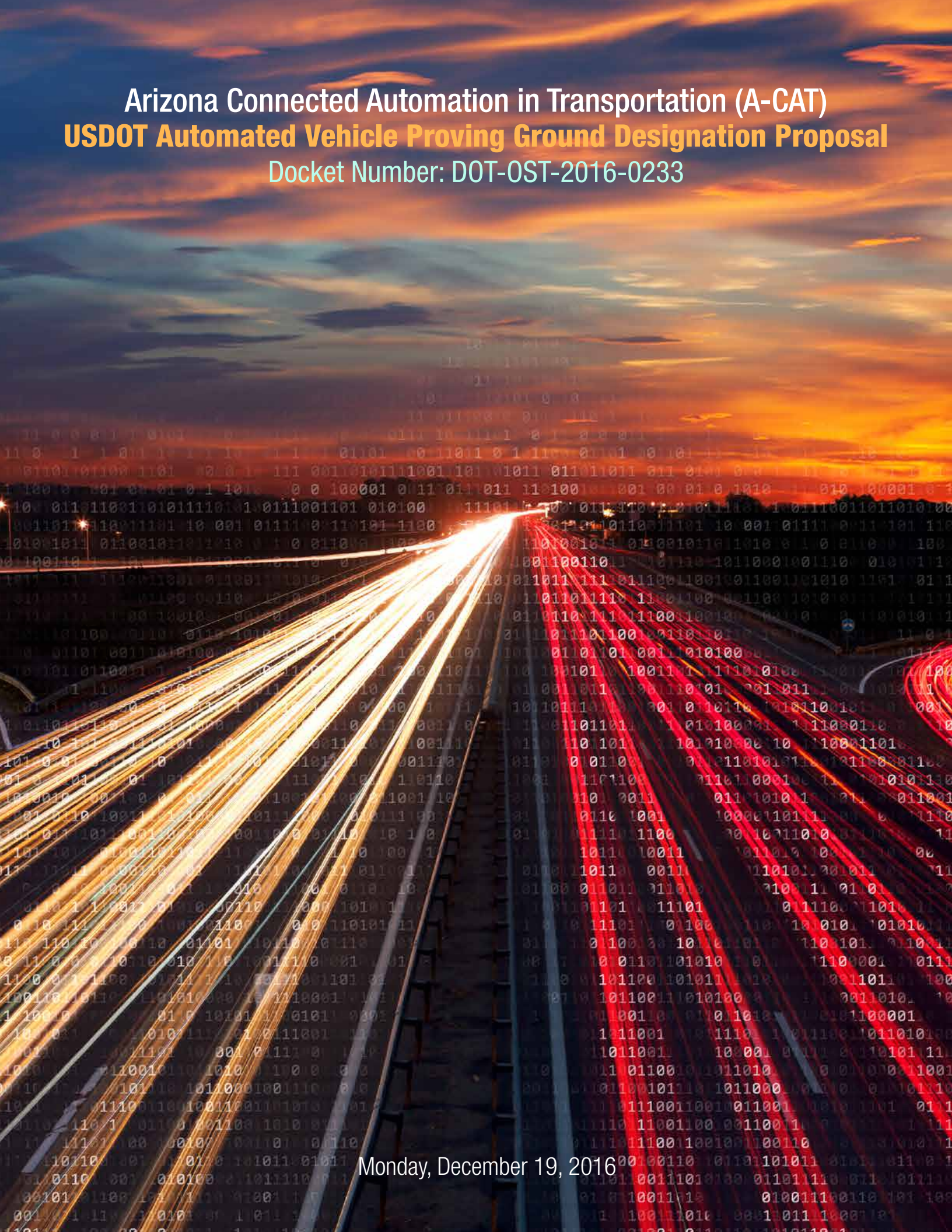
Arizona Connected Automation in Transportation (A-CAT)

USDOT Automated Vehicle Proving Ground Designation Proposal

Docket Number: DOT-OST-2016-0233



Monday, December 19, 2016

ADOT

Maricopa County
Department of Transportation

THE UNIVERSITY OF ARIZONA®

MCDOT SMARTDrive Program℠

December 19, 2016

U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, D.C. 20590

Dear U.S. Department of Transportation,

The leadership of the Arizona Connected Automation in Transportation (A-CAT) is pleased to submit this application for one of the U.S. Department of Transportation Automated Vehicle Proving Grounds Pilot sites. The **Arizona Department of Transportation**, the **Maricopa County Department of Transportation**, and the **University of Arizona** have been collaborating on local and national connected vehicle projects since 2007. The state has strong support for connected and automated vehicle technology through the Governor's Executive Order 2015-09 on Self-Driving Vehicle Testing and Piloting in Arizona and establishment of the Self-Driving Vehicle Oversight Committee.

Our Emergency-Vehicle Infrastructure Integration (E-VII) connected vehicle concept was the foundation that resulted in the SMARTDrive Test Bed implementation in 2012. We have successfully implemented Multi Modal Intelligent Traffic Signal System (MMITSS) applications, included concepts realized in the Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.) application, and developed work zone alert applications. We continue to engage our local, academic and private partners to implement, test and demonstrate transformative and cost-effective systems using connected and automated vehicle technologies.

