# Birmingham Regional Transportation Energy Efficiency and Smart City Roadmap

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August 2017



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# Birmingham Regional Transportation Energy Efficiency and Smart City Roadmap

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### **EXECUTIVE SUMMARY**

Transportation is undergoing a revolutionary change as new technologies are quickly emerging to dramatically alter the way people and goods are transported, leading to increased mobility options, greater efficiencies, and lower emissions. In addition, the nation's metropolitan areas are on the cusp of major changes as the power of information technology greatly expands and enables unified communication systems and better integration of city-wide functions, including energy use, transportation, and other services. Transportation is the lifeblood of metropolitan areas and a major factor in development of smart cities. Transportation is fundamental to dramatically increasing efficiencies, reducing or eliminating emissions, and potentially providing grid and building services. Synergistic integration of transportation energy efficiency technologies is essential for optimal smart city evolution.

The U.S. Department of Energy's Vehicle Technologies Office is looking carefully at the barriers and opportunities for cities to more actively support transportation energy efficiency as part of smart city development and benefit from the societal, economic, and environmental advantages therein. Sponsored by the U.S. Department of Energy's Vehicle Technologies Office and the Clean Cities Program, the goal of this roadmap is to establish a vision and provide a pathway for broadly incorporating transportation energy efficiency as an integral component of Birmingham smart city development. This roadmap presents six broad strategies with opportunities and challenges, as well as essential actions. Additionally, the next steps are presented and include thoughts on an implementation plan and timeline. Key repeatable elements and lessons learned are also discussed for building an effective initiative. Finally, the appendix of this document provides a detailed listing of results from the Birmingham Roadmapping Workshop. This roadmap serves the Birmingham regional metropolitan area, but also can function as a guide and template for other cities looking to further their transportation energy efficiency as part of smart city development.

Many different facets define a smart city, but an important thread is livability and sustainability. A smart city is heavily data driven and strives to integrate all essential sectors, including transportation, medical, educational, business, urban design, residential, and recreational. Central elements of Birmingham's transition to a smart city are discussed and include the importance of transportation as the city's lifeblood and key to interconnectivity. Birmingham's vision is to utilize new transportation and infrastructure technologies (e.g., energy-efficient mobility systems, smart city elements, and innovative urban revitalization approaches) to transform the city. This will lead to a modern, thriving community that showcases the transformational power of the smart city concept on mobility, accessibility, economic growth, land development, and quality of life.

Figure ES-1 presents an integrated approach that encompasses six strategic areas for the Birmingham Regional Transportation Energy Efficiency and Smart City Roadmap, including (1) governance, (2) intelligence and forecasting, (3) asset management, (4) policy, (5) funding, and (6) engagement and outreach. Broadly, governance includes strategy development and implementation, performance management, and metrics. Intelligence and forecasting encompass identification of critical infrastructure, transportation, and communication systems; establishment of projected travel modes and consumer travel preferences; and identification of future transportation technologies and smart city opportunities. Asset management includes all critical infrastructure, transportation, and communication and focuses on coordinated and integrated asset planning and management. *Policy* is determined by primary community drivers for the Birmingham region and must have the flexibility to accommodate technological change and leverage funding and business opportunities. Funding identifies, acquires, and allocates resources and may include non-monetary elements. Finally, engagement and outreach are multi-dimensional and encompass a broad array of stakeholders and activities, including public/private partnerships, information development and distribution, and marketing and education. Policy is the keystone of the process and shapes and is refined by all other strategic areas. Ultimately, the principal aim is to focus and integrate activities across all strategic areas and address any discontinuities and fragmentation.



Figure ES-1. Birmingham's integrated strategic approach for transportation energy efficiency and smart city development.

The Birmingham Metropolitan Regional Transportation Energy Efficiency and Smart City Initiative is currently in its nascent phase. However, the kick-off workshop and roadmap development process have identified key repeatable elements and lessons learned that would be informative to other cities and regions looking to increase transportation energy efficiency as part of smart city development. These repeatable elements include a kickoff workshop to build engagement and a strategic framework, as well as to identify challenges, opportunities, and actions. Secondly, ongoing stakeholder engagement is important through review processes (e.g., webinars and conference calls) to fully develop and refine the roadmap. Finally, continual stakeholder input is necessary to roadmap implementation, including development of a specific plan, organizational structure, and metrics. The following identifies a number of lessons learned for building an effective initiative:

• **Initiative champion(s) and leadership:** In order to successfully initiate a Transportation Energy Efficiency and Smart City Initiative, a strong champion(s) is needed from the outset, as well as establishment of long-term leadership to bring the initiative to fruition.

- **Vision:** The metropolitan area needs to create a vision or tie into an established vision to help frame the overall initiative. This vision should showcase a better future to help motivate and engage stakeholders.
- **Formalized organizational structure:** Because of the complexities and breadth of stakeholder involvement, identification and development of a formalized organizational structure is essential. Without this organization, it is likely that activities will be disjointed thereby undermining the effectiveness and efficiency of the initiative and the basic smart city philosophy of integration.
- **Stakeholder coalitions:** Multiple, diverse community stakeholders should be targeted and involved from the beginning of a Transportation Energy Efficiency and Smart City Initiative to maximize support, participation, ownership, and breadth of communications.
- **Stakeholder drivers:** One major political challenge is that multiple entities are responsible for and control different components of the transportation system and do not necessarily share the same overall perspective. Opportunities should be provided for stakeholders to express their perspectives and driving interests early on and throughout the planning process.
- **Goals and supporting data:** A strong emphasis should be placed on development of goals for the initiative that are backed up by data that all community stakeholders can agree upon. Two levels of performance metrics are necessary for the initiative. The first level gauges the progress of the roadmap strategy and the second level is needed to assess the overall impacts of the initiative within the metropolitan community. It is important for performance metrics to directly tie back to the primary community drivers for the Birmingham metropolitan area to achieve accountability and maximize and sustain stakeholder commitment.
- **Policy alignment:** Policy alignment of existing city and regional plans for transportation and other critical infrastructure and assets is also essential to the success of a smart city. The metropolitan growth and revitalization efforts in place or planned and how to tie into and leverage them need to be understood and transportation-specific elements must be identified and assessed.
- **Comprehensive plan with integrated strategic activities:** Transportation energy efficiency and smart city development encompass many complex and disparate aspects. This necessitates development of a comprehensive, integrated plan, including a robust set of coordinated strategic activities. This will help break the initiative down into manageable parts and better integrate actions.
- **Strategic area dependencies and prioritization:** Dependencies between strategic areas and the level-of-effort and timeframes for each should be mapped out. Within each strategic area, identify the opportunities, challenges, and actions that are needed to be addressed. Prioritize projects based on a value analysis.
- **Regional strategy with local ownership:** Emphasizing local ownership of the regional strategy is important for promoting transportation energy efficiency as part of smart city development. In this way, a comprehensive approach can be adopted, leveraging and optimizing a broad array of insights and resources, while maintaining local stakeholder interest and engagement.
- **Kick-off workshop:** A kick-off workshop(s) should be conducted with key stakeholders to start the initiative. Identification of primary stakeholder drivers and establishment of consensus on strategic areas builds stakeholder engagement.
- **Follow-up engagement activities:** Follow-up engagement activities (e.g., webinars and meetings) should be conducted to build stakeholder interest and commitment and further develop the roadmap initiative and subsequent implementation. Other relevant stakeholders that were not involved in the kick-off workshop(s) should be included to expand participation and input.

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# ACRONYMS

BRT	bus rapid transit

- PRT personal rapid transit
- RPCGB Regional Planning Commission of Greater Birmingham
- TIGER Transportation Investment Generating Economic Recovery
- UAB University of Alabama at Birmingham

# Birmingham Regional Transportation Energy Efficiency and Smart City Roadmap

# 1. OVERVIEW

Transportation is undergoing a revolutionary change as new technologies are quickly emerging to dramatically alter the way people and goods are transported, leading to increased mobility options, greater efficiencies, and lower emissions. In addition, the nation's metropolitan areas are on the cusp of major changes as the power of information technology greatly expands and enables unified communication systems and better integration of city-wide functions, including energy use, transportation, and other services. Transportation is the lifeblood of metropolitan areas and a major factor in development of smart cities. Transportation is fundamental to dramatically increasing efficiencies, reducing or eliminating emissions, and potentially providing grid and building services. Synergistic integration of transportation energy efficiency technologies is essential for optimal smart city evolution.

