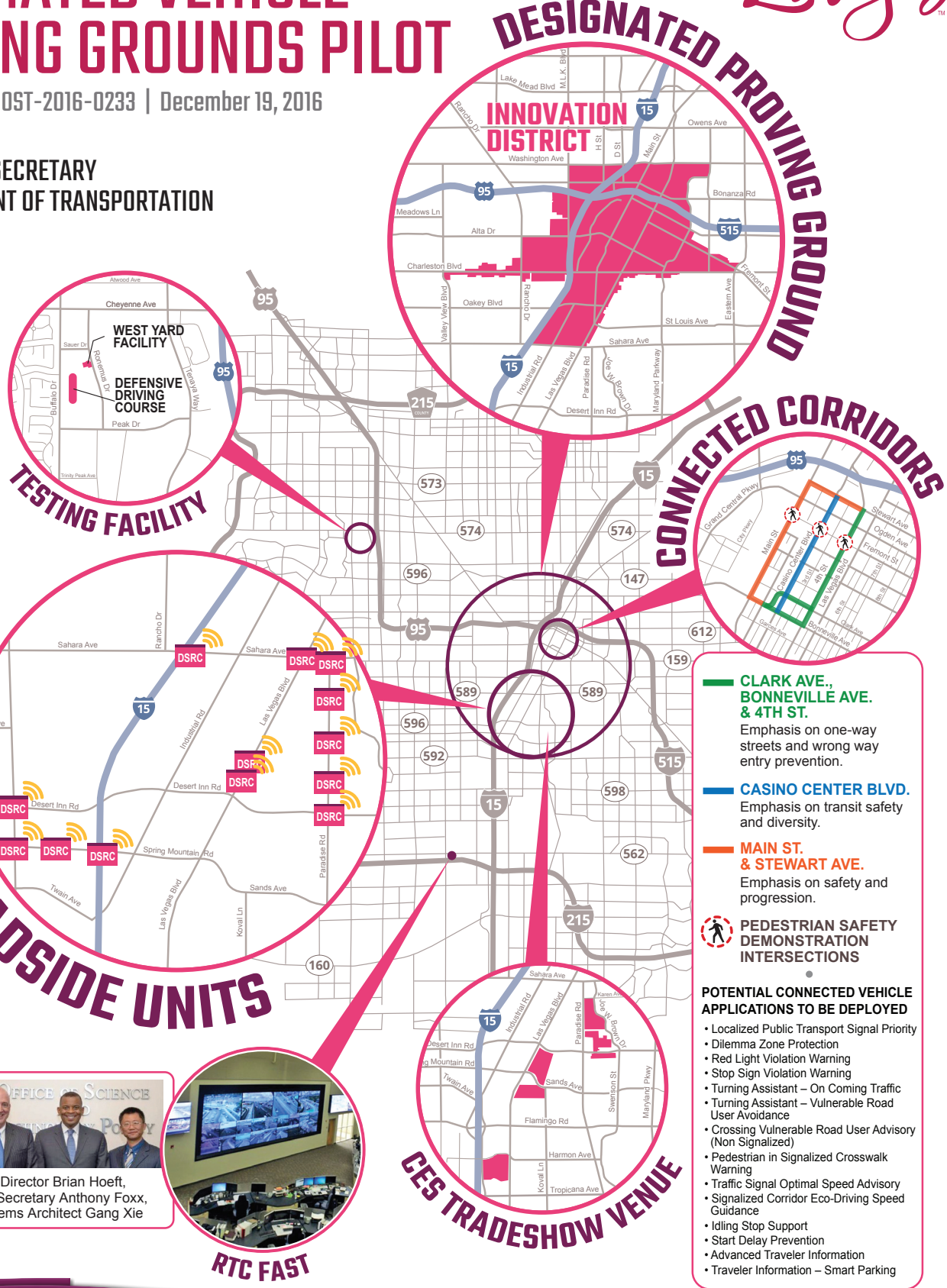
PROPOSAL FOR DESIGNATION OF

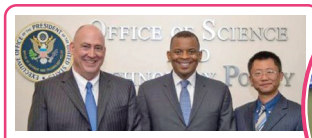
AUTOMATED VEHICLE PROVING GROUNDS PILOT

Docket No.: DOT-OST-2016-0233 | December 19, 2016

OFFICE OF THE SECRETARY
U.S. DEPARTMENT OF TRANSPORTATION

CITY OF Las Vegas





Program Director Brian Hoeft, USDOT Secretary Anthony Foxx, and Systems Architect Gang Xie

City of Las Vegas – Ready and Invested in AV

CITY OF LAS VEGAS NEVADA

CAROLYN G. GOODMAN
MAYOR

December 19, 2016

The Honorable Anthony R. Foxx
Secretary, United States Department of Transportation (USDOT)
1200 New Jersey Avenue, SE
Washington, D.C. 20590

Subject: Solicitation of Proposals for Designation of Automated Vehicle Proving Grounds
Docket No.: DOT-OST-2016-0233

Secretary Foxx:

The City of Las Vegas is vibrant, iconic, and on the cutting edge of developing safe practices that enable automated vehicle (AV) implementation and innovation. Solutions to everyday issues such as traffic congestion, parking, and accessibility are at our fingertips. With full-time staff already integrating AV technology and a demonstrated commitment to safety and security, **the Las Vegas is primed to be one of USDOT's AV proving grounds.**

Our Designated Safety Officer will engage representatives across City departments to oversee local AV deployments while remaining committed to the safety of road users and pedestrians. As part of the City's commitment to sharing our safety planning work, the City will work directly with the National Highway Traffic Safety Administration (NHTSA), other federal stakeholders, partners, and members of the Community of Practice.

In addition, we understand the importance of keeping data secure in this environment of advanced transportation communications and will work with USDOT to share all best practices as part of the Community of Practice. Las Vegas' yearly Consumer Electronics Show provides the Community of Practice with annual access to our experience with real-world AV deployments, including vendors already operating connected and automated equipment on our streets.

We respect that these transportation improvements also come with ethical and societal impacts. This year, our inaugural GO NV event will highlight our focused efforts to prepare our city for widespread automated vehicles and to work with partners from the public and private sectors, federal and local governments, and international partners so that stakeholders are represented and heard. GO NV will feature Dr. Mark Rosekind, NHTSA Administrator, to help us establish a foundation that supports safe, long-term AV technology use operating within laws, regulations, and federal policies.

The City of Las Vegas is well matched to serve the USDOT as an AV proving ground. From our upgraded infrastructure, including a connected corridor already under development, to our application for a USDOT Smart Cities grant, our efforts to be at the forefront of this changing transportation world demonstrate our commitment to improving the lives of our traveling public. At the same time, we appreciate the responsibilities that come with being iconic and progressive. Las Vegas has a unique AV test environment that we would be proud to share with USDOT and the rest of the nation.

