Grant Application for NOFO # DTFH6116RA00002

Part 1 - Vision Narrative

BEYOND TRAFFIC: THE SMART CITY CHALLENGE

February 4, 2016

Submitted by:

City of Rochester New York

ROC FORWARD

City of Rochester

City Hall Room 308A, 30 Church Street
Rochester, New York 14614-1290
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Lovely A. Warren
Mayor

U.S. Department of Transportation (USDOT)
Federal Highway Administration (FHWA)
Office of Acquisition and Grants Management
1200 New Jersey Avenue, SE
Mail Drop: E62-204
Washington, DC 20590
Attn: Sarah Tarpgaard, HCFA-32

RE: Notice of Funding Opportunity Number DTFH6116RA00002 – Beyond Traffic: The Smart City Challenge

Dear Ms. Tarpgaard,

On behalf of the City of Rochester, I am pleased to submit the attached application for the USDOT Smart City Challenge. As one of America's most creative cities, Rochester embraces the opportunity to compete for this innovative program that will accelerate the pace of change in our nation's urban centers. Rochester's Smart City vision aligns well with USDOT's goals for the Challenge. Our vision is centered on utilizing emerging transportation technologies to help alleviate concentrated urban poverty; an issue so critical that it is widely recognized as our city and region's most significant challenge. Successful implementation of Rochester's Smart City vision will not only lead to improved safety, enhanced mobility, and a more sustainable environment, it will have a direct and meaningful impact on the health and prosperity of our city's most disadvantaged residents.

The City of Rochester is an ideal partner for USDOT due to our smaller size and collaborative community spirit, our broad-based partnerships between government, industry, academia, and not-for-profit groups, and our demonstrated experience with using innovation to address our community's challenges. Our four-season climate affords the unique ability to test technologies in a wide variety of conditions. As Secretary Foxx recently mentioned in his address to the Transportation Research Board, Rochester's Inner Loop East Transformation project demonstrates how our city is able to engage varied resources to bring about a project that is innovative, collaborative and reunites communities through the transformation of our transportation system. Rochester is a progressive city with a rich history of embracing technology and is committed to being bold in the 21St Century. Rochester is well positioned to take on the Smart City Challenge and in so doing, help our citizens climb the ladder of opportunity.

Thank you for your thoughtful consideration of our application.

Sincerely,

Lovely A. Warren
Mayor

WHAT'S INSIDE

OUR VISION

The City of Rochester is resurgent. Historically one of America's first "boomtowns," Rochester has more recently endured a half-century of decline, causing job-loss, reduced private sector sources of regional funding, and a high percentage of poverty-stricken citizens. Today, our city is experiencing a wave of revitalization. Thousands of units of new housing have or soon will be built in the Center City, and an emerging Downtown Innovation Zone is generating high quality jobs and investment. These combined forces have changed the fortunes of our urban core, where the focus is now on managing growth rather than stemming decline. Whether dissecting the Midtown Plaza superblock, removing the sunken Inner Loop Expressway, developing intermodal transportation hubs, or aggressively building out an extensive bicycle network, the City of Rochester is committed to creating a smart, sustainable city for the 21st Century.

the next 15 years. To that end, Rochester recognizes the unique opportunity that the Smart City Challenge provides to dedicate technological advancements in the transportation sector to achieve our goal of reducing urban poverty and improving the quality of life for all citizens. This will be done in three ways: improving safety for travelling citizens, enhancing mobility by creating more and better travel options, and advancing environmental sustainability by reducing energy consumption and greenhouse gases (GHG).

By investing in the Smart City Challenge and leveraging private sector funds, we will be able to enhance long-term transportation solutions that better connect communities to employment centers, education centers, health care facilities, and services. The City of Rochester and its assembled consortium of partners, is committed to successful implementation of the Smart City Challenge. If awarded, the results achieved in Rochester will be replicable in cities across the country.

> **Our goal is to reduce poverty by 50% in 15 years, using our Smart City Vision as a driving force of change.**

However, our city and region faces a critical test that will determine whether or not that 21st Century city meets the needs of all of our residents. In spite of its abundant resources and apparent wealth, Rochester, when compared to other mid-sized cities, is home to a crippling concentration of urban poverty. Recent studies indicate that Rochester has the highest rate of child poverty, the highest rate of extreme poverty, and the second-highest rate of poverty overall in the nation. Unless the rate and scale of poverty in our community is addressed, the city and region will struggle to meet its full potential.

Through the leadership of Mayor Lovely Warren and Governor Andrew Cuomo, in coordination with a broad public, private, and non-profit initiative, the community has targeted a 50% reduction in poverty over

Transportation & Poverty

Transportation has played a regrettable role in creating an environment in which poverty can concentrate and spread. Cities have historically grown outward with each transportation innovation as faster, more efficient transportation services enabled people to live further from the historic center. This phenomenon is nothing new. However, the proliferation of the car, coupled with supportive infrastructure, land use, and financial policies, enabled this to take place on a massive scale beginning in the 1950s.

The impact on cities such as Rochester was two-fold. First and foremost, suburbanization robbed cities of a significant share of their middle and upper-income families, leaving

behind a largely poor and working-class populace. The City of Rochester's population peaked in 1950 at over 330,000; today, the City's population is just over 210,000, a loss of more than one-third. Secondly, the rush to serve the car and compete with suburban development led cities to make poor decisions or allow such decisions to be made on their behalf. These decisions included wholesale demolition of neighborhoods to accommodate interstates and expressways, often built through established African-American communities; widening of streets to increase vehicular throughput, typically at the expense of bicyclists and pedestrians; removal of streetcar and trolley lines from city streets and corridors; and demolition of historic buildings and streets in favor of parking facilities and car-oriented development.

Rochester, like many cities, was scarred by these decisions. As much of the historic fabric of the city was destroyed, the social networks that bound residents and businesses together were lost as well. As people left the city, businesses followed, creating a downward spiral of disinvestment in many neighborhoods. This also created a spatial mismatch between new job opportunities and lower-income residents. As jobs migrated to the periphery, inner city residents' ability to access them became strained; this, combined with a host of other factors, ultimately resulted in chronic unemployment and poverty in city neighborhoods.

Transportation is neither the cause of nor solution to poverty. However, it is undeniable that transportation is a contributing factor and that efforts to improve accessibility and mobility for all residents can significantly improve outcomes for our city's most disadvantaged. Take Sheila for example; she resides in a city neighborhood and works a low-wage job at a small manufacturer a short walk from home. Sheila is able to stay out of poverty in part because, although she does not own a car, most everything she needs is located within her local community. Day care, grocery, health care, and employment are all within easy reach.

However, the employer decides to relocate the business to a suburban site ten miles away. The new location is too far to walk or bike and is poorly served by transit. Sheila cannot afford a car on her salary and must rely on the current transit service. Because bus service is not as frequent in this low-density suburban area, she must now add 90 minutes to her daily commute each way. Her day care provider can no longer accommodate her child's schedule and so a new provider is found, adding another 30 minutes to the commute. Sheila's health and that of her child suffer as doctor visits must be curtailed. She often shows up late to work due to the fluctuations in travel times caused by traffic conditions, weather, and other events out of her control. This prompts her employer to terminate her position. With no comparable employment opportunities in

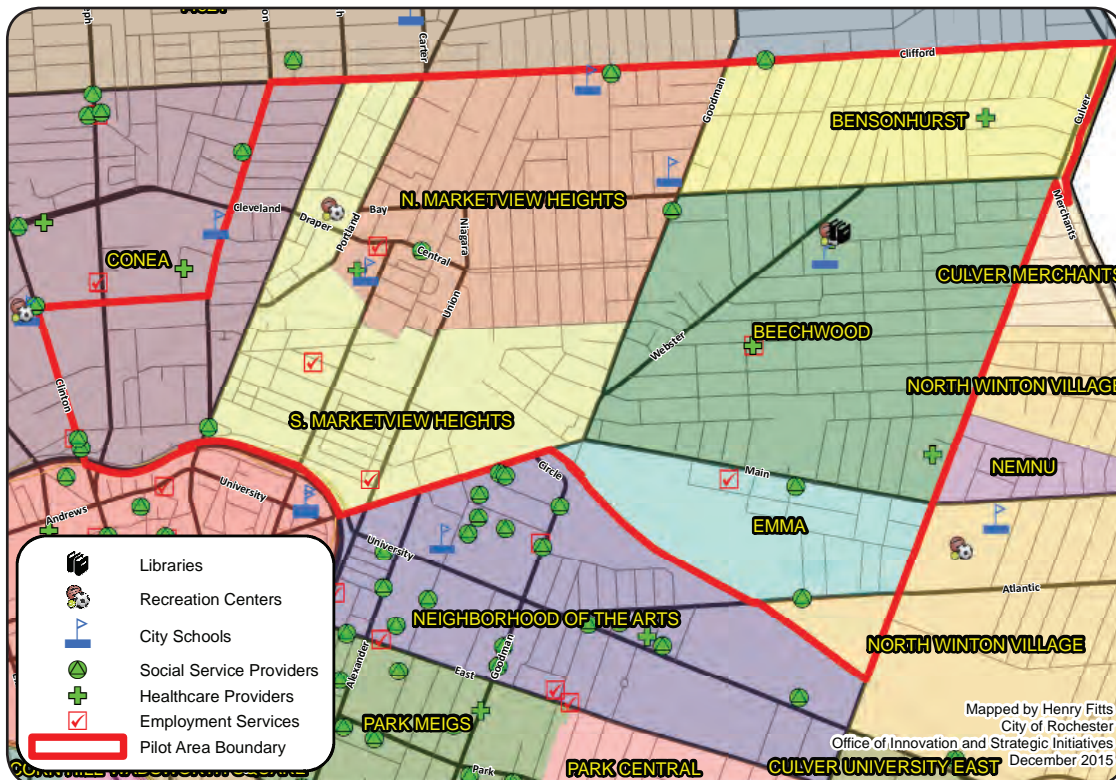| HIGHEST	HIGHEST	SECOND-HIGHEST
The highest rate of childhood poverty (50.1%)	The highest rate of extreme poverty	The second-highest rate of poverty in the nation

Rochester's Poverty Issue by the Numbers: according to a September 2015 Rochester Monroe Anti-Poverty Initiative report.

her neighborhood, Sheila and her child are now living in poverty.

This is a very common scenario playing out in Rochester and in cities nationwide. Unless addressed, it threatens our nation's future economic competitiveness. Yet it presents a unique opportunity to use the resources of the Smart City Challenge to make our cities' future transportation system work for all residents. This is Rochester's challenge - one that we are well prepared to address.

