MARYLAND DEPARTMENT
OF TRANSPORTATION

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Docket Management Facility
U.S. Department of Transportation
1200 New Jersey Avenue SE.
West Building Ground Floor, Room W12-140
Washington DC 20590-0001

Dear Docket Clerk:

The Maryland Department of Transportation (MDOT) is pleased to provide comments on the U.S. Department of Transportation's (U.S. DOT) request for comments on "V2X Communications" (Docket DOT-OST-2018-0210) in support of the U.S. DOT's advancement of a safe, efficient, and equitable transportation future. Maryland is open for business and eager to support the advancement of automated driving systems to realize the potential life-saving and economic benefits, while ensuring safety for all.

The MDOT is a multimodal agency with responsibility for and expertise in roadway and bridge design, motor vehicle safety, transit, bicycle / pedestrian issues, aviation, and ports. For more than three years, the MDOT has led a public-private working group to address connected and automated vehicle (CAV) issues in Maryland and to position the State to encourage testing and deploying CAV technologies. Our vision is to uphold and enhance a safe, efficient, and equitable transportation future by delivering collaborative and leading-edge CAV solutions.

The MDOT does not support multiple technologies operating in the same spectrum with the same goals without a better understanding of standards for interoperability (e.g. avoid post deployment interoperability problems like those experienced in electronic tolling applications); a plan for prioritizing safety messages over 5G infotainment messages; an assessment of the potential impacts to latency of safety messages; and a determination regarding the reliability of safety messages being delivered under emergency conditions (e.g. hurricanes or terrorist attacks) that result in damaged infrastructure and high demand for communications.

Specifically, we offer the following comments on the V2X Communication docket, DOT-OST-2018-0210, including responses to the nine questions posed by the U.S. DOT.

Please provide information on what existing or future technologies could be used for V2X communications, including, but not limited to, dedicated short-range communications (DSRC), LTE C-V2X and 5G New Radio. What are the advantages and disadvantages of each technology? What is the timeframe for deployment of technologies not yet in production? Please provide data supporting your position.

The MDOT believes that existing and future technologies should be complementary and not competitive. This would allow the development of innovative devices that could lead to improved safety. Private sector utilities, however, such as cellular service, have not been reliable during major emergency situations such as hurricanes (e.g. Federal Communications Commission state of the infrastructure reports of the 2016 through 2018 hurricane seasons state that cellular networks were down and in some cases have yet to be repaired), terror attacks, or potential network outages. Those reports go on to state that without redundancy built into the system, the transportation network could be damaged and inoperable when it is most needed for rescue and rebuilding efforts

The carriers' 5G deployment timeline is unclear. The MDOT is actively exploring DSRC deployment across the State in test / experimental scenarios, including the potential to migrate various active applications in use on other spectrums DSRC roadside units are deployed on I-95 at the Maryland's Fort McHenry Tunnel to capture data regarding the number of On-Board Units (OBU) present in the vehicle stream. This data will help us understand penetration of OBUs and when there are enough devices to provide useful applications. Safety applications will be deployed when sufficient OBUs are available in our vehicle fleet.

Of the V2X communications technologies previously discussed, at present only DSRC is permitted to be used in the 5.9 GHz spectrum band for transportation applications. If that allocation were to be changed to allow any communication technology for transportation applications, could DSRC and other technologies (e.g., C-V2X, 5G or any future technology) operate in the same spectrum band or even the same channel without interference? Why or why not? If there are any technical challenges to achieving this goal, what are they and how can they be overcome?

Two communications broadcasts on a given spectrum range during a given time frame within a limited area have the potential to interfere with each other. When a "911" call is broadcast, it needs to be received by all responders and not blocked by non-essential spectrum usage for personal calls, infotainment, or other individual (personal / commercial) uses that are not life-safety related.

Our concerns fall into two categories. The first category is Standards and Interoperability. Third-party provider safety messages must be translated for use by all users, and critical safety messages may be delayed as broadcasts to other users may be using the same spectrum space (i.e., Verizon, AT&T, Comcast (CDMA vs GSM). An example would be the auto industry's use of propriety equipment, such as Sirus versus XM radio, prior to the merger. The second category is Latency / Prioritization. High priority safety messages may be delayed or dropped due to competing technologies using the same spectrum. Vehicle operating systems may block or interfere with infrastructure messages, resulting in transmission errors.

Interoperability is not a new concern. The U.S. DOT should take steps to avoid interference issues, as this has been a continuing concern for tolling. Over the past 20 years, several different communication protocols have been developed and are still used for tolling. Despite a U.S. Congress mandated national toll interoperability requirement, developing a nationally acceptable and achievable interoperable communications protocol has proven to be time consuming and costly. The national experience in achieving toll interoperability is an example of the magnitude and type of problems that may arise and persist when competing technologies with differing communication protocols are used in the same spectrum to support a single function. The interoperable toll example suggests following a similar path for transportation safety, which includes life-safety functions, is not a desirable course.

To what extent is it technically feasible for multiple V2X communications technologies and protocols to be interoperable with one another? Why or why not? Can this be done in a way that meets the performance requirements for safety of life applications, as they were discussed in the V2V NPRM? What additional equipment would be needed to achieve interoperability or changes in standards and specifications? What is the projected cost of any necessary changes? How soon can these changes and equipment prototypes be available for testing?

