National Cooperative Highway Research Program

July 2020

Supplemental Announcement of NHCRP Projects

The National Cooperative Highway Research Program (NCHRP) is supported on a continuing basis by funds from participating member states of the American Association of State Highway and Transportation Officials (AASHTO), with the full cooperation and support of the Federal Highway Administration, U.S. Department of Transportation. The NCHRP is administered by the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine. The NCHRP is an applied contract research program that provides practical and timely solutions to problems facing highway and transportation practitioners and administrators.

The main program is announced in May of each year. Additional projects may be identified throughout the year, however, and this supplemental announcement covers three such projects that NCHRP is now soliciting panel nominations for.

Nominations of others and self-nominations for panel members should be submitted online from the TRB website by August 21, 2020, at the MyTRB portal at this link: Online Panel Nominations You will be asked to login to MyTRB. If you do not already have an account, you will be asked to quickly create one using your email and a password. To ensure proper consideration of nominations, please provide all of the information requested. A current resume is necessary to determine relevant knowledge and experience.

Communication to determine an individual's interest and availability in serving will be made from this office only after we have matched available expertise (e.g., knowledge and experience as presented in the resume) with that required by the nature of the project.

List of Projects

Project Number	Title
20-102 (24)	Infrastructure Modifications to Improve the Operational Domain of Automated Vehicles
20-102 (27)	Realistic Estimates of CAV Implementation Timing
20-102 (29)	Incorporating New Mobility Options into Transportation Demand Modeling

NCHRP 20-102(24)
Infrastructure Modifications to Improve the Operational Domain of Automated Vehicles

Allocation: $1,000,000
NCHRP Staff: Christopher McKenney

Connected and automated vehicle (CAV) technologies are quickly advancing, resulting for a growing need for roadways and infrastructure to begin considering the impacts of CAVs as well as the AV deployments that will be limited to operational domains (OD) where vehicles can readily demonstrate safe operation. Limitations in ODs may stem from factors that challenge an automated vehicle's ability to accurately perceive the surrounding environment and effectively make decisions, such as adverse weather and degraded lane markings.

While city and state agencies may not be able to control some of these OD limitations, they can take steps to modify infrastructure to improve benefits of the OD, such as economic opportunities and accessibility, connect strategic locations, and simply be an attractive place for AV testing and deployment. Infrastructure modifications may include infrastructure-to-vehicle (I2V) communication systems, signage, and civil infrastructure such as curbs and barriers to provide different levels of segregation between the CAVs and other road users. Uniform and well-maintained traffic control devices, such as lane markings and traffic signs, may improve the extent of AV OD.

AV functionality depends on perception algorithms to accurately detect and respond to infrastructure based on sensor information. Just as humans learn to drive through experience, many perception algorithms use machine learning that is trained to detect and classify objects and events based on past experience. Atypical conditions are more challenging for perception systems. Segregation can create a less complex environment by eliminating mixed road users that can be unpredictable, or can even take advantage of an AV's conservative behavior. Infrastructure owners and operators want to understand how the OD of near term deployments may benefit from infrastructure modifications.

In order to achieve a smoother transition to CAV transportation, state and local agencies must understand how and when traditional highway and street infrastructure may be affected and the impacts this could have on design, operations, maintenance, and policy.

This research will review and identify potential infrastructure modifications that could improve the OD of AVs. The analysis will:

- Impact with modifications to Design Standards and Guidelines with regards to procurement and regulation requirements requiring flexibility to fast-changing needs, functional requirements, and product availability;
- CAVs physical and digital interaction with Digital Infrastructure/Connectivity in ways that impact their standards and practices. This could include the impact on maintaining roadway markings and signage in a visible/retroreflective way, and supplementing these by newer technologies as more vehicles are equipped with automated driving system (ADS) technology;
- Reviewing types of changes with Variable Roadway Features with consideration for alternative methods/technologies. This could include Urban Design and the needed changes in curb space necessary to accommodate alternative pick-up/drop-off scenarios;
- Investigate aspects of technology and operation that influence OD, such as vehicle connectivity, dedicated lanes, AV sensors, perception algorithms, operating speeds, and pickup/drop-off locations;

- Review lessons learned from AV testing and deployment activities;
- Identify and characterize aspects of physical and digital infrastructure elements that may limit OD, such as V2I, curbs, barriers, reflectivity, geometry, and quality of data; and
- Develop implementation guidance for infrastructure modifications, including potential improvements to OD, costs, and impacts to other road users.

Outputs of this research will update and expand the guidance for state and local transportation agencies in evaluating and—if necessary—adapting their standards, practices, and institutional frameworks for roadway and infrastructure, urban design, and related maintenance and operations—to reflect the deployment of connected and automated vehicle technologies.

This research will also provide state and local transportation agencies with guidance on how to modify infrastructure to improve the OD of AVs. The assessment will provide insights based on AV technology and operations. It will provide a catalogue of potential infrastructure modifications, and describe how these modifications will impact ODs. Key considerations for prioritizing potential modifications will be provided to infrastructure owners and operators to enable decision making and investments.

Project 20-102(27)
Realistic Estimates of CAV Implementation Timing

Allocation: $150,000
NCHRP Staff: Camille Crichton-Sumners

Public agencies planning for the implementation and use of connected, automated vehicles (CAVs), and shared mobility systems need realistic information related to the timeline for implementation for agency decision making. Stakeholders need estimates of market introduction and growth profiles for a broad range of representative CAV and shared mobility services that will account for limiting factors such as:

- technological progress needed to ensure that highly automated systems can be proven safer than human-driven vehicles within their intended operational design domains
- level of technical effort and investments needed to expand operational design domains for each CAV application from their initial limited deployment sites to a wider range of conditions
- the time needed for different sectors of the user population to become comfortable with the use of the new technologies and services
- inertia associated with vehicle lifetimes and the rate of turnover of the vehicle fleet
- historical data regarding the rate of growth in new vehicle features from options on high-end vehicles to standard equipment on all new vehicles

These estimates should be defined for a range of assumptions from optimistic to pessimistic so that planners can account for uncertainties.

This research shall identify and compile useful and credible information on CAV implementation timelines that will aid decision makers in transportation agencies. Assumptions currently being made by planners, real estate developers, and international market analysts should be documented. A survey approach for updating the estimates annually will be developed in coordination with the original equipment manufacturer (OEM) trade alliances and become a model for future efforts dealing with topics such as electrification of the fleet and shared mobility.

Project 20-102(29)
Incorporating New Mobility Options into Transportation Demand Modeling

Allocation: $125,000
NCHRP Staff: Lawrence D. Goldstein

Transportation demand modelers are challenged by the new mobility options available to travelers. These options include shared mobility services, automated vehicles, and micromobility technologies. Modeling may be done for the near term (when evaluating new services) and longer term (when preparing transportation improvement plans) and the longer term projections are particularly difficult. NCHRP Report 896, *Updating Regional Transportation Planning and Modeling Tools to Address Impacts of Connected and Automated Vehicles,* and AMPO's *National Framework for Regional Vehicle Connectivity and Automation Planning* describe new approaches for planning that consider uncertainty and agencies could benefit from knowing how these approaches are being applied. A topic of particular interest is the proclivity of travelers to share rides with strangers.

The objective of this research is to identify the key transportation demand modeling parameters related to traveler use of the new mobility options, review and summarize traveler behavior studies that could inform selection of those parameters (including factors that positively or negatively affect traveler acceptance), and recommend approaches to track and project changes in traveler acceptance of these mobility options.