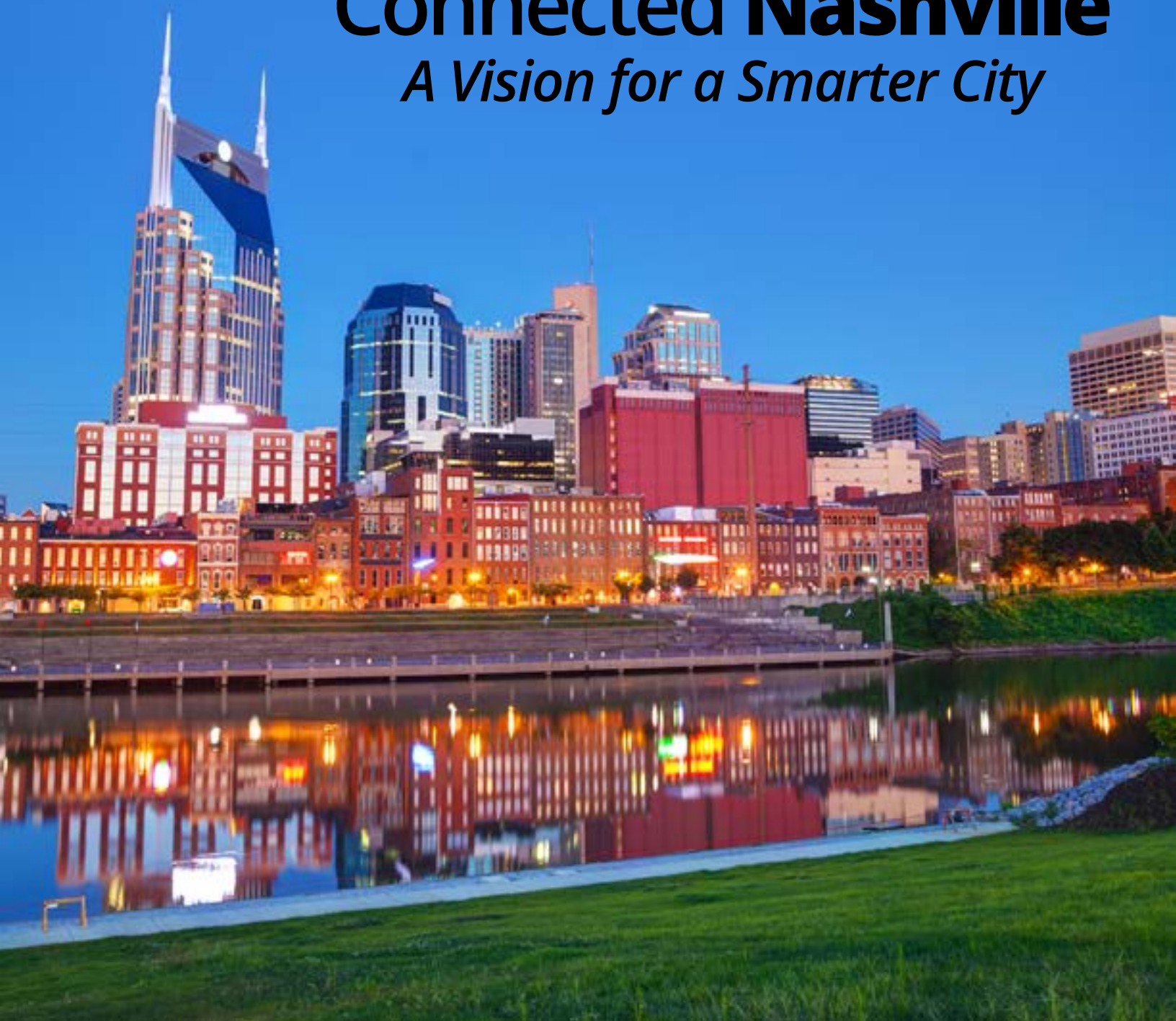
Connected **Nashville**

A Vision for a Smarter City

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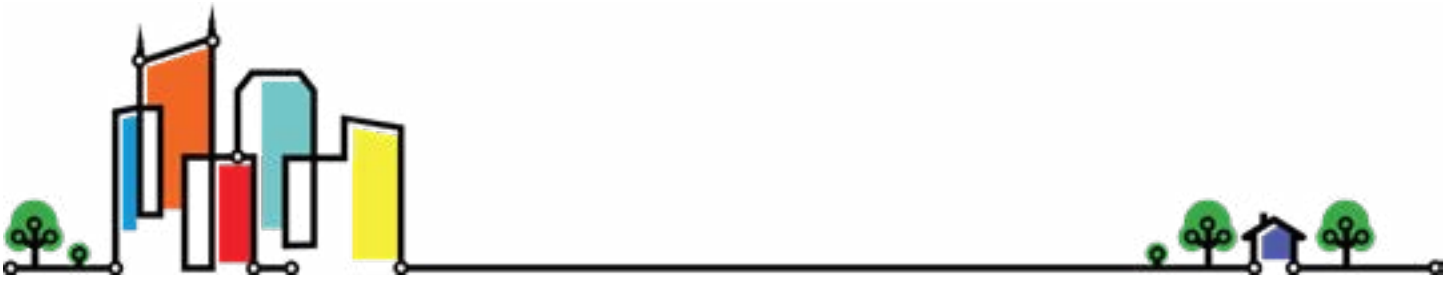

Letter from Connected **Nashville** Co-Chairs

Dear Readers,

Technology as an enabler of the work of cities is not a new concept. Departments and agencies of Metro Nashville have long used systems to accomplish tasks such as compiling property records, managing court dockets and scheduling trash pickup.

However, in the last few years, we have collectively witnessed technological advances like the Internet of Things, ubiquitous mobile devices, and autonomous vehicles present opportunities to solve old problems in new ways. With many of these new technologies come vast amounts of data and new data analysis tools. New data and new tools allow for deeper insights into ongoing challenges and, when used effectively, help us craft better solutions, particularly related to challenges of tech inclusion and diversity.

Beginning in May 2016, a group of 75 community members with diverse backgrounds and opinions worked together to first examine Metro's stated priorities and then look globally at how we might address our priorities in new ways using technology and data, with an unwavering eye on equity. Hundreds of members of our community vetted the group's suggestions. The resulting document is ***Connected Nashville: A Vision for a Smarter City.*** It represents, for the first time, a publicly reviewed set of technology-oriented strategies for Metro Government to follow in addressing our stated priorities over the next four to six years.

We are most grateful to have had the support and input of Nashville residents, Metro departments and agencies, nonprofit agencies, universities and local businesses throughout this process. By building on these partnerships between the community, public sector, private businesses and academia, we can to ensure a high quality of life and a sustainable future for all Nashvillians.

Sincerely,

Keith Durbin,
Chief Information Officer/Director of Information Technology Services

Dr. Fallon Wilson

Bryan Huddleston

Connected Nashville Committee Co-Chairs


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Introduction to Connected **Nashville**:
A Vision for a Smarter City

Introduction

Nashville is a growing and vibrant city. To shape growth in the ways that our communities want, Metro Government departments and agencies develop plans to guide that growth. Foremost among existing plans is ***NashvilleNext***, the product of a 3-year process informed by 11 thousand people with the purpose of guiding growth, development and preservation through 2040. Nashville communities have also contributed to plans that direct transportation (***Vision 2020***), parks (***Plan to Play***), the environment (***Livable Nashville***) and education (***The Academies of Nashville: A Five-year Plan for the Implementation and Sustainability of High School Reform)***, to name a few. Each offers compelling goals for Nashville to realize a better future.

Smart Civic Technologies Emerge

As Nashville has evaluated and solidified community goals, technological developments have ushered in a new era that promises to enable Metro Government and Nashvillians to meet challenges in ways that have not previously been feasible.

A flourishing digital marketplace offers the promise of civic technology solutions to problems across government services. These technologies, in combination with gigabit connectivity, sensors that can provide real-time access to a vast array of community information, and innovative delivery methods, have created an environment for technology to play a larger role in society and government than ever before.

At the same time, technology now plays a pervasive role in the lives of Nashville's residents and visitors. Technology is embedded in our smartphones, car navigation systems, and in products that automate simple tasks in our homes.

Blending technology experiences that our residents obtain through their smart phones and social environments with the advances of government technology, Nashville has the opportunity to become a Smart City – a city that uses technology and data to solve local challenges.

Addressing Metro's Priorities

Metro's priority with this *Connected Nashville* plan is to address the challenges that are at the forefront today, not to chase the latest dazzling technology, or pursue technology for technology's sake. Metro's residents want affordable housing, equitable educational opportunities and transportation solutions. It is clear that each of these areas of need can be addressed, in part through the right technologies.

In 2016, Mayor Megan Barry created and charged the *Connected Nashville* working group to define, document and present recommendations to guide Nashville's quest to become a smarter city. Leaders and subject matter experts from Metro Nashville businesses, academia, non-profit sectors and all levels of government came together to develop the 21 recommended strategies and their attendant strategic actions which make up *Connected Nashville: A Vision for a Smarter City*.


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Guiding Principles

This document presents a number of specific strategies and actions that have the potential to make Nashville a smarter and more connected community. These strategies are not all-inclusive, nor can they anticipate future developments and demands. To guide future efforts, the ***Connected Nashville*** *working group has developed the following guiding principles for Metro Government and our partners to consider when using technology and data in the community.*

- ## Guiding Principle: Collaboration

  Connected Nashville is focused on meeting community goals through active partnerships with engaged residents, academic partners, nonprofit agencies and the business community, along with agencies within the Metropolitan Government, in surrounding counties, and at the state and federal levels to maximize both opportunities and impact.

- ## Guiding Principle: Community Focus

  Connected Nashville is focused on meeting community goals to promote a high quality of life for all Davidson County residents, and a welcoming environment for visitors to Nashville. Using technology for community benefit includes respecting the need for individual privacy, protecting sensitive information, acknowledging residents' concerns and ensuring responsible and beneficial use of data and information.

- ## Guiding Principle: Equity and Inclusion

  Connected Nashville is focused on meeting community goals that promote social, cultural, educational and economic opportunity and empowerment and to ensuring inclusion, availability, affordability, and public access to the benefits brought by technology.

- ## Guiding Principle: Responsibility and Transparency

  Connected Nashville is focused on meeting community goals to foster trust in government through openness, transparency and accessibility to our residents; to create communication channels that effectively engage and inform; and to promote accountability through community feedback.

- ## Guiding Principle: Sustainability and Resiliency

  Connected Nashville is focused on meeting community goals in a manner that is designed for endurance over the long run with the ability to be adaptive and manage inevitable change.

About this Report

The Spark

In late 2015, the United States Department of Transportation (USDOT) announced the *Smart City Challenge.* This was a unique funding opportunity to demonstrate and evaluate a holistic approach to transportation performance within a city using technology, and to integrate this approach with other domains such as public safety, public services and energy.

Our Submission

Through Mayor Barry's leadership, Metro gathered a group of Nashville's local transportation, technology and academic leaders to draft a vision for this opportunity. Though Nashville was not one of the finalists announced by the DOT, the process sparked inspiration and collaboration around the concept of using technology and data to address transportation challenges. It likewise highlighted a number of the gaps in Metro Nashville's ability to meet such challenges from strategic, technical and operational viewpoints. As a result, our Mayor committed to working toward Nashville's renewed vision in the coming years.

The Process

To follow up on that commitment, Mayor Barry led the assembly of a committee to strategically address specific points of the vision. She named as the committee's co-chairs **Dr. Fallon Wilson**, founder of The Ed Digital Think Tank and Co-Founder of Black in Tech Nashville, **Bryan Huddleston**, local technology leader, technology workforce development advocate and former CEO of Nashville Technology Council, and **Keith Durbin**, Chief Information Officer and Director of the Information Technology Services Department of the Metropolitan Government. The co-chairs worked with Mayor's office staff to carefully and intentionally assemble a diverse 76-person working group that crossed industries, academia, governments, communities and non-profit agencies.

In May 2016, Mayor Barry convened and addressed the first meeting of the *Connected Nashville* working group. She charged the group to investigate and define community recommendations to inform Metro Government and Nashville as a whole to support better-connected, more citizen-centered public services, and to better prepare Nashville to pursue opportunities that technology would provide and enable in the future.

Members of the working group were further organized into subcommittees around five areas of focus: **Economic Development, Livability and Housing, Mobility and Transportation, Education and Achievement** and **Technical Standards**. The subcommittees worked through the process illustrated below, phase by phase, supported by staff from Metro's Information Technology Services Department. The five areas of focus developed into the six categories in our smart city "Mandala", pictured on page 17: Economy, Mobility, Environment, Governance, People and Living.

Figure 1, The Connected Nashville Process

To facilitate their research and stimulate thought, the working group heard from national and international experts in smart city technology, strategy and civic engagement, received an overview of existing and planned smart city technologies within Nashville government, and researched vetted community plans incorporating these technologies. These plans were the foundation of the recommendations contained in this report (*Figure 2*).

