

# BEYOND TRAFFIC

## SMART CITY CHALLENGE



ACCESS • CHOICE • OPPORTUNITY



## ACT I

### MEANWHILE IN CHARLOTTE 2016...

#### ANITA

Anita looked down at the piece of paper partially crumpled in her hand.

- #2I to Trade & Tryon (7:04am - 7:18am, 14 min.)
- Wait time at Transit Center (42 min.)
- #II to U. City & John Kirk (8:00am - 8:42am, 42 min.)

She had written out these directions last night after walking to the library to use their free Wi-Fi.

Once settled on her first bus, Anita started perusing the textbook for her Paralegal Certificate course at UNC Charlotte. Everyone told her that education would help her get out of poverty, but she was finding it hard to even get out of Druid Hills and over to the University area. The upcoming Blue Line Extension would drop her off right on campus. ***But how is the Blue Line Extension going to help me if I can't even get to it?***

#### TONY

When a green tech startup in Charlotte offered Tony a job, he immediately packed up and moved all the way from Portland, OR. The city was completely unfamiliar, but his bicycle was an old friend, so he decided to bike to his first day of work.

The ride was harrowing. Tony wove through congested lanes of honking cars and trucks and buses before arriving at the office visibly frazzled. Not exactly the first impression he was going for.

That night, he was supposed to meet up with new friends over in the Coulwood neighborhood. Biking was off the table, so he pulled out his phone to look up bus schedules, light rail routes, and Uber availability. He grew frustrated trying to figure out which buses went where and it wasn't clear how to buy a ticket. Uber was on surge pricing. ***I guess I'll have to drive. So much for green commuting.***

#### JOE AND SARAH

Joe took another swig of 5-Hour Energy. He'd left this morning at 4:15 with a load bound towards Charlotte, but the traffic on I-77 extended as far as he could see.

He reluctantly reached for his iPhone, on which his very stressed-out dispatcher was calling yet again. "Are you almost there?" Sarah asked. No pleasantries.

It was 4:56 pm. The customer closed their docks around 5:00, but maybe if he arrived soon, they would still receive the load. Either way, he would have to pull off the road as soon as his 11-hour limit hit.

Meanwhile, Sarah sat in her office staring at the map littered with digital truck emblems. None of them seemed to be moving. Congestion in urban areas across America made it shockingly difficult for her to get trucks from points A to B, and the number of accidents has slowed down the trucks and decreased the bottom line even more. She thought she might get a promotion this year, but the way things were going for her company, she would be lucky to stick around at all. ***I hope he gets there in time.***



Cyclist navigating a busy street

## ACT II

### INTRODUCTION

Charlotte is one of the fastest growing cities in the nation, and this growth is expected to accelerate over the next few decades. There are 731,424 people living in Charlotte (2010 census), with 2,457 persons/mile, and an urbanized area population percentage of 59%. Approximately 400,000 new residents will call Charlotte their home in the next 25 years. This level of growth offers enormous opportunity for our community but will also challenge our infrastructure, environment, and quality of life.

How might we provide our existing and future residents with more transportation choices and quality access to jobs, all while maintaining a competitive edge in the global economy?

The Smart City Challenge couldn't have come at a better time for our city as we grapple with growth challenges that are virtually unprecedented. From Anita's need for more convenient access to transit (and the Internet), to Tony's desire to drive less in order to exemplify his environmental priorities, to Joe and Sarah's concerns about reliable transport times

and their small company's economic viability, their issues are woven together as they try to navigate their lives in Charlotte.

We believe the Smart City Challenge will help us in addressing some of the key challenges we are facing:

- First mile / last mile connection
- Digital exclusion
- Equitable access to opportunities
- Safety
- Navigating transportation options
- Environmental issues exacerbated by congestion
- Productivity loss / decreased quality of life due to congestion
- Distracted driving

Like many other southeastern cities, Charlotte needs to improve the economic mobility of lower income residents. A recent study by University of California – Berkeley and Harvard University identified the Charlotte area as ranking 50th out of the 50 largest urban areas in its residents' ability to achieve economic mobility into an income level above the one in which they were born. While many



*City of Charlotte skyline*

factors play into addressing this alarming reality in Charlotte, shortening commute times and providing access to affordable transportation are both identified as key indicators necessary to increase economic opportunity.

Our Smart City Challenge action items included in this proposal will help us create more inclusive neighborhoods, improve transportation choices, and help our residents achieve increased upward economic mobility. That is why our Smart City Challenge proposal focuses so strongly on access, choice, and opportunity for all residents. Ultimately, it is about the people who live and work here. People like Anita, Tony, Joe, and Sarah and the thousands of existing and future residents who call Charlotte their home.

The Smart City Challenge funding, combined with Charlotte's commitment to transportation choices, the environment, a maturing transit system, our track record of getting things done, our public and private sector partnerships, and our rapid growth are a recipe for success and opportunity.

## CHARLOTTE'S SMART CITY VISION

The only thing we can be sure about the future is that Charlotte is committed to leading the way. Smart cities are not only about the utilization of data and technology, they are, more importantly, about community and people. To Charlotte, a smart city is a platform on which we connect people, places and things. It is an ecosystem where collaboration, cooperation, and communication build on a data and technology platform to improve the quality of life of all its citizens that results in making them safer, enhancing their mobility options, and addressing climate change. Charlotte has already begun to build a smarter city and is seeing tangible results through programs like Envision Charlotte, the Greater Charlotte Smart City Cabinet, and the Digital Inclusion Task Force.

We realize, however, that we have just scratched the surface and the possibilities are limitless, but not without obstacles that must be identified and

overcome. USDOT's Smart City Challenge provides Charlotte and its partners the opportunity to build upon what we have already established and develop and implement a vision that will enable us to create Charlotte's Urban Mobility Ecosystem. As part of the application process, Charlotte engaged in a process with over 50 public and private partners to identify our transportation challenges and the needs of our citizens and businesses, and to determine which technologies, strategies, applications and institutional arrangements hold the most promise. Bringing together partners from various industries, universities and firms, Charlotte hosted a three-day human-centered design workshop to evaluate how we might:

- ...increase economic opportunities through mobility choices

- ...collect, analyze, and use big data

- ...utilize or build upon existing resources, relationships, and partnerships

- ...better move goods in, around, and through our region

- ...continue to implement transportation infrastructure and land use policies to provide choices to move and live differently.

### **Did You Know?**

#### HUMAN-CENTERED DESIGN WORKSHOP

Our commitment and the dedication of our partners were demonstrated during our recent three-day human-centered design workshop. The workshop focused on identifying ideas that united the Smart City Challenge criteria with the city's existing vision and priorities. The workshop assembled more than 50 people from a variety of public, private, academic, and non-profit organizations. The participants engaged in human-centered design exercises, such as empathy building and rapid prototyping. The collaborative group built upon each other's concepts while keeping the needs, wants, and constraints of our citizens at the forefront.

Out of this process emerged the vision described in the following pages, which outlines our evolutionary steps to integrate data and technology into the management and operations of our City while examining the technical, policy and institutional mechanisms needed to make these steps become reality. Most importantly, in conjunction with our partners, we will be able to demonstrate, quantify and evaluate the impact of our vision and assess its reproducibility and transferability to other cities facing similar challenges and to improve the lives of Anita, Tony, Joe and Sarah. Specifically our community's vision will be told through,

1. **Connecting Community:** Using the OneConnect Charlotte mobility interface and analytics platform for payment and trip planning through digital inclusion methodologies (page 6).
2. **Moving People:** Solving the first and last mile challenge through deployment of dedicated infrastructure for autonomous vehicles, electric vehicles, and coordination with a shared economy (page 11).
3. **Transporting Things:** Implementing a freight priority system that includes vehicle to infrastructure technology and priority signalization (page 16).

The proposed geographic areas for these three vision initiatives are shown in the map on the next page. Each vision initiative will make a positive impact on safety, mobility, and climate change.