Being designated as an Automated Vehicle Proving Ground will expand Arizona's current deployment in Anthem, AZ and will apply connected and automated vehicle solutions. The A-CAT leadership team knows this is just the beginning of a significant shift in how we plan, design, operate, and innovate our future transportation systems. The partners and the Anthem community are committed to ensuring this is a successful Pilot and that we establish a strong foundation for continued deployment in the future. Arizona is on the leading edge, and we look forward to partnering with you on this transformational Automated Vehicle Proving Grounds Pilot program.

Dallas Hammit, P.E.
Deputy Director, Arizona Department of Transportation
ADOT

Jennifer Toth, P.E.
Director, Maricopa County Department of Transportation

Introduction

The Arizona Connected Automation in Transportation (A-CAT) partners, comprised of the Arizona Department of Transportation (ADOT), the Maricopa County Department of Transportation (MCDOT), the University of Arizona (UA) Transportation Research Institute (TRI) and OZ Engineering submit this proposal in order to have the Anthem Connected Vehicle Test Bed located in Anthem, Arizona recognized as one of the United States Department of Transportation's (USDOT) approved Automated Vehicle (AV) Proving Ground pilot locations.

Arizona has been in the forefront of transportation research and is one of the 10 states selected by AASHTO in 2004 to advance connected vehicle technology. At that time, MCDOT, ADOT and UA undertook a research project to identify how new connected vehicle technology applications could enhance traffic signal operations, incident management and traveler information. As a result of this opportunity, MCDOT and UA developed the concept of vehicle prioritization and used this concept to develop applications to improve safety for emergency responders. This concept later led to the development and deployment of the USDOT's Multi Modal Intelligent Traffic Signal Systems (MMITSS).

Today, the vision of the A-CAT partners is to realize the full potential of safety and mobility benefits and broad-scale implementation of connected and automated vehicles. The primary objective of the automated vehicle proving ground pilot in Anthem will be to develop integrated connected and automated vehicle technologies in accordance with national standards without compromising the safety of the public to achieve the following goals:

- Show a ***commitment to safety***
- ***Readiness to improve mobility and safety*** for all by utilizing ***existing connected/automated vehicle technology*** to develop the next phase of automated transportation
- ***Invest*** in Arizona's economic ***future*** by continuing to expand its ***connected vehicle infrastructure***
- ***Promote adoption*** of connected/automated vehicle technology ***through leadership***
- ***Develop public and private partnerships*** to further connected/automated vehicle technology
- ***Share data and results*** gained through the development of connected/automated vehicle technology with all public and private transportation industry entities
- ***Deliver timely results*** to USDOT by expanding upon current infrastructure
- Develop policies and best practices while ***adhering to existing laws, regulations and federal policy***

Commitment to Safety

Safety is a primary concern when introducing new and advanced capabilities and technologies into an existing transportation infrastructure. The A-CAT partners will develop a detailed Safety Management Plan (SMP) to address the safety needs of travelers, development and testing personnel, and other personnel who will participate in the proposed A-CAT AV Proving Ground deployment. This plan will include identification of safety needs and risks to human participants. The draft and final SMP will be submitted to the USDOT under the established time frames and revised as appropriate to respond to comments by the USDOT.

In order to leverage the safety plans developed, the A-CAT partners will conduct Vehicle and Road Safety Audits (VRSAs) to identify the critical safety concerns with the use of safety scenarios describing the site operations. These audits will be conducted within the test bed during MMITSS testing and demonstration events. Fail-safe modes for automated vehicle operations will be established, tested and documented. Additionally, safety concerns of stakeholders identified during the development of the Concept of Operations will be addressed. Careful execution of the proposed VRSAs will further ensure safety by evaluating existing issues associated with the site.

Deficiencies identified will be brought to the attention of the corresponding authorities and USDOT for resolution. In-depth analysis using the standard evaluation processes will be applied. The safety operational concept will also include the plan for ensuring worker safety during the technology installation, testing and operations. The plan will follow established processes for traffic control and risk mitigation for intersection-

related equipment installation and receive approval by the respective public agencies as required. The A-CAT partners will develop a training plan for the operators, personnel, research teams, agency staff, private partner team members and other stakeholders. This training plan will be an important component of the SMP.
The A-CAT partners will follow the current USDOT Guidance Summary for Human Use Approval for Connected Vehicle Deployments and Federal Automated Vehicles Policy - DOT's Vehicle Performance Guidance and Framework. The A-CAT partners will coordinate with manufacturers and other entities to aid the National Highway Traffic Safety Administration (NHTSA) in safety assessments per Section D of the Federal Automated Vehicle Policy. However, the manufacturers and entities will be directly responsible to NHTSA to meet USDOT requirements.

