National Highway Traffic Safety Administration (NHTSA), Department of Transportation (DOT).

Pilot Program for Collaborative Research on Motor Vehicles With High or Full Driving Automation
49 CFR Parts 555, 571 and 591 [Docket No. NHTSA–2018–0092] RIN 2127–AL99

COMMENTS

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

Arizona has become a technology leader in the United States. With the governor's executive order, Arizona is also leading the way with Automated Vehicle (AV) technology and many companies are coming to Arizona to take advantage of our progressive testing environment. Likewise, Maricopa County is very interested in taking advantage of opportunities to integrate AV technology into its mainstream operations. Maricopa County's overall priority is to improve safety, mobility, reduce pollution, and keep Maricopa County economically competitive for businesses and attractive to families.

Maricopa County Department of Transportation (MCDOT) supports and concurs with NHTSA that research and gathering of data under real world scenarios is essential to advance transportation safety through the deployment of new and developing vehicle technologies. We have been a strong proponent of operational testing on public roads. Our focus is to collaboratively participate in research to better understand the societal benefits and infrastructure implications of new technologies on roadways. Through the **MCDOT SMARTDrive Program**[SM], launched in 2011, we have developed a 10-mile real world test bed in Anthem, Arizona in partnership with the Arizona Department of Transportation (ADOT) and University of Arizona (UofA).

The initial goal of the Program was to identify how new technology applications could enhance traffic signal operations, incident management and traveler information. Anthem is a master planned community located in Maricopa County roughly 17 miles north of Phoenix. Being located on the northern edge of the Greater Phoenix Metropolitan Area, Anthem offers many benefits for connected and automated vehicle (CAV) research and operational testing including a diverse topography, a variety of traffic systems, and a close proximity to numerous CAV stakeholders including private companies, academic institutions, and other public agencies with interest in transportation. The combination of these private companies, their testing facilities and the advantageous environmental conditions make Anthem an ideal location for CAV testing. The Anthem community is engaged and supportive of the advanced technology deployments and testing. This offers a unique opportunity for general public involvement in the development, testing, and eventual deployment of advanced driving system components.

CAV Implications to Road Infrastructure

Monitoring the environment outside the vehicle has always been the job of the human driver. Automated Driving System (ADS) applications that will enable future driverless vehicles will take over portions (or possibly all) of that monitoring job through technology. How does that impact the decisions we make for future deployments of road markings, signage, and geometry?

Some automated vehicles rely on identifying road markings with the help of machine vision systems, such as radars and cameras. The Transportation Research Board (TRB) is currently funding a research project to identify performance characteristics of pavement markings that could affect the ability of machine vision systems to recognize them. Another TRB research is on Impacts of CAV Technologies on Highway Infrastructure.

Automakers and technology companies have different views on the role of infrastructure owners and operators specific to CAVs. Some have publicly stated that agencies should do nothing more than maintain roads and road markings/signage in a generic "state of good repair." Others have challenged agencies to think outside the box; considering concepts like smart signs that might have bar codes or enhanced retro-reflectivity, traffic management centers (TMC) that communicate messages about temporary work zone closures, or even Dedicated Short-Range Communications (DSRC) embedded within barrels to supplement V2I and V2V communications of information.

MCDOT has performed planning level studies and has identified some of the key infrastructure elements that will be increasingly impacted as ADS becomes more commonplace in vehicles including:

- **Roadway Infrastructure Elements.** With an increase in ADS technology, the importance of maintaining roadway markings and signage in a visible/retroreflective way, and supplementing these by newer technology might be critical.
- **Design Standards and Guidelines.** Given the automated nature of lateral and longitudinal control of CAVs, it is likely that some of the design standards that relied on human variability can be updated. For example, automated lane-tracking and precision mapping can enable narrower lanes at higher speeds for CAVs.
- **Digital Infrastructure/Connectivity.** Supplementing current road-side signs and signal-heads with digital infrastructure that communicate prescribed information to vehicles can help enhance their safety and efficiency. Several CV applications are designed to rely on V2I communication to receive such information via DSRC or cellular communication.
- **Variable Roadway Features.** Infrastructure elements such as Variable Message Signs utilize changeable messages to convey advisory information to drivers. Future technology might enable that same message to be

communicated directly to CAVs where the computer could perceive and respond. Additionally, features such as reversible lanes, dynamic speed limits etc. are currently designed for human perception and may need to be updated for eventual CAV interaction.

