



The impacts of built environment on home-based work and non-work trips: An empirical study from Iran



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ABSTRACT

This paper aims to explore the impact of built environment attributes in the scale of one quarter-mile buffers on individuals' travel behaviors in the metropolitan of Shiraz, Iran. In order to develop this topic, the present research is developed through the analysis of a dataset collected from residents of 22 neighborhoods with variety of land use features. Using household survey on daily activities, this study investigates home-based work and non-work (HBW and HBN) trips. Structural equation models are utilized to examine the relationships between land use attributes and travel behavior while taking into account socio-economic characteristics as the residential self-selection. Results from models indicate that individuals residing in areas with high residential and job density, and shorter distance to sub-centers are more interested in using transit and non-motorized modes. Moreover, residents of neighborhoods with mixed land uses tend to travel less by car and more by transit and non-motorized modes to non-work destinations. Nevertheless, the influences of design measurements such as street density and internal connectivity are mixed in our models. Although higher internal connectivity leads to more transit and non-motorized trips in HBW model, the impacts of design measurements on individuals travel behavior in HBN model are significantly in contrast with research hypothesis. Our study also shows the importance of individuals' self-selection impacts on travel behaviors; individuals with special socio-demographic attributes live in the neighborhoods with regard to their transportation patterns. The findings of this paper reveal that the effects of built environment attributes on travel behavior in origins of trips do not exactly correspond with the expected predictions, when it comes in practice in a various study context. This study displays the necessity of regarding local conditions of urban areas and the inherent differences between travel destinations in integrating land use and transportation planning.

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1. Introduction

Travel challenges in developing countries are different from wealthier global. While recent studies suggest that car ownership rates in advanced economies have been peaked (Goodwin, 2012), motorization continues sharply in developing countries due to the economic growth and rising incomes. Recent research have estimated that the majority of vehicle use by 2050 will be found in developing countries, especially China, India and other Asian countries (United Nations Habitat,

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2011). So policy proposals to reduce negative impacts of car dependency in developing countries could not thoroughly follow the same tools.

Multiple studies have investigated the subject of travel behavior to identify various factors which are determinants of daily trip patterns. In this regard, urban planners have been interested to understand the chief factors that can promote active travel patterns and decrease car-oriented behaviors in order to obtain sustainable urban transport. Considering the land use and transport planning as an integrated subject is the most prominent strategy adopted by several researchers in travel behavior studies (e.g., Newman and Kenworthy, 1989; Giuliano, 1995; Newman et al., 1995; Gordon and Richardson, 1997). The association between land use and travel behavior provides a wealth of empirical studies in North America and Europe. Based on their research methodology, the empirical studies on interaction between built environment and travel patterns have been divided into two main groups: comparative and analytical approach. The analytical approach which explores the correlations of land use and transport through multiple variables, has been studied as aggregated and disaggregated models. The aggregated models which are mostly performed to test the impacts of physical patterns on collective travel behaviors in a large geographical zone by using aggregated data (e.g., Pushkarev and Zupan, 1977; Frank and Pivo, 1994; Cervero and Gorham, 1995), were criticized due to their oversimplification of complex relationships between traffic behaviors and urban form (Gordon and Richardson, 1997; Kitamura et al., 1997). In order to eliminate cited limitations, a number of studies collected disaggregated data by individuals' trip diary and survey in the unit of households (e.g., Handy, 1996; Boarnet and Crane, 2001; Cervero, 2002; Naess and Jensen, 2004). This model usually provides a more comprehensive understanding of individuals' decision making on choosing special trip patterns. Since the 1990s town planning has dramatically shifted to employ particular built environment characteristics introduced by new urbanism policies (Duany and Plater-Zyberk, 1991) such as density, design and diversity to organize more sustainable trip patterns.

Whereas travel is traditionally considered as a derived demand, travellers are assumed to choose their travel patterns based on the cost and benefit of different ways to obtain their desired activities (Van Wee, 2002). So, built environment impacts individuals' travel patterns through altering the trip opportunities. Nonetheless, empirical studies on land use influences cannot fully resolve the issues of individuals' travel behavior, specifically since debates on residential self-selection have emerged (Bagley and Mokhtarian, 2002). Moreover, some studies argue that far from being completely determined by basic needs, travel demand is largely influenced by individuals' attitudes toward travel (Mokhtarian and Salomon, 2001).

Although integrated land use and transport strategies have gained extensive policy interest in North America, Europe, and Australia over the past two decades, there is some doubt about the implication of these policies in countries like Iran. Moreover, the differences in spatial characteristics in developing countries such as level of monocentricity, population densities, design and geographical locations (Cervero, 2013) make it difficult to implicate the land use as an efficient tool to control travel behaviors. Additionally, local governments application of biased versions of western land use strategies in metropolitan areas, accounts for more unorganized patterns of transportation.

Far less is known on the subject of land use and travel planning in Iran, though new studies are moderately ascending. This paper aims to explore how built environment attributes in one quarter-mile buffer areas influence on home-based travel behaviors. We expanded travel patterns to both work and non-work destinations to investigate the effects of various urban form characteristics on the amount of weekly trips produced by individuals. To develop the study, micro-level travel data were obtained from a household survey conducted in 2014 and structural equation models were employed to explore travel behaviors while controlling socio-economic attributes for individuals' decision making. In the next section, related studies on travel behavior are reviewed. Section 3 expresses the methodology of the study. Section 4 indicates the data analysis and SEM results. The final section concludes the paper.

2. Built environment and travel behavior

There is a considerable amount of research on the link between built environment and travel behaviors in different countries by various contexts. In travel research the potential to adjust travel demand by modifying the built environment is explored through measures that are often named Ds. The original "three Ds" referred to density, design and diversity (Cervero and Kockelman, 1997), and were later completed by destination accessibility and distance to transit (Ewing and Cervero, 2001; Ewing et al., 2009). On the other hand, travel behavior outcomes have often been modeled as trip frequency (e.g., Zegras, 2007; Fan, 2007; Frank et al., 2007a,b; Cao, 2010), trip length (e.g., Boarnet et al., 2008; Boer et al., 2007), modal choice (e.g., Cervero, 2002; Chatman, 2003; Ewing et al., 2004; Zhang, 2004; Frank et al., 2007a,b) and vehicle miles traveled (VMT) (e.g., Bhatia, 2004; Frank and Engelke, 2005; Greenwald, 2009).

It is believed by the most studies that density often influences travel behaviors through reducing car ownership and VMT (e.g., Bhatia, 2004; Zhou and Kockelman, 2008) and leads to increased walking and transit trips (e.g., Bhatia, 2004; Greenwald, 2009). It has been pointed out that density certainly effects travel behavior due to the conditions of dense places that provide shorter distances among activity destinations, better access to public transport stations and more tendencies toward walking trips (Ewing and Cervero, 2010).

Another important dimension of built environment is diversity that is defined by the number of various land uses in a given area. Recent research has found that higher degree of mixed land uses result in less VMT (Kuzmyak, 2009), more choice of walking for work and non-work trips (Frank et al., 2008; Rajamani et al., 2003) and more transit mode choices (Cervero, 2002; Frank et al., 2009).

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