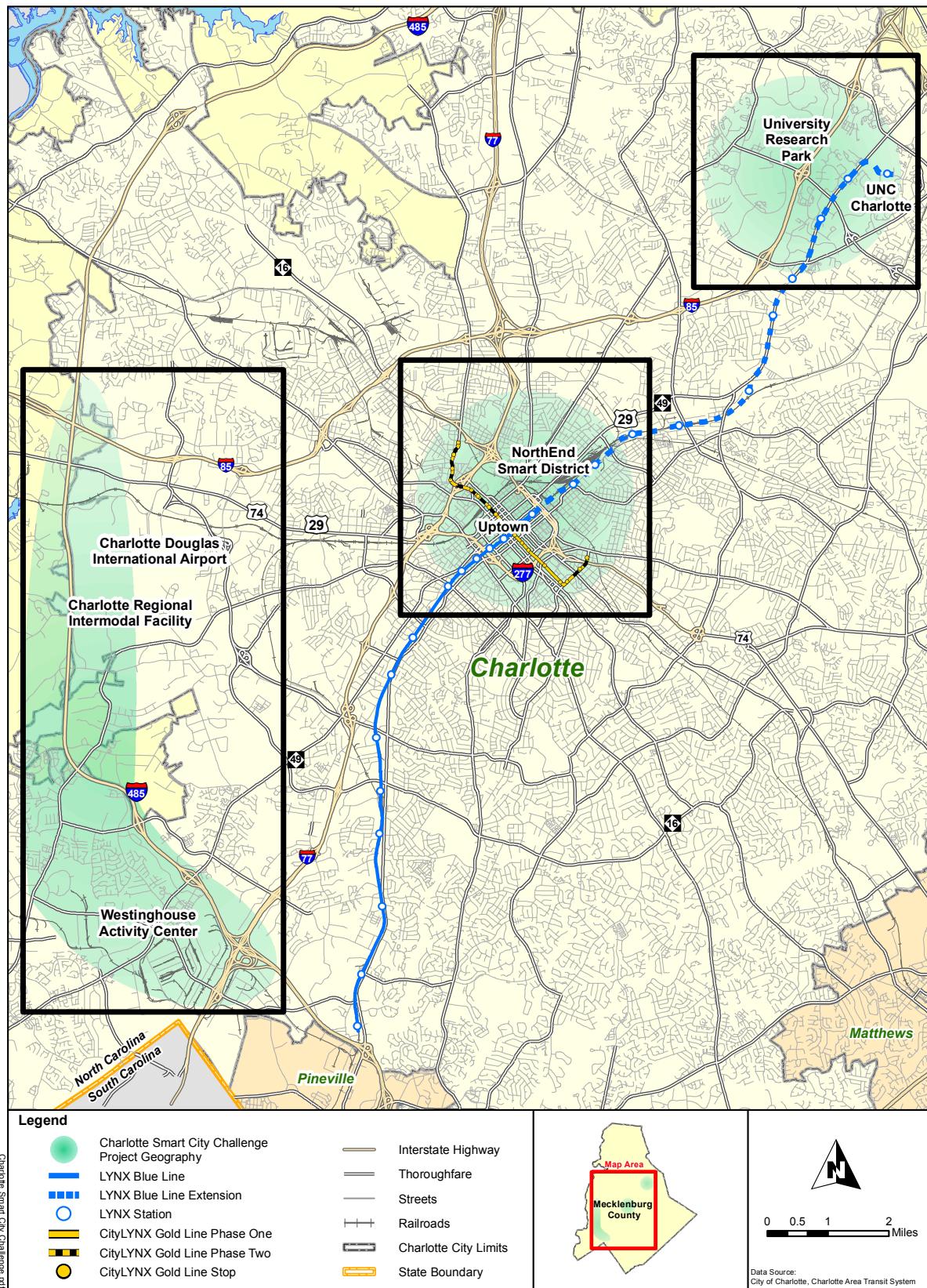


*Pedestrians on SouthEnd Rail Trail*



*Street Crossing for LYNX Blue Line Train*

## Charlotte Smart City Challenge: Project Geographies



## CONNECTING COMMUNITIES— ONECONNECT CHARLOTTE

Our first initiative is the new **OneConnect Charlotte (OCC)** integrated interface and network of smart kiosks at existing transit hubs. OCC will leverage existing private services by integrating car sharing, automated-all-electric-transit, fixed-line transit services, bike sharing, parking, and other transportation options in one free, easy-to-access app. In addition to being part of an institutional platform, this data will be fed into an open data platform that will allow access to entrepreneurs and innovators to fuel new ideas to leverage technology to enhance mobility, increase safety and address climate change.

Autonomous vehicles hold the promise of drastically improving public transportation by efficiently meeting the needs of people along the first and last mile portion of transit trips. However, we believe that there is an interim period between full autonomous deployment and the current state of privately owned vehicles, where the shared-use economy could begin to solve first and last mile needs more effectively. Our Connecting Communities initiative creates a platform that enables the shared economy to improve first and last mile connectivity to transit as well as to other destinations in one's neighborhood or the City.

Our vision for the OCC interface, an app accessible through smart devices and smart kiosks in the public domain, in combination with the shared-use economy, is focused on the following four objectives.

1. Create a Data Backbone to Enhance Mobility
2. Bridge the Digital Inclusion Gap
3. Provide Seamless Connectivity and Trip Planning Between All Modes of Transportation
4. Enable a Single Payment per Trip Across Transportation Modes

### 1. CREATE A DATA BACKBONE TO ENHANCE MOBILITY

An analytics engine is only as good as the data that feeds it.

Charlotte and its partners will create a data backbone to be the heart of our Urban Mobility Ecosystem. Charlotte already has mobility data and infrastructure, but we will augment this through the deployment of connected vehicle technologies, e.g., Mobileye, iBeacon sensors in buses, transit stations, bus stops and high traffic commercial areas to provide data

for anonymous origin/destination and safety analytics. We will also deploy smart streetlights and digital kiosks that will allow us to not only collect more data but to create a digital infrastructure network to support our Urban Mobility Ecosystem.

Over time, as more

Charlottes use the OCC platform, it will build a robust database containing trip choice and cost information, private industry availability, location and safety information.

Through our partnerships, all this data will be collected, integrated and managed so that it can then be analyzed to determine the most efficient, safest and cost effective methods of improving **ACCESS, CHOICES, and OPPORTUNITIES** for transportation.

Charlotte currently has a city-wide communications network composed of a variety of media (fiber optic cable, wireless links, etc.) to support the operation of our traffic management system. This communication network provides us with the flexibility to integrate new detection technologies into the system as they emerge (such as sensors that may be developed to read connected vehicles data).

To augment the existing sensor network, we will be able to leverage the network created by our smart streetlights and kiosks as well as crowd-sourced data to develop CHADS – the Citywide Human Acquisition of Data System. CHADS will be

### #3 INTELLIGENT SENSOR-BASED INFRASTRUCTURE



"the deployment of iBeacon sensors in buses, transit stations, bus stops and high traffic commercial areas to provide data for anonymous origin/destination analytics."

comprised of a diverse, statistically valid sample size of Charlotte residents who are willing to share their trip data. OCC app users may be motivated to share travel data freely for a variety of reasons, including enhanced mobility, competition, and supporting an initiative that will help others, reduce congestion, and minimize greenhouse gas emissions. Our proposed crowd-sourced approach to collecting travel and trip data may require incentives to obtain users from all demographic groups, but even with the expense of potential incentives, this “human” data network would be less expensive and more powerful and accurate than an array of sensors located throughout the city.

Real-time trip data from thousands of users in the Charlotte area, combined with the data from our existing and augmented sensor and vehicle to vehicle network, will provide inputs to our proposed data analytics platform that can be used for many purposes including:

- Powering the OCC app
- Telematics for the proposed “last mile” autonomous vehicle fleet that supports CATS
- Information for the connected vehicles in the freight priority zones

## #4 URBAN ANALYTICS



“While data is the fuel for smart mobility, analytics is the engine that turns the data into power.”

The real value of information is apparent when analytical techniques are applied to the data to extract actionable information that allows society to make informed, data-driven decisions. While data is the fuel for smart mobility, analytics is the engine that turns the data into power.

## 2. BRIDGE THE DIGITAL INCLUSION GAP

Equitable implementation of transportation technology and opportunity is a top priority. The OCC app is the critical link to this desired access. Although the app

will be developed in partnership with the private sector, we are committed to providing it free of charge to the public.

In addition, the OCC app will be available on smart kiosks at all Light Rail Stations, the Amtrak station, the Greyhound station, the airport, and major bus transit stops. Users can populate their digital wallet using debit cards, credit cards, and online methods such as PayPal, but the widely available smart kiosks will also be equipped to accept cash. This system enables patrons to make transportation choices across modes.

The smart kiosks and smart street lights will provide Wi-Fi hotspots so that anyone near the kiosk can access the OCC app with a private smartphone. The smart kiosks will also have a voice-over-IP connection to the City’s 311 line to provide human support for using the OCC app or to offer direction for people needing other types of help.

## 3. PROVIDE SEAMLESS CONNECTIVITY AND TRIP PLANNING BETWEEN ALL MODES OF TRANSPORTATION

While Google and other transit systems have started to explore multimodal trip planning, the traveling public often struggles to determine the most efficient way to travel within urban areas. The first and last mile connections to existing transit routes, for example, can be the extra hurdle that makes transit seem hopelessly impractical for daily life.

## #5 USER-FOCUSED MOBILITY SERVICES AND CHOICES



“Equitable implementation of transportation technology and opportunity is a top priority.”

Charlotte will partner with the private industry to take multimodal trip planning a step further by integrating autonomous vehicles, premium transit service, the private ride-sharing economy, B-cycle (our local bike-share program), bus service, and single occupancy vehicles.

Seamless trip planning will provide citizens with opportunities to make new choices when it comes to cost-efficient, timely, and healthy transportation throughout the City. For the first time, the shared economy of using many different modes of transportation in a day will be open to everyone in the city, regardless of socioeconomic status.

#### **4. ENABLE A SINGLE PAYMENT PER TRIP ACROSS TRANSPORTATION MODES**

Currently, travelers have to maintain multiple user accounts or perform several transactions to access different modes of transportation, especially when moving from a private industry mode (e.g. ride-share) to a public transportation mode (e.g. light rail). In addition, it is difficult to make a quick decision to determine the most economical way to travel without familiarity with each individual service provider.

This objective provides access to more transportation modes for all users and enables opportunities for more cost efficient or timely transportation choices. OCC app users will be able to:

- Choose their trip based on what is most important: cost, travel time, environmental impact, or exercise
- Make a single payment for the entire trip
- Pay for mobility across any mode with or without a credit card or a bank account.

#### **#5 USER-FOCUSED MOBILITY SERVICES AND CHOICES**



"OCC app users will be able to choose their trip based on total trip cost, make a single payment for the entire trip, and pay for mobility across any mode with or without a credit card or a bank account."