- **Roadway Maintenance and Operations.** Infrastructure features such as work-zones and dynamic operational strategies (dynamic shoulder use) pose unfamiliar domains for ADS technology, especially at lower levels of automation. Supplementing such features with dynamic electronic information systems that communicate revised "working plans" to CAVs can improve their operational design domain beyond their normal operations.

MCDOT has also been engaged in pilot tests outside of Anthem, building their overall body of knowledge and experience in next generation ITS and CAV deployment. In 2016, MCDOT completed a Feasibility Concept for the implementation of Smart Work Zone (SWZ) Technologies along MC85 from 107th Avenue to 75th Avenue to be used during upcoming planned construction activities. The four main goals of this SWZ deployment are:

- Improve speed limit compliance through the work zone
- Increase travel time reliability through the work zone
- Reduce crashes in the work zone
- Reduce queues resulting from the work zone

MCDOT recognizes that pilot projects like the SWZ deployment could be further expanded through the introduction of CAV technologies. Devices installed on vehicles could provide supplemental location and speed data to the SWZ deployment, enhancing the reliability of the current system and potentially reducing the costs of infrastructure-based detection equipment needed to operate it. As in-vehicle systems become more commonly available, drivers would also be able to receive warnings and/or brief instruction on how to navigate the work zone directly to their vehicles, supplementing roadside signage and potentially reducing the need for as many signs.

To that end, the key **MCDOT SMARTDrive Program**SM stakeholders (ADOT, MCDOT, and UofA) have already initiated a pilot program to provide low latency in-vehicle work zone information directly to freight vehicles. A partnership with several trucking companies was established, and planning is underway to put devices in their vehicles in 2019.

In the future, on-board driver assist systems like automatic emergency braking and collision avoidance would be enhanced through real-time data from work zones. This would enhance the safety of the driver, enhance the safety of the construction worker or piece of equipment, and in general reduce the number of collisions in work zones.

Low Speed Automated Vehicle (AV) Shuttles

In a near term timeframe our vision is to pilot, as a national model, the first operational Level 4 or Level 5 AV shuttle service in Maricopa County for the citizens serving as jurors for the Superior Court in Maricopa County. Our goal is to demonstrate a long term, viable and economical AV transit shuttle service option for the county that will provide a safer, cleaner and more modern mode of transit for our citizens. We have identified an Operational Design Domain for the operation. However, at least one low speed AV Shuttle manufacturer in Arizona has expressed a need for exemptions as the shuttle is built bottom up an autonomous vehicle and current NHTSA requirements may need granting of exceptions. To advance the testing of ADS in a real world environment, NHTSA may consider proactively granting exceptions that do not compromise the safety of the public.

MCDOT and its partners through public-private-academia partnering have an interest to test certain elements or combinations of elements of ADS in real-world conditions to support safe advancement of ADS. Maricopa County sees the potential for many opportunities to utilize AV services throughout the county. For example, 17 percent of Maricopa County's citizens are 62 years old or older. Many of these residents live in the designated senior living communities of Sun City, Sun City West and Sun Lakes. AV shuttles provide an opportunity to improve the mobility of the residents in these communities, especially those with mobility challenges.

Additionally, MCDOT is launching its long-term transportation planning study (TSP2040) next year. Within the study, MCDOT will evaluate its transportation infrastructure and will include an analysis detailing emerging technologies and how these technologies, including AV will affect the current transportation system. We will also be evaluating what policies and procedures need to be revised or adapted to further support both AV and CV technologies.