# 2. U.S. DEPARTMENT OF ENERGY'S VEHICLE TECHNOLOGIES OFFICE AND CLEAN CITIES PROGRAM

The U.S. Department of Energy's Vehicle Technologies Office (VTO) is looking carefully at barriers and opportunities for cities to more actively support transportation energy efficiency as part of smart city development and benefit from the societal, economic, and environmental advantages therein. Sponsored by the U.S. Department of Energy's Vehicle Technologies Office and the Clean Cities Program, the goal of this roadmap is to establish a vision and provide a pathway for broadly incorporating transportation energy efficiency as an integral component of Birmingham smart city development. This roadmap will not only serve the Birmingham regional metropolitan area, but also will provide a guide and template for other cities looking to further transportation energy efficiency as part of smart city development. This roadmap presents six broad strategies with opportunities, challenges, and potential actions. Additionally, next steps are presented, including thoughts on an implementation plan and timeline. Key repeatable elements and lessons learned are also discussed for building an effective initiative. Finally, the appendix provides a detailed listing of the results from the Birmingham Roadmapping Workshop.

# 3. BIRMINGHAM VISION AND CALL TO ACTION

Many different facets define a smart city, but an essential thread is livability and sustainability. A smart city is heavily data driven and strives to integrate all major sectors, including transportation, medical, educational, business, urban design, residential, and recreational. The following sections discuss important elements of Birmingham as a smart city, including the importance of transportation as the city's key to interconnectivity. Birmingham's vision is to use new transportation and infrastructure technologies, smart city elements, and innovative urban revitalization approaches to transform the city into a modern, thriving community that showcases the transformational power of the smart city concept on mobility, accessibility, economic growth, land development, and quality of life.

# 3.1 Smart City Transportation Vision

Birmingham's vision is closely linked with the ideas expressed in its comprehensive plan, which holistically addresses development of its communities, including economic conditions, land development patterns and trends, transportation needs, human health disparities, and overall quality of life. The subsequent framework plans (i.e., district-level comprehensive planning documents that build off the comprehensive plan) are the city's primary policy tool for achieving its vision to be a city of smart places. Facilitating community reinvestment, especially in low income and minority neighborhoods, is a primary goal of Birmingham's smart city effort.

#### 3.1.1 Strategic Opportunity Areas and Mobility Hubs

Birmingham's vision is to center revitalization on "strategic opportunity areas" that contain necessary economic, social, and transportation resources needed for success. Acknowledging the transformative power of transportation, the comprehensive plan calls for linking a number of strategic opportunity areas along the bus rapid transit (BRT) corridor and locating BRT stations within those areas. One of the central functions of strategic opportunity areas is to serve as "mobility hubs." Mobility hubs are places of connectivity where different modes of transportation from walking, to biking, to transit, to shared ride services come together seamlessly and support intensive concentrations of higher density development. 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, and providing cost-effective solutions for "last mile" connections. Mobility hubs epitomize the city's vison for its future and incorporate the following three typologies:

- Regional Mobility Hubs: Serving multiple communities, regional mobility hubs serve regional activity centers, have potential for the highest levels of population and employment densities, and generate the highest level of travel demand. Potential transit travel modes include high-capacity public transportation services such as Birmingham's planned BRT system and local bus services. Regional hubs are defined based on their scale, character, transit service availability, type, and function.
- Community Mobility Hubs: Serving major regional destinations, community mobility hubs serve 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: For neighborhood mobility hubs all stations are 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 that were not included in previous definitions.

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. Birmingham is beginning to realize success through effective transformation of these areas. Figure 1 illustrates key elements of Birmingham's smart city vision, including the proposed BRT corridor and stops, mobility hubs, automated transit network, and strategic opportunity areas. As envisioned, the transportation system will be innovative in scope and derive benefit from integrated data and technology and smarter use of existing infrastructure. Birmingham desires to build on the existing inter-modal freight rail network, capitalizing on its new interstate connections and gaining from the combined strengths of individual modes. Transportation modernization is integral to increased connectivity, economic development, sustainability, and livability. For success to continue, Birmingham must make a "big leap" and modernize its transportation infrastructure and service delivery.

#### 3.1.2 Implications

Birmingham views transportation modernization as integral to its evolution as a smart city and desires leveraging all existing transportation modes for moving people and freight. The city wants to center transportation modernization on strategic opportunity areas and mobility hubs, looking to increase interconnectivity and maximize usage of multiple transportation modes.



Figure 1. Annotated map of proposed smart cities challenge technology and programmatic demonstration sites.

# 4. CURRENT SITUATION

The population of metropolitan Birmingham is approximately 1.1 million and, according to the

U.S. Census Bureau, Birmingham city proper contains approximately 163,000 jobs, with 130,000 of them located in the Birmingham BRT corridor. Birmingham has 99 neighborhoods, is one of the Southeast's premier medical meccas, and maintains 18,500 students enrolled at the University of Alabama at Birmingham (UAB). Alabama is now also the fifth largest auto-producing state, with employment in the auto industry nearing 43,000.

Sificial See

Through the UAB Sustainable Smart Cities Research Center, Birmingham has an innovation center that can support transformation of the community through use of smart technologies and information systems, effective

transportation alternatives, renewable energy options, and sustainable environmental solutions. UAB's commitment to economic development is aligned with regional and state strategies, including "Blueprint Birmingham," which is the community's growth strategy led by the Birmingham Business Alliance and Accelerate Alabama. Blueprint Birmingham seeks to drive recruitment of new projects, business retention, and develop home-grown start-ups. Lawson State Community College (i.e., a historic black college and university) is located in Birmingham and is a participating member of the Alabama Center for Automotive Excellence and is one of the National Alternative Fuels Training Consortium affiliated National Training Centers. Lawson State's Birmingham campus will link directly with the Birmingham

BRT, host a mobility hub, and connect with other hubs currently being planned as part of the city's comprehensive planning process.

# 4.1 Urban Revitalization

Birmingham has made strategic investments in revitalization efforts, including a new downtown baseball stadium (i.e., Regions Field), the Negro Southern League Museum, and Railroad Park. Birmingham has worked with local non-profit organizations such as the Woodlawn Foundation through which the city's Woodlawn district has been transformed. 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 the city (see Figure 2). Numerous businesses have relocated to Birmingham or renewed their commitment to stay in Birmingham with Innovation Depot being the Southeast's premier technology business incubator. In Birmingham, businesses are nourished in a number of ways (e.g., the micro loan program of the Regional Planning Commission of Greater Birmingham [RPCGB]). Additionally, a program called the Innovate Birmingham Regional Workforce Partnership will deploy \$6 million in federal funding from the U.S. Department of Labor to train young adults in Birmingham for 925 high-paying, technology-focused jobs. In 2013, Mayor Bell signed a memorandum of understanding with the UAB Sustainable Research Center to partner on projects to make Birmingham more livable.



Figure 2. Revitalization of the Lyric Theater originally built in 1914.

Birmingham has successfully leveraged funding using economic development tools, tax increment finance districts, and capital improvement cooperative districts 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 BRT stations. Other institutions provide philanthropic support and civic contributions.

# 4.2 Transportation

Birmingham is served by five interstate highways (i.e., I-20, I-59, I-65, I-22, and I-459) and three Tier 1 rail providers that thread their way through the Birmingham area and were originally fundamental to the area's industrial development. In this area, RPCGB has initiated a regional freight plan study and a bicycle and pedestrian plan. However, Birmingham is challenged to meet its mobility needs because of 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 roadways are not friendly for pedestrians or cyclists and lack of inter-community connections are all contributors to a widening gap in socio-economic conditions.

In 2015, the U.S. Department of Transportation awarded the City of Birmingham a Transportation Investment Generating Economic Recovery (TIGER) VII grant to build a BRT system in three distinctive travel corridors and the Birmingham city center. The provision of federal funding to assist with development of this infrastructure is a critical catalytic element. The hope is the BRT will strengthen the city's diverse communities by connecting them to services and linking residents to opportunities. Birmingham intends to leverage resources provided through the TIGER VII grants to catalyze reinvestment in the city's neighborhoods and increase development along the BRT corridor. Birmingham has also worked successfully with RPCGB, which is the metropolitan planning organization for Birmingham metropolitan areas, to leverage funds for sidewalks, trails (see Figure 3), roadways, and intelligent transportation systems infrastructure.



