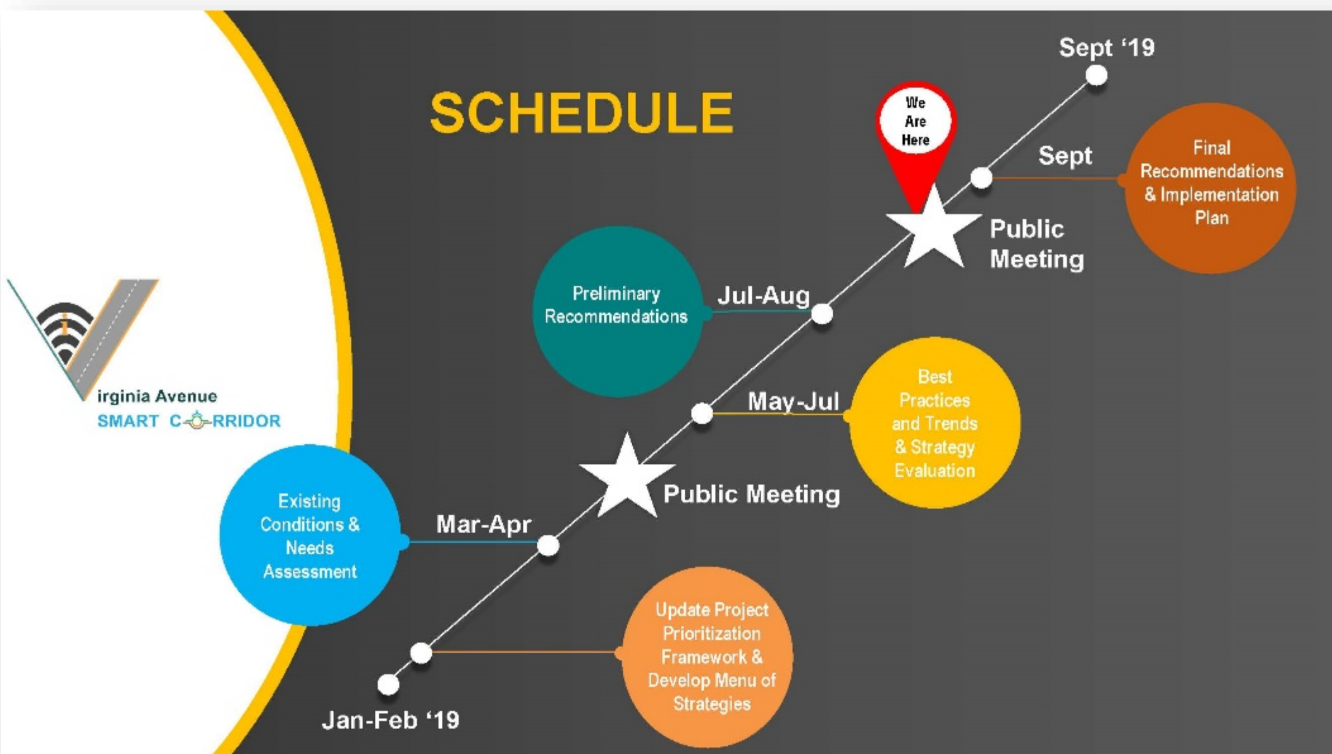
SCHEDULE


SCHEDULE
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Sept '19
We Are Here
Sept
Final Recommendations & Implementation Plan
Public Meeting
Preliminary Recommendations
Jul-Aug
May-Jul
Best Practices and Trends & Strategy Evaluation
Public Meeting
Existing Conditions & Needs Assessment
Mar-Apr
Update Project Prioritization Framework & Develop Menu of Strategies
Jan-Feb '19


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PROJECT PRIORITIZATION


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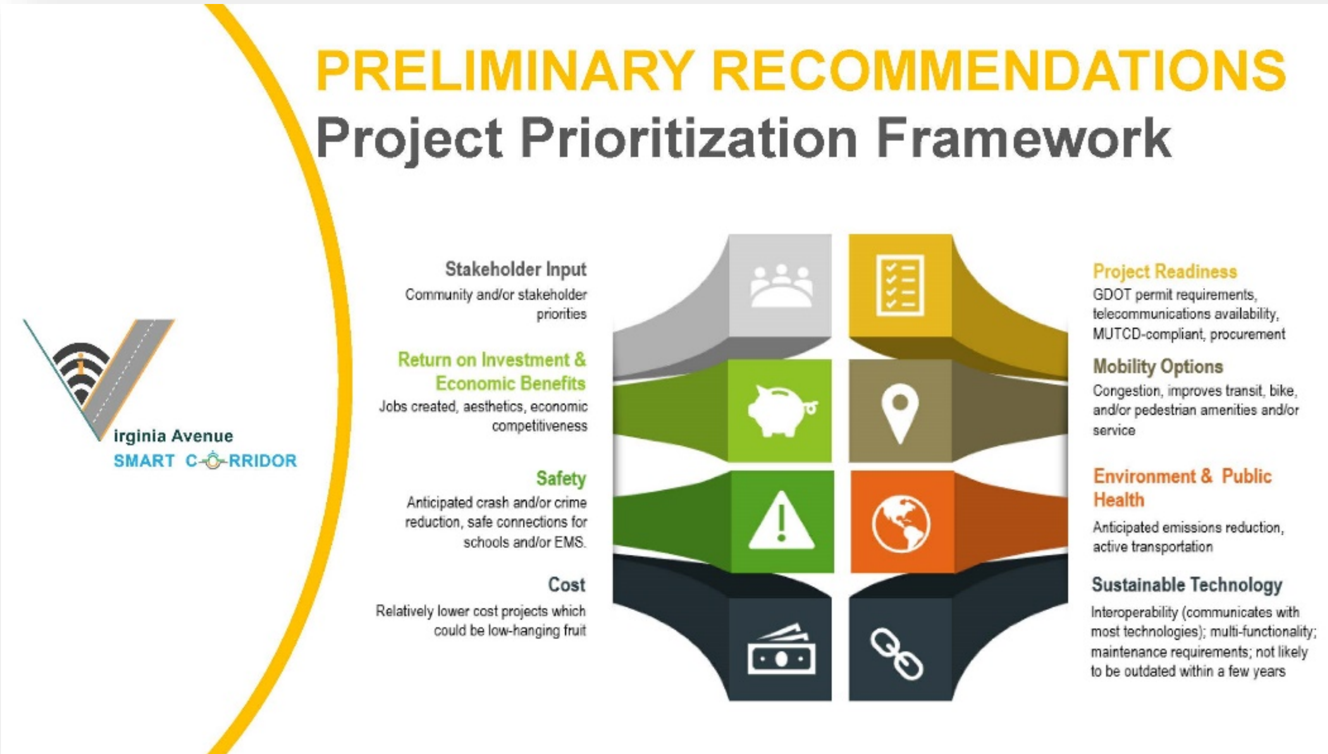
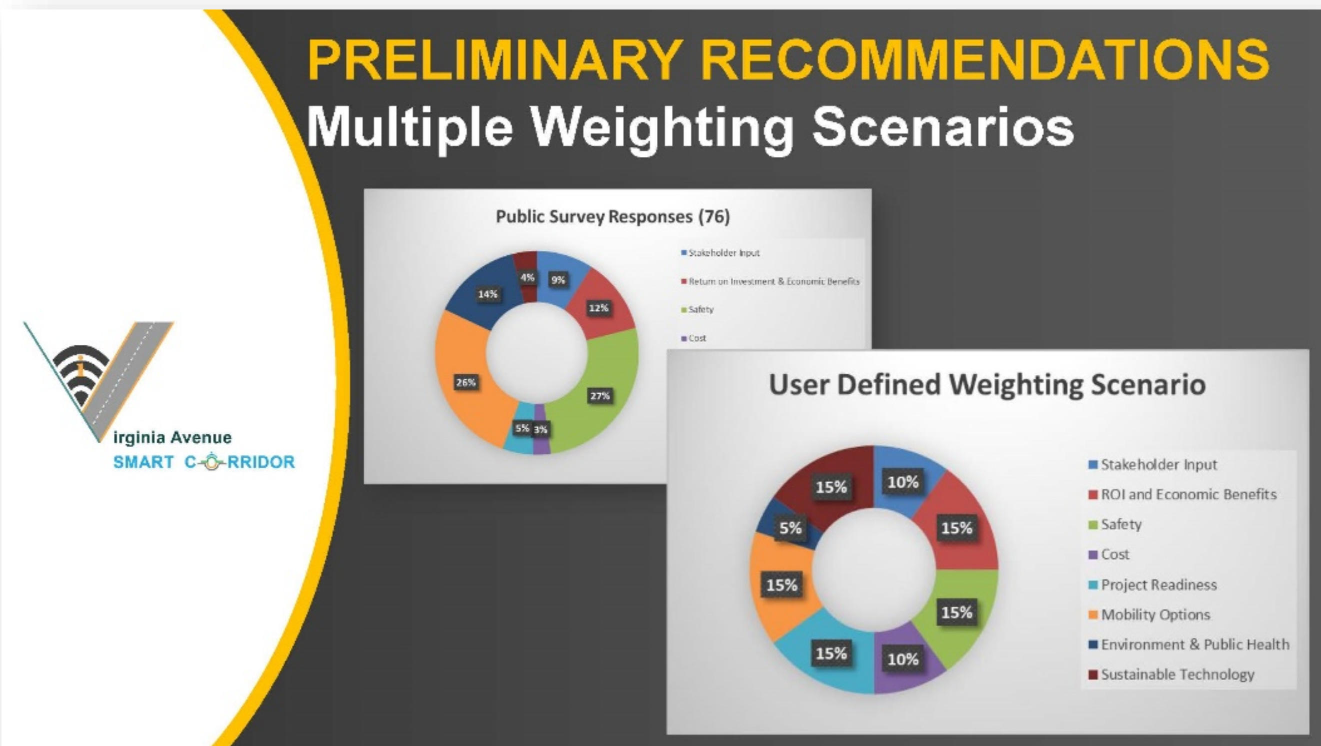
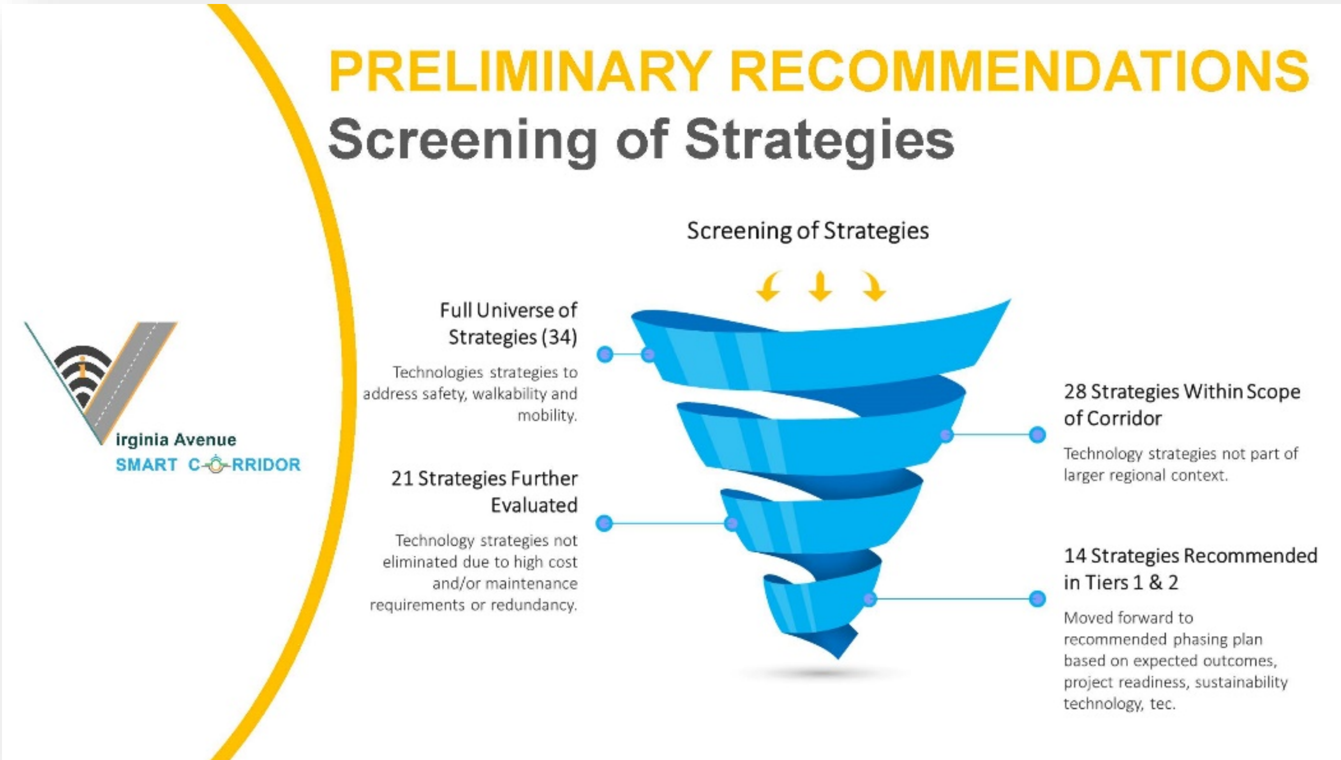
WHAT TYPES OF SOLUTIONS DID WE REVIEW?
Signals
Bikes/ Pedestrians
Transit
Street Lights
Pavement/ Sidewalks
Wayfinding
Parking
EV Charging
Video Surveillance
Wi-Fi
Curbside
Apps
Data Exchange


