OMAHA

WE DON'T COAST®

OMAHA: We Don't Coast, We Build a Smart City

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PART 1

Vision Narrative

Photos courtesy of HDR Engineering; HDR Architecture; The Omaha Convention & Visitors Bureau; and Tom Kessler.

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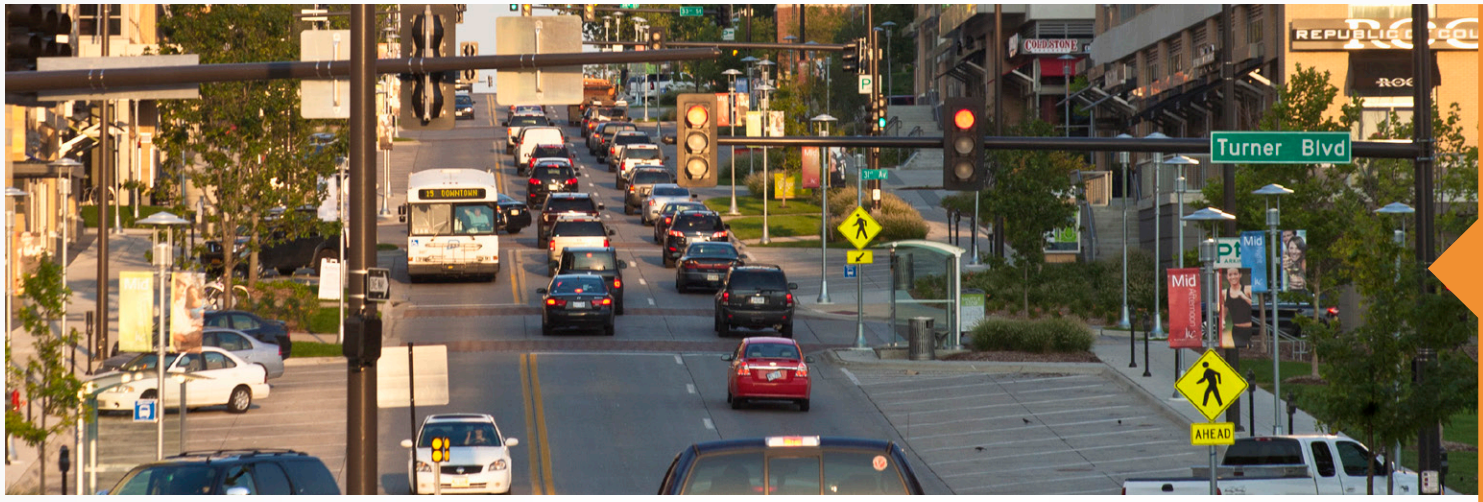
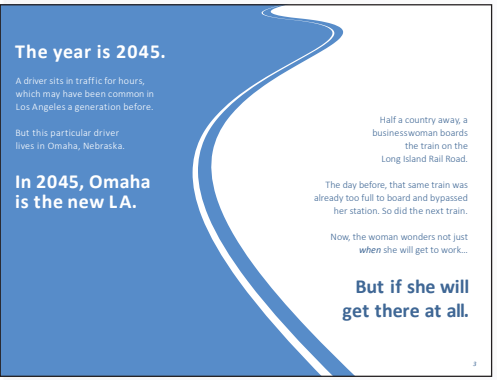


"In 2045, Omaha is the new L.A." - sprawled across the first page of the USDOT's Blue Paper - offers a bleak outlook for the future of transportation in our country, with the status quo. However, we know that in Omaha, *We Don't Coast*. Our motto is simple, yet emblematic of the philosophy we use to rally community change and innovation. Our community is driven by a mantra that celebrates our uniqueness and love for our place in the world. You may ask, "*Why Omaha?*"



USDOT Blue Paper

Omaha is the perfect location for America's first Smart City because we have a vision that embodies the goals and objectives of the Smart City Challenge. Omaha possesses the characteristics necessary to make it the ideal city to demonstrate how advanced data, ITS technologies, and applications can be used to reduce congestion, keep travelers safe, and protect the environment.

LOCAL FEEL, WITH NATIONAL APPEAL

Home to five Fortune 500 companies and five Fortune 1000 companies, Omaha is nestled in the heart of America. Local attractions draw many national and international audiences. Omaha hosts Henry Doorly Zoo and Aquarium, the "world's best zoo," according

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#1 - The Top 10 Best American Cities to Work in Tech in 2015
(*SmartAsset* - September 2015)

The 5 Best Big Cities
(Best in the Midwest)
(*Time Magazine* - August 2015)

#1 - Best Cities for Car Drivers
(*nerdwallet* - May 2015)

One of the top 13 Fastest Growing Tech Hubs in the U.S.
(*Uncubed.com* - February 2015)

#2 - Best U.S. Cities for Millennial College Students
(*CNBC* - May 2015)

to *TripAdvisor,* and is home to a large number of national events, most of which are located in our proposed demonstration corridor. These events include the NCAA College World Series, the NCAA Men's Basketball Tournament, the NCAA Women's Volleyball Championship, the Olympic Swim Trials, and the Berkshire Hathaway Shareholder Meeting. These events bring hundreds of thousands of people to our proposal demonstration corridor every year, providing repeated opportunities for enhanced public feedback.

ENVIRONMENT

Omaha has a heightened interest in addressing air quality issues because our city is teetering at the edge of nonattainment with respect to National Ambient Air Quality Standards. If we do not identify ways to stoke behavior change in our citizens, it is projected that we will be in nonattainment within the next decade.

Omaha is a true midwestern city in which the weather varies dramatically from season to season. Omaha provides the perfect testing grounds for tomorrow's technologies in any type of weather.

MOBILITY

When it comes to getting around, Omaha has a lot to brag about:

- an average 19.4 minute one-way commute;
- a Metro Transit Bus system that serves more than 5.2 million people annually;
- 20 miles of marked bike lanes and routes for cyclist commuters;
- 90 daily departures for domestic and international travel out of Eppley Airfield.

Despite a robust public transportation system, Omaha has traditionally been very automobile dependent. Fewer than 2 percent of the population uses transit. With the Smart City Challenge, we have the opportunity to make real, measurable change with respect to getting people to choose alternative modes of transit and transportation.

Congestion levels in the Omaha metropolitan area are generally moderate and tolerable but we are on the cusp of slipping into serious congestion levels. We believe that this makes Omaha the ideal environment for testing congestion-reducing technologies and strategies. In other cities where congestion levels are much more severe, it will be difficult to assess the benefits of these technologies and strategies.

WHY OMAHA?

Omaha is rich with diversity and opportunity. We welcome the challenge and look forward to sharing our philosophy and our vision with the country. The following pages highlight our Smart City vision and further illustrate, *Why Omaha!* ◁

Our Vision for Omaha

Make our transportation system safer for drivers, bicyclists, and pedestrians and make our overall community a safer place to live and work.

Improve the mobility of our citizens, visitors, and businesses so that this is never seen as a limiting factor when choosing where to go for recreation, work, entertainment, or retail.

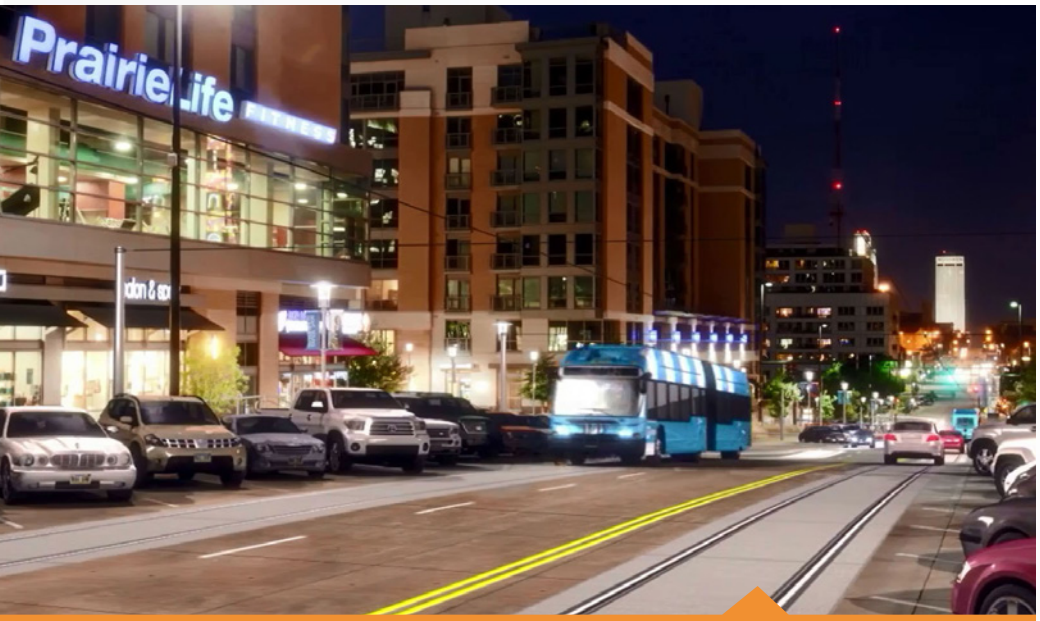
Not only address climate change, but have meaningful impact on it with long lasting effects that ensure our city will be the livable place we want it to be for our future generations.

The statements above are not only our ***Vision for Omaha***, but these are the core values by which we make critical transportation decisions in our great city. They guide us and inform us as we navigate through the project development process to ensure we are moving forward in a positive direction.

This same ***Vision for Omaha*** applies to our approach for making Omaha a Smarter City. There are a myriad of project concepts, programs, and initiatives that are all worthy of implementation and inclusion in Omaha's approach to becoming a Smarter City. For this Smart City Challenge Grant, Omaha wants to emphatically state that we are already a Smart City, but we want to become a *Smarter City!*

Many years ago, there used to be a cynical statement applied to ITS or any application of technology to the transportation system: *It is a solution looking for a problem.* Well, time has proven that very wrong. Technology, along with advancements in mobile communications, has so infiltrated our everyday lives—in the ways we commute, do business, and find our way around. No one can imagine going back to the pre-technology days, and everyone wonders how we ever did anything without a smart phone! It has been akin to making the leap from the horse and buggy to the automobile. Omaha is looking to make that same leap forward in safety, mobility, and climate change.

