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Final Report

Project Title:

New Data for Relating Land Use and Urban Form to Private Passenger Vehicle Miles

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Project Description

This research project developed the most extensive and spatially detailed analysis of annual vehicle miles traveled (VMT) by type of vehicle, place of residence, and land use pattern. We combined a unique Massachusetts State dataset of annual odometer readings since 2001 for more than six million vehicles with GIS data layers of housing, infrastructure, and demographic characteristics in order to associate actual miles driven (for private passenger vehicles) with place of garaging at a very fine grain of spatial detail. The work involved close collaboration with MassGIS (the State's GIS Office) and the Boston Metropolitan Area Planning Council (MAPC), two key state and regional planning agencies involved in the policy analysis and modeling of land use, growth management, and transportation strategies for reducing greenhouse gas emissions.

We have witnessed disruptive changes in the cost of gasoline, in public awareness of transportation impacts on greenhouse gas emissions, and in the practicality of congestion pricing, realtime traffic routing, car sharing and related transportation pricing and logistic mechanisms that utilize emerging information technologies. From past studies, we know that the impacts of these changes on private passenger VMT will vary widely by type of vehicle, household demographics, and many geographic characteristics of place of residence such as land use patterns and access to jobs, transit, and amenities. Understanding these relationships will be critical in designing appropriate transportation policies that can be effective and efficient in reducing environmental impacts with a minimum of social and economic disruption.

Method

The work was made possible through the opportunity to analyze and cross-reference two unique datasets that have already been assembled for administrative purposes by Massachusetts state agencies: annual safety inspection records that include odometer readings and are reported to the Registry of Motor Vehicles (RMV), and spatially detailed land use and demographic data that have been prepared by the State's GIS Office (MassGIS).

We had eight years of data for all six million plus private passenger vehicles that have been inspected in Massachusetts, which was a formidable but quite doable task. The MassGIS staff, together with the MIT research team, had extensive experience with the database management tools and the statistical modeling and online analytic processing techniques that were needed to process these large datasets appropriately while maintaining data security and confidentiality.

Because of our large sample size and rich GIS data layers, we were able to use the annual mileage estimates together with the land use and transportation interactions identified in the literature, to develop and calibrate multi-stage models of VMT (vehicle miles traveled) that are sensitive to land use patterns and household characteristics.

These models can be helpful in estimating the impact of disruptive changes in energy costs, growth management, and transportation options.

Findings

The work provided spatially detailed baseline data about 2001-2008 driving patterns throughout Massachusetts (by type of vehicle, type of neighborhood, population density, transit accessibility, land use mix, etc.) plus a related set of indicators and calibrated analytic models that will assist in 'what if' analyses of changing land use and transportation circumstances in metropolitan areas throughout the country. Since the key datasets continued to be collected for administrative reasons, the methods we developed also facilitated subsequent analysis of changed driving patterns resulting from current shocks to the system.

Conclusions

The project focused on descriptive statistics and thematic maps at town, TAZ, and grid-cell levels of the annual mileage estimates on a per vehicle and per household basis. We examined whether there have been significant changes in the vehicle mix or vehicle mileage and in the city/suburb/exurb/rural patterns during the 2007-2008 period when gas prices and environmental awareness have increased substantially. The results of this phase were helpful in providing a comprehensive picture of private passenger VMT for public presentation and discussion. They facilitated discussion of straightforward 'what if' estimates of development impacts.

Outputs

This project supported the safety inspection data preparation and initial correlation with land use and urban form characteristics. This research will be continued in Phase II of our project: Linking Mileage to Auto Accident Risk and Urban Form. We expect the continuation of the research in Phase II to have significant outputs to detail.