PRELIMINARY RECOMMENDATIONS
Project Prioritization Framework
Virginia Avenue
SMART CORRIDOR
Stakeholder Input
Community and/or stakeholder priorities
Return on Investment & Economic Benefits
Jobs created, aesthetics, economic competitiveness
Safety
Anticipated crash and/or crime reduction, safe connections for schools and/or EMS.
Cost
Relatively lower cost projects which could be low-hanging fruit
Project Readiness
GDOT permit requirements, telecommunications availability, MUTCD-compliant, procurement
Mobility Options
Congestion, improves transit, bike, and/or pedestrian amenities and/or service
Environment & Public Health
Anticipated emissions reduction, active transportation
Sustainable Technology
Interoperability (communicates with most technologies); multi-functionality; maintenance requirements; not likely to be outdated within a few years


PRELIMINARY RECOMMENDATIONS
Multiple Weighting Scenarios
Virginia Avenue
SMART CORRIDOR
Public Survey Responses (76)
Stakeholder Input
Return on Investment & Economic Benefits
Safety
Cost
9%
12%
27%
3%
5%
26%
14%
4%
User Defined Weighting Scenario
10%
15%
15%
10%
15%
15%
5%
15%
Stakeholder Input
ROI and Economic Benefits
Safety
Cost
Project Readiness
Mobility Options
Environment & Public Health
Sustainable Technology


PRELIMINARY RECOMMENDATIONS
Screening of Strategies
irginia Avenue
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Screening of Strategies
Full Universe of Strategies (34)
Technologies strategies to address safety, walkability and mobility.
21 Strategies Further Evaluated
Technology strategies not eliminated due to high cost and/or maintenance requirements or redundancy.
28 Strategies Within Scope of Corridor
Technology strategies not part of larger regional context.
14 Strategies Recommended in Tiers 1 & 2
Moved forward to recommended phasing plan based on expected outcomes, project readiness, sustainability technology, tec.


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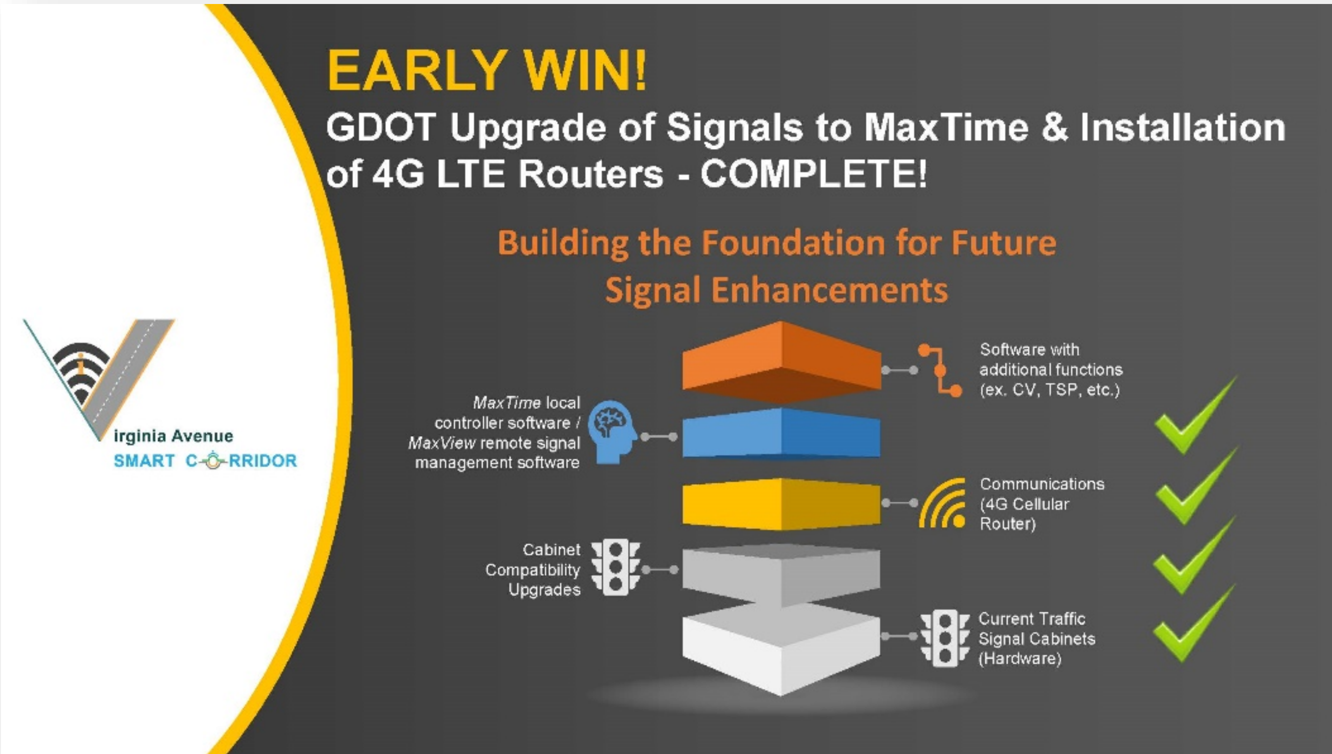
PRELIMINARY RECOMMENDATIONS
Strategies