Omaha is the ideal proving ground for tomorrow's transportation system.



Our transit system is a mix of traditional fixed routes with express routes to suburban portions of the city.

Omaha presents the perfect opportunity and proving ground for the USDOT to demonstrate the leap forward that our transportation system is about to make. What makes Omaha the ideal venue is that we are at the crossroads of America, both geographically and technologically. We are the prototypical city for this demonstration with a population demographic that encompasses all that makes America great – from young to old in a diverse community across the income scale. Our climate allows for the ideal test bed in that we experience weather ranging from extreme cold in the winter to high temperatures in the summer. Our city comprises a typical urban core that is a mix of traditional commercial and residential buildings with the associated traffic issues as well as vibrant retail, restaurant, entertainment, and sporting venues that make Omaha a destination for visitors and events from across the country. That entertainment core is one that is common to many cities and is the hub of activity for the entrepreneurs and millennials that are the future of Omaha. Omaha has embraced the sharing economy and you will find bike sharing and car sharing prevalent.

The Omaha central core is surrounded by residential development both close in as well as spread out and increasingly spreading away from the downtown core, which presents one of the challenges many cities are facing. Our transportation system is a traditional mix of interstates and arterials that are heavily used for both ingress and egress from downtown as well as having to handle commercial traffic and special event traffic. The roadways in Omaha are managed through our combined law enforcement and transportation management center (TMC), operated jointly by the Nebraska Department of Roads (NDOR) and the Nebraska State Patrol, and our vast array of cameras, dynamic messaging signs (DMS), and sensors located throughout the city. Our transit system is a mix of traditional fixed route with Bus Rapid Transit (BRT) and express routes to the suburban portions of the city. All of these

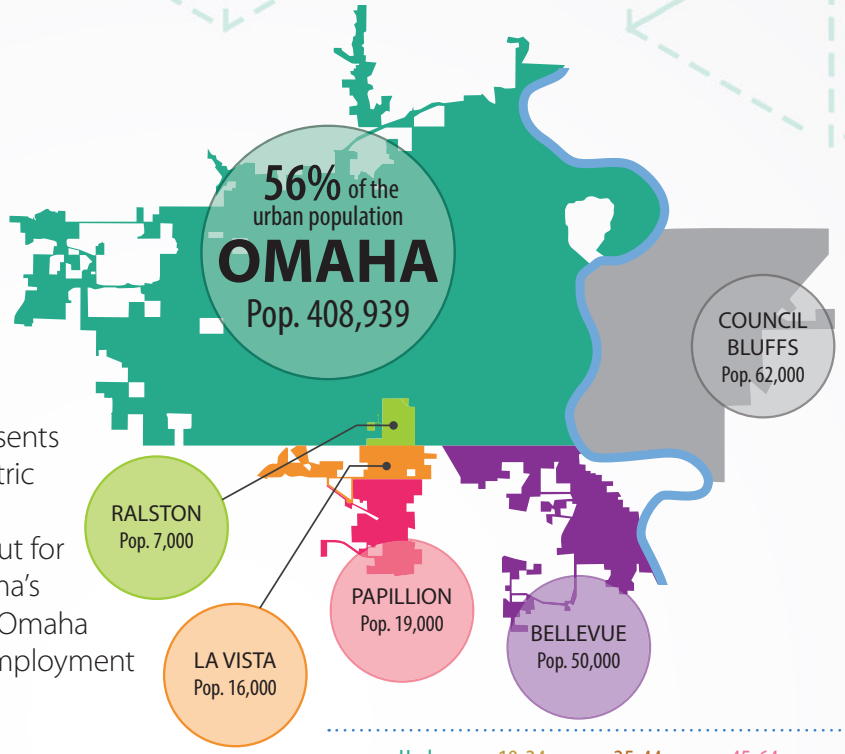
elements put together show that *Omaha is the ideal proving ground for tomorrow's transportation system.*

When you have a test bed that has so many of the same issues and same attributes that many other cities across the United States are familiar with, but in one location, it makes the transferability of the results that much easier for practitioners. Not only is Omaha an extremely easy venue for others to be able come visit and learn from what we implement here (Omaha is served by all of the major airlines and discount carriers), but we also host many major events, from the College World Series to the Olympic Swimming Trials, to a recent visit by President Obama. Our people can easily host the representatives, guests, and dignitaries of the USDOT when they want to showcase what the Smart City Challenge has produced.

Omaha's city leadership, from the mayor's office to the city council, are 100 percent committed to carrying Omaha into the future. State leaders as well as our national political leaders are embracing this proposal and the Smart City Challenge as the ideal opportunity to showcase what Omaha has already started and what it can do moving into the future. We know the actions we are taking now will have far reaching consequences into the future for Omaha and the people who call it home. These actions we are about to take will make Omaha a safer place to live, improve our ability to move throughout the city, and improve the quality of our environment for generations to come. ◁

Omaha's Population

The City of Omaha and our urbanized area perfectly align with the USDOT's ideal characteristics for its Smart City. According to the 2010 Census, Omaha had a population of 408,939, which places it in the center of the desired range. With a 2010 urbanized population of 725,008, about 56 percent of the urban area population is located within the city, which represents a significant portion that is well above the desired metric of 15 percent. Omaha is a significant population and employment center not only for the urbanized area, but for the surrounding region. In fact, during President Obama's recent January 13 address in Omaha, he noted that in Omaha 40,000 new jobs have been created and that the unemployment rate is below 3 percent in Nebraska.



SURROUNDING POPULATION

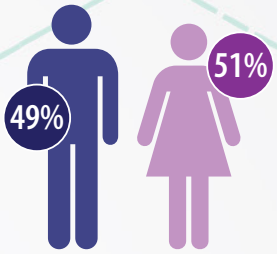
The Omaha area is located along the Missouri River on the Nebraska-Iowa border. While Omaha is by far the largest city, there are several other cities that together, make up a significant portion of the urban area. Council Bluffs, Iowa, has a population of 62,000 and is adjacent to Omaha on the east side of the Missouri River. The City of Bellevue, Nebraska is the largest city in Sarpy County with a population of 50,000. Other Nebraska cities in the urban area with populations greater than 5,000 include Papillion (19,000), La Vista (16,000), and Ralston (7,000).

DENSE URBAN POPULATION

In 2010, the population density for the Omaha urbanized area was 2,368 people per square mile. There are many individual census tracts within the city that have a much higher population density. Overall, the population densities for the city and urban area exceed those of many peer cities.

LOCAL URBANIZED AREA

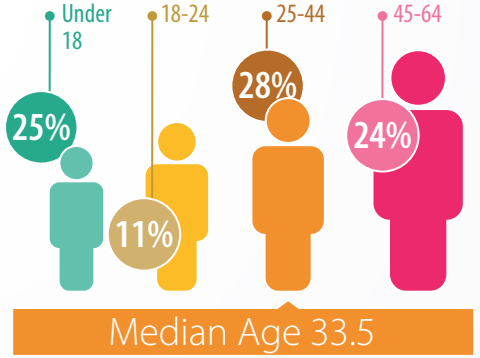
In the last 20 to 30 years, the Omaha area has seen steady and moderate population growth. Generally, the suburban areas outside city limits have grown at a faster rate than the urban core. However, in the last 10 to 15 years, an extensive amount of redevelopment has occurred within older parts of the City. Many of these redevelopments are more walkable, transit-oriented and less dependent on auto travel. ◁

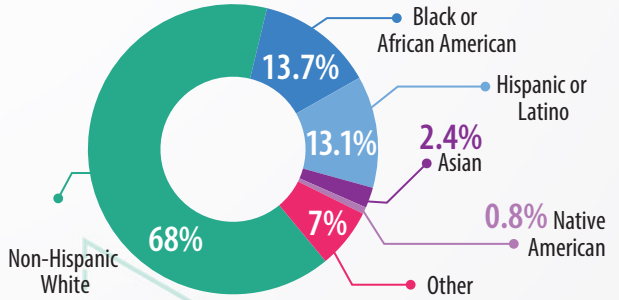


U.S. Census Bureau 2010 STATISTICS

Average Household Size 2.45

Average Family Size 3.14





Our City

EXISTING PUBLIC TRANSPORTATION SYSTEM

The Omaha area is served by an extensive public transit system that is operated by Metro Transit. Metro operates 27 fixed routes and express service routes as well as paratransit service. In 2015, Metro implemented route, schedule, and service changes as a result of rider surveys and a Regional Transit Vision that was developed in partnership with the Metro Area Planning Agency (MAPA), which is the metropolitan planning organization for the Omaha area. Metro was awarded a $15 million TIGER Grant in 2015 to implement an 8-mile-long BRT route along Dodge Street that connects downtown Omaha to many of the large population and employment centers in the City. This project, currently under final design, will bring many new transit technologies to the area, including transit signal priority, queue jumps, real-time arrival information, and compressed-natural gas (CNG) powered transit vehicles. Metro's ridership has seen a steady rise since 2003, with more than 4.2 million people using the system annually. An urban circulator feasibility study is also underway.

There are many challenges in the planning, design, operation, and maintenance of a safe, efficient, and sustainable transportation system. With all of the technological advances in transportation, a shift in where people want to live within a city, and their preferred method of travel, long-range planning for transportation will become more difficult compared to our largely auto-oriented planning methods currently used.

In terms of design and operations, technology will radically change our current standards. From lane widths to roadway lighting to traffic signal design, technology will force engineers to modify current designs to reflect the impacts technology will have on our transportation system.

Finally, funding for transportation infrastructure has been and will continue to be a challenge, especially in the short term. However, with improved technology, we can integrate a safer, more efficient, and sustainable transportation system with more *bang for the buck* than in the past.

East to west connectivity can be particularly challenging with West Dodge Road/Dodge Street serving as the only arterial that spans the city from east to west.