The A-CAT partners will work with the University of Arizona's Office for the Responsible Conduct of Research and their accredited Human Subject Protection Program (HSPP) to obtain Human Use Approval. This program, which focuses on the application of applied research, offers an accredited Institutional Review Board (IRB) to obtain Human Use Approval for the AV Pilot Deployment. As such, the University represents a separate and integrated resource and capability to the Team. Members of the A-CAT partners have received certified IRB training through the HSPP and the Collaborative Institutional Training Initiative at the University of Miami (CITI).

Designated Safety Officer

The ADOT Deputy Director for Transportation and MCDOT Director will lead the A-CAT partners, and will provide overall oversight of the Safety Management Plan. The executive leadership has appointed two designated safety officers from their respective agencies, who will jointly serve as the designated safety officers: The ADOT Deputy State Engineer for Transportation Systems Management and Operations and MCDOT Transportation Systems Division Manager/County Traffic Engineer. In addition a certified Safety Resource Officer will provide test bed safety oversight. ADOT's State Safety and Security Oversight Program Manager will serve the role of Safety Resource Officer.

The safety officers will establish the AV Proving Ground Safety Committee, which will include representatives from the following agencies among others:

- USDOT
- Arizona Department of Public Safety
- Maricopa County Sheriff Office
- Daisy Mountain Fire District
- Anthem Community Council

The safety officers will also participate in the Community of Practice regular quarterly meeting of safety officers. The safety officers will establish regular and frequent meetings with the technical team to review safety procedures, safety data, adherence to standards, safety training and other safety aspects as identified in the Safety Management Plan.

The safety officers are committed to sharing their approaches to safety and non-proprietary/non-confidential safety data generated through testing and operation.

Readiness to Improve Mobility and Safety

Arizona has been committed to investing in connected vehicle (CV) technology to increase mobility since 2004. The result of this commitment is the Arizona Connected Vehicle Test Bed. Launched in 2012, the 5.3 mile Arizona Connected Vehicle Test Bed (constructed by Maricopa County) is a partnership between Maricopa County Department of Transportation (MCDOT SMARTDrive Program℠), the Arizona Department of Transportation (ADOT), and the University of Arizona (UA). It consists of 11 (eleven) MCDOT signalized intersections and one ADOT signalized (diamond) freeway interchange. The test bed is located in the master planned community of Anthem, AZ, which is an unincorporated area of Maricopa County. Developed in 1999, Anthem has about 25,000 residents and 10,000 registered vehicles. Anthem residents travel through the 11 (eleven) traffic signals included in the test bed as part of their daily activities of commuting to work, school, shopping and other activities. The test bed is one of the USDOT National Affiliated Test Beds.

Each test bed intersection is equipped with a dedicated short-range communication (DSRC) roadside unit (RSU) that broadcasts MAP and signal phase and timing (SPaT) data. Each intersection also hosts the USDOT MMITSS prototype system. The MMITSS system operates 24-hours a day, seven-days a week in a "live" traffic environment, and the MCDOT incident response vehicles (Regional Emergency Action Coordinating Team or REACT) that are equipped with vehicle on-board units (OBU) operate in the network frequently during the week.

Figure 1 shows a map of the Arizona Connected Vehicle Test Bed. The green and orange markers show the locations of the installed roadside units (RSU). The circles represent the 300-meter range of each RSU. Green represents units that are actively broadcasting MAP and SPaT data and are running MMITSS applications. The orange marker represents a unit that is installed but not currently broadcasting MAP and SPaT or running MMITSS applications. The interchange (diamond) at I-17 and Daisy Mountain has been installed; however, the controller needs to be upgraded in order to support SPaT data.

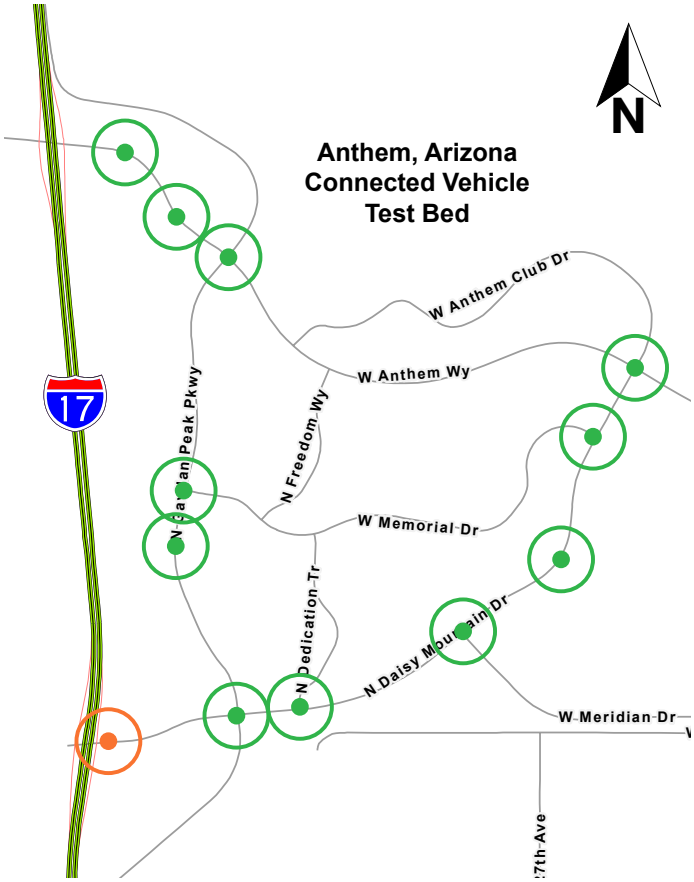


Figure 1: Arizona Connected Vehicle Test Bed (Anthem, Maricopa County)

All traffic signals in Anthem are integrated into the MCDOT Traffic Management Center and are centrally controlled. The University of Arizona research team has access to the system to enable active test bed monitoring, software upload and download applications, and system maintenance.