Figure 3. Birmingham's Red Rock Ridge and Valley Trail System.

# 4.3 Information Technology and Data

A challenge exists in Birmingham to integrate all information systems, technology, and available data and exploit its power to the fullest. Birmingham has many older, siloed information systems, but is in the process of upgrading all information technology infrastructure to adhere to security guidelines and allow for a more robust and secure network platform. Voice over internet protocol communications have already been deployed across the board with integrated unified communications systems. Several enterprise resource planning systems are already in place, as well as geographic information system mapping that integrate with other enterprise resource planning systems. Birmingham has completed the required infrastructure, including fiber optics layout, to support next generation (i.e., NG 911) systems. Finally, the city is considering a gigabit fiber network "self-healing" ring deployment that will provide high bandwidth internet connectivity to all city businesses and the public.

The multi-modal transportation system envisioned for Birmingham will be driven by data with transportation at the core but with data related to community health, economics, energy, and resilience also integrated. To date, most data collected by the city have been historical travel data used for forecasting and planning purposes and evaluating the effectiveness of transportation improvement projects. For roadways, Birmingham collects traffic counts, travel speed data, and information on accidents and crashes. For transit, the City collects ridership data. The City has begun to collect data on pedestrians and bicycles through pedestrian facility counts, with Zyp Bikeshare providing useful data on biking patterns in the city. In the future, the goal is to collect more data from multiple modes and sources, integrate data from other databases, collect and analyze data in real time, and gather data more efficiently using personal technologies and smart city infrastructure. This will enable automatic data collection and distribute data and analysis in real time to citizens and stakeholders. Data will continue to be stored, analyzed, and distributed from the Regional Transportation Data Center (i.e., a partnership between the Regional Planning Commission and UAB developed in 2009) and with the support of the UAB Big Data Analytics Laboratory.

Data sharing is a major proprietary challenge and one the data center will be looking to resolve, with a goal of providing real-time access. Birmingham has a commitment to open data and data sharing, making data accessible and usable by the public to maximize its benefit and promote entrepreneurship and innovations. Because of the variety of data, integration and analysis will require development of protocols with the city and key stakeholders. Currently, the city is in discussion with the Code for Birmingham Brigade regarding establishment of an open data policy.

# 4.4 Implications of Urban Revitalization, Transportation, and Information Technology

Birmingham has already completed numerous projects in the areas of urban revitalization, transportation, and information technology and data; many more are currently on the way. This provides significant opportunities for future smart city transportation efforts to tie into and leverage. However, there are challenges for smart city transportation, including poor connectivity across modes, underutilization of resources, aging infrastructure, and a limited variety of options. Integration of information technologies, which is essential to smart city development, is also a challenge as a result of siloed institutional systems and proprietary barriers to data sharing. Birmingham is in the process of continuing to significantly upgrade its information and technology systems.

# 4.5 Birmingham's Existing/Planned Transportation Systems

The U.S. Department of Transportation has developed a 30-year transportation plan entitled, "Beyond Traffic," with a principle focus of pivoting cities away from cars to energy efficiency mobility systems that are better suited to the urban environment. Transportation systems that are currently available or planned and support Birmingham's smart city vision and mobility hub concept include the following:

• Traffic Management Center: Designed to monitor traffic using closed-circuit television 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. The traffic control center maintains and monitors (24/7) more than 700 traffic intersections. The goal is to work in a multi-agency/ multi-jurisdictional manner so the traffic management center'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.

- Public Transportation: In 2015, Birmingham won a U.S. Department of Transportation TIGER VII grant to assist with development of its long-planned BRT system. BRT will be the spine of the re-imagined transit system where it serves a series of mobility hubs; local bus services feed the BRT system instead of running into a central location.
- Transit Services: Fixed route and paratransit services are provided to the City of Birmingham by the Birmingham Jefferson County Transit Authority, which operates 35 routes. The Birmingham Jefferson County Transit Authority is undertaking a complete overhaul of its fixed-route bus services that will include improvements in technology such as automated vehicle location, real-time vehicle arrival systems, automated passenger counters, and electronic payment systems.
- Smart Parking: With roughly 4,700 on-street parking meters and another 7,000 structured parking spaces, a major opportunity exists to utilize interactive parking systems to alleviate traffic congestion, provide citizen and visitor convenience, and increase city revenue. A new system permits identification via an interactive map of available open on-street parking spots and open spaces in parking garages, as well as payment by phone (see Figure 4).



Figure 4. Birmingham's smart parking.

- Car Share Access: Car sharing is currently only available on the UAB campus as part of a congestion mitigation strategy, but could be expanded more broadly throughout the city to revitalize communities and make them more livable by reducing the need for larger roadways and additional surface parking. Car sharing can offer economic savings for government and private companies by reducing fleet costs, minimizing local transportation expenses, and meeting sustainability goals.
- CommuteSmart: This is a services program that operates in Alabama's four metropolitan transportation management areas and in the Birmingham area; it maintains 35 vanpools. The program also provides ride matching services and incentives through a database of more than 26,000 commuters in the region that has eliminated more than 3.8 million vehicle miles through carpooling.
- Commercial Shared Ride Services: The City of Birmingham and neighboring jurisdictions recently passed ordinances allowing transportation network companies, such as Uber and Lyft, to operate within their jurisdictions. The Birmingham City Council has also approved an ordinance allowing low-speed taxicab services, such as Joyride, to operate in the city.
- Bikeshare Stations/Bicycle Facilities: Since 2015, the City of Birmingham has hosted the Zyp Bikeshare Program. Zyp Bikeshare maintains a dense network of kiosks and bikes with services

focused primarily in Birmingham's City Center and adjacent neighborhoods. Zyp Bikeshare includes 100 pedal electric assist (i.e., pedelec) bikes and also employs sustainable docking stations (see Figure 5), which makes it the first pedelec bikeshare system in North America. As of July 31, 2017 Zyp Bikeshare in Birmingham has logged 138,546 miles, 109,849 total trips, and in 2017 maintains 586 active members and 8,027 occasional members.



Figure 5. Zyp Bikeshare sustainable docking station.

- 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 for Jefferson County. In 2011, Birmingham was awarded a TIGER IV grant entitled, "Roads to Recovery," which is the first phase of a planned complete streets and multi-modal transportation system. This helped the city jumpstart implementation of the Red Rock multi-use trail system.
- Smart Cards: Birmingham envisions the future availability of metropolitan smart cards that permit seamless transportation services and allow access to travel across multiple transportation modes (e.g., transit, Bikeshare, parking, and so forth).
- Freight Villages: Birmingham is looking to develop freight villages, which are integrated logistics centers to take advantage of existing rail, highway, and waterway infrastructure. A freight village is a defined area where all activities related to transportation, logistics, and distribution of goods are carried out by various operators. As envisioned, freight villages will accommodate state-of-the-art distribution centers and industrial activities and will shun passive activities such as container storage. These types of distribution centers and automated manufacturing and industrial activities are already taking root in Birmingham around the automotive manufacturing industry. Birmingham has received a TIGER I grant for the Birmingham Regional Intermodal Freight Facility. Birmingham's freight villages are envisioned to be located adjacent to modal shift facilities, where goods are moved between two or more forms of freight transportation such as rail to truck and barge to rail/truck (see Figure 6).

## 4.5.1 Implications of Existing/Planned Transportation Systems

Birmingham is on the move with regards to transportation systems having an already established traffic management center, an established public transportation system soon to be upgraded with BRT, fixed route and paratransit services, and elements of forward-looking car share, shared ride services, smart parking, and Bikeshare and pedestrian facilities. Further, Birmingham is planning to introduce universal smart cards for access to all transportation services and implementing integrated freight villages. All of these elements build a strong foundation from which to build and the flexibility to expand transportation energy efficiency as part of smart city development.



Figure 6. Freight village concept for Birmingham.