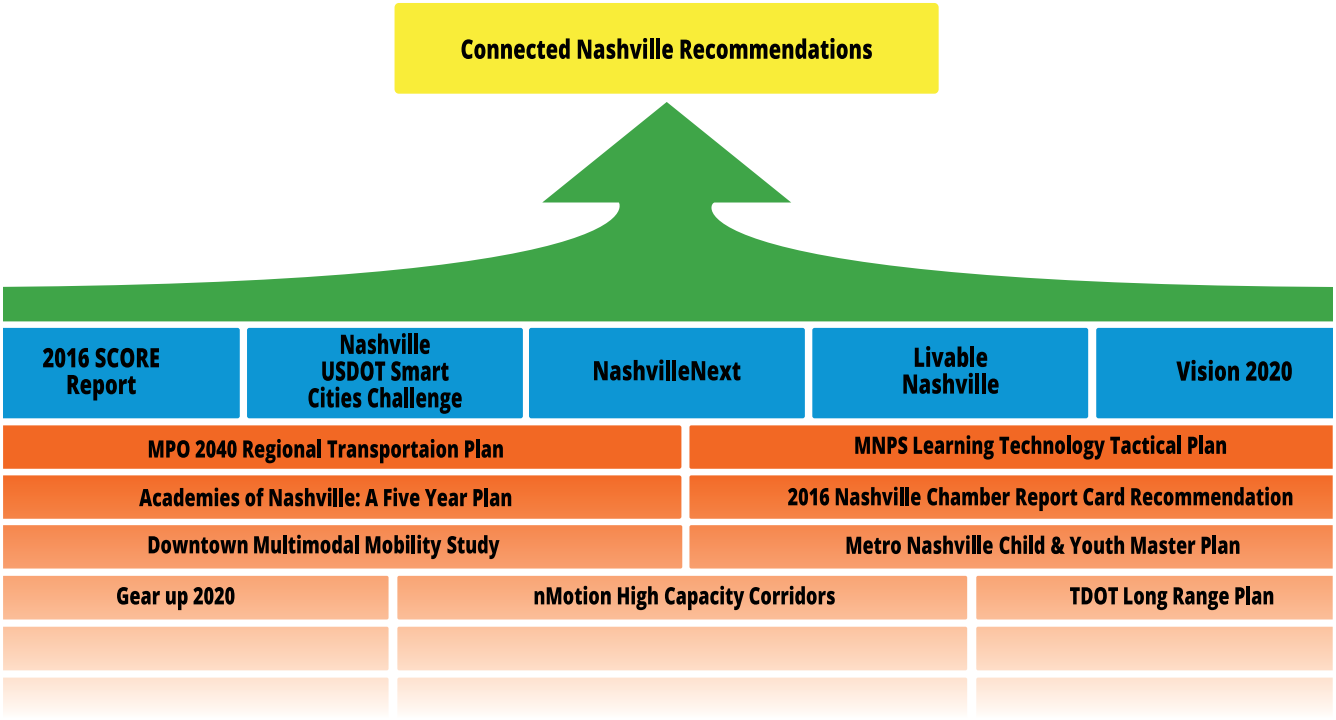

Figure 2, Examples of Community Plans Considered by the Working Group

Community Feedback

After completing the first three phases of development, the group compiled a set of draft recommendations. The draft was shared with hundreds of members of the community online and at a series of public meetings to gather feedback on the committee's suggested strategies. Using feedback gathered, the group refined the draft recommendations for presentation to Metro Government leadership.

These ideas and priorities, developed with community feedback, are intended to further inform Metro and departmental action plans. The strategies presented will likewise give quasi-governmental entities, nonprofits and businesses thoughts on initiatives that they may undertake to serve the public and help to make Nashville a smarter and more connected city.

About this Report (con't)

The Result

Connected Nashville: A Vision for a Smarter City is the product of an eighteen months effort from the working group, designed to focus on how we can apply technology to solve local challenges within six dimensions – education, transportation, environment, governance, livability and economy – recognized globally as components of a smart city framework. Since a single report cannot cover all potential strategies or activities, a set of Guiding Principles (page 9) exists to guide Metro's actions and reflect the spirit in which the C*onnected Nashville* plan was developed.

The "What is a Smarter City?" section of this document (page 16) defines the smart city concept for Metro Nashville in detail. Also within this report are 21 strategies. Each strategy reflects an element of the six smart city dimensions. Each strategy has associated strategic actions, which serve as the suggested activities that Metro departments and agencies should consider in support of a given strategy. As strategic

Figure 3, Cities Used for Case Studies

actions in many cases are connected across various strategies, linkages between strategic activities are indicated by this icon 🔗, with the linked strategy number(s) and strategic action number(s) indicated.

Associated with each strategy is a peer community example – a case study of how another city has used a technology-based solution to support progress toward meeting a goal within that community. For these case studies, we selected cities with distinct differences, various needs, and customized approaches to guide our residents in understanding how the *Connected Nashville* recommendations might look in practice.

Finally, cities across the globe are struggling with technical standards around which to organize smart city technology projects. A set of technical standards (page 76) around integration and interoperability, security, and privacy are laid out as suggested minimums to inform the development and/or procurement of technology solutions for Metro initiatives.

Participants

Connected Nashville Co-Chairs

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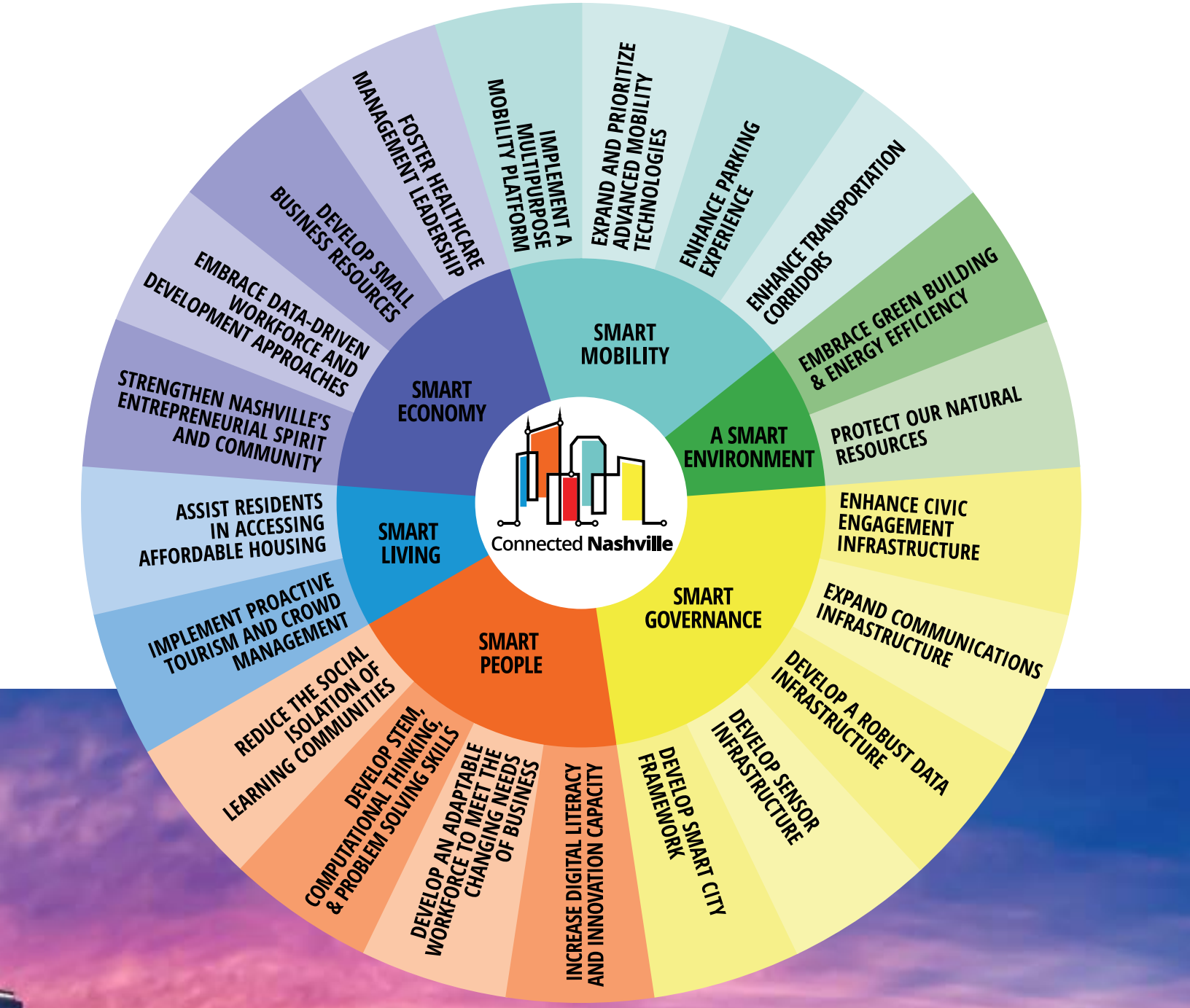
What is a Smarter City?

Technology plays a role in nearly every aspect of the modern urban lives of Nashvillians. But just using technology does not make a city smart…

A smarter city:

- Achieves goals and meets challenges of its community through the use of technology and the analysis of the data generated through technology.
- Uses technology, digital communication and data to gain a better picture of service needs and engages the community to solve community issues.
- Uses technology and innovation to improve the lives of citizens by improving the services it provides to its residents and creating a foundation for communal empowerment.
- Ensures equitable and inclusive access to quality of life for all of its residents.

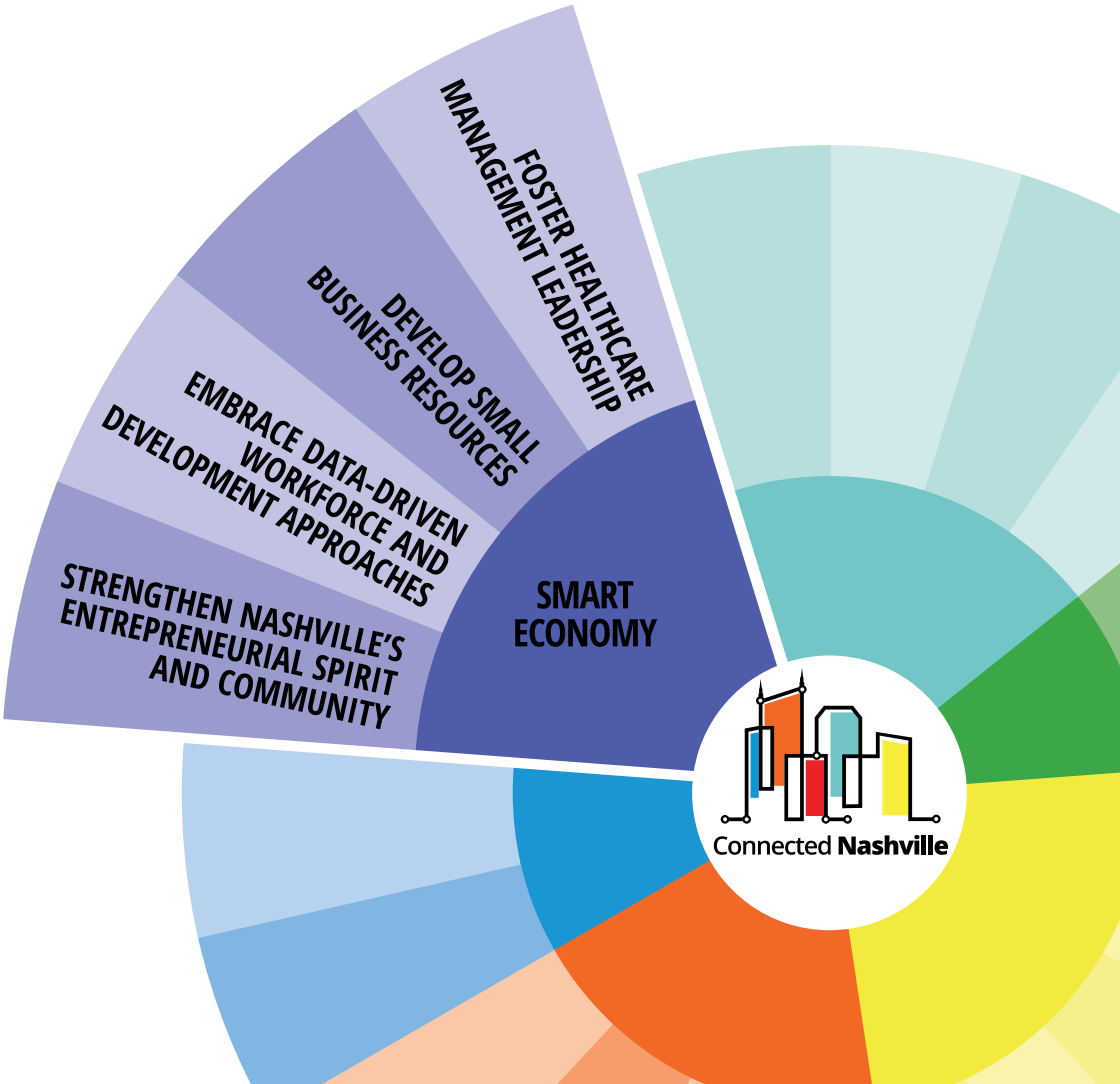
Connected Nashville's holistic approach to becoming a smarter city is embodied in six dimensions critical to Metro's future: Economy, Environment, Governance, People, Living, and Mobility.


