

Statement of Work

Impacts of Automated Vehicles on Highway Infrastructure

1.1 Background

Automated Driving Systems (ADS), including Automated Vehicles (AVs), are increasingly being used on US public roadways. Tempering safety with the desire to facilitate AV use and adoption, state and local DOTs are interested in understanding what elements of highway infrastructure are important for AV operation. Further, as investment decisions are made to carry highway infrastructure into the future, designers, builders, owners and maintainers are beginning to consider AV use as a given feature of the future highway environment. Understandably, highway owners are concerned regarding their future highway investments, and want to be proactive in building the needs of AVs into their project plans and designs. Similarly, highway infrastructure is designed and built with the intent that it will last decades, and decisions made now will have an impact on the operation of traffic, AV and otherwise, well into the future.

FHWA has identified a requirement to assess and understand the demands and potential impacts of automated vehicles both on current infrastructure assets, and on the future design of new infrastructure. To accomplish this, and produce a product relevant and useful to state and local DOTs, it is anticipated that a varied range of questions will need to be addressed as part of the effort, including:

- What should DOTs be doing right now with existing infrastructure to prepare for the needs of increasing AV use (Striping/sign maintenance, etc.);
- What will the impacts be of AV use on the existing highway infrastructure, and how does the concept of “state of good repair” play into these impacts;
- Based on input from the AV sector, what will the design and maintenance needs of future highways be;
- How should DOTs be preparing their physical infrastructure for the future needs of potentially high levels of AV usage on the national highway network?
- How should a DOT determine its “Readiness” for AV use on its highways?

Extensive and ongoing engagement with the ADS/AV industry, DOTs, and highway construction/maintenance stakeholders is considered critical in the performance of this requirement, and proactive outreach and involvement must be integral to each task of this requirement.

1.2 Objective

The primary objectives of this project are: 1) Assess and understand the demands and potential impacts of AVs on our current infrastructure assets and, 2) Assess and understand the potential needs and impacts of AVs on the future design of new infrastructure.

The outcome of this project shall be the production of immediately practicable documentation and webinars to educate and inform DOT stakeholders about AV-related infrastructure needs, ultimately assisting in their immediate and future infrastructure planning and design efforts.

1.3 Detailed Requirement

The Contractor shall provide all personnel, equipment, supplies, facilities, transportation, tools, materials, supervision, and other items and non-personal services necessary to perform thorough and superior-quality research.

Task 1: organize and conduct a kickoff meeting to be held either at the Federal Highway Administration's Turner-Fairbank Highway Research Center (TFHRC) or remotely via webconference, that will address the following:

- Introduction of research and FHWA team members;
- Review the scope of work;
- Establish individual roles and responsibilities;
- Refine, if necessary, the working schedule;
- Produce and deliver within two weeks from the meeting date: a contact list, detailed minutes and a meeting summary that includes any action items.

Task 2: Conduct a literature/practice review and synthesis that reflects a careful and thorough investigation regarding published and unpublished material on AV use, technology, and its impacts to highway infrastructure. This shall include synthesizing machine-readable sign and pavement marking technologies, which shall list available products and mature technologies that can communicate information from road signs to connected and automated vehicles.

It is anticipated that this task will be accomplished through interviews and document/publication research of industry and owner agency practices. Due to limitations imposed by the Paperwork Reduction Act of 1995, the issuance of printed and/or electronic surveys is limited to a total number of nine (9); therefore, it is anticipated that most of the data for this effort *will not* be obtained by survey. The expectation is that the contractor will possess the knowledge, network, and resources to be able to gather all necessary material to successfully complete the project.

Task 3: Conduct research and develop a comprehensive document that distills the information gathered in Task 2, and performs a detailed investigation into the subject of present and future needs and impacts of AVs to the highway infrastructure environment. Generally, the research effort will investigate topics involving the following:

Identification of visibility standards--for maintaining highway pavement markings and signs such that AVs can interpret them. Develop a list of signing and marking provisions, potentially to be included in future versions of the MUTCD, that need

further revision to provide adequate uniformity to meet the needs of both human and machine interpretation.

