ANALYSIS, MODELING, AND SIMULATION (AMS) FRAMEWORK FOR CONNECTED AND AUTOMATED VEHICLE (CAV) APPLICATIONS - UPDATE

Developing a foundational framework for AMS tool capabilities to include connected and automated vehicle technology and the AMS tool impacts (includes status update).

BACKGROUND

CAV technologies offer potentially transformative societal impacts—including significant mobility, safety, and environmental benefits. The Federal Highway Administration (FHWA) has led the development, research, and standards-making of these technologies, and is currently developing deployment approaches and guidance.

Deploying CAV applications requires transportation agencies to effectively and fully quantify the impacts of such implementations, and to identify which application best addresses their unique transportation problem. Current traffic analysis and planning tools, however, are not well suited for evaluating CAV applications because of their inability to incorporate vehicle connectivity and automated features. It is necessary to adapt and re-engineer the existing set of tools available to agencies, validate these models/tools, and provide a mechanism to share these models/tools with public agencies. To this end, FHWA initiated an effort to develop an AMS framework for CAV applications (figure 1).
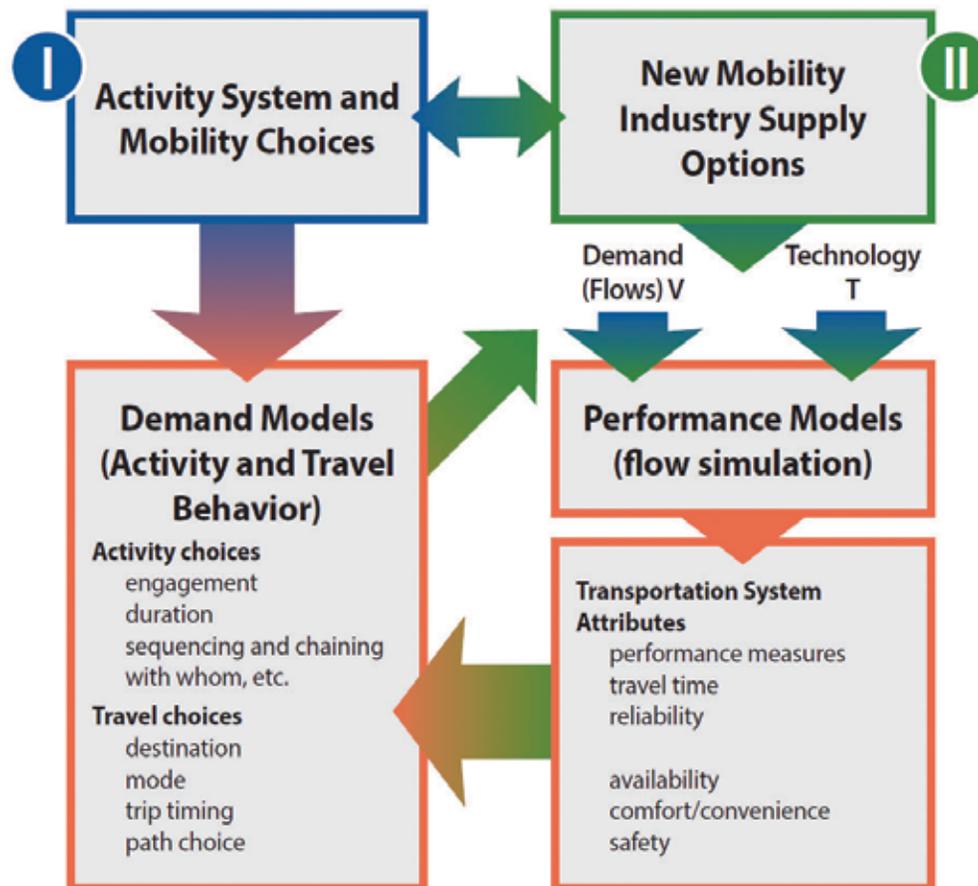

Figure 1. Methodological framework for network- and system-level assessment of CAV impacts. (Source: FHWA).[1]

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Figure 1 identifies two important components of the framework and the inability of current tools to address them: (I) major activity shifts and mobility use (e.g., changes in activity patterns because of CAVs and their use as a mobility tool), and (II) new mobility industry supply options (e.g., new forms of mobility options created by CAV technology). (I) and (II) influence existing demand and performance models, which will need to be improved to reflect CAV movement/operational logic.

STUDY DESCRIPTION

FHWA initiated this effort in late 2016. It includes:

1. Developing the concept of operations and system requirements for the AMS framework.

2. Reviewing prior and current CAV AMS work.

3. Assessing CAV data availability and future data sources for model development and calibration.

4. Assessing capabilities of existing AMS tools for analyzing CAV applications at the tactical and strategic levels (e.g., microscopic, mesoscopic, and macroscopic resolutions).

5. Identifying current CAV modeling gaps and needs.

6. Defining an overall AMS framework to enable evaluation of the impact of CAV applications.

7. Developing a proof-of-concept prototype using the framework and applying it to a small-scale, vehicle-to-infrastructure (V2I)-based case study using a real-world AMS network.

STATUS UPDATE

Since the inception of this effort, the project team has accomplished several tasks:

1. A high-level, concept of operations was developed in June 2017 that: defined how a CAV AMS environment could operate, identified the conceptual CAV AMS framework, and identified needs and expectations of users. System Requirements were also finalized in June 2017; these defined the capabilities, components, interfaces, constraints, and requirements of the CAV AMS framework.

2. A report was completed in August 2017 that reviewed and assessed academic literature, applicable Federal, State, and local project reports, and future planned efforts related to AMS studies of CAV applications.

3. A document was prepared in September 2017 that assessed current and upcoming data sources (from large-scale pilots, small-scale field tests, stated-preference studies, etc.) for developing and validating CAV models.

4. An assessment (completed in November 2017) evaluated the usability/adoptability of existing AMS tools in the CAV environment; the assessment also reviewed capabilities such as modeling major activity shifts and mobility use, new mobility industry supply options, and performance models. These components are generally unavailable in tools today and are of significance for CAVs.

SUPPORTING EFFORTS

This project is part of a larger effort to provide necessary, adequate, and validated CAV-aware AMS tools to practitioners. The framework developed here will be utilized to develop and validate model logic for selected CAV applications and to conduct a series of AMS, freeway-based case studies in "Developing Analysis, Modeling, and Simulation (AMS) Tools for Connected and Automated Vehicle (CAV) Applications"; a newly initiated FHWA-led project.[1]

REFERENCES

1. FHWA Factsheet (2017). "Developing Analysis, Modeling, and Simulation (AMS) Tools for Connected and Automated Vehicle (CAV) Applications". In production.

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