



JUNE 12, 2017

**CITY of TAMPA**  
**ATCMTD INITIATIVE:**  
Transportation Connectivity  
and Accessibility for All

**1** Volume 1: Technical Application

CITY OF TAMPA, FLORIDA *application for*  
**Advanced Transportation and Congestion Management  
Technologies Deployment Initiative**

**NOTICE of FUNDING OPPORTUNITY NO. 693JJ317NF0001**



U.S. Department of Transportation



U.S. Department of Transportation  
**Federal Highway  
Administration**



# MESSAGE FROM THE MAYOR



“Tampa has taken a ‘city-as-lab’ approach, which means we aren’t afraid to test the newest innovations. If it doesn’t work, we move on. But when it does, when we pilot driverless cars, connected vehicles, advancements in water reuse and data-sharing ... when it works, Tampa wins.”

**W**elcome to Tampa! Tampa is the third-largest city in the state of Florida and the metropolitan heartbeat of Tampa Bay, a region of more than 3 million people. Tampa is a city of resilience – a city built by the determination of immigrants from Cuba, Italy, Spain, South and Central America, Scotland, and others. Thousands came to Tampa in search of prosperity, safety, and equal opportunity, but what the early architects of this great city brought to Tampa was just as valuable as what they sought. They brought a vision and a motivation that laid the groundwork for a better tomorrow, a vision we are still building on today.

Our journey from a small port town to the 55<sup>th</sup> largest city in the United States has been one of perseverance and vision. It’s that vision that led us out of the Great Recession. While there was no blueprint for our recovery, we emerged stronger. Today, we stand united as a vibrant city rich in diversity and culture. Diversity is a prerequisite for creativity and innovation, and by extension, economic competitiveness. We have never been more competitive for business, for intellectual capital, or for trade as we are today. We are home to championship-winning sports teams, a collection of museums and cultural assets, and world-class educational institutions.

We are building neighborhoods that provide true live-work-play environments, and a city that fosters public safety, healthy living, and the highest quality of life. In downtown Tampa, we completed the Riverwalk, a project championed by six mayors and pushed through 40 years until its completion in 2015. This waterside walkway features Tampa’s most valuable natural asset, the Hillsborough River, and connects our downtown in an innovative way. In the Channel District, our port is exporting more goods than ever before and connects us with international markets. In West Tampa, we are re-imagining neighborhoods that are safer, provide travel choices, and give residents more opportunities to raise their families. In 2016, Tampa became the first city in the world to introduce a **WELL Certified** district – an area with a modern focus on health and wellness, walkability, clean air, and sustainable development.

We need mobility options offered through a safe, efficient and modern transportation system to fully realize a return on the significant investments we’ve made in our city. Therefore, we are pleased to respond to the Advanced Transportation and Congestion Management Technologies Deployment Initiative Notice of Funding Opportunity. We are a city on fire, a city with swagger, a city re-imagined. We are excited to offer our city as a laboratory to test new transportation technologies and foster reproducibility of successful application and knowledge transfer to other regions experiencing similar mobility challenges. Now it’s time to leverage our existing transportation investments and strengthen them with new, innovative technologies to realize a smarter transportation system.

Thank you for your consideration.

A handwritten signature in blue ink that reads 'Bob Buckhorn'.

City of Tampa Mayor Bob Buckhorn

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## ACRONYMS and ABBREVIATIONS

ATCMTD	Advanced Transportation and Congestion Management Technologies Deployment
AV	autonomous vehicle
BPS	beacon positioning system
CRA	[Tampa] Community Redevelopment Agency
CUTR	Center for Urban Transportation Research
CV	connected vehicle
DSRC	dedicated short-range communications
EV	electric vehicle
EVP	emergency vehicle pre-emption
HART	Hillsborough Area Regional Transit
ICM	integrated corridor management
IEAA	impaired/elderly assistance application
LED	light-emitting diode
MMITSS	multimodal intelligent traffic signal system
MPO	[Hillsborough County] Metropolitan Planning Organization
O&M	operations and maintenance
P3	public-private partnerships
PMG	project management group
PSTA	Pinellas Suncoast Transit Authority
SPaT	signal phase and timing
TBARTA	Tampa Bay Area Regional Transportation Authority
TECO	Tampa Electric
THEA	Tampa Hillsborough Expressway Authority
TIA	Tampa International Airport
TIM	traffic incident management
TSP	transit signal priority
USF	University of South Florida

# a) COVER PAGE

<b>Project Name</b>	The City of Tampa ATCMTD Initiative: Transportation Connectivity and Accessibility for All
<b>Eligible Entity Applying to Receive Federal Funding</b>	City of Tampa
<b>Total Project Cost (from all sources)</b>	\$40,842,379.00
<b>ATCMTD Request</b>	\$11,871,500
<b>Are Matching Funds Restricted to a Specific Project Component? If so, Which One?</b>	No
<b>State(s) in Which the Project is Located</b>	Florida
<b>Is the Project Currently Programmed in the:</b> <ul style="list-style-type: none"> <li>• <b>Transportation Improvement Program (TIP)</b></li> <li>• <b>Statewide Transportation Improvement Program (STIP)</b></li> <li>• <b>MPO Long Range Transportation Plan</b></li> <li>• <b>State Long Range Transportation Plan</b></li> </ul>	No. The Tampa ATCMTD Initiative System Elements are included in the Smart City Vision, CV SPaT Challenge, THEA CV Pilot Deployment, and in state legislation.
<b>Technologies Proposed to Be Deployed (briefly list)</b>	<ul style="list-style-type: none"> <li>✓ Bluetooth sensors</li> <li>✓ High-water/flood sensors</li> <li>✓ Connected vehicle on-board DSRC units</li> <li>✓ Connected vehicle roadside DSRC units</li> <li>✓ Emergency vehicle pre-emption (emitters and receivers)</li> <li>✓ Transit signal priority</li> <li>✓ Adaptive signal system (including new controllers, cabinets and arterial detection)</li> <li>✓ Parking space detection</li> <li>✓ Indoor beacon positioning system</li> <li>✓ Arterial DMS</li> <li>✓ Intelligent street lights</li> <li>✓ Transportation information kiosks</li> <li>✓ Static/dynamic wireless charging coils/pads</li> <li>✓ Data analytics/machine-learning (software as a service)</li> </ul>

## b) PROJECT NARRATIVE

### i. PROJECT DESCRIPTION

#### i.1. INTRODUCTION

The City of Tampa will leverage existing transportation infrastructure investment by applying ATCMTD funding to deploy advanced technologies that will address current and expected transportation challenges. Tampa's ATCMTD Initiative will also demonstrate the benefits of multi-agency system integration, end-user connectivity and open data for enhancing our transportation system in areas such as:

- Safety and security
- Accessibility, equity and opportunity
- Traffic congestion and corridor travel time reliability
- Multimodal travel and public access to real-time information
- Operational decision support and performance monitoring
- Efficiency, emissions and sustainability

This application features carefully selected concepts that the City is confident will maximize return on investment. These investments – in infrastructure and partnerships with other public agencies, private companies and academia – help establish an “ecosystem” that will spur innovation, facilitate collaboration and minimize risk.



Finally, we recognize that many cities across the nation share Tampa's transportation challenges. The City will pioneer seven forward-looking concepts – the Tampa ATCMTD Initiative **System Elements** – with a focus on reproducible technology, application and knowledge transfer for other regions with similar mobility challenges.

### THE TAMPA ATCMTD INITIATIVE 7 SYSTEM ELEMENTS

#### No. 1: Intelligent Sensor-Based Infrastructure

Provides sensor-based infrastructure to support the other six system elements. Traffic monitoring cameras and environmental, Bluetooth and flood sensors are several of the components that will improve mobility, operational decision-making and deliver greater return on investment.

#### No. 2: Multimodal Integrated Corridor Management

Leverages new and existing systems, existing network capacity and machine-learning to improve cross-network mobility, TIM and emergency response along the I-275/Kennedy Boulevard integrated corridor – a vital link between downtown and TIA, and one of Hillsborough County's worst corridors for congestion and crash rates.

#### No. 3: Smart Parking

Collects and analyzes sensor data to disseminate parking availability information, helping drivers to quickly find, reserve and pay for parking. Also enables Tampa to better manage and optimize its parking supply, increase turnover and facility entry and generate new revenues to sustain O&M.

#### No. 4: Pedestrian Safety, Mobility and Navigation

New approach for addressing Tampa's legacy pedestrian safety problem that demonstrates potential quality of life and emergency response benefits associated with indoor- and crosswalk-mobility applications for all users including the elderly and visually impaired.

#### No. 5: Transportation System and Smart Grid Communications/ Energy Distribution Integration

An innovative partnership between the City of Tampa and TECO whereby investments in the communications component of a smart grid electric utility energy distribution system will be leveraged to support regional advanced transportation enhancements, specifically providing connectivity among proposed ATCMTD system elements and integration with the City's existing TMC.

#### No. 6: Integrated Multimodal Traveler Information and Trip-Planning Platform

Leverages and enhances HART's existing open-source software to include a variety of multimodal traveler information applications to improve accessibility, convenience and mobility.

#### No. 7: Automated Transit/Electric Shuttle Vehicle Wireless Power Transfer/Charging

Leverages investments in HART's autonomous transit circulator, the Tampa Downtown Partnership's Downtowner electric shuttle service, and TECO's smart grid energy distribution system by providing static and dynamic wireless inductive vehicle-charging.

# Intelligent Sensor-Based Infrastructure



### SMART STREET LIGHTING and INTEGRATED SENSORS

Energy-efficient, sustainable LED fixtures with video camera and sensor technologies to detect/communicate the following: parking availability; pedestrians at street crossings; incidents; emergency vehicles; traffic congestion and volumes; safety concerns; environmental threats and air quality; and operations performance data

### BLUETOOTH SENSORS

Sensors along roadways that anonymously receive signals from vehicle-based, Bluetooth-enabled devices to enhance

ICM operations and provide vehicular origin-destination and travel time data. Data enhances incident detection and emergency response, and can impact travelers' modal decisions. Technology also supports traffic rerouting and evacuation; and performance monitoring and measurement

### HIGH-WATER/FLOOD SENSORS

Sensors installed in flood-prone roadway locations that detect water levels and soil/subsurface moisture content to detect/predict roadway flooding and support road closures, traffic rerouting and evacuation

### CONNECTED VEHICLE ON-BOARD UNITS

In-vehicle technology that communicates various "status" data to roadside infrastructure such as traffic signals to provide/enhance ICM, pedestrian safety, and improve emergency response via signal pre-emption

### CONNECTED PERSONAL INFORMATION DEVICES

Devices that detect pedestrian presence and communicate data to traffic signals, street lights, and indoor navigation receivers to help vulnerable pedestrians cross streets safely and navigate indoors at the Tampa Convention Center

## WHY DOES TAMPA NEED IT?

Sensors are generally the point at which transportation data originates. Data is used in a multitude of use – cases such as TMC operational decision-support, traveler information and mode choice, presence of pedestrians, emergency response and environmental alerts.