# 5. BIRMINGHAM TRANSPORTATION ENERGY EFFICIENCY AND SMART CITY STRATEGY

Figure 7 presents an integrated approach encompassing six strategic areas for the Birmingham Regional Transportation Energy Efficiency and Smart City Roadmap, including (1) governance, (2) intelligence and forecasting, (3) asset management, (4) policy, (5) funding, and (6) engagement and outreach. Broadly, governance includes strategy development and implementation, performance management, and metrics. Intelligence and forecasting encompass identification of critical infrastructure, transportation, and communication systems; establishment of projected travel modes and consumer travel preferences; and identification of future transportation technologies and smart city opportunities. Asset management includes all critical infrastructure, transportation, and communication and focuses on coordinated and integrated asset planning and management. Policy is determined by the primary community drivers for the Birmingham region and must have the flexibility to accommodate technological change and leverage funding and business opportunities. Funding identifies, acquires, and allocates resources and may include non-monetary elements. Finally, engagement and outreach is multi-dimensional and encompasses a broad array of stakeholders and activities, including public/private partnerships, information development and distribution, and marketing and education. Ultimately, the principal aim is to properly focus and integrate activities across all of these strategic areas and address any discontinuities and fragmentation.

Strong interdependencies exist among the six strategic areas of the Birmingham Transportation Energy Efficiency and Smart City Roadmap. Governance plays an oversight role for all other strategic areas and is especially instrumental early on when the direction and organizational structure of the initiative is being formed. Intelligence and forecasting and asset management provide fundamental building blocks and information necessary to begin framing policy options. Asset management informs not only policy, but intelligence and forecasting as well. The realities of funding availability and mechanisms for acquiring and allocating resources strongly influence policy options, as well as public/private partnerships and stakeholder engagement and outreach. Engagement and outreach activities ramp up early in the initiative and maintain a relatively steady level throughout, even as the focus of these activities evolve with time. Policy development is the keystone of the process and shapes and is refined by shapes by all other strategic areas. Policy must reflect the primary stakeholder drivers and meet the community's needs to the greatest extent possible.

For generic reference, Figure 8 provides a visual illustration of an estimated level of activity within each strategic area as a function of time. As shown, a natural flow of the strategic activities occurs from

the early phases of the initiative through maturity. It is important to develop an integrated, forward-looking strategy to build off Birmingham's extensive existing and planned transportation and smart city infrastructure. The focus is to synergistically use and leverage all stakeholder assets to achieve a common vision. To do this, a clear, integrated strategy is necessary for organizing the initiative and gaining stakeholder buy-in and long-term commitment because stakeholders manage the initiative's many diverse elements moving forward. The following subsections outline and discuss in more detail the six strategic areas of the Birmingham Regional Transportation Energy Efficiency and Smart City Roadmap.

# Transportation Energy Efficiency and Smart City Integrated Approach



Figure 7. Birmingham's integrated strategic approach for transportation energy efficiency and smart city development.



Figure 8. Estimated level of activity by strategic area as a function of time.



Governance includes strategy development and implementation, performance management, and metrics, and should be inclusive and diversified by representing all key stakeholders of the Birmingham regional metropolitan area. The first requirement is to establish an initiative champion(s) and determine which entity(ies) will lead and manage the governance process. This could be government, an educational institution, private organization, quasi-governmental entity, or other organization(s). It is also important to develop a formalized and robust organizational structure, which would include elements such as a steering committee and working groups that would likely be based on the strategic areas. Teamwork is essential for successfully pulling together and implementing a transportation energy efficiency initiative, including the necessity to develop a broad coalition of stakeholders. Of utmost importance is the need to achieve a common transportation energy efficiency and smart city vision. Ultimately, a set of goals for the initiative needs to be established and must be supported by the robust data agreed upon by the stakeholders. Additionally, performance assessment processes and metrics (see Section 6.1.1) should be developed that directly tie back to the primary community drivers for Birmingham. The following have been identified as major participants in development and implementation of the Birmingham Regional Transportation Energy Efficiency and Smart City Initiative.



Alabama Clean Fuels Coalition

Alabama Power Company

Birmingham Airport Authority

Birmingham Automobile Dealers Association



Jefferson County Mayors Association

Medical complexes

Public





Birmingham Business Alliance













Birmingham Jefferson County Port Authority

Birmingham Jefferson County Transit Authority

Birmingham MSA Municipalities

Building Owners and Managers Association

City of Birmingham, including neighborhood associations

Jefferson County











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Residential and commercial real estate development associations and planners (NAIOP, ULI, CREW, ACRE, CCIM)

Restaurant and other business associations

School boards (Jefferson County, Hoover, City of Birmingham, Bessemer, and Tarrant)

Transportation planners

U.S. Census Bureau

UAB TREND Laboratory and Smart Sustainable Cities Center

U.S. Green Building Council, Alabama Chapter



# 5.2 Intelligence and Forecasting

Intelligence and forecasting includes identification of critical infrastructure, transportation, and communications systems; determination of projected travel modes and consumer travel preferences; and identification of future transportation and smart city technologies. Intelligence and forecasting will also incorporate assessments conducted under the strategic area of asset management. A crucial element is the identification of salient questions and the necessary data, models, and analysis to answer them. All of these elements are important for establishing a robust prediction knowledge base to frame transportation energy efficiency and smart city opportunities (see Figure 9). For intelligence and forecasting, data collection can be achieved via established and emerging systems with opportunities that exist to build on Birmingham's smart city initiatives through UAB.

Data collection should be designed to facilitate a "single source of truth" by capturing it one time (preferably via automated means) in real time at or by the source. The data would then be shared through systems integration to all parties who need it on-demand. Barriers exist, including encouraging all parties to share data amongst each other and within their respective organizations, lack of equipment to collect data that at times is conflicting, and challenges in data comprehension. Additionally, no established framework exists for data needs identification; specifically for what purpose, when, and by whom. Technology advances are also outpacing forecasting and planning capabilities, thereby requiring strategies that are flexible to accommodate unforeseen technological change and opportunities in the future. To date, data collection has been through the City of Birmingham's housing portal: http://birminghamhousingstudy.com, which is in the process of being updated.



Figure 9. Key elements of intelligence and forecasting for establishing a predictive knowledge base.

The following entities have been identified as potential major participants for intelligence and forecasting:







Alabama Power Company

Alabama Clean Fuels

Coalition

Birmingham Airport Authority



**Birmingham Business** Alliance



Birmingham Jefferson **County Port Authority** 



**Birmingham Jefferson** County Transit Authority













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City of Birmingham, including neighborhood associations

Jefferson County

RPCGB

Residential and commercial real estate development associations and planners (NAIOP, ULI, CREW, ACRE, CCIM)

School boards (Jefferson County, Hoover, City of Birmingham, Bessemer, and Tarrant)

UAB TREND Laboratory and Smart Sustainable Cities Center



Birmingham MSA Municipalities

# 5.2.1 Critical Infrastructure/Transportation Systems, Travel Modes, and Consumer Preference Studies

An essential element of intelligence and forecasting is to account for current and projected critical infrastructure and transportation system development. As part of this activity, it is important to include assessments from the asset management strategic area. It is also important to identify and inventory sources of existing and projected travel mode and travel preference studies for the Birmingham metropolitan area and to augment this base with additional studies as necessary.

### 5.2.2 Advanced Transportation Opportunities

The transportation sector is evolving quickly and will offer many opportunities and challenges for the Birmingham metropolitan area. Energy-efficient mobility systems provide a variety of options for potentially improving access to mobility while reducing energy consumption and emissions. Several areas (e.g., drive smoothing, platooning, and vehicle resizing) are particularly attractive. Drive smoothing incorporates advanced signaling and communications technologies to significantly reduce stops, starts, and hard acceleration and deceleration episodes. Platooning typically envisions grouping heavy and/or medium-duty vehicles to reduce aerodynamic drag while maintaining near constant vehicle speeds. Vehicle resizing benefits from matching and using appropriately sized vehicles for their intended use. The following topics discuss some opportunities in more detail.

Connected and Autonomous Vehicles: Birmingham will instrument vehicles and infrastructure to meet the transportation mobility needs of the future. The city wants to use dedicated short-range communications technology to enable information sharing among instrumented vehicles and infrastructure that is crucial for allowing testing and adoption of connected vehicles. Additionally, work will proceed to integrate various communications platforms in support of connected vehicles. These communications will remove existing barriers through promotion of shared transportation processes, shared resources, and common rules of operation. Currently, three automakers located in Alabama (i.e., Mercedes-Benz, Honda, and Hyundai) are exploring and have incorporated autonomous vehicle technology into their vehicles. Auburn University is involved in research related to autonomous vehicles and UAB continues research on related safety systems. The Alabama Legislature has established the Alabama Joint Legislature Committee to Study Self-Driving Vehicles to monitor related technology developments and to evaluate potential needs for legislation to encourage adoption of appropriate technologies that would keep Alabama businesses competitive and Alabama drivers and pedestrians safe. See Figure 10 for a rendition of central elements of early connected and autonomous vehicle technologies. The numbers in the bubbles represent responses from participants in the United States to a survey question asking "which of the information technologies/driving support systems identified would you like to use in your car?"