Omaha's transportation system is currently dominated by a need to accommodate automobile travel. Two principle interstates, I-29 and I-80, provide connections to points beyond the city, with I-680 serving as a link between the two in western Omaha. Beyond the interstates, most vehicular travel occurs on the city's system of arterials, which loosely follow the originally platted grid of the city. However, over time some linkages have been lost. East to west connectivity can be particularly challenging with West Dodge Road/Dodge Street serving as the only arterial that spans the city from east to west. The dependence on arterials is particularly strong in Omaha's western areas, where the road network is less dense. As a result, many arterials west of downtown experience moderate to severe congestion.

Omaha has a solid foundation for a bicycle and pedestrian system. There are 199 miles of off-street trails and another 84 miles proposed, but on-street bicycle facilities are *limited* in most areas. The extent of the sidewalk system is variable depending on the area of the city and the present land development pattern, with areas of the city developed in the 1960s and 1970s having the largest gaps.

Metro Transit provides scheduled, fixed-route bus and paratransit services. Service is oriented to providing access downtown, with the highest service frequencies along West Dodge Road/Dodge Street and the Northwest Radial Highway. According to the 2010 Census, fewer than 2 percent of workers commute via transit, and ridership numbers indicate that few people choose transit over other modes.

Railroads no longer play the prominent role they once did in Omaha's history, but along with truck routes there is a significant system of freight movement. As such, railroads are concentrated primarily in industrial areas, and any related delays do not appear to cause major mobility issues.

Omaha is well-served by three airports, all of which are easily accessible by car. With its centralized location, Eppley Airfield in particular is well-positioned for accessibility, and there may be opportunities to expand mode choices to and from downtown.

Moving into the future, maintenance will become even more important. While our existing infrastructure will continue to deteriorate, the systems that

use new technologies will also need regular maintenance and replacement. It is important that life cycle costs for operations and maintenance are considered when deploying new technologies, and the fail-safe systems that must be used when high-tech infrastructure fails or reaches the end of its life.

CONDUCIVE ENVIRONMENT

In general, Omaha has a functional transportation system but one that is increasingly under pressure to accommodate more and longer vehicular trips. By addressing the major issues of roadway congestion in western areas, and planning for future growth, the City has an opportunity to improve mobility through strategic investments that will provide a more balanced, equitable system.

LEADERSHIP AND CAPACITY

The City of Omaha is fully committed to realizing our vision for a Smart Omaha. Investment decisions made today will affect Omaha's future, both in terms of the obligations they establish and their economic returns. It is important that we make sound, thoughtful investments that have long-term, positive impacts for the community both economically and fiscally. Our intention is to inspire others to more meaningfully adapt and transform their own communities according to the guiding principles of a Smart City.

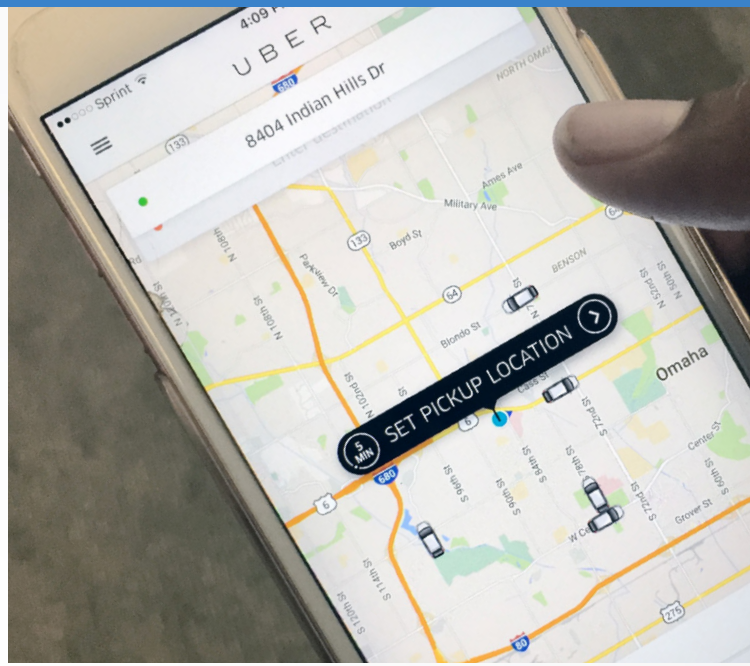
Omaha is well positioned to make this happen. In 2013, Omaha adopted its Traffic Signal System Master Plan for the city and is currently in the early stages of implementations. With this important tool already in place, it opens the door to innovation and forward-thinking approaches to addressing the City's most challenging transportation concerns. Support by the City's leadership has helped to position Omaha for several key initiatives in the next couple of years.

SHARING ECONOMY

Omaha's vibrant, entrepreneurial culture lends itself well to a sharing economy. The City has already embraced Uber, Lyft, Airbnb, and excess food sharing programs throughout the metropolitan area.

The bike-share program in Omaha, Heartland B-Cycle, has been a huge success with both residents and tourists alike—we now have more than 70 stations across the city.

Zipcar has recently expanded its operations in Omaha with further expansion plans in the near future. Local universities including University of Nebraska at Omaha and



UBER

lyft

zipcar wheels when you want them

airbnb

Bcycle

Creighton University both offer a Zipcar program for students and staff.

Public services are increasingly going all electronic, using a public access network to make services more accessible to both young and old alike. This in turn reduces trip generation and vehicle traffic and greenhouse gas emissions. We are truly experiencing an avalanche of creativity in Omaha as collaboration and sharing take place naturally amongst the entrepreneurs and pioneers who call Omaha home.

Omaha is committed to integrating our infrastructure with the sharing economy, including ride-sharing, bike-sharing, as well as modifications to parking infrastructure to accommodate the radical changes in the parking demands.

OPEN DATA

Many private companies have already taken advantage of a wide variety of data to improve the information available about a city's transportation system. INRIX, for example, uses location data from fleet vehicles to display real-time congestion information. The technology to predict future traffic conditions is starting to become a reality. However, much of the data used in existing applications is generated by the private sector (via location data from smart phones and global positioning systems [GPS]), not the public sector.

Omaha is looking to change that. The City is committed to providing the real-time data generated by traffic signal controllers to be open and machine-readable. Images from Close Circuit Television (CCTV) systems will be shared. Speed, volume, and occupancy data from traffic sensors, as well as sensors that monitor pavement conditions will be made available. This is another source of data that can build upon all of the existing data currently available from vehicles and fuel even more innovation in big data and data analytics.

Omaha is fully committed to providing open data in an accessible, readable, and discoverable way to allow other communities and organizations to learn from the challenges and opportunities we experience in Omaha. The city understands and appreciates the role it will play in helping to establish opportunities for others to learn from our participation in the Smart City Challenge. ◁

Proposed Study Area

Omaha is proposing a district wide approach for deploying and demonstrating the Smart City Challenge. The proposed district is in the central business district right in the downtown area, next to Century Link Convention Center and TD Ameritrade Ballpark. The proposed deployment corridors include 10th Street connecting Henry Doorly Zoo and Aquarium through the Historic Old Market area into downtown Omaha. The deployment area includes Dodge Street, where the BRT is being designed for 2018 construction. The district includes an active Union Pacific Railroad, and Cuming Street, which provides access to the Eppley Airport located east of downtown Omaha.

1 AUTONOMOUS AND CONNECTED VEHICLE INFRASTRUCTURE

Omaha proposes to use connected vehicle technology to automate the driving experience in the test corridor. Omaha will build an infrastructure to support the connected vehicle. Information from embedded sensors, roadside equipment including weather and pavement conditions, traffic signal timing information, roadway geometry information, obstacle detection, upstream and downstream vehicle coordinates and their operating speed, acceleration, and destination characteristics information will be provided to the connected vehicle for processing and decision making purposes.

2 VIRTUAL TRAFFIC SIGNALIZATION

Instead of providing red-yellow-green indications from a signal pole and mast arm, connected and intelligent vehicles will receive signal phasing and timing information from roadside controllers at intersections using dedicated short range communications technology and will be able to use the signal phasing and timing information to make decisions whether to stop or proceed through the intersection safely.

3 SMART ROADWAY PAVEMENT SURFACE

This project will deploy a smart roadway pavement for connected vehicles to drive on. The existing concrete/ asphalt pavement will be replaced with a smart pavement that includes embedded in-pavement electric charging infrastructure, embedded LED lighting to replace pavement markings, and solar powered technology to generate electricity.

