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How to get there? A critical assessment of accessibility objectives and indicators in metropolitan transportation plans

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ABSTRACT

Accessibility, the ease of reaching destinations, is increasingly seen as a complimentary and in some cases alternative to the mobility oriented planning paradigm, as it allows capturing the complex interactions between land use and transportation systems while providing a social perspective on transportation planning. However, although accessibility has been extensively researched in the last decades, it is still largely marginalized in transportation planning practice. Accordingly, the aim of this study is to critically assess how accessibility is incorporated into metropolitan transportation plans and translated into performance indicators around the world, to ultimately derive policy recommendations. This research assesses 32 recent metropolitan transport plans from North America, Europe, Australia and Asia with respect to their goals, objectives and performance indicators. The results suggest that there is a trend toward a greater integration of accessibility objectives in transport plans, yet few plans have accessibility-based indicators that can guide their decision-making processes. Our findings show that in order to foster accessibility-based approaches to transportation planning, plans need to have clearly defined accessibility goals with a distinction between accessibility and mobility. Furthermore, multi-criteria analysis approaches including accessibility indicators need to guide the decision-making process. This study contributes to a greater understanding of the challenges and successes associated with implementing accessibility in transport planning.

1. Introduction

Accessibility is increasingly seen as an alternative to mobility oriented planning paradigm (Geurs et al., 2012), as it allows capturing the complex interactions between land use and transportation systems (Hansen, 1959) and provides a social perspective on transportation planning (Banister, 2008; Lucas, 2012). While mobility merely reflects the ease of moving, accessibility addresses the ease of reaching desired destinations, which is in fact the reason why people undertake trips (Preston and Rajé, 2007). Accessibility is one of the most comprehensive measures to assess the complex performance of land use and transportation systems in a region. As it has been well documented in the literature, accessibility can help in reducing car use, increasing social equity, and support economic development. Accordingly, transportation planning is increasingly framed in terms of access to opportunities (Geurs et al., 2012; Handy, 2008; Lucas, 2012; Manaugh et al., 2015; Preston and Rajé, 2007). Nevertheless, the concept of mobility is still prioritized over accessibility in practice (Halden, 2011; Levinson, 2005; Proffitt et al., 2015).

The aim of this paper is to critically assess how accessibility is incorporated into metropolitan transportation plans and translated into performance indicators around the world. This analysis seeks to identify best practices and provide guidelines on how to effectively use accessibility in planning. In order to do so, a qualitative content analysis of 32 recent plans from metropolitan areas in North America, Europe, Australia and Asia is conducted. The analysis focuses on the vision, goals, objectives and performance indicators stated in the plans. The general trends as well as the best practices are highlighted in this study. This study contributes to a greater understanding of practical challenges and successes associated with accessibility planning. This research is of relevance to decision-makers and transportation planners wishing to better integrate accessibility in their plans and practice. It also provides researchers with a greater understanding of the current planning practices, and potentially contribute to bridging the gap between ongoing research and planning practice.

2. Literature review

2.1. What is Accessibility?

In simple words, accessibility can be understood as the ease of reaching services and activities (Litman, 2013). For the purpose of this

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study, we focus on geographical accessibility, that is the ease of reaching destinations (Preston and Rajé, 2007). Following this definition, accessibility is largely contingent on the spatial distribution of destinations, the land use component, and the ability to move from one place to another, the transport component (Geurs and van Wee, 2004). The land use component is related to the spatial distribution of opportunities. Urban opportunities can include, but are not limited to, jobs, health services and retail stores. The transport component refers to the transport infrastructure specific to each mode. In addition to transport and land use, there are temporal and individual components to accessibility (Geurs and van Wee, 2004). The availability of opportunities for example (opening hours of shops and services, job starting time) represents temporal elements, whereas personal characteristics such as income and car ownership reflect the individual component.

Given the multiple components of accessibility, accessibility can be measured in different ways (Geurs and van Wee, 2004; Handy and Niemeier, 1997; Paez et al., 2012). Firstly, accessibility can be measured at the individual level (person-based), or at the location level (place-based) (Miller, 2005). Whereas person-based metrics focus on the individual component, place-based metrics mainly account for the land use and transport components. The individual component is sometimes included in location-based studies by stratifying population by age group or socio-economic characteristics, and by segmenting destinations (by job types for example) (Fan et al., 2012; Alexandre Legrain et al., 2015; A. Legrain, Buliung et al., 2016; Paez et al., 2010). Location-based accessibility is most commonly used by policy-makers as it provides a comprehensive measure of the land use and transport system at the regional level (Dodson et al., 2007). Location-based metrics typically accounts for the number of opportunities that can be reached from a specific location, based on the travel costs to destinations using a specific mode (Handy and Niemeier, 1997).