SMART ECONOMY
SMART MOBILITY
A SMART ENVIRONMENT
SMART GOVERNANCE
SMART PEOPLE
SMART LIVING
Connected Nashville
FOSTER HEALTHCARE MANAGEMENT LEADERSHIP
DEVELOP SMALL BUSINESS RESOURCES
EMBRACE DATA-DRIVEN WORKFORCE AND DEVELOPMENT APPROACHES
STRENGTHEN NASHVILLE'S ENTREPRENEURIAL SPIRIT AND COMMUNITY
IMPLEMENT A MULTIPURPOSE MOBILITY PLATFORM
EXPAND AND PRIORITIZE ADVANCED MOBILITY TECHNOLOGIES
ENHANCE PARKING EXPERIENCE
ENHANCE TRANSPORTATION CORRIDORS
EMBRACE GREEN BUILDING & ENERGY EFFICIENCY
PROTECT OUR NATURAL RESOURCES
ENHANCE CIVIC ENGAGEMENT INFRASTRUCTURE
EXPAND COMMUNICATIONS INFRASTRUCTURE
DEVELOP A ROBUST DATA INFRASTRUCTURE
DEVELOP SENSOR INFRASTRUCTURE
DEVELOP SMART CITY FRAMEWORK
INCREASE DIGITAL LITERACY AND INNOVATION CAPACITY
DEVELOP AN ADAPTABLE WORKFORCE TO MEET THE CHANGING NEEDS OF BUSINESS
DEVELOP STEM, COMPUTATIONAL THINKING, & PROBLEM SOLVING SKILLS
REDUCE THE SOCIAL ISOLATION OF LEARNING COMMUNITIES
IMPLEMENT PROACTIVE TOURISM AND CROWD MANAGEMENT
ASSIST RESIDENTS IN ACCESSING AFFORDABLE HOUSING

Dimension 1:

Smart Economy

In order to assure sustainable growth for Nashville, our community must foster entrepreneurship and innovation to remain competitive in evolving local, national and global economic landscapes. To plan for ongoing economic success, we must encourage collaboration between government, academia and industry, and establish programs that make Nashville an attractive location for existing businesses and for prospective new corporate citizens.

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Strategy 1:

Foster Healthcare Management Leadership

According to industry research by the Nashville Healthcare Council, Nashville's healthcare industry "contributes an overall economic benefit of $38.8 billion and more than 250,000 jobs to the local economy annually. Globally, Nashville's health care industry generates more than $84 billion in revenue and more than 500,000 jobs." An August 2016 study by the Brookings Metropolitan Policy Program, entitled *From healthcare capital to innovation hub: Positioning Nashville as a leader in health IT*, states that Nashville's opportunity "revolves around multiple areas of competitive advantage" including major IT investments within Nashville's healthcare industry. Brookings further states that Nashville is at an advantage due to "substantial flows of high-value products and services generated in the region and sold through its extensive networks in national markets, and a high concentration of health-related research at Vanderbilt University".

Strategic Actions

1. Support innovation in the region by creating easy to use transfer contracts between universities and key industry associations to increase the economic impact of Healthcare Information Technology (HIT).
2. Provide business support for local software firms selling their products outside the region.
3. To build closer business ties between healthcare and IT, form a consortium of IT firms as well as a cross-industry working group that focuses on using healthcare data to improve human health.
4. Expand existing accelerator programs by expanding partnerships with institutions, and explore nontraditional methods in IT and coding training. 🔗 11.3
5. Develop a mentoring program to provide HIT experience to students in a variety of clinical settings. 🔗 9.3
6. Launch a CEO network that brings global management to Nashville, helps young IT companies attract capital and connect to large healthcare firms, and strengthens the link between new businesses and established firms.
7. Work with partners to explore and develop local ability to use blockchain as a new way of recording, managing and authenticating healthcare records. 🔗 19.7
8. Sponsor coding user groups, and connect those groups with healthcare firms using HIT data-discovery challenges.

PEER COMMUNITY EXAMPLE

Medical Records on Blockchain

At the intersection of medical research and medical treatment, a team in Boston developed MedRec, an application designed to securely store medical records using blockchain, an online-distributed ledger for record-keeping. Beth Israel Deaconess Medical Center collaborated with the MIT Media Lab to conduct a six-month pilot of MedRec at Beth Israel. Over the course of six months, researchers tracked inpatient and outpatient medication data with code deployed through virtual machines at MIT. In a simulation of the data exchange process between institutions that a blockchain application would utilize, the team recorded vaccination history, blood work records, treatments and prescriptions by using two different databases within Beth Israel. Positive results led to plans for additional pilots with a larger network of hospitals.

Learn: http://bit.ly/BlockchainTutorial

Explore: http://bit.ly/BChealth

Strategy 2:

Develop Small Business Resources

According to *American City Business Journals' 2017 Small Business Vitality* survey, Nashville ranked No. 18 among 106 metros in the area of small business success. During the first quarter of 2017, the Nashville Area Chamber of Commerce saw an average membership increase of 20 per month. Nashville is constantly expanding support for entrepreneurs and small businesses, but sometimes these efforts occur in silos, and it is often difficult for small business owners to gain full view of all opportunities. To stay on the path of progress, Nashville must create a network of small business resources, and use data and analytics to develop those resources based on current needs and trends.

Strategic Actions

1. Engage in a structured inventory assessment to understand what resources and capital funding networks are available, underused or at capacity, and make the results accessible to the public online. 🔗 4.1
2. Create digital tool with searchable databases of all available commercial real estate across the city, with options to sort by geographical area and property characteristics, as well as options to view detailed specifications and history. 🔗 4.1
3. Develop and promote a regional public/private data marketplace platform, available to the public, which presents data (open and otherwise) from government, business and academic sectors in one web-based location, along with simple data visualization tools. 🔗 4.1, 7.2, 8.1, 10.4, 13.1, 13.2
4. Develop a small business portal to assist individuals that are starting or growing their businesses to obtaining logistical, regulatory and development-related resources and information. 🔗 4.1

PEER COMMUNITY EXAMPLE

Small Business Support for the Digital Age

Austin Smart Start, a partnership between Austin's Development Services and Economic Development agencies, helps new small business owners navigate development review, permitting and inspections. Smart Start is a municipal application that guides users through each of the major steps of the development process, answering their questions along the way, informing them about regulations and connecting them with resources.

Learn: http://bit.ly/AustinSmartStart

Explore: http://bit.ly/AustinSB

Strategy 3:

Embrace Data-driven Workforce and Development Approaches

Nashville's economic success relies heavily on our workforce. Developing a successful workforce requires ongoing enhancement of the methods we use to gather and analyze information related to our efforts. Tennessee Department of Labor and Workforce Development's five-year *State Workforce Strategic Plan* recommends that we "use Labor Market Information and other available data to drive decision-making and strategic planning." The plan further states that "knowing where the jobs are, assessing the needed competencies and skills, and understanding the labor market context, all remain as important as ever for effective jobseeker and business relations programs." A key factor of Nashville's success in workforce development is the ongoing effort to fill technology sector jobs. Targeted economic and workforce development efforts require continual data collection for feedback and improvements. Using data and analysis, we can improve our local workforce development efforts, as well as recruitment efforts in specific geographical areas to ensure consistent, long-term economic growth across the city.

Strategic Actions

1. Explore new technologies that improve how we match applicants to jobs using job boards, algorithmic matching technologies, artificial intelligence, online skills assessments, career development portals and online social networks.
2. Use standardized methods such as shift share analysis of industries to determine causes and trends in regional job growth.
3. Create connections between policy, economic development and budget deliberations. Explore processes that will allow us to consider our goals for economic development when we conduct city budget planning.
4. Gather and analyze data on areas of impact, including economic and social, prior to awarding or renewing any incentives.
5. Explore business skills training and mentorship, including digital literacy, as an important component of rehabilitation of formerly incarcerated people, to equip them with the tools necessary to be successful members of the workforce. 🔗 12.1

PEER COMMUNITY EXAMPLE

Creating Career Pathways with Data

In Lancaster County, Pennsylvania, workforce and education planners are applying a **career pathway framework**, using labor market data to drive long-term employment success. Manufacturing is the leading industry in Lancaster County. By reviewing projections of new and replacement jobs over a 10-year period, planners can identify occupation groupings within the industry, and each grouping can form a career "roadmap". Using this framework, they analyze databases that indicate the levels of knowledge and skills required at various levels of employment. This allows planners to determine what is required to reach entry, intermediate and upper-level categories for each "Production Career Pathway". These data collections allow planners to assess what percentages of the workforce display skill compatibility with presently-available jobs and jobs that Lancaster County will need to fill over the next ten years.

Learn: http://bit.ly/PathwaysWhitePaper

Explore: http://bit.ly/LancasterWDB

Strategy 4:

Strengthen Nashville's Entrepreneurial Spirit and Community

Nashville has a rich history of supporting entrepreneurs, at a consistently higher level than the national average (Livablity.com *Top 50 Cities for Entrepreneurs 2016,* WalletHub *Best Places to Start a Business 2017*, Forbes *Best Places for Businesses and Careers 2017*). Opportunities and resources are plentiful. New ideas are abundant. The framework, fostered through organizations such as the Nashville Entrepreneur Center, which connects ideas to resources across Nashville, is a critical component for continued success. This framework, if we strengthen it, will extend Nashville's entrepreneurial training and development initiatives across all ages, genders, races, ethnicities, incomes and locations.

Strategic Actions

1. Explore and adapt programs that pull existing initiatives into a comprehensive platform that allows entrepreneurs to engage with diverse resources and services. 🔗 2.1, 2.2, 2.3, 2.4
2. Encourage and assist Metro Nashville Public Schools in incorporating business skills across Nashville's educational curriculum, especially through the Academies of Nashville.
3. Develop programs and partnerships to increase digital entrepreneurship capabilities related to ecommerce and online business opportunities for less traditional entrepreneurs for primary or auxiliary income.
4. Work with telecommunications partners toward ubiquitous high speed, low latency internet communications in Davidson County by accelerating licensing and permitting processes, making an inventory of permissible Metro Government physical assets available, and encouraging investment in underserved areas of the county.

PEER COMMUNITY EXAMPLE

Comprehensive and Customized Entrepreneur Engagement

The folks at Helsinki Business Hub understand that to attract and support entrepreneurship in Helsinki requires a multi-layered approach. HBH aims to foster continued business growth in Helsinki by making sure that the city offers resources to attract and serve entrepreneurs and new businesses. From tailored industry information and custom fact-finding tours to investor introductions and help understanding the business ecosystem, HBH creates a support system to ensure that entrepreneurs have everything they need to succeed – all free of charge.

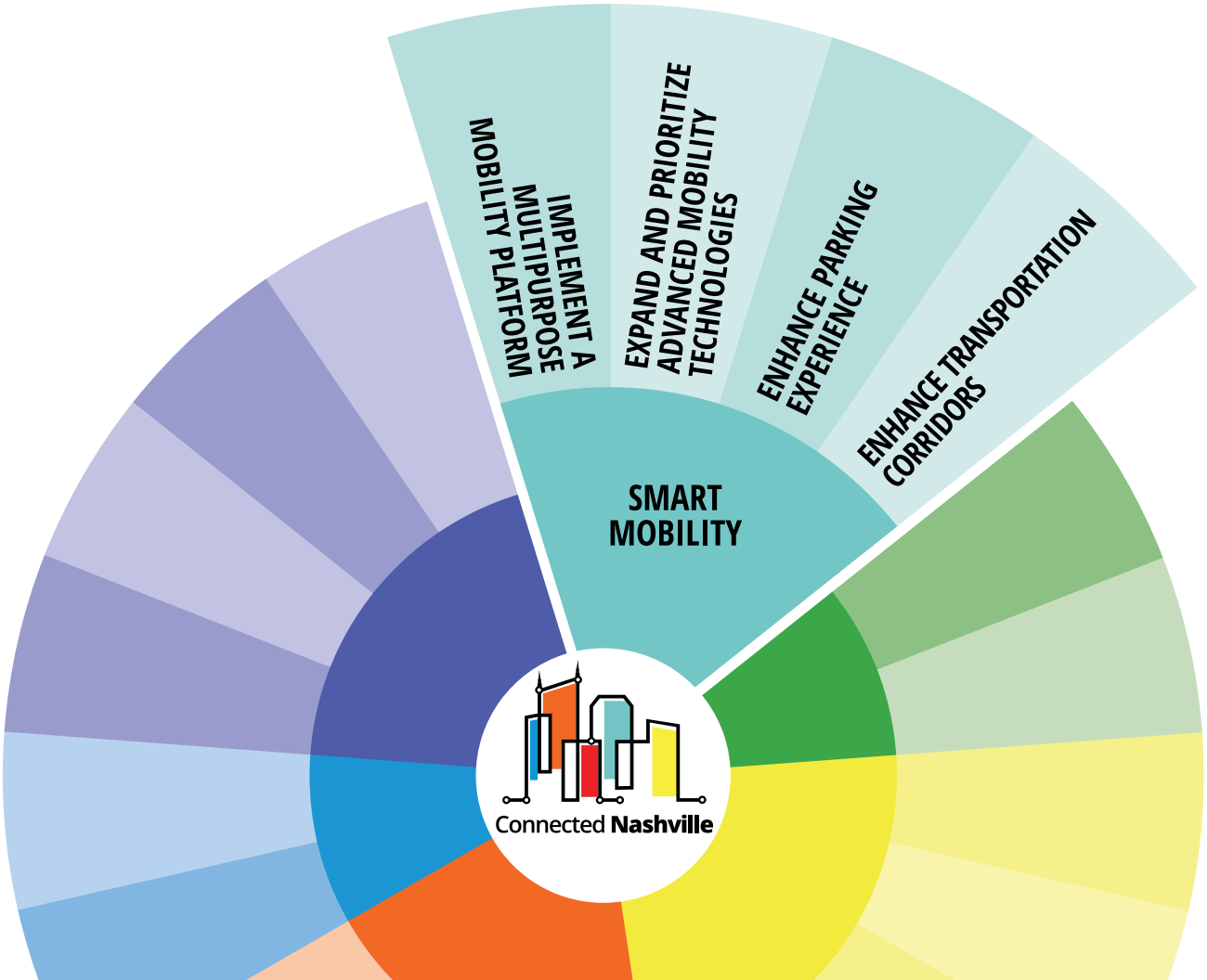
Learn: http://bit.ly/HBHub

Explore: http://bit.ly/WhyHF

Dimension 2:

