



Project Summary

Texas Department of Transportation

0-5974: Estimating Texas Motor Vehicle Operating Costs

Background

This report summarizes the findings of a two year extension to the TxDOT sponsored study 0-5974 entitled “Estimating Texas Motor Vehicle Costs” (Vcost) undertaken by a Center for Transportation Research (CTR) team of mechanical engineers and economists at the University of Texas at Austin. The work was conducted in two phases over a four-year period beginning in 2007 and this report details the second phase conducted over the period 2009-2011. It reports results in three areas; first total operating costs for the major vehicle classes currently seen on Texas highways, second engine models for hybrid light vehicles, and finally results from examining the impact of transmission types through gearbox and differential sub-models.

What the Researchers Did

The challenge for the team was to design an approach that could be updated as further improvements are introduced by mechanical engineers and vehicle designers. The team was split into mechanical engineers who selected representative vehicle engine, transmission and differential designs reflecting the 2010 Texas motor vehicle fleet and a CTR team that modeled the findings so that TxDOT staff could use updated Vcost estimates. The model containing the results and a user manual were the products of the work. It addresses:

1. Heavy trucks, particularly the ubiquitous 80,000 lb. semi-trailer that accounts for almost 80 percent of long distance freight in the state,
2. Engine-transmission-differential systems,
3. Hybrid models for autos and heavy trucks, and
4. Reports findings in an enhanced version of the Vcost model.

What They Found

The basic Vcost model was termed CT-Vcost and utilizes an object-oriented programming structure where modules are developed to perform specific tasks. The toolkit’s default data are based on verified secondary vehicle cost data and certified vehicle databases, including the EPA’s Fuel Economy and Annual Certification Test Results databases. The toolkit also allows users to change parameters so that cost calculations are specific to any particular situation, and can be updated as the economic or technological landscape changes.

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Cost categories in the CT-Vcost toolkit include:

1. Depreciation,
2. Financing,
3. Insurance,
4. Maintenance costs,
5. Fuel cost,
6. Driver costs,
7. Road use fees, and
8. Other fixed costs, such as annual vehicle registration and inspection fees.

Analysis types that can be performed with CT-Vcost include single vehicle analysis, multi-vehicle comparisons, fleet vehicle analysis, growth rate and market penetration simulation, and route cost analysis. CT-Vcost is compatible with the sophisticated fuel economy prediction models also developed in this study. The fuel economy models have the ability to predict fuel consumption for default or custom drive cycles specified by the user. Output from the fuel economy models can be used within the toolkit to perform route cost analyses. CT-Vcost is also easy to update and calibrate for other states or regions. In summary, CT-Vcost was designed to be intuitive and flexible enough for simulating different scenarios and situations that users may envision.

What This Means

The rapidly changing world of vehicle engineering, design and Vcost estimation will further impact TxDOT in several areas including:

1. Fleet replacement, latest engines are more expensive and drivers are increasingly demanding automatic gearboxes,
2. Economic models needed by bonus and penalty calculations and a variety of cost-benefit calculations.
3. Higher costs may alter vehicle miles of travel (VMT) estimates used in a range of planning models, and
4. Improving trucker use of toll road systems. The current traffic and revenue studies cannot provide accurate cost benefits for truck use and the evidence strongly suggests that toll rates are currently set too high if they are intended to stimulate truck utilization.

The key objective of 0-5974 in 2007 was to provide TxDOT staff with a model that reflected the new Texas fleet rather than that of the 1980s when the last study was conducted. CT-Vcost is a milestone in providing TxDOT with current auto and trucking cost estimates. It is being used in a new study—0-6692 Truck-Rail Intermodal Flows: A Corridor Toolkit—which will be designed to identify the cost point where rail intermodal can compete with trucks on a range of Texas corridors. The model is designed to be updated relatively easily as new technologies are adopted by the industry and users, keeping the model up to date and relevant to TxDOT needs.

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