Automated Transit Networks: Birmingham is interested in pursuing development and testing of an automated transit network that is more commonly known as personal rapid transit (PRT), which is best described as a hybrid between a private car and public transit. PRT could effectively supplement Birmingham's soon-to-be-constructed BRT system and encourage car-free development by providing destination-to-destination service with minimal walking to and from stations. PRT is envisioned as an important part of Birmingham's Shuttleworth International Airport's continued evolution. PRT could provide critical connections between the airport terminal and adjacent facilities, including a soon-to-bebuilt, consolidated rental car facility and proposed office and light industrial development on adjacent properties.

**Intelligent Sensor-Based Infrastructure:** Birmingham is committed to working with the Alabama Department of Transportation and UAB to develop and implement sensor deployment to meet current and future needs for transportation infrastructure. Installation of sensors is important for monitoring traffic conditions, optimizing signal timings, supporting incident management, and facilitating informed decisions on mode choice given real-time information and available options.



Figure 10. Elements of the early connected and autonomous vehicle.



Asset management encompasses a broad strategy that is based on information, technical analysis, and engineering to cost-effectively manage and maintain asset service levels. Asset management includes all critical infrastructure, transportation, and communications and focuses on coordinated, integrated asset planning, mapping, and management. In Birmingham, the sheer size and scope of asset identification and management is a challenge because there are many complex locations to be considered. Minimal data on existing assets are currently available and, in order to bound this activity, it is important to clarify and assess only what really needs to be tracked and evaluated.

# 5.3.1 Critical Assets and Integrated Asset Management

Ultimately, optimized asset management is the appropriate alignment of processes, resources, and functional contributions across various assets, as opposed to the existence of differing asset and departmental silos and competing short-term priorities. Opportunities for appropriately optimizing asset management exist through established international framework standards such as the International Organization for

Standardization 55000 covering management of physical assets and the Publicly Available Specification 55 for outlining good management practices for many asset-intensive industries. The following preliminary list shows critical assets for the Birmingham regional metropolitan area:

- Airport
- Birmingport
- Buildings
- Bus transit
- Charging stations
- Freight/goods complexes
- Grid-connected renewables
- Large expanding businesses
- Large multi-unit housing developments
- Malls
- Marquee events
- Medical institutions

- Metropolitan information/communications systems (e.g., broadband)
- Municipal transportation
- PRT
- Rail yards
- School transportation (secondary and higher education)
- Soft assets (e.g., wide downtown streets and bike lanes)
- Standalone restaurants and retail
- Transportation I-20/-59, I-65, I-22, and I-459
- UAB



Policy should directly respond to the primary drivers for the Birmingham metropolitan regional area and meet community needs while maximizing overall impact. Establishment of policy is challenging because of the diversity and number of stakeholders involved and difficulties of achieving a common transportation and smart city vision. Public/private partnerships are fundamental to policy development, with many opportunities existing to leverage lessons learned and best practices from other areas. To the extent possible, all policies should leverage funding and business opportunities and be flexible in accommodating future technological change. Figure 11 illustrates the critical factors required for framing and, ultimately, developing a robust public policy for transportation energy efficiency and smart city development.

Both a push and pull strategy could be effective for Birmingham's transportation energy efficiency and smart city policy development. This strategy would include development of driving policy initiatives combined with a strong effort to establish market pull from businesses and other entities that would benefit from transportation energy efficiency and smart city development. For example, sponsorship of alternative refueling stations could provide ownership and encourage faster adoption of advanced, energy efficient, transportation options. As a longer-term approach, developing partnerships with key automobile stakers could significantly increase the availability and reach of resources to support the Initiative. While it is recognized that governmental jurisdictions would need to work together for ultimate success, this may be accomplished by embracing various civic organizations that already seem to be cooperating in the Birmingham region. For example, the Birmingham Business Alliance will play an important role through their annual state and federal agenda and involvement of their Government Affairs Committee. This "regional strategy combined with local ownership" can be a very effective means for advancing and sustaining ambitious metropolitan initiatives.



Figure 11. Critical factors required to establish policy for transportation energy efficiency and smart city development.

## 5.4.1 Primary Drivers

The primary drivers identified for Birmingham that are instrumental to policy development include the following:

- Air quality
- Cost effectiveness
- Economic development
- Environmental sustainability and leadership
- Increased public safety
- People and goods movement (e.g., energy efficiency, safety, and reliability with future proofing)
- Improved access to transportation services including mobility options for the disadvantaged
- Quality of life (wellness and neighborhood connectivity/cohesiveness)
- Reduced congestion
- Reduced overall transportation footprint (e.g., less driving and alternative transportation)

# 5.4.2 Policy Options

It is important for policy options to emphasize flexibility to accommodate unforeseen technological changes and leverage future funding and business opportunities. The following is a preliminary list of policy options identified for the Birmingham regional metropolitan area:

- State wide roadmap
- Model ordinances/policies to encourage alternative refueling infrastructure
- Highway 280 ease of travel, PRT to airport
- Install alternative fuel vehicle infrastructure
- Expand public electric vehicle supply equipment charging
- Financially incentivize auto dealers/sales people to lease/sell advanced technology vehicles
- Building codes and standards for electric vehicle infrastructure
- Electrify airport service vehicles and public and school transportation



Funding activities encompass acquiring and allocating resources and may include monetary and non-monetary elements. A strong emphasis should be placed on cost drivers, including estimating and forecasting. At times, there is uncertainty concerning the future cost of transportation energy efficiency; however, observation of other models and enlistment of the Alabama Department of Transportation could help determine the future cost of relevant technologies. To implement projects, broad, consistent, and predictable funding bases will be needed with efficient and accountable funding distribution mechanisms. A number of challenges exist in regards to funding, including significant uncertainty and insufficiency in funding from the federal and state levels. There are also challenging differences in funding requirements, because different agencies and entities use different funding pools and maintain different sets of requirements and regulations that may be contradictory.

### 5.5.1 Opportunities

Funding is potentially available from both the public and private sectors and should be pursued holistically. The following list identifies a number of potential funding sources for transportation energy efficiency and smart city development in Birmingham:

- Alabama Department of Economic and Community Affairs Energy Programs
- Businesses
- Community/business partnerships, including establishment of broad value propositions
- Congestion mitigation and air quality funding
- Economic development projects
- Environmental Protection Agency grants and funding opportunities

- Foundations
- Infrastructure bank capitalized with public/private funds
- Trump administration infrastructure plan
- U.S. Department of Energy grants and funding opportunities
- Utilities
- Volkswagen settlement funds
- World Games 2021

## 5.5.2 Optimized Distribution Mechanisms

The importance of clear, inherently understandable and streamlined funding distribution mechanisms cannot be overemphasized. To maximize stakeholder participation, barriers and red tape to identification and acquisition of funding resources for transportation energy efficiency and smart city development should be minimized. Many examples of efficient funding distribution mechanisms and procedures already exist across the nation and serve as examples. It is also important to identify an optimal central repository and potential distribution mechanisms for one-stop funding information and broad stakeholder awareness and accessibility. The repository should be intuitively easy to find and navigate and should be linked to other sites to increase awareness.



# 5.6 Engagement and Outreach

Engagement and outreach is multi-dimensional and multi-directional, with an essential element being achievement of broad stakeholder involvement. In order to lay the foundation for the Initiative and sustain it for the long term, strong stakeholder buy-in and commitment is essential. Figure 12 illustrates a number of important elements that are part of engagement and outreach. Effective models for engagement and outreach exist and opportunities are available to utilize intermodal facilities to reach multiple transportation modes (e.g., bus, rail, intercity bus, and bikeshare). Challenges for engagement and outreach do exist; for example, it is difficult to identify what technologies and options will be available in

the future and to assess the long-term benefits for specific stakeholders. Additionally, it is important to be able to develop specific initiatives and benchmarks to communicate roadmap objectives and answer "What's in it for me" for various stakeholders. Finally, education for stakeholders and the public about the fundamental change to transportation needs to be continuous and clear.