The MDOT defers to the industry and challenges private businesses towards technological progress in this field. We urge the U.S. DOT to set boundaries in which innovation can occur while prioritizing safety above all else. We reiterate the concern of following the same path as tolling and commercial vehicle systems, both of which still experience unresolved interference and interoperability issues.

To what extent is it technically feasible for different generations of the same V2X communications technologies and protocols to be interoperable with one another? Why or why not? Can this be done in a way that meets the performance requirements for safety of life applications? What additional equipment or changes in standards and specifications would be needed to achieve interoperability? What is the projected cost of any necessary changes?

The average vehicle is in service for seven to ten years, with fleet turnover occurring in fifteen to twenty years. Infrastructure service life is significantly longer than that of the vehicle fleet; therefore, MDOT believes there is a need for backward compatibility and newer generations of V2X communications technologies and protocols must be backward compatible. Progression in V2X communication technology should be addressed in the same deliberative, scheduled, and budget conscious manner that other infrastructure and vehicle safety maintenance and repairs are managed. If a technology is considered "meeting the requirements for safety of life applications" upon deployment, it should be satisfactory until the vehicle / equipment is replaced or a recall is issued

Even if they are interoperable across different technologies and generations of the same technology, would there be advantages if a single communications protocol were to be used for V2V safety communications? What about other V2X safety applications, such as those involving V2I and V2P communications?

Yes, a single communications protocol message plan, with defined message type, priority ranking, and basic information packets sent in a sequential order would be desirable whether the communication technology is consistent or not. This includes V2X, V2V, V2I, and V2P messages.

How would the development of alternative communication technologies affect other V2I and V2P communications, such as those supporting mobility or environmental applications? Do these applications have the same or different interoperability issues as V2V safety communications? Do different V2X applications (e.g., platooning) have different communication needs, particularly latency?

V2X applications may use different communication protocols for different message types (e.g. life safety messages across DSRC, non-life safety messages across 5G/C-V2X). Existing electronic tolling and truck weigh stations are V2I applications and precise vehicle location during communications is a critical piece information that is sensitive to latency. The combination of latency and noise in data processing may result in the existing V2I applications receiving bad data sets, requiring the data to be repeated in a different communication package that meets the V2I application needs.

Do different communication technologies present different issues concerning physical security i.e., how to integrate alternative communication technologies into vehicle syst/ems), message security (i.e., SCMS design or other approaches), or other issues such as cybersecurity or privacy? Would these concerns be affected if multiple but still interoperable communication technologies are used rather than one?

A single system would appear to reduce the security footprint by reducing the number of protocols and standards involved and reducing the number of opportunities for security vulnerabilities. Different communication technologies provide different avenues over which intrusions into the system may occur, and successful attacks over one technology may be spread over all technologies through devices or systems used to maintain inter-operability between systems. Encryption should be used to protect data in electronic form, in storage or transit, using a technology that is certified to meet or exceed the level that has been adopted by the National Institute of Standards and Technology. Encryption should render such data indecipherable without an associated cryptographic key necessary to enable decryption of such data.

How could communications technologies (DSRC, C-V2X, 5G or some other technology) be leveraged to support current and emerging automated vehicle applications? Will different communication technologies be used in different ways? How?

Different message requirements lend themselves to different communication technologies. For example, reliable location life-safety or payment specific messages carried across DSRC with low latency and minimum dispersion versus infotainment or similar messages that may be more tolerant of service disruptions and delays carried across 5G.

In much the same way that emergency operations (police, fire, etc.) have their own frequencies and communications technologies that are designed to work in emergencies in support of life-safety, we envision many vehicle applications that will perform at a similar level and be justified to need that level of reliability. Cellular networks do not provide that level of reliability. We believe DSRC should be afforded the highest level of service so that it can attain a level of reliability suitable for life-safety systems. That suggests sharing spectrum with non-critical infotainment applications is not prudent.

How could deployments, both existing and planned, assess communications needs and determine which technologies are most appropriate and whether and how interoperability could be achieved?

Deployments could assess the latency, cybersecurity, and prioritization needs previously discussed and are necessary to ensure final policies do not result in the selection of technologies that only appear beneficial on the surface and have long-term impacts that U.S. DOT, State DOTs, and other owners of the infrastructure system will have to address in the future, due to negative public safety impacts. The MDOT supports further stress testing of the network to better understand its capabilities under extreme conditions when there are large weather events, heavy network use, or disruptions in the line of sight communication. Ensuring that life-safety messages can operate reliably under most conditions is a necessity especially for transportation systems, which provide the backbone over which emergency services, public health, commerce, and education services move.

The MDOT thanks U.S. DOT for providing an opportunity for state and local agencies to comment on the V2X Communications Docket. The MDOT is continuing its efforts to plan for CAV / ADS advancement in Maryland and is pleased to contribute to the national efforts on this important issue. Our entire department will continue to work with federal agencies and other public and private partners. We look forward to a continued partnership with U.S. DOT.

Respectfully submitted,

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