Smart Mobility

Getting around Middle Tennessee is a growing challenge. Smart Mobility focuses on accessibility and efficiency of all things related to transportation in Nashville. It prioritizes clean and non-motorized options. It includes everything from parking solutions and traffic control to enhanced options for getting around our growing community. It enlists tools that help citizens to gain and use information about available resources. And it recognizes Nashville's connectedness to our surrounding counties and our state.



Strategy 5:

Implement a Multipurpose Mobility Platform

Davidson County's short-term and long-term transportation functionality is a critical factor of sustained growth. Giving residents and visitors access to a variety of transportation options will reduce environmental impact caused by driving alone, as well as ease traffic and improve quality of life. According to the April 2014 *Multimodal Mobility Study* conducted by Metro Public Works, 85% of respondents stated a preference for walking, transit or biking downtown in an ideal mobility environment. Mobile platforms can provide real-time access to information and seamless trip planning between various on-demand and shared mobility options.

Strategic Actions

1. Implement an open modular mobility platform to integrate all potential modes of transportation and provide multimodal routing algorithms with extended optimization techniques for multimodal transit. 🔗 19.4
2. Implement systems that offer tools for wayfinding, transit location tracking, fare payments, and trip planning/decision making tools with real-time information about options for bus, train, bike, walking, taxis and shared rides. Include web and mobile apps for residents and visitors. 🔗 7.5, 8.5, 8.6, 10.8
3. Use the web and mobile apps for the public to incentivize underused and more efficient modes of transport. 🔗 8.5
4. Use information provided through these systems to establish a baseline of existing modal options in targeted areas, promote options to users and track progress towards goals.
5. Ensure that the technology support elements including broadband, monitoring devices, traffic control devices and sensors are connected and adaptable, able to communicate in real time and are deployed in alignment with Metro Government plans and in step with regional Intelligent Transportation Systems goals. 🔗 18.1, 20.2, 20.3
6. Develop and set up data resources based on data within Metro Government, such as Vision Zero, right-of-way projects and traffic incidents; share these openly to track closures and detours and improve traffic flow. 🔗 19.1, 19.2
7. Promote awareness of technology-enhanced tools, such as applications that support accessibility to amenities (libraries, parks, etc.) to the public. Integrate mobility awareness into curricula of organizations such as Financial Empowerment Center, Habitat for Humanity, college freshman orientations and others.

PEER COMMUNITY EXAMPLE

Customized Transit at Your Fingertips

Go Denver is a travel application for mobile phones that makes available all public and private travel options, allows users to select preferred transport, plan trips, compare results and track trips over time. The application is also designed to gather insights based on user preferences and activities over time, in order to improve Denver's transportation and better serve residents.

Learn: http://bit.ly/GoDenFAB

Explore: http://bit.ly/DenverSTP

Strategy 6:

Expand and Prioritize Advanced Mobility Technologies

Traffic congestion costs the average Nashville driver 45 hours a year on the road (*Annual Urban Mobility Scorecard*, Texas A&M, 2016), and Nashville drivers lose $1,632 each year due to traffic in the form of congestion-related delays, vehicle operating costs and car crashes (TRIP Report, *Tennessee Transportation by the Numbers*, 2016). The key to expanding the use of available alternatives to driving is coordination of technology with expansion of multimodal infrastructure, especially around higher density growth centers, and particularly to support future incorporation of autonomous vehicles. Nashville's *nMotion* plan and other recommended projects, services, and infrastructure are aligned to reduce drive-alone trips by incorporating technology.

Strategic Actions

1. Continue work with state-level agencies and policymakers as well as the automotive industry to establish safety and registration policies for the testing and operation of connected and autonomous vehicles.
2. Engage with automotive and technology industry leaders to test connected and autonomous vehicles traveling in urban contexts on fixed routes.
3. Adopt prioritization of connected and autonomous vehicles that are fleet/shared ownership, electric, fully automated and, for passenger vehicles, shared by multiple passengers.
4. Evaluate the potential impacts of connected and autonomous vehicles on traffic and travel by modeling, parking, right-of-way allocation and management, and development impacts.
5. Plan for and pilot right-of-way technology that anticipates the communications and navigational needs of connected and autonomous vehicles. 🔗 18.1
6. Establish partnership with fixed-line transit with first mile/last mile connection via mobility on demand service, setting up opportunity for service via autonomous vehicles.
7. Encourage adoption of transportation demand management policies and practices that utilize technology improvements to reduce dependence on personal, single occupant vehicles and promote multimodal and shared mobility options, including incentives to use alternatives to driving alone.
8. Ensure publicly-available transit vehicles (buses, bikeshare, transportation network companies) are equipped to transmit location and scheduling information in real time.

PEER COMMUNITY EXAMPLE

Pittsburgh: Driving the Future of Autonomous Vehicles

The city of Pittsburgh serves as a decades-long case study for autonomous vehicle (AV) integration. As early as the mid-1980s, scientists at Carnegie Mellon University were constructing self-driving cars from parts of other vehicles. In a 1989 CMU publication, entitled *ALVINN, An Autonomous Land Vehicle in a Neural Network,* Dean Pomerleau, a computer science professor at CMU describes a self-driving unit developed as part of military-funded research. Today, Pittsburgh is the home of autonomous vehicle start-ups such as Aurora Innovation. Both Ford and Volvo have premiered their AVs in pilot programs in Pittsburgh. Most recently, in May of 2017, Carnegie Robotics announced a collaboration with Swift Navigation, a company out of San Francisco (a city matched only by Pittsburgh in its AV leadership), to develop cutting-edge GPS technology for autonomous vehicles.

Learn: http://bit.ly/CMUNavLab

Explore: http://bit.ly/ALVINN

Strategy 7:

Enhance Parking Experience

Downtown Nashville and its immediate surrounding areas host a variety of events such as sporting events, concerts, festivals and conventions. The capacity of Bridgestone Arena alone is 20,000 people, not to mention the 69,000-person capacity of Nissan Stadium. With a single sold-out venue, much less situations like 2017's simultaneous Stanley Cup playoff games and CMA Music Festival, downtown parking can be perceived as extremely limited. Part of the challenge is building awareness of parking options, and communicating availability within those locations. Other challenges include lack of integrated resources for locating parking across different lots and garages, a lack of personal car alternatives and incentives, and inconsistent enforcement. A combined approach using technologies and policies can optimize the availability, productivity and connectivity of parking to support a comprehensive mobility system. As downtown and urban centers become less auto-oriented and more people-oriented, on-street parking may be repurposed for other uses, such as park space, retail, or bicycle and pedestrian infrastructure, to maximize the utility of that public space.

Strategic Actions

1. Plan and implement a pilot of smart and connected parking meters/spaces that allow for centralized management, smartphone payment, dynamic and progressive pricing (in lieu of time limits) and other features, such as visual wayfinding, to assist the public in finding parking and Metro in managing the availability of parking. Make metadata about those spots publicly available. 🔗 19.1

2. Work with private paid and public parking garage and lot owners to develop a mechanism of open sharing of metadata about parking spaces, including pricing, to provide opportunities for integration with broader trip planning applications. 🔗 2.3

3. With broad adoption of demand-based and progressive pricing, set targets for the number of blocks downtown that are between 75%-85% occupancy.

4. Emphasize compliance through a simple payment interface and utilize sensors to monitor vehicular occupation of a space, allowing enforcement to focus efforts on drivers that ignore payment interface. 🔗 20.3

5. Link multimodal transit apps and systems to satellite parking/park-n-ride around urban core and activity centers, using transportation demand strategies to incentivize fewer car-trips in urban core. 🔗 5.2

6. Remove parking minimums in areas identified for growth in *NashvilleNext*, and explore parking maximum targets for priority growth areas.

7. Enhance monitoring of curb space to improve management and allocation of curb access, prioritization and repurposing, adhering to community visions of best use of public space.

PEER COMMUNITY EXAMPLE

San Francisco's Smart Parking Solution

With demand-responsive availability and pricing, SFpark utilizes garages and meters in a platform using an open data and source code to manage parking in San Francisco's busiest areas. Sensors monitor patterns and state-of-the-art meters feature expanded payment options for users. In addition to the parking information map available on the SFpark.org homepage, information on parking availability is distributed via the free *SFpark* iPhone app, Android app, and the region's 511 phone system.

Learn: http://bit.ly/SFPinfo

Explore: http://bit.ly/SFPmoreinfo

Strategy 8:

Enhance Transportation Corridors

Historically, Metro Nashville's streets and transportation infrastructure have been developed to ensure speedy and safe transit for automobiles to the detriment of walkers, bikers and public transportation riders (*TDOT History*, ©Tennessee Department of Transportation). As an element of developing opportunities for citizens to use all transit options, creating new and updating existing physical infrastructure that has smart technology incorporated from the beginning has been shown to support a successful multimodal transportation system (*Transportation in the Digital Age: Disruptive Trends for Smart Mobility*, Deloitte, March 2015). Additionally, connected corridors are well placed to support multimodal access envisioned by Nashville's Complete Streets policy, improving the safety and vitality of the corridor for all users.

Strategic Actions

1. Use data to establish baseline for performance along key corridors and between growth centers. 🔗 2.3, 19.1
2. Implement guidelines for making transportation system decisions according to priority placed on increasing technology and infrastructure to support the following ordered list: 1) walking, bicycling, transit, 2) fleets of electric, fully automated, multiple passenger vehicles, 3) other shared vehicles, 4) vehicles used to deliver goods and freight and 5) low or no occupancy vehicles.
3. Establish zoning regulations that promote mixed-use infill and transit-oriented development and deemphasize zoning requirements centered on automobiles, such as removing parking minimums.
4. Promote flex lanes to strategically re-purpose right-of-way for traffic flow, transit, deliveries and other modes of mobility or activity, such as during one of Nashville's many special events.
5. Incorporate features in existing or new mobile apps and web-based interfaces that promote incentives and alternatives to driving alone. 🔗 5.2, 5.3
6. Incorporate into a web and mobile app the means to simplify and promote transportation demand management efforts, such as the MTA EasyRide corporate commuter benefits partnership program, B-cycle memberships for business, and other strategies that reduce the number of vehicles on the road. 🔗 5.2
7. Enhance built environment along corridors with hardware that interacts in real time with all modes of travel; include feedback from low-cost sensors in landscaping and smart LED street lights. 🔗 18.2, 20.1
8. Extend the traffic signal timing system and traffic management system beyond current extent to additional corridors and secondary streets.
9. Pilot use of and deploy traffic flow sensors that can contribute to traffic flow and cycle traffic lights dependent upon the situation. 🔗 20.1
10. Create parking districts in priority growth areas with revenues from parking reinvested locally to support enhanced streetscaping and beautification efforts.