Tampa experiences environmental threats such as low-lying roadway flooding and hurricanes, which the City needs to track and mitigate impacts of on the transportation network



Lack of real-time, downtown parking information



Coordinate traffic signal operations

## WHAT ARE THE BENEFITS?



Improved pedestrian/driver safety and emergency response to incidents and other critical conditions

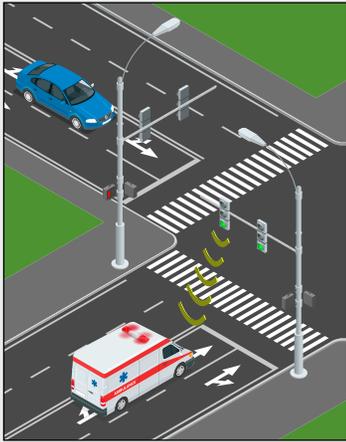


Reduced flood-related losses and associated maintenance costs, leverages existing investments in CV DSRC and Bluetooth sensor deployments



Better utilized transportation infrastructure, mode utilization, resource allocation, asset management and maintenance, performance monitoring and operational decision support

# Multimodal Integrated Corridor Management



## TRAFFIC SIGNAL EMERGENCY VEHICLE PRE-EMPTION (EVP) and TRANSIT SIGNAL PRIORITY (TSP)

- ✓ Installs DSRC roadside and emergency vehicle onboard units to pre-empt traffic signals and provides responders traffic signal status, improving response time and safety in the I-275/Kennedy Boulevard corridor
- ✓ Expands the USDOT/TEHA CV Pilot Deployment to provide DSRC transit signal priority along Kennedy Boulevard

## COMPARATIVE ROUTE TRAVEL TIME CALCULATION and DISSEMINATION

- ✓ Bluetooth sensor deployment to calculate travel times along Kennedy Boulevard/I-275 and routes connecting these facilities
- ✓ Leverages freeway and arterial DMS and computer/smartphone applications to share comparative route travel times

## TRAFFIC SIGNAL SYSTEM UPGRADE and PERFORMANCE MEASUREMENT

- ✓ Provides SPaT status information via DSRC roadside units to optimize traffic flow and safety between signalized intersections
- ✓ Implements a performance monitoring and reporting tool with diagnostic dashboards, heat maps and analytical tools to optimize signal operations
- ✓ Upgrades traffic signal controllers to enable adaptive traffic signal control
- ✓ Builds upon FHWA's ongoing efforts with MMITSS

## DATA ANALYTICS for DECISION SUPPORT

- ✓ Machine-learning platform with integrated decision support system to predict trouble spots before they occur, stage resources and recommend actions to optimize operations
- ✓ Leverages a combination of historical, weather, sensor and Waze data aggregated by the TMC

### WHY DOES TAMPA NEED IT?



Inrix reports that in 2016, Tampa drivers spent an average 27 hours in heavy traffic congestion at a cost of nearly \$1 billion



3 intersections along Kennedy Boulevard rank among top 30 high-crash intersections in county



Hillsborough County MPO's 2013 **Intelligent Transportation System (ITS) Master Plan Update** calls for ICM strategies and support systems to improve congestion, mobility, traveler information, and emergency response

### WHAT DOES IT COST?

**\$4,391,500**

- ✓ Systems engineering and design
- ✓ CV EVP and TSP DSRC roadside units installed
- ✓ In-vehicle emergency, transit vehicle units installed
- ✓ Adaptive signal control installed
- ✓ Bluetooth vehicle travel times detectors installed
- ✓ Arterial DMS installed
- ✓ Flood/high-water sensor station installed
- ✓ System integration
- ✓ 5-year cost of O&M/communications

### WHAT ARE THE BENEFITS?



Anticipated benefit-to-cost ratio 9.7:1 to 20.4:1 based on ICM projects in San Diego and Dallas, respectively



Reduced fuel consumption, improved air quality

Real-time demand and network optimization



Improved transit utilization and efficiency

Better emergency response and improved safety

"... massive amounts of rich data [is] being gathered but underutilized by urban transportation enterprises."

**WADE ROSADO, DIRECTOR, ANALYTICS FOR URBAN INSIGHTS**



**IMPROVED PARKING EFFICIENCY and OPERATIONS**

- ✓ Vehicle detection technologies that determine on- and off-street parking occupancy and availability
- ✓ Data analytics to optimize operations and monitor inventory
- ✓ Integration with TMC and mobile apps to provide push alerts and guidance to available parking, particularly during peak periods and planned special events
- ✓ Improved parking garage/lot operations and intake
- ✓ Parking reservations to reduce searching time

**PARKING INFORMATION RESERVATIONS and DISSEMINATION**

- ✓ Shared with app users via third-party providers such as Waze
- ✓ Integrated with traveler information platforms such as HART's open-sourced OneBusAway and the TMC
- ✓ Ability to make parking reservations, reducing the congestion caused by drivers searching for available parking
- ✓ Potential to provide parking info to CVs via DSRC roadside units

**VALUE-ADDED SERVICE for BUSINESSES and GOVERNMENT:** Businesses can embed a real-time parking map on their websites, reducing the potential loss of sales and tax revenue that occurs when customers can't find available parking



**WHY DOES TAMPA NEED IT?**

**30%** OF CITY TRAFFIC = DRIVERS LOOKING FOR **PARKING**

City lacks viable methods to share parking information

"As the downtown continues to be more vibrant and active, the demand for parking has gone up."

**KAREN KRESS, DIRECTOR  
TRANSPORTATION AND PLANNING  
FOR TAMPA DOWNTOWN PARTNERSHIP**

**WHAT DOES IT COST?**

**\$1,000,000**

- ✓ Systems engineering and design
- ✓ Parking occupancy detectors such as smart street light fixtures, pucks and LEDs
- ✓ Data processing equipment and fees
- ✓ Installation/construction
- ✓ System integration
- ✓ 5-year cost for O&M/communications

**WHAT ARE THE BENEFITS?**



Enhanced trip-planning capabilities



Reduced traffic congestion



Reduced driver frustration



Optimized parking policy, rates, enforcement



Potential 43% reduction in trip times



Potential 21% reduction in VMT



Reduced gas consumption and carbon emissions



Increased parking and retail revenues

# Pedestrian Safety, Mobility and Navigation



### SIGNALIZED INTERSECTION and CROSSWALK PEDESTRIAN MOBILITY SYSTEM

Implements DRSC roadside units and mobile device applications to grant signal priority for pedestrians needing additional crossing time and to provide warnings about potential vehicle conflicts. Introduces intelligent materials to crosswalk pavement markings (“smart paint”) that can communicate with a special electronic haptic cane for the visually impaired pedestrian to provide them with active crosswalk guidance and safe street crossing. This component builds on FHWA’s Cooperative Research and Development Agreement with SRI/Intelligent Materials.

### CONVENTION CENTER PEDESTRIAN NAVIGATION SYSTEM

Implements indoor beacon positioning system (BPS) technology at the Tampa Convention Center that coupled with pedestrian-carried mobile devices with audio and textual guidance, enhances accessibility of the Center particularly for elderly and impaired pedestrians.



## WHY DOES TAMPA NEED IT?

Tampa has a poor record for pedestrian safety and limited accessibility for the elderly and visually impaired, who experience mobility challenges and struggle with access to employment and rehabilitation – particularly at intersections in the downtown area

**12% OF TAMPA'S POPULATION IS 65+**

**PEOPLE SPEND 90% OF THEIR TIME INDOORS** yet GPS technology is largely incapable of precisely pinpointing an individual’s location when they are inside a building  
*Bureau of Labor Statistics*

**ITS Master Plan Update** calls for capabilities to improve pedestrian safety and crowd management

## WHAT DOES IT COST?

**\$775,000**

- ✓ Systems engineering and design
- ✓ Procurement, configuration installation of DSRC roadside units and smart paint crosswalk and components
- ✓ Procurement, configuration, installation of Tampa Convention Center BPS
- ✓ System integration
- ✓ 5-year cost of O&M/communications

## WHAT ARE THE BENEFITS?



Improved pedestrian safety, experience, mobility and accessibility to services

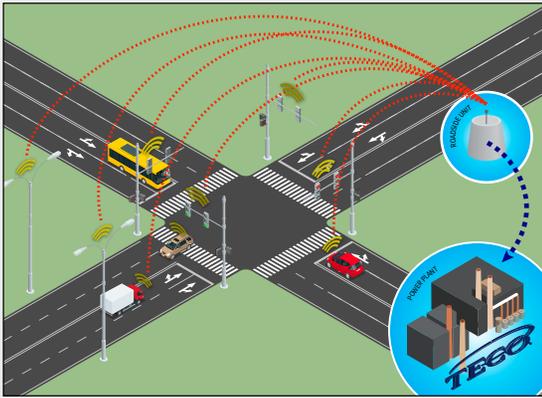


Improved emergency response to individuals requiring urgent assistance within the Tampa Convention Center



Application can be expanded by retailers to identify pedestrian shopping patterns and drive economic benefits

# Transportation System and Smart Grid Communications/Energy Distribution Integration



- ✓ Partnership between the City of Tampa and TECO that leverages a smart grid electric distribution system to support transportation enhancements – specifically providing connectivity among proposed ATCMTD system elements and integration with the City’s existing TMC
- ✓ Expands functionality of smart grid communications in downtown Tampa and along Kennedy Boulevard
- ✓ Enhances TMC, TECO and public safety operators’ responsiveness to system anomalies, incidents, changing traffic conditions and maintenance needs.
- ✓ Expands communications system capacity and security to accommodate emerging data demands of CVs and AVs

## WHAT ARE THE BENEFITS?



Efficient, reliable, secure and environmentally friendly electrical and communications network



Meets the electrical and communications demands of Tampa’s CV implementation and all ATCMTD system elements



Strengthens P3 with TECO and leverages its investment in new energy technologies and smart grid



Reduced carbon emissions and improved air quality



Advances deployment and adoption of CVs, AVs and EVs



Less risk of power and communication outages and lower ongoing maintenance costs

## WHY DOES TAMPA NEED IT?



Limited infrastructure to support demands of connected vehicles (CVs) and automated vehicles (AVs), many of which will be electric



Existing “century-old” energy grid is inefficient, unreliable, unsecure

Safety-critical CV and AV investments require secure, stable, and reliable communications



TECO is developing a smart grid, but it is incomplete and needs to evolve further to provide communications for ATCMTD system elements, emerging CV-AV deployments and other ITS infrastructure

## WHAT DOES IT COST?

**\$2,200,000**

- ✓ ATCMTD system element integration with TECO smart grid communication backbone

“The Smart Grid can give us cleaner air, better health, lower electricity bills, and reduced (CO<sub>2</sub>) emissions ...”