4 BIG DATA ANALYTICS AND CONNECTED CITIZENS

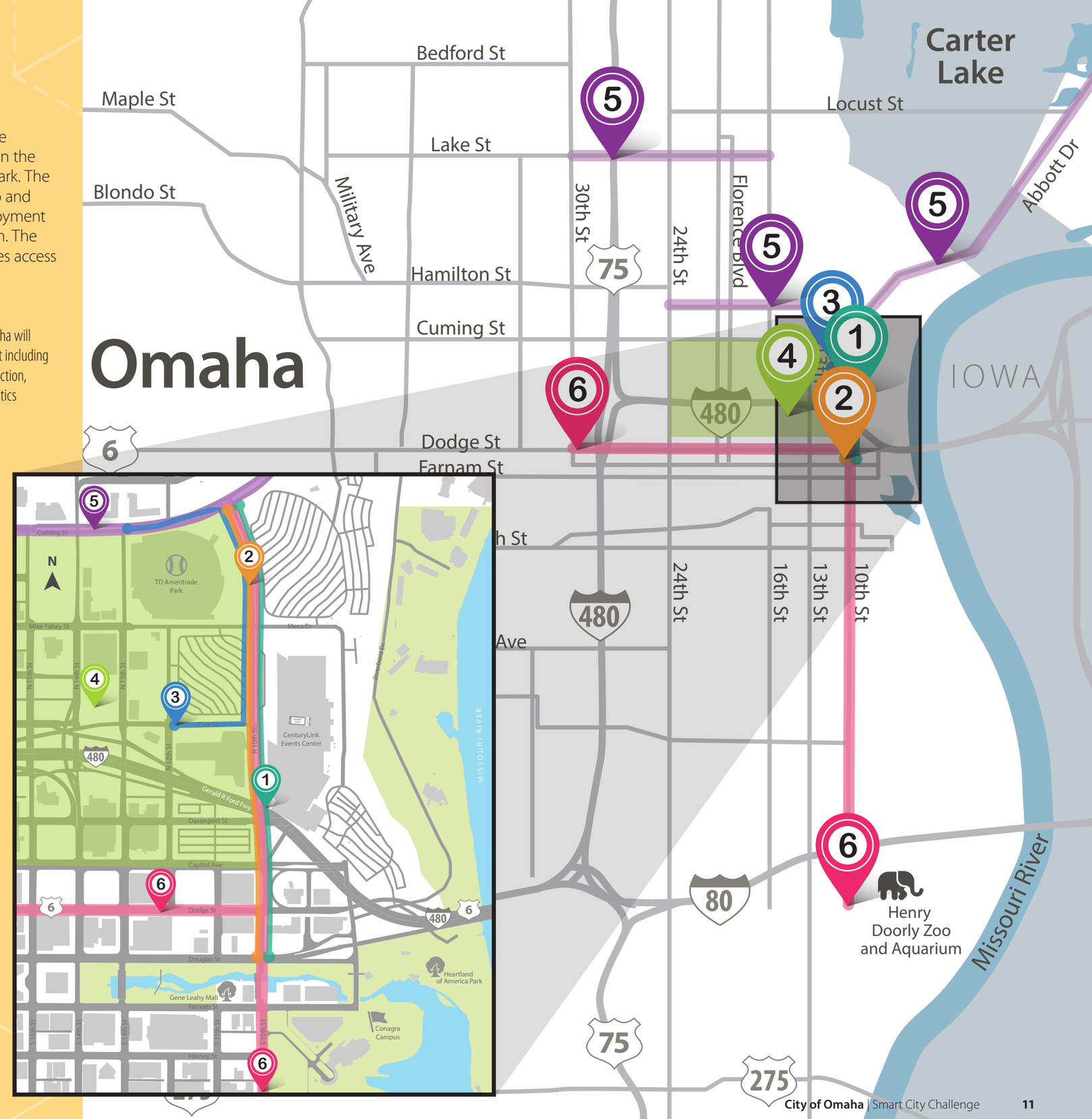
Omaha has an existing partnership with INRIX through an NDOR agreement. We propose to leverage this existing partnership to perform big data analytics. Data sharing protocols will be established and information dissemination will occur through specific methods of delivery. Autonomous and connected vehicle technology demonstration would require collection, processing and dissemination of tremendous volume of data in short time intervals to enable the connected vehicle make critical decisions to develop and provide driver guidance. The big data analytics is at the heart of the automation and smart city demonstration projects. Our University Transportation Center (UTC) partners will work closely with INRIX on this project.

5 SMART LIGHTING AND ELECTRIC CHARGING INFRASTRUCTURE

This project will employ smart lighting controls on streetlights along with LED lamp conversion. The electric power savings with the LED conversion will be directed toward the electric charging stations resulting in a net-zero impact on the electricity usage in Omaha.

6 BUS RAPID TRANSIT AND AUTONOMOUS SHUTTLE PROJECT

Omaha proposes to evaluate autonomous transit vehicles, under the supervision of an on-board driver on a downtown street. The City will use connected vehicle technologies to improve the operation of transit vehicles. Omaha will work with Metro Transit to implement new methods to achieve transit signal priority.



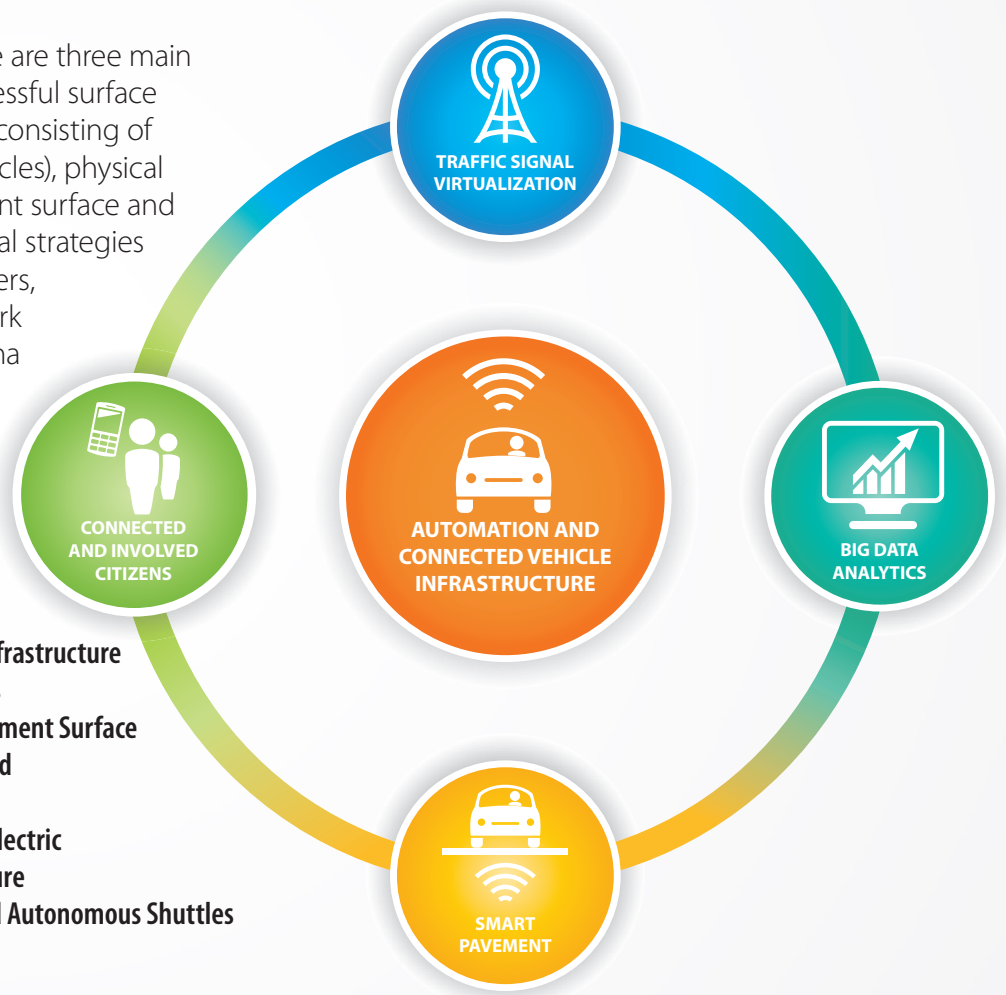
USDOT Vision Elements

USDOT has developed 12 vision elements for the Smart City. The vision of the Smart City challenge is to demonstrate and evaluate holistic, integrated approach to improving surface transportation performance within a city and integrating this approach with other smart city domains such as public safety, public services, and energy. Omaha is proposing an integrated approach with the following innovative projects and technology components to achieve the Smart City vision. We propose a district wide projects approach that would provide a platform to deploy, test, and verify the reproducibility of the USDOT 12 Vision Elements in Omaha.

Omaha is teamed up with Iowa State University and Creighton University (located in Omaha, Nebraska) as part of the Region 7 UTC. Other local partners like University of Nebraska will be consulted during critical milestones of the Smart City deployment to provide unbiased evaluation of the deployed systems.

Broadly speaking, there are three main components to a successful surface transportation system consisting of users (citizens and vehicles), physical infrastructure (pavement surface and utilities), and operational strategies (signal timing parameters, messages on signs, work zones, data, etc.). Omaha is proposing the following projects to demonstrate all 12 vision elements of the Smart City in an integrated manner:

1. **Automation and Connected Vehicle Infrastructure**
2. **Virtual Traffic Signals**
3. **Smart Roadway Pavement Surface**
4. **Big Data Analytics and Connected Citizens**
5. **Smart Lighting and Electric Charging Infrastructure**
6. **Bus Rapid Transit and Autonomous Shuttles**



1. AUTOMATION AND CONNECTED VEHICLE INFRASTRUCTURE

This project is the core to our Smart City Challenge deployment. Omaha proposes to use connected vehicle technology to automate the driving experience in the test corridor. As part of the Smart City Challenge, Omaha will build an infrastructure to support connected vehicles. Connected vehicles will be fed with signal phasing and timing (SPAT) information, pavement marking information, and weather condition information among several other pieces of critical information. The connected vehicle definition here includes automobiles, transit vehicles, freight trucks, rail, and bicycles. Pedestrians and bicyclists would have the ability to connect with the smart infrastructure using smart phones or third party after market devices. The Smart City Challenge provides a great opportunity to demonstrate safety, mobility, and environmental benefits in an urbanized area.

The test corridor in Omaha will have smart infrastructure deployed to support connected vehicles as well as driverless shuttles/transit vehicles and fully automated trucks. Vehicle-to-infrastructure (V2I), vehicle-to-vehicle (V2V), and vehicle-to-device (V2X) communications would be deployed and demonstrated. Real-time data will be collected using intelligent sensors and the information will be analyzed to make decisions that will affect driver behavior and vehicle position.

The big data would be analyzed and core decisions will be relayed back to the user (smart and connected vehicle) using several communication methods such as Wi-Fi, Cellular, Dedicated Short Range Communications (DSRC), and fiber communication.

Technology Elements
Highest Priority

- Vision Element #1 URBAN AUTOMATION
- Vision Element #2 CONNECTED VEHICLES
- Vision Element #3 INTELLIGENT, SENSOR-BASED INFRASTRUCTURE

Innovative Approaches to Urban Transportation Elements
High Priority

- Vision Element #4 USER-FOCUSED MOBILITY SERVICES & CHOICES
- Vision Element #5 URBAN ANALYTICS
- Vision Element #6 URBAN DELIVERY & LOGISTICS
- Vision Element #7 STRATEGIC BUSINESS MODELS & PARTNERING
- Vision Element #8 SMART GRID, ROADWAY ELECTRIFICATION & EVs
- Vision Element #9 CONNECTED, INVOLVED CITIZENS

Smart City Elements
Priority

- Vision Element #10 ARCHITECTURE & STANDARDS
- Vision Element #11 LOW-COST, EFFICIENT, SECURE & RESILIENT ICT
- Vision Element #12 SMART LAND USE

Secure, resilient communication technology will be used in the deployment.