The test bed has successfully demonstrated the MMITSS, work zone alert and incident warning applications to transportation and elected officials from USDOT, international, national, state and local entities. Additionally, several articles related to the test bed and its applications have been published in technical journals, newsletters and magazines including – USDOT publications, ITE Journal, Government Technology, APWA Newsletter, TRB publications, Arizona Republic, NACo publication and several others. The test bed has also contributed to five Ph.D. thesis awards.

The total current investment in the test bed to date is over $3.5 million and includes:

- Test bed planning, development and construction: $1.2 million
- MMITSS Application (USDOT, Connected Vehicle Pooled Funds, Arizona match): $2.2 million
- USDOT funded test bed upgrade of 11 DSRC radios is planned for March 2017. This upgrade will also include Security Credential Management System (SCMS). USDOT is furnishing additional radios for bench and lab testing of applications
- Work zone and incident warning applications development: $75,000
- Operations cost including vehicle operations, demonstrations, system maintenance: $40,000 (annually)
- Agency staff resources (systems engineering, technology management, program management, public information, executive leadership)
- Research team resources (principal investigator, research staff, students)
- Consultant team (data management and processing, documentation, evaluation)

Future Connected Vehicle Investments

Figure 2 shows an overview of the proposed expansion to the test bed on the I-17 freeway. The red markers and circles represent five RSUs planned for installation at the interchanges of New River, Anthem Way, Pioneer, and Carefree Highway. The blue markers and circles represent nine additional RSUs located on north and south-bound I-17. The rationale for selecting these locations includes establishing an eight (8) mile section of freeway where test vehicles can drive in a loop – from the Carefree Highway to New River and back with adequate DSRC coverage to test the traffic applications that are developed.

Several connected vehicle applications can be developed and deployed in the extended test bed, including:

- System and traffic information, including a MAP, speed limit, lane restrictions (e.g. HOV, or dynamic) work zone and incident management messages from every RSU to support traffic management in the corridor
- Adaptive ramp metering that uses connected vehicle data for flow rate determination and vehicle actuation
- Ramp meter priority for special classes of vehicles including emergency vehicles, transit vehicles, and trucks
- Freeway speed harmonization (variable speed limits) [based on the USDOT Dynamic Mobility Application INFLO prototype]
- Freeway queue warning [based on the USDOT Dynamic Mobility Application INFLO prototype]
- Freeway dynamic lane control/restrictions (e.g. limit lane use by vehicle class and provide lane closure warnings/directions)
- Work zone and incident warnings (dynamic)

Future plans also include equipping Anthem resident vehicles. The Anthem Community Council (see attached letter of support), and community members have shown strong support in volunteering their vehicles for aftermarket OBU installation. The goal is to have 2,000 passenger vehicles equipped. This will be result in 20 percent penetration rate of equipped vehicles within Anthem.

Figure 2: Proposed Connected Vehicle Expansion (I-17 Freeway)

Steps to Automated Proving Grounds Implementation

A-CAT is excited by the opportunity to further its pursuit of mobility by expanding its Arizona Connected Vehicle Test Bed and potentially becoming a proving ground for automated vehicles (AV). This opportunity will aid A-CAT in it desire to help accelerate adoption of connected automated vehicle (CAV) technology through its convergence phase.

The primary purpose in advancing the Automated Vehicle Proving Ground Pilot is to demonstrate the integration of connected and automated vehicle applications on an operational freeway and arterial road network. Currently, most of the automated vehicle testing in 'live' operational environments is performed without any connectivity to the infrastructure. Additionally, public agency-led connected vehicle

testing and pilot implementations have not included automated vehicles. The A-CAT partners propose to offer USDOT a proving ground for development and testing of integrated automated and connected vehicle technologies. We believe that an integrated transportation environment will create a comprehensive transportation environment for all stakeholders – public agencies, private entities and auto manufacturers.

Promote Adoption Through Leadership

The A-CAT Partnership offers USDOT a strong and uniquely qualified team for the Automated Vehicle Proving Ground Pilot. The partnership, which was originally established in 2007, has broadened over the last eight years to include additional agency partners, as well as partners from the private sector and academia. Below is the proposed leadership and program administration framework. The framework is structured to effectively contribute to the Community of Practice at executive, program and technical levels.