EARLY WIN!
GDOT Upgrade of Signals to MaxTime & Installation of 4G LTE Routers - COMPLETE!
Building the Foundation for Future Signal Enhancements
Software with additional functions (ex. CV, TSP, etc.)
MaxTime local controller software / MaxView remote signal management software
Communications (4G Cellular Router)
Cabinet Compatibility Upgrades
Current Traffic Signal Cabinets (Hardware)
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14
STRATEGIES INCLUDED IN PRELIMINARY RECOMMENDATIONS
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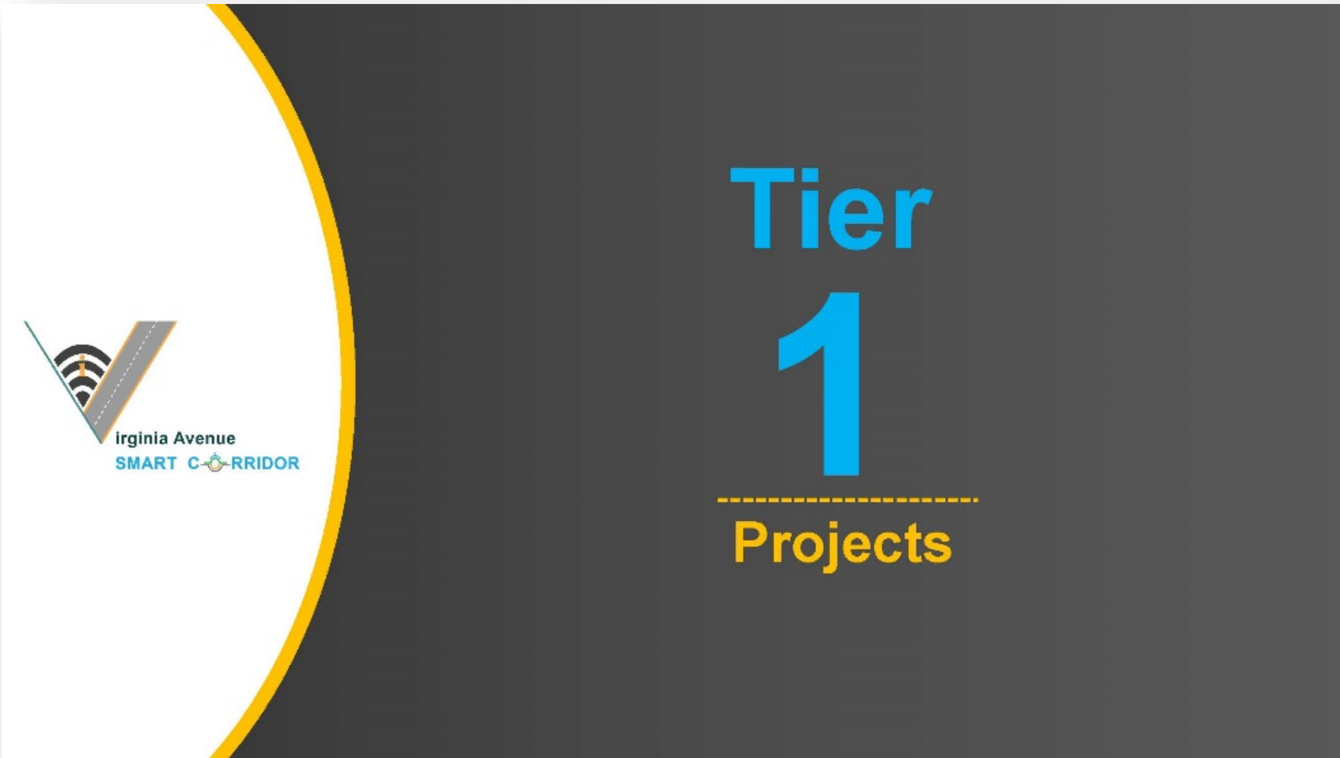
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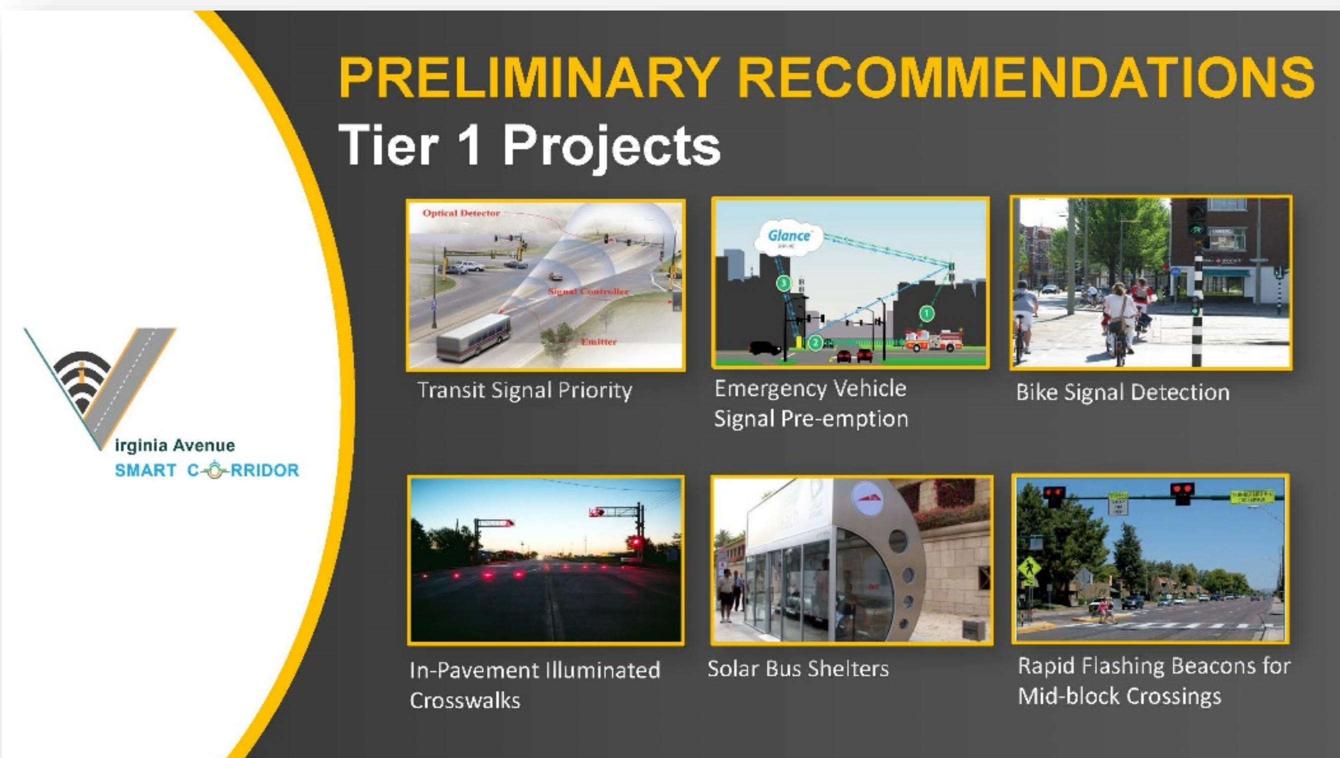
Tier
1
Projects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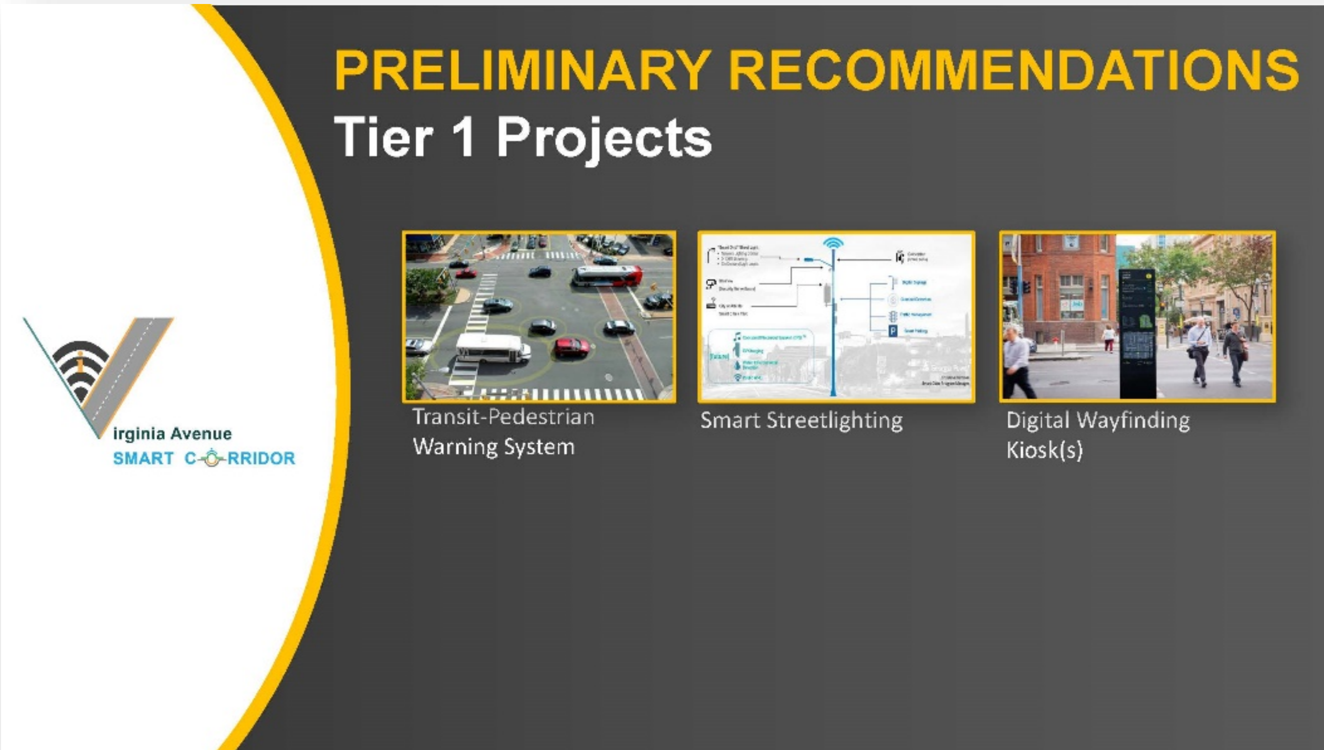
PRELIMINARY RECOMMENDATIONS
Tier 1 Projects
Optical Detector
Signal Controller
Emitter
Transit Signal Priority
Glance
Emergency Vehicle Signal Pre-emption
Bike Signal Detection
In-Pavement Illuminated Crosswalks
Solar Bus Shelters
Rapid Flashing Beacons for Mid-block Crossings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PRELIMINARY RECOMMENDATIONS
Tier 1 Projects
Transit-Pedestrian Warning System
Smart Streetlighting
Digital Wayfinding Kiosk(s)


