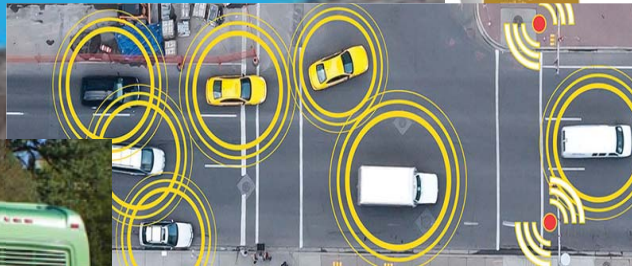


BIRMINGHAM RISING



TRANSIT ORIENTED DEVELOPMENTS



BIRMINGHAM RISING! MEETING THE CHALLENGE TO BECOME AMERICA'S NEXT SMART CITY

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Introduction

William T. Coleman, Jr., the fourth Secretary of Transportation, painted a picture of the ways in which our society would travel and interact. Under his leadership, the U.S. Department of Transportation set about creating a planning and decision-making framework to guide that future. Secretary Coleman's future became reality...for most of the country. For others, time seemed to stand still and little progress was made. Such is the case for the City of Birmingham.

Fast forward to today. Under the leadership of Secretary of Transportation Anthony Foxx, the U.S. Department of Transportation has developed a 30-year transportation plan for the nation. The plan, entitled Beyond Traffic, has a very clear thesis: the United States needs to pivot away from its reliance on the car towards mobility systems that are better suited to cities. We couldn't agree more!

The City of Birmingham will be one of the U.S. cities that helps the nation achieve its transportation vision. The City is reemerging as a vibrant southern city, a place where people choose to live, businesses can innovate, grow, and thrive, and visitors seek out for historic, cultural, and recreational experiences. Through careful comprehensive community planning, good leadership, collaboration and targeted investment, Birmingham is taking advantage of new opportunities, and improving the overall quality of life for its residents. Renewed investment in the City's transportation system will breathe new life into the City, especially those areas that are experiencing urban decay.

Our City

Located in a dramatic physical landscape, Birmingham is the county seat of Jefferson County and is the largest city in Alabama. It is flanked by parallel mountain ridges of the southern extension of the Appalachian Mountains, which contain the minerals upon which the city's early heavy industry was founded. Multiple railroad corridors that thread their way through the Birmingham area were the key to the city's development as an industrial powerhouse, facilitating the transformation of the area's rich mineral wealth into one of the nation's most important sources of iron and steel during the Industrial Revolution.

Economic decline initiated by population flight to the suburbs was exacerbated by the concurrent mass exodus of heavy industrial jobs from Birmingham. The iron and steel industry had long been the foundation of middle income prosperity in Birmingham. However, by the 21st century, this keystone had been effectively pulled from Birmingham's economic arch.

As the effects of the Great Recession of 2008 are waning, Birmingham is gaining vitality and population. This is in part thanks to a mammoth effort to reinvent itself as a more livable community, attractive for the businesses and professionals that will drive our economy in the 21st century. The Smart City concepts presented herein will support this renewal and help expand economic opportunity to Birmingham's long neglected minority and low-income neighborhoods.

According to the 2010 U.S. Census's Designated Place data, the City of Birmingham had a population of 212,237. At that time, the City comprised 28.3% of the urbanized area's total population, and had an average population density of 1,453 persons per

square mile. This is well within the population and density characteristics of a Smart City.

According to the U.S. Bureau of the Census's LEHD, the City of Birmingham contains approximately 163,000 jobs, of which just under 130,000 are located in the awarded Birmingham BRT corridor. The Downtown and UAB/Five Points South subareas combined have over 70,000 jobs, which is approximately 43 percent of the City's total jobs, and 54 percent of the jobs in the BRT corridor. The BRT corridor plays an important role in our vision to transform Birmingham into a Smart City. The vision will be articulated more clearly later in this response.

Other things to know about the City of Birmingham include:

- Birmingham has 99 neighborhoods
- Birmingham is the Southeast's premier medical mecca
- 18,500 students are enrolled in UAB
- Close to 80 percent of the State of Alabama's population is within a 100 mile radius of the City of Birmingham
- Birmingham is served by five (5) interstate highways: I-20, I-59, I-65, I-22, and I-459
- Birmingham is served by three (3) Tier 1 rail providers
- 60 percent of the 11 state Southeastern market can be reached by truck within one-day's freight travel time
- 90 percent of the U.S. population can be reached by truck within a three-day freight travel time

In terms of how the City of Birmingham relates to the State of Alabama and the synergistic role of the two entities, know that Alabama is now the fifth largest auto producing state, and employment in the sector is approaching 40,000. Alabama's three global automakers, Mercedes-Benz, Honda and Hyundai,

combined to produce more than 1 million vehicles in 2015, the first time the state's annual output has reached that big-league milestone. All three automakers are exploring, and have incorporated autonomous vehicle technology into their vehicles. This technology includes everything from navigation systems, to communications and entertainment systems, to automatic braking, and crash avoidance systems.

Automobile and parts manufacturing, and the technology that accompanies it has become the state's top export category, reaching \$6.6 billion in 2014. New auto-related investment in the sector during the past four-years tops \$5.5 billion.

Birmingham city closely aligns with the USDOT's characteristics for a Smart City, as it provides:

- Existing public transportation system and plans for new additions to the public transportation services;
- Environment that is conducive to demonstrating proposed strategies;
- Leadership with proven record of commitment and dedication, and the capacity to carry out the demonstration throughout the period of performance;
- A solid commitment to integrating with the sharing economy and share assets in a seamless way; and
- A clear commitment to open data and data sharing, thus making data accessible and usable by the public to maximize benefit and promote entrepreneurship and innovation.

Our Challenge

The City of Birmingham is challenged to meet its mobility needs because of its poor transportation connectivity across all modes, underutilization of existing transportation resources, limited transit, bicycle, and pedestrian options, and aging/crumbling and outdated transportation infrastructure. The transportation system has been cited as a barrier to opportunities and access to both health services and healthy foods. The historic network of roadways is not friendly to pedestrians or cyclists, and the general lack of pedestrian facilities and inter-community connections are all contributors to a widening gap in socio-economic conditions. In addition, the City of Birmingham also is confronted with a declining total population, an aging citizen base, and concentrations of poverty. Each of these issues is exacerbated by the poor quality of the existing transportation system.

Additionally, the City does not have information systems built. The technology and data that currently exists are disconnected and isolated, and endures in pockets/silos. The challenge is to integrate it all-- the systems, the technology, the information – and to exploit its power to the fullest.

Our Opportunities

The City is transforming rapidly and its change is inevitable. Birmingham's downtown is already experiencing a resurgence, and the City as a whole is undergoing a regeneration of its ninety-nine (99) neighborhoods. The City's revitalization efforts are largely focused on: improving quality of life for citizens; protecting and enhancing the unique sense of place; rebuilding the economy with a foundation of diversity and resiliency; and orientation toward innovation and a healthy workforce. Birmingham and its greater region are

strategically targeting catalytic transportation and land use/land development efforts in a handful of core areas and travel corridors, and are beginning to realize success through these areas successful transformation. For this success to continue, the City of Birmingham needs to make a "big leap", and modernize its transportation infrastructure and service delivery. However, modernization does not mean looking to the status quo. Instead, the City of Birmingham is looking to become a national leader for urban mobility.

In 2015, the U.S. Department of Transportation awarded the City of Birmingham a TIGER VII grant to build a bus rapid transit (BRT) system in three (3) distinctive travel corridors and the Birmingham City Center. The provision of Federal funding to assist with the development of this important infrastructure component is a critical catalytic element for the project. The BRT itself is one of the larger catalytic elements intended to support, and in some cases help jump start, the redevelopment of impoverished neighborhoods. The hope and promise of the BRT system is that it will usher in a new era of travel for the City of Birmingham; that it will strengthen the City's diverse communities by connecting them to services and linking residents to opportunities. However, the City's transportation transformation does not end here as this is just the beginning.