## 5.6.1 Primary Efforts

Engagement and outreach include a variety of multi-dimensional activities. Two of the most important include facilitating establishment of public/private partnerships and achievement of broad stakeholder engagement and buy-in. Support has to come from multiple sources and partnerships with entities such as utilities, energy and business communities, automakers and dealerships, non-profits, health care providers, and various City of Birmingham and related agencies and authorities. Early engagement of stakeholders is a must to encourage participation and a sense of ownership in the overall initiative and process.

Marketing and education will involve a number of activities, including development of a consistent, unified Birmingham branding to build local pride and ownership. In addition, a key to the ultimate success of transportation energy efficiency is economics. As such, a strong effort to work with businesses, government, and public stakeholders is needed to identify and clarify value propositions of transportation energy efficiency within the context of smart city development. Subsequently, unbiased information should be made readily available to the public to facilitate decision making.

## 5.6.2 Centralized Repository and Leveraging Distribution Mechanisms

Establishment of a centralized repository is essential for stakeholder coordination and one-stop-shop information and technical support (which is especially important for small entities). A single information source reduces confusion and helps to provide a cogent message, while being more economical than multiple information repositories. A centralized information clearinghouse accelerates implementation by identifying common interests and complimentary resources (e.g., financial and marketing), as well as providing consistent customer service. There are also many ways to enhance visibility and

communications through leveraging of other distribution mechanisms. For example, automakers, auto dealers, and utilities supply a steady stream of information and marketing to their customers and are excellent conduits. Through internet, TV, radio, and print media, automakers and dealers can further promote automotive and advanced technology vehicles. Utilities are in a position to highlight and encourage installation of electric vehicle recharging infrastructure via their monthly bill statements, as well as other means. In addition, non-governmental organizations maintain many tools at their disposal, including lobbying, grass roots outreach, and advocacy.

# 6. NEXT STEPS

In January 2017, a kick-off workshop was conducted for the Birmingham Metropolitan Regional Transportation Energy Efficiency and Smart City Roadmap. This workshop identified the scope, primary community drivers, and six strategic focus areas for the roadmap. Numerous challenges, opportunities, and potential actions were also identified by strategic area. Results from the workshop defined the following broad timeframes and geographic focus area parameters as a guide for roadmap activities:

Timeframe	Geographic Focus Area
Near Term 2017 through 2020	Downtown/city center/City of Birmingham
Mid Term 2020 trough 2025	Metropolitan Birmingham/Jefferson County/MSA
Long Term 2025 through 2030	Corridors to other cities

Flexibility is important with timeframes being general guidelines where actions can take place anytime in the geographical target areas. It would be optimal if conversations would start soon between the city of Birmingham and the surrounding metropolitan areas, with understanding that complexities for urban areas differ significantly from rural areas. Early phase efforts will likely be smaller in scope, with lessons learned, and significantly expanded. The following implementation plan and timeline identify some potential key activities in development and implementation of the Birmingham roadmap.

# 6.1 Implementation Plan and Timeline

The Birmingham Regional Transportation Energy Efficiency and Smart City Roadmap consists of six strategic areas: (1) governance, (2) intelligence and forecasting, (3) asset management, (4) policy, (5) funding, and (6) engagement and outreach. Table 1 illustrates the highlights of Birmingham's activity timeline in regard to these six strategic activity areas. The early phases of the effort focus heavily on establishment of leadership and a vision for the initiative, identification and recruitment of major stakeholders, development of organizational structures, identification of critical assets and plans for the Birmingham region, and identification of consumer travel modes and preferences. As the foundation of the program increasingly becomes established, a transition will be made to policy development and sourcing for funding acquisition and disbursement. Engagement and outreach is ubiquitous throughout the lifecycle of the initiative, but will evolve in focus as the initiative matures.

#### 6.1.1 Performance Assessment Processes and Metrics

Establishment of performance assessment processes and metrics are an important overall element of success. An independent performance evaluation would focus on gathering, managing, and analyzing data needed to produce performance metrics and comparing these with pre-set targets to validate progress. For the Birmingham Transportation Energy Efficiency and Smart City Initiative, two levels of performance metrics are required. The first would gauge the progress of implementation of the roadmap's strategic activities. The second level of performance metrics would evaluate and quantify the impact of

Governance			2,3,4	6		
Intelligence & Forecasting			3,5	7,9,10	11	
Asset Management			3,5	8		15
Policy			3,5		12	16
Funding			3,5		13	17
Engagement & Outreach			3,5		14	18,19
	April 2017	July 2017	Oc 201	ct Ja 17 20	in 18	April Ju 2018 20

#### Table 1. Birmingham Program Activities and Timeline

#### 2017

- 1 Identify champion(s) and long term leadership of the roadmap and transportation energy efficiency and Smart City initiative
- 2. Identify a vision for the initiative including development of goals backed up by data on which the stakeholders agree. Identify salient questions and data requirements to answer them.
- 3 Identify and develop a diverse coalition of stakeholders
- 4 Establish governance body structure and roles (i.e., steering committee and working groups)
- 5 Establish working group(s) organizational structure and roles
- 6 Establish performance assessment processes and metrics
- 7 Identify current and projected critical infrastructure/transportation/communication development
- 8 Identify critical assets for potential impact on transportation energy efficiency and smart city development
- 9 Identify key sources of existing and projected travel mode studies and consumer travel preference studies. Conduct additional studies as necessary.
- 10 Identify current and potential future advanced transportation technologies and opportunities they afford

#### 2018

- 11 Incorporate asset management assessment
- 12 Identify policy options with an emphasis upon flexibility to accommodate technological change and leverage funding and business opportunities
- 13 Identify funding opportunities and barriers to tapping them
- 14 Identify initial generic engagement and outreach efforts (e.g., Birmingham branding and website framework)
- 15 Develop an integrated asset management plan including a formal asset management framework (e.g., ISO 55000, PAS 55)
- 16 Establish formal transportation energy efficiency and smart city policy for the Birmingham regional metropolitan area
- 17 Identify an optional central repository and potential distribution mechanisms for one-stop funding information
- 18 Identify optimal central repository for engagement and outreach information and materials for stakeholder accessibility and user convenience
- 19 Identify other distribution mechanisms to leverage engagement, outreach, and communications

transportation energy efficiency and the smart city initiative on the Birmingham regional metropolitan area. Some key metric areas for consideration may include enhanced energy efficiency, mobility and access, improved traffic safety for all users, reduced environmental impacts, and improved sustainability and economic growth. It is important that performance metrics at both levels tie directly back to the primary community drivers for the Birmingham metropolitan area to ensure accountability and continued stakeholder interest and engagement.

Widely established and accepted metrics processes exist, including the Federal Government Performance and Results Act Modernization Act and the Office of Management and Budget Circular A-11. These processes provide guidance on how to develop performance metrics, including requirements for validity, completeness, consistency, accuracy, and timeliness. To ensure the metrics are fully effective, a typical explicit approach to metrics development includes the following elements:

- *Logic Model Creation:* The logic model maps out the stream of inputs, activities, achievements, and results by which value is created for customers, constituents, and society. It is important to ensure there is internal clarity and consensus around the content and logic of the "value creation stream."
- *Identification of Key Points of Measurement:* The logic model is used to identify key points of measurement when documenting the value creation stream. For some points, metrics can be created. For other points, deemed results may be inferred from systematic analysis of other data.
- *Cross-Walk to Goals and Objectives:* It is important to cross-walk the logic model with the initiative's goals, objectives, and performance targets. This ensures there is alignment between the initiative's value creation stream and its performance planning.
- *Verification and Validation of Metrics:* To ensure metrics will provide useful and reliable data, they are vetted against five criteria (i.e., valid, complete, consistent, accurate, and timely).