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Tier
2
Projects

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# PRELIMINARY RECOMMENDATIONS

## Tier 2 Projects

Public Wi-Fi

Cameras

Driverless Shuttle

Automated Traffic Monitoring/Object Detection

Solar USB Charging Bench(es)

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# NEXT STEPS

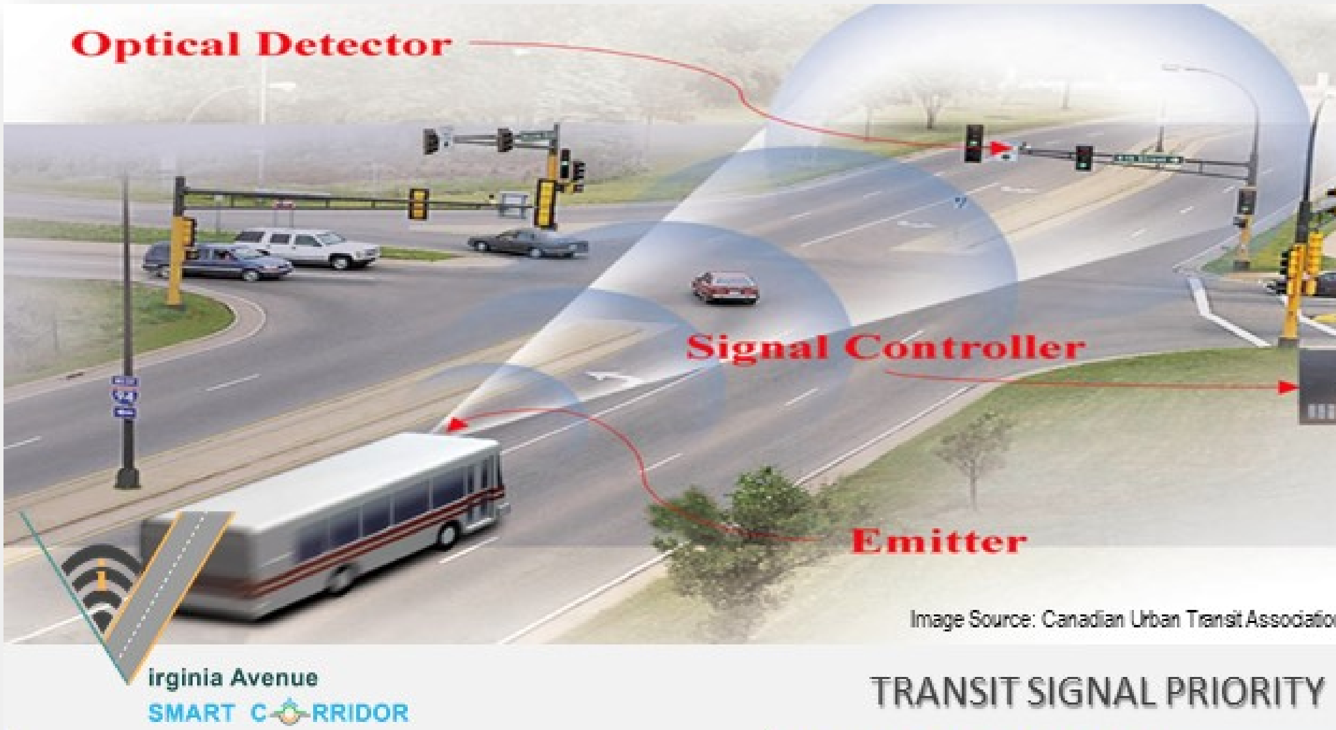
# WHAT's NEXT?

- Finalize recommendations
- Develop Implementation Plan
  - Assign strategies to locations
  - Phasing plan
  - High-level cost ranges
  - Funding strategy
  - 100-Day Action Plan
- Develop Final Report

# QUESTIONS?

## 10.2 Appendix B: Project Fact Sheets

Project fact sheets were developed for all applications that were moved forward for further evaluation. Only projects 1-15 are recommended for implementation. Project IDs 16-21 were prioritized as Tier 3 to revisit later as technology and the corridor scoping study advances.




# TRANSIT SIGNAL PRIORITY

**APPLICATION DESCRIPTION:**
Traffic signal priority is an operational strategy to reduce the delay to transit vehicles at signalized intersections. This requires communication between the transit vehicles and the traffic signals to alter the signal timings to favor the transit operations.

**TELECOMMUNICATION REQUIREMENTS:**
- 4G LTE Cellular

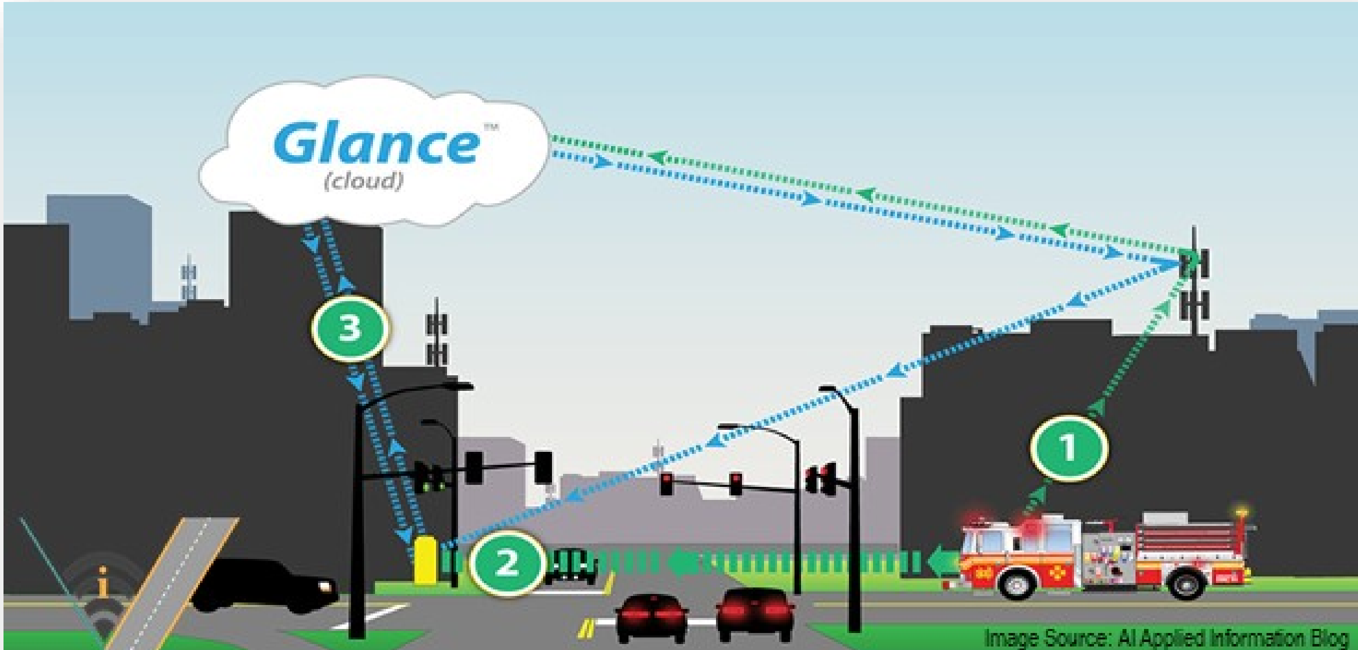
**POTENTIAL LOCATIONS ALONG CORRIDOR:**
- Corridor-wide at all signalized intersections.

**DEPLOYED IN OTHER CITIES:**
- Candler Road and Buford Highway in Metro Atlanta
- City of Los Angeles

**PROJECT PRIORITIZATION:**


**PROJECT SCORE: 80.5**

**APPROXIMATE COST:**
- **Cost per Location:** $13,500 per intersection for detection and equipment.
- **Total Cost:** $135,000 for 10 signalized intersections
- **Other Cost Considerations:** $75 per transit vehicle for transponders

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# EMERGENCY VEHICLE SIGNAL PRE-EMPTION

## APPLICATION DESCRIPTION:

Traffic signal pre-emption or prioritization is a system that allows the normal operation of traffic signals to be deterred. The Manual on Uniform Traffic Control Devices (MUTCD) defines traffic signal pre-emption as "the transfer of normal operation of traffic control signal to a special mode of operation".