Our Vision

Our vision is to utilize new transportation and infrastructure technologies, Smart City elements, and innovative urban transportation approaches to transform the City of Birmingham into a modern, thriving community that showcases the transformational power of the Smart City concept on mobility, accessibility, economic growth, land development, equity, and quality of life

The City of Birmingham is looking to remake itself into a 21st Century City. Its leadership has a renewed commitment to the City's growth and development, and is actively seeking new ways to attract new talent and business. They know that in order to achieve the vision that they have set for Birmingham's future and overcome its past deficits, that they need to take bold actions to remediate the City's transportation system.

The City of Birmingham has a strong desire for its transportation system to establish a broad reach, linking the City and the region that it serves to new markets and destinations around the world. At the same time Birmingham's leadership is seeking to take advantage of both the City's geographic location and historic legacy as the "Pittsburgh of the South", building upon the existing inter-modal freight rail network, and capitalizing on its new interstate connections--gaining from the combined strengths of individual modes.

Birmingham's vision for its transformation reflect a city that is intelligent in character-- harnessing the tremendous power of digital social networks, elements of the sharing economy, and technological advancements to expand its economic and social capabilities, and exploit its tremendous potential. It is inclusive in its services-- always moving forward, leaving no one behind. The transportation system is innovative in its scope. It derives its benefit from integrated data, technology and smarter use of its existing infrastructure.

The City of Birmingham's vision is closely linked with the ideas expressed in both its comprehensive plan. The Comprehensive Plan holistically addresses the development of its communities, looking at economic conditions, land development patterns and trends, transportation needs, human health disparities, and the overall quality of life. Facilitating

community reinvestment, especially in the low-income and minority neighborhoods, is one of the primary goals of Birmingham's response to the Smart Cities Challenge. Through its inclusive planning process and strategic public investment, the City of Birmingham has set in motion an economic engine that is gaining the momentum needed to restore prosperity to Birmingham's neighborhoods. The new construction occurring in the Parkside District and Woodlawn are evidence that with targeted public investment community renewal is possible.

The City's approach to catalyzing a renaissance of its neighborhoods is to center revitalization efforts around "strategic opportunity areas." The strategic opportunity areas are activity centers that contain the necessary economic, social, and transportation resources to help them be successful. The comprehensive plan calls for linking a number of strategic opportunity areas together along the BRT corridor like a string of pearls, and locating BRT stations within them. This acknowledges the transformative power of transportation, and is key to the City's revitalization strategy. In short, the strategic opportunity areas are intended to serve multiple functions, and are envisioned to be the catalysts for community reinvestment. One of the functions intended for the strategic opportunity areas is for them to serve as "mobility hubs".

Mobility Hubs are an attempt to address the negatives brought about by land development patterns that responds exclusively to a single travel mode, the automobile, and whose supportive infrastructure (i.e. wide, high-speed arterial roadways, parking facilities, etc.), discourages the movement and use of other transportation modes. They are places of connectivity where different modes of transportation – from walking to biking to transit to shared ride services – come together seamlessly. They also support intensive

concentrations of higher density development, accommodating places for people of all incomes, age, and ability to work, live, shop and/or play, and connecting communities to the rest of the region through reliable, rapid transit services. In essence, mobility hubs are activity centers that integrate land use and transportation, and epitomize the City's vision for its future.

Mobility hubs are hardly a household phrase. But the concept of a central places that links different modes of transportation, as well as other things such as shopping, entertainment, recreation and family services – is fundamental to the City of Birmingham's vision for its revitalized communities. They elevate the importance of public transit, cycling, and pedestrian travel. This elevation of importance is critical to ensuring the development of an efficient, sustainable transportation system. Public transit and non-motorized transportation facilities within the hubs help to reduce automobile travel, which impacts air quality. Equalizing and/or prioritizing cycling and pedestrian travel within mobility hubs also helps in addressing community health issues by providing employees, residents, and visitors to communities that host mobility hubs the opportunity for walking and cycling.

Mobility hubs are proposed to be located within neighborhood activity centers, and are all about making it easier to move from one mode of transportation to another, anchoring seamless, convenient connections across the metropolitan planning area. They're also about improving the relationship between transportation and land use. There's no point building a mobility hub in the proverbial "middle of nowhere." In order for them to work, mobility hubs need to be located close to many people, whether they are at work, at home, or at play. In other words, they need to be livable.

Complementing the Birmingham BRT's service design and capital investment, which will reduce the need for customers to travel to Birmingham's downtown to transfer, mobility hubs will help customers access the BRT and other local transportation options, as well as provide a viable, cost-effective solution for "last mile" connections.

Table 1 provides a description of how the mobility hubs are envisioned to work within the City of Birmingham.

Incorporation of new technologies into the infrastructure, testing of automated and connected vehicle technologies, use of smart data collection and sharing practices, smart land use, and user-focused mobility services are all of critical importance to the successful implementation of the Mobility Hubs concept.

Our vision is for the City of Birmingham to be a living laboratory for testing innovative transportation concepts that will allow the City of Birmingham to close existing socioeconomic gaps that have been defining transportation mobility, access to services, and growth opportunities for years and provide enhanced transportation options to move people and goods in a safer, more efficient, more sustainable, and more equitable way.

If selected for the Smart City Challenge, the City of Birmingham proposes to leverage existing resources, expand on recent transportation and urban planning initiatives, and introduce new technologies, strategies, and institutional changes to address local transportation challenges, spur economic development, and improve the quality of life for our citizens.

Transportation options that are currently available or planned, and that will support the Mobility Hub concept include:

- Traffic Management Center (TMC).** The City of Birmingham operates a Traffic Management Center (TMC), located in Birmingham’s City Hall. The TMC is designed to monitor traffic using CCTV cameras and control traffic signal intersections, and proactively deploy traffic management strategies to reduce congestion during special events, emergencies, or daily stop-and-go traffic.
- Public Transportation.** In 2015, the City of Birmingham applied for and subsequently won a U.S. Department of Transportation TIGER VII grant to assist the City with the development of its long planned bus rapid transit (BRT) system. The BRT system will be the spine of a re-imagined transit system, where the BRT serves a series of mobility hubs, and local bus services feed the BRT system instead of running into a central location. The BRT is proposed to a 10-minute frequency during the peak travel periods, and a 15-minute headway during the off-peak periods.
- Local Bus Service improvements.** The Birmingham Jefferson County Transit Authority also is undertaking a complete overhaul of its fixed-route bus services. While the major improvements to local bus services are primarily focused on changes to routes, improvements also include technology upgrades such as automated vehicle location (AVL), real-time vehicle arrival systems, automated passenger counters (APC), and electronic payment systems.
- Car Sharing Program.** The City of Birmingham hosts a car share program. The University of Birmingham at Alabama (UAB) Car Share, is operated by a private entity and is currently limited to students and faculty at UAB. Employed as part of the University’s congestion management strategy, the car share program provides these individuals who need a car for occasional use an option to rent a vehicle for a short period of time.
- CommuteSmart.** The City of Birmingham is an active partner in the Regional Planning Commission of Greater Birmingham’s CommuteSmart initiative. CommuteSmart is a commuter services program that operates in the State of Alabama’s four (4) metropolitan transportation management

Regional Mobility Hubs	Serving multiple communities, regional mobility hubs serve regional activity centers and have the potential for the highest levels of population and employment densities, and that generate the highest levels of travel demand to and from these centers. Potential transit travel modes include high-capacity public transportation services such as Birmingham’s planned bus rapid transit (BRT) system, as well as express and local bus services. Regional hubs are defined based on their scale, character, transit service availability and type, and function
Community Mobility Hubs	Community scale mobility hubs serve major regional destinations and/or functionally important gateways that have inter-regional connections such as airports, emerging activity centers, universities and colleges, major parks and stadiums, and regional shopping centers
Neighborhood Mobility Hubs	All stations located on a high-capacity transit line, primarily providing access to both high-capacity and local transit services for nearby residents in lower-density, single-use areas which were not included in previous definitions.

area's (TMA's) i.e. Huntsville, Birmingham, Montgomery, and Mobile. Within the Birmingham metropolitan planning area, CommuteSmart actively supports and helps to maintain 35 vanpools. They identify 2,559 active carpools in the rideshare database.

