

# New England University Transportation Center



NE University Transportation Center  
77 Massachusetts Avenue, E40-279  
Cambridge, MA 02139  
Phone: 617-253-0753  
Fax: 617-258-7570  
web.mit.edu/utc

<b>Principal Investigator:</b>	John Collura	<b>Co-Principal Investigator:</b>	Wayne Burleson, Song Gao
<b>Title:</b>	Professor	<b>Title:</b>	Professor, Associate Professor
<b>University:</b>	University of Massachusetts, Amherst	<b>University:</b>	University of Massachusetts, Amherst
<b>Email:</b>	collura@umass.edu	<b>Email:</b>	<a href="mailto:Burleson@ecs.umass.edu">Burleson@ecs.umass.edu</a> , <a href="mailto:sgao@engin.umass.edu">sgao@engin.umass.edu</a>
<b>Phone:</b>	413.545.5404	<b>Phone:</b>	413.545.2382, 413.545.2688

## Final Report

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*Project Title:*

# A Decision Support System to Assess Disruptive Impacts of Alternative Transportation Financing Approaches

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The New England University Transportation Center is a consortium of 8 universities funded by the U.S. Department of Transportation, University Transportation Centers Program. Members of the consortium are MIT, the University of Connecticut, University of Maine, University of Massachusetts, University of New Hampshire, University of Rhode Island, University of Vermont and Harvard University. MIT is the lead university.

Description of the problem: As states continue to consider taking on more responsibility in transportation, a major issue State Departments of Transportation (DOTs) face relates to financing future transportation investments. A financing approach being considered includes the placement of tolls along selected interstate highways where tolls are not currently collected. Questions of interest to state DOT officials and transportation policy makers relate to the potential impacts of such approaches. The objective of this project was to initiate the development of a decision support system (DSS) to assist State Departments of Transportation in the evaluation of the impacts related to placing tolls on interstate highways. Anticipated impacts include capital and operating costs to implement the required toll collection strategies and technologies; expected changes in existing demand along the interstate and alternate routes; potential toll revenue; and privacy and equity implications. With the aid of this DSS, a decision-maker would be able to specify different toll system characteristics, add options such as desired levels of privacy and equity, and in a matter of minutes estimate capital and operating costs, forecast revenues, perform net present value and payback period analyses for alternative toll collection systems. The project also included the development of an illustrative example to demonstrate the application of the DSS to assess the impacts of alternative toll approaches along a segment of Interstate 93 through Boston. The expectation is that this DSS will be expanded to evaluate other financing approaches including congestion pricing strategies, vehicle miles traveled (VMT) based fees, and innovative fuel tax schemes indexed to inflation.

Approach: The technical approach for this project will focus on the development of a decision support system (DSS) to aid State transportation officials in formulating, evaluating, and selecting user based financing approaches. Central to the application of this DSS will be the evaluation of the anticipated impacts associated with these financing approaches and their disruptive technologies.

The composition of the DSS will consist of four modules: 1) a graphical user interface; 2) database; 3) model base; and 4) knowledge base.

The graphical user interface (GUI) allows the DSS user to specify the desired financing alternatives, facilitates data input, and provides access to the other three modules.

The model base (MB) module includes the capital and operating cost and revenue projection models. In addition, the MB houses the payback period analysis model and the net present value (NPV) based benefits cost model developed to assess the monetary, non-monetary/monetizable, and qualitative impacts of the financing approaches. Monetary impacts include investment costs such as capital and operating expenses associated with toll and fare collection and privacy preserving equipment); non-monetary/monetizable impacts include, for example, travel time savings or delays. Qualitative impacts address equity, privacy, and other concerns that are very difficult to quantify fully in dollar terms.

The knowledge base (KB) includes facts and rules. Facts relate to, for example, anticipated increases or decreases in demand or costs and the expected useful life of equipment and other technology required in each financing approach; and a schedule of proposed tolls, transit fares, VMT fees, and fuel tax rates. Rules could include the use of "if then" statements embodied in a particular encrypted technique which serves the purpose of identifying the need for a computer software and or hardware investment in order to achieve a desired level of privacy or equity.

The data base (DB) includes, for example, historical data such as the past and current operating costs and demand levels and a schedule of existing tolls, transit fares, and fuel tax rates.

Methodology: Initial steps involve articulating policy objectives, formulating alternatives, identifying the alternative route network, and determining the existing infrastructure. The following policy objectives were established: Toll revenues should be sufficient to cover operation and maintenance of the facility while providing substantial revenues to support future corridor improvements; conversion of a non-toll roadway into a toll facility should not divert significant portion of traffic onto secondary roads; the tolling schedule should be simple and easy to implement; toll charges should be fair and equitable to road users, proposed toll charges should be comparable to tolls currently charged on similar segments of other toll facilities in the State; and road user privacy and equity concerns should be acknowledged and addressed in system design.

Findings: Impacts include the estimated capital and operating costs to implement the required toll collection strategies and technologies; expected changes in existing demand along the interstate and alternate routes; potential toll revenue; and privacy and equity implications.

Conclusions: It is recommended that this DSS be expanded to evaluate other financing approaches including congestion pricing strategies, vehicle miles traveled (VMT) based fees, and innovative fuel tax schemes indexed to inflation. A major conclusion of the paper is that such a DSS would serve as a useful tool for state transportation policymakers and state DOT officials as they consider alternative financing approaches to generate the revenues required to make short and long range transportation investments. As data related to toll collection equipment technology, system cost and performance is time sensitive, it is recommended that both knowledge base and data base modules of the DSS were updated on a yearly or bi-yearly basis. Updated DB and KB modules can be maintained by, for example, either a federal transportation agency, a leading industry organization such as IBTTA, or by an academic transportation research center, such as the one at the University of Massachusetts at Amherst.

A more extensive Final Report can be found at:

<http://amonline.trb.org/2012-1.498485/t-12-012-1.512231/297-1.512539?qr=1>

(12-3714 Evaluating Impacts of Placing Tolls on Interstate Highways), or by contacting John Collura at [collura@umass.edu](mailto:collura@umass.edu).