Mayor Warren has taken steps to drive change, launching the Mayor's Office of Innovation and Strategic Initiatives, and leading the Rochester-Monroe Anti-Poverty Initiative (RMAPI). Together with key agency partners, the City is preparing new program and policy recommendations to impact poverty, including issues of transportation. The program has state level support from the office of Governor Cuomo and direct communications with a task force comprised of high level New York State officials. Governor Cuomo is already pointing to the effort as an example for other states to follow.

RMAPI and the City recently approved an anti-poverty target area encompassing three contiguous neighborhoods. This target area will be where we will test and measure the impact of new anti-poverty strategies. The area was selected through a data driven process that identified an area with good existing resources that is impacted by socioeconomic issues. The Office of Innovation will help design programs with data sharing best practices, and ensure capabilities to track long term individual outcomes. The Office will also be retained to evaluate program impact, and help make modifications when necessary. Given the attention, investment, data sharing, and evaluation about to occur within this area, it is an ideal location to also pilot new transportation technologies designed to positively impact people in poverty.

The Anti-Poverty Target Area: the neighborhoods of Marketview, Beechwood, and EMMA.

Our Proposed Elements

The City of Rochester and its partners intend to develop a 21st Century transportation system that addresses our mobility and safety needs while growing the local and regional economy and offering a stairway out of poverty. A primary focus will be on enhancing transit accessibility for our residents, 73% of whom are underserved by public transportation. We must face our challenges directly, creating a path to quality jobs for our citizens while building a more robust and smart transportation system. This is consistent with our stated vision and with the USDOT Ladders of Opportunity Initiative promoted under Secretary Foxx's leadership. By investing in Rochester's Smart City vision and leveraging private sector funding, we will create an enhanced transportation network that better connects our residents to employment, education, health care, and other services.

Our goal is to accelerate ongoing efforts to re-establish Rochester as a global innovation hub. Through this program, we can create up to 10,000 high quality jobs in Rochester by 2020 and rebuild our manufacturing base in the process. The City and region are determined to work with our partners in the public and private sectors to have Connected Shared Automated Vehicles (CSAV) built in Rochester and the USA. We are engaged in preliminary discussions with EasyMile, one of our key partners in this endeavor, regarding this manufacturing facility.

The USDOT Smart City Challenge has shone a light on innovative operational strategies and technologies such as connected vehicles (CV) and automated vehicles (AV), offering new hope for addressing the complex transportation challenges we face as a nation and nourishing hopes for continued economic prosperity. It's clear that we cannot rely on past solutions to work in today's environment. Cities like Rochester constantly face the dilemma of doing more with less. The growing frustration of travelers, combined with worsening infrastructure performance, demand that new and innovative strategies be developed. The application of CSAV shuttles for the first and last mile offers the potential

for significant performance improvements at much lower costs and in much faster timeframes than previously possible. These solutions are scalable and synergize with our City's investments in multi-modal transportation improvements to meet the needs of our residents, now and in the future.

The City of Rochester has assembled an impressive consortium of local, regional, and state agencies and organizations, institutions of higher learning, and industry partners who are committed to the success of Rochester's vision for the Smart City Challenge and addressing anti-poverty initiatives. Highlights of the primary proposed elements are listed below:

Urban Automation – partnership between the City, EasyMile, Kodak, and the Rochester Genesee Regional Transportation Authority (RGRTA) to deploy automated transit shuttles on the internal street network of Eastman Business Park (EBP), a 1,200-acre private technology campus in the City of Rochester. This will solve first/last-mile issues with transit accessibility, demonstrate the effectiveness of automated transit, and position EBP and Rochester for future economic growth. Upon successful testing at EBP, it is anticipated that deployment would transition to public streets in the City of Rochester, with early deployment focused on the anti-poverty target area and/or the Downtown Innovation Zone. The City will work with New York State to enact legislation that facilitates automated vehicle deployment initially in Rochester and then expanding statewide.

Intelligent, Sensor-Based Infrastructure – partnership between the City and GE to deploy GE's Current technology via the City's extensive street lighting system. This technology uses intelligent LED light fixtures outfitted with sensors, transmitters, and microprocessors to create a comprehensive data grid offering unparalleled possibilities for a variety of considerations, such as traffic optimization, parking management, asset oversight, and environmental awareness.

Urban Analytics – partnership between IBM, RIT, and the City to harness the power of Big Data and RIT's intellectual capacity to address a wide variety of municipal needs, such as performance measurement, service delivery optimization, and public information sharing.

User-Focused Mobility Services and Choices – partnership between Xerox, RGRTA, shared mobility service providers, and the City to develop a leading edge application for real-time transportation information to enable better decision-making with respect to travel options and integrated payment for those options. This will advance the "Mobility on Demand" concept and facilitate more of our residents to choose car-free or car-light lifestyles. Interoperable, mobile fare payment combining a wide variety of travel options (transit, rideshare, carshare, bikeshare, taxi, parking, etc.) is the goal and equitable access for un-banked residents without access to credit is a primary consideration.

Urban Delivery & Logistics – partnership between Verdant Global and the City to establish a highly-efficient, automated AgriFactory at an existing vacant warehouse in the City of Rochester. The Verdant AgriFactory will demonstrate a leap beyond traditional greenhouse production, yielding significantly more fresh healthy produce than previously thought possible while also repurposing existing vacant warehouse space that is easily accessible to urban populations. This technological advancement has the potential to significantly reduce emissions by eliminating inefficient long-range transport of produce. Its fully automated system lends itself to local distribution via connected and/or automated vehicles, just-in-time delivery techniques, and use of analytics to minimize conflicts between delivery and traffic needs on city streets.

Implementation of Rochester's vision for a Smart City will enable the USA to demonstrate global leadership in these emerging technologies, clearing the way for safer, more mobile, and sustainable cities. Furthermore,

successful implementation will help Rochester, and cities nationwide, attack urban poverty and improve the quality of life for those living in poverty. Rochester is a smaller city, enabling us to be more nimble and allowing the federal dollars to fund more innovative solutions. Our collaborative, cooperative environment minimizes risk, providing assurance that our city and region is focused on delivering a Smart City focused on the future. The consortium that will guide this investment is wide-reaching, demonstrating that our community is supportive of and invested in implementing the Smart City Challenge.
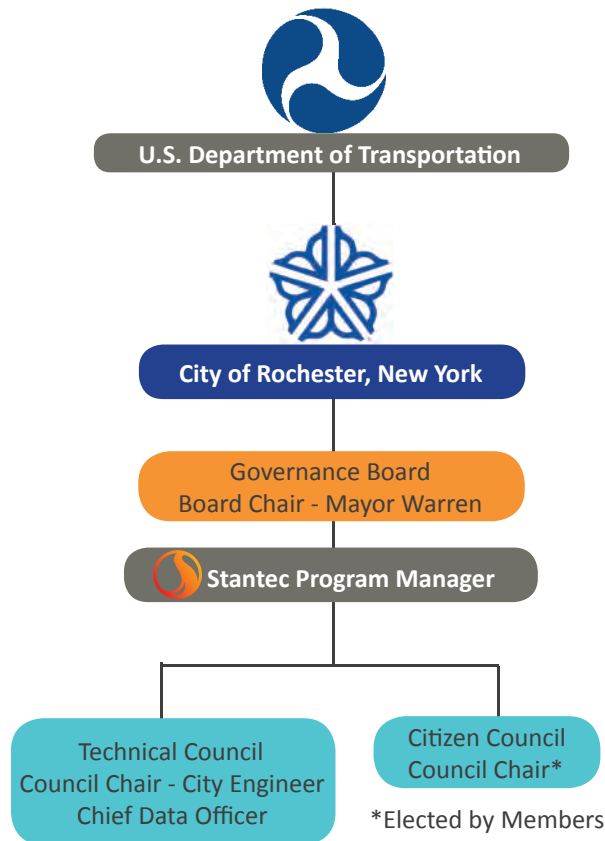

Program Management

Implementation of a comprehensive governance framework is critical to ensuring interagency collaboration and transparent accountability throughout the life of the Smart City Challenge. The City of Rochester will serve as the primary Point of Contact with USDOT for all aspects of the Smart City Challenge. To assist City staff and leadership with management responsibilities, Stantec will provide project management services and technical expertise, working closely with all project partners to ensure successful implementation of the City's vision. It is anticipated that a Governing Board, chaired by the Mayor and consisting of high-ranking officials from the many public and

private sector partners, will provide high-level oversight of the Smart City program. A Technical Council will provide ongoing operational management of research and technical activities. The City Engineer will chair the Council, assisted by Stantec, with staff-level representation from all project partners. The City's Director of Innovation will serve as Chief Data Officer for the purposes of the Smart City Challenge. Lastly, a Citizens Advisory Committee will be established with representation from City staff, Stantec, and the many public advocacy organizations that will help to ensure that the Smart City initiatives are meeting the needs of the public. The Committee will elect a Chairperson from among its members, who will then serve on the Governing Board and appoint a representative to serve on the Technical Council.

POPULATION CHARACTERISTICS

Rochester is an ideal candidate for the Smart City Challenge. According to the 2010 Census, Rochester has a population of 210,565 representing a significant share of the overall population (29%) living within the urbanized area. The 35.78 square miles of land that comprise the City exhibit a density of 5,884.9 persons per square mile. Rochester is the third-largest city in New York State. It is the seat of Monroe County, which had a 2010 population of 744,344. The city is at the center of a larger six-county metropolitan area which had a population of 1,079,671 in 2010.

Rochester is also a very diverse place. 41.7% of the population is African American, 37.6% is White, 16.4% is Hispanic or Latino, 3.1% is Asian and 1.2% is American Indian, Alaska Native or Native Hawaiian. Further, recent Census data indicates that Rochester has the highest rate of child poverty (50.1%), the highest rate of extreme poverty, and the second-highest rate of poverty overall in the nation. With a diverse population and residents facing economic hardships, successful implementation of Smart City elements in Rochester will have broad applicability in cities nationwide.

U.S. Department of Transportation

City of Rochester, New York

Governance Board
Board Chair - Mayor Warren

Stantec Program Manager

Technical Council
Council Chair - City Engineer
Chief Data Officer

Citizen Council
Council Chair*

*Elected by Members

OTHER CHARACTERISTICS

Existing Transportation System

Fixed route bus transit service in the City of Rochester and broader region is provided by the Rochester Genesee Regional Transportation Authority's Regional Transit Service (RTS). RTS currently operates more than 40 routes serving the city and neighboring suburbs. More than 18 million riders utilized RTS on an annual basis.