#### **How does it work?**

The OCC app will be developed by private industry partners. Following a competitive procurement, the City will partner with the selected app developer to facilitate the app's success. The app will integrate several existing and proposed data components and industry partners, including:

- Existing Automatic Vehicle Location (AVL) and Automated Passenger Counter (APC) data from CATS transit vehicles
- Existing B-Cycle bike-share AVL and payment systems
- A proven trip-planning platform from the private industry
- Ride-share partners
- Proposed autonomous AVL systems

#### **Did You Know?**

##### MOBILITY NETWORK

METRIC	2016	2040
Miles of Freeway	192	192
Miles of Thoroughfare	585	646
Miles of Bikeways	190	390
Miles of Sidewalk on Thoroughfares	713	963
Number of B-Cycle Stations	24	50
Miles of Light Rail	9.6	19
Miles of Streetcar	1.5	16
Local and Express Bus Routes	74	Expanded
Miles of Commuter Rail	0	25

- A proven and secure digital wallet provider
- A proven point-of-sale system provider for the kiosks
- Existing partnerships to support development of the state-of-the-art kiosks
- Hundreds of sensors deployed as a part of this project
- Integration with a data analytics platform provided by our industry partners (see Analytics Platform on page 18).

## Data Integration and Analytics

Recognizing the value of data integration and analysis, we recently created a citywide Data and Research Team within the Office of Strategy & Budget. This team is responsible for advancing the use of data in problem-solving and decision-making to improve services, inform policy, increase engagement, and promote economic opportunity and growth in Charlotte. This team is coordinating open data and analytics initiatives across city organizations to:

- Promote a culture of innovation.
- Support the integration of data into performance management.
- Build skills and capacity around data.
- Partner with the community to create actionable intelligence and new applications.

Current partnerships include private companies such as ESRI, SAS, OSIsoft, and Microsoft, as well as institutional and community partners such as the Charlotte Analytics and Big Data Society, the UNC Charlotte Data Science Initiative, the UNC Charlotte Urban Institute and ISC Community Database, Johnson C. Smith University, and the Code for Charlotte Brigade. Each of these partners attended the Smart City Challenge workshop.

As a part of its commitment to accelerating the use of data to meet societal challenges, Charlotte is actively working on a partnership with What Works Cities, a national initiative of Bloomberg Philanthropies that helps cities use data to engage residents, make government more effective, and improve residents' lives. Our What Works Cities project is focused

around open data and problem-solving with analytics. During the cross-department pilot project, Charlotte will:

- Develop a comprehensive data program and governance structure
- Codify the collection and liberation process for data, and
- Establish a process for collaborative, data-based problem-solving.

These efforts demonstrate our commitment to using open data, analytics, and collaboration to affect change. The dedicated infrastructure of the Data and Research Team, the rich partnerships with experts and innovators in the community, and the learnings from our engagement with What Works Cities position us to leverage new datasets to address complex problems and improve current operations.

## #7 STRATEGIC BUSINESS MODELS AND PARTNERING OPPORTUNITIES



"This team is coordinating open data and analytics initiatives across city organizations to...create actionable intelligence and new applications."



*Millennials take selfie at LYNX station*

## How does it impact the lives of people?

The OCC interface is the cornerstone of our vision where our access, choice, and opportunity initiatives converge. The deployment of the mobile app and kiosks will achieve new heights in social equity for mobility. Deployment of the OCC app is a step towards improving the lives of the most fragile in our city.

The OCC app will allow Tony to finally experience Charlotte in the way he imagined before moving here. The seamless trip planning and single payment

options will give him the confidence he needs to navigate the city as an environmentally conscious millennial.

Transportation users throughout the city will see drastic improvements in their transportation choices and opportunities through trip planning, single payment options, and easier multimodal travel. Increases in transit ridership and transformation of the shared economy to provide last-mile transit connectivity will improve safety, reduce greenhouse gas emissions, and reduce dependence on single occupancy vehicles.

## **Fulfillment of Smart City Challenge Goals**



### IMPROVE SAFETY

Recent research by the National Transportation Safety Board has shown public transportation to improve safety over single passenger vehicles. This is true for buses (see NTSB study titled "[Report on Curbside Motorcoach Safety](#)") and especially true for light rail systems. Enabling users of our transportation system to more easily gain access to the existing light rail system through the use of the OCC Interface will reduce single occupancy vehicle crash rates, injuries and fatalities in our city.



### ENHANCE MOBILITY

The most obvious impact of the OneConnect Interface is its effect on mobility. It enables all users, of all demographics to make mobility choices based on the metrics that are important to them. Whether they choose timeliness, cost, or concern for the environment as their metric, our city will benefit from empowering transportation users to create a more effective transportation system.



### ADDRESS CLIMATE CHANGE

The OneConnect Interface enables travelers to make multimodal choices that were previously unknown or unavailable. Every time a trip is planned or purchased with this interface, our smart mobility analytics platform will be working to determine the most effective transportation trip. Whether it's the fastest arterial route for a single occupancy vehicle, a bike-share trip, a transit trip, a ride-share trip, or some combination of all of these, every option will be optimized. Therefore we know that climate change will be addressed every time the OneConnect Interface is used.

## MOVING PEOPLE – FIRST AND LAST MILE AV

We are proposing a network of autonomous all-electric driverless transit routes located in two pilot areas of Charlotte:

- NorthEnd Smart District
- University Research Park and UNC Charlotte

In these areas, we will partner with the private industry to cultivate a variety of technology, transit, infrastructure, and livability enhancements. While we focus on the shared-use economy across the entire City, this initiative focuses the first phase of testing autonomous shared vehicles in two focus areas. In the future as autonomous vehicles saturate the market, the new network of autonomous all-electric driverless transit routes will connect the Blue Line Extension and other shared-use transportation options with underserved residential populations, the University, and areas zoned for innovative commercial use.

This network will allow transit users to hail an autonomous all-electric driverless transit vehicle (AV Transit Vehicle) from the OCC app, which they can also access from transit station kiosks.

### #8 SMART GRID, ROADWAY ELECTRIFICATION, AND ELECTRIC VEHICLES



“...hail an autonomous all-electric driverless transit vehicle...”

### #2 CONNECTED VEHICLES



“...The AV Transit Vehicles will receive transit signal priority with special connected vehicle train/tram signalization at intersections to improve their journey time.”

### #1 URBAN AUTOMATION



“We are proposing a network of autonomous all-electric driverless transit routes ...”

### #12 SMART LAND USE



“....underserved residential populations, the region’s University, and areas zoned for innovative commercial use with the Blue Line Extension and other shared-use transportation options.”

The AV Transit Vehicle will provide first mile/last mile service to our premium transit service in support of the shared economy. The service will operate with at-grade, rubber-tire transit vehicles similar to the current [CityMobil2 demonstration](#) in several cities in Europe.

The AV Transit Vehicles will receive transit signal priority at intersections to improve their journey time. As demonstrated in CityMobil2, an autonomous transit system of this type is deployable with today's technology with a public-private partnership. In future phases, the fixed routes will be networked together and additional routes will be added at UNCC and through Uptown to improve point-to-point, on-demand mobility.



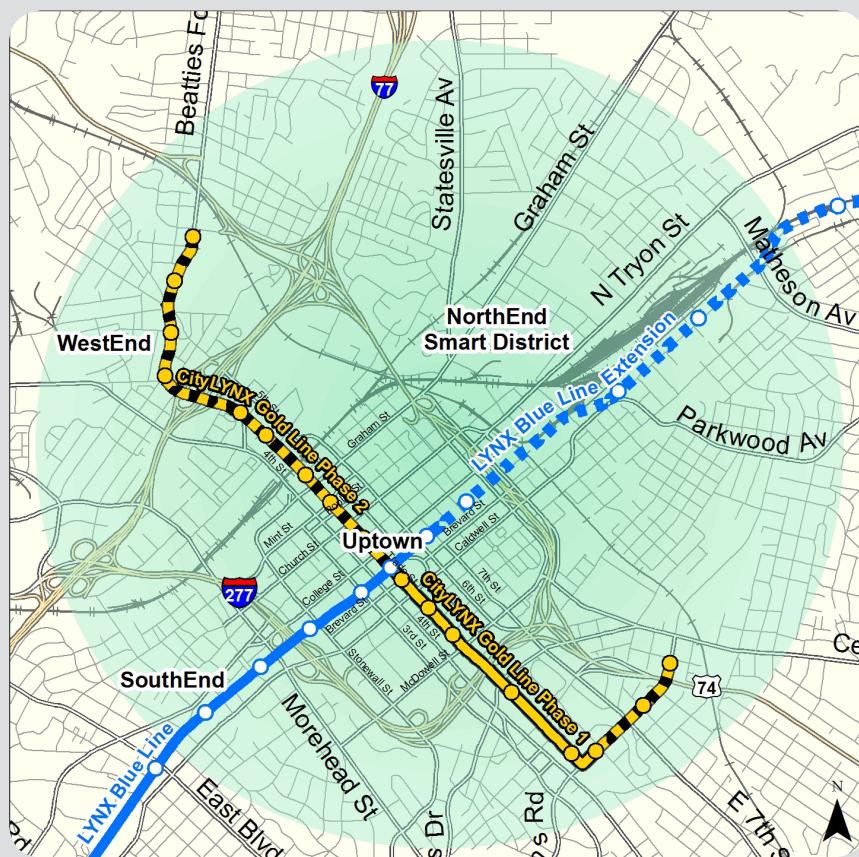
Driverless transit vehicle

### Did You Know?

This geography along the NorthEnd Smart District is a story of contrasts. On the surface it compares higher or at the same level to the City of Charlotte in key economic demographics. On first glance the whole area is prospering. It includes Uptown Charlotte and the SouthEnd area. Both have experienced rapid growth due in large to the LYNX Blue Line. In the table below it is apparent that not everyone is able to participate in this prosperity.

