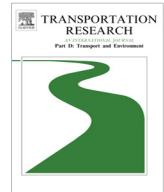




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journal homepage: www.elsevier.com/locate/trd

Effect of built environment measures on trip distance and mode choice decision of non-workers from a city of a developing country, India



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ARTICLE INFO

Article history:

Available online 11 May 2016

Keywords:

Bangalore
 Built environment
 Non-worker
 Trip purpose
 Vehicle owners & non-vehicle owners

ABSTRACT

This paper investigates the influence of built environment measures on trip distance and walking decision of non-workers by segmenting the populace based on trip purpose, vehicle ownership, and the presence of school-going children in households. The built environment measures of home zone of individuals considered for the present analysis include zonal population density, zonal school enrolment, land use mix diversity index, and an indicator variable that captures if neighbourhoods have footpaths of adequate width available. Statistical analyses conducted on home-based trips indicate that an increase in the land use diversity of a zone has its strongest negative effect on distance travelled for participating in personal/household business activities. The non-vehicle owning group exhibit a higher tendency to walk than the vehicle-owning group for an increase in the land use diversity of zones. Further, the study suggests that school-enrolment in a zone also influences the travel decisions of non-workers in families with school-going children.

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Introduction

The emerging interest in promoting built environment-related policies to address urban transport-related externalities has engendered a number of empirical studies in the area of travel behaviour analysis (e.g., Van Acker and Witlox, 2010; Ewing, 1995). Built environment measures (e.g., density, accessibility, street design) are found to influence motorised trip rates (Boarnet and Greenwald, 1999), share of sustainable transport modes (Limanond and Niemeier, 2004), and travel distance by motorised modes (Cervero and Kockelman, 1997). However, past studies exploring the effects of various built environment attributes on travel behaviour have brought forth mixed findings. While many research have found comparable effects of the built environment on travel behaviour across different urban areas (e.g., Boarnet and Greenwald, 1999; Boarnet and Crane, 1998; Boarnet and Sarmiento, 1998) others have noted that the type of built environment measures and their influence on travel behaviour vary even across different regions in a country/continent (e.g., Badoe and Miller (2000) for a summary of case studies from North America). Furthermore, the association between the built environment and travel behaviour are observed to vary amongst different population segments (e.g., Antipova and Wang, 2010) and by trip purpose (e.g., Frank and Pivo, 1994).

Over the past years, many studies have analysed the association between the built environment and individuals' travel decisions concerning different trip purposes (e.g., Cervero and Kockelman, 1997; Frank and Pivo, 1994). An emerging topic

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in this area is non-work travel behaviour. Non-work trips, unlike work trips, are more flexible and discretionary in nature, and it is generally hypothesised that built environment exerts its greatest influence on non-work trips than work trips (Rajamani et al., 2003). Another emerging front of research is the activity-travel behaviour of non-workers. Non-workers (generally include homemakers, retired individuals, job seekers, and unemployed individuals) have more flexibility over the selection of daily activity-travel schedule than workers (and students). This difference in daily schedule flexibility has implication for transportation planning and policies. For example, Bricka (2008) noted that the built environment measures (such as density, distance to transit, mixed use) shaping the trip chaining decisions of non-workers and workers were different in the US. The findings of Bricka's analysis shows the need for promoting different built environment-related policy measures for influencing workers' and non-workers' travel behaviour. However, empirical investigation into the activity-travel behaviour of non-workers is very limited when comparing with the research on workers' travel decisions (Bricka, 2008; Misra and Bhat, 2000). To the authors' knowledge, very limited research into the influence of built environment attributes on trip distance and mode choice decision of non-workers by segmenting this populace based on trip purpose, vehicle ownership and the presence of school-going children in households.

This paper attempts to address the research gap mentioned above by undertaking a case study from the developing country, India. The rest of the paper is organised as follows. Next section provides a brief summary of the past works that are most relevant to the current research. Section 'Study area, data source, and models' introduces the study area and data sets. Findings of the analyses on the travel behaviour of non-workers who participate in different types of activities are presented in Section 'Travel behaviour of non-workers who participate in different types of activities'. Next section summarises the estimation results of the models that link built environment attributes with the travel behaviour of vehicle owning and non-vehicle owning non-workers. In Section 'Travel behaviour of individuals belonging to households with/without school-going children', an attempt has been made to investigate the influence of built environment measures on trip distance and mode choice decision of non-workers by segmenting the individuals based on the presence of school-going children in households. Final section summarises the present work, and highlights the scope for further research.

A brief summary of relevant works

Analysis of the link between the built environment and activity-travel behaviour is a research topic that has received wide attention over the past decades. The recent developments in the area of the association between the built environment and travel behaviour has been summarised elsewhere (Saelens and Handy, 2008; Ewing and Cervero, 2010; Gim, 2012; Badoe and Miller, 2000). This section provides a brief summary of the past works that are germane to the current research. Table 1 presents a compendium of works by stratifying them based on non-workers' travel behaviour and non-work travel behaviour. The table helps identify the focus of investigation of the previous works, the important built environment measures included in them, and the possible extensions to the previous studies.

The summary of previous works provides the following insights. Very limited research works have analysed trip distance and mode choice behaviour (especially walking) of non-workers as a function of built environment measures. The analysis by Chowdhury (2011) investigated trip distance. However, the study excluded social trips and pick-up/drop-off trips (especially children) from the analysis. Bricka's analysis shows the variations in the influence of built environment measures on trip chaining decisions of non-workers belonging (or not belonging) to households with children of school-going age (5–12 years) (Bricka, 2008). This finding may be interpreted from the perspective of pick-up/drop-off activities undertaken by non-workers in households with school-going children. Hence, analysing the influence of the built environment on trip distance and mode choice decision of non-workers in households with school-going children can be a topic of investigation. Studies of non-workers' travel behaviour, especially those controlling for 'D's (Cervero and Kockelman, 1997), i.e., Density, Diversity, and Design, are limited when compared to the research works on non-work travel behaviour. Even though several research works have analysed travel behaviour pertaining to single non-work trip purposes (or activity types) (Muhs, 2013; Van Acker et al., 2011; Limanond and Niemeier, 2004; Steiner, 1997), very limited have studied the influence of built environment attributes on travel decisions related to participation in different activities/trip purposes. The case study of Tanangsnakool (2011) analysed trip distance by activity types, but did not control for socio-demographic characteristics. Furthermore, Tanangsnakool's analysis included the trip distance behaviour of vehicle owners and non-vehicle owners (Tanangsnakool, 2011). However, their study did not estimate statistical models for comparing the influence of built environment measures on the travel behaviour of individuals belonging to different groups. From the perspective of statistical analysis, the summary (Table 1) indicates that traditional models (linear regression model, binary logit model, etc.) can be implemented for analysing the travel behaviour of individuals/households (e.g., Cervero and Kockelman, 1997; Rajamani et al., 2003) with the built environment measures captured at different scales (e.g., zonal level population with walking environment in neighbourhood level). Another point to be mentioned from the summary presented in Table 1 is that, so far, no case studies have analysed the travel behaviour of non-workers or non-work travel behaviour (in general) form Indian cities. On the other hand, many other developing nations have investigated the influence of the built environment on non-work travel behaviour for deciding upon transport policies (e.g., case study of Zegras (2004) from Chile, and Wang et al. (2011) from Beijing).

Based on the literature review, a few important research problems are identified, which are addressed through a research undertaken from a city of a developing country, India. The objectives of the current research include:

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