Traffic Control Options at Originally All-Way Stop-Controlled Intersections with Autonomous Vehicles and Human-Driven Vehicles Mixed Traffic

Yu (Fred) Song
Research Assistant, Department of Civil and Environmental Engineering, University of Wisconsin-Madison, yu.song@wisc.edu

David Noyce
Arthur F. Hawnn Professor and Chair, Department of Civil and Environmental Engineering, University of Wisconsin-Madison, danoyce@wisc.edu

With more and more autonomous vehicles (AVs) being tested on public roads, it is foreseeable that AVs and human-driven vehicles (HDVs) will co-exist on highways and streets for a considerable long period of time. AVs can drive themselves, detect obstacles in their way, and avoid colliding with objects as designed. This type of defensive driving style of AVs may lead to problems when AVs meet human-driven vehicles, as human drivers' behavior may change to take advantage of AVs' driving style. At certain facilities with multiple conflict points and traffic control depending on drivers' communication (e.g., eye contact and gestures), this problem is expected to be seen frequently. Using an all-way stop-controlled intersection as an example, this study investigates how the conventional stop sign traffic control will perform with an AV-HDV mixed traffic, considering potential interaction between AVs and aggressive drivers. With the expectation that the conventional all-way stop-controlled intersections may face reduced efficiency and worsened safety, the study also proposes a simple signal-detector based traffic control option to address the issues. The operational and safety performance of these two traffic control options are modeled and evaluated using micro-simulation.

Keywords: traffic control; all-way stop-controlled intersection; AWSC; autonomous vehicle; driver interaction