	UPTOWN CHARLOTTE	SMART DISTRICT
<b>POPULATION</b>	15,436	11,896
<b>MINORITY</b>	43.90%	91.50%
<b>HOUSEHOLD INCOME</b>	\$72,648	\$23,651
<b>UNEMPLOYMENT</b>	7%	28%
<b>HIGH SCHOOL GRADUATION RATE</b>	79%	51%
<b>BACHELOR DEGREE</b>	67%	13%

The LYNX Blue Line Extension (BLE) and City LYNX Gold Line are anticipated to stimulate a new age of development to the NorthEnd Smart District area. A challenge for the City is to balance economic growth across all segments of its population. In order to meet this challenge, new mobility options and digital inclusion strategies will be developed.



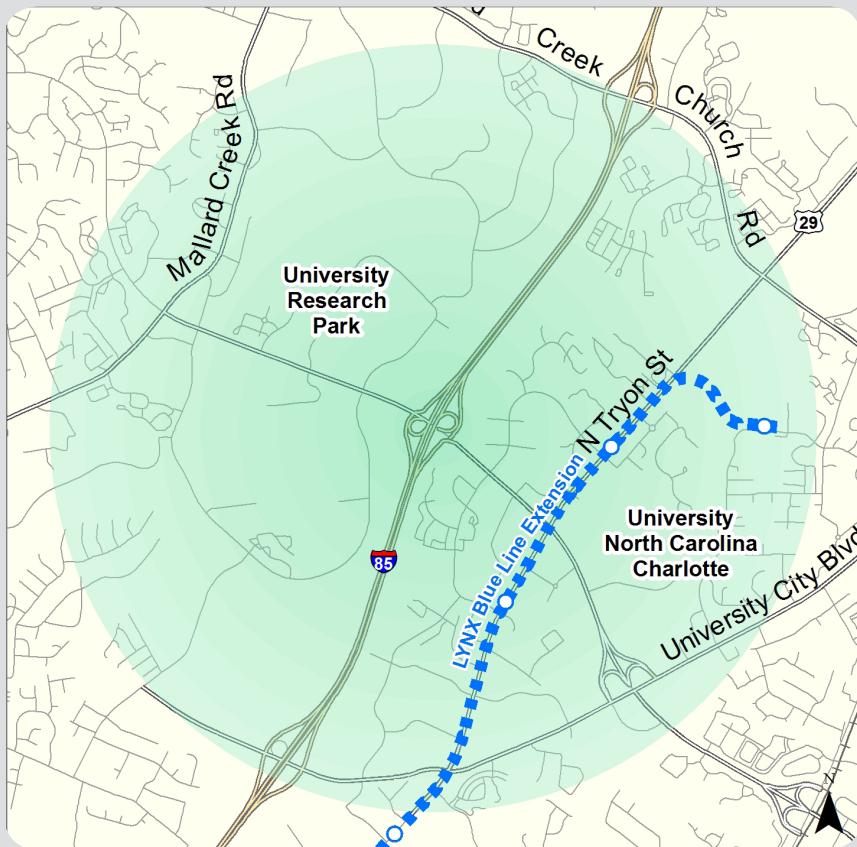
## Did You Know?

University Research Park (URP) has 30,000 employees that range from back office support to corporate headquarters and research facilities. Superior utility infrastructure with dual redundant power and extensive fiber infrastructure make URP especially attractive to data and research intensive businesses that rely on uninterrupted power.

UNC Charlotte enrollment in the past eight years has grown 28% topping out at 28,000 students.

The Charlotte Research Institute (CRI) opened in 2005. Regionally, CRI works with the community and the campus to accelerate technology commercialization, increase the growth of entrepreneurial ventures, develop intellectual capital, as well as partner in new business and research ventures to spur economic growth in the community, region, and state.

Additionally on campus is the Energy Production and Infrastructure Center (EPIC). EPIC is a collaborative industry/education partnership formed by UNC Charlotte to supply highly trained engineers to meet industry demands and provide sustainable support by increasing capacity for applied energy research.



## How does it work?

Our AV transit system will use proven technologies from established system developers through a competitive procurement after the grant award. As demonstrated in CityMobil2, autonomous transit operation is deployable today with appropriate preparation of the infrastructure, signage, and station design. This implementation will be an important first step in demonstrating the viability of revolutionary transit vehicles that can transform transit as we know it today.

The AV Transit Vehicles use GPS, radar, lidar, and video technologies to navigate from station to station avoiding obstacles and other road users. The City has existing high resolution GIS and lidar data to use for this purpose. We will support the safety of the system by using dedicated lanes and operating at relatively lower speeds during the demonstration phase. The transit vehicle will be hailed by patrons using the integrated mobility smartphone app or via simple selections at the smart kiosks at each station stop. While at stations, the all-electric vehicles will be charged using smart charging plugless charging technology.

A team of transit operators will monitor the vehicles using high bandwidth connected vehicle links during revenue service times using remote video surveillance, remote diagnostics, and the ability for remote piloting of the AV Transit Vehicles should trouble arise. Our existing high bandwidth transportation communications backbone will provide a baseline for these connected vehicle communications. As the vehicle approaches signalized intersections, transit priority will be enacted

## #4 URBAN ANALYTICS



“Transit pick-up and destination requests, service time performance, and other metrics will be monitored in real time and analyzed with our smart analytics system.”

## #5 USER-FOCUSED MOBILITY SERVICES AND CHOICES



“The transit vehicle will be hailed by patrons using the integrated mobility smartphone app or via simple selections at the smart kiosks at each station stop.”

using our connected vehicle software platform. Dedicated and concurrent traffic phases for the transit crossing will be enabled where possible to send the transit vehicle on its way without delays. Transit pick-up and destination requests, service time performance, and other metrics will be monitored in real time and analyzed with our previously described smart analytics system.

### Did You Know?

#### CHARLOTTE'S COMMITMENT TO ELECTRIC VEHICLES

Charlotte continues to be a leader in the EV space. Using Energy Efficiency and Conservation Block Grant Program funds, we implemented a publicly accessible EV charging program and added several plug-in electric vehicles to our fleet. The program included a public education campaign where we partnered with Chevy and Nissan dealers to educate customers on the EV charging stations. The City currently operates 22 free level-2 charging stations and is home to 50 additional privately-owned charging stations throughout the City. As part of the Smart City demonstration project, we will continue to implement our vision to make Charlotte EV-friendly and convert our fleet, including transit, to a low-carbon one. Four of our corporate partnerships, including Vulcan, will allow us to do this.

## How does it impact the lives of people?

An AV transit system focused on first and last mile connections demonstrates how cost-effective transit service can be provided to underserved populations and locations. The system helps solve the age-old transit service problem of making these first and last mile connections. Public sector benefits include reduced cost for providing transit service to underserved areas, zero emissions, improved level of service, and increased ridership.

This demonstration will directly impact residents and businesses within the service regions. Residents will enjoy improved mobility, improved safety, and decreased travel time to their destinations. Businesses will enjoy improved access for employees and customers. Quality transportation expands the worlds of our residents. As we expand AV operations to include Uptown, UNC Charlotte, and the surrounding Charlotte region, we will attract new residents, industries, jobs, and economic opportunities.

For Anita, the AV transit system represents a brighter future. The ability to connect from her neighborhood directly to the Blue Line will shorten her commute time drastically, giving her more time to spend with her kids and study for her Paralegal Certificate course.



*Electric vehicle charging on North Tryon Street.*

## Fulfillment of Smart City Challenge Goals



### IMPROVE SAFETY

We all know that autonomous and connected vehicles hold the promise of revolutionizing automobile travel. The safety impacts of these technologies are simply remarkable. The autonomous and connected vehicles we have proposed in this section will provide a foundational test environment with the ultimate aim of spurring deployment of these vehicles along first and last mile routes throughout Charlotte and in other cities. The near-term safety impacts of our initial deployment will be measurable and impactful, but these vehicles will have a monumental effect on safety in this country for years to come.



### ENHANCE MOBILITY

The autonomous vehicle connections to the light rail transit line will address the first and last mile gap between traditional transit service and the communities within the Applied Innovation Corridor, University Research Park, and UNCC Charlotte. These connections will cause dramatic reductions in transit travel times between home, work, amenities, and attractions for thousands of travelers in Charlotte.



### ADDRESS CLIMATE CHANGE

Every trip made in our proposed electric autonomous vehicles will effectively reduce greenhouse gas emissions for that trip to zero. The connection of these vehicles with the light rail line will make longer trips possible, enabling more prevalent use of transit for trips over ten miles and eliminating greenhouse gas emissions for the entire trip. Assuming a minimum of 100 ten-mile trip reductions per day, autonomous vehicles could reduce greenhouse gas emissions by up to 175 tons over the course of a year.

## TRANSPORTING THINGS – FREIGHT PRIORITY ZONES

Charlotte's largest employment sector is the freight and distribution industry. The City currently is the nation's fifth largest distribution center, and in just the last five years, Charlotte's annual freight traffic has increased from \$6 billion to \$15 billion. Our prominence as a freight distribution hub is expected to continue to grow by leveraging the following local advantages:

- Proximity to southeastern ports
- Excellent highway access (I-77, I-85, I-485, and US 74)
- Extensive rail network
- Charlotte Regional Intermodal Facility at Charlotte-Douglas International Airport

A majority of these distribution centers are concentrated in the Westinghouse Activity Center and around the airport. Together these two geographic areas will form Charlotte's first Freight Priority Zone. These zones will focus on improving the first and last miles of freight movement to and from Charlotte's distribution centers by giving signal priority to freight traffic in these areas.