The automation project will require a data rich environment to provide guidance information to the users and connected vehicles. This data rich environment warrants installation of sensor-based infrastructure. Omaha proposes to install several sensors as part of the Smart City initiative. These sensors will collect and report real-time data-enabling automated vehicles to make critical decisions, but it will provide big data for evaluating the transportation system performance and operation in the City. The sensors will also be used to monitor transportation assets and infrastructure management, prioritize investment decisions, and ensure a state of good repair.

Connected Vehicle Reference Implementation Architecture (CVRIA) will be used as the basis for identifying the key interfaces across the connected vehicle environment. ◁

Demonstrated Vision Elements

2. VIRTUAL TRAFFIC SIGNALS

Omaha proposes to virtualize the traffic signals along the test corridors. Instead of providing physical indications from a signal pole and mast arm, connected and intelligent vehicles (including transit vehicles) will receive (SPAT) information from roadside controllers at intersections using DSRC technology and will be able to use the SPAT information to make decisions whether to stop or proceed through the intersection safely. This strategy can be extended to provide virtual signal visualization on the vehicle dashboard or the windshield for drivers to eliminate the pole and mast arm infrastructure. Pedestrian cross walk indicators can initially be managed using the existing ped poles and indications, but pedestrian phase information can also be broadcast such that any pedestrian carrying a smart phone can receive this information before crossing a street. Bicyclists can use smart phone applications to obtain SPAT information, or third party after market devices with a small display screen can be installed on bicycles for signal phasing information.

Virtualization of the traffic signals has several benefits including improved safety, reduced maintenance and replacement costs, and reduction of roadside hazards in urban areas (with elimination of signal poles and mast arms). Reliable traffic signal timing and phasing information would be available to all users during adverse weather conditions and under conditions when a traffic signal pole is hit by a vehicle. They also offer resilience by providing SPAT information during power outages at signalized intersections. Many cities have aging traffic signal infrastructure including poles and mast arms that are in poor condition. It will take billions of dollars to replace and maintain this aging physical traffic signal infrastructure in all U.S. cities. Virtualization of traffic signals provide a cost-effective solution to address this national problem. This virtualization strategy can easily be extended to unsignalized intersections with the connected vehicles technology, where vehicles know each other's positions by GPS coordinates and the system can recommend to the driver if there is a safe gap at an intersection to enter safely or not.

Communication between signal controllers and connected vehicles can be achieved using several methods including DSRC. Privacy and security are critical and it is imperative that data be safeguarded. Any Personable Identifiable Information (PII) need

to be given top priority for protection, and safeguards need to be in place. It is anticipated that the prototype security credential management system (SCMS) will be provided by USDOT for deployment to address the PII issues.

CVRIA will be used as the basis for identifying the key interfaces across the connected vehicle environment. There are four types of Connected Vehicle Applications: Environmental, Mobility, Safety, and Support being developed by USDOT. As an example, the Intelligent Traffic Signal System (ISIG) application uses both vehicle location and movement information from connected vehicles as well as infrastructure measurement of non-equipped vehicles to improve the operations of traffic signal control systems. The application uses the vehicle information to adjust signal timing for an intersection or group of intersections to improve traffic flow, including allowing platoon flow through the intersection. It is anticipated that this application from CVRIA would be applied in the virtual traffic signal demonstration project.

Virtualization of traffic signals will provide the ability to perform global signal timing coordination and synchronization reducing stops and delay for the users. This will also result in reduction in emissions and pollutants due to fewer stops. ◁

Demonstrated Vision Elements

3. SMART ROADWAY PAVEMENT SURFACE

This project will deploy smart roadway pavement for connected vehicles to drive on. The existing concrete/asphalt pavement will be replaced with a smart pavement that includes embedded in-pavement electric charging infrastructure, and sensors. City of Omaha has reviewed various commercially available products with these capabilities and recommend potential deployment of a product called *Integrated Roadways* for a segment of the Smart City deployment project. In addition, embedded LED lighting to replace pavement markings, and solar-powered technology to generate electricity could also be considered for the project. Potential market solutions like solar roadways already exist today, and Omaha is open to teaming up with these product manufacturers to deploy smart pavements. Sensors and heating elements will be embedded in the smart pavement to measure weather and temperature. Snow melting on the smart pavement can be implemented using in-built heaters. Information related to pavement surface, friction, and driving conditions can be collected and disseminated to connected vehicles. It is envisioned that inductive charging of electric vehicles in-motion will be demonstrated as part of this project. Various pavement marking strategies using LED lights will be tested including crosswalk markings, dynamic lane assignments (including reversible lanes) and potentially modular lanes. Omaha has had reversible lanes in operation along Dodge Street (the busiest arterial in Omaha) and Farnam Street for several decades, and Omaha drivers are very familiar with reversible lane operations. The demonstration project will deploy all of these elements either along one corridor or along several corridors depending on the funding availability. Improved safety, enhanced mobility and climate change metrics will be deployed and evaluated with this demonstration project. ◁

Demonstrated Vision Elements

4. BIG DATA ANALYTICS AND CONNECTED CITIZENS

Historically, in the transportation industry, particularly operations and maintenance, engineers collected a very small sample of data on which they base decisions. Today so much data exists from so many different sources on a continuous basis. The challenge is how to harness the opportunities that arise from this data. As a public agency, one challenge is providing data about the roadway and traffic systems for public use. Another challenge is using existing data to better operate and manage the transportation system in real time. A third challenge is identifying ways to capture data that does not yet exist… all while preserving the privacy and security of source from which the data is generated.

As part of our vision, the City proposes to work with private organizations and the public to address these issues. The City of Omaha, through the NDOR, has a license to utilize INRIX data, which is real-time location data collected from fleet vehicles on the street network. The City envisions working with INRIX to better automate the processes of identifying congestion, incidents, work zones. But instead of stopping at that point, developing better methods to notify drivers as well as adjust the signal system to better accommodate altered traffic flows through smart phones, navigations systems, dynamic message signs and other methods.

In addition to better utilizing private data, the City envisions investigating better methods to disseminate information about our traffic signal system (such as malfunctions, power outages, etc), and roadway network via our CCTV infrastructure and numerous roadside sensors.

Finally, the City will work with private partners to identify new ways to capture new data sources in real-time and develop operational strategies to utilize that data.

A critical component of this project in Omaha is to reach out to the citizens through a coordinated outreach effort. In 2015, CNBC ranked Omaha the second best city for millennial college students. Millenials are early adopters of new technologies. Omaha is a progressive city that attracts business and young professionals. The Greater Omaha Chamber of Commerce and specifically its Young Professionals group and Empowerment Network will be consulted for this project. Data sharing protocols will be established and information dissemination will occur through specific methods of delivery for this project, tapping into this generations' natural behaviors and experiences. Local campaigns will be developed to reach all citizens including people with disabilities, older adults, and young millennials.

Autonomous and connected vehicle technology demonstration would require collection, processing and dissemination of tremendous volume of data in short time intervals to enable the connected vehicle make critical decisions to develop and provide driver guidance. The big data analytics is at the heart of the automation and smart city demonstration projects. Our University Transportation Center (UTC) partners will work closely with INRIX on this project. ◁

Demonstrated Vision Elements

5. SMART LIGHTING AND ELECTRIC CHARGING INFRASTRUCTURE

This project will deploy smart lighting controls on streetlights along with LED lamp conversion. The electric power savings with the LED conversion will be directed toward the electric charging stations, resulting in a net-zero impact on the electricity usage in Omaha. Currently, Omaha has 60,000 streetlights equipped with either High Pressure Sodium or Metal Halide lamps. Conversion of these to LED lamps will result in a significant power savings that can be utilized toward electric charging infrastructure. The smart controls in combination with LED lamps will provide the ability to adjust the lighting levels as necessary. This will also provide an opportunity to work with the Omaha Police Department and their ShotSpotter technology (currently deployed in Omaha) to fight crime. The ShotSpotter technology alerts police to gunshots fired by using sensors to detect the sound frequency. The smart lights can be interconnected with this technology to achieve synergies. During incidents, the smart lights can trigger a PTZ camera to record the event as well as increase the LED lighting levels in the area. It is anticipated that cellular communication can be used to communicate with the smart lights. Omaha, in coordination with OPPD, will evaluate various communication technologies for this project, including cellular communication using Verizon Wireless who is a partner with Omaha.

The electric charging infrastructure can be installed at parking meters downtown and payment options can be integrated with the parking payment options. Currently, Omaha uses a pay-by-phone app for parking meters. It will be very convenient and easy to integrate additional electric charge station usage fees with this phone app. At other locations, electric vehicle charging stations can be installed in the vicinity of streetlights and parking garages with minimal expense. ◁

Demonstrated Vision Elements

6. BUS RAPID TRANSIT AND AUTONOMOUS SHUTTLE PROJECT

Autonomous vehicles will revolutionize how our surface transportation system works. Not only will this affect private vehicle ownership, but the way in which transit services are delivered. Today, large portions of a transit agency's budget is dedicated to salaries and benefits of drivers. Autonomous vehicles provide the opportunity for a transit agency to transform its service area, schedules, frequency, and/or fares with this technology. The City envisions evaluating an autonomous transit vehicle, under the supervision of an on-board driver, on one of our streets in the downtown area. The autonomous technology could be tested on not only a new transit vehicle, but also an existing vehicle retrofitted with equipment that enables it to operate at various levels of autonomy.

The City envisions using connected vehicle technologies to better improve the operation of the transit vehicle as well as providing better user services to the traveling public. Through V2I, V2V, and V2X communications, the City will work with the local transit agency to implement new methods to achieve transit signal priority (TSP). Metro Transit, in conjunction with Mobileye and various vehicle manufacturers will implement crash avoidance systems. The City and Metro Transit, in conjunction with private app developers, will develop and test new applications, such as schedule and route

information and payment methods, to better inform and attract users to transit, increasing the demand for transit ridership, and decreasing the demand for single-occupancy vehicle trips.