Conducive Environment

Rochester is one of America's most creative communities. We rank among the top communities for patents issued per capita as well as the percentage of workers in creative industries. The talent pool and our collective capabilities are well-regarded. In summer 2015, Rochester was named the home for the new American Institute for Manufacturing Integrated Photonics, a National Network for Manufacturing Innovation (NNMI) institute. It is no surprise that our City is well-positioned to take a lead role among US cities to demonstrate and deploy advanced transportation technologies.

Leadership Continuity

The City of Rochester is a Strong Mayor-Council government system. In this system, the Mayor possesses wide-ranging administrative control over government functions. Mayor Lovely A. Warren is in the third year of her first term as Mayor and has already announced her intention to seek re-election to a second term. The primary staff members are long-term municipal employees who possess significant experience with federal projects and programs. At the outset of the program, a succession plan will be developed to ensure continuity should leadership or staff-level changes take place.

The project will be managed by the City's Bureau of Architecture & Engineering and overseen by the consultant team at Stantec, a global firm with recognized specialties in advanced transportation technology. Stantec's involvement will also ensure continuity and continued focus on successful program delivery.

Sharing Economy

Rochester is home to a strong tradition of grassroots community development and alternative thinking. The City is currently working to support the sharing economy and

alternative ownership structures designed to develop a more economically inclusive community. In the last few years several efforts have popped up in these areas:

Market Driven Community Cooperatives

Since 2014, the Mayor's Office of Innovation has been investigating the potential for economic development strategies centered around worker-owned cooperative businesses. These businesses are designed to create entry level employment opportunities in some of Rochester's most distressed neighborhoods.

Democracy Collaborative, a national leader in community wealth building and worker-owned cooperative development, recently completed a study looking into the feasibility of this strategy in Rochester. Democracy Collaborative remains involved with the Evergreen Cooperatives, a successful model in Cleveland, Ohio that links new worker-owned businesses to the supply chain needs of local anchor institutions like universities and hospitals.

The study identified significant local anchor interest and six specific business opportunities based on market research. Democracy Collaborative is recommending forming a non-profit holding company to provide administrative and human resources support to subsidiary for-profit worker-owned businesses. The non-profit will also manage a revolving loan pool and business development services to help launch new worker-owned businesses. The Mayor and City Council are highly excited about the potential for this project, and are funding the next phase of the project to ensure businesses will be operational in early 2017.

Kiva Rochester Chapter - Though Rochester has a robust small-business community, many entrepreneurs and would-be business owners face insurmountable financial barriers when trying to launch or expand their businesses due to restrictive lending policies and assessments of risk. Kiva is an international crowdfunding microfinance institution that provides 0% interest loans to low-income and underserved entrepreneurs and small businesses. Funding for the loans is secured through internet crowdfunding as well as matching funds from community

organizations. The loans are issued to qualified borrowers following a process that evaluates and establishes creditworthiness. Borrowers undergo an assessment of creditworthiness through a process of social underwriting, in which character and strength of support networks - as opposed to exclusionary criteria such as FICO scores, collateral, and cash flow - are used as the best indicators of success. Borrowers pay back the loans to Kiva, who then reissues the funds to other qualified borrowers.
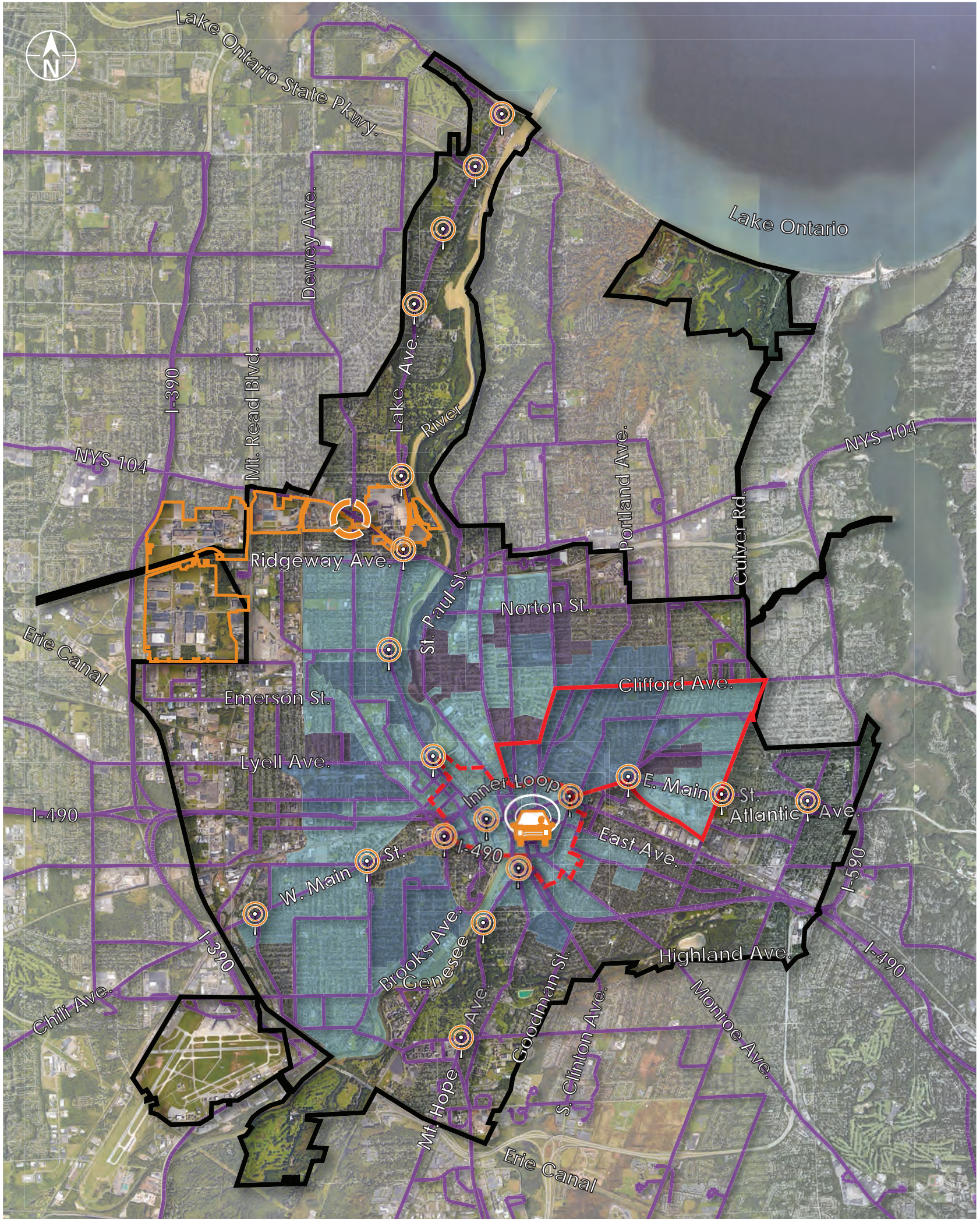
The City is currently working with the Rochester Area Community Foundation and local banks to establish a Rochester Kiva chapter with a $100,000 revolving loan pool that matches internet donors. The program will be launched in summer 2016 with a key Kiva staff person working with neighborhood based organizations in one of Rochester's underserved neighborhoods.

RocShare - RocShare is a new organization, founded in 2014, committed to promoting the sharing economy in Rochester. RocShare has been inventorying and mapping sharing economy resources. They annually hold Sharefest, a conference showcasing local sharing economy efforts, and the FreeMarket, an event where donated items are available for new owners. Finally, RocShare has been working to provide policy proposals for how the City might better support the sharing economy and associated efforts.

Open, Accessible Data

The City is increasing the amount of open data it makes available to the public. In 2012, the City hired its first city-wide GIS coordinator in the Department of Information Technology. In 2013, the City launched its first open data portal - an interactive mapping interface which allows neighborhood groups and citizens to explore their communities and look at data points from crime to property values to compiled census demographics. The data is also available for download for more intensive analysis and comparison. The City looks forward to working with its partners, specifically IBM and RIT, to increase open format data sharing with the public.

LEGEND

⬛ (black line)	City of Rochester Border
🟣 (purple line)	RTS Bus Routes
🟧 (orange box)	Eastman Business Park (EBP)
🟥 (red box)	Anti-Poverty Target Area
⬛ (red dashed box)	Center City

◎	Potential Roadside Technology
◯	Automated Vehicle Transfer Hub @ EBP
🚗	Connected Vehicle Demonstration Area

Jobless Adults in Poverty per SqM

	0 - 533
	534 - 1066
	1067 - 1599
	1600 - 2131

City of
Rochester

ROC FORWARD

OUR APPROACH

Urban Automation

The transportation system of the 21st Century Smart City will be safe, accessible, equitable, and sustainable. Automated transportation services represent the next era of mobility innovation. Automated transit in particular offers an exciting opportunity to augment and expand existing public transportation services in order to better serve the mobility needs of our city's residents and businesses. Automated transit provides a new solution to the first-mile/last-mile accessibility challenge of existing fixed route transit services. In partnership with EasyMile and Kodak, we propose to conduct field testing and deployment of automated transit shuttles at the 1,200-acre Eastman Business Park (EBP) campus, located primarily within the City of Rochester.

EBP, formerly Kodak Park, is one of the nation's largest urban technology campuses. EBP is entirely privately-owned and operated, with its own streets, railroad, wastewater treatment, fire protection, and power generation. Over 6,000 workers are currently employed at EBP. With 2.5M square feet of space and over 300 acres of developable land, there will be significant growth in the years ahead. As such, EBP is a perfect real-world testing and deployment site for automated transit shuttles. There are currently six Regional Transit Service (RTS) routes which provide access to EBP. However, because public buses do not operate on the campus, it can be challenging for workers to get between the bus stop and their workplace. Automated transit can solve this problem, leading to a greater share of trips being taken by transit.

It is anticipated that deployment at EBP will grow over time, serving as a distinguishing feature that attracts jobs and investment to this urban campus. Rochester will also aggressively pursue opportunities for manufacturing and assembly of these automated transit vehicles, potentially creating large numbers of high quality jobs in our community. Upon successful testing at EBP, it is anticipated that deployment would transition to public streets in the City of Rochester, with early deployment focused on the anti-poverty target area and/or the Downtown Innovation Zone. The City will work with New York State to enact legislation that facilitates automated vehicle deployment initially in Rochester and then expanding statewide.