**NATURAL RESOURCES DEFENSE COUNCIL**

**2.8-6.0 TO 1**

✓ Anticipated benefit-to-cost ratio of updating the U.S. grid to “smart” status  
Source: Electric Power Research Institute, 2011

# Integrated Multimodal Traveler Information and Trip-Planning Platform



- ✓ Expansion of HART's OneBusAway traveler information platform to integrate multiple sources of traveler information including parking and payment options
- ✓ Open-source, sustainable software platform that leverages development efforts of other municipalities across the nation
- ✓ Implements additional kiosks at mobility hubs to provide public traveler information
- ✓ Publicly accessible, multiple-channel dissemination platform

## WHY DOES TAMPA NEED IT?



Tampa lacks multimodal information and trip-planning tools, and has fragmented access to existing traveler information for existing and emerging travel options such as bike-sharing, on-demand EV shuttles and the Marion Street autonomous transit circulator service

Tampa has limited mobility options for vulnerable people like elderly, low-income and disabled individuals



Need to reduce single-occupant vehicle use and increase throughput on congested roads

Implementing and maintaining separate, nonintegrated traveler information platforms is cost-prohibitive and inefficient

## WHAT DOES IT COST?

**\$715,000**

- ✓ Systems engineering and design
- ✓ OneBusAway data integration and app development
- ✓ Transportation information kiosks (procurement, configuration, installation)
- ✓ System/kiosk integration
- ✓ 5-year cost for O&M/communications

“We’re interested in having One-Bus-Away be as useful for as many people as possible ... we are looking at how we make it more user-friendly for blind and low-vision riders.”

**ALAN BORNING, COMPUTER SCIENCE AND ENGINEERING PROFESSOR INVOLVED IN CREATING ORIGINAL ONEBUSAWAY APP**

## WHAT ARE THE BENEFITS?



- ✓ Reduced software development and maintenance costs
- ✓ Improved accessibility, multimodal traveler information, and experience, convenience and perception of services



- ✓ Meets the mobility needs of vulnerable populations such as elderly, low-income and disabled people
- ✓ Improved person throughput along congested corridors such as Kennedy Boulevard

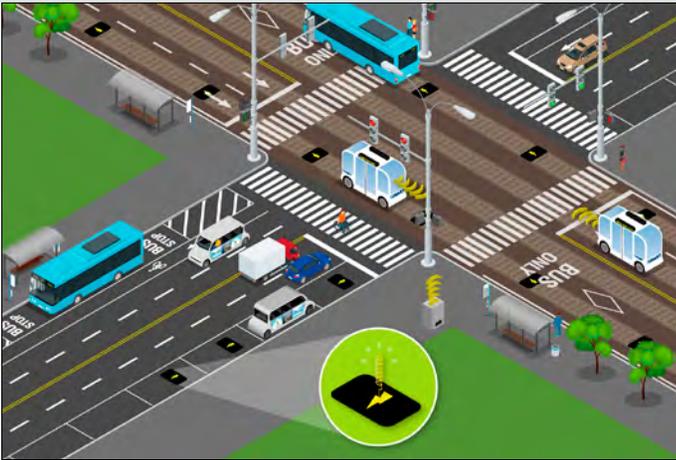


- ✓ Improved management, optimization and dissemination of transportation information and mobility services

“[ One-Bus-Away ] has had a real-world impact and will definitely make people’s lives easier in terms of accessing transit.”

**SEAN BARBEAU, UNIVERSITY OF SOUTH FLORIDA CENTER FOR URBAN TRANSPORTATION RESEARCH**

# Automated Transit and Electric Shuttle Vehicle Wireless Power Transfer and Charging



- ✓ Charges EV batteries using wireless inductive charging when parked in a parking spot or in the garage, temporarily stopped at stations and traffic signals (stationary charging) and when in motion (dynamic charging)
- ✓ Provides a sustainable energy source for the Marion Street autonomous transit circulator and Downtowner EV shuttle services
- ✓ Uses TECO's smart grid for electrification
- ✓ First step toward implementing wireless charging technology for larger AV shuttle/transit fleets

## WHAT ARE THE BENEFITS?

- ✓ Reduced dependence on fossil fuels and improved air quality (zero emissions)
- ✓ Significantly extends operational range (time/distance) of EVs
- ✓ Reduced O&M costs
- ✓ More convenient than plug-in charging
- ✓ Reduced need for a larger battery – the most expensive, least reliable and heaviest component of EVs. This represents a cost savings compared with plug-in models, which are dependent on larger batteries
- ✓ Advanced deployment and adoption of AVs/EVs
- ✓ Nearly invisible charging infrastructure
- ✓ Not impacted by unfavorable weather conditions

## WHY DOES TAMPA NEED IT?



Supports the existing “manned,” on-demand Downtowner EV shuttle service and downtown Marion Street “unmanned” autonomous transit circulator service, currently being developed

Enhances the sustainability of service by reducing the need and labor required to recharge batteries



Reduces ongoing fuel costs and emissions

Guarantees continuation of service and efficient operations without having to routinely recharge or swap out batteries, or rotate in spare vehicles



Fosters research opportunities toward developing smarter mobility solutions

## WHAT DOES IT COST?

**\$1,690,000**

- ✓ Systems engineering and design
- ✓ Wireless charging pads (.5 segment, 1 lane in each direction)
- ✓ AV modification for wireless inductive charging
- ✓ Roadside power supply cabinets
- ✓ Electric power supply infrastructure
- ✓ System integration

“Every carmaker, and I say that meaning every carmaker, has an active program at some stage of maturity to introduce vehicles with wireless charging.”

**DAVID SCHATZ,**  
VICE PRESIDENT OF SALES AND BUSINESS  
DEVELOPMENT, WITRICITY

## i.2. ENTITY ENTERING into the FHWA ATCMTD AGREEMENT

The City of Tampa will be the entity entering into the ATCMTD agreement with FHWA. The administration coordinates and manages all public works and utility operations and programs. Reporting directly to the administration, the Transportation and Stormwater Services Department will oversee the ATCMTD Initiative and day-to-day management. The Contract Administration Department of the City will manage the ATCMTD Initiative funding and budget.

As detailed in **Section i.11**, an impressive team of public and private partners are committed to the Tampa ATCMTD Initiative. **Section ii** presents our overall staffing organization, and the foundation for our project management approach and partner coordination. The City will solicit contractor support for the role of system manager to oversee project management, development, design and deployment. Various City department representatives and key personnel from partner agencies will comprise a project management group (PMG) led by the City's primary point of contact and Chief Traffic Management Engineer Vik Bhide. A partner Executive Oversight Committee will help guide the effort.

## i.3. GEOGRAPHIC AREA DESCRIPTION

Tampa is a typical midsized city with a population of 335,715, according to the 2010 U.S. census. In 2015 the Tampa's population was estimated at 369,075, and it is projected to grow to over 480,000 by 2040. Because vacant land within the corporate limits is scarce and there is little potential to annex undeveloped property, the vast majority of growth must occur via downtown residential development, transit-oriented development, and infill of the city's residential neighborhoods. The region also anchors the I-4 Tampa-Orlando corridor, which is poised for economic prominence with its growth of jobs, population and retail development (**Figure 1**).

## i.4. REAL-WORLD ISSUES and CHALLENGES ADDRESSED

If downtown is the heart of Tampa, then its diverse modes of transportation are the vessels, and its people the blood. Like a healthy circulatory system, people must be able to travel through the city safely and freely, without obstruction, to keep the city's heart strong. The overall well-being of Tampa and its residents and visitors are at risk if modes aren't connected, information



*Numerous special events in Tampa draw travelers to the area year-round.*

is fragmented and systems are inaccessible. The system elements highlighted in **Section i.1** and detailed in **Section i.5** will collect, analyze and distribute information in new ways, to allow all travelers, regardless of age or ability, the freedom to move about our city in ways they never have.

The city is fortunate to have favorable year-round weather, low unemployment and frequent special events that drive the local economy, and unprecedented population growth; however, these benefits come with challenges including:

- **Increasing population growth and demand for transportation services:** Tampa is experiencing a boom in population growth, resulting in greater densities downtown and placing greater demand on our transportation infrastructure. I-275 and Kennedy Boulevard consistently rank among the most congested roadways in Tampa. Actual traffic volumes are almost double the serviceable capacity resulting in a level of service of F.<sup>1</sup>
- **High percentage of unfamiliar travelers:** Tourist attractions, special events, transportation hubs and employment centers continuously attract unfamiliar drivers to downtown, adding to the pedestrian safety problem. These travelers do not know how to access city transportation services, resulting in greater reliance on single-occupant vehicles.
- **Poor pedestrian safety and mobility:** Pedestrian deaths in Hillsborough County increased 50 percent in 2015 – the most deaths since 1998. The Tampa metro area ranks seventh nationally as the “most dangerous places

<sup>1</sup> Demand exceeds capacity; very long queues and delays; most vehicles wait through more than one green signal.

a)	b)	i.	i.1.	i.2.	i.3.	i.4.	i.5.	i.6.	i.7.	i.8.	i.9.	i.10.	i.11.	i.12.	i.13.	i.14.	ii.
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**Figure 1: Tampa ATCMTD Initiative Immediate Deployment Area and Services**



to walk” by Smart Growth America. If people are afraid to walk or drive out of fear of hitting someone or being hit, the flow of people to downtown is hindered, dragging down economic productivity.

- **Lack of rail, metro or light-rail mass transit:** A lack of transit adds pressure on Tampa’s existing roadway system compared with similar mid-sized cities. Recent additions of the Downtowner EV shuttle and the planned

Marion Street autonomous transit circulator will help meet the needs of underserved populations in innovative ways.

- **Increasing levels of pollution and energy usage:** Hillsborough County has one of the worst ozone – or smog – problems in the state and it is the only Florida county to have earned an “F” grade for ozone pollution from the American Lung Association.

## i.5. TRANSPORTATION SYSTEMS and SERVICES

### System Element No. 1: Intelligent Sensor-Based Infrastructure

A high-level overview of Tampa's transportation systems and services, or system elements were initially described in the at-a-glance pages in **Section i.1**. Tampa's system elements are described in further detail in this section. System elements were crafted from previously defined needs and issues as documented in regional plans. The system elements proposed in this section and illustrated in **Figure 2** will address ATCMTD goals and objectives as defined in **Section i.10**.

#### Smart Street Lighting and Integrated Sensors

On Dec., 3, 2014, TECO filed with the Florida Public Service Commission to switch to energy-efficient light emitting diode (LED) street light fixtures, which have become cost-competitive with older technologies but produce significant energy savings, and have environmental and safety benefits. This system element builds upon TECO's request and will replace older, inefficient fixtures downtown along the Kennedy Boulevard project segment with smart LED fixtures. Smart lighting will be used for the following objectives:

- **Video Monitoring and Surveillance:** Video from cameras installed within the smart street light fixtures will be monitored and analyzed by software to help manage traffic, alert drivers to pedestrians at crosswalks (**Figure 2**), and determine parking space availability and field conditions. Pertinent data will be leveraged by other ATCMTD functions such as ICM and Smart Parking (System Element No. 2 and System Element No. 3, respectively).
- **Emissions Monitoring:** Environmental sensors installed within smart street lights will collect weather and pollution data (temperature, CO<sub>2</sub>, humidity, pollen, UV information) to issue communitywide weather and environmental alerts, and monitor the performance of transportation assets in reducing pollution. This will improve the well-being of all individuals but particularly those with sensitivities to the environment such children, the elderly, or those with allergies. Furthermore, it will also help the City better understand which investments have the greatest benefit-cost ratios so that future funding can be allocated toward those investments.