Sincerely,

Carolyn G. Goodman
Mayor

Elizabeth N. Fretwell
City Manager

2014 WINNER OF THE
U.S. CONFERENCE OF MAYORS
CLIMATE PROTECTION AWARD

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City of Las Vegas: Your AV Partner

No other city would be a better stage than the City of Las Vegas (The City) for an automated vehicle (AV) proving ground. The entertainment capital of the world, Las Vegas' notoriety is supported by a foundation of technical expertise that makes our City a place for residents and visitors alike to benefit from advanced transportation solutions. These new technologies will increase the safety and efficiency on our roadways and the City recognizes the importance of testing and deploying automated technologies. Therefore, the City has already invested in AV, as illustrated on the map shown on our front cover and details provided in the Demonstrated Investments section. That is why the City proposes our Downtown Urban Core as the USDOT Designated AV Proving Ground. The Designated AV Proving Ground is a 2.5-mile radius centered on the City's Innovation District, which includes the area around the Convention Center.

Las Vegas is also an ideal location for AV testing since the climate and urban area is conducive to year-round deployments. In addition, the City also offers nearby access to other environments, including snow. The City uniquely provides urban scenarios which are important for testing. Some of these include high pedestrian activity, including tourists and visitors; highly mixed physical capability population; highly mixed ethnic and socio-economic populations; porte coche operations; high levels of pedestrian and vehicle traffic 24 hours per day, and roadways with a variety of physical characteristics.

Improved mobility for all users is a key consideration for the City. Our AV proving ground plan includes locations where solutions providers will be able to address the needs of citizens as they manage commuting and their last mile to and from their transit stop. This AV proving ground is part of the City's larger plan to address the needs of citizens who otherwise would not be able to access transportation networks. With a safe AV program in place, citizens will have more access to jobs and networks.

The City is committed to AV development, has the intelligent transportation network and technical capability for AV deployments. This document outlines the current focus areas and activities currently under way. We look forward to sharing our knowledge, research, and lessons learned with USDOT and the Community of Practice.

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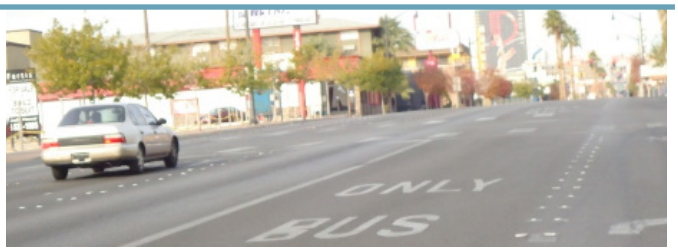
MANDATORY CRITERIA

The City meets the mandatory criteria to be an AV proving ground. Qualifications regarding the following criteria are detailed in our Commitment to Safety and Research, Application, and Data Sharing sections.

- **Our Designated Safety Officer**, Woody Smith, will support USDOT in promoting a safe environment for the launch and deployment of technological advanced transportation innovations. Woody is the Public Works Department designated Safety and Health Officer and maintains several workplace safety plans. An Autonomous Vehicle Safety Plan is currently under development, and Woody will be instrumental in its creation and maintenance as a living document as testing and deployment of AV continues in the City. He is committed to participating in the Community of Practice's regularly scheduled quarterly safety meetings. The City is eager and willing to host the Quarterly Safety Meetings.
- The development of connected and autonomous vehicle (CAV) technologies cannot occur in silos, and we would be **more than willing to share the City's approaches to safety and the data generated through testing/operations, and also to learn from the Community of Practice.** Each city and region will have its own unique learning experiences that will contribute to the Community of Practice. One example of knowledge gained through our experience with Consumer Electronic Show (CES) vendor demonstrations was the technical requirements for interoperability of connected vehicles communicating with the same roadside units (RSU). Opportunities to share information such as this will include presentations at conferences, leading webinars, preparation of white papers, participation through the Community of Practice, and posting data on our Innovate.Vegas website (to be launched by end of December 2016).
- The City proposes our Downtown Urban Core as the USDOT Designated AV Proving Ground. The **Designated AV Proving Ground is a 2.5-mile radius centered on the City's Innovation District,** which includes the area around the Convention Center. The Innovation District was established in February 2016 for the promotion and adoption of new transportation infrastructure and mobility technologies. It demonstrates the political and management support for development/deployment of CAV. Existing investments have already been made and will continue to instrument our urban core (and ultimately the City) with infrastructure to support vehicle-to-infrastructure communication and proving of AVs, as illustrated on the map shown on our front cover and in details highlighted in the Demonstrated Investments section. Examples include Local Motors' Olli and Keolis/ Navya's 100% autonomous, driverless electric vehicle on Fremont Street. Keolis/ Navya is working with the City to begin on-street testing of their AV in January 2017. With safety as a priority, the City's Traffic Field Operations West Yard Facility provides an established environment to "bench test" equipment prior to on-street deployments.

PROPOSED CONTRIBUTIONS

The City is an integral part of the larger AV deployment environment of Nevada. The City has a focused and specific approach to our AV proving ground. The City intends to use the Designated Proving Ground, which is centered on our Innovation District, and includes roads adjacent to the Convention Center to concentrate on safety efforts. **We developed a Safety Oversight Board** comprised of local and national experts, who will channel resources to enable the Las Vegas geographic area to be a world-class, safe environment for the launch and deployment of technological advanced transportation innovations.



Fremont Street's bus-only lanes are potential locations within the Innovation District for exclusive and safe AV pilots.

Las Vegas, through the CES, is and will continue to be the epicenter for the launch and demonstration of AV technology. As part of the USDOT's Designated AV Proving Ground Pilot, Las Vegas will be a specific, focused, prepared, and safety-conscious Community of Practice member, willing to contribute expertise, vendors, and a controlled community of 120,000 early adopters who join us for CES every year.

Established AV Program

City Council adopted the Innovation District resolution in February 2016, solidifying their commitment to testing and deployment of AV within the City's urban core. The City commits to sharing with the Community of Practice all of our experiences with deployments within our Innovation District and the CES-related deployments, both on road and on the track built in the lot of the Las Vegas Convention Center. The Proving Grounds will provide the ability for real world deployments all year round that will benefit our community and solve real transportation needs. The City Council has made it a priority to provide a safe and convenient mode of transportation within the City's urban core for all residents, visitors, and workforce. The City is excited to announce that they are underway with plans to deploy a slow speed automated people mover within the Fremont East Entertainment District and has received a commitment from Keolis/Navya for an on-street deployment of their driverless vehicle in early 2017.

The City will be one of the first in the world to launch this type of technology on-street. Fremont Street currently has bus service with exclusive bus lanes in several areas, which provides critical infrastructure and space conducive to testing of AVs and supports long term deployment. In addition, First Street, another working AV corridor in progress, is a low-volume roadway connecting to the Bonneville Transit Center, a regional transit hub to the Resort and Casino District within the Innovation District. This practical connection will serve as a future AV corridor to provide passengers with convenient access to employment centers and recreational destinations.