Methodology to categorize highway “Readiness Levels”--for automated vehicle operation;

Roadway characteristics—What features of existing and future roadways are critical to AV function and efficiency and how will that information be conveyed to AVs

Non-uniformity in traffic control—What is the impact of the variability of highway traffic control (striping, signage, etc.) to AV operation;

State of good repair—What role does a highway’s State of Good Repair have on the safe and efficient use of AVs. Would our understanding of what is considered to be a State of Good Repair change if many/most vehicles in the future were operated as AVs;

Nature of industry engagement—How, and to what level, is the AV industry engaged with owners and maintainers of highway infrastructure;

Role of digital infrastructure and data—What is considered necessary digital highway infrastructure in the AV context, and how will this work with AVs. What data resources do DOTs have that would be useful to AV manufacturers, and what barriers exist to accessing this data;

Concerns of state and local agencies—From a physical infrastructure perspective, what are local agency concerns, issues, and challenges associated with AV use and operation;

Current research and activities on standards—What infrastructure standards efforts have been (or are being) developed or altered to accommodate AVs;

Priority issues for road owner/operators—What are the biggest issues with AV use from the perspective of highway infrastructure owners and maintainers;

Issues during mixed fleet transition—What challenges are associated with a mix of vehicles (AVs & non-AVs) operating within the same highway space;

Potential impacts on vulnerable users—How does/will AV use impact the needs of ADA users, pedestrians, and cyclists with regard to infrastructure.

This is not an exhaustive list, and it is intended that the contractor will consider it as a conceptual starting point to frame their research approach. It is expected that the contractor will perform a thorough, superior-quality research effort and needs assessment with an appropriate level of detail to produce new, relevant and practical information immediately useful to DOT stakeholders. This will be in the form of a report, organized such that there is an overall logical flow that conforms to the general themes of:

- Present Needs and Impacts,
- Future Needs and Impacts,
- Infrastructure Readiness.

To meet FHWA expectations in addressing the subject matter of this requirement, it is anticipated that the contractor will have a high level of engagement with the ADS/AV industry, infrastructure owners (DOTs), FHWA AV offices, and other key stakeholders

throughout the performance of the contract. The findings and recommendations will reflect balanced and thorough collaboration with the various information sources and stakeholders.

It should be noted that, although it may be generally covered in this present effort, the topic of the impacts of truck platooning on bridge approaches will be specifically addressed in-depth in a separate FHWA requirement.

Task 4: The Contractor shall produce one (1) TechBrief (in standard FHWA TechBrief document format) that captures and summarizes the goals, methods, and results of the project. This shall be developed concurrently with the other project deliverables. The standard FHWA TechBrief format can be found in the most current version of the Communications Reference Guide, <http://www.fhwa.dot.gov/publications/research/general/03074/index.cfm>

Task 5: Development of three (3) webinar presentations that will describe and summarize the project effort, presenting the basis and findings of the project in three segments:

- Webinar 1: Present Demands and Impacts of AV Operation on Highway Infrastructure.
- Webinar 2: Future Needs of Highway Infrastructure Design in the AV Environment.
- Webinar 3: Expert Panel Discussion: What “AV Readiness” Means.

The webinars shall be scheduled sequentially, and approximately two weeks apart. The webinars shall be recorded, and delivered to FHWA as electronic files that may be placed on the FHWA website. The webinars shall also include separate practice sessions (one each), where the webinar is presented internally to FHWA staff for review and comment in advance of the “live” event. For the “practice” webinar, the contractor shall provide the conference call and webconference account, and shall develop the invitation list. For the “live” webinar, the contractor shall provide the webinar/call-in accounts, shall develop the invite list, and shall develop a marketing flyer/email to be sent out to stakeholders to advertise the webinar.

Task 6: Development and deliver the culminating document for the project, including a comprehensive final report that details the context, motivation, methodology, and findings. The final report will also be presented in-person at Turner-Fairbank Highway Research Center, and simultaneously as a live webconference. For this webconference, FHWA will provide a physical meeting space, conference call account, and web room.