### How does it work?

Signal priority at signalized intersections is not a new concept; it has been used by emergency and transit vehicles for at least 25 years. Charlotte currently uses emergency and transit preemption at approximately 100 signalized intersections. We are in the process

## #6 URBAN DELIVERY AND LOGISTICS



“...These zones will focus on improving the first and last miles of freight movement to and from Charlotte's distribution centers...”

## #2 CONNECTED VEHICLES



“...use Infrastructure to Vehicle (I2V) technology to enable freight signal priority.”

of building a solution between CATS and our signal system software that will enable signal priority at most signalized intersections.

We have already begun conversations with our Centrolina Council of Governments (CCOG) and several local freight distribution partners regarding the pilot project for freight signal priority. These partnerships will enable us to use Infrastructure to Vehicle (I2V) technology to enable freight signal priority. We will first work with our partners whose trucks are already equipped with AVL systems, then develop a program to equip other partners to take part in the Freight Priority Zones.

The concept for freight movement would mirror the transit signal priority approach. The process works like this:

### RECEIVE

As a freight truck travels through the Freight Priority Zone, its Basic Safety Message information (location, speed, acceleration, etc.) is transmitted anonymously and securely through the signal system link.

### REQUEST

The signal system uses the smart analytics platform to determine when the freight vehicle is near a traffic signal in the Freight Priority Zone and relays the request for priority to the signal system. Through a series of predefined algorithms, the signal system decides if that request can be accommodated.

### MAKE THE CHANGE

The traffic signal system makes the change by keeping the signal green or ending another phase early to give the green signal for the truck's approach.

### REPORT

The signal system records the day and time of the priority movements. This information would be used to evaluate the success of the demonstration.

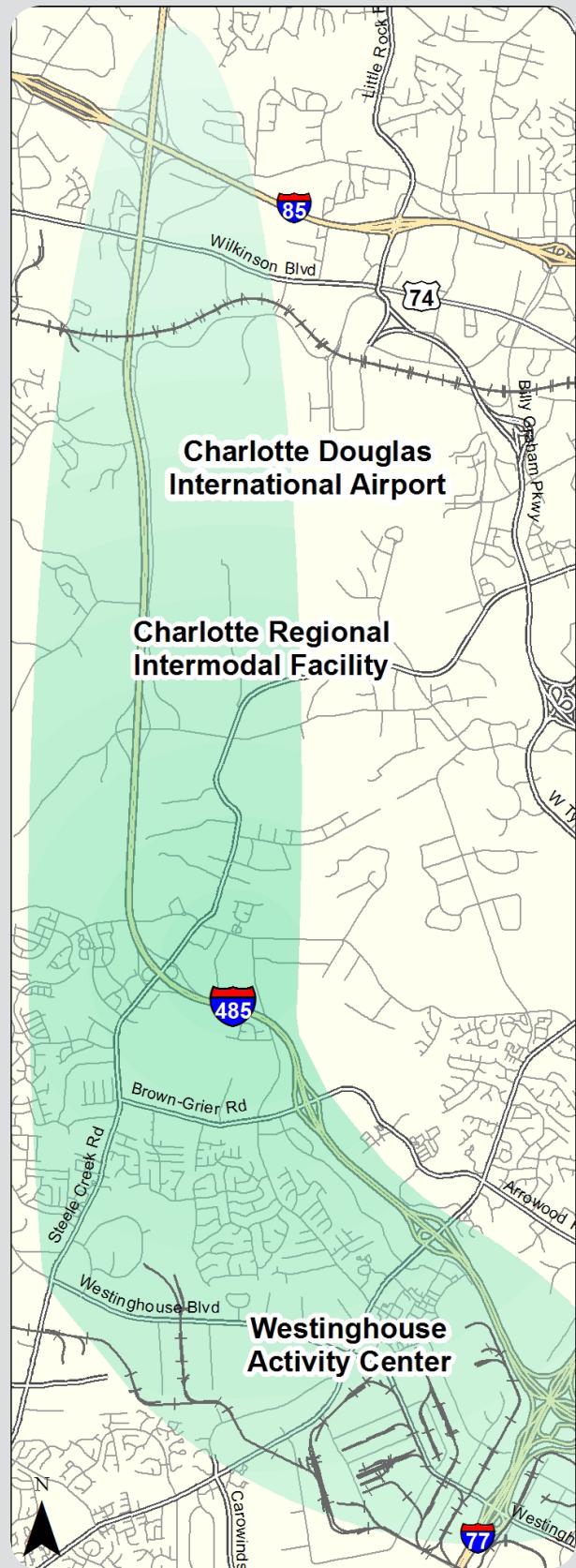
### Did You Know?

The Intermodal Facility is expected to generate \$7.6 billion in regional economic development throughout the next 20 years. It also promises to create more than 7,000 jobs in Charlotte and the surrounding region by 2030.

The facility, which is capable of 200,000 lifts annually, transfers containers between trucks and trains.

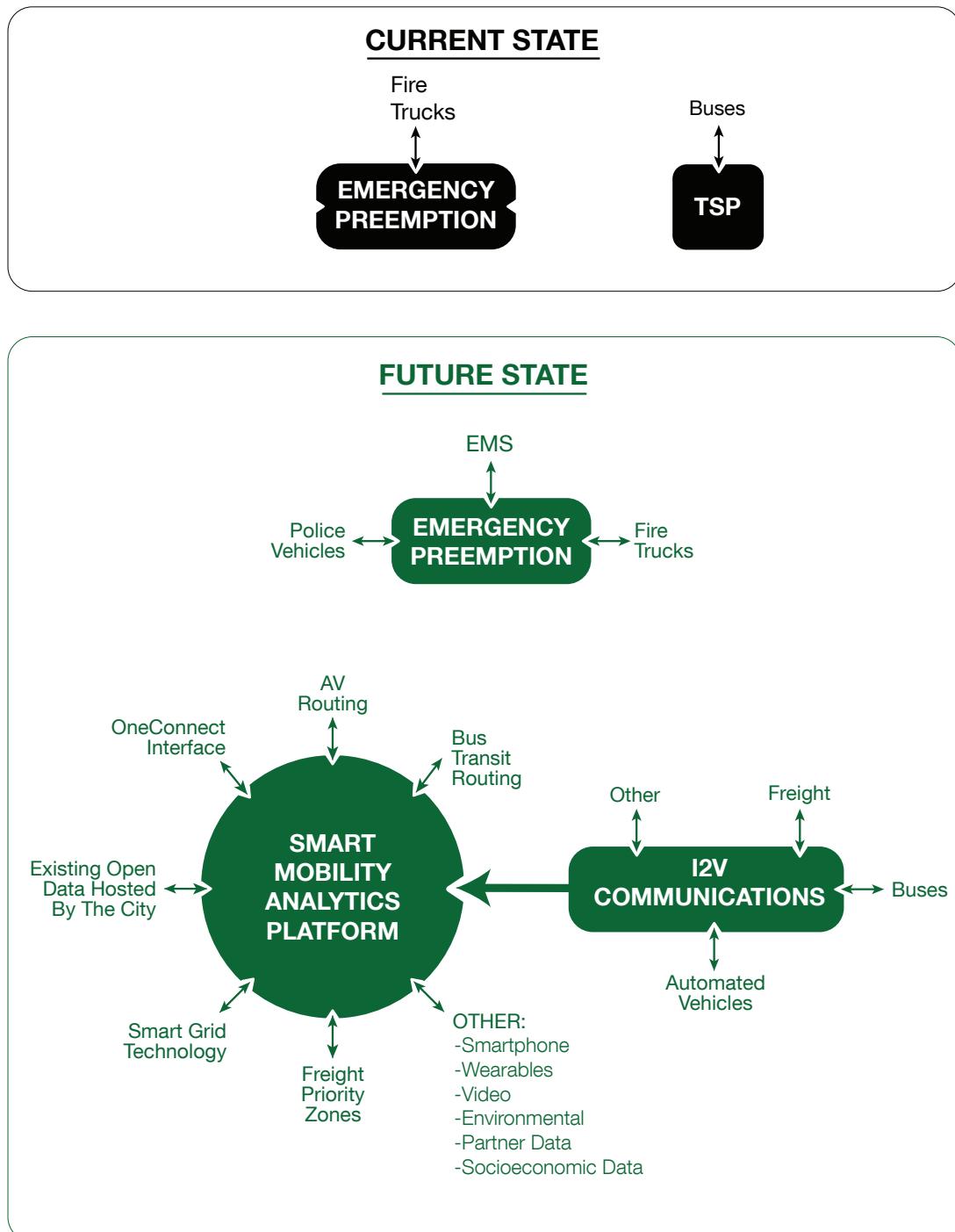
The \$92 million facility was constructed with the assistance of \$15.7 million in federal funding and additional financial support from the State of North Carolina.

The Westinghouse Activity Center is the second largest employment center in Mecklenburg County behind Uptown Charlotte and the largest industrial employment concentration in North Carolina.



## Analytics Platform

Our proposed Freight Priority Zones will expand the use of signal priority to include freight and other vehicles. The new system will incorporate a smart mobility analytics platform that uses algorithms and multiple data sources to improve traffic flow.