In addition to our Innovation District AV program, the CES event offers unequaled access to real world deployments of AVs with dozens of vendors interoperating connected and automated equipment on the streets of our city. **The Traffic Engineering Field Operations team has begun testing and evaluating RSUs, including dedicated short range communications (DSRC) at the West Yard Facility.** This facility offers the ability to "bench test" technologies before integrating into cabinets on city streets. These unique features are discussed in detail in our Demonstrated Investments section and the map on our front cover.

National/Regional Leadership in Mobility Challenges

Las Vegas is well known as the Entertainment Capital of the World and is home to the famous Las Vegas Strip. Looking beyond entertainment and the Strip, Las Vegas has mobility challenges similar to other urban US cities. Las Vegas is home to over 2.1 million and by 2045, it is expected that there will be close to 3 million residents. We have and will continue to face mobility challenges resulting from our rapid growth and urban sprawl. This growth will increase the strain on our current infrastructure, public transit capacity, public services, and overall safety and mobility of our residents and visitors. We are planning for our future. Recently, the City completed two long-term planning visions (Mobility Master Plan and the Downtown Master Plan), and participated in a collaborative regional planning effort called *Southern Nevada Strong*. As the Southern Nevada Strong Final Report indicates, our community can get stronger through the "collaborative effort to plan, create, and sustain neighborhoods where residents can have access to quality education, a variety of housing choices, good paying jobs, and transportation options".

The City has identified transportation challenges and continue to research and implement both short- and long-term solutions that simultaneously promote safety, sustainability, air quality improvement, enhanced mobility, and increased quality of life in the region. AV has the potential to solve many transportation challenges, and that is why the City is focusing efforts on CAV technologies to address mobility and safety challenges.

Mobility Challenges

Through planning efforts, the need for a public transportation option has been identified that will connect the urban downtown destinations and encourage use of alternative modes of transportation. This need is driving the effort to launch a Downtown Circulator, a complementary service focused on the downtown urban core in addition to the regional public transportation service provide by the Regional Transportation Commission of Southern Nevada (RTC). The service will connect residents to life activities such as medical care, government services, jobs, family friendly museums, shopping, and entertainment. Further, the Downtown Circulator will connect passengers from the Bonneville Transit Center to downtown jobs and government services.

Many of these riders are low income and without access to a vehicle (based on the 2014 on-board survey: 52 percent of passengers have an annual household income of $20,000 or less and 73 percent have no access to a car). This project will provide transportation choices for underserved communities. In the short-term, the City is planning for deployment of a traditional shuttle service within its downtown urban core with connectivity to a pilot deployment of an automated transit vehicle that provides service for a shorter segment on Fremont Street. Ultimately, the vision is for the circulator service to include AVs along the entire route. Through controlled on-street deployments, the technology can be proven and long term benefits evaluated. **This will address a major issue facing every metropolitan area in the country: improving mobility for underserved communities.**

Safety Challenges

Las Vegas has a vision for a safe, convenient transportation environment for all residents and visitors. The goal is for zero fatalities. However, the State of Nevada has experienced 243 fatalities from January 1, 2016 to October 2, 2016. This is an increase from 222 fatalities in 2015 for

the same time period. Within the City, there were crashes that occurred along arterial corridors such as Charleston Boulevard, Rancho Drive, Decatur Boulevard, and Sahara Avenue. These roadways have a high transit ridership and pedestrian activity as well as wide rights-of-way with high vehicular volume.

The typical contributing factors for vehicular crashes within Las Vegas include aggressive driving, speeding, distracted driving, and impaired driving. The typical contributing factors for pedestrian crashes are improper crossings and occurrences at night. Proper deployment of emerging technologies such as CAV has potential of greatly addressing the safety challenges. This is why the City is currently focusing efforts to create a network of connected corridors within the downtown urban core and working with partners such as the Delphi, NXP, Savari, and the GENIVI Alliance. **The solutions developed along these corridors will be scalable for deployment on the corridors noted above, throughout the region, and nationally.**

The AV deployment on Fremont Street and connected corridor deployments within the Innovation District will not only provide a way to showcase the AV technology but also prove the technology to ultimately solve mobility and safety needs. It will provide an easily replicated model for other metropolitan areas to apply within their cities.

Community of Practice Contributions to Safety Plans, Testing Data, and Stakeholders

Safety Plan Sharing

In the following section, Commitment to Safety, the City describes plans to develop detailed safety plans for future AV deployment. The City fully commits to sharing all of these coming plans with the Community of Practice.

Since the City is currently planning the deployment of slow speed automated people movers in the Fremont East Entertainment District, Las Vegas commits to sharing the safety plans for this deployment, the stakeholder engagement work, as well as any of the data or research outcomes. Safety will be our first priority. Since this will be an onstreet deployment, the safety management plan will account for interaction with people on the street and how it will be operated in a controlled environment.

Some specific safety concerns include interaction of the AVs with pedestrians, management of the vehicle's maintenance and programming, maintenance of a safe speed, interaction with other vehicles, and cybersecurity concerns. The City will conduct a road safety audit of the routes to better understand potential interactions between cars, trucks, pedestrians, motorcycles, and bicycles with the AVs. The focus would be on the human factors of these interactions. The safety audit will document the concerns which will be outlined in the safety plan.

Access to Testing Data

The City's deployment projects integrate transportation data from multiple platforms (public sector, ITS, commercial traffic data, and non-proprietary/non-confidential safety data from private vehicles) into a fully interoperable platform that can be used for data analytics and dissemination to the open-source community. As other cities and regions adopt mobility enhancement initiatives for their residents, the data platform used for City projects will be showcased as a case study for other cities and transit agencies to use as a starting point. Two platforms for sharing of the testing data will be used.

The first platform will be the City's Innovate.Vegas website. The City prides itself in transparency and sharing of data as demonstrated in our participation in the "What Works Cities" program since 2015 with the Bloomberg Philanthropies. The Innovate.Vegas website will highlight our current projects within the Innovation District, be a tool to educate the public, and a method to share information with other agencies. It will contain maps, project information, team contact information and most importantly project testing data and technical assessments.

The second platform will be through RTC's award-winning Bugatti dashboard (http://bugatti.nvfast.org/), which has already provided a model for data interoperability and dashboarding that is being widely used across the country. The Freeway and Arterial System of Transportation (FAST) Dashboard is an on-line website totally designed, developed, and written by RTC FAST staff. It provides an easy-to-understand web-based user interface to enable transportation professionals, decision makers, and the public to pull and depict real-time and historical transportation network monitoring and performance information in a wide variety of user-selectable and user-customizable displays. The FAST Dashboard builds on the enormous storehouse of raw data automatically gathered by the freeway and arterial management systems. The City will work with RTC FAST to incorporate meaningful data into the Bugatti dashboard for the Community of Practice.