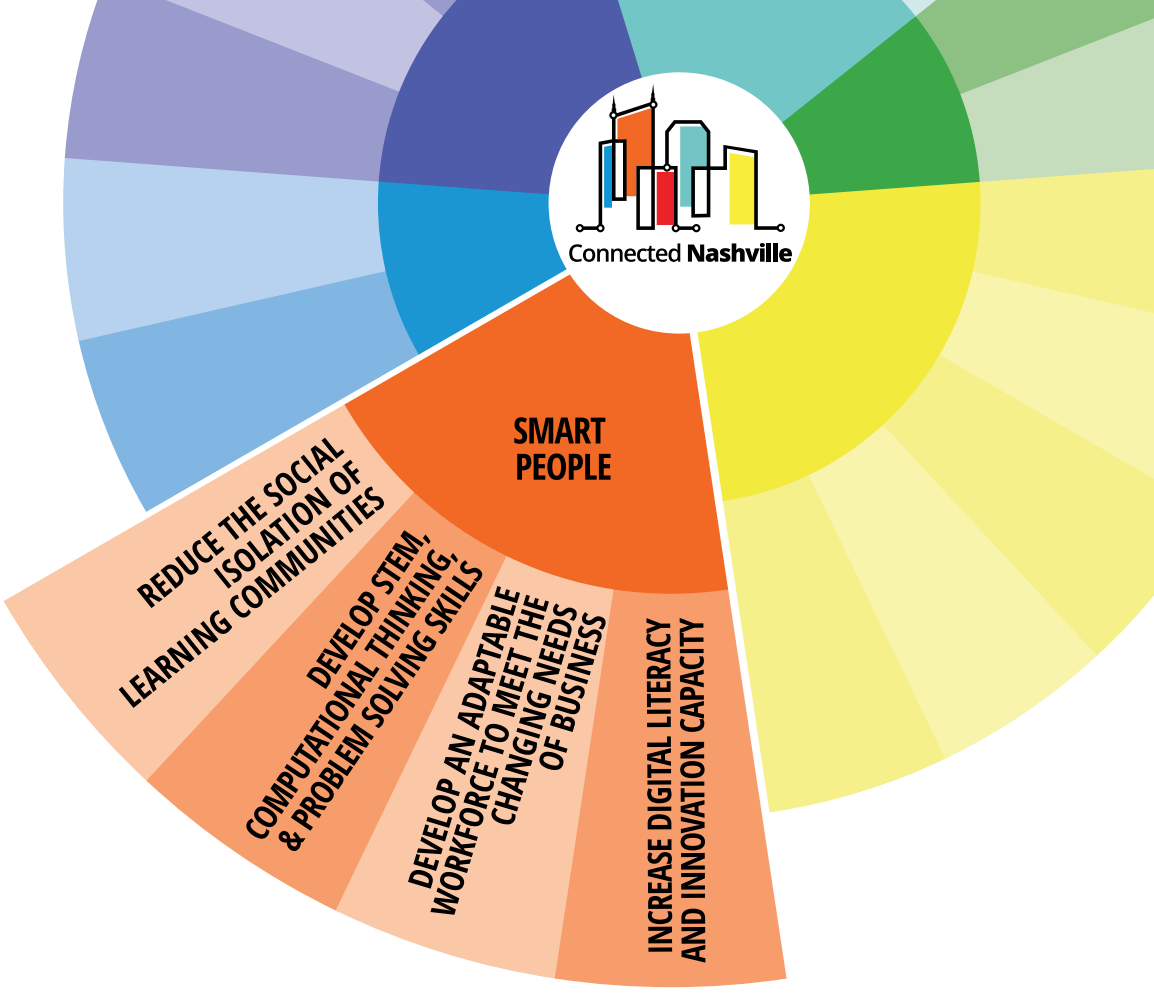
PEER COMMUNITY EXAMPLE

Creating and Connecting Diverse, Transit-friendly Communities

The Indianapolis Smart Corridors initiative includes automation of bus rapid transit (BRT) & car share routes, intelligent infrastructure & Intelligent Traffic Systems (ITS) and real-time data & dynamic modeling to manage travel demand. The City of Indianapolis has established a set of Multimodal Corridor and Public Space Design Guidelines that guide planning focused on using technology to support all modes of transportation, with seamless transitions from one mode to another.

Learn: http://bit.ly/IndySCC

Explore: http://bit.ly/IndySSR



Dimension 3:

Smart People

Nurturing a smart and connected community is not just about applied technology. It's about using technology to make sure that 21st century education is inclusive, available to people at every stage of life, and centered on skills that are applicable to today's tech-driven job market. It's about embracing differences and learning from them. Fostering a society of smart people is about preparing Nashvillians to connect with a fast-paced global community in ways that are creative, meaningful and successful.

Strategy 9:

Reduce the Social Isolation of Learning Communities

Nashville can enhance individual empowerment, social inclusion, economic development, cultural prosperity and sustainable development by building what UNESCO terms a "learning city". A learning city mobilizes its resources in all sectors to promote inclusive learning at all levels, revitalizes learning in families and communities, facilitates learning for and in the workplace, extends the use of modern learning technologies, enhances quality in learning and fosters a culture of lifelong learning.

Metro has worked to connect K-12 learning environments, as demonstrated by the many local partnerships with Metro Nashville Public Schools. A learning city also requires the unification of institutions providing education beyond K-12 into postsecondary, community college, university and technical training environments, and organizations operating in various sectors to reach people at all stages of life.

Strategic Actions

1. Align businesses, nonprofits, colleges, civic leaders, parents, faith communities, community organizations, and resources to reduce the social isolation of Nashville learning communities to support Nashville's educational, digital equity, and career-oriented objectives. This will positively affect the talent pipeline and the success of our community as a whole.
2. Host and encourage citywide and global learning opportunities that bring diverse communities together.
3. Work within the community to develop and provide an online portal that aligns businesses, nonprofits, colleges, civic leaders, parents, faith communities, and community organizations to support learning. 🔗 1.5

PEER COMMUNITY EXAMPLE

A Smart Community - The Learning City Model

As applied in Bristol, the UK's first learning City, UNESCO's Global Network of Learning Cities (GNLC) is an international network focused on policies and strategies to support cities who promote lifelong learning in economically, socially, culturally and environmentally sustainable communities. Using modern technology and best practices, a learning city facilitates learning both inside and outside of the classroom, for and in the workplace, and within the family and community. Commitment at the local level is critical to successfully execute future-ready solutions. The Learning City model seeks to empower citizens with the knowledge to build a city that is sustainable, technologically advanced and inclusive.

Read more about Bristol Learning City:
http://bristollearningcity.com/

Strategy 10:

Develop STEM, Computational Thinking, and Problem Solving Skills

In March of 2017, *Forbes* Magazine published an article titled *The Cities Creating The Most Tech Jobs 2017*. Nashville ranked number 7 out of the 16 featured cities with a whopping 75% growth in tech-sector jobs within a 10-year period, from 2006-2016. The boom in tech-related jobs requires a re-engineering of how Metro educates K-12 students in school and out of school, especially as it relates to empowering female students and students from underrepresented communities (e.g. gender, race/ethnicity, immigrant/refugee communities, and differently abled) to pursue tech careers.

Strategic Actions

1. Train both teachers and education-based non-profit instructors in computational thinking and design thinking.
2. Given Metro Nashville Public Schools' focus on literacy, align literacy standards with computer science standards to help teachers align both mandates.
3. Align assessments of STEM with literacy standards to help inform instruction and alignment of district priorities.
4. Map all existing in school and out of school STEM, media, arts, humanities and computational thinking trainings, and opportunities for youth in Davidson County to identify location, cost, timeframe, gaps and scale. 🔗 2.3
5. Build on Opportunity Now and Metro Nashville Public Schools data to track students' STEM-related trajectories.
6. Develop free summer opportunities for students K-12 to enroll in STEM, media, arts, humanities and computational thinking programs, with special emphasis on creating and scaling programming for elementary students in order to ensure that older siblings can also enroll in tech-related summer experiences.
7. Create intentional tech programs that empower students from underrepresented communities (e.g. gender, race/ethnicity, immigrant/refugee communities, and differently abled) and diverse language communities. Collaborate with local colleges and universities that have National Science Foundation (NSF) Broadening Participation grants and TRiO (federal outreach and student services) grants to help fund tech inclusion programs for underrepresented communities.
8. Increase transportation options (e.g. Strive, mobile units, etc.) for students to attend STEM, media, arts, humanities and computational thinking programs throughout the week. 🔗 5.2
9. Develop opportunities for community access to data science and visualization training using Metro Government's own data in seeking answers to questions within Nashville neighborhoods. 🔗 19.2

PEER COMMUNITY EXAMPLE

Cultivating STEM-Centered Success in Education

The Advanced Placement (AP) Computer Science Principles course is administered by the College Board and Code.org. AP Computer Science Principles offers a multidisciplinary approach to teaching the underlying principles of computation. The course introduces students to the creative aspects of programming, abstractions, algorithms, large datasets, the Internet, cybersecurity concerns, and computing impacts. Female, black and Latino student participation in Advanced Placement computer science exams has more than doubled in the past year, helped by the introduction of this course designed to introduce the principles to students, particularly those who have never engaged in computer science studies.

Learn: http://bit.ly/APCSCourse

Explore: https://usat.ly/2B7dgy2

Strategy 11:

Develop an Adaptable Workforce to Meet the Changing Needs of Business

The rapid development of technology has transformed the world of business. Nashville Technology Council (NTC) estimates that as of 2016, 1,600 tech jobs go unfilled annually in Middle Tennessee. Innovative and thoughtful action is required to develop the educational pathways and pipelines for the jobs of the future in Nashville. To help with this strategy, Governor Bill Haslam has put forth an ambitious goal of having 55% of Tennessee residents earn a post-secondary credential by the year 2025. Metro Nashville can assist in this effort by scaling current practices and building new pipelines of workers.

Strategic Actions

1. Provide opportunities for students of all ages to increase their practical and soft skills through experiences, access to tools, and support in career growth.
2. Increase access to the breadth and depth of postsecondary information and the support to make that information actionable.
3. Develop a cross-city university/college/trade consortium to work together to align post-secondary options and opportunities for students and nontraditional students especially those from underrepresented communities in post-secondary programs.
4. Develop cultural, civic, and commercial innovation centers around Nashville to promote commerce and engage learners of all ages in building products and solving city issues.

Experience-based Job Training

LOCAL COMMUNITY EXAMPLE

Mayor Megan Barry's Opportunity Now Program

Opportunity NOW is a coordinated initiative launched by Mayor Megan Barry to provide young people in Davidson County access to employment. In Nashville, we have seen fewer and fewer teenagers and young adults working during the summers and after-school. At the same time, Nashville employers across various industries are concerned about the lack of "soft" skills among their youngest employees—skills most readily learned through actual work experience. In its first summer, 2017, nearly ten thousand youth between the ages of 14 and 24 were connected to internship positions.

Explore: http://bit.ly/OppNow

Strategy 12:

Increase Digital Literacy and Innovation Capacity

According to the Metro Nashville Public Schools' *BrightBytes* survey produced in 2016, 16% of students are without a home computer, laptop or tablet while 10% are without home internet connectivity. The 2015 Metro Social Services *Community Needs Evaluation* estimated that 75,720 people in Davidson County did not have internet access. These Nashvillians, regardless of socioeconomic status, physical disability, language, race, gender, or any other characteristics that have been linked with unequal treatment, need assistance to enter the digital age.

This is further complicated by digital readiness, a person's likelihood to succeed or struggle when they use technology to navigate their environment, solve problems and make decisions, and by the digital divide, which greatly affects underrepresented communities.

Strategic Actions

1. Encourage collaboration throughout Nashville by connecting existing organizations serving the community to strengthen technology adoption and digital empowerment. 🔗 3.5
2. Create solutions that will be sought and shared to enable people with disabilities, seniors and those who need some form of accommodation to more easily use a computer and access the Internet.
3. Work with community partners to create and execute an asset and deficit mapping process of digital inclusion in the city. This may take the form of a survey, as is performed every three years in Austin, Texas.
4. Develop a committee composed of Metro Nashville Public School tech leaders to help align in school and out of school tech trainings and opportunities for MNPS students and families.
5. Create enhanced digital literacy programs that go beyond the basics to develop and support programs that enrich users' experiences and enable people to move from novice to expert users, and for some to become digital innovators or professionals. Some cities are developing innovation hubs and citizen user testing groups (CUT) to build solutions to social problems in the city.
6. Create and develop programs providing access to affordable, available and sufficient devices and technical support. This includes partnering with local businesses on WiFi access for learning, seeking mobile hotspot programs and/or affordable LTE, increasing assistive tech (to help those with different abilities) at community sites, and increasing support for device ownership programs.
7. Develop trainings on Metro Government's web portals to empower Nashville residents with information about their communities. Opportunities exist around open data and legislation, among other topics. 🔗 19.2
8. Create resources to be integrated into all programs to encourage people to use the Internet responsibly while protecting their digital privacy and security. Parents and other caregivers will be provided training and resources so that they can actively guide their children's online activities and protect their children's digital safety.