## Did You Know?

### KEY EXISTING ITS FEATURES

The autonomous all-electric driverless transit vehicles discussed in this section and the Connecting Communities section listed previously will build upon key existing infrastructure in Charlotte, including:

- 300 miles of City-owned communication infrastructure with a 10 GigE backbone
- 755 signals controlled by a central signal system each with ethernet communications that may be leveraged as communications access points to support Smart City Applications
- More than 356 cameras controlled by a central signal system that integrates directly with the Charlotte Mecklenburg Police Department (CMPD) video management platform
- Remote Weather Information System (RWIS)
- Collocated Traffic Management Center and CMPD real-time crime center
- CATS buses equipped with Computer Aided Dispatch (CAD), AVL, and APC systems
- A signal system that is currently being integrated with the Transit AVL system to enable transit signal priority for the entire transit fleet
- A city-wide ITS and Communications Master Plan and Regional ITS Architecture to guide integrated systems deployment.



*Uptown Charlotte signalized intersection*

## How does this impact the lives of people?

Improving the speed and efficiency of freight traffic in the Freight Priority Zones will provide significant benefits to both the public and private sector. This system demonstrates a public-private partnership with multiple freight transportation providers. Both public and private sectors will receive the following benefits:

- Improved safety.
- Improved travel time reliability.
- Increased productivity.
- Reduced maintenance costs (pavement and traffic markings and vehicle wear and tear).
- Improved air quality due to less idling.
- Increased global competitiveness that enables Charlotte to remain and grow as a leading freight distribution hub.

Distribution and logistics is Charlotte's largest employment sector. The implementation of Freight Priority Zones will bolster our growth strategies for

the Westinghouse Activity Center and airport areas, two of its major employment centers. Economic growth in these areas will create additional higher wage, quality jobs, increasing economic opportunity and economic mobility for existing and future residents of Charlotte. Truck drivers like Joe will witness the positive impact that freight signal priority deployment will have on his daily schedule. He will be able to make an informed route decision for the safest, most efficient delivery of goods. Similarly, Sarah will have more confidence promising her customers a certain delivery time, knowing that her drivers will be able to stay on schedule.



*Freight truck on Rozzelles Ferry Road*

## Fulfillment of Smart City Challenge Goals



### IMPROVE SAFETY

The integration of AVL data with the signal system will create a synthesized network so that freight can interact more smoothly with other traffic. Accelerating and monitoring freight movements creates order on the roads, allowing cyclists, pedestrians, and other drivers to travel with bolstered confidence.



### ENHANCE MOBILITY

Freight signal priority represents a revolutionary fusion of technologies: signal systems and real-time truck AVL data. Moving trucks quickly through intersections translates to less time that they are sitting in traffic; freight signal priority will reduce congestion and facilitate smoother access for our distribution industry. As Charlotte becomes an increasingly attractive distribution hub, the addition of new industry partners will boost our economy and create new employment opportunities.



### ADDRESS CLIMATE CHANGE

The establishment of Freight Priority Zones is a major stride towards addressing climate change in Charlotte. When trucks have to stop and idle at signalized intersections, they generate significantly greater volumes of greenhouse gases than they would if their trips were uninterrupted. Freight signal priority will give our residents cleaner air to breathe and a healthier daily lifestyle as they leave home to take advantage of many transportation choices citywide.

## IMPLEMENTATION APPROACH

Our vision for Charlotte as a smart city will be realized by a coalition of team members and stakeholders through a strategic implementation plan. The following sections outline the required components of the vision narrative:

- Program Management Approach
- Team Partners and Key Stakeholders
- Data Commitment
- Risk Mitigation
- Performance Management
- Capacity and Commitment
- Cost Share Resources

## PROGRAM MANAGEMENT APPROACH

Our commitment to completing a Smart City Challenge implementation that would be used for other smart cities to replicate is unwavering. This commitment begins with our city's leadership from the Mayor and City Council and extends to our executive management and staff, as shown by their letters of support found in the Appendix to this document. The Project Management team will be accountable to the Executive Leadership team and will provide programmatic oversight and direction using a plan in accordance with the Project Management Body of Knowledge. The project management plan will cover these areas:

- **Scope Management:** describes what services are advisable to achieve successful project outcomes and documents how the advisable services will be completed. The project team will use a work breakdown structure to define the scopes as smaller, manageable tasks with achievable deliverables and will monitor progress both individually and on an overall project level as multiple team leaders will be completing work concurrently.
- **Requirements Management:** involves collecting and synthesizing specific input on project requirements and related assumptions from project stakeholders. The project team will identify the

best methodology to collect/analyze the competing requirements, balancing them again the project objectives and competing demands of scope, time, cost, quality, resources, and risk.

- **Schedule Management:** describes the schedule, who will be responsible for the schedule, how it will be managed, including the frequency and communication of updates. The project team will develop a schedule management plan that is closely integrated with the scope of the identified project tasks and underlying activities that need to be accomplished and when those tasks need to be accomplished within the life of the project.
- **Financial Management:** involves estimating project costs, determining a budget, and controlling costs during project execution. The project team will develop a financial management plan that supports the objectives through a fiscally-sound budget that is closely monitored with progress reports.
- **Quality Management:** involves creating and following policies and procedures to ensure that a project meets the defined needs it was intended to meet. The project team will develop a plan that outlines metrics for measuring quality and how quality corrections will be implemented.
- **Resource Management:** involves identifying the members of the project management team and clearly outlining appropriate roles and responsibilities.
- **Communication Management:** involves identifying methods and frequency of communication with project stakeholders.
- **Risk Management:** involves anticipating obstacles and developing strategies to mitigate risk as outlined in the Risk Mitigation section.
- **Procurement Management:** involves methods that will be used to conduct, administer, and close-out procurements that are in accordance with USDOT's Code of Federal Regulations.

## TEAM PARTNERS AND KEY STAKEHOLDERS

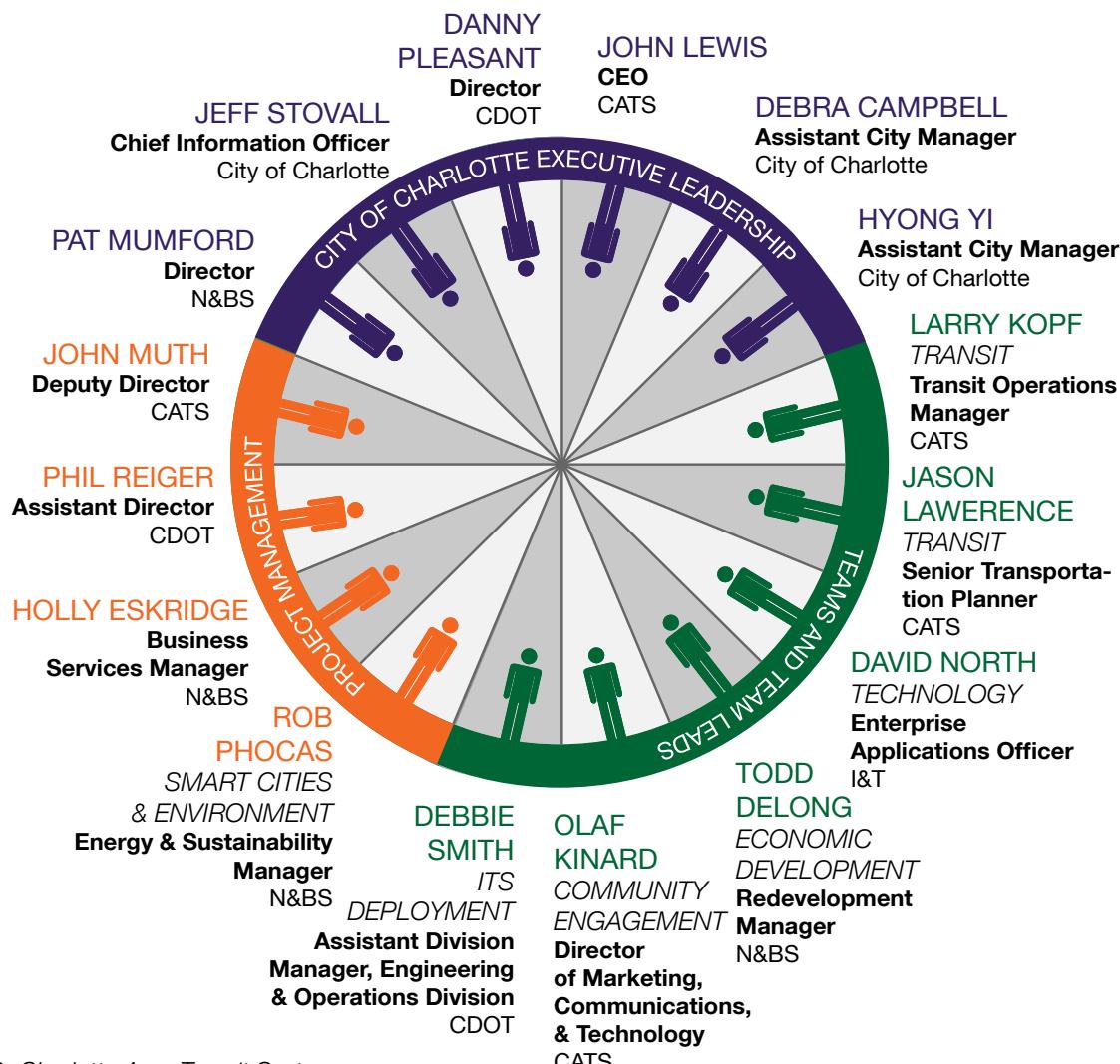
Charlotte boasts a robust team of planners, engineers, project managers, and technical specialists that have and are continuing to deliver a host of forward-thinking, high-complexity, and large-scale projects and programs.