- **Commercial Shared Ride Services.** The City of Birmingham recently passed an ordinance allowing shared ride services such as Uber and Lyft to operate within the City of Birmingham. Many of the City's neighboring jurisdictions followed suit soon after, noting that it did not make sense for them to do so if Birmingham did not allow these services as Birmingham is the economic, cultural, and entertainment hub for the region.
- **Inter-modal Connections.** The City of Birmingham is currently completing construction on an inter-modal transportation center in its downtown. The Birmingham Inter-modal Center will provide connections between local bus services, interregional and intercity bus services, passenger rail, taxi and shared ride services, bikeshare, and the City's urban trail network.
- **Bikes Share Stations/Bicycle Facilities.** Since 2015, the City of Birmingham is home to the Zyp Bikeshare program. Currently, Zyp Bikeshare is a dense network of kiosks and bikes whose existing services are primarily focused in Birmingham's City Center and its adjacent neighborhoods. Zyp has aspirations of expanding beyond downtown, and is looking to provide bikeshare across the City, as well as in neighboring cities. The Zyp bikes are "smart bikes." That is, the bicycles employ technology that knows where they are, and where they've been. Travelers can check their previous routes on the web or within Zyp Bikeshare's app, a useful tool for

individuals seeking to achieve a health goal, planning entities looking to identify travel patterns, or for folks who simply want to know where they have been.

Along with state of the art bicycles, Zyp Bikeshare also employs sustainable docking stations. The stations use clean energy, and are powered independently. Both the station and bikes are charged fully by solar panels. Stations and bikes communicate with the larger network wirelessly. Stations may be permanent. However, their design allows them to be portable so that they can be adapted temporarily for specific events.

The City of Birmingham envisions that Zyp Bikeshare stations will be located in all mobility hubs, and provide seamless connections for travelers who choose to use transit, walk, or drive to the activity centers and the adjacent neighborhoods.



- **Car Share Access.** Car sharing offers a potential model for the City of Birmingham in its quest to become a Smart City. While car sharing is not currently accessible beyond the UAB campus, car sharing can support Birmingham's efforts to revitalize communities and make them more livable by reducing the need for additional/larger roadway infrastructure and surface parking. Additionally, car sharing can provide a potential economic savings for both government and private companies

by helping to reduce their fleet costs, minimize local transportation expenses, and meet sustainability goals.

- Pedestrian Facilities.** In 2010, the Freshwater Land Trust, in partnership with the Jefferson County Department of Health, completed the Red Rock Ridge and Valley Trail Plan (Red Rock) for Jefferson County, home-county to the City of Birmingham. The City of Birmingham subsequently adopted the Red Rock Plan and has since integrated it into its comprehensive plan and supporting Community Framework Plans. In 2011, the City of Birmingham applied for and was awarded a TIGER IV grant. Entitled Roads to Recovery, the TIGER IV grant is the first phase of a planned Complete Streets and multi-modal transportation system, and helped the City to jumpstart the implementation of the Red Rock multi-use trail system. To date, more than 27 miles of sidewalks, bike lanes, and off-road trails have been constructed.



- Smart Parking.** With roughly 4,700 on-street parking meters and another 7,000 structured parking spaces, there is tremendous opportunity for the City of Birmingham to utilize interactive parking systems that would help alleviate traffic congestion, provide Citizen and visitor convenience and increase City revenue.

The City has reviewed several Smart Parking System solutions and is preparing to procure a system that meets its desired needs, such as the ability to identify available open on-street parking spots and open spaces in parking garages on an interactive map. The desired system will also enable user to pay for parking using a smart phone app that is compatible with IOS, Android and Windows. Users also would be notified when their meter time is about to expire.



In addition to these Smart Cities strategies, the City of Birmingham also is actively working to embrace freight transportation as part of its vision for the Smart Cities Challenge. Building on the region's success in obtaining a TIGER I grant for the Birmingham Regional Inter-modal Freight facility, the City of Birmingham is looking to develop freight villages, integrated logistics centers to take advantage of its existing rail, highway, and waterway infrastructure.

A freight village is a defined area within which all activities relating to transportation, logistics and the distribution of goods, both for national and international transit, are carried out by various operators. Freight villages, as envisioned for Birmingham, will accommodate state-of-the-art distribution centers and industrial activities that serve large market areas, and shun passive activities such as container storage. These types of distribution centers and automated manufacturing and industrial activities are already beginning to occur within the Greater Birmingham region around the automotive manufacturing industry.

The City of Birmingham's goal in developing freight villages is to leverage freight operations to create economic value for underutilized and abandoned industrial sites, and in particular provide a strategy for the reuse of brownfield sites. The City also is looking to create shared value for the communities in which the freight village would be located. This includes the development and expansion of support businesses such as retail (restaurants, banking, stores), and hotels, as well as providing office space for non-retail businesses. Other City goals to be accomplished

through the development of freight villages include: a. increased rail mode share, b. improved environmental quality, and c. the creation of a more efficient and cost-effective freight delivery system.

The City of Birmingham's freight villages are envisioned to be located adjacent to modal shift facilities. Modal shift facilities are themselves located within the freight village. Modal shift facilities are transportation facilities where goods are moved between two or more forms of freight transportation such as rail to truck; barge to rail/truck; air and rail/truck. They will be sensitive to the surrounding land uses, blending in with their communities, and contributing to the City's quality of life. Ideally, they will employ the City's newly developed character based zoning criteria, showcasing how open space and industrial space can coexist, demonstrating the City's desire to incorporate "green building" techniques and employ low impact design for parking and staging areas.

There are several existing industrial sites within the City of Birmingham with rail access that are proximate to interstate highways, and have both air and water transport nearby. These are locations where freight villages might evolve and thrive.



Our Goal

The City of Birmingham will use the funding available through the Smart City Challenge to accomplish the following programmatic goals:

- Enhance Mobility and Access
- Improve Traffic Safety for All Users
- Reduce Environmental Impacts and Support Sustainability
- Stimulate Economic Growth

Specific measurable program objectives are set to monitor progress and demonstrate impacts of planned initiatives on mobility, safety, climate change, sustainability, and economic growth. Goals and objectives are summarized in Table xx along with corresponding performance measures. These are in line with programmatic goals set forward by the Regional Planning Commission of Greater Birmingham as presented in the Birmingham

2040 Regional Transportation Plan. Further refinement of program objectives and performance measures will take place as part of the Deployment Plan Development phase of the Smart Cities Challenge program.

Independent performance evaluation is planned and will focus on gathering, managing, and analyzing the data needed to produce performance measures and comparing such measures with pre-set targets to validate system performance and identify any system inefficiencies. The City of Birmingham and other stakeholders will support and facilitate information sharing with the independent evaluators and access to the site for data gathering and processing to ensure that the independent performance evaluation is performed in a timely and efficient manner.

The overall goal of this effort would be to quantify and evaluate the impact of advanced

Table 2. Smart Cities Challenge Goals, Objectives, and Performance Metrics

Smart Cities Goal	Program Objective	Performance Measures
Enhance Mobility and Access	Improve Mobility	Travel Time Index Vehicle Miles Travelled (VMT) Lane-Miles of Congestion Congested Vehicle Hours Travelled % Change in Travel Time Due to Congestion Investment in ITS
	Provide Transportation Choices	Public Transit Service Area Transit Service Hours per Capita Total Bikeway Miles Total Trail Miles Ratio of Bikeway Miles to Major Roadways Number of CommuteSmart Registrants Number of Zyp BikeShare Registrants % of Trips Made by Transit % of Trips Made by Non-Motorized Mode % of Trips Made by Shared Modes Vehicle Miles reduced by Incentives Programs (Get Green, Commuterclub)