# 7. KEY ELEMENTS AND LESSONS LEARNED FOR BULDING AN EFFECTIVE INITIATIVE

The Birmingham Metropolitan Regional Transportation Energy Efficiency and Smart City Initiative is currently in its nascent phase. However, the kick-off workshop and roadmap development process have identified key repeatable elements and lessons learned that would be informative to other cities and regions looking to increase transportation energy efficiency as part of smart city development. These repeatable elements include a kickoff workshop to build engagement and a strategic framework, as well as to identify challenges, opportunities, and actions. Secondly, ongoing stakeholder engagement is important through review processes (e.g., webinars and conference calls) to fully develop and refine the roadmap. Finally, continual stakeholder input is necessary to roadmap implementation, including development of a specific plan, organizational structure, and metrics. The following identifies a number of lessons learned for building an effective initiative:

- **Initiative champion(s) and leadership:** In order to successfully initiate a Transportation Energy Efficiency and Smart City Initiative, a strong champion(s) is needed from the outset, as well as establishment of long-term leadership to bring the initiative to fruition.
- **Vision:** The metropolitan area needs to create a vision or tie into an established vision to help frame the overall initiative. This vision should showcase a better future to help motivate and engage stakeholders.
- **Formalized organizational structure:** Because of the complexities and breadth of stakeholder involvement, identification and development of a formalized organizational structure is essential. Without this organization, it is likely that activities will be disjointed thereby undermining the effectiveness and efficiency of the initiative and the basic smart city philosophy of integration.

- **Stakeholder coalitions:** Multiple, diverse community stakeholders should be targeted and involved from the beginning of a Transportation Energy Efficiency and Smart City Initiative to maximize support, participation, ownership, and breadth of communications.
- **Stakeholder drivers:** One major political challenge is that multiple entities are responsible for and control different components of the transportation system and do not necessarily share the same overall perspective. Opportunities should be provided for stakeholders to express their perspectives and driving interests early on and throughout the planning process.
- **Goals and supporting data:** A strong emphasis should be placed on development of goals for the initiative that are backed up by data that all community stakeholders can agree upon. Two levels of performance metrics are necessary for the initiative. The first level gauges the progress of the roadmap strategy and the second level is needed to assess the overall impacts of the initiative within the metropolitan community. It is important for performance metrics to directly tie back to the primary community drivers for the Birmingham metropolitan area to achieve accountability and maximize and sustain stakeholder commitment.
- **Policy alignment:** Policy alignment of existing city and regional plans for transportation and other critical infrastructure and assets is also essential to the success of a smart city. The metropolitan growth and revitalization efforts in place or planned and how to tie into and leverage them need to be understood and transportation-specific elements must be identified and assessed.
- **Comprehensive plan with integrated strategic activities:** Transportation energy efficiency and smart city development encompass many complex and disparate aspects. This necessitates development of a comprehensive, integrated plan, including a robust set of coordinated strategic activities. This will help break the initiative down into manageable parts and better integrate actions.
- **Strategic area dependencies and prioritization:** Dependencies between strategic areas and the level-of-effort and timeframes for each should be mapped out. Within each strategic area, identify the opportunities, challenges, and actions that are needed to be addressed. Prioritize projects based on a value analysis.
- **Regional strategy with local ownership:** Emphasizing local ownership of the regional strategy is important for promoting transportation energy efficiency as part of smart city development. In this way, a comprehensive approach can be adopted, leveraging and optimizing a broad array of insights and resources, while maintaining local stakeholder interest and engagement.
- **Kick-off workshop:** A kick-off workshop(s) should be conducted with key stakeholders to start the initiative. Identification of primary stakeholder drivers and establishment of consensus on strategic areas builds stakeholder engagement.
- **Follow-up engagement activities:** Follow-up engagement activities (e.g., webinars and meetings) should be conducted to build stakeholder interest and commitment and further develop the roadmap initiative and subsequent implementation. Other relevant stakeholders that were not involved in the kick-off workshop(s) should be included to expand participation and input.

# APPENDIX A BIRMINGHAM ROADMAPPING WORKSHOP RESULTS

On January 18, 2017, a kickoff workshop was conducted for the Birmingham Regional Transportation Energy Efficiency and Smart City Roadmap. The workshop convened discussions to frame the scope, drivers, and six broad strategies for the roadmap that are discussed in the body of this document. With extensive stakeholder input, the workshop also identified significant challenges, opportunities, and potential actions within the six strategic areas. The following tables identify the results from the breakout sessions of the Birmingham workshop.

Table A1. Governance.

#### **CHALLENGES** • Poor collaboration between municipalities • Who owes the roadmap and process? Make a priority! • Who owns the roadmap given the geographic divisions • How to manage and implement • Organizational structure, roles, and responsibilities • Parochialism versus regionalism • Data dissemination – privacy versus transparency **OPPORTUNITIES** • Capabilities exist • Governance group – diversified – make a priority • Successful models that can be adopted • Make transportation electrification under smart city governance group • Existing collaboration (e.g., this workshop) ACTIONS • **Project ID:** Roadmap Steering Committee • **Project ID:** Establish governance body: divide it into Output: Manage/monitor progress focus areas: transportation, energy, data, and health Impact: Stakeholder engagement/informed **Relevant Parties:** • **Project ID:** Review data challenges and approaches in - UAB other communities James Fowler Output: Recognition of complexity - U.S. Green Building Council, Alabama Chapter Impact: Realistic expectations • **Project ID:** Education roadshow • **Project ID:** Establish a project management team Output: Educate key leaders Output: Organizational readiness Impact: Informed stakeholders Impact: Leadership/public perception **Relevant parties:** - Alabama Power - Birmingham Business Alliance (BBA)/Chamber - Alabama Clean Fuels Coalition

Table A2. Intelligence and forecasting.

#### CHALLENGES

- Collecting good travel behavior data
- Getting everyone to share
- No framework exists (for what data needs to be collected, when, by whom, and for what purpose)
- Technology advancements outdating planning
- Gas prices hard to predict and understand
- Health access (e.g., think about autonomous vehicles implications for senior mobility and affecting health access)
- Understanding/gathering data
- Data collection
  - Conflicting data
  - Lack of equipment to collect data
  - Erroneous or misinterpreted data collected
- Comprehensive feedback from citizens/students about transportation choices and preferences
- Senior mobility

#### **OPPORTUNITIES**

- Data collection via existing and emerging systems
- Growing tech/data analysis scene
- City of Birmingham and UAB have an info-sharing memorandum of understanding
- Planned/ongoing projects to build backbone
- Upcoming neighborhoods moving between them

#### ACTIONS

- **Project ID:** Identify current long-term plans in community Output: Map with location and travel patterns
- Impact: Ability to visualize mobility need
  Project ID: Household travel survey
- **Project ID:** Household travel survey Output: Know how people get to and from work Impact: Ability to set goals for mode share
- **Project ID:** Develop data requirements and technology plan (data center) Output: Plan of tactical prioritized projects and schedule Impact: Scope, schedule, and budget "shovel ready"
- **Project ID:** Establishment of a clearing house for data Impact: One place for all data
- **Project ID:** Expand data center (existing) to public facing clearinghouse Output: Information – more data, better info Impact: Knowledge/tools – maps, geographic information system and analysis tools Relevant Parties:
  - Regional planning commission of greater Birmingham/UAB

- Dynamic infrastructure
- Build on Birmingham smart city initiatives (UAB). Smart city work can help the planning process. UAB has good best practices to learn from
- **Project ID:** Method-repository Create inventory/database of equipment and existing and future needs wish list of equipment and locations Output: Gathering and measuring impact and effectiveness Impact: Public education and buy-in

Relevant Parties:

- Who owns process will drive who is involved
- Regional planning commission
- Transit Authority
- Alabama Power
- Market intelligence
- **Project ID:** Survey citizens about transportation for top priorities
- **Project ID:** Travel survey Output: Travel mode/frequency understanding Impact: Inform strategy/planning Relevant Parties:
- UAB/Regional Planning Commission: Travel survey of UAB
- Airport authority, BBA, Birmingham transportation engineers/city
- Possibly others

#### Table A3. Asset management.

#### CHALLENGES

- Undocumented institutional knowledge; lots of 30-year people who just know how to do it not sustainable.
- Change mindset from maintenance/technical to risk and cost. Owning and operating information. Change mindset of just have to change oil every 3K miles, but maintaining cost. Need analysis to question.