- **Public Safety:** Gunshot detection to enhance public safety and law enforcement operations.
- **Additional Functions:** The smart lighting fixture is separate from the street lighting base, allowing new sensors to be added or upgraded without replacing the entire fixture. This adds to the sustainability and future return on investment. Other market-ready sensors that can be integrated within the smart lighting fixture can detect motion, audio, environmental and vibration. Sensors are interchangeable and configurable, enabling the City to only implement sensors required at locations to meet transportation objectives.

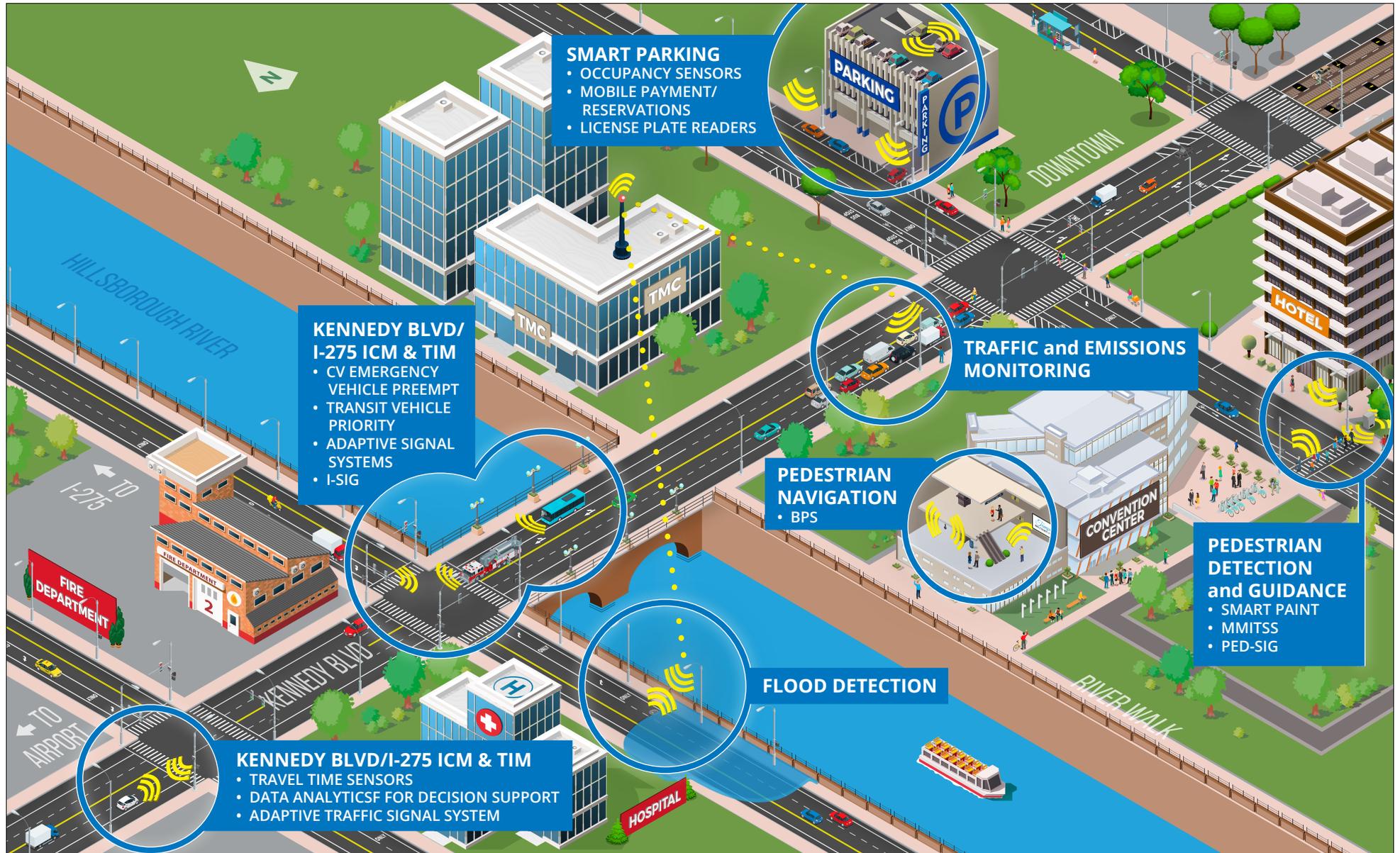
#### Roadway In-Pavement and Subsurface Flood Sensors

In August 2015 and June 2016, the City of Tampa experienced heavy rains that caused significant flooding. This component of System Element No. 1 will install flood sensors at locations downtown and along Kennedy Boulevard that measure pavement state and subsurface saturation levels. Using collected data, operators can take proactive and precautionary actions such as closing roadways before flooding occurs. The City will leverage its partnership with Waze to proactively issue warnings and road closure information.



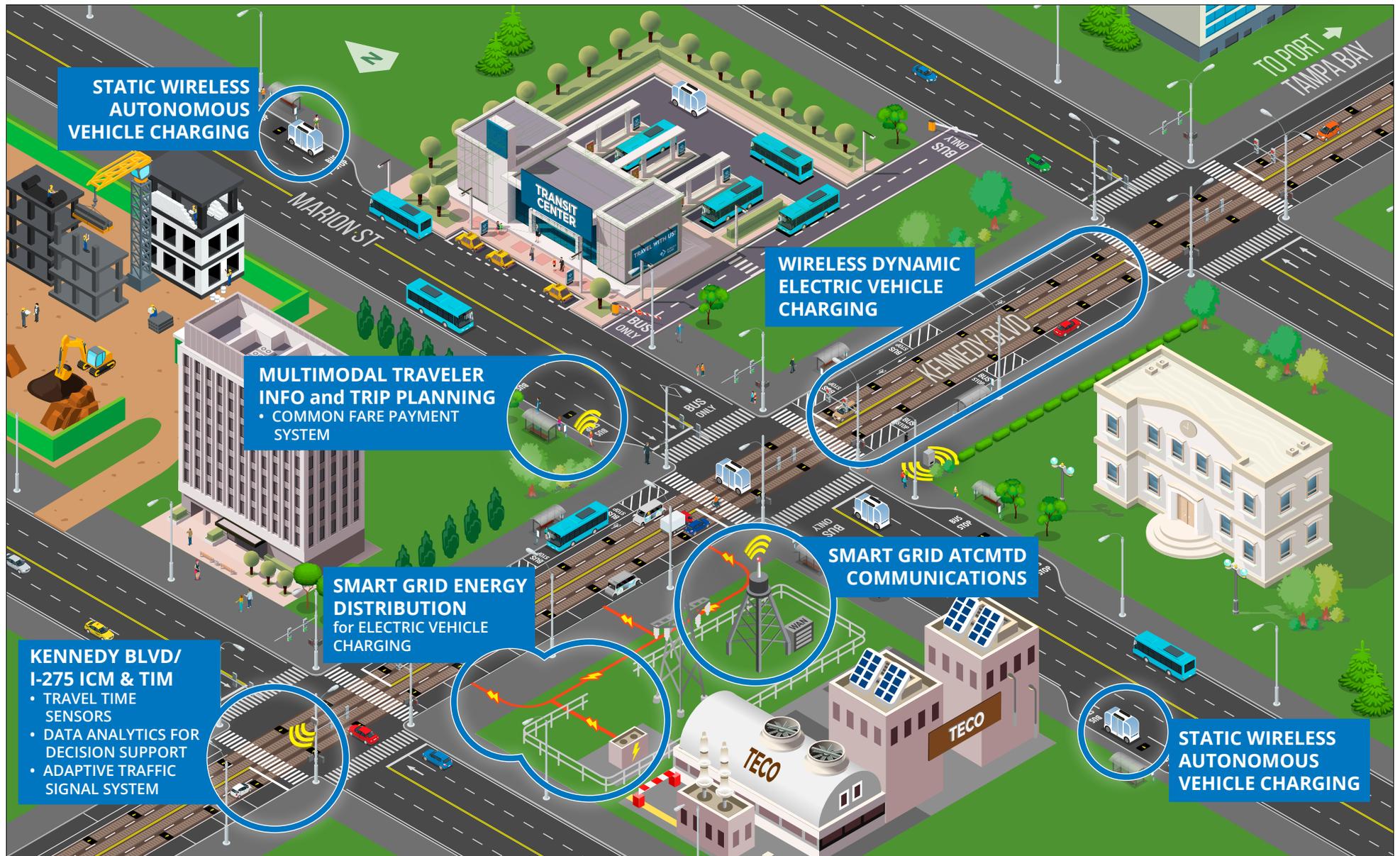
Tampa is susceptible to hurricanes, heavy rains and flooding events.

Figure 2: Tampa ATCMTD Initiative System Elements Conceptual Infographic (Page 1 of 2)



a)	b)	i.	i.1.	i.2.	i.3.	i.4.	i.5.	i.6.	i.7.	i.8.	i.9.	i.10.	i.11.	i.12.	i.13.	i.14.	ii.
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Figure 2: Tampa ATCMTD Initiative System Elements Conceptual Infographic (Page 2 of 2)



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## System Element No. 2: Multimodal Integrated Corridor Management

Kennedy Boulevard (US 60) is a critical east-west link in Tampa's transportation network – a regional route of significance, a hurricane evacuation route, and a natural alternate route to I-275. Kennedy Boulevard connects the region's two major employment centers – downtown Tampa and Westshore District – and links downtown with TIA and major bay-area bridges, and serves as a major route to regional hospitals, schools, Port Tampa Bay, rail stations, retail centers and special event venues shown in **Figure 1**. It is expected that Kennedy Boulevard, a parallel route to I-275, will serve to relieve mobility impacts stemming from roadway incidents and FDOT's NEXT program and its efforts to modernize the interstate system in Tampa. A brief overview of these coming improvements is outlined here: [www.tampabaynext.com/](http://www.tampabaynext.com/).

Kennedy Boulevard is plagued by congestion many hours of the day, impacting vehicle and transit travel times and reliability, pedestrian safety, and emergency response to and from incidents along I-275. System Element No. 2 will use the sensor-based infrastructure of System Element No. 1 to monitor and react to conditions, but it takes the additional step of implementing additional technologies and processes to proactively improve conditions. These additional steps include the following:

- **EVP and TSP:** Tampa will deploy dedicated short-range communications (DSRC) roadside units along Kennedy Boulevard – from downtown to TIA, and along select arterials that connect Kennedy Boulevard with I-275 – to implement EVP and TSP. The City will equip emergency and transit vehicles with corresponding DSRC radios that enable vehicle-to-infrastructure communication required to support EVP and TSP. The City will leverage THEA's on-going CV deployment and its relationships with vendors to cost-effectively and seamlessly expand Tampa's CV infrastructure. This will not only meet the information and data-sharing needs of this system element, it also expands the capabilities of THEA's CV program.
- **Travel Time Calculation and Reporting:** Travel Time Calculation and Reporting: Tampa will deploy Bluetooth sensors along I-275, Kennedy Boulevard and the arterials connecting these facilities. Bluetooth detectors

will be used to generate and disseminate travel times for comparative travel routes along I-275 and Kennedy Boulevard using existing, new or relocated arterial DMS. Comparative travel time information posted on DMS will help drivers to make more informed travel-related decisions while en route, shifting demand in real time between these parallel networks and maximizing the operational efficiency and capacity of both routes.