<p>Improve Traffic Safety for All Users</p>	<p>Reduce Crash Occurrence</p> <p>Reduce Crash Severity</p> <p>Reduce Incident Hotspots</p> <p>Improve Incident Management and Response</p>	<p>Total Number of Crashes Number of Crashes per million VMT Number of Crashes by Travel Mode (vehicle, transit, pedestrian, bicycle) Number of Crashes due to Human Error</p> <p>Fatality rates (3-year moving averages) Injury rates (3-year moving averages) PDO rates (3-year moving averages)</p> <p>Change in number of locations with significant above average total incident rates</p> <p>Average EMS Response to a traffic Incident Average incident clearance time</p>
<p>Reduce Environmental Impacts and Promote Sustainability</p>	<p>Reduce Automobile Use</p> <p>Reduce Pollution and Fuel Consumption associated with Transportation</p> <p>Promote energy efficient transportation alternatives</p> <p>Promote environmental, social, and economic sustainability of the Birmingham community</p>	<p>VMP per Capita % of Total Employees Telecommuting % of commuters using different transportation modes % Net greenhouse gas emissions impact of transit service</p> <p>% of Fuel Efficient Vehicles in Commercial Fleets Green House Gas Total NOx Total (tons per year) PM2.5 (tons per year)</p> <p>% Market Share of Electric and Hybrid passenger cars Number of Electric Vehicle Charging Stations Energy use at mobility hubs</p> <p>Score on the STARS Communities Sustainability Rating System</p>
<p>Stimulate Economic Growth</p>	<p>Support Economic Competitiveness</p> <p>Provide Affordable Transportation Options for Commuters</p>	<p>Support Economic Competitiveness</p> <p>Provide Affordable Transportation Options for Commuters</p>



technologies and initiatives undertaken as part of the Smart City Challenge and summarize lessons learned for the benefit of other cities facing similar challenges. Also, remaining technical, institutional, and policy challenges related to deployment of systems that support Smart City priorities will be identified and countermeasures to address them will be presented.

Our Approach

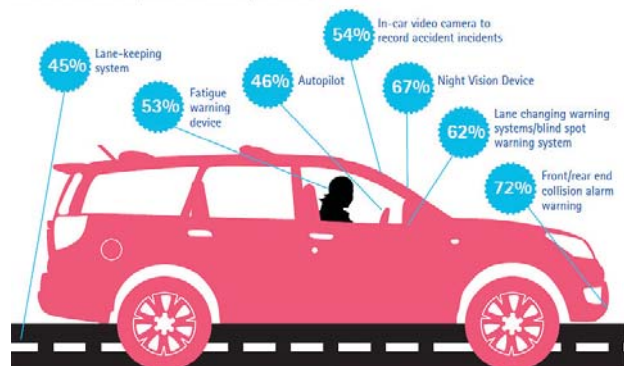
Building on our current assets and strategic plans for moving Birmingham forward, we intend to use the Smart City Challenge funding to introduce smart, technology-driven transportation improvements that will address current transportation challenges identified within a city and provide equitable, high quality transportation options and services to fulfill the needs of the traveling public and transportation industries.

The City's vision for its transformation into a Smart City is inclusive of many of the elements of the USDOT's definition of a smart city. As such, several Smart City transportation systems improvements and innovations which are envisioned to be employed in Birmingham are closely linked with USDOT's vision elements of a successful Smart City. Examples include the following:

- Connected Vehicles.** The City of Birmingham plans to utilize funds from the Smart City Challenge to instrument its infrastructure to meet the transportation mobility needs of the future. Two-way short-to- medium-range wireless communications capability is an important first step in this direction. The City will use Dedicated Short Range Communications (DSRC) technology to enable information sharing among instrumented vehicles

(V2V) and between instrumented vehicles and infrastructure (V2I) which is crucial for allowing testing and adoption of connected vehicles. Furthermore, the City will work with the Regional Planning Commission of Greater Birmingham-- the Birmingham region's metropolitan planning organization and Central Alabama's regional transportation organization, the Alabama Department of Transportation, and communications providers to integrate various communications platforms that are enabled by either DSRC or other available networks in support of connected vehicles deployment. This includes communications technology such as cellular, Wi-Fi, or satellite. Those communications remove existing barriers through the promotion of shared transportation processes, shared resources, and common rules of operation.

Assuming the maturity of national research and development efforts in the area of connected vehicles in the near future, the City of Birmingham will actively seek opportunities to participate in pilot testing



of connected vehicle concepts. As an early adopter of connected vehicles the City of Birmingham will validate its designation as Smart City and will play an important role in connected vehicles evaluation and technology transfer initiatives. The City also will work with BJCTA to explore opportunities for instrumentation of transit buses so that they can become part of the connected vehicles program.

Working closely with experts at the University of Alabama at Birmingham, the City will develop and implement a comprehensive plan for assessing impacts of connected vehicles deployment on congestion, traffic safety, fuel consumption, air quality, and user satisfaction. Technology transfer, training, and outreach will provide evidence of the impacts of connected vehicles on mobility, safety, and the environment and will facilitate enhanced adoption and deployment of connected vehicles in other medium size cities in the future.

- Automated Transit Networks.** The City of Birmingham understands the importance of urban automation and plans to work closely with researcher partners at the University of Alabama at Birmingham and the automotive industry to remove institutional barriers and address new technical and policy challenges associated with vehicle automation. The City of Birmingham is interested in pursuing the development and testing of an Automated Transit Network, more commonly known as Personal Rapid Transit (PRT). PRT is probably best described as a hybrid between the private car and public transit. In concept, PRT vehicles could hold up to four people or fewer, mimicking the private, quiet ride of a car. Relative to existing transportation alternatives, there would be very little emissions, no traffic congestion, no loud noises, and no

offensive odors produced by PRTs. PRT could effectively supplement Birmingham's soon to be constructed bus rapid transit system, and encourage car-free development by providing destination-to-destination service with minimal walking to and from stations.

PRT is envisioned to be an important part of Birmingham's Shuttlesworth International Airport's continued evolution, providing critical connections between the airport terminal and its soon to be built consolidated rental car facility, proposed office and light industrial development on adjacent properties, and hotel and conference space, and at the Uptown development located at the edge of downtown Birmingham.



- Intelligent, Sensor-Based Infrastructure.** As a Smart City, the City of Birmingham realizes the importance of installing sensors on the transportation network to monitor traffic conditions, optimize signal timings, support incident management, and facilitate informed decisions on mode choice, given real time information and available options. Birmingham is committed to addressing this need and plans to collaborate with the Alabama Department of Transportation and experts at UAB to develop and implement sensor deployment

plans that meet current and future needs of transportation infrastructure instrumentation.

A Smart City requires the use of technology to collect, process, and disseminate information thus allowing system managers and users to optimize efficiency, safety, and conserve resources. The instrumentation of vehicles, roadways, and other infrastructure with sensors, as well as the use of supporting resources (such as video monitoring, tracking of GPS data from tags or mobile phone signals, smart fare cards) to monitor traffic conditions and track the movement of vehicles, pedestrians and bicyclists in real time are all essential ingredients for the delivery of a successful, integrated transportation program that provides efficiency and choice as part of a Smart City paradigm.

DSRC wireless communications, GPS, and vehicles sensors are needed to enable the exchange of information among connected vehicles and between instrumented vehicles and the infrastructure. Smart phone apps allow users to get real time information about transit schedules, car-sharing options, bike-sharing locations, and parking availability. Additionally, smart sensors can be used to monitor continuously the conditions of transportation network assets in order to optimize resources used for operation and maintenance. Moreover, availability of robust data can help tremendously the City

of Birmingham in its efforts to prioritize needs and make smart investment decisions in the future.

Sensors may be also needed in buildings and other infrastructure elements to monitor their condition, manage water use and wastewater, or for smart-grid energy transmission. For example, electrochemical sensors can be used to determine the vapors emanating from organic pollutants during rain events in storm drains and detect the chemical composition of the contaminants. The chemical sensors can then be used to identify locations most sensitive to pollution during rain events, which ultimately discharge untreated into receiving waters (such as rivers and streams). The City of Birmingham will work

closely with local utilities companies to leverage resources from the Smart City Challenge program in order to introduce sensor instrumentation on the Birmingham testbed. In addition to using sensors as part of an intelligent infrastructure, Birmingham will explore the use of interactive technologies, such as crowd-sourcing, to get information about

citizens' needs and preferences, which will help decision makers to address key issues affecting the public as part of the Smart City program.