Connected Shared Automated Vehicle (CSAV) Shuttles

Over the past few years there has been significant research and demonstration of various AV products. Companies such as Google and automobile manufacturers have been testing their AVs with impressive results for a number of Ready-to-Market (RTM) products such as CSAV shuttles. More work is needed to refine the technology, but the pace of progress has accelerated. There is growing public awareness that the use of AVs by the public is a matter of when and not if. In fact, starting in 2016 many demonstration projects will begin to gradually transition to public streets across the globe. We want Rochester to take a lead role. Large companies and start-ups are investing billions of dollars in the research and development of AV technologies in combination with innovative business models such as Uber and on-demand transit. Over time, this will result in a massive transformation of the mobility landscape with significant societal implications. Safety is the single most important benefit associated with AVs given that over 90% of traffic incidents are caused by human error.

Connected Shared Autonomous Vehicle (CSAV)

A natural extension of AV technology is into the sphere of public transportation. More specifically, the application of electric CSAV shuttles for complementing and integrating with traditional modes of transit. This has been in the demonstration phase in Europe for the CityMobil2 initiative (see image below) during the past five years and holds great promise in addressing the challenges faced by transit operators. Today these agencies face growing public frustration with inadequate parking at major transit centers and lack of reliable connections, which negatively impact ridership targets.
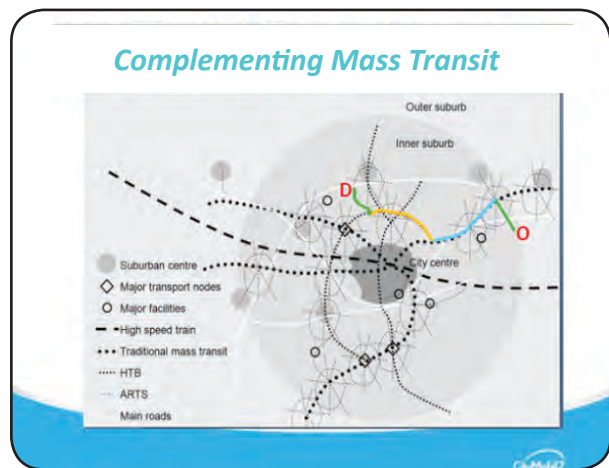
first/last-mile) some infrastructure preparation may be required. For example, CSAV shuttles can share space with bicycles in a downtown area with dedicated curb-side bicycle lanes. In other cases, such as connecting major transit hubs to parking areas, Hard Shoulder Running (HSR) strategies can be deployed to accommodate higher speed CSAV shuttles. The Rochester setting and number of college campuses and business parks presents multiple opportunities for synergistic application of CSAV shuttles during peak hours. Keys to success of CSAV shuttles are:

The CityMobil2 Initiative

Complementing Mass Transit

CSAV shuttles can also address mobility requirements in urban settings such as college campuses and large residential developments. For example, city residents may face daily challenges finding parking spaces for inter-city trips and/or access to and from transit stations. CSAV shuttles can address these challenges in a very efficient, reliable, safe, and friendly manner. They can be especially effective in areas not served by traditional bus or mass transit and can help connect those centers with transportation hubs. Furthermore, CSAV shuttles can serve as new modes of transit with dynamic routing - in essence combining the best features of ridesharing services with traditional fixed-route operations. CSAV will allow impoverished citizens get to their jobs.

Depending on specific CSAV shuttle implementation scenarios (urban centers or

» Technology testing and prototype development (ongoing)
» Appropriate regulatory frameworks for operations under reduced speeds for safe and efficient early deployment (in development)
» Identification of sites with demonstrated transit need, demand, and infrastructure integration
» Operational expertise to ensure efficient and reliable services
» Improved "backbone transit" such as BRT, connection buses, or shuttle buses to improve travel time and reliability

CSAV shuttles can operate at low speeds (25mph) and can be integrated with dedicated bicycle lanes that are increasing in Rochester and cities across North America. This approach will help to accelerate CSAV shuttle adoption, enhance transit system ridership, and contribute to modal shift and the overall optimization of our transportation network in Rochester.

![ROC FORWARD logo]

Connected Vehicles

Rochester is an older, fully built-out city with minimal opportunity to physically grow. In fact, the City has aggressively pursued a program of "right-sizing" streets to better meet the needs of today's population. In the past, the primary focus of street design was on wider roads and faster moving car traffic. Today the goal is to accommodate cars while maximizing space for other users, namely bicyclists, pedestrians, and transit users. To continue this approach in the face of rising demand now and in the future, it is critical to maximize the efficiency of the existing transportation system.

Connected vehicle technology provides previously unimaginable opportunities to better manage the system by greatly enhancing traffic safety, monitoring and responding to traffic conditions in real-time, optimizing emergency response and public transportation services, among many other benefits. Connected vehicle technology will allow cities to meet demand, improve service, and reduce costs. To that end, the City of Rochester proposes to partner with GE to deploy their Current® technology on the City street system.

Current takes advantage of the existing street lighting system to deploy a network of sensors, transmitters, and microprocessors that can communicate with vehicles. This technological advancement offers a myriad of possibilities, such as advising drivers of unexpected hazards or upcoming traffic congestion and suggesting alternate routes, or warning a wrong-way driver entering the expressway system while simultaneously notifying authorities and the traveling public.

The City will also partner with Mobileye to deploy their Shield+ collision avoidance technology on both the RTS bus fleet as well as on the City's fleet of nearly 500 public works vehicles. This will greatly enhance safety for bicyclists and pedestrians on city streets while providing better travel time reliability and service delivery to our residents and businesses.

Intelligent, Sensor-Based Infrastructure

A Smart City is able to collect and analyze data to inform the public, measure performance, and optimize investment decision-making. In the absence of a robust network of sensors, collecting reliable data and providing real-time information is a significant challenge. Through our proposed partnership with GE, sensors will be ubiquitous throughout the city, enabling City government to collect a wide range of data, including multi-modal traffic volumes and speeds, pavement condition, weather information, ambient air quality data, parking availability, and motor vehicle crashes. The City will work in partnership with RIT and IBM to determine how best to integrate this new data collection capability with existing data in order to improve customer service, manage costs, and improve government accountability.

Like many other cities across USA, Rochester's roadway infrastructures, including pavements, bridges, and signs, are deteriorating rapidly due to material aging, improper usage, harsh environments, and natural and man-made damages. With the advancement of sensor technologies, it becomes feasible to collect the large-scale, in-field, and detailed infrastructure data, such as 3D pavement surface data, using high-performance cameras, lasers, LiDARs, and Inertial Navigation System (INS). This allows for better insight and understanding of large-scale in-field infrastructure behavior. We will build a framework for the sensor-based and spatially-enabled next generation intelligent, sustainable infrastructure management system, including the key components of data acquisition, automatic information extraction, data integration, and intelligent infrastructure management with assistance from our partners, IBM and GE.

Urban Analytics

A wealth of new data will be generated through the many initiatives of our Smart City vision, complementing a growing supply of data that is already available. Our industry partners at IBM are recognized global leaders in analytics, with unmatched expertise in working with agencies and organizations around the world to solve problems using the power of information. IBM will work in tandem with an interdepartmental research team at RIT, in conjunction with the City and non-profit community partners such as Reconnect Rochester and the Center for Disability Rights, to develop information sharing platforms, smart mobile applications, and other techniques to address a wide variety of issues ranging from Transportation Demand Management in the downtown area to city-wide universal access and design and goods movement.

User-focused Mobility Services and Choices

A critical component in enhancing mobility for travelers is to give them better information that can be used to make smart decisions about their trip. Through our partnership with Xerox and other partners, the City will develop a leading edge application for real-time transportation information to enable better decision-making with respect to travel options and integrated payment for those options, advancing the "Mobility on Demand" concept and facilitating more of our residents to choose car-free or car-light lifestyles. Interoperable, mobile fare payment combining a wide variety of travel options (transit, rideshare, carshare, bikeshare, taxi, parking, etc.) is the goal and equitable access for un-banked residents without access to credit is a primary consideration.

Parking management is another important factor for the City. Parking can impact congestion, affect safety, and impede access. Determining occupancy is the key to understanding demand and setting the appropriate metered parking prices. When hourly parking meter prices don't keep up with demand, the search for parking becomes painful. That search creates congestion and dangerous conditions as frustrated motorists circle for parking. While there's a municipal impact on revenue, the real weight of these policy decisions rests squarely on the backs of customers, people like motorists, merchants, bicyclists, pedestrians, and other stakeholders.

Xerox's Merge® platform will provide a means of managing parking operations with a central management solution. Merge® fully integrates and provides analytics on all aspects of metered and off-street programs. The system integrates hardware and software to provide real-time information about coin collections, meter maintenance, enforcement, and occupancy by applying real-time data to solve parking and mobility issues.

Our goal is to be inclusive with all citizens. Therefore, we have engaged representatives of the Center for Disability Rights, Inc. (CDR), a not-for-profit, community-based advocacy and service organization for people with all types of disabilities, including over 10,000 disabled adults aged 20-64 living in poverty. CDR has already provided a number of important insights regarding our transportation system of today and tomorrow, including:

» Universal design should be used throughout any transportation plan to ensure we don't have any segregated transportation for people with disabilities.
» For communication, emphasis should be put on text communication either via a texting or a web-based platform, like Twitter. This will help to target the younger population as well as the Deaf Community.
» All web-based site or applications should be screen-reader friendly to ensure the Blind population has access to the information.
» A mobile application that identifies the accessible entrance on buildings is needed to help with transportation coordination. This would allow a person to choose to get off at a bus stop closest to that entrance or plan another accessible path of travel.

Urban Delivery and Logistics

The Rochester team has included Verdant Global to help transform Rochester into a truly sustainable Smart City. Their patented technology enables them to produce fresh, consistent, insecticide-free produce year round. Their business model uses existing vacant structures and repurposes them to operate fully automated AgriFactories for local consumption. The City will partner with Verdant Global to establish a highly-efficient, automated AgriFactory at an existing vacant warehouse in the City of Rochester. This will eliminate many long-haul delivery trucks from our busy streets and highways and greatly reduce GHG emissions. Its fully automated system lends itself to local distribution via connected and/or automated vehicles, just-in-time delivery techniques, and use of analytics to minimize conflicts between delivery and traffic needs on city streets.