Along with the revamped Metro bus system and new BRT line, Omaha's recently completed Alternatives Analysis (AA) called for the development of a modern urban circulator line that would connect from the University of Nebraska Medical Center campus through midtown to the City's downtown arena/convention center/ballpark district and emerging north downtown neighborhood. This urban circulator complements the other transit investments and allows users to easily move around downtown. It will also reduce the need for parking and encourage an increase in jobs, population, and development. Omaha plans to tap this added value to help pay for the urban circulator. Initial estimates from the AA project that the urban circulator will add more than 8,500 jobs, 3,150 residents, and $1 billion of new development to the corridor. These numbers are especially important in the downtown area due to its proximity to neighborhoods with the region's highest rates of poverty and unemployment. Recent studies have shown that Omaha has a large surplus of parking in downtown with only 53 percent of the stalls being used during peak times. In fact, when comparing Omaha to other cities in the region it is clear that Omaha is "over parked". Omaha has roughly 41,000 parking stalls and 26,000 workers in downtown, while Denver has approximately 44,000 stalls and nearly 125,000 workers and a portion of downtown Minneapolis contains 30,000 stalls and 90,000 workers. That is a ratio of .33 parking stalls per worker in Minneapolis, .35 in Denver and 1.53 in Omaha.

Although not yet completed, studies currently underway indicate that Omaha will not be able to capture the amount of development projected for downtown due to the amount of land devoted to parking. The study indicates that reducing parking ratios by 30 percent could allow the projected additional $1 billion in development to occur. Improved transit, a shared and managed parking system, Smart City technologies, and autonomous vehicles have the potential to virtually eliminate downtown parking and significantly increase development. Similarly, major parking reductions in Omaha's suburban mixed-use nodes and corridors would further increase the amount and density of development throughout the city. Together these changes will improve access to health care, services, jobs, and education, increase the City's tax base, and maximize public services and infrastructure. It is possible to envision a future where Omaha's pattern of nodes and corridors will result in rapid transit connections between nodes along the highest density corridors while autonomous vehicles provide "last-mile" connections to nearby lower-density neighborhoods. It also provides an opportunity to capture the added value of development to help pay for the systems needed to make it possible.

Omaha has the capacity, tools, and plan in place to create a model for the revitalization, infill, and new development of the American city that could easily be replicated throughout the country. In short, Omaha's unique urban and suburban character, mix of growth management, annexation and land use authority, node and corridor land use pattern and focus on downtown development makes it a perfect laboratory for studying the benefits of Smart City technology and autonomous vehicles on America's cities. ◁

Demonstrated Vision Elements

Evaluation of each project will be completed using our UTC partners, Iowa State University, and Creighton University. The university research faculty will provide unbiased evaluation of the deployment and will be consulted during critical milestones of the infrastructure deployment phases as well.

City of Omaha Smart City Projects Summary

DEMONSTRATED USDOT VISION ELEMENTS BY PROJECT	Technology Elements (Highest Priority)			Innovative Approaches to Urban Transportation Elements (High Priority)						Smart City Elements (Priority)		
	Element #1	Element #2	Element #3	Element #4	Element #5	Element #6	Element #7	Element #8	Element #9	Element #10	Element #11	Element #12
1. AUTOMATION & CONNECTED VEHICLE INFRASTRUCTURE	●	●	●	●	◔	—	●	—	●	●	◔	◔
2. VIRTUAL TRAFFIC SIGNALS	●	●	●	●	●	◑	●	◔	●	●	●	◕
3. SMART ROADWAY PAVEMENT SURFACE	◕	◕	◕	●	◔	◔	◔	●	◑	◕	◕	—
4. BIG DATA ANALYTICS & CONNECTED CITIZENS	◑	◕	●	●	●	◔	◕	◔	●	●	◔	◔
5. SMART LIGHTING & ELECTRIC CHARGING INFRASTRUCTURE	●	◑	●	◑	◔	◑	◕	●	◕	●	●	◔
6. BUS RAPID TRANSIT & AUTONOMOUS SHUTTLE PROJECT	●	●	●	●	●	◑	◕	◕	●	●	●	●

VISION ELEMENT DEMONSTRATION KEY: ● – 100% ◕ – 75% ◑ – 50% ◔ – 25%

Minimizing the Risks for Greater Success

While a project of this magnitude does not come without risk, the City of Omaha and our partners have not only identified potential risks, but methods by which each of those risks will be mitigated. Each of these are briefly described below.

The proposed timeline for this challenge is aggressive. The project has a budget of $40 million to be implemented over a three-year period starting in fiscal year 2016. To mitigate the risk, the City has proposed a vision consisting of a small number of large projects (that meet all 12 of the vision elements identified by USDOT), rather than a large number of small projects. This approach minimizes the risk associated with managing too many projects and increases the chances of an overall successful deployment. The City also has verbal commitments from many public and private partners to assist in the successful completion of the projects, as well as a number of in-house staff of qualified engineers and supporting consultants.

Historically, meeting regulations to satisfy the National Environmental Policy Act (NEPA) in the state of Nebraska has been a lengthy process. However, because the vision of this challenge is focused more on technological innovation and research and less on physical infrastructure, extensive NEPA reviews are not anticipated. In addition, the NDOR and the Nebraska Division of the Federal Highway Administration have recently executed a new programmatic agreement that streamlines and substantially reduces the length of time needed for NEPA approvals. The City is also currently implementing our traffic signal system master plan, which will not only have approved NEPA, but also will have the state-of-the-art communications and traffic signal infrastructure in place to support our vision.

The City of Omaha has proposed a vision consisting of a small number of large projects that meet the 12 vision elements identified by USDOT, rather than a large number of small projects. This approach minimizes associated risks and increases overall successful deployment.

Regarding autonomous vehicles, there may be some City ordinances and state statutes that need to be passed or modified to accommodate autonomous vehicle technology. In 2015, the state of Nebraska responded quickly, instituting the appropriate policies to allow ride-sharing services in the state. Any additional required legislation can be introduced to the state legislature in the Spring 2016 session. ◁

POTENTIAL RISK	ASSESSMENT OF RISK
PROJECT APPROACH	Low Risk
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	Low – Medium Risk
CITY ORDINANCES	Low Risk
STATE STATUTES	Low – Medium Risk

Partners

Omaha is excited for the potential to work with partners in the community to position Omaha to set the pace for Smart City innovation. To date, we have confirmed partnerships with transportation, power, education, and technology based organizations.

METROPOLITAN AREA PLANNING AGENCY

MAPA is a council of governments and the metropolitan planning organization for the Omaha-Council Bluffs region, comprising the counties of Douglas, Sarpy, and Washington in Nebraska, and Pottawattamie and Mills in Iowa. It performs multimodal transportation planning as required by federal law, and collaborates with local governments and public agencies on community planning.

METRO

Metro is responsible for the operation of fixed route, express/commuter bus downtown weekday rush hour, and Americans with Disabilities Act Complementary Paratransit Service within the city limits of Omaha.

NEBRASKA DEPARTMENT OF ROADS

NDOR is a state government agency charged with building and maintaining the state and federal highways in Nebraska.

OMAHA PUBLIC POWER DISTRICT

OPPD is a publicly owned electric utility in Nebraska. It is one of the largest public electric utilities in the US. OPPD serves more than 352,000 customers. OPPD is headquartered in Omaha.

INRIX
For more than 10 years, INRIX's business has been traffic. They have more than 50 patents related to traffic and transportation. They help governments tap into big data and the Internet of Things to engineer systems for Smart Cities that go beyond traffic to address the individual, economic, and environmental challenges of urbanizations worldwide.

IOWA STATE UNIVERSITY
Iowa State is an international university with a students from all 50 states and more than 100 countries located in Ames, Iowa. As UTC partners, Iowa State will work with Creighton University to provide evaluation of Omaha's Smart City projects.

WERNER ENTERPRISES
Headquartered in Omaha, Werner is a premier transportation and logistics company with coverage throughout North America, Asia, Europe, South America, Africa, and Australia. Werner is among the five largest truck carriers in the U.S.

VERIZON WIRELESS
Verizon Wireless provides wireless services to 137.5 million subscribers. It is the largest wireless telecommunications provider in the U.S.

CREIGHTON UNIVERSITY
Creighton University, located in Omaha offers a top-ranked education. Creighton's nine schools and colleges deliver powerful education that connects arts and sciences, law and business with health science programs. Creighton has more than 8,000 undergraduate, graduate, and professional students.

UNITE PRIVATE NETWORKS
Unite Private Networks provides high-bandwidth, fiber-based communications networks and related services to schools, governments, carriers, data centers, hospitals, and enterprise business customers throughout the United States. Service offerings include dark and lit fiber, private line, optical Ethernet, Internet access, data center services, and other customized solutions.

Existing Transportation System

The Omaha area has a very comprehensive transportation system of roads, transit routes, bicycle facilities, and rail. In the three-county region that consists of Douglas and Sarpy Counties in Nebraska as well as western Pottawattamie County in Iowa, there are 5,500 miles of roadway. Of this roadway mileage, approximately 90 miles are freeways and 642 miles arterial streets.

I-80 and I-29 serve the Omaha area. I-80 is the second longest interstate in the United States, connecting the San Francisco area on the west coast and the New York area on the east coast, and serves approximately 185,000 vehicles per day in Omaha. Interstate 29 is an important corridor that connects Canada and Mexico. These two corridors alone are vital links for not only local commuter traffic but also national freight traffic.

In addition to I-80 and I-29, there are several important freeways in the Omaha area. I-480 connects the central business district to both I-80 and I-29. US-75, also known as the JFK Freeway, links Omaha to the city of Bellevue and Offutt Air Force Base (AFB), which is home to the U.S. Strategic Command and the 55th Wing. Offutt AFB is one of the largest employment centers in the area. US-6, also known as the West Dodge Expressway, serves primarily commuter traffic for the fastest growing part of the city.

The arterial street system is a significant portion of the roadway system in the Omaha area. The intersections of arterial streets are most often controlled by traffic signals. In the city of Omaha alone, there are nearly 1,000 traffic signals, most of which are located along arterial streets. In 2012, the City of Omaha developed a master plan to upgrade our traffic signal system, including controllers, communications, and ITS infrastructure.