Some challenges still remain related to data fusion, integration, and storage of the vast amounts of data expected to be generated within a Smart City context. The City of



Birmingham will rely on the expertise of faculty at UAB to develop and employ appropriate data mining techniques that will assist greatly to interpret and use the data in efficient and creative ways for the benefit of the public.

- Urban Analytics.** The multi-modal transportation system envisioned for Birmingham will be driven by data. Data will allow system planning that truly reflects demand and community needs. The operation and effectiveness of the transportation system will be continuously monitored in real-time, ensuring that community needs are being met regardless of conditions. Data gathered from a variety of sources will allow the integration of mobility with broader goals of community health and economic vitality. All of this will rely on the collection of data from multiple (and sometimes seemingly disparate) sources, synthesis and analysis at a data center, and its provision to all stakeholders in a timely and easily accessible format. Transportation data will be at the core, but data related to community health, economics, energy, and resiliency will be integrated as well to ensure that all members of the community are being served.

Transportation system monitoring has traditionally been difficult for medium sized cities like Birmingham. Unable to afford the extensive detector and monitoring systems found in many larger cities, data collection has often depended on very limited sampling efforts. Fortunately, the foundation for data analytics is already in place in Birmingham. The Regional Planning Commission and UAB established the Regional Transportation Data Center in 2009, a partnership which monitors the performance of the regional transportation system and makes data and analysis available to stakeholders. Currently the

Center focuses on collecting and analyzing historical travel data such as counts, vehicle speeds, travel times, transit usage, and incident reports. The data are used to monitor congestion trends, identify hot-spots for congestion and incidents, and prioritize transportation projects. The data are also used to evaluate the effectiveness of transportation improvement projects. But this is just scratching the surface of what the Center will be as the Birmingham vision moves forward. The Center has recently begun to incorporate more multi-modal data for transit, bicycles, and pedestrians. Freight will also have growing importance, as Birmingham serves as a link between the Piedmont-Atlantic and Gulf Coast mega-regions.

To tackle the extensive analytics that will be required in the future, UAB has brought their Big Data Analytics Lab into the effort. The lab, which originates in the Electrical Engineering Department, provides big data expertise across the UAB medical and research centers and is pursuing cutting-edge research with industrial collaborators. By combining data from multiple sources in novel ways, Birmingham will be able to develop a multi-modal transportation system that truly supports the vision of personal mobility, community health, and economic vitality.

- Smart Cards.** The City of Birmingham envisions that access to all of the transportation services-- transit, bikeshare, parking-- will be seamless. Currently,



the region's transportation providers all provide access to their services using different payment mediums. Public transit in Birmingham utilizes, cash, paper passes, and ticket books. Zyp Bikeshare users access bikes at kiosks using either a credit card or a pre-paid key fob. They also can use their smart phones via the Zyp Bikeshare app. Drivers accessing on-street parking and the City's public structured parking facilities use loose change and cash respectively.

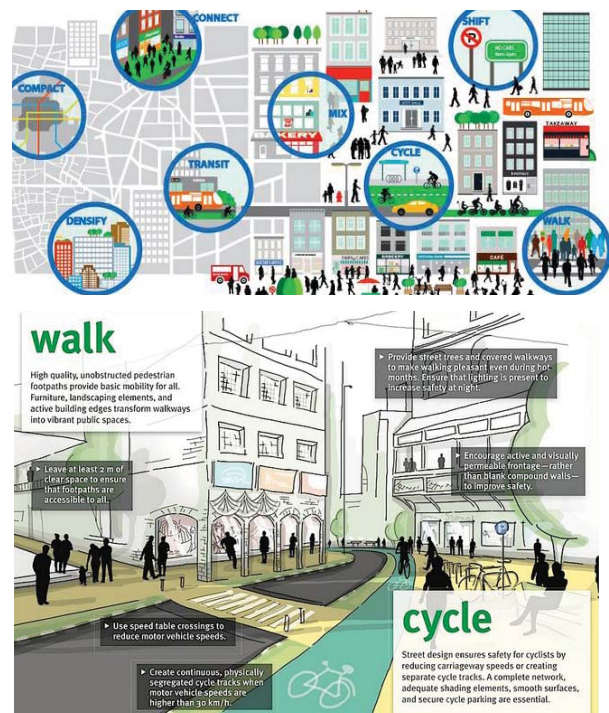
Smart cards, as envisioned for Birmingham, will employ new technology currently being deployed by the nation's banks to provide travelers with a more secure payment system that is universally accepted, is flexible in its design, enables travelers to better budget for transportation, and allows access to travel across multiple transportation modes. Frequent use also will enable travelers to better track their use of the transportation system, as well as agencies to better understand how the system is being used. Finally, the technology will aid agencies to cut down on operating costs by eliminating the need to manage multiple payment mediums and reducing the risk posed by fraud by physically collecting money.

- Smart Land Use.** The City of Birmingham has embraced its new urban future. The Birmingham Comprehensive Plan (Comprehensive Plan), drafted in 2012 and adopted in October 2013, lays out a critical foundation for the achievement of a more vibrant and sustainable city and region. The Comprehensive Plan establishes an inclusive vision for revitalization. It offers an exhaustive list of strategies for encouraging and attracting community reinvestment, as well as ideas for how to develop healthy neighborhoods. This includes recommendations for a variety

of housing choices accessible across a range of incomes, age, and ability as well as infrastructure recommendations for complete streets, and policies to minimize health disparities.

Public and private investments in places and public amenities such as the Woodlawn and Avondale neighborhoods, the Lakeview and Parkside districts, Railroad Park, Region's Field, and the Birmingham Crossplex are all examples of the integrated, holistic approach that the City is taking to address the complex challenges it faces. The subsequent Framework Plans, district level comprehensive planning documents that build off of the Comprehensive Plan, are the City's primary policy tool for achieving its vision to be a City of Smart Places. The Framework Plans provide greater clarity, detail, and direction for land use, land development, transportation, housing, active and passive greenspace i.e. parks, trails and open space, utilities and economic development.

The concept of Smart Places revolves



around the City's vision for its communities and neighborhoods to be better connected to services and opportunities, to be more walkable and bicycle-friendly, to offer a range of housing choices that are affordable to all, to be supportive of neighborhood scaled businesses as well as the larger urban economy, and to provide safe and healthy environments for its residents. To that end, City through its development of its mass transit services and particularly the BRT system, will establish a system of connected mobility hubs. Mobility hubs were previously described in Our Vision for Birmingham as a Smart City.

- **Strategic Business Models and Partnering Opportunities.** The City of Birmingham will collaborate very closely with the University of Alabama at Birmingham and utilize expertise and technical capabilities of faculty members at UAB to plan, design, implement, and evaluate initiatives undertaken as part of the Smart City Challenge program. A collaboration agreement between UAB and the City of Birmingham was signed in February 2013 and marked the beginning of this successful partnership which serves as a solid foundation for the Smart City Challenge program.

Through the UAB Sustainable Smart Cities Research Center (SSCRC), UAB has an already established role as an engine of innovation that can transform the community through the use of smart technologies and information systems, effective transportation alternatives, renewable energy options, and sustainable environment solutions. The partnership between UAB Sustainable Smart Cities Research Center (UAB SSC) and the City of Birmingham creates excellent research, education, and training collaboration opportunities within a unique setting

where the city becomes a living laboratory for implementation and testing of innovative research application to benefit the community.

Moreover, UAB is a University partner of the Southeast Transportation Research, Innovation and Education Center (STRIDE) a Regional University Transportation Center (UTC) led by the University of Florida. STRIDE University partners devote their energies to three major focal areas: transportation safety, livable communities, and economic competitiveness which are directly related to Smart City Challenge program priorities. UAB is also a member of the National Center for Transportation System Productivity and Management (NCTSPM), a Tier 1 National University Transportation Center led by the Georgia Institute of Technology.

The well-established partnership between the City of Birmingham, UAB's Sustainable Smart Cities Research Center, and the STRIDE and NCTSPM University Transportation Centers as part of the Smart City Challenge will foster cross-disciplinary research, training, and outreach that will promote the development of innovative solutions for sustainable smart cities and communities and dissemination of findings for the benefit of transportation agencies, professionals, and the public at large.