It will also provide much needed purpose for vacant and abandoned buildings, thereby invigorating distressed neighborhoods and properties. It may also lead to direct employment, provide passive surveillance, create a new tax base, and potentially stimulate other economic and business activity. Through their business case specifics, the opportunity may exist to give back new sources of regional funding that can then be reinvested in the community through new community services, community centers and other social investments. We believe this can ultimately lead to a reduction in poverty in the very neighborhoods these initiatives occur.

Strategic Business Models & Partnering

The City of Rochester is a firm believer in entrepreneurial government. This is evidenced by the establishment of the Office of Innovation & Strategic Initiatives and the support it has received through Bloomberg Philanthropies and IBM's Smarter Cities

Initiative to develop innovative solutions for reducing poverty in our community. The City brings this same approach to the Smart City Challenge. As detailed in Section 7, the City has assembled a dynamic and broad consortium of partners across all levels of government, academia, business, and community. These partners are committed to making Rochester the successful Smart City that will serve as a model for using technological innovation to improve safety, enhance mobility, and protect the environment while also expanding equity and attacking urban poverty. Upon notification of our selection as a Smart City Finalist, the City of Rochester will work with its partners to further define roles and responsibilities, and terms of reference, for each functional body.

The City of Rochester is partnering with RIT, a comprehensive national research university with nearly 19,000 students. RIT is a member (sub-grantee) of the Region 2 University Transportation Center (UTC) consortium whose strategic goal is economic competitiveness. This partnership will allow the City to leverage the intellectual capacity of both RIT and the UTC as a whole.

It is anticipated that opportunities for cost-sharing and in-kind service delivery will be made available. The ability to leverage the federal resources provided through the Smart City Challenge to attract additional financial and technical assistance will help to ensure that Rochester's Smart City vision produces a real and long-lasting impact on Rochester, New York State, and the nation as a whole.

Smart Grid, Roadway Electrification, & Electric Vehicles

The Office of Electricity Delivery & Energy Reliability (OE) has taken on a national leadership role to modernize the nation's electricity delivery system. A Policy Framework for the 21st Century Grid describes four goals to be pursued to ensure that all Americans benefit from investment in the Nation's electric infrastructure: better

alignment of economic incentives to boost development and deployment of smart-grid technologies; a greater focus on standards and interoperability to enable greater innovation; empowerment of consumers with enhanced information to save energy, ensure privacy, and shrink bills; and improve grid security and resilience.

OE has established seven principal smart grid functional characteristics:

» Self-healing from power disturbance events
» Enabling active participation by consumers in demand response
» Operating resiliently against physical and cyber attack
» Providing power quality for 21st century needs
» Accommodating all generation and storage options
» Enabling new products, services and markets
» Optimizing assets and operating efficiently

By focusing on Eastman Business Park as a potential private pilot campus, the ability to analyze each of these functional characteristics in a setting that is transferrable to a public portion of the City becomes possible.

As part of an existing program, the City is partnering with Energetics and the Electrification Coalition to grow the Electric Vehicle (EV) ecosystem in Rochester and in so doing, expand the market for EVs. EV Charging Station Plans for the five regions along the I-90 Corridor (Capital District, Mohawk Valley, Central New York, Genesee Valley/Finger Lakes, and Western New York) will be implemented, spurring EV acceptance and adoption. The outcome will be: 1) 25 EV charging stations (5 in each region) strategically installed in critical areas to enable greater EV use, 2) educated municipalities on EV charging station permitting and communities on EV technology, 3) 900 rebates for EV purchases to spur EV sales and establish more EV advocates (the new EV owners), and 4) 40 ride-n-drive events to promote EVs and allow consumers a test drive opportunity of different makes and models in a single location.

The Rochester EV Deployment Community will also foster a model EV Community in which EVs are embraced by the public and promoted by business and government. This approach moves EVs from a niche product into a dominant and ubiquitous concept. The outcomes will be: 1) 9 EV charging stations in City of Rochester garages for public and city-owned EVs, 2) EVs for the City of Rochester as an ambassador of the technology and to showcase their operation, and 3) an extensive community engagement to inform and educate the residents and businesses throughout the City about the benefits of EVs. The Rochester EV Deployment Community will create replicable models for other New York communities to use for accelerating EV adoption.

An example of a charging station in Rochester.

Connected, Involved Citizens

Our citizens are going to determine if any measures proposed to address the Smart City Challenge are indeed a success. Fortunately, we have a number of strong, citizen lead organizations that currently provide input on transportation related issues. Three such organizations are: Rochester Cycling Alliance, Reconnect Rochester, and Community Design Center Rochester. Through education and outreach, each of these groups help create a broad base of support for our existing public transit system, shape regional policies to improve the system, and reconnect our community in ways that improve personal mobility, urban vitality, environmental sustainability, and economic development. We would look to these groups, as well as other City and citizen-lead organizations, to be partners in all phases of the Smart City Challenge.

We will be reaching out to citizens that are not currently engaged through the use of the City's website, television and radio, public outreach meetings, and social media.

Social media will be especially useful in broadening public awareness of the initiatives that will be undertaken. We will meet people where they expect to be met in this day and age where 85% of American adults use the internet and 91% of adults have a cell phone. We want to engage a wide range of people during the process and the best way to reach an audience more inclined to use new technology is through social media.

Architecture & Standards

Given the amount of data that will be collected from a variety of partners, a robust system of integrated functionality supported by a common, shared database is a must. The City of Rochester currently employs ITS systems for transportation data collection. As described in the IBM Smarter Cities Challenge Report, a solution based system will need to incorporate the following:

- » Person-centric applications
- » Mobility
- » Master data management
- » Content management systems
- » System interfaces
- » Data security
- » Role-based user access

» Audit-tracking and reporting
» Data warehousing
» Operational reporting
» Analytics and predictive analytics
» Document management
» Disaster recovery and performance

As an on-going task within the Smart City Challenge, an evaluation will be made of these system components to determine if the existing ITS system requires updating. If new standards are needed, recommendations will be provided to USDOT and the Connected Vehicle Reference Implementation (CVRIA) to the extent possible.

Using the CVRIA, we will determine the roles, processes, data flows, physical components, and communication protocols necessary for privacy and security operations using the SCMS prototype. We will concurrently use the Systems Engineering Tool for Intelligent Transportation (SET-IT) to complete the project architecture of diagrams and definitions of all layers and functional components along with an inclusive Privacy and Security Management Operational Concept, aligning requirements to necessary aspects of the CVRIA. Our program management consultant, Stantec, will identify the needs, stakeholders, systems, and Smart City Connected Vehicle applications that will make up our deployment program. We will enter the information gathered into the SET-IT software and tailor each application at layer 2 in the physical and enterprise views. We will then tailor the layer 1 and layer 0 physical diagrams as well as the layer 0 enterprise diagrams in preparation for presentation of the project architecture to the stakeholder review panel. We will generate the Concept of Operations from the SET-IT software and provide support and/or develop the remaining sections of the Concept of Operations not detailed in the generated document.

Information & Communications Technology

In Rochester, like many other cities, our existing Information and Communication Technology (ICT) infrastructure is lacking capital investment due to our resurgence from the recessionary era of past decade. The Smart City Concept will allow us to re-evaluate our ICT infrastructure and build a robust, efficient, secure and resilient ICT to lower our consumption while building a redundant hi-bird communication system. Through our partnership with IBM and GE, we will focus on Green Networking as the way to help reduce carbon emissions by the ICT industry. The Smart City Challenge will present us with opportunity to implement our City's green networking vision by selecting energy-efficient networking technologies and products, and minimize resource use whenever possible. Our ICT green networking practice will include: implementing virtualization; practicing server consolidation; relying on cloud computing; upgrading older equipment for newer, more energy-efficient product; employing system management to increase efficiency; and promoting telecommuting. Our vision is to lower consumption by 25% by 2025 and we will leverage mostly private sector capital investment by providing multi-year incentives in sharing cost reduction revenue.

We will develop security requirements for the DSRC devices that we expect to deploy in Rochester. We will follow the Common Criteria methodology, an ISO standard, to complete an analysis of needs and develop recommendations for a security standard. The methodology includes analyzing threats, assumptions, policies, objectives, and developing security functional requirements to mitigate threats and ensure confidentiality, availability, integrity, authenticity, and non-repudiation of transmitted data for ICT. We will compare our analysis against similar domestic and international efforts to ensure a comprehensive assessment of security needs. Our team expects to leverage our existing analyses and update use cases, measures, and requirements, with an overall system

implementation and application deployment viewpoint, to develop and execute an effective security management operational strategy.

Our partners at Stantec have extensive experience with the current SCMS design through their close working relationship with USDOT and its partners as they have developed the fundamental security system (SCMS) for vehicle-to-vehicle (V2V) and vehicle-to infrastructure (V2I) safety systems and applications. Our team will leverage the expertise in this domain to determine which requirements can be fulfilled based on the prototype SCMS and align these requirements to each SCMS functional component. Using the CVRIA, we will determine the roles, processes, data flows, physical components, and communications protocols necessary for privacy and security operations utilizing the SCMS prototype. The team will concurrently use the SET-IT to complete project architecture of diagrams and definitions at all layers and functional components along with an inclusive Privacy and Security Management Operational Concept aligning requirements to necessary aspects of the CVRIA. The Security Management Operational Concept will include clear direction on how to approach ensuring physical security at the vehicle and roadside infrastructure level. Several current hardware security standards exist for ensuring against tampering of physical devices, many of which may be applicable to DSRC devices integrated or added on to vehicles. In addition, maintaining strong internal organizational controls, whether at the technical, legal, administrative, or personnel levels should be developed and included in this Concept in order to provide as robust a security environment as possible. We have already conducted research and analysis into these areas of control, and will bring its understanding to development of the deployment plan. Tools to monitor, measure, and track security elements at all levels of the Smart City system will also be specified in the Security Management Operational Concept.

Smart Land Use

The story of poverty in Rochester is one fueled by disinvestment and depopulation. The City lost 24% of its population between 1970 and 2010, and increased its poverty rate by 18% over the same timeframe. These figures are even more dramatic in high poverty areas, with those who are able moving away from issues of crime and disinvestment towards safety and economic opportunity. Neighborhoods like Marketview Heights have had more than 20% of their homes demolished due to vacancy and blight. According to Census LODES Origin Destination Data, less than 5% of employed residents in neighborhoods like Marketview Heights hold jobs in their neighborhood, and over 50% of those employed are making long daily commutes to low skill jobs in the suburbs. Over 50% of the jobs located in the neighborhoods are held by suburban commuters. This seemingly illogical reverse commute is one of the hallmarks of the decline of these neighborhoods and the macro-economic forces driving this transformation.

