Transportation Research Part D 59 (2018) 237–245

Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

A planning tool for evaluating vehicles miles travelled and traffic safety forecasts of growth management scenarios: A case study of Baton Rouge and New Orleans

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ARTICLE INFO

Keywords:
Vehicle miles travelled
Traffic safety
Growth management
Transportation planning

ABSTRACT

This study describes an adaptable planning tool that examines potential change in vehicle miles travelled (VMT) growth and corresponding traffic safety outcomes in two urbanized areas, Baton Rouge and New Orleans, based on built environment, economic and demographic variables. This model is employed to demonstrate one aspect of the potential benefits of growth management policy implementation aimed at curbing VMT growth, and to establish targets with which to measure the effectiveness of those policies through a forecasting approach. The primary objective of this research is to demonstrate the need to break with current trends in order to achieve future goals, and to identify specific policy targets for fuel prices, population density, and transit service within the two study regions. Models indicate based on medium growth scenarios, Baton Rouge will experience a 9 percent increase in VMTs and New Orleans will experience 10 percent growth. This translates to corresponding increases in crashes, injuries and fatalities. The paper provides forecasts for planners and engineers to consider an alternative future, based on desired goals to reduce VMTs and therefore improve safety outcomes. A constrained-forecast model shows a cap on VMTs and crash rates is achievable through policy that increases fuel prices, population density and annual transit passenger miles per capita at reasonable levels through a growth management approach.

1. Introduction

Increasingly, state departments of transportation (DOTs) are under pressure to address issues outside their typical purview, including solving transportation problems that result from land use and development decisions made at the local level. In the absence of legislatively mandated comprehensive planning requirements or statewide growth management programs that integrate land use planning and transportation investment across jurisdictions, many DOTs struggle to address these challenges. State DOTs are under pressure from the federal government to implement policies and plans that result in cleaner air, which often comes from lowering vehicle miles travelled (VMTs) and to create a safer transportation system with lower crash, injury and fatality rates. Such goals can be mutually reinforcing and recent studies demonstrate a statistically significant correlation between built environment and transportation variables with VMT, crash rates, injury rates, and fatality rates (per capita) at the metropolitan level (Ewing et al., 2014a;

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https://doi.org/10.1016/j.trd.2018.01.001

Ewing et al., 2014b).

In building upon the work cited above, this study asks the following research questions:

Research Question 1: What would be the outcomes of adjusting non-land use variables, such as fuel prices and transit service to yield benefits to VMTs and transportation safety at a regional level?

Research Question 2: What would be the outcomes of adjusting land use variables, such as population density, employment density and walkability on VMTs and transportation safety?

Research Question 3: Would it be feasible for state and regional planners to adjust some combination of fuel taxes, transit service levels, and land use variables, over a long period, to curb VMTs and improve safety outcomes?

This research adapts the elasticity models in the papers cited above to demonstrate how VMT impacts crashes, and how it could be possible to significantly impact safety outcomes through policies that aim to curb travel demand while forecasting future growth scenarios. Second, this research applies a constrained-forecast to target safety goals, under multiple growth scenarios.

The model was applied to data for the New Orleans and Baton Rouge metro regions, resulting in a worksheet for each region that transportation planners and officials can use to forecast various future scenarios. The use of this model, to demonstrate anticipated status quo outcomes as well as potential alternatives that could be achieved through policy change to key local, regional, and state stakeholders, links theoretical academic research to specific government actions, providing a useful model for translating research into practice. At the state and regional level, this study builds upon efforts to envision a future for southeast Louisiana that embraces the principles of smart growth by providing clear policy targets for fuel prices, population density, and transit for the Baton Rouge and New Orleans regions in order to cap VMT and improve transportation safety outcomes by 2030 (Louisiana Recovery Authority, 2007). The results of this study could be replicated in any metropolitan area across the United States.

2. Literature review

As part of our overall growth management study, a review of literature pertaining to all aspects of growth management was conducted, narrowed to a focus on how to more effectively integrate land use and development with transportation planning (Reference Redacted). Within this broad field of inquiry, Rooney et al. (2010) identify several successful strategies for achieving meaningful integration in decision-making, chief among which is to approach communities with transparent goals and no pre-conceived ideas about the “correct” solution. Meta-analyses of the effectiveness of regional planning efforts find that land use and transportation scenario plan can have an impact on policy adoption and ultimately, VMT reduction (Bartholomew and Ewing, 2009). Similarly, Barella et al. (2010), seeking to understand the challenges of addressing sustainability at state DOTs, identify best practices for influencing land use policy, even where statewide smart growth programs or comprehensive planning mandates do not exist.

To frame the modeling exercise described here, the authors sought research evaluating the relationships between various aspects of the built environment and VMT, and between VMT and crashes. Improved safety is a key goal of all transportation agencies, and extensive research demonstrates that there is a correlation between safety outcomes and VMT. Many researchers have modeled the relationship between VMT and crashes using various data inputs. Some of these models control for demographic or economic factors that impact crash rates (Kweon, 2007), while others (more relevant to this research) home in on policy impacts. Litman (2012) notes that adjusting transportation pricing (e.g., through higher fuel prices, tolls, parking pricing reform, distance-based pricing, or public transportation fare reduction) can significantly impact safety outcomes (up to a 60% decrease in traffic fatalities, making pricing reform potentially “the most cost effective safety strategies overall” [p. 21]), however, Litman also observes that this benefit is often overlooked by advocates of pricing reform.

Meanwhile, findings diverge regarding the relationships among various aspects of the built environment and crash outcomes, with some finding intersection density, street network patterns, and the relative importance of arterials in the network as key determinants, while others have found land use and zoning-related factors such as business density and population to be prime predictors of safety (Dumbaugh and Rae, 2009; Marshall and Garrick, 2011; Tay and Rifaat, 2009; Ewing et al., 2013; Moudon and Stewart, 2013; Gladhill and Monsere, 2012). While results indicating which specific factors have the most statistically significant impacts on crash outcomes vary, all the above variables interrelate to some degree and should be considered as part of a holistic approach to improving safety outcomes. However, nearly all agree that increased motor vehicle travel (i.e. VMT) in a given area results in increased crashes.

Therefore, this research relies on understanding how various attributes of the built environment—and changes thereto—influence travel demand. Numerous models for estimating future VMT growth or calculating VMT elasticity exist (Ewing et al., 2013). Notably, lack of understanding of how land use patterns affect travel behavior (including but not limited VMT) has been identified as a “weak link” in these models (Polzin et al., 2004). Efforts to identify significant land use variables affecting travel demand have found that higher density, compact, mixed-use development, and small block sizes are correlated with lower VMT, but struggled to explain mixed results in the effectiveness of plan and policy changes aimed at achieving such characteristics, among and even within urban areas (Cervero and Murakami, 2010; Zhang et al., 2012). In addition, travel forecasting methods have been developed to capture transportation impacts of various development designs, providing insight into how to encourage growth that minimizes travel demand (Hough and Black, 2012; Rodier and Spiller, 2012; Schneider, Handy, and Shafizadeh, 2014). Ewing et al. (2014a), having reviewed previous VMT research, identified the significant variables that predict VMT growth and developed a structural equation model based on data from 443 urbanized areas in all 50 states. They concluded that population, income, and gas prices, along with development density and transit service (the indirect effects of which occur through land use impacts having a much stronger effect than the impact of transit ridership alone), are primary drivers of VMT. Their analysis integrates demographic factors, development patterns, transportation costs, and roadway capacity and design.

In a separate study, Ewing et al. (2014b) developed elasticities of variables that predict outcomes for crash, injury, and fatality