#### **OPPORTUNITIES**

- Complex locations: UAB, rail yards, and airport
- Stuff is breaking more frequently and it costs more to fix; there is incentive to make it work better/longer

- Highway project 20-59. Highway project is long term and if it is wrong, it could create issues
- Size/scope
- Information sharing/gathering
- What do we really need (transportation demand)?
- Conflicting priorities among stakeholders
- Minimal data on existing assets
- International Organization of Standards 55000 standards/Publicly Available Specification 55 framework
- Wide streets downtown

#### ACTIONS

- Project ID: Install global positioning system on buses for people to see (in process)
   Output: Bus scheduling would be better anticipated Impact: ↑ ridership, ↑ econ dev, ↓ emissions
- **Project ID:** Freight/goods complex location clarity Output: Need identification for mobility at airport and rail yard

Impact: Attract external business and increase mobility efficiency

- **Project ID:** "Pilot" expand existing UAB car share program to Parkside district; multi-family developments Output: Utilize used electric vehicles/M<sup>-</sup>V charging Impact: Increased education/plug-in electric vehicle market growth/transportation options
- **Project ID:** Work with large employers to install charging stations
  - Impact: Charging opportunities
- **Project ID:** Expand/begin workplace charging in Birmingham

Output: Access to charging

Impact: Cleaner air, reduced noise, and lower cost Relevant Parties:

- Municipality/state government, whoever controls asset
- Alabama Power
- Individual agencies (e.g., Birmingham Jefferson County Transit Authority)
- Government affairs people

- Project ID: Expand bike lanes
   Output: Increase % of ridership by bike
   Impact: Economic dev ↑, Health ↑, Emissions ↓
- **Project ID:** Develop integrated asset management plan Output: Plan adopted by all asset owners/operators agreements

Impact: Plan with increasing benefits

- **Project ID:** Charging stations at rest stops Impact: Increase access to charging
- **Project ID:** Airport PRT Output: Reduce congestion/travel times Impact: Increase transportation options
- **Project ID:** High speed rail to Atlanta Output: Increase travel speeds to and from Impact: Economic development and emissions ↓
- **Project ID:** List/share existing infrastructure Output: Advantages and weaknesses. Are there improvements planned already? Relevant Parties:
  - Alabama power distribution planning
  - Municipal transportation
  - Building entities
  - Transit authority including light rail

#### Table A4. Policy.

#### CHALLENGES

- How strict are the policies?
- Potential for loopholes?
- Limited local rule most enabling law requires state legislation
- Uncertainty at state and federal levels
- Lots of players (e.g., electric vehicle companies, alternative fuels, transportation strategies, and municipalities)

#### **OPPORTUNITIES**

- Copy what other groups have done; utilize best practices and more
- Private/public partnerships lots of good scuttle, but reason to be optimistic

- Which code/standard legislation best suites Birmingham, Alabama? (e.g., If electric vehicle charging unit must be installed per number of parking spots, who owns/operates/pays for power?)
- Flexibility for tech changes
- Having all local municipalities working at the same level for infrastructure
- Many examples of codes/standards/legislation to use
- Parking as productive activity (charging)
- Convince new construction sites to prepare for alternative fuel (electric charging stations)

#### ACTIONS

• **Project ID:** Hwy 280 ease and speed of travel to/from City of Birmingham – PRT, light rail, expanded, reconfigured Output: ↑ employment in metro, lower transit time/emissions – economic development

Impact: ↑ taxes/employment

- **Project ID:** Model ordinance/policy, how to book Output: Guidance for policy makers and practitioners Impact: Knowledge/tools Relevant Parties:
  - BBA

#### Table A5. Funding.

#### CHALLENGES

- Wise, careful investments
- Adopting/funding incentives (tax credits and rebates)
- Uncertainty at federal/state level
- High fund/electric vehicle co-existing
   Now funded by gas (fueling)
- Unknown future cost
- Aging infrastructure high cost
- Determine self-funding options for implementation based on value and business case

#### **OPPORTUNITIES**

- World games
  - High profile event funding for hosting national events
- VW Settlement
- Congestion mitigation and air quality
- Federal grants (U.S. Department of Energy, U.S. Department of Transportation, and Environmental Protection Agency)
- Technology is both environmentally and economically viable and sustainable; bus model makes sense

#### ACTIONS

- **Project ID:** Infrastructure bank (capitalized with both public and private money) Output: More money, more freedom Impact: Better/more impactful projects
- **Project ID:** Low income focus; define and address specific transportation needs Output: Clarity that roadmap/plan serves all Impact: Support from entire community
- **Project ID:** Public private investment Output: Report on current U.S. public/private opportunities Impact: Identify potential opportunities Relevant Parties:
  - Alabama Power, Alabama Clean Fuels Coalition (ACFC), mayor's office, BBA, old players/money

- **Project ID:** Develop state-wide roadmap Output: Single policy focus for state Impact: One voice and one plan for funding
- **Project ID:** Suggest preplanning for all new construction for alternative fueling (i.e., new construction raceways) Relevant Parties:
  - County/city entities
  - Utility
  - Business/developers
  - Differences in funding requirements
    - Multiple disciplines and agencies involved and each will have a different available pool of funding and a vastly different set of requirements and regulations related to funding, which may, at times, be contradictory
  - Funding
    - Transport funding insufficient (state and local level versus U.S. federal government)
  - President-elect infrastructure plan
  - Different funding sources
    - Multiple agency involvement opens multiple doors to tap different funding and grant programs
  - Create investments and/or fees to influence behaviors
  - Incentives (not third party)
  - Economic development projects underway
  - Funding once we frame the story
    - All this that we are doing today → document that helps tell story
  - **Project ID:** Determine value advantage for segments that could benefit

**Relevant Parties:** 

- UAB, U.S. Department of Energy, Local-chains, BBA, Birmingham Business Journal examples, who delivers message
- **Project ID:** Central repository for funding information Output: One stop Relevant Parties:
  - City of Birmingham, Jefferson County Mayors Association, BBA – tie grants with source, and UAB

Table A6. Engagement and outreach.

#### CHALLENGES

- Getting buy-in from the public
- Car-dependent culture
- Dealer/salesmen promotion
- Long-term benefits; hard to understand what's in it for me
- Challenge of security and safety, especially regarding autonomous vehicles
- Paradigm change

#### **OPPORTUNITIES**

- Use intermodal facility to reach four modes (i.e., bus, rail, intercity bus, and bikeshare) of travelers to collect data (e.g., using surveys and head counts)
- Collaborative follow-up to this meeting
- Effective models exist
- UAB  $\rightarrow$  urban campus

#### ACTIONS

- **Project ID:** Mode share goal and plan (tied to 1a) Output: Goal for fewer people driving non-electric vehicles
  - Impact: More efficient/green travel as a region
- **Project ID:** Begin outreach tomorrow Output: Mayor/county united roadmap development plan Impact: Community involvement
- **Project ID:** Dealership education on electric vehicles Output: Understanding electric vehicle sales; educate dealerships

Impact: More electric vehicles on road

• **Project ID:** Work with rental car companies Output: Give customer a chance to experience that type of car

Impact: Increase sales

• **Project ID:** Media campaign to educate on charging vehicle at home Output: Education

Impact: Show the public the feasibility of ownership

- **Project ID:** Social media Output: Who does this well? Relevant Parties:
  - Alabama Clean Fuel Coalition and BBA
- Project ID: Incorporate transportation strategy in all existing communications
  - Relevant Parties:
  - City of Birmingham (newsletter), ACFC, and BBA

- Alternative fuel vehicles in large numbers on every car lot
- In getting started, lack of knowledge as to what is possible
- Electric vehicle availability (original equipment manufacturer)
- Development of stakeholder consensus groups/process
- Clarify funding value for new technologies
- Exposure (direct and indirect)
- Start town hall meetings describing technology available and coming
- Empower citizens and promote sustainable transportation
- Power of education
- **Project ID:** Hands-on interactive outreach meeting Output: Demo charging stations, smart car, and sell security
  - Impact: Increase knowledge and buy-in from community
- **Project ID:** High-visibility charging in growth zones/new mixed-use development Output: Advertising and ride and drive Impact: In areas where people travel into/out Relevant Parties:
  - Developers, real estate associations "Shannon Walchuck," and factories
- **Project ID:** Develop and implement a road show Output: Public engagement Impact: Public awareness
- **Project ID:** Database of all outreach initiatives: medical facilities, schools, and a lot already being done, youth champion, recycling, piggybacking Relevant Parties:
  - UAB (within different schools) and Alabama Power
- **Project ID:** Pilot programs; electric vehicle and development

Output: Experimental education for policy-makers and public about electrification options/tools

Impact: Feel better/at ease knowledge - lessons learned