



# Accessibility modelling: predicting the impact of planned transport infrastructure on accessibility patterns in Edinburgh, UK



Saleem Karou\*, Angela Hull<sup>1</sup>

School of the Built Environment, William Arrol Building, Heriot-Watt University, Riccarton, Edinburgh EH14 4AS, United Kingdom

## ARTICLE INFO

### Keywords:

Accessibility  
Transport planning  
Spatial equity  
Edinburgh Tram  
Geographic Information System (GIS)

## ABSTRACT

The achievement of good spatial accessibility and equity in the distribution of urban services is one of the supreme goals for urban planners. With Scottish Government backing, the City of Edinburgh Council (CEC) has started to construct a tram network to cater for the future needs of Scotland's capital city by providing an integrated transport solution using trams and buses. Spatial Network Analysis of Public Transport Accessibility (SNAPTA) which is a GIS-based accessibility model has been developed to measure the accessibility by public transport to different urban services and activities. The model responds to several limitations in other existing accessibility models in planning practice. It offers an alternative and practical tool to help planners and decision makers in examining the strengths and weaknesses of land use – transport integration. SNAPTA has been applied to a pilot study in Edinburgh city to identify the contribution of the infrastructure improvements of the tram system and Edinburgh South Suburban Railway (ESSR) to improved accessibility by public transport to six types of activity opportunities. This paper outlines the concept and methodology of the SNAPTA model, and presents the findings related to this pilot study with a focus on changes in potential accessibility to jobs between four different public transport network scenarios. The accessibility values so obtained help to identify the gaps in the coverage of the public transport network and the efficiency in the spatial distribution of urban services and activities. The findings focus on whether the planned transport infrastructures for Edinburgh will lead to better accessibility and reduced inequity (in terms of accessibility) across the city.

© 2014 Elsevier Ltd. All rights reserved.

## 1. Introduction

Being able to reach the spatial opportunities in the city-region where you live without too much hassle is considered as one of the dimensions of quality of life in empirical studies of life quality (Bowling and Windsor, 2001; Leitmann, 1999; Roseland, 1997). The ability to access necessary services is a function of the range of transportation choices available and their travel time, safety, cost, and convenience as well as the internal structure of settlements and the spatial distribution of opportunities (Banister and Hickman, 2007; Forward, 2003). The efficient connection of the distributed infrastructure of services and facilities with the infrastructure for movement across city regions is a pressing issue for urban managers. The changing intensity of development at locations in the city-region affects travel demand and the performance of the transport system whilst city scale transportation investment alters the accessibility of different parts of the city-region (Banister and Hickman, 2007; Chapin and Kaiser, 1979; Himanen et al.,

2005; Holl, 2006; NICHES, 2007; O'Sullivan, 1980; Priemus et al., 2001; Sultana, 2006). The dialectical relationship between transport services and spatial opportunities affect both accessibility and spatial equity, another concept closely linked to quality of life.

The role that public transport plays in connecting communities and neighbourhoods and the impact of transport investment on those same communities is acknowledged in local transport policies that seek, for example, 'To improve the transport choices households have available to reach a range of services' or 'To promote accessibility to everyday facilities for all, especially for those without a car' (Hull and Karou, 2011). The spatial growth of urban areas and the decentralization of employment and facilities have made it harder for people without access to a car to make the daily commute and to take advantage of distributed retail and leisure opportunities.

In this respect, there has been a growth of interest in the concept of accessibility over the last decades, with many accessibility studies published in the academic press discussing how to measure accessibility and the contribution such decision support tools might have. Recently, the development of accessibility models has used a multitude of approaches to inform land use and transport decision-making (Karou and Hull, 2012). Therefore, translating the concept of accessibility into a practical planning tool

\* Corresponding author. Tel.: +44 (0) 77 3558 1551.

E-mail addresses: [saleem.karou@gmail.com](mailto:saleem.karou@gmail.com), [sk240@hw.ac.uk](mailto:sk240@hw.ac.uk) (S. Karou), [a.d.hull@hw.ac.uk](mailto:a.d.hull@hw.ac.uk) (A. Hull).

<sup>1</sup> Tel.: +44 (0) 131 451 4407.

stems from the need for powerful techniques to help planners and decision makers deal with urban and transport management and provide better evaluation of the impacts of different schemes (or combinations of schemes) advanced by transport and land-use policies.

This paper focuses on accessibility addressing issues of spatial equity and transport disadvantage through two objectives. The first objective is to develop an accessibility model – the Spatial Network Analysis of Public Transport Accessibility (SNAPTA) – which has responded to the need for academic research models to be more practical and useful models for the world of planning practice. The second objective is to test the model through empirical study in the city of Edinburgh based on *ex ante* evaluation of the new tram system and Edinburgh South Suburban Railway (ESSR) to compare between the accessibility impacts of different scenarios of the completion of these infrastructures.

