CENTER FOR TRANSPORTATION EQUITY, DECISIONS AND DOLLARS

POLICY BRIEF

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Applications of Accessibility Analysis for Predicting Travel Outcomes Throughout the U.S.

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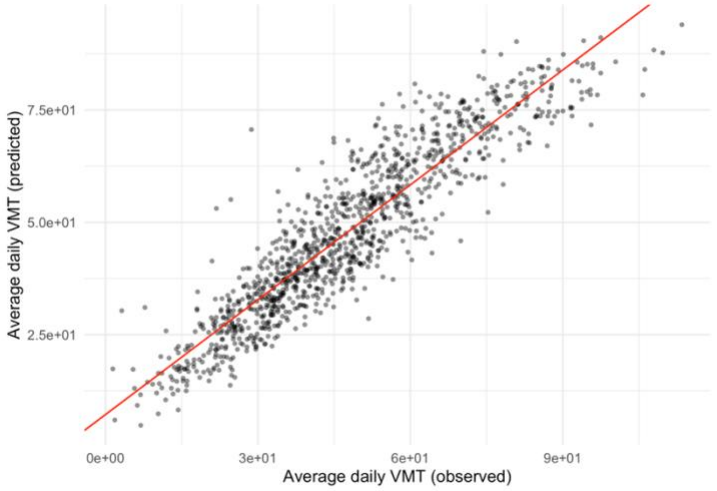
Executive Summary

Background

Many transportation agencies, planning organizations, and local governments are interested in predicting travel outcomes like vehicle miles traveled (VMT) and transit ridership, yet most lack formal tools for evaluating the effects of individual decisions on travel behavior. More agencies are now beginning to incorporate accessibility analysis—measuring access to destinations by different modes—which can also be useful for predicting travel outcomes.

Methods

This study ultimately focused on simple models—using vehicle ownership information and multimodal accessibility metrics to predict VMT and transit ridership—as a way for practitioners to tie specify policies or transportation investments to likely travel outcomes. The study is divided into three parts. Part 1 leverages unique VMT data available in Massachusetts to understand the link between accessibility metrics and travel outcomes in the greater Boston area. Part 2 extends those concepts nationally using household VMT data from the National Household Travel Survey, paired with accessibility metrics from the U.S. EPA. Part 3 explores the link between accessibility metrics and transit ridership using data in six regions across the U.S.



Findings

This study offers compelling evidence supporting the use of accessibility metrics for predicting travel outcomes. Part 1 produced robust non-linear models that explain more than 90 percent of the variation in average household VMT in Census block groups using just multimodal accessibility measures and information about average vehicle ownership. The national models in Part 2 are less compelling, but support the findings in Part 1, suggesting that models of household VMT may be transferable across the U.S. The models in Part 3 are also less compelling but suggest there is great potential for estimating transit ridership using accessibility metrics. Automobile ownership is strongly linked to higher VMT and lower transit ridership. The relationships among different modal accessibility metrics are complex, but our models suggest that increased driving accessibility is linked to higher VMT, while increased transit and walking accessibility are linked to lower VMT. The ratio of transit to driving accessibility appears to be a key predictor of transit ridership.

Scope of Problem

More transportation agencies are becoming interested in predicting how infrastructure investments, system improvements, and other built environment will affect travel demand and travel behavior. Yet existing tools like travel demand models and even some sketch planning tools are too resource intensive for many agencies to use in frequent decision-making applications, nor are they designed specifically for this use. There are several isolated studies suggesting accessibility analysis is suitable for this purpose, but none are broad enough in scope to validate their use on a widespread basis.

Policy Recommendations

This study reveals several important findings pertaining to the widespread application of accessibility-based travel models, and the related policy implications.

1. Vehicle ownership remains a key factor influencing travel behavior. This is useful from a modeling perspective but has mixed implications for decision-making. Vehicle ownership can be influenced by a range of factors including household income and transportation options—i.e., multimodal accessibility. In many ways, this makes it a useful proxy for those with limited data, but also less instructional for decision-makers who have limited direct influence on vehicle ownership. Nonetheless, vehicle ownership is still important to consider in combination with accessibility metrics, which could therefore influence land use and transportation decisions more directly. For instance, this work suggests that transit and walking improvements may be less effective in areas characterized by high vehicle ownership and, conversely, efforts to manage vehicle ownership—such as parking regulations and TDM policies—could have a significant effect on VMT. This view is supported by a considerable body of research suggesting the price and availability of parking is a key determinant of travel behavior.

2. Multimodal accessibility metrics can be used to predict average household VMT with a high level of reliability. This finding is confirmed by our robust models in the greater Boston area, which rely on a comprehensive VMT database and optimized accessibility metrics. Our most promising models rely only on accessibility metrics and vehicle ownership data, indicating that decision-makers can tie travel outcomes directly to those factors for which they have more direct control and omit external factors like income that, while important to consider, also have great potential to shift over time. In other words, this research suggests that policymakers can anticipate how built environment changes will likely influence travel behavior, independent of who lives in those places.

These models are not as useful for predicting individual household VMT at a national scale, according to the limited available data, but the same patterns seem to hold. This indicates that our model developed for the Boston area may be transferable, but more validation is needed. A lack of reliable household VMT data is one key obstacle to more widespread validation and adoption of the models.

3. Multimodal accessibility metrics are also useful for predicting transit ridership. As in models for predicting VMT, vehicle ownership remains a key factor in predicting transit ridership, with accessibility metrics improving model performance considerably. As with our national VMT model, a simple linear transit ridership model only explains about 30 percent of variation in transit ridership at the Census block-group level.

4. There is complicated interplay among accessibility by different modes that should be accounted for in models of travel behavior. Considered individually, driving, transit, and walking accessibility all appear to have a negative relationship to VMT and a positive relationship to transit ridership. Taken in combination, however, driving accessibility appears to have a small or positive effect on VMT, while transit and walking accessibility have increasingly negative effects. The effects of accessibility on transit ridership may be even more complex, but these complexities can be simplified by considering the ratio of transit to driving accessibility instead of each metric individually; walking accessibility does not appear to have a significant effect. The relative transit accessibility metric also seems to yield more consistent results across multiple regions.

One important implication of these findings is that driving accessibility should not be taken on its own as an indicator of travel behavior, despite its strong association with travel behavior. The highest driving accessibility is typically observed in areas where transit and walking accessibility are also highest—a function of proximity to jobs. Improving access to jobs by driving, however, such as through new highway investments or capacity improvements, will likely cause driving to increase.

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