Name	***Agency/ Organization***	***Title***	***A-CAT Role***
Dallas Hammit	ADOT	Deputy Director for Transportation	Executive Leadership
Jennifer Toth	MCDOT	Director and Maricopa County Engineer	Executive Leadership
James Windsor	ADOT	Deputy State Engineer for Transportation Systems Management and Operations	Safety Officer
Nicolaas Swart	MCDOT	Transportation Systems Management Division Manager/County Traffic Engineer	Safety Officer
Reza Karimvand	ADOT	State System Technology Manager	Program Manager
Faisal Saleem	MCDOT	ITS Branch Manager and MCDOT SMARTDrive Program℠	Program Manager
Herman Bernal	ADOT	State Safety & Security Oversight (SSO) Program Manager	Safety Resource Officer
Larry Head, PhD	UA, TRI	Professor of Systems and Industrial Engineering and Director of the University of Arizona Transportation Research Institute	Technical Team Lead
Tomas Guerra	OZ Engineering	Intelligent Transportation Systems, Principal	Data Systems and Software manager

Executive Leadership

The executive leadership and oversight will be jointly provided by Jennifer Toth, Director of MCDOT and Dallas Hammit, Deputy Director for Transportation of ADOT.

Dallas Hammit joined ADOT in June 1999 as senior resident engineer in the Yuma District. He later served both the Yuma and Prescott Districts as district engineer. In 2009, Dallas became deputy state engineer for operations, and in 2012, he became senior deputy for development. In 2014, Dallas was appointed State Engineer. Today, he continues to serve as state engineer and deputy director for transportation. As leader of the Infrastructure Delivery and Operations Division (IDO), Transportation Systems Management and Operations Division (TSMO), and the Multimodal Transportation Division (MPD), Dallas oversees development and delivery of the ADOT construction program, including environmental studies, engineering design, land acquisition and construction. He also supports the maintenance and operation of more than 6,000 miles of interstate and state

highways in Arizona. Mr. Hammit co-chairs the State Transportation Innovation Council, the Every Day Counts initiatives for Arizona, as well as serves as a committee member on the AASHTO Standing Committee on Highways. He also is vice chair on AASHTO's Innovation Initiative.

Jennifer Toth, Director and Maricopa County Engineer, serves on the national Connected and Automated Vehicle Executive Leadership Team (CAV-ELT) as well as the V2I Deployment Coalition Executive Committee led by AASHTO. Toth is a champion and strong advocate for transportation safety, innovation and technology. Throughout her career she has served and chaired several national, state and local committees related to safety, data, technology and innovation. She is committed to promoting the development of innovations in transportation. Most recently, Jennifer delivered a presentation at the Florida Automated Vehicle Summit updating attendees on the CAV-ELT's progress in prioritizing policy issues and developing national guidelines to accelerate the deployment of Automated Vehicles in convergence with Connected Vehicles.

Safety Management

The management of the safety programs will be led by James Windsor, ADOT Deputy State Engineer for Transportation Systems Management and Operations and Nicolaas Swart, MCDOT Transportation Systems Management Division Manager/County Traffic Engineer. In addition Herman Bernal, Arizona Department of Transportation (ADOT) State Safety & Security Oversight (SSO) Program Manager will provide safety oversight and will be the test bed Safety Resource Officer.

They will document in the Safety Management Plan (SMP) references to applicable laws, regulations and policies. The entities will be required to provide plans on how they intend to comply with all such applicable laws and regulations. The safety officers will monitor compliance and periodically report to appropriate local, state and federal authorities. Compliance will also be incorporated in accordance with the guidance provided in the Federal Automated Vehicle Policy. The local and state law enforcement agencies will be involved in granting permission to the vehicle manufacturers or other entities. The agency granting permission may choose to suspend or revoke the permission upon recommendation from the safety officers.

James Windsor oversees the Transportation Systems Management and Operations (TSM&O) Division of ADOT which includes the ITS Operations Section, the Traffic Management Section which includes the Traffic Operations Center and Incident Response coordination across the State. He is also responsible for the Operational Traffic and Safety section that delivers the State's Highway Safety Improvement Program (HSIP) and associated Strategic Highway Safety Plan (SHSP).

Nicolaas Swart oversees the Transportation Systems Management Division which includes the ITS Branch, Traffic Management Center, Traffic Studies and Design as well as Signal Operations. Nicolaas was instrumental in establishing the AZTech Partnership which is regional traffic management partnership in the Phoenix Metropolitan area that guides the application of Intelligent Transportation System technologies for managing regional traffic. Swart leads the monitoring of traffic operations and implementation of roadway safety improvements. He has also implemented a roadway safety program that proactively identifies improvements at intersection and run off the road locations. He is a member of the Maricopa Association of Governments (MAG) Safety Committee and has been involved in several Roadway Safety Assessments (RSA's) in the region.

Program Administration

The program administration will be jointly provided by Faisal Saleem, ITS Branch Manager and MCDOT SMARTDrive Program℠ and Reza Karimvand, State System Technology Manager for ADOT.