## TELECOMMUNICATION REQUIREMENTS:

- 4G LTE Cellular

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Corridor-wide at all signalized intersections

## DEPLOYED IN OTHER CITIES:

- Intersection and corridor deployments throughout Metro Atlanta (Alpharetta, Dunwoody, Gwinnett County, and Marietta).

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 73.0

## APPROXIMATE COST:

- **Cost per Location:** $5,000 per intersection for equipment
- **Total Cost:** $50,000 for 10 signalized intersections
- **Other Cost Considerations:** $2,500 per emergency vehicle


Image Source: Bicycle Dutch

Virginia Avenue SMART CORRIDOR

# BIKE SIGNAL DETECTION

**APPLICATION DESCRIPTION:**
Bicycle detection is used at actuated signals to alert the signal controller of bicycle crossing demand on a particular approach. Bicycle detection occurs either through the use of push-buttons or by automated means.

**TELECOMMUNICATION REQUIREMENTS:**
- 5G Cellular; and/or
- DSRC

**POTENTIAL LOCATIONS ALONG CORRIDOR:**
- Bobby Brown Parkway (East Point Path #6)
- N & S Central Avenues, International Blvd/Delta Blvd, and Madison Street

**DEPLOYED IN OTHER CITIES:**
- Atlanta, GA; Austin, TX; Portland, OR; Berkley, CA; Washington, DC; Denver, Co; Minneapolis, MN; San Francisco, CA; Seattle, WA; Vancouver, BC

**PROJECT PRIORITIZATION:**


**PROJECT SCORE: 67.5**

**APPROXIMATE COST:**
- **Cost per Location:** $2,000 - $20,000
- **Total Cost:** $20,000 - $200,000 (4 locations)
- **Other Cost Considerations:** additional costs depending on detection technology and/or existing controller capabilities

Image Source: Herbert, Rowland & Grubic, Inc.

Virginia Avenue
SMART CORRIDOR

# CV-BASED ADAPTIVE SIGNAL CONTROL TECHNOLOGIES

## APPLICATION DESCRIPTION:

CV-based ASTC systems can provide real-time spatial information (such as, position, speed, and acceleration and other traffic data) necessary for evaluating traffic conditions on a road network. Communications between a vehicle and infrastructure enables the intersection controller to obtain much more detailed information of the surrounding vehicle states within the transmission range.

## TELECOMMUNICATION REQUIREMENTS:

- 5G Cellular; and/or
- DSRC

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Corridor-wide at all signalized intersections

## DEPLOYED IN OTHER CITIES:

- North Ave Smart Corridor, Atlanta, GA
- Portland, ME
- Quincy, MA

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 67.0

## APPROXIMATE COST:

- **Cost per Location:** $25,000 per signalized intersection for equipment and engineering for controller set-up
- **Total Cost:** $250,000 for 10 signalized intersections

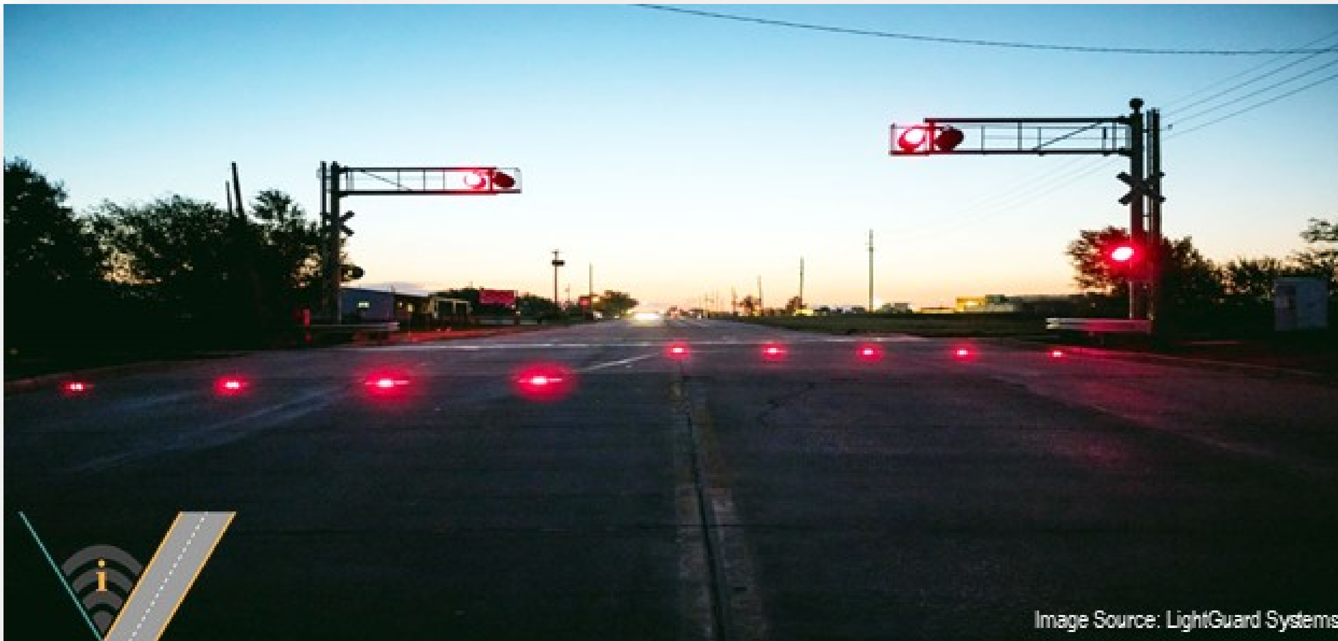
Image Source: LightGuard Systems

Virginia Avenue
SMART CORRIDOR

# IN-PAVEMENT ILLUMINATED CROSSWALKS

## APPLICATION DESCRIPTION:

In-pavement illuminated pedestrian crosswalks are crosswalks that are embedded with amber lights on both sides of the crosswalk and oriented to face oncoming traffic. The warning lights could produce a bright, daytime-visible light focused directly in the driver's line of sight clearly indicating the curve, hazard, crosswalk, variable lane, or lane edge.

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Anywhere near bus stops with intersection crosswalks

## DEPLOYED IN OTHER CITIES:

- Rock Island Rail Trail, Amarillo, TX
- Pasco, Washington

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 66.3

## APPROXIMATE COST:

- A system with 10 In-Roadway Warning Lights, 2 signs, A/C power and push button activation starts at cost of $11,800, price could go higher for system upgrade and more functions.

Image Source: BBC News

Virginia Avenue
SMART CORRIDOR

# SOLAR BUS SHELTERS

## APPLICATION DESCRIPTION:

Solar bus shelters are bus shelters powered by the sun to provide shelter, air conditioning, USB charger ports, digital transit maps, and/or in some areas, free Wi-Fi.

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Retrofit the existing bus shelter to solar-powered bus shelter
- Install two new solar bus shelters along the corridor, possibly one located at the eastern side of the corridor (near hotels and restaurants) and one located in the western side of the corridor (in the center of residential area)

## DEPLOYED IN OTHER CITIES:

- Hialeah, FL
- Miami, FL
- Corona, CA
- Dubai, UAE

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 66.0

## APPROXIMATE COST:

- The estimated cost for an air-conditioned shelter is about $65,000 per unit;
- The costs for open-air shelters with rooftop solar panels could vary according to different manufacturers and different technological standards.

Image Source: BikePed Images

Virginia Avenue SMART CORRIDOR

## RRFB/PHB WITH AUTOMATED OPTIONS FOR ACTIVATION

### APPLICATION DESCRIPTION:

A RRFB (Rectangular Rapid Flashing Beacon) or PHB (Pedestrian Hybrid Beacon) is a pedestrian-activated signal that uses flashing and solid lights to improve roadway crossing safety. When activated, the signal immediately flashes yellow to alert drivers before changing to a red stop light. When vehicles are stopped, pedestrians are given a Walk signal.

### TELECOMMUNICATION REQUIREMENTS:

- 5G Cellular
- DSRC

### POTENTIAL LOCATIONS ALONG CORRIDOR:

- Between Harrison Rd and I-85 On/Off Ramps
- Between Northbound I-85 Ramp and Delta Blvd

### DEPLOYED IN OTHER CITIES:

- Atlanta, Brookhaven, Chamblee, & Doraville, GA
- Tucson, AZ; Detroit, MI; Columbus, OH

### PROJECT PRIORITIZATION:


### PROJECT SCORE: 65.3

### APPROXIMATE COST:

- **Cost per Location:** $80,000 - $130,000 (PHB), $4,500-52,000 (RRFB)
- **Total Cost:** $160,000 - $260,000 (2 PHB locations)
- **Other Cost Considerations:** median/refuge island construction, additional signage, and/or striping


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# TRANSIT-PEDESTRIAN WARNING SYSTEM

**APPLICATION DESCRIPTION:**
Vehicle to Pedestrian (V2P) warning systems are used to detect pedestrians as well as bicycles, wheelchairs and other items in the area surrounding a bus. They include warning systems that send alerts to drivers, and to pedestrians via their smartphones. Buses have to be equipped with On-Board Units and Road-Site Unites and sensors are also required.

