

# TECHBRIEF



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# Enhanced Prediction of Vehicle Fuel Economy and Other Vehicle Operating Costs Evaluation

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This document is a technical summary of the FHWA  
*Research and Technology Evaluation: Enhanced Prediction  
of Vehicle Fuel Economy and Other Vehicle Operating Costs*  
report (Forthcoming).

## INTRODUCTION

This brief summarizes an evaluation of the Enhanced Prediction of Vehicle Fuel Economy and Other Vehicle Operating Costs (VOC) research project. The research project sought to update existing VOC equations used by the Federal Highway Administration (FHWA) in the Highway Economic Requirements System (HERS) model.

The purpose of the evaluation was to assess the VOC research's short-term outcomes, including potential users' early interest in, and application of, the VOC models and the U.S. Department of Transportation (USDOT) staff and contractors' internal responses to the updated VOC models. The evaluation also sought to identify lessons learned during the research project that could benefit similar projects in the future.<sup>(1)</sup>

## BACKGROUND

FHWA uses VOC equations in the HERS model for benefit-cost analysis to rank and select potential highway improvement projects. HERS analyses also inform the biennial *Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance* Report to Congress (C&P Report).<sup>(2)</sup> Existing VOC models are based on equations developed nearly 40 yr ago.<sup>(3)</sup> Multiple patches were added to the VOC equations over the years to adapt them to evolving technologies, but by 2014 a model update was clearly needed.

In September 2014, the FHWA Office of Transportation Policy Studies engaged a research contractor to update the existing VOC models. The research contractor sought to create models that reflected the current vehicle fleet but could be adapted to new technologies while also accounting for new parameters not previously included in HERS. The 5-yr contract included developing predictive models of vehicle fuel consumption and four nonfuel VOCs: oil consumption, tire wear, maintenance and repair, and vehicle depreciation. The agreement also specified that the research contractor would evaluate the research effort's initial outcomes.

## FINDINGS

The following subsections give the overall findings by evaluation area.

### Early Interest and Application of the Updated VOC Models

Overall, potential users' early interest and planned use of the VOC models support the hypothesis that the updated VOC models would generate further interest and be used by government and nongovernment entities. The research contractor conducted outreach activities during the course of the research and after the delivery of the updated VOC models. This outreach introduced the procedures and models to hundreds of stakeholders from academia, government, and the private sector. Interested parties reached out to FHWA, and sometimes to the research contractor directly, for more information on the models, including a private company that indicated plans to incorporate the methodology into its pavement lifecycle assessment software.

### Internal Response to, and Perception of, the Updated VOC Models

Feedback provided by USDOT staff and contractors does not fully support the hypothesis that internal stakeholders will have a positive response to the updated VOC models based on perceived increases in quality and usefulness. While internal stakeholders indicated that the updated VOC models are an improvement over current methods—with the potential to update and enhance VOC estimates in HERS and other government efforts—concerns were voiced about specific fuel efficiency equations and the complex vehicle depreciation model. However, since the conclusion of the evaluation study period, work has continued on these equations, which have been revised to account for these issues.

## RECOMMENDATIONS

One perspective emerging from the stakeholder interviews was that the contractor's research could have been more closely aligned with the existing VOC models. Some alignment issues resulted from the research contractor's focus on developing models for a future vehicle fleet that included hybrid electric and alternative fuel vehicles. Those involved in the HERS implementation review questioned whether the contractor should have focused more on updating VOC models to support HERS analysis.

Stakeholders reviewing and testing the VOC models gave feedback indicating that conventional methods of project oversight—such as gathering stakeholder feedback and reviewing progress reports—may not have fostered sufficiently foresighted review of research progress on the VOC models. Issues with respect to fuel-economy and vehicle-depreciation assumptions may not have been fully anticipated due to the complexity of the models, but future research should ultimately rectify these issues.

To ensure a better understanding of research expectations and a more foresighted review of research progress, the evaluation team recommends the following actions:

- FHWA and researchers should establish an early agreement on research assumptions, baselines, and expectations to ensure that research fully reflects FHWA's priorities.
- If applicable, FHWA and researchers should develop a theory of change (e.g., logic model) that maps out how research activities feed into outputs and affect future outcomes.
- Contracts for complex research projects should include more engaged methods of project oversight and progress review. Such projects should regularly convene staff and stakeholders to discuss potential concerns and approve research progress.
- For research projects that develop novel models or technologies, research reviewers should be involved with model development and testing at the earliest stage feasible.
- FHWA staff and other stakeholders should periodically revisit project expectations and theory of change (e.g., logic model) to ensure that a given contract continues to proceed according to plan.

From an evaluation perspective, the VOC project illustrates risks with conducting a prospective evaluation of future impacts. While the research contractor delivered the VOC models to contract specification and within the contract period of performance, schedule changes limited the evaluation team's ability to assess uptake and impacts of the revised VOC models. Future evaluation teams should carefully assess the likelihood and impacts of schedule risks and develop appropriate contingency plans.

## REFERENCES

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**Researchers**—This study was performed under contract number HW9AA3 by Greg Bucci, Lora Chajka-Cadin, and Daniel Friedman of the Volpe National Transportation Systems Center.

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