### Executive Leadership

**Debra Campbell, Assistant City Manager:** Debra Campbell provides technical and managerial support to Planning, Transportation and the Charlotte Area Transit departments. Prior to assuming this role, she served as the director of a joint City-County

Planning agency that provides planning services to the City of Charlotte and the unincorporated portion of Mecklenburg County. Her work centers on the goal of helping to develop and implement public policy that makes Charlotte-Mecklenburg an eminently livable, economically vibrant, and memorable urban community.

**Hyong Yi, Assistant City Manager:** Hyong Yi provides managerial support for 311, Charlotte Water, Engineering & Property Management, Innovation & Technology, and Solid Waste Services as well as serves as the staff resource for the Charlotte City Council Environment Committee. He leads the City's environmental sustainability and smart city efforts.



CATS: Charlotte Area Transit System

CDOT: Charlotte Department of Transportation

I&T: Innovation and Technology

N&BS: Neighborhood and Business Services

**John Lewis, CATS Chief Executive Officer:**

John Lewis arrived in September 2015 and is leading CATS through a significant stage of growth to construct the LYNX Blue Line Extension, expand existing light rail platforms to accept three car trains, and advance the CityLYNX Gold Line Phase 2 (streetcar) through final design and into construction. Lewis brings a wealth of transit knowledge and experience to Charlotte, having previously served as CEO of the Central Florida Regional Transit Authority (LYNX) where he provided strategic leadership to Central Florida's primary mass transit system.

**Danny Pleasant, AICP, Transportation Director:**

Danny Pleasant is responsible for the full spectrum of planning, designing, building, operating and maintaining city streets for walkers, bicyclists, transit riders and motorists. His department provides staffing for a three-county metropolitan planning organization and a twelve-county air quality planning region. With his background as a professional planner, Danny is dedicated to building quality communities using thoughtful transportation planning and urban design strategies. Danny joined the City of Charlotte in 2002, after serving 14 years as Transportation Planning Bureau Chief for the City of Orlando, Florida.

**Jeff Stovall, Chief Information Officer:**

Jeff Stovall joined the City of Charlotte as its first Chief Information Officer in 2008 and is responsible for leading the City's Innovation and Technology department. In his tenure, he directed the City's technology preparations for the successful 2012 Democratic National Convention, consolidated divisional IT organizations into a new City department, implemented a significant modernization of legacy applications and infrastructure, and moved the City to use mobile, social and cloud-based systems. Prior to the City of Charlotte, Mr. Stovall was the director of IT merger integration planning for Sprint Nextel, responsible for leading multiple post-acquisition technology integration efforts.

**Patrick T. Mumford, Neighborhood & Business Services Director:**

As Director for the City of Charlotte's Neighborhood & Business Services unit, Patrick T. Mumford is responsible for the strategic direction and implementation of housing, neighborhood, economic development and code

enforcement policies and programs, overseeing a staff of approximately 150. The unit was established to maximize the City's efforts and resources in neighborhoods and business corridors and its priorities include using existing local resources to the fullest, expanding code enforcement, implementing accountability and compliance procedures for City partnerships and supporting the City's youth initiatives. Mumford was named to the new post in March 2009.

**Project Management****Phil Reiger, Charlotte Department of**

**Transportation Assistant Director:** Phil Reiger shares the responsibility for the CDOT's 400+ employees dedicated to "Connecting Charlotte" by enhancing the driving, bicycling and walking experience. CDOT delivers a broad range of services such as managing more than 2,400 miles of city streets and 700 signalized intersections, 1,600 miles of sidewalk, 150 miles of bikeways, and a \$200 million capital improvement program. Most recently, he led efforts to attract Google Fiber to deploy its ultra-high speed internet services within the Charlotte city limits.

**John Muth, CATS:** Under John M. Muth, Deputy Director for Development and Chief Development Officer, the Development Division of CATS has the lead in planning for and creating Charlotte's rapid transit system. Now in the early stages of a 25-year, \$3 billion development effort, the rapid transit system will include bus rapid transit guideways, light rail transit, streetcar lines, and commuter rail services, and will be an integral part of an overall transit system that will serve over four times as many transit riders as the system did in 2001.

**Holly Eskridge, Business Services Manager:**

Holly Eskridge has more than 15 years of project management experience that focuses largely on brownfield and greyfield redevelopment. She has managed more than \$100 million in grant funding and has extensive experience in public policy advocacy and economic development. Holly also works closely with increasing environments that support innovation and entrepreneurship in Charlotte.

**Rob Phocas, Energy & Sustainability**

**Manager:** Serving an organization of 7,000+ staff and a city of nearly 800,000 people, Rob Phocas supports a variety of internal and external programs in the energy, sustainability, and smart city spaces. Examples of internal initiatives include the implementation and continued evolution of Charlotte's Internal Environmental Operations Plan, which sets goals, tracks, measures, and reports the organization's environmental footprint. Externally, Rob works very closely with Envision Charlotte and other community entities to advance Charlotte's goals.

**Team Leaders****Jason Lawrence, Charlotte Area Transportation System (CATS) Senior Transportation Planner:**

Jason Lawrence is responsible for CATS Major Investment Studies and Draft/Final Environmental Impact Statements for transit corridors identified in the 2025 Transit/Land Use Plan and the 2030 Transit System Plan. Jason has performed bus service planning, conducted alternative analyses, completed population/ridership forecasting, and implemented the Sprinter Airport Enhanced Bus service. Jason is a member of the LYNX Blue Line Extension (BLE) Light Rail Team where he authored and designed the LYNX BLE Bus/Rail integration plan.

**Larry Kopf, Chief Operations Planning Officer, Assistant Director of Public Transit:**

Larry Kopf leads the Bus Operation division responsible for bus service, transit service for the disabled, and vanpool services. With a focus on customer service, staff in this division provides over 20 million rides each year to residents of Charlotte and the surrounding counties. Responsibilities include short-range planning projects, such as the Countywide Transit Services Plan, designed to adjust services as appropriate to meet the changing needs of the population. Operations staff also handles fleet planning and maintenance, bus and light rail scheduling, and coordinates with other divisions in long range planning.

**Debbie Smith, CDOT Assistant Division Manager:**

Debbie Smith assists the Engineering & Operations Division Manager with day-to-day operations of about 80 engineers, technicians, and field staff. Smith also assists with budget preparation,

program/process improvements, and leads several special program projects. Smith was formerly the Traffic Safety and Intelligent Transportation Section Manager for five years, managing a staff of seven engineers and technicians.

**David North, Enterprise Application Manager:**

David North has a broad background in applications development and service delivery with over 30 years in the business. His unique blend of business and technical experience, across multiple industries, and on a global as well as a local level, has allowed him to make significant contributions to his business partners. In addition, his professional experience as a developer, systems architect, project and program manager, product manager, managing consultant and IT executive give him a very broad background in the applications world.

**Olaf Kinard, Director of Marketing & Communications, Assistant Director of Public Transit:**

Olaf Kinard heads up the division responsible for Marketing, Communications and Technology, which promotes community relations, develops communications, and marketing programs to increase ridership for CATS and for information technology planning and implementation. The division manages all of CATS' customer service activities, including all pass sales and customer information needs at the transit center, conducts extensive market research to ensure CATS' ability to meet customer needs, manages public involvement and community relations activities, and coordinates media relations for CATS.

**Todd DeLong, Redevelopment Manager:** As the Redevelopment Manager for the City of Charlotte, Todd oversees the City's redevelopment initiatives such as public private partnerships, economic development strategic planning, and business matching grant programs. Prior to joining the City of Charlotte in July 2014 Todd was a Senior Associate for a real estate and economics advisory services firm in Florida where he served as an advisor to local governments, developers, and institutions throughout the U.S. on a variety of engagements related to market feasibility, public private partnerships, special taxing districts, economic and fiscal impacts, and economic development strategies.

## Stakeholders

Led by the City Manager's Office, we have assembled a diverse group of stakeholders that reflects our previous smart city experiences to help create our vision as a smart city and the strategies to achieve it. This group also will help oversee, evaluate, and report on the demonstration project.

We have received 32 letters of support for our smart city proposal which are provided in the **Appendix**. In addition to senior leadership and staff from the City, key stakeholders include:

ACADEMIA	NONPROFIT	PRIVATE
Central Piedmont Community College	AARP	ABB
Johnson C. Smith University	Advocations	AT&T
Queens University	Centralina Council of Governments	Bosch
The University of North Carolina at Charlotte	Charlotte Center City Partners	Cisco
	Charlotte Chamber of Commerce	Duke Energy
	Code for Charlotte	Econolite
	Crisis Assistance Ministry	Ericsson
	Envision Charlotte	ESRI
	Foundation for the Carolinas	Ford
	Queen City Forward	General Motors
	Centralina Council of Governments	IBM
		Lyft
		Microsoft
		MIT Labs
		OSI Soft
		Proterra
		SAS
		Sidewalk Laboratories
		Supernormal
		Trane
		Trinity Partners
		Uber
		Via Transportation
		Vincent Enterprises

## DATA COMMITMENT

We have an [Open Data Policy](#) that was signed by the City Manager on January 1, 2015. The Innovation & Technology Department is responsible for oversight of the Policy, for maintenance of our [Open Data Portal](#), and for working with departments on open data-related projects. The Policy encourages city departments to provide open data through the city's portal to promote transparency and accountability, civic engagement, and ability of third parties to leverage government data through application and service development. The Open Data Portal currently has 66 datasets, made public in a convenient, machine readable, open format, and available for use, reuse, and redistribution. Our engagement with What Works Cities is designed to accelerate our work around open data, increasing the timeliness, quality, accessibility, and number of datasets available through the Open Data Portal.

