Impacts Assessment to Prepare for Future Transportation System

Impact Area Traffic Signals	
Description	The goal of intelligent signals is to provide more efficient movement and increase the safety of pedestrians, bicyclists, and vehicle operators. Smart traffic signals communicate with vehicles to provide messages that can inform drivers about the timing of signals. Some signals may also be capable of using information from vehicles to alter signal timing to improve efficient movement of freight or communicate with pedestrians to improve pedestrian safety. For example, several transit authorities are operating pilots with signal prioritization for transit buses to improve the reliability of their transit systems. Prioritization of freight in particular could provide emissions benefits by minimizing idling. Traffic signals with connectivity can also allow for more efficient management of the transportation system. These connected signals could communicate with automated vehicles to improve their operation and safety. Automated vehicles could match their speed to pass through traffic signals at ideal times based on instructions from the signals. The signals could also be part of a network communicating crash or other hazard data to approaching AVs. ODOT has implemented an internet based data portal to share signal phase and timing (SPaT) and map messages to enable earlier adoption of some of the connected vehicle traffic signal applications.

	Automated vehicles might require physical changes to traffic signals to accommodate machine reading. Industry has indicated that greater national uniformity in traffic signal design and implementation would be helpful. Signals should have a clear association with the specific lane each signal is for. Light emitting diode light modules need to have a refresh rate that is greater than 200 Hz.[1]
Certainty/potential time horizon	Smart signals already exist and are being installed around the country, including in Oregon. They are an example of a connected vehicle technology that could improve safety by communicating with both conventional and automated vehicles. The extent to which automated vehicles will require more standardized, readable traffic signals is uncertain at this time.
Co-benefits/ advancing established goals	Smart signals are expected to enhance safety for all road users, with a greater impact as more vehicles are able to communicate with the infrastructure. They also can improve the flow of traffic and reduce emissions by helping vehicles spend less time idle at intersections. Smart signal technology can protect pedestrians and other vulnerable road users by altering signal timing based on pedestrian traffic.
Barriers	Cost of installation of the technology and the lack of an agreed upon standard for vehicle-to-infrastructure technology. Many owner/operators rely on legacy equipment for their traffic signals. Upgrading these older signals would represent a major overhaul in these jurisdictions.

[1] "TCD Suggestions for Automated Driving Systems (ADS)," Auto Alliance, February, 25, 2019.

Impact to infrastructure owner/operator	Costs will include installation of connected vehicle infrastructure, as well as building the organizational capacity needed to establish, manage, and maintain the system on an ongoing basis.
Relevant national guidance/key decision makers	Traffic signal designs are somewhat standardized in the MUTCD. The federal government has maintained a technology neutral stance regarding DSRC and 5G, although the FCC has reserved some of the 5.9 GHz band for DSRC vehicle safety applications. The Society of Automotive Engineers (SAE) standard J2735 specifies the SPaT and Map message set standards for traffic signal to vehicle communication of signal operation details. The US DOT Intelligent Transportation Systems Joint Program Office is leading an effort called the Connected Vehicle Reference Implementation Architecture (CVIRA). The goal of CVIRA is to identify and encourage standards for connected vehicle technologies. The forthcoming update to the MUTCD could address changes to traffic signal standards to accommodate machine vision.
Next steps	Track the progress of updates to the MUTCD. Monitor industry direction related to use of the 5.9GHz spectrum for vehicle to infrastructure communications. Support preservation of the 5.9 GHz band for transportation safety purposes. Update signal controllers to a modern signal controller and connect signals to central systems where possible. Implement an internet data sharing portal for SPaT and Map messages from connected signals.