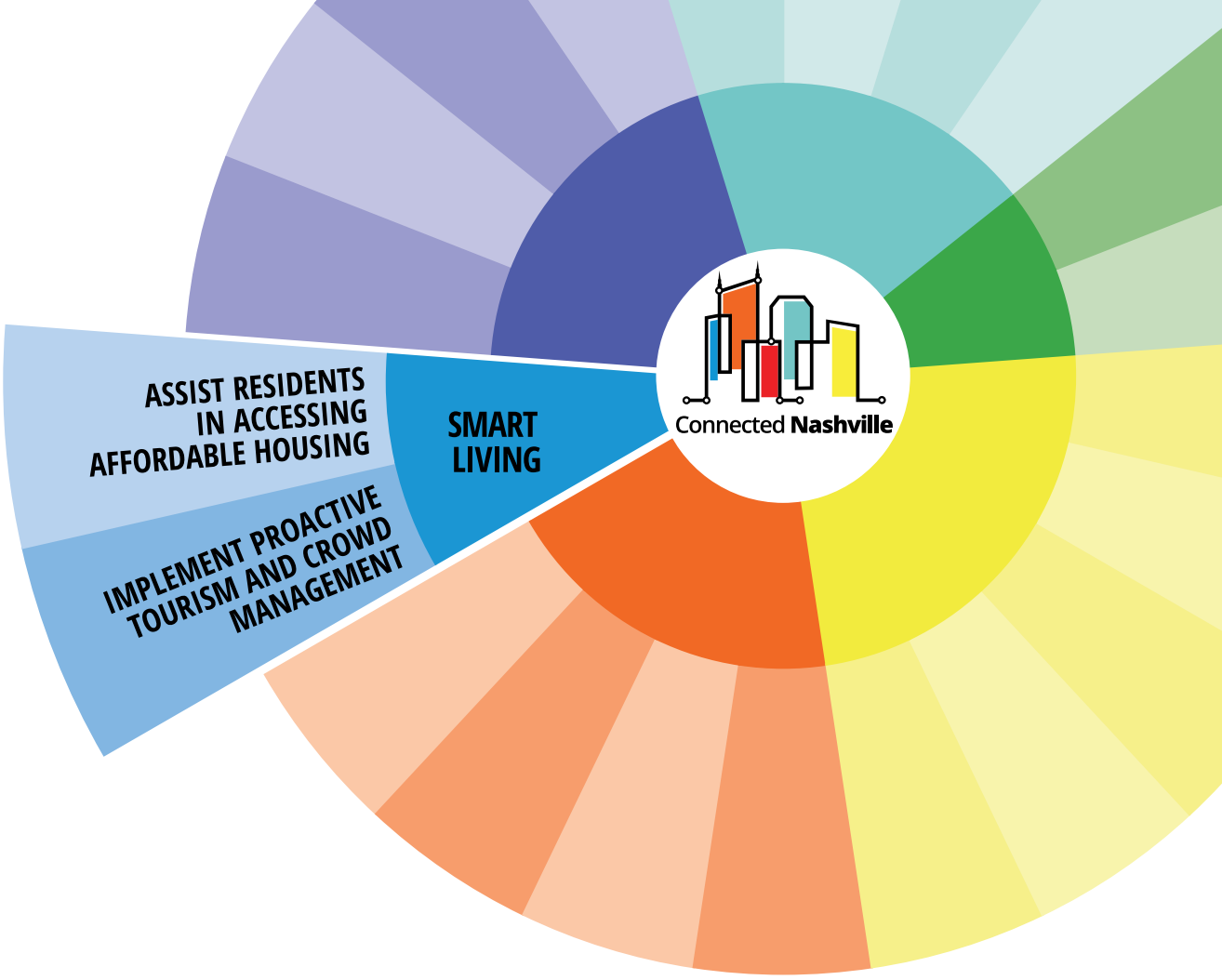
PEER COMMUNITY EXAMPLE

Breaking Barriers to Digital Inclusion

Tech Goes Home (TGH) is a Boston-based organization whose goal is to directly deal with common barriers to technology adoption – a device, connection to the Internet, and training that makes technology relevant to the recipient. TGH also understands that lack of availability is not the only challenge that people from traditionally excluded groups face when it comes to the digital divide. Their multi-layered approach tackles challenges at the school, home and community levels to ensure that the digitally excluded in underrepresented communities not only have access to tools and skills they need, but that they also have the opportunity to thrive as part of a supportive ecosystem.

Learn: www.techgoeshome.org

Explore: http://bit.ly/DigitalIncl



Dimension 4:

Smart Living

Smart living represents a holistic approach to responsible management of various elements of life in Nashville. Promoting our culture, wise use of resources and ready access to affordable housing are all part of making Nashville a great place to live. Keeping Nashville a safe, happy and culturally vibrant city means taking care of both visitors and residents. A livable city is one that uses technology to gather, use and disseminate information on factors that affect the happiness of its residents while recognizing and respecting personal privacy.

Strategy 13:

Assist Residents in Accessing Affordable Housing

There are many programs aimed at making housing more attainable for more people. However, even with the variety of programs that exist, a lack of cohesiveness results in a lack of knowledge about the variety of options that fall under the affordable housing umbrella. The additional challenge is that home inventory turnover in Nashville is quicker than the national average, and quickly rising rental costs can make the housing search cost-prohibitive.

According to *The Tennessean's* analysis of data gathered by the *Associated Press*, Nashville home inventory is down 66% since 2012. Zillow reports that Nashville's average rental price is $130 per month higher than the national average. With for-sale homes filling quickly and rental units in high demand, residents seeking affordable housing need a resource that allows them to keep pace with local real estate movements. Current and potential residents will benefit from a single point of information about opportunities to find high quality, affordable, safe and attainable housing options in Davidson County. Additionally, a larger audience could benefit from a resource that helps illustrate what the picture of affordable housing currently looks like, and could look like, for Nashville.

Strategic Actions

1. Investigate and organize the publicly available information/datasets that are currently available from non-profit and government sources, and assimilate the data into a GIS-based mapping system with open APIs for ease of integration with other systems. This would include the identification and potential development of key missing or needed data. 🔗 2.3, 19.5
2. Create a housing navigation system providing housing types, availability and qualifications, including mapping and visualization tools. 🔗 2.3, 19.5
3. Within the navigation system, provide real-time updates to give users relevant and timely information about housing options.
4. As a supplement to the navigation system, provide functionality to guide users toward affordable housing options that best suit their financial needs. Provide access to information on creditworthiness and resources to aid financial planning.

PEER COMMUNITY EXAMPLE

Affordable Housing Made Accessible

Offered by the Department of Housing Preservation and Development and Housing Development Corporation (not NYC directly), NYC Housing Connect gives users the opportunity to learn about, search for and apply for affordable housing across the city. NYC Housing Connect works with private real estate professionals and community sponsors to promote and fill affordable housing opportunities.

Learn: http://bit.ly/NYCHConnect

Explore: http://bit.ly/HousingNY

Strategy 14:

Implement Proactive Tourism and Crowd Management

Nashville has long been known as one of the nation's most vibrant tourist destinations, and is poised to continue that momentum into the near future. According to the Nashville Convention & Visitors Corp., Nashville attracts over 13 million visitors every year. Planning for crowds, monitoring crowds and managing crowds are essential elements of a smart and connected city. Nashville has the opportunity to use technology to enhance the tourism experience for visitors and provide more efficient crowd management tools for city management.

Strategic Actions

1. Pilot freestanding, internet-connected public information kiosks in high-traffic tourist areas. These can provide wayfinding, interactive information on nearby sites and amenities, free WiFi and device charging. Costs may be offset with cooperative marketing agreements. 🔗 20.1
2. Expand Metro's public WiFi network to engage more community sites, particularly with additional coverage at Metro Parks locations. 🔗 18.4
3. Explore utilizing Music City Center's wayfinding application at Nashville International Airport to provide personalized directions to airline passengers as soon as they exit their planes.
4. Explore technologies and conduct a pilot to offer location-based mobile phone messaging to residents and visitors in a geographic area. 🔗 17.4, 20.5

PEER COMMUNITY EXAMPLE

Linking Citizens to the Benefits of Digital Access

LinkNYC is a service that offers kiosks across the city with free WiFi, device charging and phone calls. The kiosks include tablets that provide access to information about city services, maps and directions. All of this is free for users, because the kiosks and services are paid for by advertisers who display their marketing on the kiosks. The network is designed to utilize feedback from citizens to make improvements continuously over time.

Learn: http://bit.ly/LinkLaunch

Explore: http://bit.ly/LinkKiosk

Dimension 5:

Smart Environment

The natural conditions that exist in Nashville, properly nurtured and maintained, support and benefit our daily lives. Smart environment is about active engagement in protecting the resources that drew people to Middle Tennessee. It includes maximizing the efficiency of our energy use while decreasing the total amount of energy we consume. Green buildings use technologies to monitor how our day-to-day lives positively or negatively affect our environment. Real-time monitoring and analysis of air quality, greenhouse gas emissions and water cleanliness can improve how we manage our resources and help us to make choices that improve the health and well-being of our communities for ourselves and our children.

Strategy 15:

Embrace Green Building and Energy Efficiency

The Mayor's *Livable Nashville* Committee has set forth recommendations to use green building practices to positively impact our city's livability. According to Nashville-Davidson County Greenhouse Gas Emissions inventories, as of 2014, commercial properties make up 27% of Nashville's Greenhouse Gas Emissions. Enhancing the resource efficiency of new and existing buildings will facilitate decreases in annual energy use, water use, greenhouse gas emissions and storm water runoff for existing Metro Government and Nashville buildings, make utility bills more affordable for lower-income Nashville residents, and reduce the annual energy consumption of both government and commercial buildings sectors.

Strategic Actions

1. Continue to research and pursue technologies related to construction and management of a Net Zero building, which is a building with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site.
2. Expand the implementation of building automation systems across multiple Metro agencies to increase the capabilities and efficiencies of Metro Government to gather data from energy, waste and water systems. This data may be used to proactively manage those subsystems in real-time, as in many cases changes to building automation systems can happen immediately.
3. In support of existing LEED certification policies for Metro facilities, implement a robust energy tracking and building performance platform across multiple Metro agencies that would provide interactive, real-time visualization tools, such as dashboards, that allow Metro Government leadership to review and manage building systems for Metro's building portfolio and assist in reaching building benchmark goals. 🔗 19.1
4. Encourage utilities providers to implement customer-side Advanced Metering Infrastructure, which will provide customers with access to their energy usage data in real time.

PEER COMMUNITY EXAMPLE

On the Cutting Edge of Technology and Sustainability

There is no better example of a sustainable building than The Edge in Amsterdam, a connected and autonomous building with an app. that gathers and updates user preferences. Also the greenest building in the world, the Edge boasts the highest sustainability score thus far awarded: 98.4 percent.

Learn: http://bit.ly/EdgeGreen

Explore: http://bit.ly/EdgeArticle

Strategy 16:

Protect Our Natural Resources

Nashville continues to make great efforts to support our recent accelerated growth in residents, and in the necessary civic infrastructure to support new arrivals as well as our longer-term residents. To ensure sustainable growth, we must place equal importance on the preservation of the county's natural resources. In 2017, Metro Nashville boasted over 12,000 acres of open space, including 108 Parks and 19 Greenways. Maintaining and conserving open space, increasing tree canopy cover, and improving the city's compliance with the Clean Water Act and Clean Air Act will ensure that Nashvillians have clean air, clean water and greenspace now and for future generations.