UAB's commitment to economic development is also aligned with regional and state strategies, including "Blueprint Birmingham" — the community's growth strategy led by Birmingham Business Alliance — and Accelerate Alabama, which seeks to drive recruitment of new projects, business retention and develop home-grown start-ups.

Figure 1 provides a graphic illustration of the locations within the City of Birmingham where

many of these Smart City concepts are desired. It should be noted that this document only presents a high-level vision for the Birmingham's proposed Smart City technology deployment. A detailed technical and management approach for realizing the aforementioned vision, along with specifics about the implementation requirements and the metrics to be used for quantification and evaluation of impacts associated with deployment and operations are outside the scope of the current solicitation.

Our Capacity

UAB Sustainable Smart Cities Research Center

As described previously, the Sustainable Smart Cities Research Center at the University of Alabama at Birmingham is an enabling platform for interdisciplinary collaboration to understand and transform the impact of urbanization at the scientific, economic, and human levels. The UAB SSC provides avenues for:

- **Training.** UAB SSC trains researchers and leaders in the community, to advance the Science of Cities and sustainability in the urban setting.
- **Research.** UAB SSC contributes to the development of the new Science of Cities by promoting interdisciplinary research that seeks to understand the dynamics and impact of the built environment and technologies in the efficiency of cities and the quality of life of communities.
- **Outreach.** UAB SSC educates the community on the elements of a sustainable smart city, and engages citizens in transforming their built environment by actively participating in the center's research and education programs.

UAB Bill L. Harbert

Institute for Innovation and Entrepreneurship

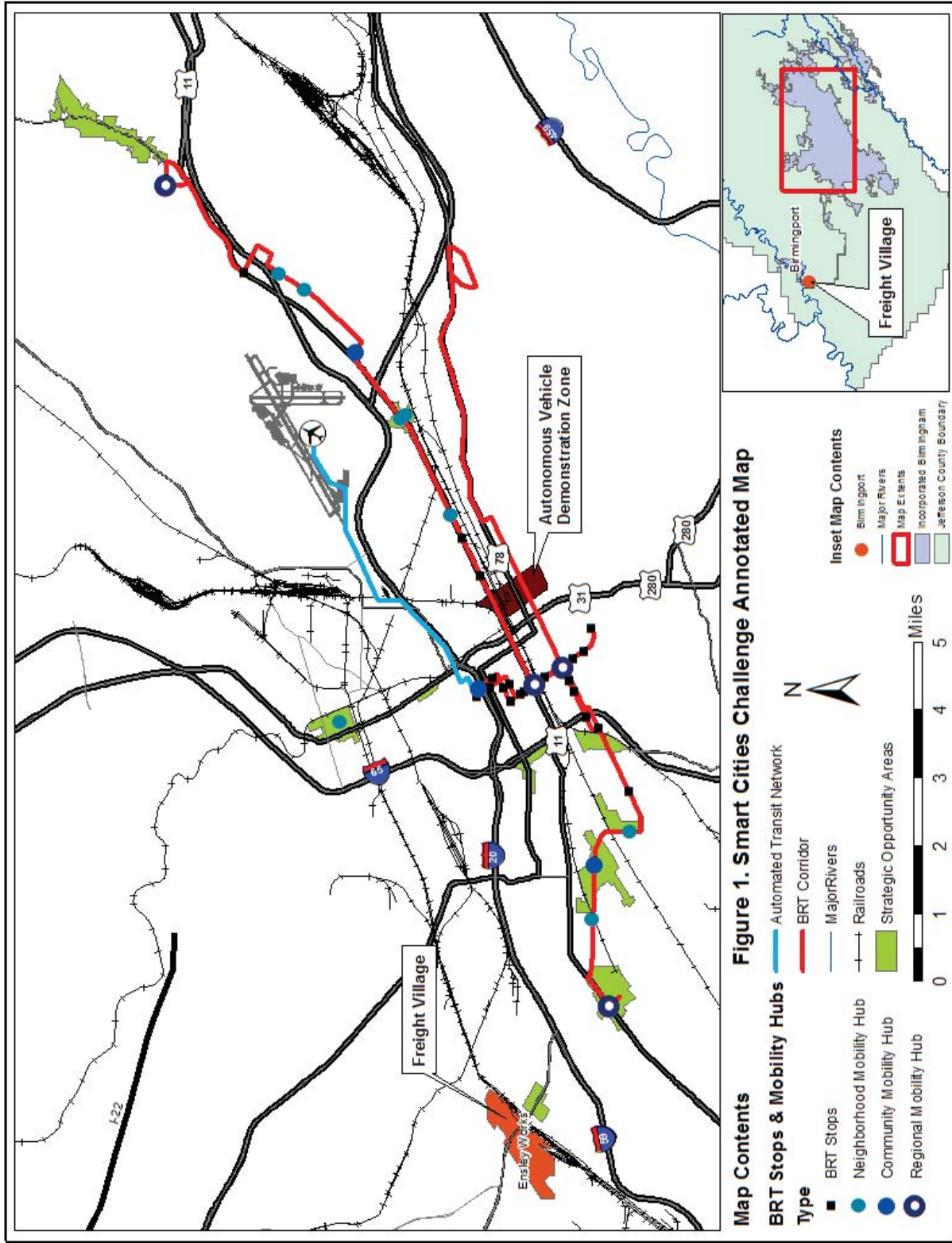
UAB's Institute for Innovation and Entrepreneurship (IIE) improves the efficiency and competitiveness of its research engine in an environment that fuels and sustains innovation among faculty, researchers, students and community leaders. IIE helps to accelerate new company formation and technology transfer through improved and flexible processes that build on successes of the UAB Research Foundation (UABRF). Since its inception, UABRF has generated more than \$64 million in licensing revenues and helped created 55 start-up companies based on products and technologies discovered at UAB. IIE is bolstered by the Invention-to-Innovation (i2i) program. i2i is a joint effort by the School of Business, UAB Research Foundation and Birmingham Business Alliance to market UAB assets with high commercial potential.

Innovation Depot

Opened in 2007, Innovation Depot is an incubator and economic development program that hosts a shared co-work space facility in what was an abandoned Sears department store in the City's Entrepreneurial Center just west of the city center. It is the Southeast's premier technology business incubator, and is at the heart of Birmingham's newly designated Eco-District.

Innovation Depot also host UAB's Office for the Advancement of Developing Industries. The 145,000 square foot space is designed to accommodate as many as 75 small businesses and up to 500 workers. However, demand has been high and there are currently 92 companies employing 540 people working under the Innovation Depot banner. In partnership with the City of Birmingham, Innovation Depot continues to work to support early stage technology companies, and has seen those it's taken under its wing stay local. About 90% of the companies that go through the program stay close to home when they

Figure 1. Annotated Map of Smart Cities Challenge Technology and Programmatic Demonstration Sites



graduate. Graduates of the Innovation Depot include companies such as RFID and Motus, a motorcycle company that employs an in-house designed and patented V-4 engine. The engine that Motus designed and developed the world's first direct-inject, liquid cooled V-4 engine. The company now manufactures from a facility in downtown Birmingham.

Workforce Readiness

The City of Birmingham has long been committed to workforce development and training. Lawson State Community College is located in the City of Birmingham, and is accessible by public transit. Considered to be a historically black college and university (HBCU), Lawson State is a participating member of the Alabama Center for Automotive Excellence, and offers three auto mechanics programs sponsored by manufacturers- Ford ASSET, GM ASEP and Toyota T-TEN. These programs are designed to help address the demand for skilled automotive technicians, and reduce the talent gap between jobs posted and available workers to fill them. Ranked among the top 50 best community colleges in the country, and consistently ranked in the top 5 of this group, Lawson State Community College also is one of the National Alternative Fuels Training Consortium (NAFTC) affiliated National Training Centers. NAFTC includes a national network of National Training Centers which are post-secondary education and training organizations that provide vehicle instruction and a demonstrated commitment to move towards providing instruction in alternative fuels, alternative fueled vehicles (AFVs), advanced technology vehicles, and related technologies. Since 2009, Lawson State has been training mechanics specifically in the care

and repair of AFV's and advanced technology vehicles to include electric vehicles. Lawson State also is a top supplier of skilled labor to Alabama's automotive industry, and graduates have found gainful employment with Mercedes Benz U.S.A., Hyundai America, Toyota, and Nissan.