Stakeholder Engagement

The City has a successful history of collaborating with all local, regional, and state agencies in Nevada that are involved in AV initiatives. The City has regularly partnered with agencies including, but is not limited to, RTC (regional MPO and administrator of FAST), NDOT, Nevada DMV, Nevada Department of Public Safety, Governor's Office of Economic Development, Nevada Center for Advanced Mobility, neighboring municipal jurisdictions (Clark County, City of North Las Vegas, and City of Henderson), and University of Nevada, Las Vegas (UNLV). The City is also an active participant in the Statewide AV Task Force.

An excellent example of the City's recent partnering efforts is the CES GO-NV Summit on January 3, 2017, which was developed in collaboration with some of the above agencies. This summit will showcase the City's and other

partner agencies' recent accomplishments and will highlight future plans for advancing the transportation industry to save lives, increase mobility, and grow economies. These strong relationships result in support from partnering agencies to help overcome any bureaucratic burdens and allow the City to move expeditiously towards becoming an AV proving ground. The City is also working with the Consumer Technology Association (CTA), which hosts the CES, to continually improve the City's capabilities to test and showcase AV technologies. Private sector partners in this year's venture include Delphi, NXP, and Savari.

As proof of our commitment to advancements in AV technology, please see the quotes below and on the following page, demonstrating stakeholder support for the City as an AV proving ground.

December 14, 2016

"Southern Nevada is at the forefront of transportation innovation because local governments and private industry know how to collaborate and make things happen. In 2011, we issued our first autonomous testing license to the likes of Google and Audi. Recently we issued our first autonomous vehicle restricted driver's license to a Nevada resident. And now, we are the first in the nation to go live with vehicle to infrastructure technology (V2I) through our partnership with Audi. Southern Nevada is home to the nation's largest regionally integrated traffic management facility, and we provide the advantage of a one-stop-shop to interested technology partners. Our innovative approach has earned the RTC the U.S. Department of Transportation's (DOT) 2014 Data Innovation Challenge Award for its traffic management dashboard and a seat on the agency's ITS Program Advisory Committee."

Tina Quigley, General Manager, Regional Transportation Commission of Southern Nevada

December 15, 2016

"Nevada continues to participate in the national conversation about automated, autonomous, and connected vehicles from policy and planning to technology and deployment. The Nevada Department of Transportation looks forward to continuing and enhancing our partnership with the City of Las Vegas for their proposed Proving Grounds activities. This effort will provide an excellent opportunity to showcase the possibilities of this technology and the power of partnerships across multiple levels of government and the private sector. "

Sondra Rosenberg, PTP, Assistant Director, Planning, Nevada Department of Transportation

December 15, 2016

"The City of North Las Vegas fully supports the City of Las Vegas' desire to become an autonomous vehicle proving ground. We understand that it's not a matter of "if" this technology will saturate the new vehicle market, but rather "when" these vehicles will become the majority on our roadways. That being said, the time to prepare for this technology is now. Our state legislature has already enacted legislation and regulations to enable the testing and operation of autonomous vehicles in Nevada. Making the City of Las Vegas an autonomous vehicle proving ground seems to be the most logical next step. This is an exciting time in the Traffic Engineering field and the City of North Las Vegas is looking forward to piloting new technologies that support this transition and, more importantly, the safety improvements we expect to see as a result of these changes."

Mike Hudgeons, PE, City Traffic Engineer, City of North Las Vegas

December 9, 2016

"Downtown Project is committed to building an innovative and connected urban core, and fully supports the City of Las Vegas' efforts to promote Downtown Las Vegas as an automated vehicle proving ground. Our unique neighborhood would provide an ideal setting for such a trial with its 24-hour activity, tourist/local mix, and variety of land uses."

Mark Carlson, V.P. of Operations, DTP Mgmt, LLC, a Nevada limited liability company

December 16, 2016

"Collaborating with all stakeholders Local Motors is innovative amongst vehicle makers in our open, co-creative approach to design, development, manufacturing and upgrade of vehicles. In this open spirit, we look forward to collaborating with the City of Las Vegas and other industry stakeholders to further the general public's adoption of HAVs by creating safer, smarter and more sustainable public roads for all. Local Motors believes that the future of transportation will be redefined by automated and autonomous vehicles, and we stand ready to build them."

Gina O'Connell – Director of Labs / General Manager-Las Vegas, Local Motors, Inc.

Stakeholder support for Las Vegas as an AV Proving Grounds

December 14, 2016

"[KEOLIS is currently collaborating] with the City of Las Vegas for a pilot to establish the viability of [AV] technology and its interactions within an urban environment (Fremont Corridor, Las Vegas)...We are proud of our partnership with the City Of Las Vegas and we look forward to utilizing this opportunity to put Las Vegas on the national map as an early innovator in AV technology and safety information gathering. We have the capabilities in place and we hope that we will be able to contribute to enabling the RTC and City to become a testing ground for this new technology. "

Francis Julien, General Manager, Las Vegas Operation, Keolis Transit America

Keolis

December 14, 2016

"By deploying connected and automated vehicle technology Savari aims at making cars and roads safer. The goal is to eliminate traffic accidents affecting drivers and pedestrians, that have been on the rise in Las Vegas. Therefore, Savari strongly supports the proposal of the City of Las Vegas to become a USDOT approved autonomous vehicle proving ground. We are looking forward to working with the city towards achieving the Zero fatalities vision."

Lynette Mandal, Director of Marketing, Savari

SAVARI™

Stakeholder support for Las Vegas as an AV Proving Grounds

Relationships with research program offices

The City has established an Innovation Team with representation from several of the City's Departments including Public Works, IT, Communications, Economic and Urban Development, and Planning. The Innovation Program and deployment of the advanced technologies requires close coordination between these various City Departments. The team meets weekly for coordination of our Smart City and AV projects. The City Innovation Team is already working closely together and looks forward to integrating with the Department's relevant research program offices.

The appropriate contact from the City Innovation Team will be identified based on the focus area of the relevant research program office. The City contact will maintain a collaborative relationship with the USDOT designee and develop a shared vision with clear goals and objects. They will maintain regular contact whether it be video conferences using one of the City's virtual meeting rooms or teleconferences, or frequent exchange through email.

Conferences

Las Vegas is excited to expand and grow its relationship with the Community of Practice as well as USDOT. **This year, our inaugural GO NV event will feature Dr. Mark Rosekind, the Administrator of NHTSA.** This event launches our focused efforts to prepare our City for AV and to work with partners from public and private sector, federal and local governments and international partners to share our experiences.

Las Vegas offers CES and other related events, such as SEMA, as an opportunity for all of the members of the Community of Practice to come together to share experiences, data and research and also to share these experiences with the rest of the monumental international audience which joins us in Las Vegas every January.

In addition, the City has historically attended and presented at transportation and engineering focused conferences organized by ITS America, Institute of Transportation Engineers, National Association of City Transportation Officials, American Public Works Association, and America Society of Civil Engineers to name a few. Members of the City's Innovation Team have also attended smart city and automotive focused conferences such as the Smart City Council meeting in Austin, and the Automated Vehicle Symposium and GENIVI Alliance All Member Meeting in San Francisco this year to gain a broader view of the AV subject matter.

