

**RESEARCH BRIEF**

**Applied Research and Innovation Branch**

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| **PROJECT TITLE**  Development of ATMA/AIPV Deployment Guidelines Considering Traffic and Safety Impacts  **STUDY TIMELINE**  May 2023 – Nov. 2024  **INVESTIGATORS**  Xianbiao (XB) Hu  Penn State University  [xbhu@psu.edu](mailto:xbhu@psu.edu)  **CDOT CONTACTS/CHAMPIONS**  Sina Zhen  Office of Innovative Mobility (OIM) [sina.zhen@state.co.us](mailto:sina.zhen@state.co.us)  **For more information, please contact**  David Reeves  Research Engineer  Applied Research and Innovation Branch  [david.reeves@state.co.us](mailto:david.reeves@state.co.us)  **FURTHER RESOURCES**  AMT pooled fund website: <https://sites.google.com/state.co.us/amt-pooled-fund/home?authuser=0> | **Development of ATMA/AIPV Deployment Guidelines Considering Traffic and Safety Impacts**  **Problem Statement**  While Autonomous Truck Mounted Attenuator/Impact Protection Vehicles (ATMA/AIPV) are being developed and show promising benefits in roadway maintenance, the practicable and implementable guidance for its deployment is largely missing in the Manual on Uniform Traffic Control Devices (MUTCD) and other federal regulations and national standards. Without such guidance, state DOTs have been making their own criteria of the annual average daily traffic (AADT) to answer the question of when and where to deploy ATMA. AADT, defined as the average 24-hour traffic volume at a given location over a full 365 days per year, is a measure used primarily in transportation planning, transportation engineering and retail location selection. For example, CDOT is using an AADT of less than 6,000 as the criteria to identify low-volume roads for ATMA deployment. This is because, due to the nature of mobile and slow-moving operations, ATMA vehicles are usually driving slowly (such as 5~15mph) and as such, the argument is to avoid slowing traffic on a busy corridor during peak hours. A problem with this criterion is that AADT on multilane highways varies for different DOTs. Roads with an AADT lower than 6,000 might be common in Colorado, but in other states, such as California and New York, most roads are much busier than that. So, the question is whether this AADT threshold is reasonable, and how should we develop a sound method to scientifically determine this threshold?  **Methods**  This Project shall develop microscopic traffic flow models (“Traffic Models”) to identify the Operational Design Domain (ODD) of ATMA, on a typical highway road segment. Learning from the Highway Capacity Manual (HCM), six (6) measures can be used to determine the level of service (LOS) of a multilane highway, namely speed, delay, throughput, density, environmental, and the ratio of demand/capacity. As such, in this Project, PSU has chosen total delay and traffic density as the performance measurements to quantitatively evaluate the impact of ATMA vehicles on traffic flow, and to support the identification of ODD. However, the key challenge in quantifying total delay and traffic density is the calibration of capacity drop caused by the ATMA system. This is due to the slow operating speed of the ATMA system, compared with the other fast-moving traffic, so that, it essentially becomes a moving bottleneck, and discounts traffic flow capacity. As such, an accurate modeling of a moving bottleneck capacity drop becomes a prerequisite for the quantification of traffic flow performance.  **Next Steps**   1. Memo on Roadway Capacity Drop Analysis with ATMA (9/30/2023) 2. Memo on ATMA deployment Guidance (1/31/2024) 3. Delivery of excel-based tool (5/31/2024) 4. Final guideline report (10/31/2024)   **Potential Impacts and Benefits**  1) Help DOT gain a fundamental understanding on the impacts of such autonomous system to traffic operation and roadway safety, which unfortunately existing literature, standards or federal policy fail to touch base upon. 2) Support DOT in developing recommended ATMA/AIPV deployment strategies, analyzing potential impacts to the traffic network while effectively maintaining the roadway facilities. 3) Develop and deliver an open-source practical software tool to benefit DOT and other stakeholders in the community. |