Impacts Assessment to Prepare for Future Transportation System

Impact Area: School Zones	
Description	To ensure safety in school zones, automated vehicles will need to adjust to rules that vary at different times of day or by local conditions and navigate areas with high volumes of pedestrians, including young children. The safety of students, parents, and teachers in school zones is critically important, and manufacturers must design vehicles that sense and respond appropriately to all pedestrians. Current signage around schools may be too complex and use too many words for automated vehicles to react to appropriately. It is uncertain if automated vehicles will be able to react appropriately to school zone signs with conditional instructions such as “when children are present.” Additionally, there is a fair amount of variability in school zone signing. A higher degree of standardization would be helpful for machine vision systems. One suggested approach has been the addition of infrared readable bar code markings on signs to enhance machine readability. Machine vision systems also cannot reliably interpret light emitting diode (LED) signs. LED modules associated with school zone signs should have a refresh rate of 200 Hz or greater to ensure they are readable by machine vision systems. Connected vehicle technologies could improve school zone safety by helping automated vehicles identify or avoid schools zones. For example, connected vehicle technology could allow for real-time data about school

	zones to be transmitted from roadside units or other infrastructure to approaching vehicles, allowing them to follow the necessary procedures. Infrastructure owner/operators can also provide data regarding school zones to AV manufacturers/AVs. U.S. DOT is leading a project to allow infrastructure owners and operators to standardize and share data with manufacturers specifically to aid in navigating work zones, which may be applicable to school zones as well. Automated vehicles will also have to interact with crossing guards and pedestrians in school zones. Safety in these environments might be improved if automated vehicles have some method to communicate their intentions to and reassure pedestrians. For example, Jaguar Land Rover has tested an automated vehicle equipped with electronic eyes that look at pedestrians to demonstrate the vehicle has noticed them.[1]
Certainty/potential time horizon	It is uncertain when automated vehicles will be deployed for commercial use. It is also uncertain whether automated vehicle manufacturers will design AVs capable of safely navigating school zones without outside input, or whether connected vehicle technology or other solutions will be needed to address these situations.
Co-benefits/ advancing established goals	Connected vehicle roadside equipment for school zones could improve safety for both motorists and pedestrians. The improvements in safety will be greater with a larger saturation of connected vehicles.

[1] https://www.seattletimes.com/business/to-earn-trust-for-autonomous-vehicles-jaguar-gives-them-virtual-eyes/

	Data sharing between infrastructure owners and operators and automated vehicle manufactures could provide benefits beyond the safe operation of AVs. Transportation agencies could receive data that would allow them to better manage and design their transportation systems.
Barriers	Cost of creating or subscribing to platforms to share information among the vehicles and infrastructure operator/owners where school zones are located. Uncertainty about whether connected vehicle applications will rely on dedicated short-range communications (DSRC) technology or 5G cellular technology. This has prevented both private companies and public agencies from investing in connected vehicle infrastructure.
Impact to infrastructure owner/operator	Costs would include installation and maintenance of the connected vehicle infrastructure, including training staff on new technology and procedures. If signage for school zones is standardized or requires additions such as infrared-readable barcodes, infrastructure owners and operators will incur additional costs replacing non-compliant signage.
Relevant national guidance/key decision makers	The federal government has maintained a technology agnostic stance regarding DSRC and 5G, although the FCC has reserved some of the 5.9 GHz band for DSRC vehicle safety applications. U.S. DOT has launch a policy initiative called Data for Automated Vehicle Integration (DAVI). The goal of DAVI

	is to identify and address data sharing needs for AVs to be integrated safely in the transportation system.
Next steps	Pilot or invest in roadside communication devices in school zones. Begin consolidating information about road systems and rules in one accessible place. Engage in dialogue with AV manufacturers about data needs. Monitor Manual on Uniform Traffic Control Devices updates for changes to school zone sign design requirements.