Reza Karimvand will serve as the ADOT Program Manager for this Proving Ground Pilot Project. He will be responsible for managing the freeway applications related to the AV deployment projects. Reza served as a Regional Traffic Engineer for ADOT's Southern Region for 10 years before serving as an Assistant State Engineer for the Arizona Department of Transportation. He has also led the Transportation Technology Department at the Traffic Operations Center. Currently, Reza is serving as a State System Technology Manager with the newly developed TSM&O Division. Reza is responsible for proposing, developing and managing

innovative technologies that can be deployed on the state highways to increase mobility and improve safety. He is a member of the V2I Deployment Initiative Technical Working Group 1 which offers reviews and input to the USDOT connected vehicle guidance and related products. Reza was instrumental in the success of the I-10 Corridor Coalition, which will allow the efficient flow of heavy vehicles from Texas to California through collective resource sharing and automation to provide friction free travel for Trucking Community.

Faisal Saleem, ITS Branch Manager and MCDOT SMARTDrive Program℠ will be responsible for the managing the arterial roads related AV deployment projects and will serve as the main point of contact for the administration of this program. Faisal has successfully led the development and deployment of the Anthem Connected Vehicle Test Bed and served as MCDOT's Program Manager for the implementation of the USDOT and Connected Vehicle Pooled Fund led MMITSS application. He has led the MCDOT team in successfully organizing MMITSS and other connected vehicle demonstrations for a diverse audience including – USDOT ITS JPO and FHWA staff, AASHTO Standing Committee on Research (SCOR), American Public Transit Agency, OEM's representing Crash Avoidance Metrics Partnership (CAMP), Anthem Community Council, elected officials and groups representing physically challenged population. Faisal also leads the commercial vehicle focused CVISN Work Zone connected vehicle application project and as well as the Regional Archived Data System (RADS) team in the Phoenix metropolitan area.

Faisal provides local agency perspectives and arterial road system input to the national connected vehicle program development. He serves as the Chair, Technical Working Group 4 (Guidance) of the V2I Deployment Coalition which provides reviews and input to the USDOT connected vehicle guidance and related products. Faisal is also co-lead in the recently established AASHTO and CAMP led Infrastructure Owners and Operators (IOO) and OEMs forum. Faisal has been a member of the ITE Connected Vehicle Task Force since its inception. Faisal is an internationally recognized leader in connected vehicle technology. He has shared his connected vehicles expertise with transportation leaders in multiple locations including Arizona, California, Washington, DC and Abu Dhabi, United Arab Emirates.

Technical Leadership

Larry Head, Ph.D. will serve as the A-CAT Technical team lead. Dr. Head is a Professor of Systems and Industrial Engineering at UA and the Director of the University of Arizona Transportation Research Institute (TRI). TRI, an interdisciplinary research entity, was established to research and address the mobility, safety and environmental challenges of a rapidly evolving transportation ecosystem.

Dr. Head has served as the Principal Investigator for the MCDOT SMARTDrive Program℠ and the Arizona Connected Vehicles Initiative since inception. He also led the MMITSS application technical development team. The application was successfully tested by USDOT evaluation team at the Anthem test bed and is available to the users through the USDOT Open Source Application Development Portal. The research also contributed to the USDOT standards development. Dr. Head has first-hand experience with autonomous vehicles. In 2007, he partnered with Raytheon, iRobot, Tucson Embedded Systems (TES), and Preferred Chassis to compete in the Defense Advanced Research Projects Agency (DARPA) Grand (Urban) Challenge. Their Scorpion autonomous vehicle successfully demonstrated autonomous driving in an urban environment.

Dr. Head served as chair of the National Academies Transportation Research Board's Traffic Signal Systems Committee (AHB25) from 2006-2012 and is currently a member of the TRB Intelligent Transportation Systems Committee and the Freeway Operations Committee. He was co-Chair of the National Transportation Communication for ITS Protocol (NTCIP) Signal Control and Prioritization Working Group (1211) from 2014-2015 and is a member of the Society of Automotive Engineers (SAE) Dedicated Short Range Communication Technical Committee from 2014 – present. Dr. Head has delivered lectures, presented papers and conducted training sessions in advanced transportation technologies nationally as well globally.

Data Management

Tomas Guerra, Intelligent Transportation Systems, Principal with OZ Engineering, will serve as A-CAT's Data Systems and Software manager. OZ Engineering, which has expertise in data management, analytics, processing and software development, is a certified Disadvantaged Business Enterprise and Small Business Enterprise. Tomas Guerra was a founding member of OZ Engineering, and has more than 25 years of software and system engineering experience. Tomas has been a key contributor in the regional planning and development of ITS in Arizona, as well as national ITS standards development and training.

Public Outreach and Participation

As there is only one opportunity to frame the message of new technology to the public and grow their enthusiasm, communications and outreach will be a critical factor to the success of the proving ground pilot. The A-CAT Program Administration Team will work with ADOT and MCDOT Communications professionals to develop and implement a comprehensive outreach plan covering public outreach and public participation activities, as well as the accommodation of site visits from external stakeholders, including USDOT staff members. This outreach plan will be developed and integrated into the PMP.

