

ABSTRACT

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Asset managers continue to prepare physical infrastructure investments needed to accommodate the emerging technologies, namely vehicle connectivity, electrification, and automation. The provision of new infrastructure and modification of existing infrastructure is expected to incur a significant amount of capital investment. Secondly, with increasing EV and CAV operations, the revenues typically earned from vehicle registrations and fuel tax are expected to change due to changing demand for vehicle ownership and amount of travel, respectively. This research estimated (i) the changes in highway expenditures in an era of ECAV operations, (ii) the net change in highway revenues that can be expected to arise from ECAV operations, and (iii) the changes in user equity across the highway user groups (vehicle classes). In assessing the changes in highway expenditures, the research developed a model to predict the cost of highway infrastructure stewardship based on current and/ or future system usage.

The results of the research reveal that CAVs are expected to significantly change the travel patterns, leading to increased system usage which in turn results in increased wear and tear on highway infrastructure. This, with the need for new infrastructure to support and accommodate the new technologies is expected to result in increased highway expenditure. At the same time, CAVs are expected to have significantly improved fuel economy as compared to their human driven counterparts, leading to a decrease in fuel consumption per vehicle, resulting in reduced fuel revenues. Furthermore, the prominence of EVs is expected to exacerbate this problem. This thesis proposed a revision to the current user fee structure to address these impacts. This revision contains two major parts designed to address the system efficiency and equity in the near and long term. For the near term, this thesis recommended a variable tax scheme under which each vehicle class pays a different fuel tax rate. This ensures that both equity and system efficiency are improved during the transition to ECAV. In the long term, this thesis recommended supplementing the fuel tax with a distance based VMT tax, applicable to electric vehicles.