- **Traffic Signal Analysis and Improvement:** This component upgrades all traffic signal controllers along Kennedy Boulevard to bring them onto the City's existing central system and to establish a common controller platform. This will allow advanced traffic signal system improvements such as adaptive signal control which will improve mobility and progression, especially when incidents along I-275 increase volumes along Kennedy Boulevard. It will also centralize and improve the collection of traffic signal performance data, which will enhance performance evaluation and reporting, and ultimately allow operators to optimize arterial operations.
- **Data Analytics and Machine Learning:** Tampa will implement a software platform at the TMC that maximizes the value of multiple, growing data streams (e.g., CV and smart sensor data). Data will be automatically analyzed to predict when congestion and crashes might occur, and to implement actions to prevent these events and optimize operations. This software as a service platform will serve as a cost-effective decision support tool, saving the City and its residents millions of dollars in insurance-related expenses and lost productivity, and fostering a safer transportation network. In coordination with FDOT's Traffic Operations team, the City will facilitate optimized resource allocation and improved response to critical events potentially reducing transportation-related fatalities and injuries.

## System Element No. 3: Smart Parking

The economic vitality of Tampa's city center and its transportation system relies on parking availability. Citizens require parking for their employment and to conduct business downtown. Visitors are often required to park to attend the dozens of planned events at the convention center, Amalie Arena and many other downtown venues. Vacationers park their vehicles before embarking on



*The many attractions and special event venues that attract travelers unfamiliar with Tampa's downtown makes parking customer service essential.*

their cruises from our port. It is critical that Tampa maintain the highest level of parking customer service. Lack of parking results in additional congestion, reduces driver and pedestrian safety, increases pollution and adversely impacts quality of life for everyone who uses the transportation system.

This includes businesses and government entities that rely on it to generate customer turnover and sales, and collect revenue to support ongoing O&M activities, respectively.

To address these concerns, Tampa will implement

advanced parking technologies such as advanced reservations and payment platforms, license plate readers, electronic message signs and occupancy detection to manage the city's parking supply, improve garage efficiency by reducing vehicle intake times by 300% and to disseminate real-time parking information. This solution collects information such as parking capacity and availability, and applies policies and pricing before publishing it to a myriad of outlets including smart device apps such as Click and Park, Parkmobile, Waze, merchant websites and HART's OneBusAway multimodal traveler information platform.

Smart Parking data and information will encourage effective mode choice, reducing congestion and the resulting negative impacts such as driver stress and distraction, gas consumption and vehicle emissions. Retailers will see more parking turnover, driving growth in retail revenues. Tampa will be able to optimize its parking hours, rates and/or limits, and the ability to do this, combined with analytics that improve enforcement efforts, will help generate new revenue

that can sustain the system element well into the future. Parking patrons would be able to reserve and pay for parking in advance, eliminating the frustration and time associated with finding available parking. Smart Parking also improves garage parking operations, significantly reducing vehicle intake times, which also improves surface street congestion during special events.

#### **System Element No 4: Pedestrian Safety, Mobility and Navigation**

Tampa Bay is the United States' second most dangerous area in which to walk. 2015 was the deadliest year on record for those walking the streets of Hillsborough County. Fifty-one pedestrians were killed in 2015 – a 50 percent increase over the 34 who died in 2014. Despite public awareness campaigns and efforts to add crosswalks and slow traffic, the problem remains.

A challenging aspect for anyone, especially those who are visually impaired and elderly, is navigating through an unfamiliar area on foot looking for a destination. This task is made even more difficult in large crowds particularly those associated with special events. These situations create a serious safety problem for the elderly, people with disabilities and the homeless – one that weighs on the conscience of these individuals every day.

To improve the downtown experience and foster an environment where everyone feels safe to walk, the City of Tampa will implement an impaired/elderly assistance application (IEAA) that helps improve pedestrian mobility. The application, which is part of a larger MMITSS concept that can be used by anyone but is focused on assisting impaired and elderly people, will be concentrated geographically around the Tampa Convention Center and nearby hotels. IEAA is composed of two systems comprise the IEAA: crosswalk assist and indoor navigation.

- **Crosswalk Assist:** This component will assist a pedestrian cross a street at a midblock crosswalk or signalized intersection. As a pedestrian approaches these areas, an application installed on their smartphone will communicate with equipment connected to the traffic signal controller activating a pedestrian call (PED-SIG). Communication between the smartphone application and traffic signal continues until the pedestrian safely crosses the roadway.

An intelligent material solution consists of photonic crystals mixed or embedded within pavement paint and markings will be applied at select locations to guide and align visually impaired pedestrians with sidewalks and crosswalks. This “smart paint” provides light, energy and information that can be applied to transportation networks and used to support a myriad of use cases. For example, smart paint information can be used by the smartphone app or a “smart cane” to provide audible alerts or guidance directing the pedestrian how to remain aligned within the sidewalk or crosswalk. The City is working with Tampa Lighthouse for the Blind to test this concept, and it plans to utilize their partnership to add additional use cases (e.g., bus stop locations) or test this technology for other guidance systems. For example, smart paint could be used to mark important roadway identifiers such as stop bars and mile markers to improve the precision of AV operations.

- **Indoor Navigation:** Pedestrians can use this app to locate key areas within the Tampa Convention Center via a BPS, which is a two-part system that works similarly to a GPS device but overcomes the limitations of GPS technology in indoor environments. The system consists of a computer-hosted BPS indoor application; sensors strategically installed around the convention center; and a smart device app. The BPS system communicates with the app, so as pedestrians enter and traverse the convention center they are seen and can ask for directions. The app then guides them to their destination.

Indoor navigation technology can improve the mobility needs of people with disabilities, but it can also be used by emergency responders to quickly locate people held hostage or otherwise in danger within large buildings. While emergency responders use GPS to locate the buildings where individuals are located, the BPS provides “last mile” connectivity to locate people within the building, shaving off valuable seconds.

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### **System Element No. 5: Transportation System and Smart Grid Communications/Energy Distribution Integration**

The TECO’s smart grid will not support CV or AV applications for the city as these require low-latency, high-bandwidth networks. The TECO smart Grid grid will be used to support Tampa’s weather/environmental sensors, smart lighting

or other sensors to enhance city services, especially in more remote or inaccessible areas where it is not cost-effective to build a wireline or cellular network. Until recently, Tampa had to rely solely on an inefficient, unreliable, century-old energy grid. Today, TECO is updating its energy grid to one that is smart, energy-efficient and reliable. Tampa will capitalize on its more than 120-year P3 with TECO and leverage TECO’s smart grid to achieve the following:

- Better-monitored transportation infrastructure: The Smart Grid will enable two-way communications between centers and devices allowing operators to automatically and quickly detect system anomalies such as pole knock-downs, power outages and light outages.
- Accelerated deployment of TECO’s smart grid and expand City’s Smart City program.
- Monitoring, prediction and alerts for floods from sensors deployed in areas prone to floods.

Our region will soon benefit from the high-speed/low-latency of 5G communications. Verizon Wireless has identified Tampa Bay as a Tier 1 market for 5G voice and data communications. This puts the region ahead of other markets to benefit from communications advances. This may play an important factor in gaining trust for CV/AV applications that require ultra-stable, high-bandwidth communications.

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### **System Element No. 6: Integrated Multimodal Traveler Information and Trip-Planning Platform**

OneBusAway (OBA) is an existing, open-source software platform for real-time transit information implemented by HART, the primary transit service provider for the City of Tampa. OBA was developed to making public transit easier to use, and it has evolved into full-fledged open-source software deployed across the country. HART began using OBA in August 2013, and a research study by Georgia Tech since then showed that the service has positively impacted transit customer satisfaction, safety, reliability and ridership.

Open-source software lets agencies to make a common investment in a set of tools and applications that can be used anywhere, saving the costs incurred when each city must “reinvent the wheel” for similar software and services.

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Each agency can leverage the development efforts of the other agencies; for example, HART deployed a new OBA website, originally designed and implemented in New York, at a fraction of the cost of developing that site from scratch. Additionally, a new issue-reporting feature is being integrated for testing with PSTA as part of a University of South Florida (USF) research project – the results of which will be immediately deployable in other cities. HART and USF both sit on the OBA Board of Directors and are well-positioned to expand the abilities of the mobile apps to include more than just bus arrival information.

Tampa will leverage HART’s OBA platform to develop it into a comprehensive multimodal traveler information and trip-planning platform. Tampa and HART will work together to integrate various data streams, including those included in the Tampa ATCMTD Initiative system elements, to meet the trip-planning needs of all travelers. Travel information will include the following:

- HART bus transit service
- Ride-hailing services
- Bike-sharing services
- Special event shuttles
- Downtowner and AV electric shuttle
- Water taxi
- Van-pooling services
- Car-sharing services
- Parking information
- Incident and congestion information

Not only will OBA be used to provide comprehensive trip-planning information, it will also be leveraged to provide access to the region’s mobile ticketing fare collection system called Flamingo Fares. The integration of OBA and Flamingo

Fares will enhance user experience by allowing customers to access Flamingo fares app via OBA. This will work toward development of a truly universal regional fare payment system.

Providing trip-planning information increases connectivity among modes so that users can plan multimodal trips through a single, user-friendly interface. This information will be displayed on kiosks at mobility hubs around downtown, possibly including HART bus stops. This could enhance public acceptance and use of transit and other multi-occupant and environmentally friendly transportation forms, which supports the City’s goals to reduce congestion, make the transportation system more efficient, and reduce vehicle emissions and fuel consumption.

**System Element No. 7: Automated Transit and Electric Shuttle Vehicle Wireless Power Transfer and Charging**

In fall 2016, Downtowner – a shared mobility service similar to Uber and Lyft – launched in downtown Tampa, giving residents, tourists and commuters another transportation option. The service, which consists of 12 EVs that seat up to five passengers, operates from 6 a.m.-11 p.m. on weekdays and 11 a.m.-11 p.m. on weekends. Users simply use a smartphone app to request a ride anywhere within the 3-mile downtown service area. The service, which is free to users, is funded by the Tampa downtown Partnership, the City of Tampa, and FDOT.

In May 2017, HART, with support from FDOT, released an RFP for an electric AV shuttle to operate along the Marion Street Transitway. FDOT is funding the



Tampa will leverage HART’s OneBusAway platform to develop it into a comprehensive multimodal traveler information and trip-planning platform for all travelers.

shuttle, which is the first of its kind to be deployed in the Tampa Bay region, at \$1 million over two years. The shared-ride service, which will begin in late 2017, will run along a 0.6-mile-long, north-south segment of the Marion Street Transitway in downtown Tampa. The transitway directly connects the multimodal Marion Street Transit Center at the north end of downtown with employment and activity centers located at the southern end. During weekdays, between the hours of 6 a.m. and 6 p.m., the transitway is used exclusively for low-speed buses and emergency vehicles – an excellent environment to test, operate and demonstrate the safety benefits of a low-speed AV shuttle service. HART, by bringing innovative technology to the Tampa Bay area, hopes to diversify its service options to better meet the needs of underserved areas.