Meetings

The City also offers the ability to host regular meetings for the Community of Practice. While we are also willing to travel to any other location for regular meetings with NHTSA and the Community, Las Vegas' McCarran airport is a national and international hub for travel, with regular direct flights to locations through the US and internationally as well.

Las Vegas commits to regular reporting of all data, regular meetings with NHTSA and other USDOT staff at Washington D.C. offices as well as with any USDOT staff local to the Las Vegas area. The City has on-call blanket contracts with national consulting firms, who have staff in Washington D.C. who can act on our behalf. The City looks to grow and deepen its relationships with NHTSA, the program staff and other groups within USDOT as we work together to promote safe deployments of AV.

Academia Partnership and Joint Research

To be on the forefront of advanced mobility, the City has successfully partnered in research with academic institutions including UNLV. UNLV has extensive expertise in this arena and some of their facilities include the Transportation Research Center, the Drones and Autonomous Systems Lab (DASL), and the Office of Economic Development. The City will leverage the

knowledge gained from ongoing public-private partnerships related to AV testing and deployment that UNLV is currently engaged in that will also support the Smart City initiatives. These include:

- UNLV partnered with Local Motors to create a research and development program that will drive new technology for automobiles. DASL will be used for the AV testing.
- UNLV, Switch and Intel partnered to reinvent learning and expand research by installing a dedicated fiber connection between campus and the Switch – Intel Cherry Creek Super Computer. The new Cherry Creek Super Computer allows researchers to analyze a large amount of complex data in a fraction of the usual time, and allows for sharing of data in real-time and high powered analytics.
- UNLV has partnered with the Brookings Institution to form the Brookings Mountain West that evaluates regional public policy including transportation. In addition, UNLV has a top ranked (Top 100) Law School that has offered courses in autonomous systems policy.

The City is also working with UNLV's College of Fine Arts School of Architecture Urban Design Studio to safely adapt areas for AV, including mapping Downtown's underutilized spatial areas. In addition, the City used a project jointly developed with UNLV to monitor use of street lights to improve pedestrian safety, decrease greenhouse gas emissions, and improve the overall reliability of our roadway lighting used by all users of the streets at night, including AVs. The City will continue this work and integrate student work into forthcoming AV projects.

December 14, 2016

"[UNLV] seeks to identify and design non-traditional spaces and places that can safely adapt automated vehicles across the Urban Core of Las Vegas. Currently, we are collaborating with the City of Las Vegas in mapping Downtown's underutilized spatial areas and in recognizing that Downtown Las Vegas is uniquely poised to embrace diverse types of autonomous and robotic vehicles."

Maria Vera
Faculty of Urban Design and Urban Culture
University of Nevada, Las Vegas

UNLV College of FINE ARTS

The City is proud to offer an internal research and innovation team. These professionals are consistently reviewing current research, articles, and other entities' AV technology efforts to stay abreast of this exciting work on national and worldwide platforms and assist in developing upcoming initiatives and are looking forward to working with USDOT to further AV technology.

Submission of Significant Activity Reports

Depending on the size of the Community of Practice, the USDOT will need a method to coordinate efforts, monitor progress, and identify items that will need to be coordinated between member entities. Activity Reports are a critical communication between the City and the USDOT. Coordination will be made with USDOT to determine the content and frequency of the reports.

COMMITMENT TO SAFETY

As discussed in our Proposed Contributions section, the City is planning to deploy AV technology on Fremont Street starting as early as January 2017. This makes having a Safety Management Plan in place critical to launch this project successfully and safely. This area is known for high pedestrian activity in a concentrated urban environment, which will provide an ideal framework for subsequent safety plans to deploy CAV technology. It is important to note that Keolis/Navya has a safety plan developed for the Fremont Street pilot and significant safety precautions will be made for this first-of-its-kind demonstration.

In addition to our experience in developing safety plans for existing AV deployments, the City is committed, absolutely, to safe development of CAVs on our roads. Our roads are heavily traveled by pedestrians and other vulnerable road users and our City is heavily concerned about safety during this transition time between level 0 and level 5 automation.

In order to develop and maintain safe practices for personnel, protocols, designs, deployment, and operation, the City has committed to the development of a Safety and Security Oversight Board.

For the long-term, the City has developed a Safety and Security Oversight Board recognizing the need for a long-term safety plan. This Oversight Board will consider all hazards and potential risks involved with deployment of on-street AVs. Planning for potential risks will be critical for future successful deployments.

Woody Smith will be the Designated Safety Officer and lead the Oversight Board in development of the Safety Management Plan. He has been with the City since 2011 and is the Designated Safety and Health Officer.

Woody is involved in development of City Workplace Safety Management Plans and identification of potential workplace safety risks. He specializes in the ability to analyze hazards and develop risk assessments for both work sites and public areas surrounding city facilities; and recommend and develop safety and health policies, plans and procedures to minimize risk to the public, employees and contractor employees.

NDOT has a well established safety program led by Ken Mammen, NDOT's Chief Traffic Safety Engineer. Ken has over 25 years of experience in traffic safety, including extensive experience with safety data. Woody will work closely with Ken during the development of the City's Safety Management Plans.

The Safety Management Plan will be a living document and updated regularly with input by the Oversight Board.

Members include representatives from City Departments and Partner Agencies, but not limited to the following:

- **City Attorney's Office –** Key issues to be addressed include liability and recommendations on required policies.
- **Fire and Rescue –** Key issues will be interaction with driverless cars and will the driverless vehicle be able to react to fire trucks and ambulance services when en route to respond to an incident. First responders have experience contributing to and creating safety plans for on-road deployments for SEMA and CES as well as many other on-road events.
- **Human Resources/Risk Management –** Risk Management assesses the level of risk associated with events/activities that occur within our City for development of insurance limits and routinely works with the City's Insurance Broker Aon Risk Services. AON Risk Services will be a resource to the City through discussions regarding the changing landscape that driverless cars pose such as who should be insured - the vehicle manufacturer, the operator, or the person driving in the vehicle.
- **Public Safety –** The transition from manned vehicles to driverless vehicles will pose safety challenges that will need to be considered. Their input will be critical to develop enforcement policies and potential codes for addressing the operations of AV on our roads. For example, if a vehicle malfunctions, who is at fault and who should be responsible?
- **Public Works –** Key issues will include integration of equipment for vehicle to vehicle and vehicle to infrastructure communications and interoperability between manufacturers and the deployment of traffic control for the safe interaction of driverless cars with manned vehicles, pedestrians, and bicyclists.
- **NDOT Traffic Safety -** Ken Mammen and staff from NDOT Traffic Safety Division will be key members of our Oversight Board. Ken specifically brings regional and national perspective on traffic safety.
- **RTC –** RTC developed a regional traffic safety plan. As part of that effort, RTC created a stakeholder group for safety planning, which the City will consult as we develop our Safety Oversight Board.
- **State Agencies –** Participation will also include partner agencies such as Nevada Department of Transportation, Nevada DMV, Nevada Public Safety, and NCAM.
- **Local Public Agencies –** This will include the Cities of Henderson and North Las Vegas, Clark County, and may include parking enforcement, parking facilities owners, street light maintenance, electric fueling station providers and utilities providers. The City includes these as potential partners in a Safety Board to oversee safety of AVs.