Additional Agency Resources

ADOT and MCDOT are committed to furnishing resources towards the development and deployment of the proving ground. These resources will at the minimum include –

- Agency staff resources to support test bed planning, design, safety, operations, outreach and coordination with USDOT staff.
- Maintenance and upkeep of proving ground road infrastructure to meet the needs of the connected and automated vehicle.
- Organization of demonstrations and development of outreach products.
- Data processing, analytics and sharing
- Others as identified during planning process

Develop Public and Private Partnerships

To meet the project goals, the A-CAT partners will establish partnerships with relevant entities. The A-CAT partners are already in exploratory stage discussion with the OEMs, Google (Waymo) and Local Motors. All major auto manufacturers including Ford, General Motors (GM), Toyota and Volvo have proving grounds in Arizona. Representatives of the Crash Avoidance Metrics Partnership (CAMP) recently visited the Anthem test bed for the demonstration of MMITSS and to explore the site for the connected automation testing. The cities of Chandler and Scottsdale within Maricopa County are current test sites for Google and GM automated vehicles. Local Motors is an Arizona-based entity which has invented 'Olli' a neighborhood automated transit solution. Transit technologies such as Olli are well suited for low density population neighborhoods like Anthem which currently do not have any neighborhood or regional transit service. Lack of this service specifically impacts those residents who cannot easily access transportation services due to disability or income.

Below is the list of entities identified for potential partnerships:

- Local Motors (Automated On-Demand Transit)
- OEMs (connected and automated vehicles)
- Utilities (smart lighting, communications)
- Communication providers (wireless, wired)
- Data providers (data, advanced analytics and precision mapping)
- Information disseminators (smart traveler information apps)
- Universities (technology development)
- Equipment manufacturers/providers (Road side and on-board infrastructure, advanced sensors)
- Public safety partners
- Public agencies partners – Infrastructure deployment and operations

Share Data and Results

The purpose of the proving ground is to assist with the convergence of connected vehicle (CV) and automated vehicle (AV) technologies. Research will be necessary for convergence and many questions will need to be answered. An example of questions to be answered includes:

- How will applications such as MMITSS, red light violation warning (RLVW), queue warning, curve warning, and dust storm warning perform for a connected automated vehicle?
- How will the data sharing from such environments foster automation?
- How will real-life traffic situations involving emergency vehicles, work zones, and incidents impact automated vehicles?
- How will the vehicles respond?
- Can an agency “certify” that they are safe?

In order to establish a viable platform to accommodate this convergence, the A-CAT partners need to develop the auto manufacturer and infrastructure owner and operator requirements for connected automation. The work accomplished by the USDOT and Crash Avoidance Metrics Partnership (CAMP) in the development of Vehicle to Infrastructure (V2I) concepts and applications will provide the foundation. They will be expanded to the automated vehicle environment, which is an area of research that has not been approached in active traffic environment.

A representative from the A-CAT partners is a local agency in the recently established Infrastructure Owner and Operator and OEM (IOO-OEM) forum created to establish data sharing needs and create processes between the IOOs and OEMs for data exchange. Through these discussions new needs for data sharing have been identified.

These relationships and the existing CV test bed in Anthem, Arizona will provide a spring board for the A-CAT AV proving ground. The A-CAT AV Proving Ground will leverage the existing capabilities and apply the data sharing processes as they are formulated to implement and test the connected and automated applications. In partnership with USDOT, appropriate processes will be established for participation in the proving ground research, sharing of data and outreach. The proposed USDOT products - Data Policy Playbook Roadmap, Operational Data Environment and Research Data Exchange will be excellent assets to foster data sharing and exchange.

The Arizona Connected Vehicle test bed has been utilized to prototype and test technologies and systems suitable for first-responder emergency vehicles, transit operations and pedestrian safety implementations. By applying SAE DSRC standards (J2735 Messages, J2945 Performance Requirements) for the communications between vehicles and the vehicle to infrastructure, a deep and hands-on understanding of the Connected Vehicle Reference Implementation Architecture has been established.

The Arizona Connected Vehicle test bed currently uses the Regional Archived Data System (RADS) as the repository for the resulting field test data including Basic Safety Messages (BSM), Signal Phase and Timing (SPaT), MAP, Signal Request Messages (SRM), and Signal Status Messages (SSM). RADS was developed by AZTech, a regional partnership led by ADOT and MCDOT was created in 1996, that has served as a national model for public-private data sharing. The AZTech data sharing processes were established in the early stages of the partnership, and in 2000, AZTech established and began utilizing RADS. All members of the A-CAT partners were instrumental in developing the AZTech data sharing agreements and are committed to promoting the advancement and convergence of CAV technology through data sharing.

RADS currently integrates data from freeway management system, arterial management systems (operated by cities and towns), 911 dispatch, high resolution signal timing data (multiple agencies) and third party probe data. Every two minutes RADS sends out data through FTP data in the public domain. RADS hardware has recently been upgraded to a state-of-art virtualized environment to support the big data needs.

