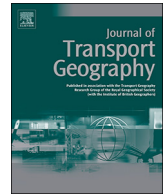




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## Accessibility-oriented development

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## ABSTRACT

Local authorities worldwide have been pursuing transit-oriented development (TOD) strategies in order to increase transit ridership, curb traffic congestion, and rejuvenate urban neighborhoods. In many cities, however, development of planned sites around transit stations has been close to non-existent, due to, among other reasons, a lack of coordination between transit investments and land use at a broader spatial scale. Furthermore, while TOD considers access to transit, it often neglects the access to destinations that is provided by transit.

We contend that accessibility-oriented development (AOD) can overcome these drawbacks of transit-oriented development. The AOD strategy fosters an environment conducive to development by balancing access to both jobs and workers. As such, AOD explicitly considers the connections between TOD locations and destinations that matter, both locally and regionally. Where markets are free to take advantage of accessibility levels, AOD is a naturally occurring process. Planners could therefore use the various tools at their disposal to influence accessibility levels (to jobs and workers) in order to attract urban development in potential AOD areas.

To test the assumptions that guide AOD strategies, access to jobs and workers are calculated in the Greater Toronto and Hamilton Area, Canada in 2001 and 2011. Cross-sectional and temporal regressions are then performed to analyze average commute times and urban development occurring across the region. Results show that residents in neighborhoods with high access to jobs and low access to competing workers experience the shortest commute times in the region, while the relationship also holds for changes in average commute times between the studied time periods. In addition, both access to jobs and access to workers are associated with changes in residential, commercial and industrial development: high labor force accessibility is associated with increases in job density, and high access to jobs is related to increases in population density between 2001 and 2011. Planners can thus leverage accessibility as a tool to direct development in their cities and to strategically adjust commute times, thereby realizing the full benefits of planned transit investments.

## 1. Introduction

Local authorities worldwide continue to pursue transit-oriented development (TOD) strategies in order to increase transit ridership, curb traffic congestion, and rejuvenate urban neighborhoods (Cervero et al., 2002; Curtis et al., 2009; Papa and Bertolini, 2015; Ratner and Goetz, 2013). For years, TOD has garnered attention by scholars and transport professionals alike (Calthorpe, 1993; City of Denver, 2014; Gilat and Sussman, 2003). Neighborhoods are often defined as TODs when they are situated close to transit, allow for higher density development, and possess diversified land uses (Cervero et al., 2004; Kamruzzaman et al., 2015). TOD therefore not only involves the construction of public transport infrastructure and provision of service, but also requires the integration of transport and land use (Bertolini et al., 2012; Jacobson and Forsyth, 2008); in this way, TOD intends to achieve a holistic way of compact urban development, enabled by supporting

public sector policies such as zoning and tax incentives. As TODs usually also encompass increased attention to urban design, livable spaces and walkability, the demand for housing in TOD areas results in increased premiums for homes located in TODs (Duncan, 2011; Mathur and Ferrell, 2013; Renne, 2009). Residents in these areas have also been found to rely more on transit and active modes of transport, seemingly fulfilling the promises of TOD (Chatman, 2006; Kamruzzaman et al., 2015), although the relationship between TOD and transit use has been found to differ between trip motives (Langlois et al., 2015), and not the “T” in TOD, but rather limited parking availability and higher density may be causing the observed decrease in car use (Chatman, 2013).

Areas planned as TOD do not always function as foreseen; in many cities, development on planned sites has been close to non-existent. One potential reason is that the connection between the (planned) transit investment and land use at both the local and broader spatial scale are often overlooked. At the local scale, transit-adjacent developments

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(TADs) may fail to take advantage of their proximity to transit and bring almost none of the benefits normally associated with TODs (Renne, 2009). The often physical nature of the definition of TODs ('density near transit') contributes to this problem (Belzer and Autler, 2002).

However, it is at the regional scale that the TOD concept tends to break down more often. TOD is an inherently local planning tool, and does, at its core, not consider regional land use patterns. While regional approaches to TOD planning have been proposed (see e.g. Newman (2009); Staricco and Vitale Brovarone (2018)), they are not sufficient to combat this issue and their use is far from widespread. The TOD concept, even in its regional variant, only considers access to transit, but not the accessibility that is provided by transit (i.e., what destinations does the transit service allow me to access?) (Belzer and Autler, 2002; Guthrie and Fan, 2016; Renne, 2009). As travel patterns are mostly determined by the region-wide levels of accessibility provided by transport systems, the use of TOD, as such, is insufficient to increase transit usage (Boarnet, 2011; Chatman, 2013) and to attract urban development. We contend that these issues can be alleviated by introducing the concept of accessibility-oriented development (AOD).