The novelty and utility of the AV shuttle will connect new riders to the abundant transit options of the Marion Transit Center, which connects 15 local routes, 12 express routes, a MetroRapid line, the Downtowner and two private intercity bus carriers. In recent years, parking lots near the transit center have been developed, causing transit patrons to use lots located further away. The AV shuttle will overcome the limited parking supply by serving as a “last mile” link between lots located further away and the Marion Transit Center Service, running at consistent 8- to 10-minute headways.

To support and enhance the sustainability of HART’s Marion Street AV and the Downtowner electric shuttle services, the City of Tampa will implement static and dynamic wireless inductive charging at strategic locations along Marion Street, Twiggs Street and Kennedy Boulevard. Wireless charging stations will also be implemented at garages for overnight charging. Wireless charging will enhance the sustainability of both services by reducing dependence on fossil fuels, minimizing ongoing operations and maintenance needs, and eliminating related vehicle emissions. Furthermore, wireless induction pads will be embedded within the street eliminating the need for overhead power supply typical to most streetcar and light rail deployments. The virtually invisible charging infrastructure will maintain the natural aesthetics of our beautiful city and contribute to a vibrant, growing downtown. It will also add to the collective knowledge of sustainable transportation energy solutions being investigated by concurrent projects such as FDOT’s Tampa Bay NEXT project.

“Our mission is to help solve the transportation needs of our area utilizing all transportation modes, while maximizing the use of the funding sources available. We are very excited about this project.”

**PAUL STEINMAN**  
 FDOT DISTRICT SEVEN SECRETARY

Along Marion Street, static wireless charging stations will be situated at the northern and southern ends of the circular route to recharge or “top off” AV shuttle batteries when temporarily stopped. While fully charged batteries will last most of the proposed 12-hour daily service, frequent, albeit brief, recharging of batteries will allow the AV shuttle service to continuously run during its service hours without having to be pulled out of service or batteries swapped out for fresh ones. This not only significantly reduces ongoing operations and maintenance costs, but will also save on costs to purchase additional AV shuttles required to maintain continuity in desired headways.

Along Twiggs Street and Kennedy Boulevard, dynamic wireless charging will automatically recharge downtown EVs while in motion. Due to Twiggs Street and Kennedy Boulevard’s location within the Downtowner service area (i.e., downtown Tampa), the dynamic wireless charging segment will act as a means to frequently recharge batteries when traveling between various points within downtown.

**i.6. DEPLOYMENT PLAN**

Our Deployment Plan is a three-pronged approach to O&M as described below.

**Leverage Agency Investment, Partnerships and Lessons Learned**

The City will leverage ongoing projects led or financed by our partners. The THEA CV project is one, but ongoing projects led by TECO and HART are others. For example, the smart LED lighting of System Element No. 1 is a TECO-owned asset and O&M costs will therefore continue to be funded by TECO.

a)	b)	i.	i.1.	i.2.	i.3.	i.4.	i.5.	i.6.	i.7.	i.8.	i.9.	i.10.	i.11.	i.12.	i.13.	i.14.	ii.
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Similarly, the OneBusAway traveler information software proposed in System Element No. 6 is owned and maintained by HART. The City also has a traffic signal maintenance agreement with the Florida Department of Transportation whereby it is reimbursed for a higher amount of the cost of signal O&M where advanced technology platforms like CVs and advanced traffic management systems (ATMS) are integrated. O&M issues likely to arise from CV deployments may be successfully mitigated using lessons learned from the THEA CV program. Overall, it is easier, less costly, more effective and less risky to integrate ATCMTD system elements with ongoing deployments rather than starting from scratch. Also, having multiple agencies bear the O&M responsibilities (each one experts in their respective subsystems) for proposed projects will translate into better agency outcomes.

**Leverage Private Investment and Partnerships**

The City will begin a shift in its O&M philosophy from being both an infrastructure and information service provider to becoming mostly an infrastructure provider. The City will collect and share information with private entities to leverage their existing platforms. Today, innovation and transportation data are driving private companies such as Waze and WayCare to deliver efficiencies that are difficult to match. This new, innovative approach will reduce risk, improve technology lifecycle outcomes, and spur private-sector innovation and jobs.

**Implement Smart Sustainable Infrastructure**

Our O&M Plan leverages technologies that will improve O&M activities and reduce ongoing costs. For example, HART’s OneBusAway platform is built from open-source software, allowing the agency to financially benefit from the development efforts of other agencies. This reduces the cost to maintain the system and to implement new functionality. Similarly, TECO’s smart LED lighting and smart grid incorporates functionality that allows these systems to self-report issues, which in turn reduces the time and effort needed perform preventative and responsive maintenance.

In FY17, Tampa began including Smart City initiatives in its transportation budget to support ongoing deployments.

**i.7. DEPLOYMENT CHALLENGES and OBSTACLES**

Tampa leads the nation in research, development and adoption of innovative transportation technologies. Having real-world experience in deploying CVs, we have encountered several regulatory, legislative and institutional issues and have learned how to address these challenges. In fact, Florida offers one of the most – if not *the* most – friendly regulatory environments in the country for ATMS technologies including CVs and AVs. Over the past five years, the state Legislature passed four separate acts of legislation supporting CV/AV research and deployment. House Bill 7027, which passed by unanimous 118-0 vote on April 4, 2016, became the nation’s first piece of legislation legalizing fully autonomous vehicles on public roads without a driver behind the wheel. These legislative actions put us steps ahead when addressing potential challenges to deployment, positioning Florida as a leader in innovation.

Locally, agency and department budgets are already constrained, and the addition of new, innovative devices will only put additional demands on staff time and resources. Our O&M plan, as outlined in **Section i.6**, reduces deployment risks by leveraging the existing investments that HART, TECO and THEA have made locally, which will deliver greater return on investment. However, we must remain cognizant of staff knowledge, skills and abilities. Our proposed budget sets aside the resources needed to train individuals so they can operate advance systems effectively.

New state legislation will assist the City in programming its projects and allocating necessary funding to support capital, O&M costs associated with ITS projects. Legislation now requires MPOs to accommodate advances in vehicle technology when developing long-range transportation plans. This assures the City and its partners that ITS projects, including CV and AV projects, will not be overlooked, and it places these projects on a comparable level with more traditional transportation improvements.

Lastly, Tampa is limited in its ability to raise the cost of parking and has a strict no-tow policy. Components such as improved monitoring and Smart Parking will improve parking enforcement efforts to generate turnover and revenues to sustain the program.

<b>a)</b>	<b>b)</b>	<b>i.</b>	i.1.	i.2.	i.3.	i.4.	i.5.	i.6.	<b>i.7.</b>	i.8.	i.9.	i.10.	i.11.	i.12.	i.13.	i.14.	<b>ii.</b>
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## i.8. QUANTIFIABLE SYSTEM PERFORMANCE IMPROVEMENTS

The Tampa ATCMTD Initiative's system elements are expected to substantially improve mobility, safety, environmental concerns, and operational efficiency.

The City of Tampa is committed to a comprehensive evaluation of the benefits and costs of each of the seven system elements. To this extent and to guarantee objectiveness, the City of Tampa will engage the Center for Urban Transportation Research (CUTR) at USF. CUTR is a federally designated University Transportation Center since 1991, and it is recognized nationally for its transportation expertise and objective research. CUTR currently leads performance measurement evaluation efforts for THEA's CV Pilot Program, which is funded by USDOT.

During implementation and immediately thereafter, the synergistic deployment of all proposed system elements is expected to generate sizeable positive impacts on users' mobility and safety. For example, EVP on the I-275/Kennedy Boulevard corridor will lead to faster traffic incident response times and correspondingly reduced incident durations and delay, and improve motorist and responder safety. Implementation of Smart Parking and associated real-time information technologies will mitigate downtown congestion and vehicle-pedestrian conflicts resulting from visitors "circling" in search of available parking. Real-time information will also help balance parking occupancy at underutilized parking facilities. Tampa's significant pedestrian safety challenges will be improved by expanded CV-based pedestrian-crossing technologies and innovative smart paint. Improved traffic signal operations and corresponding traffic flows as well as greater penetration of EV modes and wireless charging will decrease exposure to emissions and improve the environmental conditions of those households living nearby congested arterials. Improved traffic and reduced reliance on fossil fuels means less tailpipe emissions to nearby residences and lower exposure to harmful pollutants. Finally, an open-source trip-planning and fare payment system will make it easier for all people to efficiently use available modes.

Long-term mobility, safety and overall reliability improvements generated by the system elements will positively affect livability. Reduced transportation costs are likely to benefit lower-income households and improve the housing-transportation cost balance, influencing relocations and increasing business

### PERFORMANCE METRICS to BENEFIT

Benefits will be compared with infrastructure and operating cost by performing lifecycle return-on-investment and cost-benefit analyses to inform the public and stakeholders. This will also provide Congress and the USDOT with real data to influence future decision-making. Immediate and long-term benefits are expected in performance metrics including:

- Enhanced mobility
- Increased safety
- Public perception
- Increased ridership
- Improved return on investment
- Reduced impact to the environment
- Modal shift

activity for the City and the region. To measure progress, Tampa will track changes in residential and business location patterns to measure improvements within the project area.

## i.9. QUANTIFIABLE SAFETY, MOBILITY and ENVIRONMENTAL BENEFIT PROJECTIONS

Using USDOT-vetted evaluation methods, Tampa will implement a publicly accessible, dashboard view of data to quantify, assess and report on safety, mobility, environmental, livability and efficiency performance measures. Tampa will build upon existing studies and lead demonstration of new innovative applications such as CVs and pedestrian mobility. **Table 1** shows the quantifiable benefits from the USDOT/JPO Benefits/Cost database that lend support for Tampa's ATCMTD Initiative system elements. The benefits of the Tampa ATCMTD Initiative system elements are projected to be consistent with those in **Table 1** reported from other entities.

## i.10. VISION, GOALS and OBJECTIVES

Tampa's ATCMTD vision is to further maximize the safety, efficiency, reliability and overall performance of the multimodal transportation system through public and private partnerships and interconnected, sustainable technologies including sensor-based infrastructure and open-source platforms.