The City further demonstrates our commitment to larger scale development of AV based safety planning by hiring a safety planning expert. In anticipation of the on-street AV deployment in January 2017 and the designation as a certified deployment area from NHTSA, the City has hired Jeff Bagdade, a nationally known safety planning expert.

Jeff has experience developing safety plans for many states as well as safety planning for AAA, and international experience and has developed safety plans for USDOT.

Some of Jeff's work includes:

- Developing Safety Plans: A Manual for Local and Rural Road Owners
- Michigan Department of Transportation, USA, Preparation of Regional Traffic Safety Plans
- USDOT/FHWA, USA, Road Safety Audits/Assessments Training Course (NHI 380069) Development and Presentation
- USDOT/FHWA & Kuwait Ministry of Public Works, Kuwait, Road Safety Audit Training and Facilitation

As part of the City's commitment to sharing our safety planning work, the City will make Jeff available for work directly with NHTSA, other federal stakeholders, partners and members of the Community of Practice.

In addition to the safety focus, the City is also focused on the security of data coming from CAVs. The City is committed to taking steps to ensure the security of data not only from DSRC-based connected vehicles, but is also committed to secure data management in any type of advanced transportation communications.

RESEARCH, APPLICATION, AND DATA SHARING

AV Solutions for Improved Mobility in the Region and Surrounding Corridor

Las Vegas is known for its glitz, glam, and lively nightlife. Over 40 million visitors are welcomed to our valley annually and 2.1 million people call the valley home. Las Vegas is well known as the entertainment capital of the world. Pivotal to supporting this honor is a highly advanced freeway and arterial system of transportation that manages our valley roadways and freeways.

Our transportation system supports the broader region and offers an ideal environment to develop applicable mobility solutions. When residents and visitors commute on our roadways, they seamlessly cross borders between Clark County and the Cities of Henderson, Las Vegas, and North Las Vegas or commute on NDOT maintained roadways. We have a unified transportation network, standards, traffic signal coordination, and advanced management of the system. The entities within Southern Nevada don't work in silos and progressively work together on transportation for all.

The transportation professionals from all jurisdictions actively participate in the regional adoption of traffic standards for design and operation. FAST, managed by RTC of Southern Nevada, is a testament to the collaboration and forward thinking innovation by the Southern Nevada local public agencies and NDOT. The central system housed at the regional Transportation Management Center was the first of its kind. It is the central hub for arterial management, traffic signal coordination, freeway management, incident management, traffic control, and archived data management and analytics.

Because of these advances and consolidated structure of FAST, earlier this month, Audi chose the Las Vegas Valley to launch testing of a feature that allows their cars to obtain traffic light information using the valley-wide vehicle-to-infrastructure (V2I) communication network. This feature will display the information to the driver on how much longer the driver have to wait until the next green light. This is a big step towards advancing the connected and autonomous technology.

Research/Resources for AV Activities and Programs

USDOT will have access to our existing programs, partnerships, and projects, as well as anticipated and ongoing efforts. On-going activities include the deployment of a slow speed AV on-street within our urban core in January 2017. This will be one of the first on-street deployments that will provide the opportunity to evaluate how the vehicle interacts with the road infrastructure, testing and assessment of our safety protocols, and evaluation on how it is received by people.

The City is also underway with a robust connected vehicle deployment. To date, 14 traffic signals within the region have been instrumented with DSRC radios, with the potential of 4 more locations for this year's CES alone. Our experience includes the installation, inspection, and integration of the data into our regional traffic system, working with both the providers of the On-Board Units (OBU) that communicate with the DSRC radios, as well as the RSU vendors themselves. These DSRC radios connect directly into our NTCIP compliant traffic system which uses a robust fiber optic backbone for communications between the traffic signals and the central system.

As mentioned previously, the City is underway to develop a network of connected corridors within our Innovation District for deployment of CAVs. The project is underway and will install 24 additional DSRC radios in the Downtown Innovation District again using our significant fiber optic investment that has already been made, and is continually expanding to effectively utilize the latest technological advances. It is expected that these additional DSRC radios **will be operational by the second quarter of 2017.**

This project will provide a solid backbone for the safe assessment of CAVs, that use this area as a proving ground, and offers the capability of monitoring the performance of various technology deployments.

Following are other activities in partnership with RTC-FAST and private sector partners currently under way that we look forward to sharing with you:

- Work with Delphi, supplier for OBUs, which are DSRC radios that allow vehicles to communicate wirelessly with one another and with infrastructure, including traffic signals and other traffic devices.

- Work with Arada, NXP/Savarius, and Siemens/Cohda on partnerships to supply RSUs, which are DSRC radios that allow traffic signals to communicate wirelessly with the vehicles with OBUs installed.
- Work with Trafficware, suppliers for the traffic signal software which will communicate with DSRC radios that communicate wirelessly with the vehicles with OBUs installed. The City traffic signal controllers are Trafficware ATC 980 and run Apogee Controller Software, which are all NTCIP Compliant (i.e. controllers are 1202 compliant). Since the software is NTCIP compliant to USDOT standards, it is easier for all OBUs to communicate with the RSU's using accepted standards for greater interoperability of safety sensitive data sets.
- Work with Traffic Technology Systems, who has developed software that communicates with our traffic system database once per second. Data is processed and analyzed for information, such as the length of a signal's red light. This information is now being sent to Audi, and three additional car companies who will use this data will be announced at CES. The automotive OEMs will then provide these traffic signal timing predictions to drivers of cars with the feature enabled.

Our team also has experience integrating connected vehicle data into existing transportation management software and anticipates contributions to the Research Data Exchange, as well as any other tool the USDOT finds helpful to improve safety. All of these efforts directly impact our upcoming work with the CAV test bed in the Innovation District. We are partnering with these entities to lay the groundwork for AV activities and programs that can be scaled as USDOT sees fit.

As discussed, the City is an active partner in the development of research, programs, and resources to advance AV technology with academic partners.

Commitment to Open Data Sharing

The City is committed to sharing all non-proprietary collected data, our lessons learned, and experiences through deployments on our Proving Grounds within the Innovation District, working with vendors through deployments in support of CES, and in-house research and testing conducted at our Traffic Engineering Field Operations West Yard Facility with the Community of Practice and all regional, statewide, and federal partners.

DEMONSTRATED INVESTMENTS

For additional information regarding the City's demonstrated investments, please refer to the map shown on our front cover.