The paper is organised in six sections. The introduction has identified transport accessibility as a key dimension of quality of life and a priority for sustainable urban management. This acknowledges the interaction between land use and intensity, individual travel behaviour and transport provision. The next section introduces the case study of Edinburgh. Section 3 discusses the rationale for the construction of the tram system and re-opening of ESSR. In Section 4, the conceptual framework and theoretical underpinning of the SNAPTA model is presented. Section 5 focuses on the methodology of SNAPTA application to Edinburgh's network while the last two sections outline the findings and further developments in SNAPTA.

## 2. Case study of Edinburgh

The city of Edinburgh is situated in the central urban belt of Scotland with an overall density of 37.65 persons per hectare (2001 census). The policies in the land use plan and Edinburgh's geographical location (bordered by the Firth of Forth on two sides) have contained urban sprawl, through the imposition of a green belt around the urban area and the encouragement of development on brownfield sites.

Edinburgh's population is projected to grow by over 59,000 between 2010 and 2030 (CEC, 2010). As Edinburgh's population grows, the demand for travel will increase. Population growth in the city region will also impact on levels of commuting into the city. Moreover, during the next 20 years, Edinburgh's economy is forecast to play a big part in Scottish economic growth (CEC, 2010). The city is currently commencing a huge phase of redevelopment. Edinburgh Waterfront is set to provide an additional 25,800 new residential units and nearly 350,000 m of new office, retail and other commercial developments between 2006 and 2020. Significant new development is also predicted to be progressively built by 2020 in West Edinburgh with some 250,000 m of new office space and over 200,000 m of other commercial space (TIE, 2006). Fig. 1 shows the location of housing and office developments programmed for completion between 2006 and 2015 based on outstanding consents and local plan allocations (CEC, 2008).

Continuing economic success has however created a number of challenges. With a substantial population increase expected and "The number of jobs.....now expected to increase by 15% between 2000 and 2015" (CEC, 2007, p. 14) as well as the forecast rise in household car ownership by 30% from 2000 and 2016 causing twice as much time to be lost due to congestion over the same period (TIE, 2004, p. 2), the maintenance of connectivity and accessibility is one such challenge (Hull and Karou, 2011). The Transport 2030 Vision argues that, by 2030, without action, the demand for travel from/to the city by private car will far exceed the current capacity (CEC, 2010).

The City of Edinburgh Council has defined a series of actions including the implementation of new public transport infrastructures such as the tram system and ESSR to boost the transport system and improve accessibility in the Council's area. The expectation is to cut demand for road travel and to serve the new growth areas while they develop by delivering a reliable and safe public transport service and, consequently, by improving their accessibility. The Public and Accessible Transport Action Plan (PATAP) 2013–2020 suggests that the target is to increase public transport's share of all their journeys by 2015 by 1.3%, and by 2020 by 2.3%

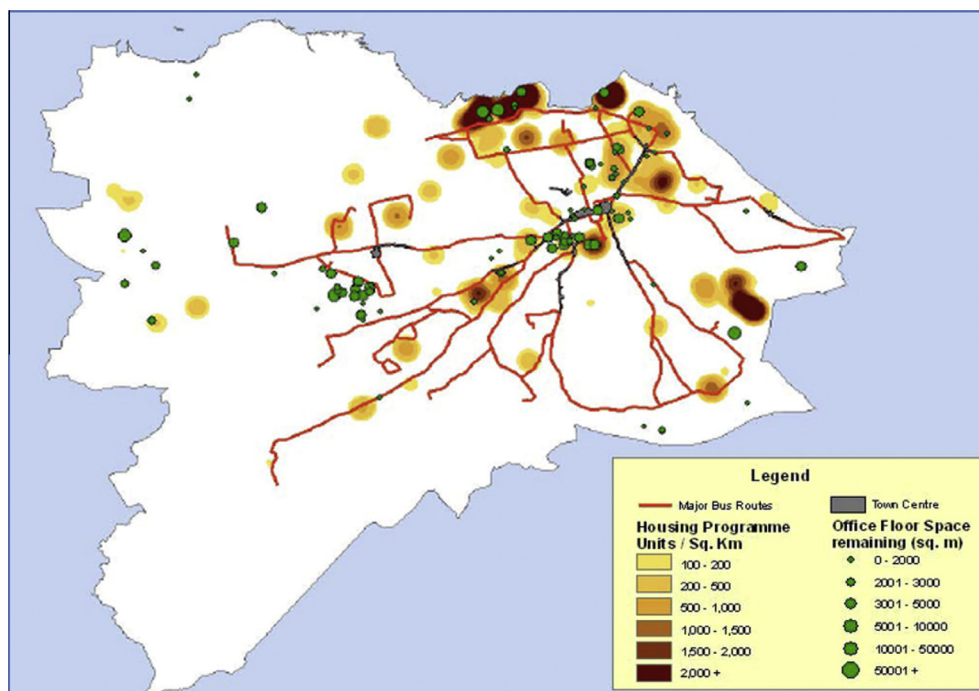


Fig. 1. Location of housing and office developments programmed for completion by 2015. Source: City of Edinburgh Council planning records (2008).

Download English Version:

<https://daneshyari.com/en/article/1059144>

Download Persian Version:

<https://daneshyari.com/article/1059144>

[Daneshyari.com](https://daneshyari.com)