To address this challenge, key recommendations of both the Rochester-Monroe Anti-Poverty Initiative (RMAPI) and the IBM Smarter Cities Initiative relate to Smart Land Use. Specifically, RMAPI recommends the purposeful development of 'Complete Communities' while IBM recommends establishment of 'Urban Villages.' Both recommendations focus on the creation of dense, mixed-use development

Smart land use can create a complete community in neighborhoods like this.

nodes that feature mixed-income housing, retail and services, employment, health care, educational facilities and other services that are well served by an integrated, multi-modal transportation network, minimizing the need for private car use. The City will work with its Smart City partners to advance these recommendations.

The City of Rochester Zoning Code provides us with a strong foundation. The Code recognizes, promotes, and protects a dense, walkable, and mixed-use urban character that is sustainable and critical to a Smart City. The Code breaks away from traditional zoning which usually attempts to separate uses and often defers to vehicle-oriented site development. Commercial Districts and Village Center Districts provide for a dense mixture of uses such as housing, retail and other complementary uses that serve the adjacent neighborhoods and the community at large. Design standards that create, enhance, and reinforce the design relationships between buildings, sites, and streets establish an ambiance that is dense and pedestrian-oriented. The Zoning Code is evolving and will continue to respond to the need for sustainable redevelopment in Rochester that protects the City's uniquely urban character.

The City is in the process of updating its Comprehensive Plan, which currently dates from 1999. A key component of the Comprehensive Plan Update is the upcoming Comprehensive Access & Mobility Plan, the transportation component of the Plan. The update process has begun and will take place concurrent with the timeline of the Smart City Challenge, providing a unique opportunity for the various Smart City initiatives to inform the Comprehensive Plan, which will guide land use and development policy and decision-making in Rochester for the foreseeable future.

RISK MANAGEMENT

Major initiatives requiring collaboration of public and private entities working towards deployment of transformative and groundbreaking solutions will require careful and ongoing attention to details to reduce risk and assure successful outcome. Our team has identified several high level key issues as well as mitigating measures to address them as noted in Table 1 below.

Table 1: Risk Management

Risk Category	Key Issues	Rank	Mitigation
Technical	Legacy Systems' Operational Incompatibilities	Medium	Identify and address as early as possible in the process
Policy	Shifting of priorities by public agencies	High	Maintain ongoing dialogue among all parties and assess
	Dedicated ongoing O&M funding	Medium	Assure Financial and Business Plans necessary funding levels
	Need for State legislation to enable innovation	Medium	Work with State leaders and elected delegation to craft and pass legislation.
Institutional	Keeping the players at the table	High	Maintain ongoing and "something for Everyone" concept
	Team readiness, education and training	Medium	Engage all players in an ongoing training program

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OUR TEAM

Partners

The City of Rochester, under the leadership of Mayor Lovely Warren and with assistance from our committed consortium of partners, is well structured and organized to accomplish this mission. The City has consistently taken a leadership role in transportation and believes the future economic vitality of the region depends on the ability to provide safe, reliable, and efficient mobility through the transportation network. It is clear that in the 21st Century we will not be able to be competitive economically without smarter transportation networks that provide improved transit accessibility to our underserved population. We must provide an efficient transportation system by using the latest development in Connected Shared Automated Vehicles (CSAV) applications, testing emerging technologies, and leveraging partnerships with the private sector. Examples are EasyMile, an international firm that is considering opportunities to establish a manufacturing facility in Rochester, and other tech giants such as GE, IBM, Xerox and Kodak.

The City of Rochester, in collaboration with the public sector agencies, private sector businesses, institutions, public advocacy, and non-profits, is fully committed to ROC Forward, Rochester's Smart City vision. If selected, Rochester will successfully establish itself as the model Smart City for the nation.

Governance Processes

Implementation of a comprehensive governance framework is critical to ensuring interagency collaboration and transparent accountability throughout the life of the Smart City Challenge. The City of Rochester will serve as the primary Point of Contact with USDOT for all aspects of the Smart City Challenge. To assist City staff and leadership with management responsibilities, Stantec will provide project management services and technical expertise, working closely with all project partners to ensure successful

Table 2: ROC Forward Smart City Consortium

Public Sector	Private Sector	Others
City of Rochester (Lead Agency)	Easy Mile	Center for Disability Rights
Genesee Transportation Council	GE	Community Design Center Rochester
Monroe County	IBM	Greater Rochester Chamber of Commerce
New York State	Kodak	Greentopia
Rochester-Genesee Regional Transportation Authority	Stantec	Reconnect Rochester
	Verdant Global	Rochester Cycling Alliance
	Xerox/PARC	Rochester Downtown Development Corp.
	Zipcar	Rochester Institute of Technology
	Zagster	

implementation of the City's vision. It is anticipated that a Governance Board, chaired by the Mayor and consisting of high-ranking officials from the many public and private sector partners, will provide high-level oversight of the Smart City program. A Technical Council will provide ongoing operational management of research and technical activities. The City Engineer will chair the Council, assisted by Stantec, with staff-level representation from all project partners. The City's Director of Innovation will serve as Chief Data Officer for the purposes of the Smart City Challenge. Lastly, a Citizens' Advisory Committee will be established with representation from City staff, Stantec, and the many public advocacy organizations that will help to ensure that the Smart City initiatives are meeting the needs of the public. The Committee will elect a chairperson from among its members, who will then serve on the Governance Board and appoint a representative to serve on the Technical Council.

Partnerships

As referenced above, the City of Rochester has assembled an impressive and wide-ranging consortium of public agencies, institutions of higher learning, leading edge private sector businesses, and public advocacy organizations. Our primary academic partner is RIT, a University Transportation Center (UTC) consortium member with significant and growing experience in transportation research. RIT will coordinate research activities associated with Rochester's Smart City vision, thereby establishing long-lasting partnerships with the public and private sector. Our many world class private sector partners will work with the City to deploy their innovative advanced transportation technologies, while demonstrating proof of concept and leading to commercialization that will grow the national economy and position America as a global leader in these emerging fields. These companies include: EasyMile, GE, Xerox, IBM, Kodak, and Verdant Global. We anticipate additional public-private partnerships to emerge as Rochester moves ahead as the selected city. Our public agency partners involve all levels of government: State (New York State Department of Transportation, the Safety & Security Planning & Development Bureau, and Empire State Development), County (Monroe County), and regional (RTS, GTC).

OUR SYSTEM

Arterial Miles

There are 103.96 centerline miles of arterial streets in the City of Rochester. The vast majority of these streets are within the City's jurisdiction.
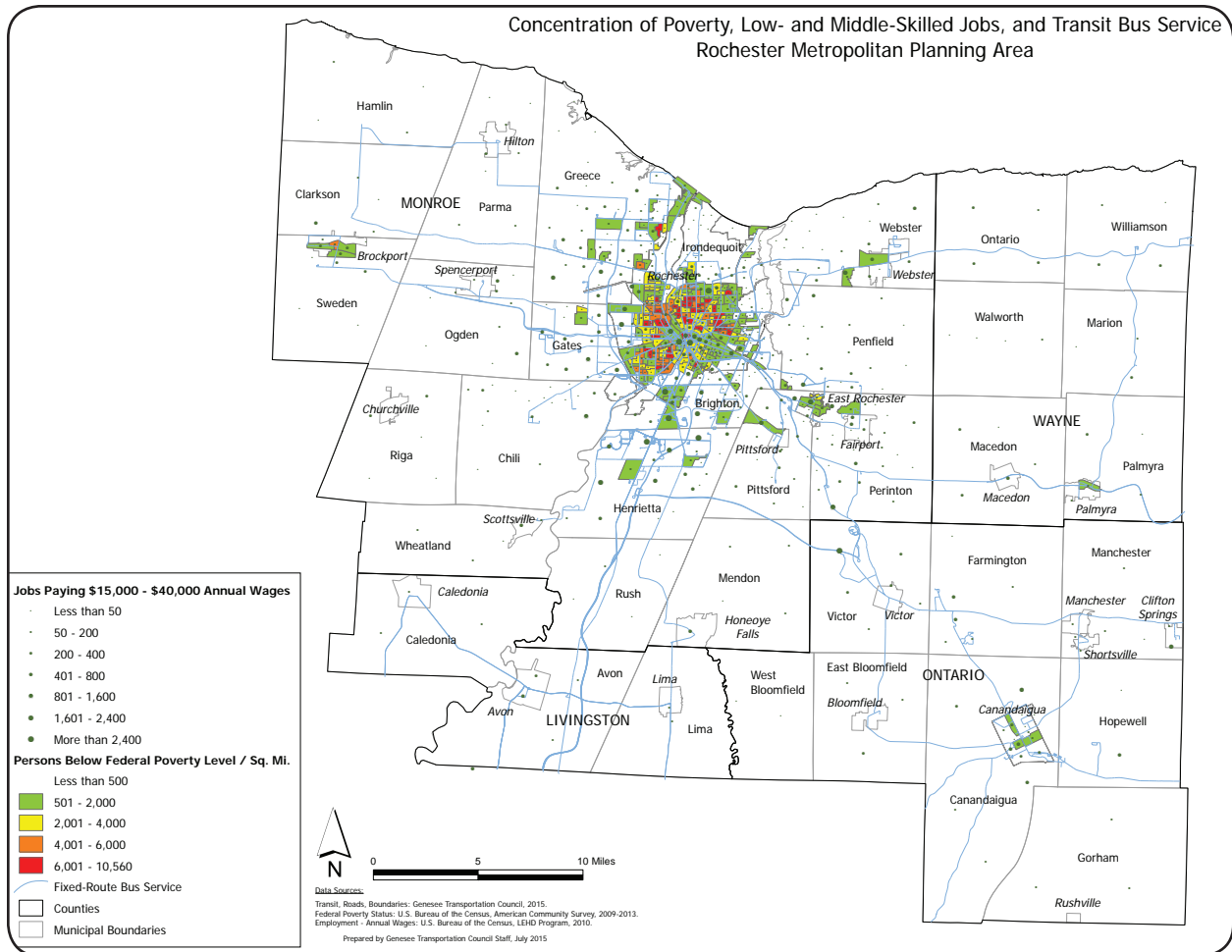
Freeway Miles

There are 14.95 centerline miles of freeway in the City of Rochester, all under the jurisdiction of New York State.