## RISK MITIGATION

A formal risk management plan initiated during the planning phase will be used throughout the project. This process will be based on Project Management Institute and technology deployment best practices. The following section highlights some of the specific risks and mitigations.

### Regulatory Risks

With the implementation of cutting edge technologies like autonomous vehicles, any agency runs the risk of encountering state and local policies that may limit their use. Fortunately, this grant is concurrent with a project in which the North Carolina Department of Transportation (NCDOT) is proactively reviewing the state's readiness for automated vehicles from a policy perspective. We will have the opportunity to provide input to the process as a stakeholder to further the readiness of the state for the proposed last mile connections. A statewide legislative readiness plan will be prepared in the near term, and special legislation will be produced as needed to remove regulatory barriers.

### Safety Risks

Safety hazards associated with the Smart City Challenge implementation include injury or property damage that may occur from the testing of autonomous vehicles. We will draw from the lessons learned and methodologies developed by other autonomous vehicle test beds to establish a protected testing environment.

### Schedule Risks

We will collaborate with technical experts for the development of smart phone apps, digital kiosks, and freight signal priority. Collaboration can incur the risk of schedule delays. To mitigate this risk, we will identify technical team leaders to enhance communication and keep critical path tasks on schedule during implementation.

### Internal Communication Risks

Similar schedule delays can sometimes result from a reliance on the maintenance of private partnerships. Luckily, we are a city built on cooperation, collaboration and partnership, especially public-private-plus partnerships. No matter the issue, if it is for the betterment of the community, all hands come together for the greater good. Be it planning and hosting the Democratic National Convention, responding to a natural disaster or addressing the lack of economic mobility in the city, we bring together public, private, academic, and nonprofit entities to solve problems together.

### External Communication Risks

We have anticipated the possibility that citizens will have concerns with how demonstration areas were chosen. "Why not our neighborhood?" could be a common question because every neighborhood has room for transportation improvements. With a public education initiative, we will clearly communicate the benefits of demonstrations in limited geographies. We will clarify that the ultimate goal is to expand if demonstrations are successful.

## PERFORMANCE MANAGEMENT

We have developed a list of performance metrics and specific goals to measure the success of the Smart City Challenge implementation. Specific metrics that will be measured in our focus areas include:

- Travel time
- User accessibility
- Health outcomes
- Cost
- Crash frequency/severity
- Economic mobility
- Transit ridership
- Vehicle miles traveled

The Smart Mobility Board of Directors will develop a plan to assess performance metrics at regular intervals throughout the process. Following is an example of the type of reporting we see being used to measure success.

### **What if...?**

- Households took one less car trip per day.
- Lower income or zero car households reduced travel time to major employment/retail opportunities by 50 percent.
- Household transportation costs could be reduced by 7 percent.
- Emissions from vehicles were reduced by 20 percent.
- Crash rates were reduced by 50 percent.

## CAPACITY AND COMMITMENT

Our leadership has a reputation for executing forward-thinking initiatives and a track record of success when it comes to advancing our status as a smart city. From the Mayor and City Council members to the City Manager and the Executive Leadership team, being actively “smart” in policy and operations has been a constant priority.

We have demonstrated capacity managing large scale projects with complex funding streams making it an ideal candidate for Smart City Challenge funding. These types of projects include:

- **Transit Investments:** We were the grantee for \$878,989,999 in federal funds to construct the Blue Line light rail and Gold Line streetcar systems.
- **American Recovery and Reinvestment Grant:** We have administered more than \$10 million in American Recovery and Reinvestment Grant funds, which resulted in installation of fiber optic cable for the transportation system and deployment of a multi-departmental digital video platform among other infrastructure.
- **Capital Improvement Program (CIP):** We manage our own 10-year, \$800 million capital improvement program.
- **Democratic National Convention:** We managed a multi-dimensional project to host the DNC in which \$50 million in federal funding was received.
- **Ladders of Opportunity Transportation Empowerment Pilot:** The City of Charlotte is one of seven cities selected by USDOT to participate in their Ladders of Opportunity Transportation Empowerment Pilot focusing on community transportation projects that revitalize, connect, and provide access to opportunity in priority transit corridors. The City of Charlotte is engaged with federal, state, and local partners in capital, neighborhood redevelopment, and safety improvements along the WestEnd of the City

LYNX Gold Line Phase II. At its foundation, this collaborative effort includes,

- Improving economically distressed neighborhoods and supporting economic development
- Connecting people to safe, reliable transportation options, and promoting public health
- Providing people access to economic opportunity and supporting social mobility

In addition, we have a broad base of partnerships to leverage for the implementation of the Smart City Challenge. We have on-call contracts already in place to obtain the technical support that the project will require.

We are a global leader in the smart city space as a result of the public-private-plus partnership we established to launch [www.EnvisionCharlotte.com](http://www.EnvisionCharlotte.com) and its sister program [www.EnvisionAmerica.org](http://www.EnvisionAmerica.org).

We recognize that one of the keys to a successful smart city is constant, honest communication. Banks, municipalities, energy companies, academics all work together on Envision Charlotte to make Charlotte's urban core the most environmentally sustainable urban core in the country, and to replicate Envision's success across the country with Envision America.

The Envision experience has even spread to Holland, Italy, and Indonesia as part of the Global Smart City and Community Coalition.

## COST SHARE RESOURCES

Several existing opportunities allow us to use additional resources to support federal funding for the Smart City Challenge implementation. In addition to more than \$370 million in local funds committed to the Gold Line and Blue Line transit systems, other investments that can be leveraged to support the success of the Smart City program include:

- \$28 million in local funds allocated for infrastructure improvements in the Applied Innovation Corridor.
- Expansion of our extensive fiber optic infrastructure to support new technology
- Selection by What Works Cities to advance innovations in data collection and open data platforms
- Funding by the Knight Foundation for a staff person assigned to work with neighborhoods in the project area on advancing economic opportunity
- \$299 million committed by NCDOT to support the Blue Line Extension project
- \$15.5 million in CIP funds allocated for Research Drive to J.W. Clay Connector over I-85
- \$15 million in CIP funds allocated for University Pointe Connector from IBM Drive to Ikea Boulevard
- \$5 million in CIP funding allocated for West Trade/Rozzelles Ferry Road infrastructure improvements

As the project begins implementation, public and private partners will come to the table with additional resources to leverage any federal funds received.



*City of Charlotte skyline*

## ACT III

### EPILOGUE – YEAR 2026

#### ANITA

After the AV transit system to the Blue Line was launched, Anita halved her commute time and devoted those precious extra hours to her Paralegal studies and her family. She still commutes using the light rail, but now it's from her home in NoDa to her job with a commercial real estate company. Anita and her teenagers love the freedom and the safety that Charlotte's OneConnect provides them to move around their community.

#### TONY

Yearning to foster bike culture in Charlotte, Tony built an iPhone app that connects seasoned bikers and those new to town. He gained a complete mastery of Charlotte's extensive public transport options and sold his car to someone in Atlanta. He now feels like his lifestyle aligns with his environmental values.

#### JOE AND SARAH

Joe stuck with his job and makes more money than ever now that he can reliably deliver more loads. The smart infrastructure installed in his truck and on his routes has limited the potential for expensive and time-consuming accidents. Sarah's company shaved at least three minutes off of every truck every single day, saving money and jobs, including Sarah's.



*Multimodal travel in Charlotte*

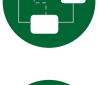
# DOCUMENT MATRIX

The Narrative Elements table provides a point of reference for how our vision aligns with the goals for the Smart City Challenge. The Vision Elements table provides more detail about how our proposal fulfills the expectation of the Smart City Challenge.

## NARRATIVE ELEMENTS

NUMBER	ELEMENT	PAGE #
1	Vision	3-29
2	Population Characteristics	2
3	Smart City Characteristics	8, 14, 19, 26, 27
4	Site Map	5
5	Vision Element Alignment	See adjacent table
6	Risk Assessment	26
7	Key Team Partners/ Stakeholders	22-25
8	Existing Infrastructure and System	8, 19
9	Define Data	6, 7, 26
10	Approach for using Existing Standards, Architectures, and Certification Processes	19
11	Measurable Goals and Objectives for the Vision	10, 15, 20, 27
12	Capacity to take on a Project of this Magnitude	27, 28
13	Opportunities to Leverage Federal Resources	28

## VISION ELEMENTS

ELEMENT	PAGE #
 1. URBAN AUTOMATION	11
 2. CONNECTED VEHICLES	11, 16
 3. INTELLIGENT SENSOR-BASED INFRASTRUCTURE	6
 4. USER-FOCUSED MOBILITY SERVICES AND CHOICES	7, 14
 5. URBAN ANALYTICS	7, 8, 14
 6. URBAN DELIVERY AND LOGISTICS	16
 7. STRATEGIC BUSINESS MODELS AND PARTNERING	9
 8. SMART GRID, ROADWAY, ELECTRIFICATION, AND EVS	11
 9. CONNECTED, INVOLVED CITIZENS	6
 10. ARCHITECTURE AND STANDARDS	19
 11. LOW-COST, EFFICIENT, SECURE, RESILIENT ICT	19
 12. SMART LAND USE	11