Strategic Actions

1. Explore and pilot connected sensors across Davidson County to gauge air quality and to allow for review, consolidation, and open publication of air quality indicators across multiple Metro communities and sites of specific interest. 🔗 20.1
2. Explore and pilot connected sensors across Davidson County in the Cumberland River and other sites of specific interest to gauge water quality and to allow for review, consolidation, and open publication of water quality indicators across multiple Metro water features. 🔗 20.1
3. Support an urban tree canopy inventory through development of a site that will allow for mapping of Davidson County's trees and make that data available openly for public use. 🔗 19.1

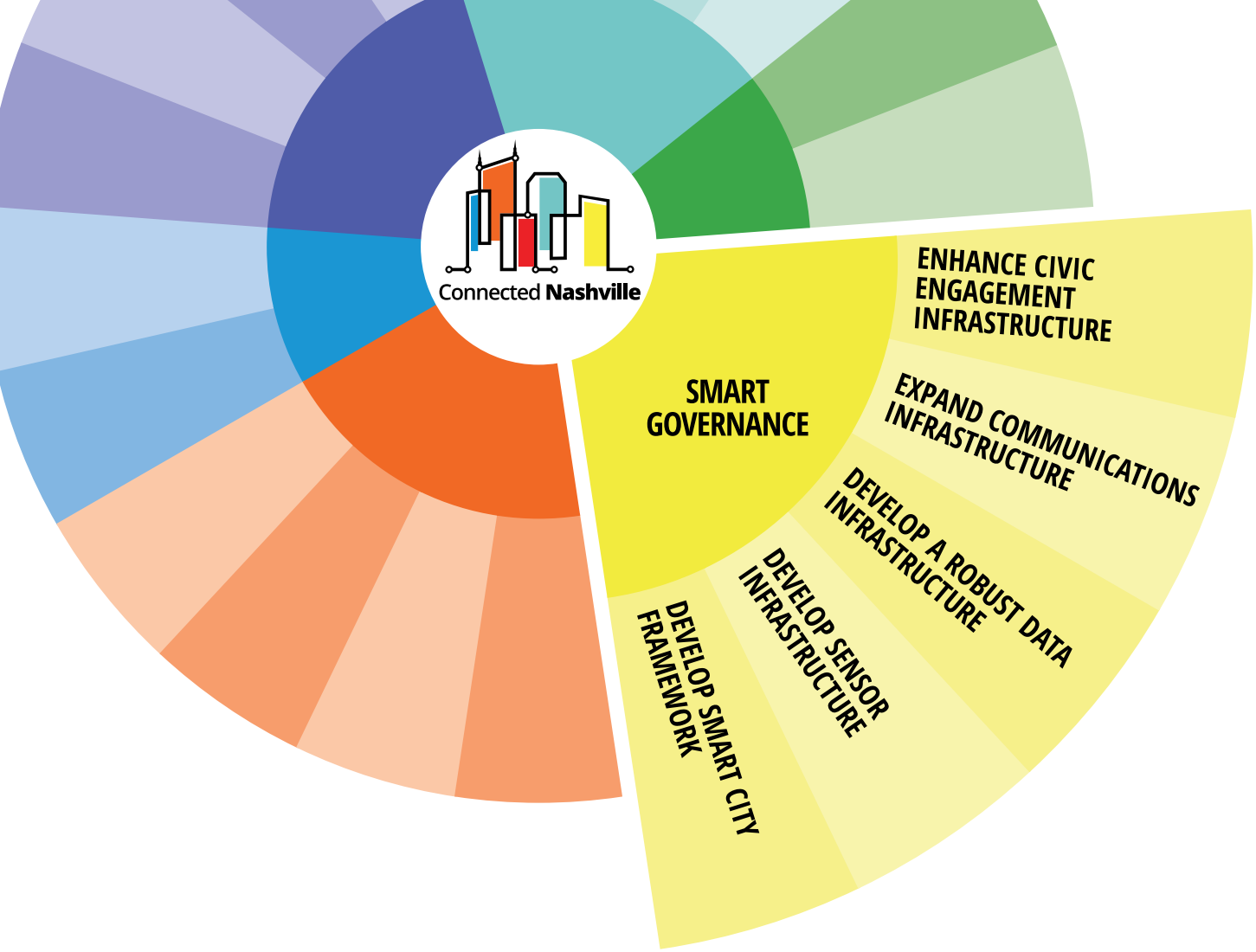
PEER COMMUNITY EXAMPLE

Vermont's Smart Solution to Expanding the Urban Tree Canopy

Vermont Urban and Community Forestry is utilizing technology and data to assess, protect and expand tree canopy in various areas statewide. Part of a comprehensive digital resource hub, their Tree Canopy Assessments are a critical part of the organization's Green Infrastructure Plan. Using both GIS imagery and photo interpretation, the organization offers tools to conduct assessments and provide metrics using simple visualizations.

Learn: http://bit.ly/VermontTCA

Explore: http://bit.ly/UrbanTC



Dimension 6:

Smart Governance

Governance is a shared responsibility between the Metro Government and the community. Together we can build a strong, sustainable, smart and connected infrastructure, which comprises the technological, structural and community resources needed to support and enhance living. It is the responsibility of the government to be transparent and responsive to its citizens, and active engagement with local government is the responsibility of the community. Smart governance facilitates civic engagement by using technology to understand community priorities and to align the direction of technology-based solutions across Metro's departments and agencies.

Strategy 17:

Enhance Civic Engagement Infrastructure

Nashville's residents and visitors expect to interact with their communities through digital technologies such as the web, mobile apps, texting, and social media. Meanwhile, Metro's population mix continues to become more diverse and multicultural as Nashville grows rapidly. To engage our public now and in the future, Metro departments and agencies must likewise use a variety of communications channels, in the modes and languages used by our residents. Developing a modern and consistent set of tools for civic engagement will increase awareness of Metro Government's services and enhance transparency. Over time, it will also improve accountability as Metro departments and agencies understand the true demand and the types of services necessary and respond to those needs.

Strategic Actions

1. Explore and implement a Digital/Mobile First executive order that demands that for all new public-facing services supported by technology, and upon the upgrade/replacement of technology solutions, the new technologies shall be implemented with a goal of allowing constituents to use them online or via mobile app as a primary means.

2. Continue implementation of **hubNashville**, a community response management system released in 2017, which provides residents and visitors the opportunity to contact Metro Government through various channels, get access to services and report problems, and then track the status of those reported issues toward resolution.

3. Continue Metro Government's commitment to open data (see Mayoral executive order #32) by publishing datasets of interest, such as hubNashville service request data, thus encouraging and equipping residents within and outside of Metro Government to visualize, analyze and understand county and Metro Government operations. 19.2

4. Explore and implement a tool whereby authorized government public safety officials can access a voice/text communications system that can reach mobile and landline phones within specified geographic areas to alert phone holders of disasters or threats to safety. 14.4, 20.5

5. Foster and promote the development of relevant, multi-language Internet content and online services such as multilingual web portals, community based web sites, content development training programs, and new collaborations across Nashville communities.

6. Pilot the broadcast of Metro's public, educational and government (PEG) television channels providing access to Metro Government video content to be simulcast in multiple languages.

7. Investigate and pilot existing and potential mechanisms by which departments and agencies can gather feedback from residents on key issues including legislation, budgets, and proposals that may then be used to enhance decision-making.

8. Pilot methods by which Metro Government public meetings may be conducted virtually online in an authenticated and trusted method using video, and remain in accordance with state open records and other relevant laws and regulation.

LOCAL COMMUNITY EXAMPLE

hubNashville: One-stop Service Request Experience

hubNashville is Nashville's non-emergency service request service, which launched in August, 2017. hubNashville provides residents with one-stop access to local government services ... without having to know which particular department or agency provides that service. Through hubNashville, residents or visitors can call 311, email hubNashville, or submit service requests at our online community at http://hub.Nashville.gov. A mobile app. will be released in spring 2018. Requests are tracked online and the submitter receives follow-up on actions taken to resolve those requests. Multi-lingual capability is baked in to hubNashville, launching with English and Spanish, with more languages to come.

Learn: http://bit.ly/hubNashville311

Explore: http://hub.Nashville.gov

Strategy 18:

Expand Communications Infrastructure

Wired and wireless Information and Communications Technologies (ICTs) form the backbone of Metro Government's communications infrastructure, including access to the Internet. Many smart city technologies rely on continuous flow of voluminous data to optimize systems, service delivery or real-time reporting. Slow, intermittent or unavailable connectivity places undue limits on smart city applications and services. Metro has historically relied upon outside vendors for these services, including a far-flung leased fiber optic cable backbone for operations. As new communications technologies develop, Metro must be able to provide a coherent, stable, robust and scalable ICT network upon which to pilot and adopt those technologies to be prepared for when and how Metro operations and services begin to require them.

Strategic Actions

1. Using the Broadband Plan developed by Metro Government as a guide, design and deploy extension of the current Metro-owned fiber infrastructure to support current and potential infrastructure projects. 🔗 5.5, 6.5

2. Pilot a conversion of standard street lighting to smart and connected LED-based street lighting. This will reduce energy use and provide a basis for exploration of connected sensor technology to support other Metro initiatives including climate monitoring, curb management, and public safety. 🔗 8.7, 20.1

3. Partner with Vanderbilt and other universities to join USIgnite and establish a 100 gigabit internet pipe between Nashville the emerging 100 gigabit national network. This will enable opportunities for development of a community application ecosystem to explore the possibilities of massive bandwidth.

4. Explore opportunities to expand the existing Metro Public WiFi coverage area. Incorporate additional Metro Government locations with a focus on broader coverage in Metro parks, at housing authority facilities, and major Metro Government public gathering locations. 🔗 14.2

Smart LED Lighting

PEER COMMUNITY EXAMPLE

An Oasis of Integrated, Smart Technologies

Dubai Silicon Oasis is a smart community, part of whose strategy as an early adopter of technology services, is to become one of the first integrated communities in the region. Dubai Silicon Oasis utilizes smart LED street lights that can consume lower levels of power when people are not present, provide feedback on environmental conditions and relay safety warnings.

Learn: http://bit.ly/DubiaSO

Explore: http://bit.ly/DubaiSC

Strategy 19:

Develop a Robust Data Infrastructure

Access to detailed, real-time information empowers people, and the systems that support them, to meet their goals. A city's operational systems and the activities of its inhabitants generate astonishing quantities of data. This data is captured by an increasingly wide array of sensors and control systems. To derive meaning and benefit from this data, Metro must be able to move it across a robust, secure telecommunications infrastructure.

A mission-supportive data architecture should promote and facilitate collaboration through consolidation, storage, analysis, reporting, security management and visualization of data in an aggregated, accessible, and transparent manner. A robust data infrastructure will facilitate computing analysis, optimization, and predictive modeling and provide real-time management alternatives, advice, and solutions to the continual challenges facing our growing smart Metro.

Strategic Actions

1. Develop a data aggregation platform that will allow Metro to amass, organize and store data from multiple, disparate governmental systems for use by Metro Government and partners. 🔗 5.6, 7.1, 8.1, 15.3, 19.1
2. Develop and promote the Metro Open Data program by actively engaging departments and agencies in their review of non-open data, publishing additional datasets, and incorporating an openness review of data for new or replacement government systems. 🔗 5.6, 10.9, 12.7, 19.2
3. Perform a proof-of-concept regional open data platform that allows cities and counties within the Metro Planning Organization/Greater Nashville Regional Council area to standardize and contribute open datasets using regionally agreed standards.
4. Pilot, with a data aggregation platform, a system that will allow for large-scale analysis of aggregated data collected from across multiple platforms. 🔗 2.3, 5.1
5. Develop a visualization platform will allow the community as well as data analysts to work with multiple datasets, and generate reports, maps and dashboards of findings. 🔗 2.3, 13.1, 13.2
6. Champion a data-driven culture within Metro Government through ongoing employee training, including development of a Metro Data Academy associated with the Open Data program.
7. Investigate community training for and pilot use within Metro Government of distributed ledger/blockchain technology as a potential foundational technology. 🔗 1.7

Open Data

PEER COMMUNITY EXAMPLE

Open. Friendly. Smart.

The City of Mesa, Arizona has developed a robust and user-friendly open data portal that makes data more accessible to the public by presenting data, as a rule, in visual formats whenever possible, in addition to the machine-readable versions. The portal also highlights data related to city priorities (transform neighborhoods, community safety, workforce development, sustainable economy and placemaking). Users are given the option to search for datasets, or they may use site suggestions for datasets related to their selected items. The city also provides access to data submitted by external agencies.

Learn: http://bit.ly/OpenMesa

Explore: http://bit.ly/MesaDataPolicy

Strategy 20:

Develop Sensor Infrastructure

Smart Cities drive technology solutions using not only the data created by human hands, but also through the inputs from and readings of an array of sensor types, which can capture points in time continuously. When technology solutions are deployed in combination with a communications infrastructure that can transport readings, the 'Internet of Things' or IoT is the broad term for these connected technologies. Users can then analyze data in aggregate and in combination with other data to facilitate quick response. The goal is real-time reaction to the environment.

Strategic Actions

1. Investigate and pilot-test dedicated or multipurpose networked sensors to monitor factors such as traffic flow, personal movement, air quality, and watershed water quality at both movable and key fixed sites across Davidson County. 🔗 8.7, 8.9, 14.1, 16.1, 16.2, 18.2
2. Continue to develop and expand Metro's existing safety camera network to incorporate additional critical human and vehicle traffic sites. 🔗 5.5
3. Pilot a program around using Metro's safety camera infrastructure as counting tools for vehicles and pedestrians. 🔗 5.5, 7.4
4. Continue to expand the availability for Metro Nashville Police Department to access and incorporate existing safety cameras from government, academic and private organizations.
5. Pilot a program to use location-based technologies to enable localized communications for residents and tourists during special events and emergency activations. 🔗 14.4, 17.4

Air Quality Sensors

PEER COMMUNITY EXAMPLE

A Smarter, Greener Vision

In what was a feature program in the White House 2014 *Smart America Challenge*, San Jose, California entered a six-month pilot with Intel to design and install sensors throughout the city to increase transportation efficiency and improve air and water quality. This was part of San Jose's *Green Vision*, a 15-year plan for sustainability developed in 2007.

Learn: http://bit.ly/SanJoseGV

Explore: http://bit.ly/GreenVisionAR

Strategy 21:

Develop Smart City Framework

Meeting community goals using technology is not just about the technical tools that address community issues and meet community goals. There is an array of structural processes that have emerged in smart cities globally, which speed and facilitate adoption of solutions. Key among these is the concept of governance, which is a methodology that defines the responsibilities, accountabilities and processes for designing, managing risks for and executing smart city objectives.