**TELECOMMUNICATION REQUIREMENTS:**
- 5G Cellular;
- DSRC

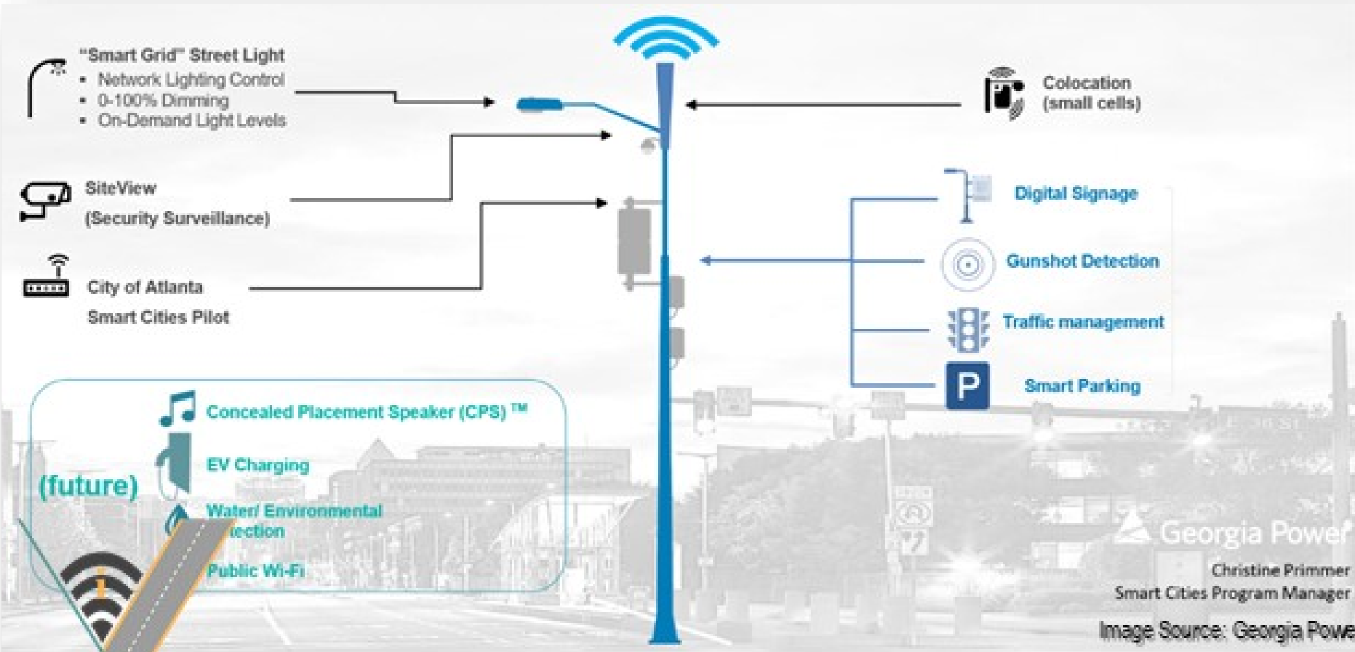
**POTENTIAL LOCATIONS ALONG CORRIDOR:**
- Insert specific location 1
- Insert specific location 2
- Or indicate if corridor-wide, including x intersections or x bus stops, etc.

**DEPLOYED IN OTHER CITIES:**
- Adelaide, Southern Australia

**PROJECT PRIORITIZATION:**


**PROJECT SCORE: 64.8**

**APPROXIMATE COST:**
- The cost of a MobileEye installation (including all equipment and cabling) is about $6,000 per vehicle (average).

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# SMART STREETLIGHTING

**APPLICATION DESCRIPTION:**
Smart streetlights implement multiple technologies at one location, including sensors for on-demand lighting, audio systems for public alerts, accident and traffic monitoring, and potential electric car charging, security cameras, parking assistance, signal management, and public Wi-Fi access. Sensors and Road-Side Units are necessary for smart streetlights.

**TELECOMMUNICATION REQUIREMENTS:**
- 4G LTE/5G Cellular; and/or
- DSRC

**POTENTIAL LOCATIONS ALONG CORRIDOR:**
- Insert specific location
- Or indicate if corridor-wide, including x intersections or x bus stops, etc.

**DEPLOYED IN OTHER CITIES:**
- Sydney, Australia
- Dubai, UAE
- London, England
- Cardiff, Wales, England

**PROJECT PRIORITIZATION:**


**PROJECT SCORE: 64.8**

**APPROXIMATE COST:**
- Cost varies significantly based on functions and whether it is retrofitting an existing streetlight or installing a new streetlight;
- Retrofitting traditional streetlights could cost from $200 to $2,000 each, with another $150 for internet and network connections.

Image Source: Studio Binocular

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# DIGITAL WAYFINDING KIOSK

## APPLICATION DESCRIPTION:

Digital wayfinding kiosks are means for replacing traditional printed signage with interactive digital screens and methods. They are commonly used to automate the direction of pedestrians to their destinations, assist them with questions, and provide other essential information. They could be customized to provide specific services.

## TELECOMMUNICATION REQUIREMENTS:

- 4G LTE Cellular

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- At the eastern side of the corridor, near the hotel and restaurant zone (Harrison Road and Bobbi Brown Parkway)

## DEPLOYED IN OTHER CITIES:

- H-JAIA, Atlanta, GA
- Georgia World Congress Center, Atlanta, GA
- Emory University Hospital Midtown, Atlanta, GA
- Big Bang Pizza, Brookhaven, GA
- Munich Airport, Germany

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 64.8

## APPROXIMATE COST:

- Costs vary depending on level of intelligence and different functions and services provided;
- Digital wayfinding kiosks can cost from $20,000 for a single exterior wayfinding sign to $200,000 for an interior system. Soofa signs have been free in the Atlanta region with paid advertising covering installation and maintenance.

Image Source: GIZMODO

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# PUBLIC WIFI

## APPLICATION DESCRIPTION:

Wi-Fi connectivity is foundational to Smart City and Corridor deployments. Lack of Internet access has implications for providing wide-spread services and addressing digital equity.

## TELECOMMUNICATION REQUIREMENTS:

- WiFi 6 (IEEE 802.11ax)

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Approximately every 1000 ft. along the corridor and other selected sites as needed

## DEPLOYED IN OTHER CITIES:

- Downtown Decatur, GA
- New York, NY
- Boston, MA

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 49.8

## APPROXIMATE COST:

- **Cost per Location:** $3,400 per WiFi Access Point
- **Total Cost:** $ 54,000 for estimated 16 AP sites plus the other costs below
- **Other Cost Considerations:** $ 25,000 for network equipment and ISP interconnection


Image Source: Government Technology

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# CAMERAS/LICENSE PLATE READERS

## APPLICATION DESCRIPTION:

Automatic license plate readers (ALPRs) are stationary units attached to poles along the street to monitor traffic, enforce parking, and monitor crimes, in addition to other uses. They capture images of passing license plates, vehicles, and sometimes the driver and passengers, along with location and a time and date stamp. The information is stored in databases accessible by law enforcement, as well as the private companies that collect the data.

## TELECOMMUNICATION REQUIREMENTS:

- 4G LTE/5G Cellular; and/or
- DSRC

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Insert specific location
- Or indicate if corridor-wide, including x intersections or x bus stops, etc.

## DEPLOYED IN OTHER CITIES:

- As of July 2012, it was being used in 38 states in the U.S., including the state of Georgia.

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 49.3

## APPROXIMATE COST:

- License plate reader cameras costs can vary due to different manufacturers and different technological standards, which could vary from approximately $200 to $1,000, as a higher resolution camera would cost more.

Image Source: WhatNow Atlanta

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# DRIVERLESS SHUTTLE

## APPLICATION DESCRIPTION:

Autonomous shuttles are vehicles that move small amounts of passengers (6-12) approximately 1 mile on a set route, and without a driver. Autonomous shuttles use guidance and detection systems using a combination of sensors, cameras, and deep learning programs.

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Specific routing would be developed as part of future transit planning efforts to tie into AACIDs' Transit Master Plan and Automated Driving System (ADS) grant application if successful
- Likely located on eastern end of corridor near hotels

## DEPLOYED IN OTHER CITIES:

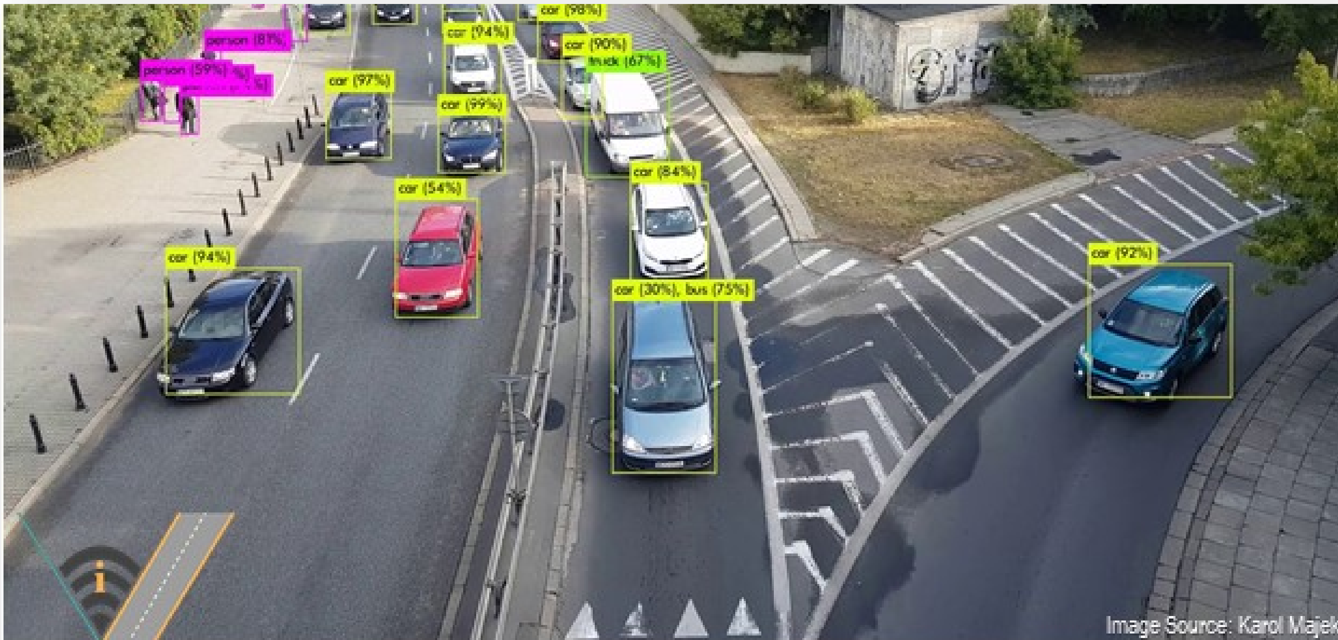
- Las Vegas, NV
- Ann Arbor, MI
- Detroit, MI
- Denver, CO
- Columbus, OH

