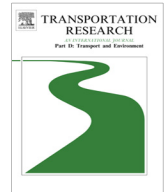




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Built environment and mode choice relationship for commute travel in the city of Rajkot, India



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ABSTRACT

Metropolitan areas around the world are looking for sustainable strategies to reduce use of private automobiles, energy consumption and emissions, often achieved by built environment interventions that encourage use of sustainable modes of transport. This study contributes by providing the empirical evidence on the relation between built environment and mode choice in context of Indian city of Rajkot. Using personal interview data and data available from Rajkot Municipal Corporation it is observed that there is a strong tendency among Rajkot residents to preselect their residential location to suit their modal preferences. This is especially true for non-motorized transport users. Among the built environment variables, access to destination and land use related indicators also have significant influence on mode choice. The study infers that the land use policy should focus on accessibility and mixing of diverse uses, and transport supply will have to be location based to support non-motorized and public transport travel.

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Introduction

Land use planning in India is often limited to prescriptive zoning that assigns per-mitted land uses to specific areas (zones) in the city while restricting other uses that may be considered unsuitable, transport planning is mainly providing road infrastructure for private automobiles. On site regulation is poor, therefore land use in Indian cities is of a mixed nature and very different from the rigid zoning proposed as part of the development plan (Brueckner and Sridhar, 2103). The mixed nature of land use makes shorter trips possible which should ideally encourage use of non-motorized modes of transport such as walking and cycling. However, the infrastructure required to sustain and encourage such non-motorized means of transport is not yet in place (Munshi, 2013). As suggested, these cities already suffer from poor urban development planning policies and its implementation. These policies have indirectly (till National Urban Transport Policy was introduced in 2006 (MOUD, 2006)) encouraged the use private automobiles (Pucher et al., 2005; Adhvaryu, 2011) resulting in high growth rate of private automobile ownership. These are not desired trends from low carbon development perspective thus, there is a need to first stop this trend and if possible revert it.

In other parts of the World, the relation between built environment and mode choice has been studied extensively for the past couple of decades. The evidence from these studies has led to a paradigm shift in the goals of urban transport planning policy. A shift from implementing transport projects to supply the ever increasing demand to the “new realism” where the interest and focus is on restricting the demand to travel by Private Automobile (PA) and to promote Non-Motorized (NMT) and Public Transport (PT) as alternate modes (Banister, 1999; Milakis and Barbopoulos, 2008). In India the policy viewpoint

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Fig. 1. Location of Rajkot in Gujarat state, India. Source: India Political (Mapsofindia).

is still dependent on the empirical evidence from other parts of the world as very few studies have looked at this relation (Munshi et al., 2008). The objective of this paper is to explore the influence of built environment on mode choice decisions for work purpose travel for a middle sized city in India with an aim to bridge this knowledge gap.

To achieve the above stated objective an empirical study was conducted with Rajkot city, a typical second tier Indian city (city with population ranging from 1 to 5 million), located in the state of Gujarat in western India (as shown in Fig. 1) as a case. The estimated population living in the city corporation limits in 2011 is around 1.2 million. Rajkot has a good small sector industry base and with rapid urban and population growth.

The remainder of this paper is organized as follows: The next section briefly reviews the previous related research. The subsequent section describes the data available for the study, the conceptual model structure, and the estimation methodology. We then present and interpret a multinomial logit model mode choice and the last section summarizes the study and suggests future research directions.

Built environment and its relation with mode choice

Built environment can be defined in several way, however the mostly widely used definition is drawn from the famously termed 6D's by Ewing and Cervero (2010). These are Density (population and jobs), Diversity (land use mix and balance), Design (neighbourhood and street design), access to Destination (distance from downtown, accessibility to jobs), Distance from public transport stops, and Demand Management (parking fees, congesting pricing, etc.). Mode choice is the mode chosen by the person to travel. It is considered in empirical literature as a function of trip-makers' characteristics (e.g., age, gender, household income, household size and composition), mode characteristics (travel cost, convenience, safety and security) and built environment characteristics.

A number of studies have analyzed the relation between built environment and travel behaviour. Among these studies are comprehensive literature reviews (Ewing and Cervero, 2001, 2010; Stead and Marshall, 2001; Cao et al., 2009). It is mostly found that built environment has a significant impact on mode choice. It is however also reported that not all of the past studies report significant and consistent influence of built environment on mode choice. The reported work is reviewed below.

Built environment indicators

Density: is represented in two ways: residents and jobs per unit area. In some cases, the density of residents is subdivided into population/households per unit area or dwelling units per unit area (Ewing et al., 1996; Schimek, 1996; Kockelman, 1997; Holtzclaw et al., 2002; Bhatia, 2004; Zegras, 2007; Kuzmyak, 2009; Munshi et al., 2014). The job density is reported to have been represented as total jobs (Boarnet et al., 2004), or retail jobs (Boarnet et al., 2004) or as density of commercial activities (Vance and Hedel, 2007).

Diversity: is represented as land use mix and balance index (explained below). In this initial studies this indicator was quantified as ratio between jobs and household (Frank and Pivo, 1994). More recent studies have used land use mix quantified as entropy index (Frank et al., 2009; Kuzmyak, 2009; Munshi, 2013) and land use balance quantified as dissimilarity index (Cervero and Kockelman, 1997; Munshi et al., 2014). Some studies have also represented diversity indicator as the balance between retail and houses or as proportions of jobs/retail opportunities.

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