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How built environment affects travel behavior: A comparative analysis of the connections between land use and vehicle miles traveled in US cities

*Lei Zhang, Jin Hyun Hong, Arefeh Nasri, Qing Shen*

### Abstract

Mixed findings have been reported in previous research regarding the impact of built environment on travel behavior, i.e. statistically and practically significant effects found in a number of empirical studies and insignificant correlations shown in many other studies. It is not clear why the estimated impact is stronger or weaker in certain urban areas, and how effective a proposed land use change/policy will be in changing certain travel behavior. This knowledge gap has made it difficult for decision makers to evaluate land use plans and policies according to their impact on vehicle miles traveled (VMT), and consequently their impact on congestion mitigation, energy conservation, and pollution and green house gas emission reduction.

This research has several objectives: (1) Re-examine

the effects of built-environment factors on travel behavior, in particular VMT in five U.S. metropolitan areas grouped into four case study areas; (2) Develop consistent models in all case study areas with the same model specification and datasets to enable direct comparisons; (3) Identify factors such as existing land use characteristics and land use policy decision-making processes that may explain the different impacts of built environment on VMT in different urban areas; and (4) Provide a prototype tool for government agencies and decision-makers to estimate the impact of proposed land use changes on VMT.

The four case study areas include Seattle, WA; Richmond-Petersburg and Norfolk-Virginia Beach, VA; Baltimore, MD; and Washington DC. Our empirical analysis employs Bayesian multilevel models with various person-level socio-economic and demographic variables and five built-environment factors including residential density, employment density, entropy (measuring level of mixed-use development), average block size (measuring transit/walking friendliness), and distance to city center (measuring decentralization and level of infill development).

Our findings show that promoting compact, mixed-use, small-block and infill developments can be effective in reducing VMT per person in all four case study areas. However, the effectiveness of land use plans and policies encouraging these types of land developments is different both across case study areas and within the same case study area. We have identified several factors that potentially influence the connection between built environment shifts and VMT changes including urban area size, existing built environment characteristics, transit service coverage and quality, and land use decision-making processes.

#### Keywords

Built environment, Land use change, Travel behavior, Vehicle miles traveled (VMT), Multilevel Bayesian model, U.S. urban transportation planning policy

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