In 2011, Lawson State Community College was recognized by the Obama Administration as a Champion of Change for its work with developing the next generation of skilled labor and providing a successful bridge between vocational and academic education.

Lawson State Community College's Birmingham campus will link directly with the Birmingham BRT, host a mobility hub, and connect to other area mobility hub(s) that are currently being planned as part of the City's comprehensive planning process. It's Bessemer campus will link with the BRT corridor as it expands west in future phases.

In addition to training mechanics, there is a statewide push to by the Alabama Technology Network, the Alabama Industrial Development Training, and community colleges are trying to accelerate teaching specific technical skills. This includes teaching computer coding skills. Code.org, is national organization focused on increasing access to computer science education. Code.org is partnering with A+ College Ready and the Alabama State Department of Education, and will invest \$500,000 to build on Alabama's efforts to expand computer science courses in K-12 classrooms across the state. The investment will double the number of Alabama teachers

qualified and trained to teach computer science in the state's public schools.

Our Commitment

Leadership. Since becoming Mayor of Birmingham in 2010,



William A. Bell, Sr. has steered the City into a new and exciting direction. After inheriting a \$77 million budget deficit, Mayor Bell quickly took control and began transforming the City, bringing about a renaissance of development and culture, and ushering in a new era of economic prosperity.

Under Mayor Bell's leadership, Birmingham has made key strategic investments to spark growth and revitalization. The development of a new downtown baseball stadium-- Regions Field-- the Negro Southern League Museum, and continued support of Railroad park has brought hundreds of millions of dollars of private investment to the thriving Parkside district and returned baseball to the City of Birmingham. Other investments, such as the Birmingham Crossplex, the Uptown Entertainment District, and implementation of the Red Rock Ridge and Valley Trail System are currently spurring residential and commercial growth in throughout the city.

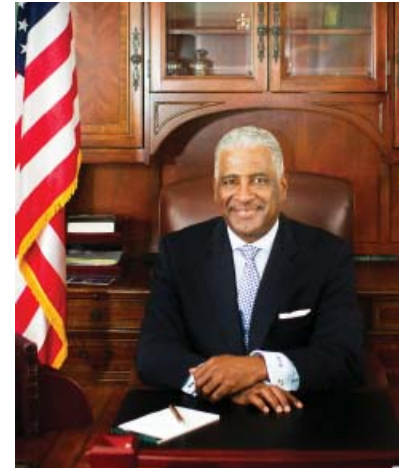
Numerous corporations have relocated to Birmingham or renewed their commitment to stay in Birmingham. This includes Healthsouth, Steris, Kamtech among others.

In 2013, Mayor Bell signed a memorandum of understanding with the University of Alabama at Birmingham Sustainable Smart Cities Research Center to partner on projects that would make Birmingham a more livable city. Through this partnership, Birmingham received one of 16 (one of four in the United States) IBM 2014 Smarter Cities Challenge Grants aimed at eliminating food deserts in Birmingham.

Mayor Bell is not only changing the face of Birmingham locally, he is Birmingham's ambassador to the world. He has served as president of the African American Mayors Association (AAMA), co-chairing the U.S. Conference of Mayors Committee on Human

Rights. He is also co-chair of "My Brothers Keeper," an initiative by the U.S. Conference of Mayors and President Barack Obama.

The Sharing Economy. The City of Birmingham is committed to the developing of its sharing economy, and will continue to integrate transportation technology solutions so that they support these highly flexible economic networks. The City already has made it easier to share resources on demand, supporting the development of the awarding winning Innovation Depot.



The City has supported the development of other co-working spaces such as REV Birmingham's SocialVenture and 55th Place Arts. SocialVenture is a facility located in the historic Woodlawn neighborhood that offers Birmingham's entrepreneurs, non-profits and start-ups shared office and retail space, and a divisible space to house meetings, workshops and receptions. 55th Place Arts offers customizable studio workspace for artists, makers, and other creatives. All of these facilities-- Innovation Depot, SocialVenture, and 55th Place Arts-- are located in proposed mobility hub locations. Innovation Depot already has access to the Zyp Bikeshare program.; the other two locations are proposed to have access to Zyp Bikeshare and BRT.

In addition to supporting co-working space, the City of Birmingham also supports the Urban Food Project. The Urban Food Project aims to build a robust local food economy while creating healthy food access. The program

assists corner store owners with shared resources that help them to purchase, market, market, and sell of fresh produce. The Urban Food Project addresses Birmingham's food desert problems by assisting Alabama's farmers plan their crops and access underserved markets i.e. Birmingham's food deserts, providing delivery services of quality produce to neighborhood restaurants and corner stores.

Finally, the City is supportive of the sharing economy in that rideshare companies such as Uber, and Lyft, as well as apartment/house sharing companies such as Air BnB are all now permitted to operate within City limits. Because Birmingham is the largest city in Alabama, its agreement to allow these businesses to operate within the City has opened up the sharing economy's market to the entire Central Alabama region.

Our Process

Decision-Makers. A decision structure has been established that includes input from each of our key team members. A risk reward matrix will be established to allow the ranking of identified components and options for specific projects during program implementation. Each strategy and implementation plan will be submitted to the committee for review and ranked against the objective of the Smart Cities Challenge, as well as the available resources for implementation. Key decision factors include: a) optimization of existing assets, b) integration with other program components, c) expandability, d) transferability, and e) the ability to advance Smart Cities Challenge objectives specifically for mobility hub. This approach will allow for diverse input for selection of technologies and approaches that best advance the City of Birmingham's overall Smart Cities program, and generate outcomes with the maximum benefit for the City. This approach also will identify activities that can be implemented in other jurisdictions and

nationwide.

Each team member will identify one representative to serve on the committee and assist with alternative selection. The committee will be chaired by the Mayor's office.

Program Management. The Program Management structure for the Smart Cities Challenge program will be put in-place from the initial formulation of the program's objectives, and will be implemented continuously through the closeout of the program. The Program Management Team will include:

- Individual Project Management Plans
- Program Scheduling
- Financial Management
- Value Engineering

Our Risks

There are several potential technical, policy, and institutional risks associated with the deployment of the City of Birmingham's Smart Cities Challenge vision. While the risks are many and varied, most all of them might be avoided and mitigated through thoughtful and careful preparation, transparency, and education. The decision-making and program management structure is designed to address many of the risks identified herein.

Our Systems

Transportation Infrastructure. As of May, 2014, the Birmingham metropolitan planning area's functionally classified roadways were comprised of:

Transit Services. Fixed route and paratransit services are provided to the City of Birmingham by the Birmingham Jefferson County Transit Authority (BJCTA). BJCTA operates 35 routes consisting of a) 29 fixed route marketed as MAX, b) one express route, c) two neighborhood circulators, d) one specialty shuttle servicing the Birmingham-Shuttlesworth International Airport, and e) two downtown circulator routes. All fixed-route and paratransit services operate Monday through Friday between 4am and 11:30pm, and on Saturdays between 4am and midnight. No services are provided on Sunday.

Shared Use Mobility Services. Several shared-use mobility services are currently available in the City of Birmingham. Examples include Zyp Bikeshare, car sharing, CommuteSmart, and Commercial Shared Ride Services. Details

about those services are available in “Our Vision”.

Information and Communication Technology

The City of Birmingham is in the process of upgrading all its IT infrastructure that adhere to security guidelines and allows for a more robust and secure network platform. The City has already deployed VoIP (voice over internet protocol) communications across the board with integrated unified communications systems. Several ERP (enterprise resource planning) systems are already in place specific to finance, public safety (police, fire, courts), human resources, document imaging, body cameras for police personnel, and the ESRI GIS mapping system which integrates with our other ERP systems.