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 48.3

## APPROXIMATE COST:

- Costs vary greatly based on whether the equipment is leased or purchased, the number of vehicles, whether infrastructure already exists, and related research costs;
- One pilot program in Arlington, TX, leasing 2 shuttles for a period of 6 months, costs around $270,000.

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# AUTOMATED TRAFFIC MONITORING/ OBJECT DETECTION

## APPLICATION DESCRIPTION:

Traffic monitoring software is technology that can be added to existing camera surveillance to automatically record traffic flow, accidents, and incidents in real time and extract data using set parameters. Using intelligent sensors and algorithms, these systems can also send out immediate alerts which are visually verifiable.

## TELECOMMUNICATION REQUIREMENTS:

- 4G LTE/5G Cellular; and/or
- DSRC

## DEPLOYED IN OTHER CITIES:

- Arizona is using thermal imaging cameras to detect wrong-way traffic;
- Ontario, Canada temporarily used it prior to the 2015 Pan American Games
- San Paolo, Brazil

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 47.0

## APPROXIMATE COST:

- The pilot program in Arizona for detecting wrong way costs $3.7 million to install 90 thermal cameras along a 15-mile road;
- ITSJPO in USDOT provides detailed cost information on traffic cameras, which is about $5000 for capital cost and $2000 for operation and management cost per unit.


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# SOLAR BENCH

**APPLICATION DESCRIPTION:**
Smart solar benches are new urban furniture pieces that will help cities, universities, retail, or business centers to create better, safer, and more user-friendly environments. They are powered by solar and it could offer functions such as charging, advertisement and information display.

**TELECOMMUNICATION REQUIREMENTS:**
- Not required

**POTENTIAL LOCATIONS ALONG CORRIDOR:**
- Near bus stops with no bus shelters

**DEPLOYED IN OTHER CITIES:**
- First list if deployed anywhere in Atlanta region
- Then indicate if anywhere in U.S. and where
- If none, indicate if international and where
- If none, indicate "no known deployments domestically or internationally"

**PROJECT PRIORITIZATION:**


**PROJECT SCORE: 46.8**

**APPROXIMATE COST:**
- Approximately $3,000 per unit.

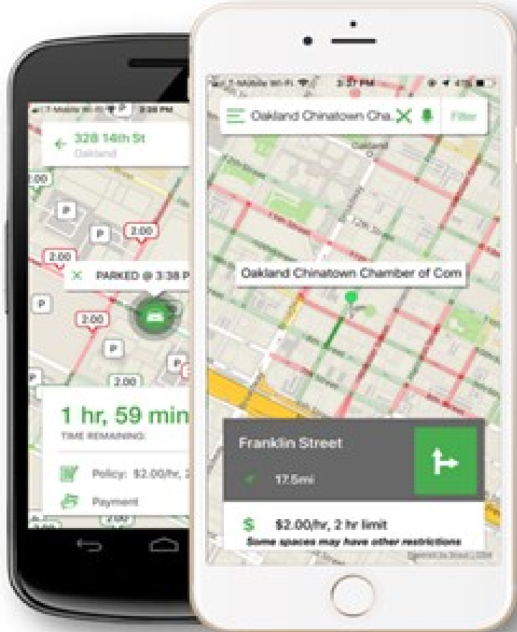


Image Source: Streetline

Virginia Avenue
SMART CORRIDOR

# PARKING AVAILABILITY APP

**APPLICATION DESCRIPTION:**

Real-time parking availability apps serve to inform drivers of available parking spaces based on street-level sensors that detect when a space becomes available.

**TELECOMMUNICATION REQUIREMENTS:**

- Satellite

**POTENTIAL FUNCTIONS:**

- Parking space availability, rates, and hours of operation
- Curb space availability
- Plan, ticket, and pay across modes, operators, and jurisdictions (Mobility as a Service)

**POTENTIAL APPS TO COORDINATE WITH:**

- Publicly Owned:
  - MARTA On the Go
  - OneBusAway
  - ATL MaaS pilot expected in 2020
- Privately Owned:
  - Park Mobile
  - BestParking
  - ParkMe
  - ParkWhiz

**PROJECT PRIORITIZATION:**


**PROJECT SCORE: 46.0**

**APPROXIMATE COST:**

- Developing an app which include GPS and map, drive planning, carpooling options and some other functions usually requires up to thousand hours of work of productivity, and the average cost of developing could be around $30,000 to $40,000.

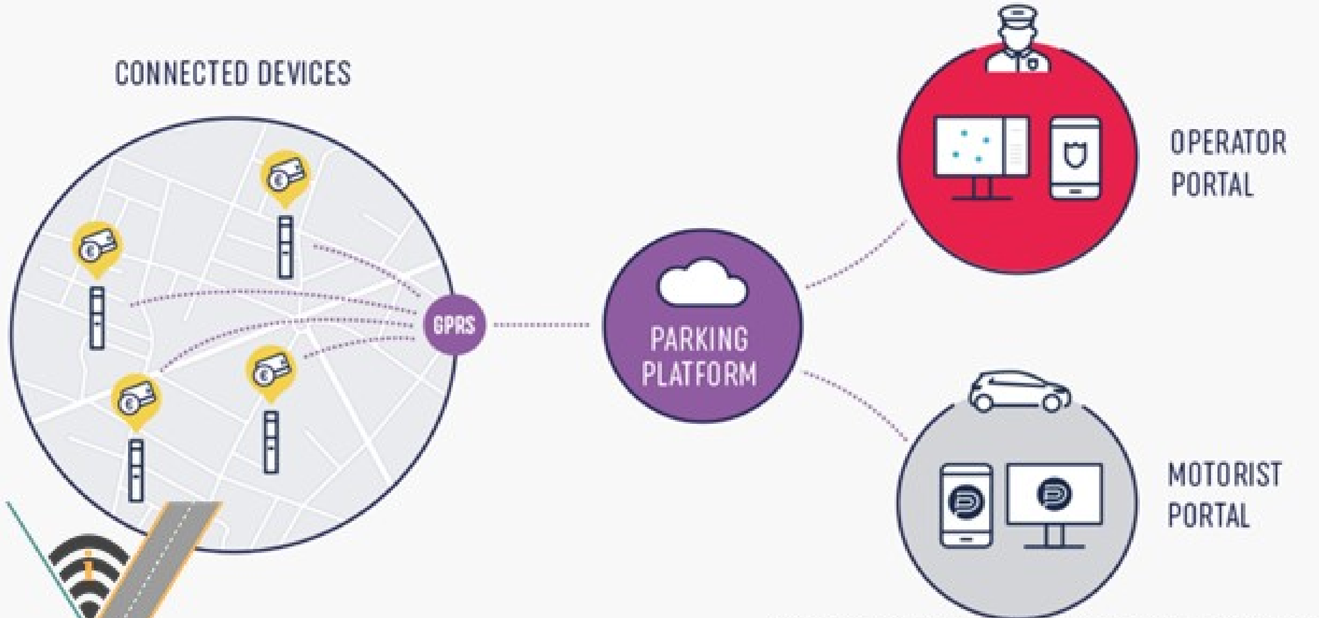


Image Source: IEM, Innovative Parking Solutions for Smart Cities

# SMART PARKING METERS

**APPLICATION DESCRIPTION:**
Smart parking meters are automated parking systems which allow for a self-parking, paperless system aimed at making parking easier for cities and drivers. They work in conjunction with parking apps, street sensors and/or mounted cameras.

**TELECOMMUNICATION REQUIREMENTS:**

- 4G LTE/5G Cellular; and/or
- DSRC

**POTENTIAL LOCATIONS ALONG CORRIDOR:**

- Near restaurant and hotel zone with higher volume of traffic

**DEPLOYED IN OTHER CITIES:**

- Smart parking meters are located in almost every major U.S. city, with 78.9 million smart meters installed throughout the United States, as of 2017.

**PROJECT PRIORITIZATION:**


**PROJECT SCORE: 42.0**

**APPROXIMATE COST:**

- Smart parking meters typically cost between $250 - $500 per meter per space.