Capital Improvements to the Proving Grounds

The City has made and is currently making significant capital investments to improve motorist mobility and safety, provide reliable transportation choices, and showcase technology. The considerable investment already made by the City and its partners not only illustrates our commitment to becoming an AV Proving Ground, but also provides a solid launching point for the immediate deployments well in advance of the January 2018 opening day as required by the USDOT. We will not need to build out the ITS infrastructure.

The traffic signal system is integrated into ATMS.Now Central System Software, the regional advanced traffic signal system at RTC FAST. FAST is one of the first integrated intelligent transportation system organizations in the country. FAST can both monitor and control traffic through the detection of traffic conditions using video imaging and inductive loop detection, traffic signaling, dynamic message signs and lane use control signals. This system can support data exchange for testing of CAVs. The City has just under 900 traffic signals and flashers connected to the central traffic system by over 125 miles of reliable, redundant (48-pair or greater) armored fiber optic cable. As mentioned earlier in this document, the traffic signal controllers are ATC 980 controllers manufactured by Trafficware (formerly Naztec) and run Apogee Controller Software that is NTCIP compliant.

Innovation District

We are proud that our City Council approved our Innovation District resolution this year. This consensus shows that elected officials support implementation of AV innovation and empowers City staff to explore technology options, create partnerships with technology suppliers, and attract technology companies and other businesses. The entire Innovation District is available for vendors to test year-round. The Designated Proving Grounds are centered on the Innovation District and encompasses the area around the Convention Center.

This space will also be a proving ground for collaborative efforts between the City and its new technology partners. The City plans to transform the downtown urban core into a technology incubator focused on safe, efficient, sustainable, and environmentally conscious mobility such as CAVs and establishing a platform for deploying innovation. This incubator environment provides a safe space for

USDOT to evaluate and scale technologies tested here and throughout Las Vegas to other applications nationwide.

Significant existing investments have been made within the established Innovation District to create a center for testing groundbreaking CAV technology. Existing telecommunications investments to support the CAV deployments within the Innovation District is estimated to be $6.4 million. This includes the conduit, fiber optic cable, cable splices, copper telecommunication cables, splice vaults, controllers and other ITS devices throughout the Innovation District. An additional $600,000 will be invested within the next year to fully deploy CAV technologies along Innovation District connected corridors.

These investment costs do not include design costs, construction management, system integration, or the traffic signal investments. Other efforts that are underway to advance AV technology in support of the Innovation District follow.

DSRC ROADSIDE UNITS

In advance of AV deployments, the City, in partnership with RTC and Clark County, has made significant efforts to work with vendors for successful installation of DSRC for testing purposes. Details on the DSRC RSUs installations can be found under the Research/Resources for AV Activities and Programs Section.

LIDAR MAPPING

Anticipating the advent of CAVs, the City invested in LIDAR mapping of the downtown roadways. This technology provides an accurate model of above ground and below ground infrastructure to create a "3D city." Detailed maps are available for deployers of AVs and map creators to access and use to improve automated technologies. This system draws on an intense and accurate survey ground control system and utilizes terrestrial and mobile high-definition survey scanning and accuracy. LIDAR data is available for programming of AVs with roadway features. In addition, Southern Nevada Water Authority has acquired LiDAR data for the entire Las Vegas Valley and currently processing that data. The City will have access to this data.

DOWNTOWN PUBLIC WIRELESS NETWORK

Currently, throughout the Downtown Innovation District, public Wi-Fi covers approximately 40% of the area, as part of a Public/Private Partnership with a local technology firm, LV.Net. The Wi-Fi is made accessible to the public at no cost to the City, and negotiations are underway to increase the performance, expand the service area, as well as allocate minimum levels of bandwidth for City use only, alongside the "free public Wi-Fi." This specifically allocated bandwidth will be used to evaluate various technologies and sensors, often referred to as the "Internet of Things" (IoT) devices. About 1 square mile of the current Wi-Fi deployment offers high speed broad wireless access utilizing the City's existing fiber optic infrastructure with a 1 Gig backbone service level. With a project currently underway, the City's intent is to expand this area to about 2 ½ square miles. This system will be deployed to enhance the CAV experience, while validating the safety aspects of the automobile's evolving technologies.

DOWNTOWN PRIVATE MACHINE NETWORK

The City is developing a robust private machine network downtown that will support communication between vehicles and traffic management technologies. Having this communication in place, users and vehicles will be able to have a more efficient and safer commute as well as access to destination information. The private machine network is expected to be 4G speed or better. This will support communication between vehicles, roadside infrastructure, and traffic management centers. Vendors partnered with the City will rest assured knowing they have access to a secure, fast communications network. This feature will be key for connecting users and vehicles to AV technologies.

GPS BASE STATION NETWORK

The City has implemented a GPS Base Station Network, which is primarily used to provide highly accurate land measurements and road mapping. The same high-level system also is utilized by UAVs and ultimately the autonomous, self-driving car. This system will be an important addition to the Innovation District.

State Authorization for the Proving Grounds

The deployment of AVs is supported by state legislation. The state of Nevada requires that AVs be registered with the DMV and, in fact, has become the first state to offer a registration to an AV. The City strongly supports the state in its efforts to create a safe environment for the development of new technology and remained aligned with federal policy and guidance as an AV proving ground.

Testing and Deployments Underway

As the first community to deploy an autonomous bus (using optical guidance with paint striping detection technology), Las Vegas is at the forefront of testing and deploying AV technology. In addition to the City's work with the CES CAV deployments and the deployments related to the infrastructure listed on the preceding page, the City has also identified the Fremont East Entertainment District as a location for one of the world's first driverless transit vehicles, and we are working with manufacturers to target deployment in 2017. The City has received confirmation from Keolis/Navya that they will be ready to test their autonomous transit vehicle as early as January 2017.

The City's existing fiber optic network is being used to create connected corridors within the Innovation District. This environment provides connectivity to traffic signals, and we are currently working on deploying elements to these corridors.

The West Yard facility offers a testing area to evaluate the effectiveness of AV technology. Currently, it is being used to test all new traffic signal equipment, including pieces to be used for AV technology. The West Yard offers room to actually install poles and other equipment to proof the technology before it is incorporated into our city streets.

In addition, the West Yard provides immediate access to an existing test strip for defensive driving courses. This area can be used an AV proving ground for live testing and deployment in a safe, controlled environment. The West Yard facility promotes interoperability and offers USDOT an in-place proving grounds for field testing and deployment.

READINESS

The City of Las Vegas is Ready

The City is "innovation ready"! The roadway infrastructure is available now for on-street testing of AV. Following this effort, the City intends to expand to a phased, on-street, mixed use deployment with other road users and pedestrians. Connected corridors will be available by second quarter 2017 for widespread vendor use. Las Vegas will be open for full functioning testing and deployment well in advance of the January 1, 2018 deadline.