Transit Services

Rochester Transit Service (RTS) currently operates more than 41 routes serving the city and neighboring suburbs. More than 17 million riders utilized RTS in 2013. The $40 million RTS Transit Center opened to the public in November 2014. The Transit Center created a centralized, indoor transfer point for bus patrons at the heart of the Downtown Innovation Zone.

RTS also provides paratransit service for over 175,000 riders in accordance with the Americans with Disabilities Act (ADA) to certified customers with limited mobility.

GTC is currently developing an update to the Public Transportation Human Service Coordinated Plan. As part of that effort, GTC conducted analyses in support of the USDOT's Ladders of Opportunities initiative. One of the analyses included mapping the location of low- and middle-skills jobs in relation to concentrations of poverty and fixed route bus service. This is shown on the map on the following page.

Jobs Paying $15,000 - $40,000 Annual Wages
- Less than 50
- 50 - 200
- 200 - 400
- 401 - 800
- 801 - 1,600
- 1,601 - 2,400
- More than 2,400

Persons Below Federal Poverty Level / Sq. Mi.
- Less than 500
- 501 - 2,000
- 2,001 - 4,000
- 4,001 - 6,000
- 6,001 - 10,560
- Fixed-Route Bus Service
- Counties
- Municipal Boundaries

0   5   10 Miles

Data Sources:
Transit, Roads, Boundaries: Genesee Transportation Council, 2015.
Federal Poverty Status: U.S. Bureau of the Census, American Community Survey, 2009-2013.
Employment - Annual Wages: U.S. Bureau of the Census, LEHD Program, 2010.
Prepared by Genesee Transportation Council Staff, July 2015

Low- and Middle-Skill Jobs in Relation to Concentrations of Poverty & Fixed Route Bus Service

Shared-Use Mobility Services

Carsharing services in the City of Rochester are currently offered through Zipcar. There are currently eight Zipcars available in the City and another two vehicles just south of the city at RIT. Zipcar and the City are working together to grow the availability of carshare services in the city. Zipcar is a partner in our Smart City vision. Although bikesharing is not currently available in Rochester, the City anticipates an initial rollout as soon as summer 2016. Zagster, a bikeshare service provider, is a partner in our Smart City vision. Ridesharing services such as Uber and Lyft are not currently able to operate in New York State, outside of New York City. The City of Rochester is supportive of pending legislation in Albany to permit ridesharing services to operate statewide. The City anticipates this legislation will be approved in 2016.

GTC is the sponsor of roceasyride, a free, easy-to-use online trip planning tool that helps people identify options to save money and protect the environment by riding the bus, carpooling, and bicycling. It includes features that make it easy to track the cost savings and the environmental benefits that result. Roceasyride serves individuals, businesses, and organizations throughout the nine-county Genesee-Finger Lakes Region, including the City of Rochester.

Information & Community Technology (ICT)

There is an extensive municipal fiber network within the City of Rochester that possesses excess capacity. The City and Monroe County are working together to take advantage of this resource, with particular interest in considering a municipal wi-fi network. This fiber backbone is a significant advantage for the deployment of Smart City Challenge elements.

Intelligent Transportation Systems

The Greater Rochester area is a recognized national leader in regional coordination for Intelligent Transportation Systems (ITS) implementation. GTC facilitates a Transportation Management Committee (TMC) that provides a forum for regional cooperation on ITS and operations issues. The City of Rochester is an active participant on the TMC and routinely collaborates with Monroe County Department of Transportation, which serves as the City's traffic engineer, and NYSDOT. On the strength of this and other initiatives, regional agencies have deployed hundreds of ITS field devices as well as central control and communications infrastructure impacting every mode of transportation in the region. As the facilitator of the TMC, GTC serves as the "gatekeeper" of the federally-mandated Regional ITS Architecture and works with all stakeholders to ensure relevant ITS elements and processes are consistent with the Regional ITS Architecture.

A forthcoming endeavor of GTC, with oversight of the TMC, is a Transportation System Management and Operations (TSMO) Strategic Plan to update the existing ITS Strategic Plan that was adopted in 2011. The TSMO Strategic Plan will look at all existing and planned ITS elements and lay the groundwork for the implementation of connected and autonomous vehicles in the region.

Smart Grid

In partnership with Energetics and the Electrification Coalition, the City is currently assisting with development of the Electric Vehicle (EV) Market Development Program using funding from the New York State Energy Research & Development Authority's Cleaner Greener Communities Program. The goal of this market development program is to stimulate and expand the market for EV purchases. It uses a three-pronged approach of installing EV charging stations, offering EV incentives, and conducting outreach. It leverages and builds on prior NYSERDA sponsored projects and EV initiatives, including EV-readiness resources, ChargeNY website, regional EV charging station plans, City of Rochester's EVSE demonstration project, and EV tourism study for Mid-Hudson. Innovative efforts are proposed that directly support Governor's ChargeNY initiative.

First, implementing EV Charging Station Plans for the five regions along the I-90 Corridor (Capital District, Mohawk Valley, Central New York, Genesee Valley/Finger Lakes, and Western New York) will spur EV acceptance and adoption in regions that lag behind NYC's and Long Island's embrace of this clean technology. The outcome will be:

» 25 EV charging stations (5 in each region) strategically installed in critical areas to enable greater EV use.
» Educated municipalities on EV charging station permitting and communities on EV technology.
» 900 rebates for EV purchases to spur EV sales and establish more EV advocates (the new EV owners), and
» 40 ride-n-drive events to promote EVs and allow consumers a test drive opportunity of different makes and models.

Second, the Rochester EV Deployment Community will foster a model EV Community in which EVs are embraced by the public and promoted by business and government. This approach moves EVs from a niche product into a dominant and ubiquitous concept. The outcomes will be:

» 9 EV charging stations in City of Rochester garages for public and city-owned EVs.

» EVs for the City of Rochester as an ambassador of the technology and to showcase their operation.

» extensive community engagement to inform and educate the residents and businesses throughout the City about the benefits of EVs. The Rochester EV Deployment Community will create replicable models for other New York communities to use for accelerating EV adoption.

DATA COLLECTION

Current Data Collection

The City has been continuously building capacity to capture and analyze data to inform decision making and measure outcomes. It has a history of sound practice in these areas especially in areas of grant management outcome tracking and in the investment and planning decisions in the Department of Neighborhood and Business Development.

The City recently overhauled its Geographic Information Systems and related IT infrastructure. This has greatly improved the access and sharing of data within the City organizations of not only of GIS data, but all the City source data and other available public data.

In spring 2015 the City launched the Office of Innovation and Strategic Initiatives, a research and strategy team reporting to Mayor Lovely A. Warren. One major focus of the team is to ensure that scientific tracking and outcome measurement are the foundation of any new City initiatives. This is not only to help evaluate progress and track success, but also to position initiatives for more sustainable funding opportunities.

The City and the Office of Innovation is an integral partner in the Rochester Monroe Antipoverty Initiative (RMAPI), a large consortium of government and non-profits working to impact poverty in Rochester. Together, the RMAPI and the City will institute an anti-poverty program in a pilot

district to test effectiveness and measure impact. Through this partnership, the Office of Innovation will work with local and state experts to design metric tracking that taps into data assets from non-profits and government agencies to track long-term individual outcomes and geographic trends. It will also work to implement best practices in data security, and privacy standards. As these programs move toward implementation, staff responsible for sensitive personal data will undergo training on privacy and security protocol.

The City currently has in place data sharing agreements with the City School District, the local Library system, and Monroe County. It shares data on students, library patrons, and recreation center users. The City primarily shares property assessment data and street asset data with the County. The City has also has expanded data sharing in partnership with Gov. Cuomo's Open NY data initiative. The Police Department also receives shared data from the NYS Department of Corrections and Community Supervision and other state and federal law enforcement agencies to help track and improve police strategy.

We have experience in and can leverage data from a variety of sources such as traffic cameras, other sensors, and social media to enable opportunities to optimize operations (traffic flow, automated traffic sign detection, and recognition), monitor infrastructure conditions (road conditions, snow conditions, pot holes), infrastructure planning (public transit), traffic enforcement (detecting passenger compartment violations, speeding violations), population sentiment detection for city agency policies, and system health monitoring.

In addition to City data collection systems, Genesee Transportation Council (GTC) commissions an annual land use monitoring project conducted by the Monroe County Department of Planning and Development that includes the City of Rochester. The most recent year for which data collection and analysis is complete is 2014.

GTC has also contracted with INRIX to provide probe-based travel time data for the region,

including access to INRIX Analytics. GTC has access to historic and real-time travel data. GTC's agreement with INRIX allows for member agencies, including the City of Rochester, to access and use this data.

GTC supports the Monroe County Department of Transportation's (MCDOT) effort to collect traffic volume and classification counts in the City on a periodic basis. This data complements the efforts of the New York State Department of Transportation (NYSDOT) to collect traffic volume and classification counts for the Highway Performance Monitoring System (HPMS).

Further, GTC is responsible for the development and on-going maintenance of a Regional Travel Demand Model and regularly conducts analyses for member agencies, including the City of Rochester, and other municipalities in the Rochester Metropolitan Planning Association.

Regional Transit Service (RTS) collects the following data for the transit system:

» Ridership data by route and stop based upon the use of the farebox on the bus.
» Ridership data by route and stop based upon the number of people who walk on the and off the bus.
» Smartcard and fare media pass tracking by serial number.
» Real-Time GPS location of the bus at each stop.
» Customer and organization contact Information through call center, fare media, social media, in person, and through e-mail.

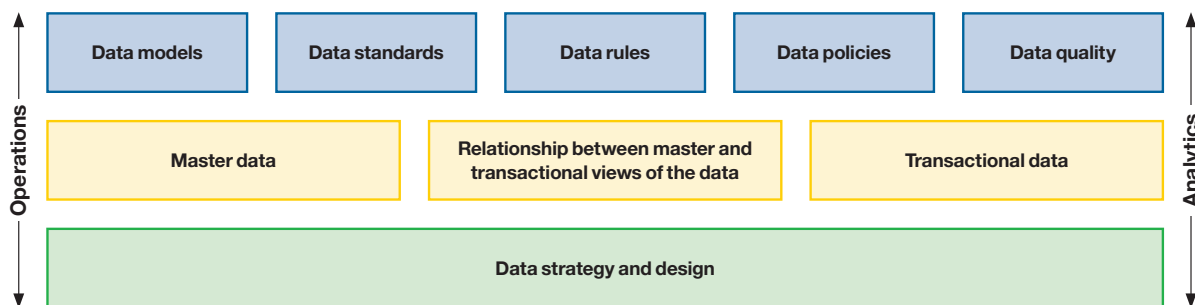A wealth of data is currently being collected, analyzed and employed to enhance the transportation system and the economic environment of the City.