Strategic Actions

1. Review the smart city governance models of other cities, and adopt a Metro Government-centered governance structure to coordinate, manage, audit, report and collaborate on the direction of smart city initiatives.
2. Adopt the recommendations of the Connected Nashville Technical Standards committee regarding Analytics, Interoperability, Security and Infrastructure standards as common practice for Metro IT systems procurements and development. (*See Appendix 1.*)
3. Continue to develop the Information Security Management program mandated by Mayor Barry's *Executive Order #34* and directed by Metro's Chief Information Security Officer to manage the current technology environment as well as the radically connected environment envisioned through the use of smart city technologies.
4. Form a working group of Metro department heads, staff, and interested members of the public to investigate the implications of privacy for Metro Government and its residents in a connected and data-driven world, and propose actions and policy to address as findings dictate.
5. Establish one or more test beds in the Metro Government right-of-way and/or on Metro property to allow for centralized, real world testing of technologies by university partners and potential vendors, with the active participation of Metro departments and agencies.
6. Develop public-private partnerships and leverage these to establish a smart city technology demonstration lab within a central Metro Government facility that will allow elected officials, department and agency executives, Metro staff and vendors, as well as members of the public to see smart city technologies in action and to understand their impact on Metro operations.
7. Investigate innovative methods of exploring and expediting proofs of concepts for smart city technologies by forming a working group of interested small businesses, focused on potential technology partners, to benchmark peer cities and create recommendations for Metro.
8. Explore the work done in other peer and larger cities who have sought to expedite and enhance the procurement process through a Public Private Partnership Office.

PEER COMMUNITY EXAMPLE

Building a Template for Smart City Solutions

City Innovate Foundation's purpose is to tackle city challenges with the use of data and technology, in a process that develops, tests, and shares potential solutions. The organization's goal is to "codify, share, and scale best practices in innovation and technology as they are developed in leading cities and government agencies across the world".

Learn: http://bit.ly/CInnovate

Explore: http://bit.ly/STIRnetwork

Glossary

Word/Phrase	Comment/Definition
Accelerator programs	Accelerator programs support new business owners with short term funding, mentoring and in-depth coaching from experienced members of the business community.
B-cycle	A fee-based bike share initiative operated by the Nashville Downtown Partnership, a nonprofit management organization.
Blockchain	A type of technology using a distributed digital ledger (digital record) that keeps records of digital transactions and displays them publicly and chronologically.
Cooperative marketing	Cooperative marketing is a form of commercial resource sharing. It allows two entities to share the cost of, and platform for, promoting a product or service, and both entities benefit from the results. An example would be WiFi sponsored by one company as part of an event where another company offers music downloads.
Data discovery	A process of gathering data from various systems, and then analyzing that data to discover any existing trends or patterns.
Data visualization	Putting data into a visual context can make it easier to understand. A pie chart or bar graph is an example of a data visualization tool that helps us easily identify patterns or trends.
Data-driven	Focused on, determined by or dependent upon the collection or analysis of data.
Day of Digital Inclusion	An online Twitter Town Hall to address the impact that digital access and skills can have on society, families and individuals, hosted by NDIA (National Digital Inclusion Alliance), along with partners and affiliates from around the country.
EasyRide	An MTA/RTA commuter program that offers complimentary use of for the use of fixed route buses, select Relax & Ride (R&R) regional buses, and Music City Star regional rail services.
Flex lanes	Flex lanes are a method to manage traffic congestion. A flex lane allows traffic to travel in either direction, depending on traffic conditions. Traffic signals are used to let drivers know whether a lane is open or closed, and whether to use it for driving or turning.
GIS	A geographic information system or geographical information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.
Green Buildings	A green building is one whose building process and structure alike are resource-efficient and responsible.
HIT	Acronym for **Healthcare Information Technology.**
Hour of Code	A global movement by Computer Science Education Week and Code.org, reaching tens of millions of students in 180+ countries through a one-hour introduction to computer science and computer programming.

ICT	Acronym for **Information and Communications Technology.**
Infrastructure	The basic physical, technological and organizational structures and facilities (e.g., buildings, roads, power supplies, computing and communications capabilities) needed for the operation of a society or enterprise.
Intelligent Transportation System	Intelligent transportation systems are systems that use information and communication to monitor and improve transportation and allow safer, more connected use of various modes of transportation.
KILL-A-Watt	A device used to detect 'phantom' electricity use, which amounts to electricity expenditure that is wasted.
LinkNYC	LinkNYC is a communications network that delivers gigabyte free public WiFi to millions of New Yorkers, small businesses, and visitors through free-standing, ad-supported kiosks across the 5 boroughs.
LTE	Acronym for **Long-Term Evolution** - a standard for high-speed wireless communication for mobile phones and data terminals.
Mobility	The quality or state of being mobile. In this context, we refer to mobility as how people move around the city using various modes of transportation (walking, biking, ride share, etc.).
Modal	In the context of the definition above, "modal" is of or pertaining to a mode of transportation.
MPO	Acronym for **Metropolitan Planning Organization** - representatives from local, state, and federal government agencies that are responsible for planning and prioritizing projects for federal funds.
MTA	Metropolitan Transit Authority, the public transportation agency serving Nashville and Davidson County.
Multimodal	In the context of "mobility," multimodal refers to a transportation plan that integrates multiple modes of transportation (e.g. walking, biking, public transport and autonomous and connected vehicles).
NashvilleNext	NashvilleNext is the 2-year long plan for Nashville's future, released in 2015 and intended to guide growth, development, and preservation in our city over the next 25 years.
Nashville Reads	Nashville Public Library's citywide book club where everyone in Nashville is encouraged to read the same book at the same time.
nMotion	Released in 2016, Nashville MTA/RTA's Strategic Plan, a 25-year comprehensive plan designed to meet the Nashville area's vision for transit.
Opportunity Now	Opportunity NOW is a coordinated initiative launched by Mayor Megan Barry to improve access for young people in Davidson County to employment and on-the-job skills training.
Parking minimums	Zoning regulations that require a developer to build a minimum number of parking spaces per unit, depending on the area. This has potential to lead to overbuilding, displacement of ground-level retailers or wasted space.

Glossary (con't)

PEG Channels	Public, Educational, and Governmental Channels - channels that provide essential local programming not provided by other media.
Right-of-way	The strip of land over which facilities such as roads, sewers, streetlights, etc are built.
Shift share analysis	A determinant of the portion of economic growth or decline that can be attributed to regional factors, national factors, economic industry, etc.
STEM	Science, technology, engineering, and mathematics.
Streetscaping	Streetscaping refers to the design quality of a street, and includes both natural and built elements that contribute to the street's aesthetic value.
Transfer contract	A legally binding document that governs the transfer of technology and licenses from its place or group of origin (such as a university) to wider distribution to people and places outside of the organization (such as to a hospital or business).
Transportation modes	The means by which we achieve mobility. This can include walking, biking, driving, and public transportation such as buses, trains. This also includes all surfaces (air, land or sea).
TRIO	The Federal TRIO Programs (TRIO) are Federal outreach and student services programs designed to identify and provide services for individuals from disadvantaged backgrounds.
UNESCO	Acronym for United Nations Educational, Scientific, and Cultural Organization. UNESCO is responsible for coordinating international cooperation in education, science, culture and communication.
User Group	In the context of technology, a user group is a club whose focus is on a specific technology or tech-based skill.
USIgnite	US Ignite is a nonprofit organization that "helps to accelerate new wired and wireless networking advances from research to prototype to full-scale smart community and interconnected national deployments." *us-ignite.org/about*
VisionZero	Originating in Sweden in 1997, Vision Zero is now a multi-national project focused on road traffic safety. Its aim is to achieve a highway system with no fatalities or serious injuries in road traffic.
Wayfinding	Tools and resources used to guide travelers on location and direction. This can includes signs, maps or other graphics, or audible tools.

References

Below is a listing of plans and reports whose previously vetted goals are included within the draft community recommendations.

2016 Nashville Chamber Report Card Recommendation, Chamber Education Report Card Committee, 2015

2016 SCORE Report: The State of Education in Tennessee, State Collaborative of Reforming Education, 2015

The Academies of Nashville: A Five-year Plan for the Implementation and Sustainability of High School Reform, Metro Nashville Public Schools, 2010

Division of College, Career and Technical Education 2015 Year in Review & Upcoming Initiatives for 2016, Tennessee Department of Education, 2015

Downtown Multimodal Mobility Study, Nashville Area Metropolitan Planning Organization, 2016

Gear Up 2020, Urban Land Institute Nashville, 2016

Livable Nashville, Mayor's Livable Nashville Committee, 2017

The Master Plan for Tennessee Postsecondary Education 2015 to 2025, Tennessee Higher Education Commission, 2015

Metro Nashville Child and Youth Master Plan, Mayor's Office of Children and Youth, 2010

Milton Keyes' Urban Data School: Smart City Data Literacy for Schools, MK Smart, 2016

MNPS Learning Technology Tactical Plan, 2013-2016, Metropolitan Nashville Public Schools, 20013

MPO 2040 Regional Transportation Plan, Nashville Area Metropolitan Planning Organization, 2016

Nashville Next, Metro Planning Department, 2015

Nashville USDOT Smart Cities Challenge, Metro Government of Nashville and Davidson County, 2016

NashvilleNext: Education and Youth, Metro Planning Department, 2015

nMotion High Capacity Corridors, Nashville MTA, 2015

Shaping the Healthy Community: The Nashville Plan, Nashville Civic Design Center, 2016

TDOT Long Range Plan, Tennessee Department of Transportation, 2015

Appendix 1:

Smart City Minimum Technical Standards

This document is distinct from prior recommendations in this document in that it is highly technical in nature. The goal is to present a set of minimum requirements and standards that help us to select technology in the best interest of our citizens based on global industry best practices. The terms and concepts used here do not reflect the language that most citizens use in day-to-day conversation. The information contained in this document will inform policy development, software development and service contracts that protect your privacy, promote cost-effective systems and guarantee that any data collected remains secure.

Integration and Interoperability

Interoperability and integration are critical to facilitate interface, prevent failure dynamics and ensure system flexibility and scalability. Interoperable platforms require machine readable, open API access data for bulk, non-real-time, and real-time data to serve different purposes and functions. Heterogeneity in both message (data) layers and behavior (control) layers is one of the biggest emerging challenges for governance enterprises given the driving need for integrated systems to provide useful and timely services to employees, residents and visitors. To address integration and interoperability, solutions must meet the following minimum requirements:

- Operational within Metro's defined technical environment
- Standardized or interoperable format and syntax for the data and content such as HTML or JSON;
- Inclusive of Interface Definition Language (IDL) to facilitate communication between software components that do not share a language
- Compliant with international information communication technology (ICT) standards, such as oneM2M, FIWARE, KSPA.

Security

There are numerous advantages inherent in a city's thinking in a holistic way about the services it provides to its citizens. Too often however, considerations of security and privacy are afterthoughts in technology-centric initiatives. It is vital that Nashville's services are end-to-end secure. Consideration of smart cities' technological solutions requires that security risks be actively assessed, understood and addressed by appropriate technical and managerial controls.

Metro has developed an extensively detailed *Cyber Security Checklist for Smart Cities Technology*; a summary of absolute minimum requirements for technology solutions appears below.

- Solution provides controls to address physical security needs. This includes safeguards that take into consideration where the devices are located during operation, what security controls the devices

feature (e.g. tamper resistant or tamper evident), and the sensitivity of the data processed by devices. Breaches of physical security must generate alerts.

- Solution fails safe/close in the case of a system malfunction or crash.
- Solution has undergone third party penetration testing ("pentest").
- Solution provides centralized mechanism for application/infrastructure administration.
- Solution provides automatic and secure updates of software, firmware, etc. for all components.
- Solution provides mechanisms for auditing and logging events, including security events.
- Solution can be continuously monitored.
- Solution provides mechanisms for real time alerting for defined events, including security events. Alerts are available via multiple modes (text, email, etc.).
- Solution utilizes strong cryptography to protect data, both at rest and in transit.
- Solution requires unique username and password to access functionality and supports strong authentication mechanisms (one-time passwords, certificate- or biometric-based authentication, etc.).
- Device level authentication is used for machine to machine (M2M) communications.
- Devices used within solution have a mechanism to prevent tampering by unauthorized sources.
- Solution does not use any backdoor/undocumented/hardcoded accounts.

Privacy

Protection of privacy is a growing concern with citizens. Data collection through various technical solutions and devices may raise concerns about potentially negative impacts on constituent privacy. To address concerns around privacy, solution providers must be able to assure Metro and to provide citizens with accurate and reliable information about city data collection and use, and policies and mechanisms for controlling that data in whatever format it may exist. Contractual provisions to address privacy and data use concerns include:

- Providers assert no ownership of data outside of providing for the agreed upon service. This stipulation includes data that results from analysis of primary data.
- Solution or provider data collection and use is well documented, including what is collected and for what purpose(s).
- All data collected is securely stored and transported.
- Data storage elements are subject to specific controls (e.g., how much data is retained, location of storage, etc.).
- Solution only collects citizen information directly relevant and necessary to accomplish specified purpose(s), and only retains citizen information for as long as is necessary to fulfill those specified purpose(s).

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A Vision for a Smarter City

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