Travel costs are generally measured based on travel time or distance (Geurs and van Wee, 2004; Handy, 1994; Hansen, 1959; A. Owen and Levinson, 2014; Vickerman, 1974). Two location-based measures are commonly used in accessibility research. The first one is the gravity-based measure which discounts all opportunities based on their travel costs. The second one is the cumulative-opportunity measure, which only counts the opportunities that are within a specific travel costs threshold. Gravity-based measures better reflect travel behavior as it accounts for the travelers' perceptions of time (Ben-Akiva and Lerman, 1979). This measure is, however, more complex to generate, as a distance-decay function must be calculated, and more difficult to interpret and communicate, as it is not directly expressed in terms of the number of opportunities (Geurs and van Wee, 2004; A. Owen and Levinson, 2014). On the other hand, cumulative-opportunity measures are easy to generate and interpret. Furthermore, these measures are highly correlated with gravity-based measures (El-Geneidy and Levinson, 2006), and hence represent an adequate measure of regional accessibility (Boisjoly and El-Geneidy, 2016).

2.2. From Mobility to Accessibility

Transportation planning has emerged as an isolated field that focused mainly on mobility, defined as the ease of moving. In this context, mobility indicators such as travel speed and travel times were put forward, with a focus on motorized transportation (Banister, 2008). Accessibility was first introduced by Hansen in 1959 to capture the interaction between the land use and the transportation networks. Following Hansen's work, researchers started to emphasize the need to include accessibility as a performance indicator in land use and transportation plans as an alternative approach to mobility-based transportation planning (Koenig, 1980; Morris et al., 1979; Wachs and Kumagai, 1973). They argued that accessibility better reflected the economic and social benefits of the network, namely in terms of land values and quality of life (Koenig, 1980; Wachs and Kumagai, 1973). More recently, accessibility has been put forward as a key element of land use and transportation planning (Banister, 2008; Handy, 2002; Straatemeier, 2008), namely with respect to social equity, economic development and environmental impacts (Handy, 2002; Lucas, 2012; Preston and Rajé, 2007). Whereas mobility-based approaches focus on travel time minimization, planning for accessibility aims at providing all individuals with a reasonable travel times to a variety of destinations (Banister, 2008). As a result, planning for accessibility gives greater consideration to active and public transportation, and incorporate land use policies that reduce distances between activities (Banister, 2008).

Although accessibility has been a central theme of research in the last decades and has recently gained attention in the planning sector, transportation planning is still dominated by a mobility-oriented paradigm. In a quantitative assessment of American transportation plans, Proffitt et al. (2015) found that accessibility is increasingly incorporated in plans, especially in larger metropolitan areas, but is still marginally addressed compared to mobility. Furthermore, in those plans accessibility is often not clearly defined and thus often used as a buzzword. Similarly, in an assessment of four metropolitan plans in California, Handy (2005) found that plans were developed around mobility. Nevertheless, the plans addressed some concerns with accessibility, although they were not defined as such. In the United Kingdom (UK) context, the concept of accessibility has been widely used, mainly due to the establishment of accessibility planning requirements by the national government (Halden, 2011). However, given the broad and flexible guidelines, accessibility is often "misused" and "abused in practice" (Halden, 2011). Furthermore, there is no consensus about which accessibility indicators and metrics should be used (Halden, 2011). While a plethora of measures have been developed in academic settings, their practical implementation remains limited, which raises questions about their usability (Boisjoly and El-Geneidy, 2016; Curl, Nelson, and Anable, 2011; Geurs and van Wee, 2004). Overall, research has shown that the paradigm shift from mobility to accessibility is far from complete. Accessibility is not yet a mature concept in planning, and is accordingly not being used effectively.

Given the increase interest in accessibility planning and the challenges related to its implementation, this study critically assesses transportation plans from metropolitan areas in North America, Europe, Australia and Asia. This study expands upon existing research in the United States (US) and the UK to include a greater variety of planning contexts. Furthermore, no study has, to our knowledge, investigated a broad range of plans from a qualitative perspective to identify best practices and successful implementations of accessibility indicators.

2.3. Research framework and methodology

The ultimate goal of this study is to investigate which practices effectively incorporate accessibility into transportation planning. To achieve this research goal, this study explores the integration of accessibility into metropolitan transportation plans and seeks to answer the following research questions:

- To what extent and how is accessibility included in metropolitan transportation plans around the world?
- To what extent are accessibility goals translated into performance indicators reflecting the ease of reaching destinations?
- What are the best practices and how could accessibility objectives be better integrated in metropolitan transportation plan?

To address our research questions, we assessed long-range metropolitan transportation plans and related documents from 32 metropolitan areas around the world. We defined three inclusion criteria for the metropolitan areas: population size, availability of documents and location. Firstly, we focused on metropolitan areas located in high-