New Data Collection

The essential goal for technologies addressing data collection is the wealth of disparate systems and data sources involved. This Big Data problem exists in every city today. This inability to collect, analyze, and sharing between the various city transportation systems and human service organizations is common to most cities across our nation. The development of a standardized set of data workflow processes, security standards, architectural design, and search criteria, will benefit many cities by reducing this disparate data gathering and sharing processes.

The City and RMAPI are currently working closely with the NYS Poverty Task Force, a group of high level state officials to formalize data sharing agreements with NYS OTDA/ Monroe County Department of Human Services (Public Benefits), NYS Department of Labor, and NYS Department of Corrections and Community Supervision. We will expand this sharing agreement to include our additional public partners (MCDOT, NYSDOT, RTS) as well as our private partners, (XEROX, IBM, GE, etc.) This will be essential to track and demonstrate long term outcomes for individuals interacting with the Smart City Challenge team.

The IBM Smarter Cities Challenge Report, dated January 27, 2016, provided a thorough outline for data collection and data governance as related to anti-poverty initiatives. In a coordination effort, our team will adopt a similar structure as described in the following manner:

A Model for Data Governance: from IBM's Smarter Cities Challenge Report

Data governance

» **Establish a Data Hub for collaboration** – this hub will centralize information for all participants.
» **Assign Data Stewards for the Data Hub** – each partner will identify a data liaison and will appoint data stewards with clear roles and responsibilities.
» **Define and Publish Data-sharing Policies and Guidelines** – create a data coalition agreement for all members of the Hub.
» **Appoint a Chief Data Officer (CDO)** – the primary role of the CDO will be to understand, advocate, and govern on behalf of the data.
» **Determine data governance actions** – develop and implement a data strategy with clear objectives, data quality management processes, data standards, and data policies.
» **Enable data analytics** – build capabilities to develop analytical models and outcome measurements.

ARCHITECTURE, STANDARDS & PROCESSES

The City of Rochester and other regional transportation agencies (GTC, Monroe County, and NYSDOT) who are participating in this project are also participating in the development and update of the Rochester's Regional ITS Architecture. Projects from the 2011 ITS Strategic Plan are integrated into the Regional ITS Architecture and evaluated for consistency with the New York State-wide ITS Architecture. Updates to the Regional ITS Architecture are undertaken as often as needed. The 2011 ITS Strategic Plan called for applying a consistent set of standards to traffic signals, communications, and data interchange across the region. All projects undergo a governance review to ensure they conform to the recommendations of the strategic plan and ITS architecture.

Furthermore, when developing the system requirements for our Smart City vision we will ensure compliancy with IEEE and ISO Standards as established by IEEE 1233: correct, compatible, complete, feasible, verifiable, traceable, and modifiable. The requirements will be developed based on USDOT guidance as well.

With respect to interacting and sharing lessons learned with the standards development organizations (SDOs), a number of state and regional transportation staff are active and participate in ITS standard development efforts. Our private sector partners are national and international leaders in the US standard development activities. For example, Koorosh Olyai is the chair of the US delegation to the International Standards Organization Technical Committee 204 (ISO TC 204) which is responsible for development of ITS Standards as well as a harmonized connected vehicle (CV) suite of standards. Our team members are also members of the SAE and IEEE connected vehicle and communications standards groups who are promulgating Internet of Things (IoT), Communications (DSRC), Big Data, Connected Vehicle (CV) and Automated Vehicle (AV) standards. These are critical in deploying a consistent set of standards for this challenge. We strongly support development of standards for interoperability purposes nationally.

With respect to interacting and sharing lessons learned with the standards development organizations (SDOs), a number of New York State and City of Rochester transportation staff are active and participate in ITS standard development efforts. Our private sector partners are National and International leaders in the US standard development activities, for example, Koorosh Olyai is the chair of the US delegation to the International Standards Organization Technical Committee 204 (ISO TC 204) which is responsible for development of ITS Standards as well as a harmonized connected vehicle (CV) suite of standards. Our team members are also members of the SAE and IEEE connected vehicle and communications standards groups who are promulgating Internet of Things (IoT), Communications (DSRC), Big Data, Connected Vehicle (CV) and Automated Vehicle (AV) standards. These are critical in deploying a

consistent set of standards for this challenge. We strongly support development of standards for interoperability purposes nationally.

GOALS & OBJECTIVES

When you look at the history of transportation in our community, the economy of the City of Rochester has been determined in no small part by transportation assets, such as the Erie Canal, the railroads, and the growth of the interstate system. Now, building on these assets, the City of Rochester's vision is structured to strengthen our transportation network in the 21st Century by leveraging advanced technologies to address the challenges we have in safety, mobility, sustainability, economic vitality, and climate change. Rochester is ready to connect everything.

Rochester will move better by enhancing mobility.

In the 21st Century, Rochester will focus on the overall connectivity of our neighborhoods. We will provide Rochesterians with the needed access to reliable, affordable transportation that provides opportunities for employment, child care, health care, education, as well as all of the other services residents and families need. As mentioned previously, Rochester has the second-highest poverty rate in the nation, resulting in a situation that threatens our community's economic future. Enhanced mobility is one avenue to help turn this situation around.

» Rochester will test automated vehicle performance in a four-season climate.
» Rochester will demonstrate that an enhanced transit service can make a positive impact on low income residents.
» Rochester will provide real-time traveler information and emerging mobility services to improve personal mobility.
» Rochester will increase mobility for pedestrian and bicycle access.

» Rochester will focus mobility improvements on our overall demographics (e.g. aging population, disabled, millennials, etc.).

Rochester will improve safety.

By using advanced technologies, including CV technologies, Rochester will reduce the number and severity of collisions, resulting in fewer fatalities and injuries.Efficiency is at the forefront of Rochester's vision for the future.

Rochester will focus on creating a connected community that will provide the infrastructure for the future.

» In the 21st Century, everyone needs the ability to be connected and therefore the City of Rochester will be incorporating a City-wide Wi-Fi network.
» Smart Road technology will also be incorporated to make sure that every signalized intersection within the City of Rochester has the ability to adapt to the changing traffic conditions.

Rochester will build for a sustainable future.

Rochester's primary goal is to build a thriving liveable community throughout the city that provides access, neighborhood cohesion, opportunity, economic competitiveness, and a "sense of place."

Rochester will adapt to a changing climate.

The technologies implemented by the City of Rochester will support a more sustainable relationship between transportation and the environment through fuel use and emissions reductions.

Upon selection as a Smart City Challenge Finalist, the City of Rochester will work with our consortium partners to identify a set of targeted performance measures that relate to the primary impact of our deployment. The deployed technologies will be capable of generating the data needed to demonstrate how well the system is performing with respect to the identified target measures.

EVIDENCE OF CAPACITY

The City of Rochester has a long history of delivering high-quality, large-scale public projects utilizing federal funding. The most current example of this is the Inner Loop East Transformation project, currently under construction. This $24 million project received $17.7 million in TIGER funding in 2013 to remove a deteriorated and underutilized section of the Inner Loop Expressway in Downtown Rochester and replace it with a new high quality complete street. This project will reconnect neighborhoods, remove structurally-deficient bridges, encourage walking and biking, and create over six acres of land for redevelopment that will generate jobs and leverage private investment. This project is being developed by the City of Rochester on schedule and on budget.

Other Recent examples of major federally-funded City transportation projects include:

» **Midtown Rising Redevelopment**, a $100 million project, is significantly shaping the rebirth of the downtown core through major public and private investment, job creation, and infrastructure development. At the heart of the project is the rehabilitation of the nearly 9-acre former Midtown Plaza into a mixed-use area designed to attract a critical mass of residents and 24/7 amenities that contribute to a vibrant live-work environment. This project has created a resurgence of downtown activity and is currently redefining Rochester's City Center for future generations.
» **The Broad Street Tunnel Reconstruction project**, a $23 million project completed in 2011 which filled in a deteriorating subsurface tunnel and fully reconstructed a major surface arterial.
» **The Port of Rochester Infrastructure Improvements project**, a $40 million project that constructed new streets, sidewalks, lighting, drainage, parking, multi-use trails, and public space on a previously-undefined parking area surrounding the historic Port Terminal Building.

Ground Breaking Ceremony for the Inner Loop East Transformation Project

Executive Commitment: The City of Rochester will be the grant recipient and primary point of contact responsible for federal grant administration and reporting procedures. Mayor Lovely Warren, as demonstrated by the cover letter to this application, is committed to successful delivery of our Smart City vision.

Workforce Capacity: The City of Rochester has an excellent working relationship with local labor unions. In fact, for three of the projects listed above, the City developed project labor agreements (PLA's) with the local unions to assure that sufficient workforce capacity is available in the Region. The City of Rochester, along with the local unions, is very proud of their teaming abilities and past successes. Likewise, the region has well-established partnerships for workforce development through regional academic partners such as Monroe Community College. Should Rochester be chosen as a Smart City Challenge finalist, the City will work with regional partners to create a workforce development strategy to ensure that the local labor force is ready and equipped for the economic opportunities that will arise.

Degree of Infrastructure Readiness: The transportation infrastructure of the City of Rochester is already well-prepared to meet the needs of the Smart City Challenge. The traffic signal system is computerized and coordinated remotely from the Regional Traffic Operations Center, where traffic monitoring capabilities are active 24/7. Likewise, the RTS transit fleet is outfitted with CAD/AVL and provides real-time arrival and status information to the public through multiple platforms. There is an expansive municipal fiber network in the city with excess capacity.

Data & Performance Management Capabilities: The City and consortium partners already collect and analyze data for a wide variety of municipal applications and public information. The City's Department of Information Technology is well aware of the Smart City Challenge and is prepared to accommodate any and all requirements in coordination with our partners.

LEVERAGING FEDERAL RESOURCES

It is anticipated that opportunities for cost-sharing and in-kind service delivery will be made available through the City and its project partners. The ability to leverage the federal resources provided through the Smart City Challenge to attract additional financial and technical assistance will help to ensure that Rochester's Smart City vision produces a real and long-lasting impact on Rochester, New York State, and the nation as a whole. Upon notification as a Smart City Challenge finalist, the City will work with our consortium of partners to secure commitments to leverage additional funding and/or in-kind products and services.

ROC Forward: creating a smart, sustainable city for the 21st Century.

City of Rochester, NY

In partnership with