**Table 1: Tampa ATCMTD Initiative Quantifiable Safety, Mobility and Environmental Benefits**

SYSTEM ELEMENT	CATEGORY	QUANTIFIABLE PROJECTION (FROM USDOT/JPO BENEFIT/COST DATABASE)
ICM	Environmental/ Mobility	ICM strategy for the I-95/I-395 corridor in Virginia has the potential to reduce fuel consumption by 33-34% and average travel times by 48-58%
ICM	Mobility	Deploying ATMS technologies and an ICM approach decreased congestion and improved traffic flow within an 8-mile corridor south of the Twin Cities in Minnesota that encouraged 58% of motorists surveyed to use arterial streets for short trips rather than I-494
ICM	Mobility	Adaptive signal control technology reduces travel time, delays, and stops with savings ranging between \$88,000-\$757,000 per year.
ICM	Mobility	ICM strategies that promote integration among freeways, arterials and transit systems can help balance traffic flow and enhance corridor performance; simulation models indicate benefit-to-cost ratios for combined strategies range from 7:1 to 25:1
ICM	Environmental	Fuel consumption fell by 5.7 percent, hydrocarbons declined by 3.7 percent, and carbon monoxide emissions were reduced by 5.0 percent when an adaptive signal control system was implemented in Toronto, Canada.
	Safety	A radio-based, GPS EVP system reduced the average response times by 5 to 7 minutes on a busy corridor
ICM	Safety/Mobility	An EVP system in Houston reduced emergency vehicle travel time by 16-23%
ICM	Safety/Mobility	Incident scene guidance and alerts through CV-applications can potentially reduce network delay up to 14%
Smart Parking	Mobility	In St. Paul, Minn., an advanced parking management system reduced travel times by 9%
Smart Parking	Mobility	San Francisco-based tool makes parking more efficient by decreasing parking spot search time by 43%
Smart Parking	Mobility	At Baltimore/Washington International Airport, 81% of surveyed travelers agreed that the advanced parking management system made parking easier compared with other airports' parking systems
Smart Parking	Mobility	In European cities, advanced parking information systems have reduced traffic volumes related to parking space searches up to 25%.
Pedestrian Navigation	Safety	Automated detection reduced vehicle-pedestrian conflicts reduced in three U.S. cities by 89% (first half of crossing) and 43% (second half)
Pedestrian Navigation	Safety	23% of pedestrians reported that a crosswalk transit vehicle turn-warning system helped them avoid a collision with a bus
Pedestrian Navigation	Safety	CV warning systems and autonomous emergency braking can reduce fatalities by 57%
Smart Grid	Environmental	Electric vehicles can save 50-85% in fueling costs per year
Multimodal Information	Mobility	40% of surveyed travelers who used a multimodal trip-planning website decided to try at least one transit service that they do not normally use
Multimodal Information	Mobility	A study found that drivers using traveler info arrived at their destinations within 15 minutes of their targets 79% of the time (42% without traveler info)
Multimodal Information	Environmental	A model in Boston indicated that changes in travel behavior due to better traveler information would result in a 25% reduction in volatile organic compounds, a 1.5% decline in nitrous oxide (N <sub>2</sub> O), and a 33% decrease in carbon monoxide (CO <sub>2</sub> ).
Multimodal Information	Environmental	A personalized travel-planning system helps commuters choose environmentally friendly options; reduces CO <sub>2</sub> emissions by 20%

<b>a)</b>	<b>b)</b>	<b>i.</b>	i.1.	i.2.	i.3.	i.4.	i.5.	i.6.	i.7.	i.8.	i.9.	i.10.	i.11.	i.12.	i.13.	i.14.	<b>ii.</b>
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GOALS	OBJECTIVES
<b>Goal A: Enhance Safety and Security</b>	<ul style="list-style-type: none"> <li>• Improve response time of emergency responders</li> <li>• Enhance visual monitoring capabilities on streets</li> <li>• Warn the public of street flooding</li> <li>• Reduce vehicle-pedestrian conflicts</li> </ul>
<b>Goal B: Increase Mobility and Accessibility</b>	<ul style="list-style-type: none"> <li>• Integrate and enhance multimodal operations of I-275 and Kennedy Boulevard</li> <li>• Enhance Kennedy Boulevard traffic signal efficiency</li> <li>• Enable bus transit priority at traffic signals</li> <li>• Collect real-time parking availability data</li> <li>• Enhance mobility for impaired/elderly pedestrians</li> </ul>
<b>Goal C: Enhance Transportation System Efficiency and Sustainability</b>	<ul style="list-style-type: none"> <li>• Deploy sustainable, cost-efficient smart infrastructure</li> <li>• Leverage and expand TECO's smart grid</li> </ul>
<b>Goal D: Enhance Multimodal Traveler Information</b>	<ul style="list-style-type: none"> <li>• Provide real-time parking availability information</li> <li>• Enhance real-time info for transit and bike- and car-sharing</li> <li>• Deploy sensor-based infrastructure as a foundation for an open-data platform for transportation info</li> </ul>
<b>Goal E: Maximize Return on Investment and Minimize Risk</b>	<ul style="list-style-type: none"> <li>• Leverage existing transportation investment</li> <li>• Expand USDOT/THEA CV Pilot Program</li> <li>• Minimize risk by leveraging existing, committed resources for operations and maintenance</li> </ul>
<b>Goal F: Build on Established Partnerships for Regional Transportation Improvements</b>	<ul style="list-style-type: none"> <li>• Minimize risk and ensure successful outcome – partners have been working together for decades</li> <li>• Foster an environment for new P3 opportunities</li> </ul>

### i.11. PARTNERING PLAN

Tampa has assembled an impressive team of public, private and academic partners who have a long history of working together (see graphic at right) and who therefore are uniquely positioned to guide development and

implementation of Tampa's seven system elements. The City will leverage its existing partnership with THEA and the various stakeholders that have been involved in the USDOT CV pilot program. These relationships and others that will be identified early in this project will help Tampa bring new technology to the marketplace that solves real-world problems and creates a safer, more mobile, smarter and environmentally friendly downtown – a downtown that will in turn improve quality of life, prosperity and opportunities for everyone.

A full listing of Tampa's partners, their roles/contributions and applicable key staff is found in **Table 3**. Commitment letters from each partner are found in Volume 2.

### TAMPA'S ATCMTD INITIATIVE PUBLIC-PRIVATE PARTNERSHIPS

PRIVATE			
AARP	Google/Waze	Pirate Water Taxi	TECO
Ayyeka	Intelligent Materials Solutions	Siemens	THEA
Coast Bike Share	Ohio State University	Strategic Property Partners	Traffic Technology Services
CUTR	Parking Sense	Tampa Community Redevelopment Agency	TrafficCast
Downtowner	Parkmobile	Tampa Lighthouse for the Blind	University of Arizona
Econolite	Ohio State University	Tampa West Shore Alliance	University of South Florida
GE	Parking Sense	Tampa Downtown Partnership	Zipcar
Georgia Tech/One Bus Away	Parkmobile		WayCare
PUBLIC			
City of Tampa	City of Tampa Parking Division	FDOT Central Office	Hillsborough MPO
City of Tampa CRA	City of Tampa Police Department	FDOT District 7	TBARTA
City of Tampa Fire and Rescue		HART	

## i.12. PLAN to LEVERAGE and OPTIMIZE EXISTING TRANSPORTATION TECHNOLOGY INVESTMENTS

Downtown Tampa is a hub of mobility options that can be better integrated to move people and goods more efficiently and effectively – linking people to jobs, shopping, events and other modes.

HART currently operates the diverse public transportation system, which includes public, paratransit, and a street car that runs between Ybor City historic district and downtown. In late 2017, HART will expand upon these modes with an shared ride AV shuttle service along Marion Street that will serve as a “last-mile” link to the Marion Street Transit Center. TIA and Port Tampa Bay, located on the western and eastern extents, respectively, of the roughly 8-mile-long ATCMTD Initiative project area are linked by HART bus Route 30 as well as the I-275/Kennedy Boulevard (US 60) integrated corridor.

TIA is the primary provider for commercial passenger airline service in the region, and the Port of Tampa Bay handles about 900,000 passengers a year.



*Coast Bike Share has 30 rental bike hubs in or near downtown Tampa.*

Cutting across these two facilities is the Hillsborough River, home to Tampa’s water taxi, a shuttle service connecting the Tampa Convention Center, special event venues, hotels, and places of employment within downtown. The Uceta Rail Yard on Tampa’s east side serves CSX Transportation as a storage and intermodal freight transport facility. Tampa’s intercity passenger rail service is based at Tampa Union Station, adjacent to downtown between the Channel District and Ybor City.

Tampa also offers the latest ride-hailing/-sharing systems such as Uber, Lyft, Zipcar and the free Downtowner EV shuttle. Additionally,



*ChargePoint electric vehicle charging station.*

a bike-sharing program called Coast Bike Share offers about 300 rental bikes distributed at 30 hubs in or near downtown.

TECO is investing millions of dollars and human resources in new energy technologies that support its smart grid evolution. Limited transportation by privately operated neighborhood EVs is available, primarily in downtown Tampa and Ybor City. Also, the City has installed 10 ChargePoint EV charging stations at eight parking facilities downtown. Expansion of TECO’s smart grid will support communications with sensors and ITS field elements. The smart grid will power EV and AV batteries associated with the Downtowner EV and Marion Street AV shuttle services.

Tampa will leverage the existing transportation network with new technologies that capture, analyze and disseminate relevant information. For example, Tampa will combine open-source software such as HART’s OneBusAway traveler information platform and arterial DMS, kiosks, the THEA’s USDOT CV Pilot Program and smartphones to disseminate information at times and locations where people need it most.

Tampa has worked with key providers to install free wi-fi throughout the city, which can be integrated with smart lighting sensors, expanding the reach of free publicly accessible information. We are also working with industry

**Figure 3: Tampa ATCMTD Initiative Schedule**

TASKS	TAMPA ATCMTD PHASE 1				TAMPA ATCMTD PHASE 2				TAMPA ATCMTD PHASE 3			
	YEAR 1		YEAR 2		YEAR 3		YEAR 4					
	1	2	3	4	1	2	3	4	1	2	3	4
Program Management (including FHWA reporting)	█				█				█			
Outreach, Awareness and Promotion of Benefits	█				█				█			
Regional, Project ITS Architecture and CVRIA	█		█		█		█		█			
Needs Refinement	█		█		█				█			
Concept Refinement	█		█		█		█		█			
Systems Engineering Management Planning	█		█		█				█			
Concept of Operations	█		█		█				█			
Systems Requirements	█		█		█		█		█			
High Level Design	█		█		█		█		█			
Detailed Design	█		█		█		█		█			
Performance Measurement Plan	█				█				█			
Before Data Collection	█				█				█			
After Data Collection	█				█				█			
Reporting	█				█				█			
Implementation/Technology Deployment	█				█				█			
System Integration, Testing and Acceptance	█				█				█			
Traffic Incident Management, Signal System Timing, Training and Other Operational Planning/Procedures	█				█				█			
Ongoing Operations and Maintenance	█				█				█			

partners like Verizon Wireless, who are working to make Tampa one of the first cities in the nation to benefit from ultra-high-speed, low-latency data and voice communications.

**i.13. SCHEDULE**

Tampa’s ATCMTD schedule was developed based on our experience with large-scale ITS deployments. Our schedule represents the time needed to conduct systems engineering activities for these types of projects. In reality, each of Tampa’s seven system elements will be developed on concurrent but

unique paths; the integration of multimodal information in HART’s open-source OneBusAway platform is not expected to take as long as, for example, deploying all subsystems to support the ICM system element, but it is in part dependent on the data collected by these subsystems.