Deliver Timely Results to USDOT

The designation of Automated Vehicle Proving Ground by USDOT will foster the implementation of a Connected and Automated test bed that the A-CAT partners envision will serve as a national model to demonstrate benefits of integrated connected vehicle and automated vehicle systems. If designated the A-CAT partnership endeavors to open the facility by January 1, 2018 for testing.

One of the success factors in the MCDOT SMARTDrive Program℠ connected vehicle test bed development and implementation is the well-defined and integrated program management. A similar approach will be applied to the AV Proving Ground Pilot. A Project Management Plan (PMP) will be prepared and integrated throughout the detailed project schedule. Regular adherence to and updating of these two program management guides will enhance internal and external communication. Benefits of this method include: improved communication with the USDOT research teams; identified and minimized project risks; and increased successful project outcomes. The Program Administration Team will develop a plan and tools for regular and continuous engagement with USDOT staff. The draft and final PMP will be submitted to the USDOT under the established time frames and revised as appropriate to respond to comments by the USDOT.

Adherence to Laws, Regulations and Federal Policies

The A-CAT partners will adhere to all federal, state, local laws, regulations and policies. The Arizona Executive Order 2015-09 provides for:

"The Department of Transportation, Department of Public Safety, and all other agencies of the State of Arizona with pertinent regulatory jurisdiction shall undertake any necessary steps to support the testing and operation of self-driving vehicles on public roads within Arizona."

The order also provides for proposed changes to state policies, rules or statutes that facilitate the expanded operation of self-driving vehicles may be proposed based on the results of pilot programs conducted within Arizona.

The A-CAT partners views public safety seriously and a thorough process will be developed in accordance with the federal, state and local laws and regulations to authorize Highly Automated Vehicles (HAVs) to operate on the public right of way. This process will contribute to the development of 'Model State Policy' as suggested in the Section C: Federal Automated Policy.

Conclusion

This proposal outlines an Automated Vehicle Proving Ground Pilot program that would test an integrated system of automated and connected vehicle technologies. It is only logical to build upon the successful Anthem, Arizona connected vehicle test bed to establish a CAV proving ground using the highly-qualified team that comprises A-CAT. The A-CAT partners believes this pilot would demonstrate that an integrated CAV system could improve safety, increase mobility and promote adoption of such a system that could lead to future investment in technology and infrastructure. The A-CAT partners are prepared to share results from the pilot program, and contribute to the development of a state model policy under federal guidelines.

Maricopa County, as the agency within which Anthem is located, has developed strong relationships with the Anthem Community Council as well as the community over several years. MCDOT is actively engaged with all traffic, safety and connected vehicle technology in the community and will continue to engage the community to address any concerns related to the proving grounds pilot. The Anthem Community fully supports advancing the proven and tested Arizona Connected Vehicle Test Bed to the proposed designation of Automated Vehicle Proving Grounds Pilot. Our constituents in Anthem are enthusiastic about this program, and to quote the Anthem Community Council Chief Operating Officer, they are ready for the next phase:

"The Council is excited to continue the Anthem community's involvement and partnership in Arizona and Maricopa County's initiatives in transportation innovation. Anthem is a growing, vibrant community, and one that will benefit from these unique and forward-thinking approaches to the safety and mobility of our transportation system."

An integrated transportation environment will benefit all stakeholders – public agencies, private entities and auto manufacturers. But more importantly, it will also provide an improved manner of transportation that will meet the challenges of a growing population while making our communities a better place to live, work and play.

anthem
community council

3701 W. Anthem Way, Ste. #201, Anthem, AZ 85086-1001
Phone: 623-742-6050 **Fax:** 623-742-6170

December 19, 2016

Arizona Connected Automation in Transportation (A-CAT) Partnership
c/o Maricopa County DOT (MCDOT)
2901 W. Durango Street
Phoenix AZ 85009

Re: Support for Designation of Automated Vehicle Proving Grounds Pilot

A-CAT Leadership:

The community of Anthem is proud to be the host site of Arizona's successful Connected Vehicle SMART*Drive* Test Bed since 2012. The Anthem Community Council (ACC) is pleased to show our support to Maricopa County, Arizona Department of Transportation (ADOT) and University of Arizona (U of A) for continued enhancement of innovative technology applications on our community's transportation network. Our community values the safety and mobility of our residents. We understand that the United States Department of Transportation designation of the Automated Vehicle Proving Grounds Pilot will lead to development of automated and integrated connected vehicles that will transform safety, personal and commercial mobility, as well as open doors to disadvantaged people.

As a partner, the ACC will support and help the A-CAT Partnership in their effort to facilitate outreach and awareness of automated and connected vehicle technologies among Anthem residents, and will help the Partnership to enlist volunteers to participate.

The Council is excited to continue the community's involvement and partnership with A-CAT's initiatives in transportation innovation. Anthem is a progressive, vibrant community, and one that will benefit from these unique and forward-thinking approaches to the safety and mobility of our residents.

Sincerely,

Neal Shearer, COO
Anthem Community Council

C: Jenna Kohl, CEO
Board of Directors