The City began deploying the system in 2015, including a multi-jurisdictional adaptive signal control technology (ASCT) system consisting of 27 traffic signals that will span the cities of Omaha, Ralston, La Vista, and Papillion, along a state highway operated by the NDOR.

An extensive network of bicycle facilities also exists in the Omaha area, including 150 miles of exclusive bike paths, as well as many lane-miles of on-street bicycle lanes and shared bicycle facilities. In 2015, MAPA developed a Regional Bicycle-Pedestrian Plan that identified short, medium, and long term projects to build out a comprehensive bicycle network in the region.

A bike-sharing program, Heartland B-Cycle, is currently operating and rapidly expanding in the Omaha area. Heartland B-Cycle currently has 31 stations operating in the downtown and midtown areas, as well as Council Bluffs. B-Cycle has plans and funding to expand to more than 70 stations and further build out its network.

In addition to bike-sharing, the Omaha area is served by several car-sharing services. In addition to traditional taxi cab companies, Uber and Lyft ride-sharing are also licensed to operate and were well-received by residents when operation began more than a year ago.

Rail is also an important piece of not only the transportation network but also the Omaha economy. The city is served by Am Trak for passenger rail service. The area is also served by several different freight railroads, including Union Pacific, which is headquartered in downtown Omaha.

The City of Omaha is currently building out our information and communications technology infrastructure. This consists of the City deploying fiber optic infrastructure. The City has also executed agreements with various private entities, including Unite Private Networks and Verizon Wireless. This infrastructure will be used to operate not only the transportation system but also other sectors of City government including public safety.

The Omaha area has a vast and expanding ITS system. The NDOR and the Iowa Department of Transportation both operate traffic management centers for the region. The NDOR coordinates directly with the Nebraska State Patrol and 911 centers. Both agencies operate a network of communications systems that manage and monitor cameras, dynamic message signs, speed sensors, and road-weather

information systems (RWIS) to monitor congestion and respond to incidents. The City of Omaha also operates a traffic management center to primarily monitor traffic signals and arterial street system. As part of our traffic signal system master plan, the City will be rapidly expanding deployment of ITS infrastructure over the next several years. NDOR and the City of Omaha have an agreement with INRIX to collect and analyze real-time and historical travel data for the freeway and arterial street system.

Smart grid infrastructure and electric vehicle charging stations are starting to appear in the Omaha area. The City of Bellevue as deployed several electric vehicle charging stations that are available to the public. MAPA, in coordination with NDOR, is developing a plan and seeking funding sources to expand this network in the region. The City of Omaha is also working closely with the Omaha Public Power District (OPPD) to investigate ways to implement both smart grid and more energy efficient technologies to the street light system. ◁

Data

Currently, several agencies within the Omaha area collect a variety of data to suit their needs. The state departments of transportation primarily collect and record speed data along the freeway system using sensors. They also conduct real-time video monitoring for incident management. NDOR and the City of Omaha also uses INRIX data, which is primarily based on real-time location data from fleet vehicles, for real-time and historical analysis. NDOR, Iowa DOT, the City of Omaha, as well as other municipalities, collect traffic volume data either in real-time or at specific intervals, to monitor congestion levels, identify historical trends, and model travel demand and conduct future forecasting. All agencies gather and analyze crash data to identify potential issues and possible countermeasures for future design. Metro Transit monitors video in real-time for driver and passenger safety.

As part of the City of Omaha traffic signal system upgrades, the City will be able to monitor traffic signal operation in real-time as well as log data for future analysis. Traffic signal controllers will have the ability to log high-resolution detector data for real-time operations and historical analysis. The City will also expand our network of CCTV cameras.

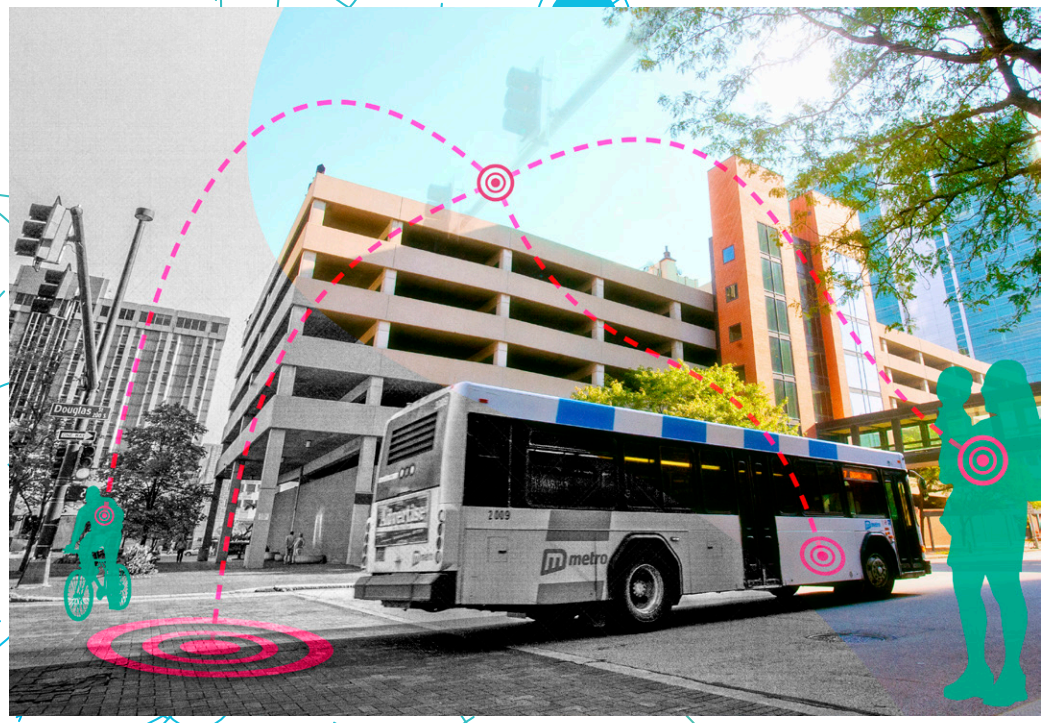
While each agency that currently collects data has a specific purpose and need for that data, other agencies and the traveling public could also benefit from the same data. For example, public safety agencies such as the Omaha Police Department could benefit if given access to roadway monitoring cameras. The Public Works Department could benefit if given access to Metro Transit forward-facing video cameras. Rather than each agency deploying its own equipment and infrastructure to achieve its needs, existing infrastructure could be shared for a reduced cost.

There are some agreements currently in place among various agencies in the Omaha area. For example, NDOR allows local jurisdictions to use its INRIX license. The City of Omaha has an agreement with Douglas County and NDOR to operate traffic signals that are located within the City of Omaha. Historically, agencies have always worked cooperatively to achieve inter-jurisdictional goals. The City of Omaha is currently working on an agreement to operate a single adaptive signal control technology system among five different agencies. ◁

ITS Approach

It is imperative that the Smart City demonstration project use ITS standards, architecture, and certification processes for documentation purposes, as well as to improve the quality of these products based on lessons learned in the deployment. This is critical as other cities look to deploy similar technologies in their communities. City of Omaha would follow a methodical approach following industry standards to demonstrate interoperable ITS capabilities that can be nationally extensible. USDOT has been working on a CVRIA project led by the ITS Joint Program Office. City of Omaha would leverage these efforts to date and continue the cooperative ITS deployment strategies to document and improve the architecture and standards in a real world environment. The two highest priority services for any connected vehicle project are:

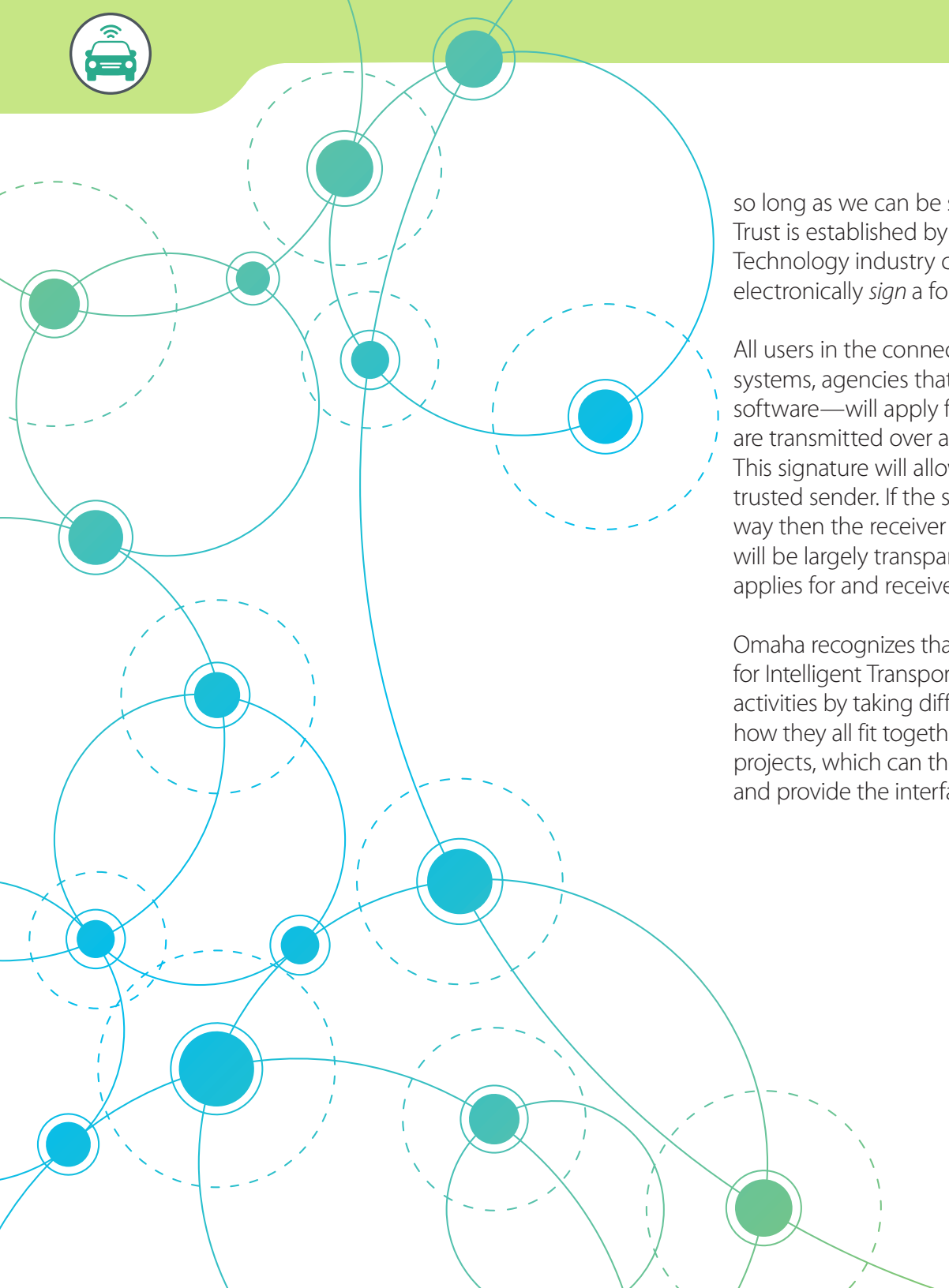
- Security Credential Management
- System Monitoring