Image Source: West Michigan Strategic Alliance (WMSA)

Virginia Avenue SMART CORRIDOR

# EV CHARGING STATIONS

## APPLICATION DESCRIPTION:

Electric vehicle (EV) charging stations are infrastructures that can charge the battery of electric vehicles. At present there are three levels of EV charging stations:

- Level 1 delivers 2 to 5 miles of range per hours of charging (low efficiency; usually used at home)
- Level 2 delivers 10 to 60 miles of range per hour of charging (for both residential and commercial use)
- Level 3 delivers 180 to 300 miles of range per hour of charging (only for commercial and industrial use)

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Eastern end of corridor near hotels and restaurants

## DEPLOYED IN OTHER CITIES:

- In Georgia State, there are almost 800 charging stations and over 2,400 charging outlets;
- In United States, there are almost 22,000 charging stations and over 63,000 charging outlets;
- In Hounslow, London, there are EV charging outlets installed in light poles along the curb.

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 40.8

## APPROXIMATE COST:

- For Level 2 charging stations, the station cost vary from $500 to $700, with parts and labor coting $1,200 to $2,000.
- For Level 3 charging stations, the station cost vary from $1,000 to $2,000, with parts and labor coting $2,300 to $6,000.
- There would be an increase in costs and installation fee if service panels need to be updated;


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SMART CORRIDOR

# AUTOMATED PARKING SYSTEMS

## APPLICATION DESCRIPTION:

Automated parking systems (APS) serve to park automobiles automatically so as to lessen the surface area needed for parking vehicles and to maximize convenience and safety.

## TELECOMMUNICATION REQUIREMENTS:

- Not required

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Eastern end of corridor near hotels and restaurants

## DEPLOYED IN OTHER CITIES:

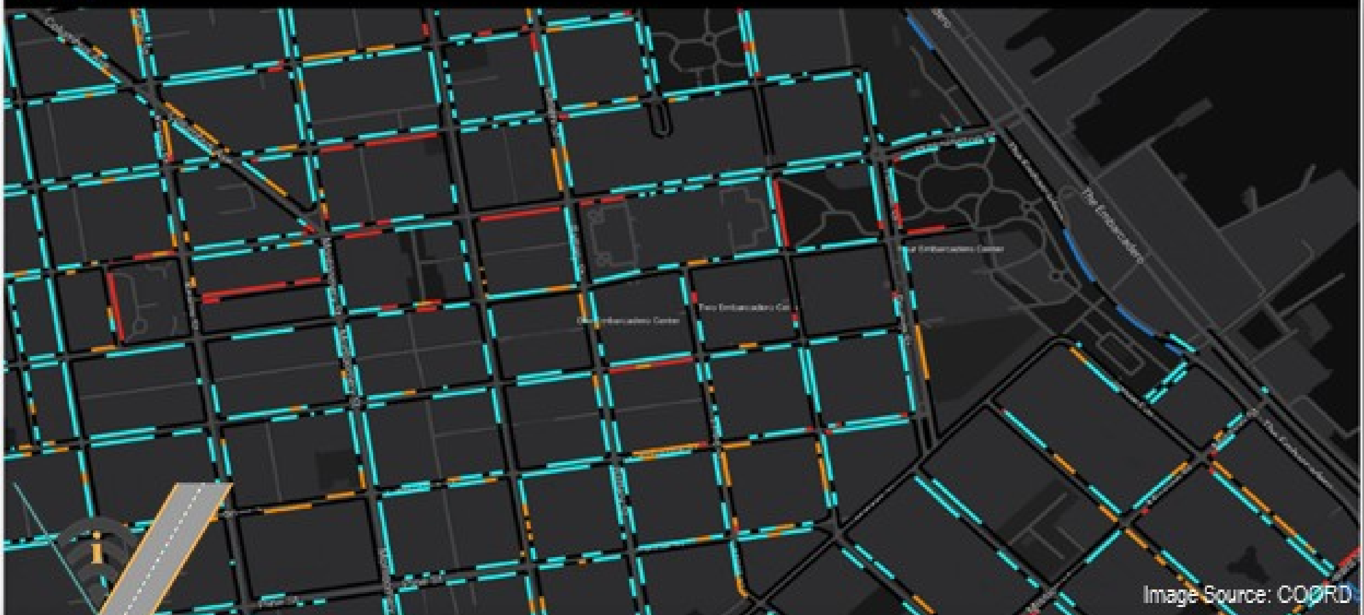
- New York, NY (Parkmatic Quadstackers System)
- Honolulu, HI (Parkmatic 10-Car Rotary System (Carousel) with outer turntable)
- San Francisco and Oakland, CA
- Germany
- Japan
- China

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 36.5

## APPROXIMATE COST:

- Total costs for stand-alone, above-grade automated parking stall is about $26,000;
- Total costs for below-building, above-grade automated parking stall is about $30,000;
- Total costs for below-building, below-grade automated parking stall is about $35,000.

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# CURBSIDE OCCUPANCY SENSORS

**APPLICATION DESCRIPTION:**

Curbside occupancy sensors can be installed in the pavement along the curb to determine if the curb is occupied. Coupled with the sensors, over time, large data streams could enable apps and platforms to inform users if a specific space is open or occupied and predict when it would become available if it's occupied. Information could be displayed and sent to users and drivers through a web-based or mobile-based platform to give suggestions on real-time parking decisions.

**TELECOMMUNICATION REQUIREMENTS:**

- 4G LTE/5G Cellular; and/or
- DSRC

**POTENTIAL LOCATIONS ALONG CORRIDOR:**

- Near the hotel and restaurant zone.

**DEPLOYED IN OTHER CITIES:**

- Curbside Flex Zones, Seattle, Washington
- Innovative Curbside Management, Washington, DC
- Curbside Management, San Francisco, CA

**PROJECT PRIORITIZATION:**


**PROJECT SCORE: 38.3**

**APPROXIMATE COST:**

- The costs of occupancy sensors could vary from $500 to $10,000 per sensor based on different detection standards. Programming occupancy sensors to specific requirements could add to the cost.

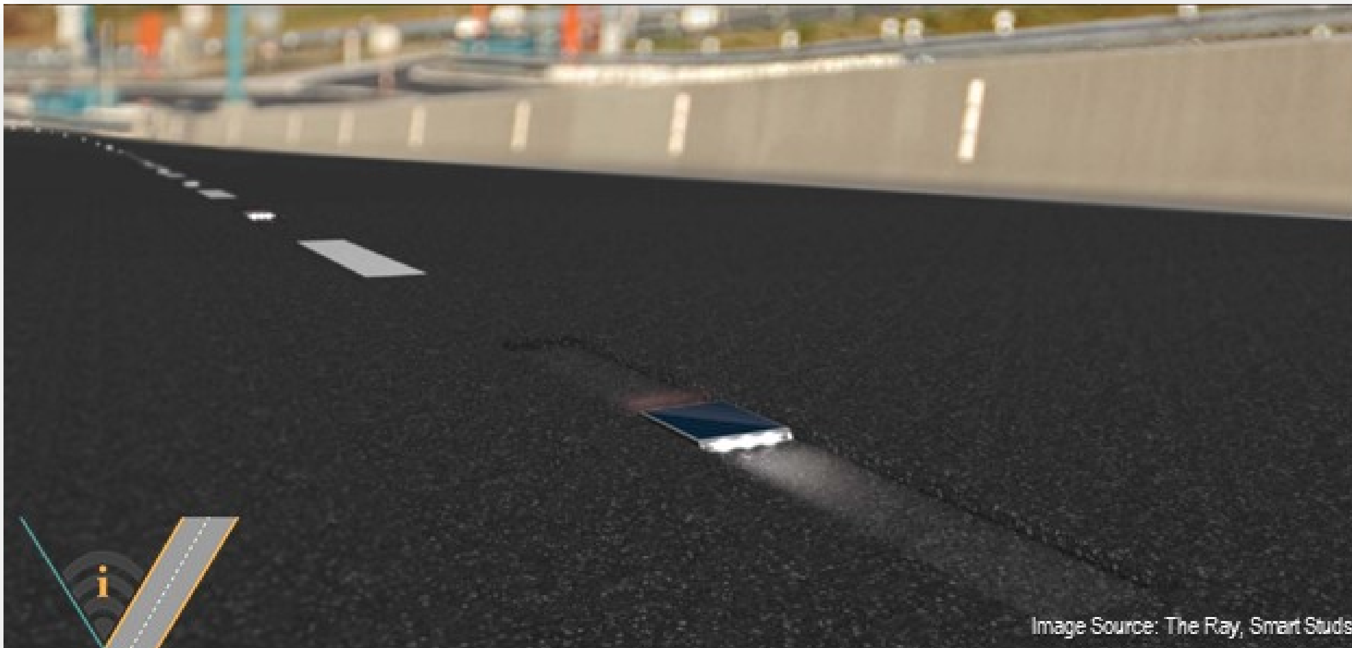
Image Source: The Ray, Smart Studs

Virginia Avenue
SMART CORRIDOR

# SMART DOTS IN STREET CENTERLINES

## APPLICATION DESCRIPTION:

Smart dots in centerlines are small devices installed at the centerline of roads to provide illumination and communication with vehicles and infrastructure in a connected transportation system to send a variety of crucial, basic alerts to drivers and passengers including fog, black ice, upcoming road incidents, and erratic drivers.

## TELECOMMUNICATION REQUIREMENTS:

- 4G LTE/5G Cellular; and/or
- DSRC

## POTENTIAL LOCATIONS ALONG CORRIDOR:

- Possibly along the whole Virginia Avenue

## DEPLOYED IN OTHER CITIES:

- The Wattway's pilot project is located next to the Georgia Visitor Information Center on The Ray (I-85).

## PROJECT PRIORITIZATION:


## PROJECT SCORE: 35.8

## APPROXIMATE COST:

- Cost not available