Beyond technology deployments, Las Vegas' success as a pioneer of innovation is the result of several key components: positive political support, wide-ranging partnerships, progressive but realistic policies, and an ability to incubate innovation. The policy, partnership, and political framework developed by the City within our Innovation District can be used by other metropolitan areas to use as a model and case study for innovative successes.

Nevada also has the foundation for Autonomous Vehicle Pilots by creating policies that enable the testing and operation. Private companies that desire to test their AV technologies can obtain licensing through the Nevada DMV. Current requirements include a surety bond cash deposit, insurance, or proof of self-insurance in the amount of $5 million; proof that one or more of the applicant's AV has been driven a minimum of 10,000 miles in autonomous mode; an established safety plan for testing on public roads, and a plan to train vehicle operators. Application for vehicle registration is for testing purposes only.

Not only do we have the infrastructure to accommodate on-street deployments, but the ability to license companies for on-street AV testing.

Multiple Users and Publicly Shared

In the 10 years since we began efforts to upgrade facilities to support safer connectivity, the City has seen dozens of partners all working together to execute deployment of interoperable connected automation on our roads.

The City has nourished relationships with dozens of private sector entities who are fully focused on advanced transportation. Our ability to bring together external partners to advance safe connected autonomy is completely reflective of our ability as a city to lead regional efforts with public sector partners. The City has excellent working relationships with many of the public-sector agencies which are needed to support efficient and thorough deployment of connected automation. The transportation teams from DMV, RTC, Nevada Center for Advanced Mobility, NDOT, Clark County, meet weekly to coordinate on transportation, deployment topics.

At the 2017 CES, Las Vegas will be one of the only locations in the world to host interoperable connected vehicles accessing the same RSUs. Several manufacturers are sharing access to RSUs to demonstrate AV applications during CES. Las Vegas is committed to continuing its investment to build interoperable, transportation equipment used by multiple users and open to the public.

As further evidence of the City's commitment to publicly share equipment and data, after the 2017 CES, the City will require, in writing, that vendors installing equipment must ensure the equipment's openness and availability to all authorized users and must make all data available for the City to share.

Facility Point of Contact

Facility Point of Contact:
Joanna Wadsworth, PE, Innovation Program Manager, Public Works
333 N. Rancho Dr., Las Vegas, NV 89106
702-229-2214

Joanna Wadsworth, PE, will be the point of contact for the City's Designated Proving Ground. She leads the City's Innovation Team and Smart City efforts. She will actively participate in the scoping of projects for testing within the City's proving grounds. She will engage the appropriate team members and ensure that the required resources are available for a successful deployment. She is also committed to sharing information throughout the process.

Community Engagement

Las Vegas has made significant strides in implementing outreach efforts that reach all members of the community as we embark on this AV journey.

We have reached out to the businesses on Fremont Street to let them know about the AV pilot deployment project. The outreach was to introduce them to the concept of AV's and see if they have any questions or concerns. We are sensitive to the many businesses within our downtown and along Fremont Street. We want to deploy a program that is beneficial to the residents, business community, and. City. The only way to have a successful deployment is to have addressed the concerns of the community.

The annual CES and inaugural GO NV in January will give residents and business owners an opportunity to have their questions answered and experience live deployment and AV technology in person. This real-world understanding provides unparalleled insight into how AVs operate and introduce the community to their capabilities. To reach an even broader audience, the City will launch Innovate.Vegas, a new website for community engagement efforts, by the end of December 2016. This will provide a forum for the City to provide information on current innovation projects and their status.

Since 2013, the city's emphasis on social media as a viable communications tool has grown significantly—and so has the City's prominence as a national leader in the usage of social media. In mid-2014, the city began to overtake other local government agencies and news organizations to become one of the most followed Twitter accounts not only in Las Vegas but throughout the state.

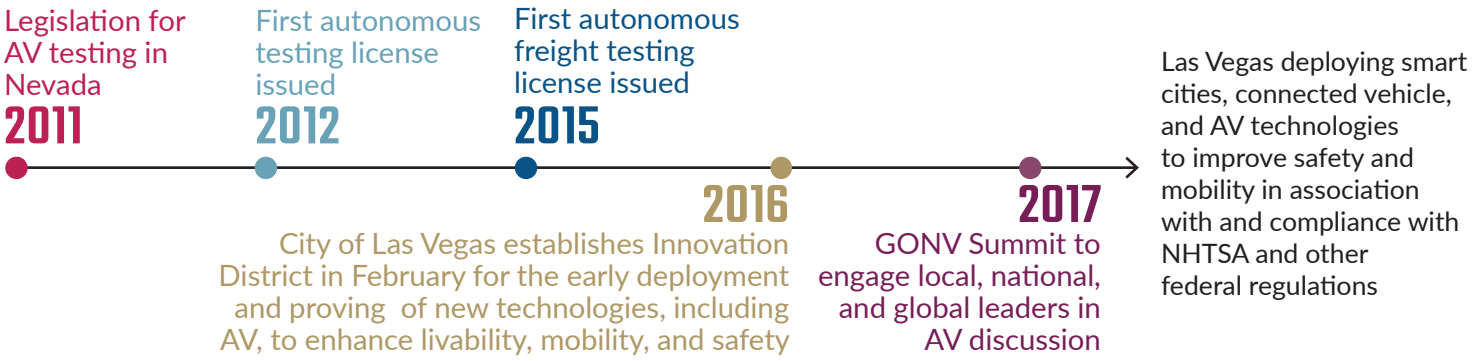
The City maintains a presence on nine different social media channels and has more than 50,000 Facebook fans, nearly 140,000 Twitter followers and nearly 32,000 Instagram followers. The total number of impressions, or the potential audience (reach) for the City's social media posts, is about seven million per month. The City's Facebook page has had 6.7 million video views so far in 2016, up from 677,000 in 2015. As social media grows, the City is prepared to engage the community in AV technology implementation through these already successful platforms.

ADHERENCE TO LAWS, REGULATIONS, AND FEDERAL POLICY

The City commits to adherence to all state and local laws and federal regulations regarding AVs, including NHTSA's policies for operating AV technology on public roads.

The state of Nevada, supported by the City, has been the lead agency to advance legislation to promote the early deployment of AVs in the state and in Las Vegas. Nevada has a history supporting legislation that promotes innovation for economic development and for applying innovation and technology to improve safety and mobility. In 2011, legislation was passed that allowed for the testing of AVs in Nevada. More recently, Governor Sandoval, the American Association of State Highway and Transportation Officials, and NDOT held a policy conference to determine what the state of the practice was in this space.

The City understands legislation regarding AVs is in development and is excited about working with the State of Nevada and NHTSA to advance AV legislation at the local, state, and national levels. The City is interested in complying with, facilitating the development of, and applying laws, such as the states' law for licensing of AVs and will work with NHTSA and engage our state partners to develop proper state legislation is in place for early deployment of AV that promotes development of this technology and is consistent with and advances NHTSA's objectives for AVs.



Timeline of AV progress and development in Nevada