Tampa’s schedule calls for all project activities (excepting O&M), to be completed – and corresponding Section 508-compliant deliverables submitted – within four years of contract execution. As shown in **Figure 3**, most project activities will be sufficiently complete within three years of contract execution, leaving about

**Table 2: Mapping Tampa's System Elements to USDOT ATCMTD Goal Areas**

USDOT ATCMTD GOAL AREA	TAMPA ATCMTD INITIATIVE SYSTEM ELEMENTS							
	Intelligent Sensor-Based Infrastructure	Multimodal Integrated Corridor Management	Smart Parking	Pedestrian Safety, Mobility and Navigation	Smart Grid Communications and Energy Distribution Integration	Integrated Multimodal Traveler Information and Trip-Planning Platform	Automated Transit and Electric Shuttle Vehicle Wireless Power Transfer and Charging	
Improve Infrastructure Return on Investment/Reduce Costs	●	●	○	○	●	○	●	
Improve Environmental Impacts/Streamline Traffic flow	●	●	○	-	●	●	●	
Measure/Improve System Performance	●	●	●	○	●	○	○	
Reduce Crashes/Improve Safety	●	●	○	●	-	-	○	
Improve Collection/Dissemination/ Access to Traveler Information	●	●	●	●	○	●	-	
Infrastructure Monitoring/Ensure a State of Good Repair	●	●	●	-	●	-	○	
Improve Economic Benefits/Efficient Movement	●	●	○	●	●	●	●	
Accelerate Deployment of V2V, V2I, V2P/AV Technologies	●	●	-	●	●	○	●	
Integration of Advanced Technologies into TSM&O	●	●	●	○	●	○	●	
Reproducibility of Systems/Services and Knowledge Transfer	●	●	●	●	●	●	●	

● Directly Applies ○ Indirectly Applies

two years for operations within the “real world” from which lessons learned and observations can be shared with USDOT and others. If selected, Tampa will consult with USDOT to develop a detailed scope of services and schedule showing the approximate delivery dates for all project deliverables.

**i.14. DOT ITS INITIATIVES**

USDOT’s mission is to research, develop, and test innovative technologies and provide technical assistance and support to agencies seeking to implement them. USDOT’s current ITS program described in ITS Strategic Plan, 2015-2019. Tampa’s ATCMTD initiative is based on local and regional transportation

needs and is focused on deploying market-ready technologies that align with and support programs outlined in USDOT’s ITS plan. Specially, our initiative supports USDOT’s efforts associated with CVs, emerging capabilities, enterprise data, interoperability and accelerating deployment.

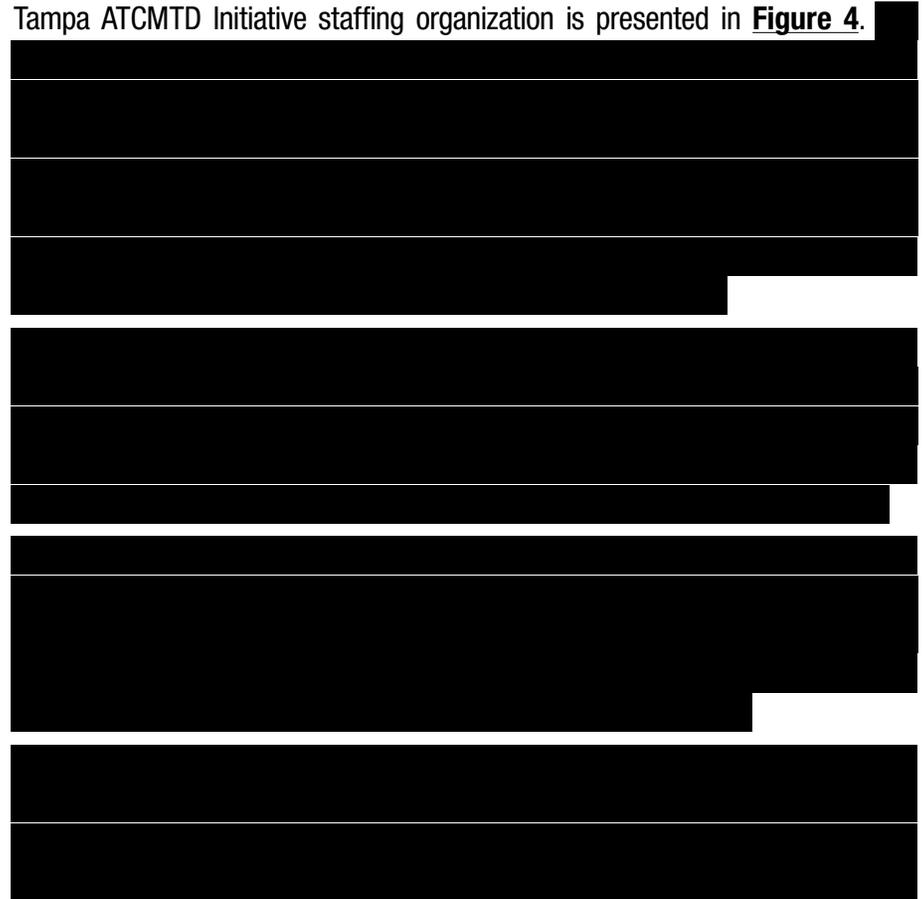
- **CVs:** Serving as one of three USDOT CV Pilot Program locations, Tampa offers significant opportunity to research and test CV technology. Lessons learned from the ongoing CV program may be used to address questions such as “How can local agencies harness and leverage CV data, technologies and applications to effectively and efficiently achieve regional goals?”

a)	b)	i.	i.1.	i.2.	i.3.	i.4.	i.5.	i.6.	i.7.	i.8.	i.9.	i.10.	i.11.	i.12.	i.13.	i.14.	ii.
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- **Emerging Capabilities:** As domestic ITS programs continue to evolve, new technologies and capabilities will emerge, leading to new operational concepts. Tampa’s ATCMTD initiative will demonstrate how these concepts can transform typical business processes. For example, the City has partnered with multiple companies to better leverage innovation typically driven by the private sector.
- **Enterprise Data:** Smart infrastructure and sensors proposed in Tampa’s ATCMTD initiative will collect additional volumes of data that can be aggregated, stored, shared and fused with other platforms to maximize its potential value. Data, in part, will be utilized a by open-source applications such as HART’s OneBusAway application, to develop a comprehensive, singular platform of multimodal trip-planning and traveler information. The City envisions that software from USDOT’s Open Source Application Data Portal (OSADP) can also be leveraged to improve the cost effectiveness of providing traveler information. The City will integrate data streams into a machine-learning platform to anticipate when events will occur and to suggest options to address them.
- **Interoperability:** Interoperability is essential for effective connectivity among devices and systems, especially with regard to complex CV deployments. Tampa’s ATCMTD Initiative leverages our legacy P3 with TECO to ensure that the communications infrastructure is in place to meet the increasing communications and connectively demands of ATMS technologies. Our initiative will leverage TECO’s ongoing effort to build out the regional smart grid to connect, monitor and effectively manage intelligent infrastructure. This will enable two-way communications between devices brought onto the smart grid allowing operators to more quickly detect system anomalies such as pole knockdowns and light outages.
- **Accelerating Deployment:** This grant will help complete TECO’s smart grid, and Tampa’s CV program combined with the grant will help smoothly transition the CV program from initial adoption to widespread deployment. It will also help power Tampa’s system elements and will power recharging of the Downtowner EV and Marion Street AV shuttles.

## ii. STAFFING DESCRIPTION

Tampa ATCMTD Initiative staffing organization is presented in **Figure 4.**



### PRIMARY POINT OF CONTACT

**Vik Bhide**

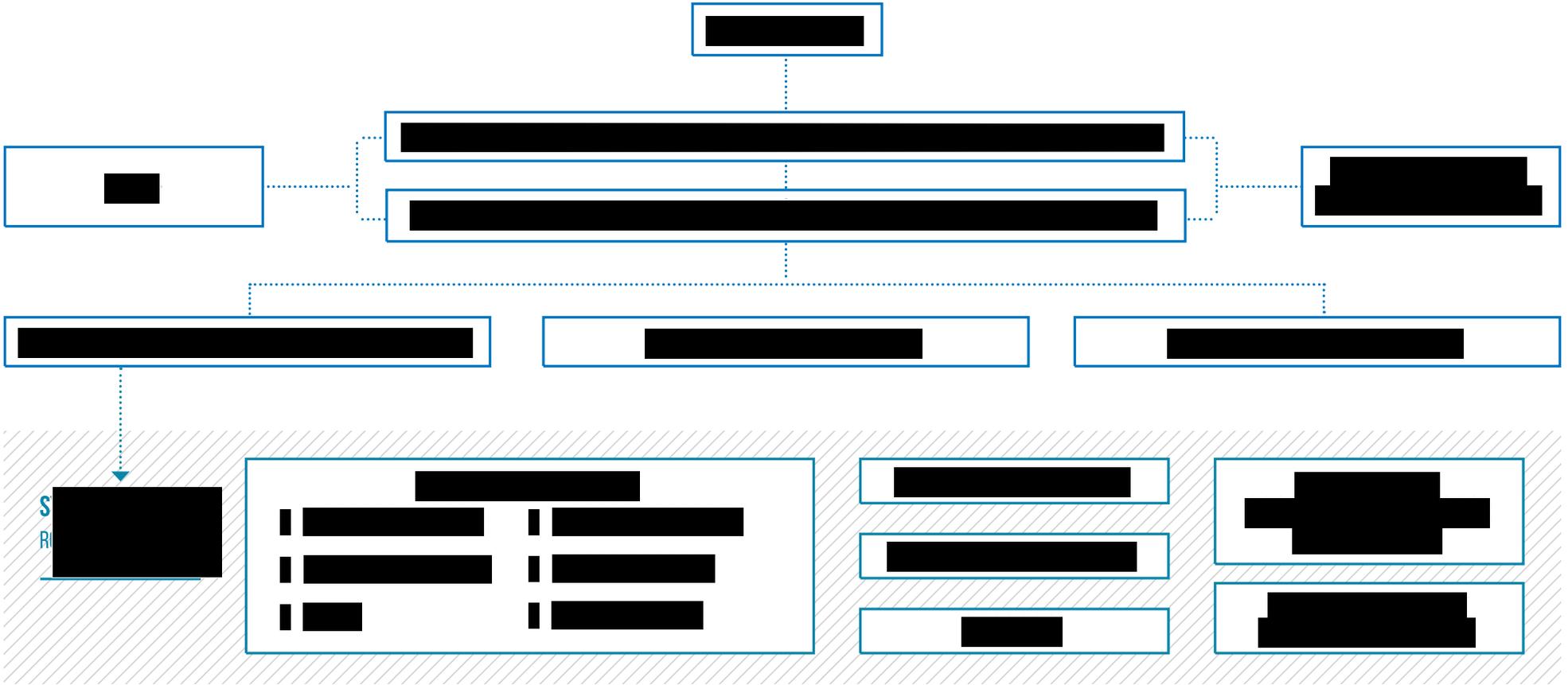
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[REDACTED]







# RESUMES

<b>a)</b>	<b>b)</b>	<b>i.</b>	i.1.	i.2.	i.3.	i.4.	i.5.	i.6.	i.7.	i.8.	i.9.	i.10.	i.11.	i.12.	i.13.	i.14.	<b>ii.</b>
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