The City of Birmingham has already completed the required infrastructure, including the fiber optics layout, to support NG 911 systems. The

Risk Type	Description
Technical	Infrastructure Readiness. Ability of keep infrastructure updated to accommodate new technology Technology Integration. Integration of multiple transportation systems and components
Political	Continuity. While the City has enjoyed continuity in its leadership since 2010, potential turnover in elected and business leadership could threaten the Smart Cities initiatives Control. There are multiple entities that control the different component of the transportation system that do not necessarily share the same vision
Policy	Alignment. Existing city plans for transportation and other critical infrastructure with Smart Cities concepts is critical to success
Funding	Funding Availability. Availability of funding in addition to monies awarded through the Smart Cities Challenge for implementation could be challenging Funding Adequacy. Even if funding is provided, ensuring their adequacy to advance all of the Smart Cities concepts might pose challenges
Institutional	Legacy System Management. Management of legacy systems during transition to new transportation concepts could be challenging, particularly around infrastructure maintenance. Education. Education of stakeholders and public about the fundamental change to transportation needs to be continuous and clear

Table 4. Birmingham Roadway System Description

Functional Classification	Region (center line mles)	Birmingham (center line miles)	Percent of Total
Freeway	196	37	18.8%
Principal Arterial	225	46	20.4%
Minor Arterial	612	147	24.0%
Major and Minor Collectors	1,320	145	10.9%

City also has a built a traffic control center to maintain and monitor (24X7) more than 700 traffic intersections.

The City recently updated its web presence, incorporating a majority of “eServices” including: online business tax payment, parking ticket and traffic fine payment, food truck vendor application, etc. An associated web app has been developed as well. The City of Birmingham has also developed a public service web portal that will be launched in the near future.

Finally, the City of Birmingham is considering a GIG (gigabit) fiber network “self-healing” ring deployment to the City as a whole that will provide high bandwidth internet connectivity to all City businesses and the public as well.

Intelligent Transportation Systems. The City of Birmingham operates a Traffic Management Center (TMC) which is utilizing CCTV cameras to monitor traffic conditions and control traffic signal intersections remotely in response to recurrent and non-recurrent congestion. The TMC was updated in 2012 to include a new video wall, Ethernet switch, video management software, work stations, encoders, time servers and video wall servers. This center is designed and set up to manage copper and fiber cable plants. It is the City of Birmingham’s goal to work in a multiagency/multijurisdictional manner so that the TMC’s reach might extend beyond the City’s boundaries, and aid with monitoring and collecting information about

the entire transportation system using its network of sensors, cameras, and other technology.

ITS Architecture and Data Standards.

Intelligent Transportation Systems (ITS) present stakeholders with a variety of options in order to address a variety of transportation needs. The framework provided by the National ITS Architecture makes system, product, and service compatibility possible, without limiting the design options of the stakeholder. As connected and automated vehicles emerge, expansion of the National ITS Architecture and Standards is needed to provide the necessary guidance so that stakeholders develop systems solutions that are compatible in order to share data, provide coordinated, area-wide integrated operations; and support interoperable equipment and services where appropriate. The Connected Vehicle Reference Implementation (CVRIA) was developed to address this need.

As a Smart City, the City of Birmingham is committed to using the National ITS Architecture and Standards as well as CVRIA guidelines to define operational, user,



performance, and program requirements for the deployment of ITS technologies and connected/automated vehicle technologies as part of the implementation process. Furthermore, the research team will document any existing gaps with respect to the use of currently available architecture, standards, and protocols in an effort to inform USDOT and standard setting organizations about further needs for refinement or development of new standards to support the adoption of interoperable architectures and integrated, fully open systems.

Our Data

Data Availability. To date, most of the data collected by the City has been historical travel data used for forecasting and planning purposes. For the roadway system, Birmingham currently collects traffic counts, travel speed data, travel time data, and information on incidents and crashes. For transit, the City collects ridership data. For pedestrians and bicycles, the City has begun an effort to collect data on these modes through pedestrian facility counts. Automated data from the Zyp Bikeshare program is also now available and providing useful data on biking patterns in the City. Data are currently analyzed and warehoused at the Regional Transportation Data Center, a partnership between the Regional Planning Commission and UAB.

Data Collection. The City will continue its current data collection efforts in the future, but the goal as Birmingham moves forward will be to focus on:

- Collecting more data from multiple modes and sources
- Integrating data from other databases (e.g., medical, geospatial)
- Collecting and analyzing data in real-time
- Collecting data more efficiently by using

personal technologies and the smart city infrastructure to automate data collection

- Distributing data and analysis in real-time to citizens and stakeholder

These additional data will allow the City to better monitor the complete transportation system in real time and shift resources as needed to accommodate changing demand or conditions. This will require real-time data analytics and distribution, something for which the Data Center is beginning to plan.

Data Warehousing. Data will continue to be stored, analyzed, and distributed from the Regional Transportation Data Center. The addition of the UAB Big Data Analytics Lab as a partner will enhance this effort.

Data Sharing. Because of the proprietary nature of so much transportation data, sharing of data has been difficult in the past. Travel time data provided by the U.S. government, for example, cannot be easily shared with outside entities due to ownership agreements. Similarly, freight data are considered proprietary by private carriers, who are reluctant to release any data related to actual types of freight moved. Even greater barriers exist with community health data, where personal privacy is paramount. One of the initial, and potentially most difficult, tasks for the data center moving forward will be to assess these data sharing hurdles and identify the most effective ways to resolve them. This will be no small effort, but will be essential to future success. The goal is to make data and analytics available to local stakeholders in real-time.

The City of Birmingham is committed to publishing datasets online, in easy-to-use formats that can be analyzed, used and republished as needed. An example is aggregated traffic accident data which includes location and time of day. Currently, the City

is in discussion with the Code for Birmingham brigade regarding the establishment of an open data policy.

Data Integration. Data integration will be performed with the support of the UAB Big Data Analytics Lab. With data anticipated from a wide variety of sources (highway, transit, freight, bicycle, medical, personal devices, and smart city infrastructure), integration and analysis will require the development of protocols with the city and key stakeholders.

Our Influence

Through the Birmingham BRT, improved public transportation services, Complete Streets, and pedestrian networks funding received from the Smart Cities Challenge will assist lower income residents climb the economic ladder to better long-term opportunities for themselves, their families, and their neighborhoods. The City of Birmingham intends to leverage the resources provided through the TIGER VII grants to catalyze reinvestment in the City's neighborhoods, and redevelopment along the BRT corridor.

In addition to the TIGER funding, the City of Birmingham has worked successfully with the Regional Planning Commission of Greater Birmingham (RPCGB), the metropolitan planning organization (MPO) for the Birmingham metropolitan area, leveraging federal funds for sidewalks, trails, roadways, and intelligent transportation system (ITS) infrastructure. The City's work with the U.S. Department of Housing and Urban Development (HUD) on the rebuilding of the Pratt Community following the April 2011 tornadoes and the U.S. Environmental Protection Agency (U.S. EPA) in remediating the North Birmingham superfund site also are examples of how the City of Birmingham has leveraged federal funds.

The City of Birmingham also has a successful

track record when it comes to leveraging private resources. The construction of Region's Field and the Railroad Park in downtown saw the City working in partnership with the local business and development community to raise funds to construct these facilities that in turn catalyzed the redevelopment of a once industrial area into a thriving enclave of young professionals, innovative businesses and entrepreneurs. Likewise, working with local non-profit organizations such as the Woodlawn Foundation, the City's Woodlawn Neighborhood has transformed itself from one of the City's worst areas into one of its most desirable.

Birmingham has successfully leveraged funding using such economic development tools and the Tax Increment Finance (TIF) districts and Capital Improvement Cooperative Districts (CICD) to fund critical infrastructure development and repairs. The City is planning to use these tools to assist with revitalization efforts in the BRT corridor and at the BRT stations which are also the mobility hubs identified in the Smart Cities Challenge vision.

The City of Birmingham and the State of Alabama are home to several financial institutions that have both a national and international footprint. These institutions have a strong track record of providing philanthropic support and civic contributions that are helping to improve the overall quality of life for residents.

Finally, The University of Alabama at Birmingham which is a partner in this endeavor is committed to leveraging its relationship with its research network and other local academic institutions to leverage their collective resources with private industry, particularly within the State's automotive manufacturing industry to research and deploy Smart Cities technology and strategies.