Since Omaha is proposing projects beyond the connected vehicle project, we anticipate requiring the following support services:

1. Data Distribution
2. Objection Registration and Discovery
3. Infrastructure Management

The connected vehicle environment is built on standardized definitions of the primitive pieces of data that flow from source to destination that can be picked up and used in many different ways. But to do all of this we need to trust that the data we get is what it says it is. Regarding the sender of the data, we do not need to know them or have an established relationship with them



so long as we can be sure that they are a trusted member of the environment. Trust is established by taking advantage of something the Information Technology industry calls Public Key Infrastructure (PKI). Anyone that has had to electronically *sign* a form online has used PKI in one of its forms.

All users in the connected vehicle environment—all drivers, operators of systems, agencies that deploy field equipment, developers of hardware and software—will apply for credentials called digital certificates. When messages are transmitted over an interface this certificate is used to *sign* the message. This signature will allow the receiver to know that the message is from a valid/trusted sender. If the signature is not there or the message is garbled in some way then the receiver can decide not to trust the incoming data. This process will be largely transparent to the end user as it is today when a web browser applies for and receives digital certificates for secure applications.

Omaha recognizes that the CVRIA and its associated Systems Engineering Tool for Intelligent Transportation (SET-IT) support initial deployments and integration activities by taking different developments and research projects and illustrating how they all fit together. The CVRIA will form the basis for our deployment projects, which can then be integrated into the U.S. National ITS Architecture and provide the interface information needed for standardization planning. ◁

Measures of Effectiveness

Safety – reduction in accidents, reduction in crime, improved public perception

Mobility – congestion levels, accessibility, shared-use, multi-modal in nature

Climate Change/Environment – reduced greenhouse gas emissions, high air quality, high water quality

Efficiency of Services – accessibility, interconnected, efficient, high public satisfaction

Business Environment – sharing economy, innovation hub, investment ready

Infrastructure – smart water management, e-services, smart meters

Livability – education, healthy environment, accessibility to all, recreation

Connectivity – communication infrastructure investment, accessibility

Energy Use – renewable energy sources, energy-saving infrastructure

Sustainability – measure of our economic, ecological, political, and cultural will

Measurable Goals & Objectives

The City of Omaha is committed to identifying and measuring the results of our proposed deployment plans and project concepts. To that end, we have devised a plan that will allow us to gather both quantitative as well as subjective data to provide feedback to our team as well as USDOT to determine the success of deployments or identify areas that require further refinement. By the very nature of the proposed deployments we have identified in this document, data is a key element in nearly everything. The City of Omaha's Smart City deployment team has specialists identified for the sole purpose of collecting this data, both real-time and post-implementation, and using it to determine performance against the goals set out at the beginning of the deployment.

We will report the performance at identified marker points in the deployment schedule and in accordance with requirements from USDOT, as well as allow for independent review and verification by USDOT evaluators.

Specifically, during our Concept of Operations phase, the Omaha Smart City Team will verify that each project or deployment phase has measurable and meaningful goals. Our Measures of Effectiveness (MOEs) will include the prescribed USDOT MOE areas of Mobility, Safety, Efficiency, Sustainability and Climate Change as well as additional MOEs that we consider to be critical to meet our Omaha Smart City objectives.

The Omaha Smart City team will have a specialized task within our scope devoted to performance measurement. This aspect of our team will be headed by an independent consultant that will report directly to our project steering committee throughout the entire deployment period and produce reports for USDOT. The performance measurement team will undertake the collection of critical data from the various deployments and use that as measures against our stated goals and objectives. The performance measurement team will also undertake a series of public surveys using online polls and apps such as My Sidewalk™ as well as in-person polling within the community to gather public perceptions and feedback on the progress Omaha is making as a Smart City. ◁

Omaha's Got Capacity

The City of Omaha has the capacity, executive commitment, trained workforce, and infrastructure to take on projects of this magnitude. As previously mentioned, Omaha is currently working on a $35 million project to upgrade our traffic signal and communication infrastructure. A master plan was approved by our elected and executive leadership at the City in 2013, endorsing this vision and investment. Omaha has successfully secured $17 million of federal funds (Surface Transportation Program and Highway Safety Improvement Program), programmed over the next five years for deployment of several phases of this major project. Omaha has also recently built a traffic operations center with a video wall. We have strategic partnerships with Verizon Wireless, Unite Private Networks (fiber provider), and INRIX for successful management and monitoring of data. These planned upgrades and investments in our infrastructure will further complement and support the Smart City demonstration projects. Unlike many cities that are competing for the Smart City Challenge, Omaha has an established vision and a plan for ITS infrastructure and upgrades to other components of our transportation infrastructure critical to the deployment of the Smart City Challenge demonstration projects *within the established three-year schedule*. Omaha staff is trained in managing projects of such magnitude using federal funds. Our staff is well qualified and experienced at handling projects of this size and technical complexity. Our Traffic Engineering division consists of 65 full-time employees, while our Public Works Department has a staff of approximately 450 employees. Many of our professional staff are registered Professional Engineers with Master's degrees in Transportation/ Traffic Engineering. Several of our staff also have Professional Traffic Operations Engineer certifications. Our team brings a multi-disciplinary approach to the Smart City Challenge and consists of IT experts, visionary engineers, strategic communication experts and executive level leaders that have demonstrated experience in delivering such complex technology projects. ◁

Leveraging Federal Resources

Timing of the Smart City Challenge could not be better, since many of these improvements would assist with the deployment and demonstration of the Smart City concepts. Omaha is currently working on several key initiatives that are using federal resources to improve our city. Previously identified projects include:

- » $35 million traffic signal master plan;
- » $15 million TIGER grant for BRT.

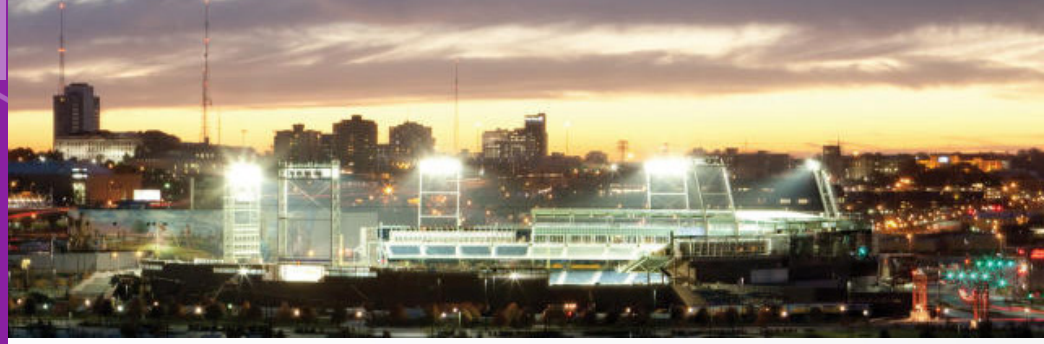
Urban circulator concept in Omaha.

METRO in partnership with City of Omaha is working on the design plans for the $30 million BRT project, which is estimated to be constructed and operational during 2018. The TIGER grant is being matched with local funds for the BRT project. The BRT project corridor will be used for the deployment and demonstration of certain elements of the Smart City Challenge.

Omaha is actively participating in the federal initiative called FirstNet. This is an emergency first responder communication system being deployed in Nebraska. Although, the infrastructure for FirstNet would be limited for the use of emergency first responders, it is anticipated that there will be synergies and efficiencies of scale with a partnership during the deployment phase. Timing of the deployment of FirstNet and the Smart City Challenge would coincide resulting in an tremendous opportunity for leveraging resources from both projects in the Omaha area.

Another resource that could potentially become available during the evaluation phase of the various projects is the UTC research funds.

If Omaha is awarded the Smart City Challenge grant, the above projects will be leveraged with the $40 million grant. In addition, Omaha pledges to work with our vast philanthropic community to secure additional matching funds. ◁



So Why Omaha?

Because we choose not to be the L.A. of 2045. We have state and city leadership who are engaged and committed. We are currently in the process of investing and modernizing our traffic signal technology, communication infrastructure, and implementing BRT. We are offering a Smart City district in the downtown event center area to implement and test multiple future technologies. This district is home to the NCAA College World Series providing a unique opportunity to increase the visibility of the USDOT Smart City program. Our community is also a place where the public gets involved and supports positive change. Our community will embrace the Smart City Challenge and be a fantastic test bed for future sustainable technology. Also note, our Smart City district is just a five minute drive from the airport allowing for convenient visits.

In Omaha, we don't coast. We work hard and lead by example. We are ready to be America's Smart City. We are driven by our sincere passion for our community, safety of the traveling public, and commitment to continue making Omaha one great, sustainable city. We are excited to help set the precedent for smart cities across the nation and the world. We look forward to being selected for further consideration as a candidate for the Smart City Challenge. ◁

OMAHA
WE DON'T COAST®