AOD will help planners to explicitly consider not just access to transit, but also the accessibility provided by transit. Accessibility, or the ease of reaching destinations, is an easy-to-use measure that can help unravel the intricacies involved in combined land use and transport planning in the minds of planning professionals and urban decision makers (Boisjoly and El-Geneidy, 2017a). *Access to destinations* is usually operationalized as the number of destinations that can be reached from a certain point in space. As such, accessibility recognizes the inherent connection between transport and regional land uses (in the form of destinations) and can be used to overcome the local focus of TODs.

We define accessibility-oriented development as a strategy that balances accessibility between employment opportunities and workers to foster an environment conducive to urban development. AOD occurs both naturally through the market and with direction from planners. The AOD concept invites planners to leverage access to steer, slow down, or speed up the phenomena that naturally follow from accessibility changes, namely changing commute times and economic development. AOD areas are therefore neighborhoods or sites where planners are using the various tools at their disposal to control accessibility levels in order to attract a particular mix of residential, commercial or industrial development. We hypothesize that transport investments made on the principles of AOD planning will naturally result in development occurring in the targeted neighborhoods, and, through lower commute times, a better quality of life for residents. This study aims to test the hypotheses underlying the accessibility-oriented development concept.

The rest of this paper is organised as follows. Section 2 describes the concept of accessibility and links it with economic development. Section 3 defines AOD more thoroughly and assesses the validity of using AOD, by testing the two underlying hypotheses in a case study of the Greater Toronto and Hamilton Area, Canada, using access to jobs and workers in 2001 and 2011. In Section 4 the results of the regression models testing AOD are discussed. Section 5 then concludes the paper and provides policy recommendations for the implementation of AOD.

## 2. Literature

### 2.1. Accessibility

Accessibility is a comprehensive measure of the land use and transport interaction in a region and illustrates the ease of reaching destinations (Geurs and van Wee, 2004; Handy and Niemeier, 1997). Accessibility was first defined by Hansen (1959), who used the measure to develop a residential land use model, under the assumption that accessibility was a main driver of residential development. This paper builds on this seminal work by testing the relationship between

accessibility and development across different modes in the Greater Toronto and Hamilton Area.

Two measures of accessibility are widely employed. Cumulative opportunity measures of accessibility compute how many opportunities an individual can reach within a predefined time threshold (Wickstrom, 1971), whereas gravity-based (or, equivalently, time-weighted cumulative opportunity) accessibility measures relax the assumption that people only travel until an arbitrary threshold, and discount opportunities by distance (or time) (Hansen, 1959). While gravity-based measures of accessibility more realistically reflect behavior, they require the prediction of a distance decay function and are thus more difficult to calculate, communicate, and compare across studies (El-Geneidy and Levinson, 2006).

The concept of accessibility has been widely used to shed light on the benefits resulting from land use and transport systems. These benefits range from higher land values (El-Geneidy et al., 2016), over smaller risks of social exclusion (Lucas, 2012), to shorter unemployment duration (Andersson et al., 2014; Korsu and Wengleski, 2010) and increased odds of firm birth in areas with high accessibility levels (Holl, 2004). Furthermore, access by public transport has been shown to be related to increased transit mode share (Owen and Levinson, 2015). Accordingly, to measure how these benefits are distributed across different socio-economic groups, accessibility measures have also been used to examine the equity of the transport and land use interaction (Bocarejo and Oviedo, 2012; Delmelle and Casas, 2012; Foth et al., 2013; Golub and Martens, 2014; Guzman et al., 2017). However, even though the connection between transport and economic development has been extensively investigated, insufficient research has coupled comprehensive measures of accessibility with urban development.

Accessibility is increasingly being incorporated into metropolitan transport plans and national planning guidelines, although mobility-planning remains the dominant paradigm (Boisjoly and El-Geneidy, 2017b; Proffitt et al., 2017). In the United Kingdom, a national accessibility framework exists, but analysis is still "generally too transport focused" and accessibility indicators are "misused" and "abused" (COST, 2012; Halden, 2011). At the municipal or regional scale, cities such as London, Paris, Sydney, and Atlanta are now employing the concept of accessibility, either as an independent goal or objective, or as part of an environmental justice assessment (Boisjoly and El-Geneidy, 2017a). In both Sydney and London, improving access to jobs or employment is mentioned as a key method to support regional economic development, and the '30-minute' city is a key element to Sydney's long-range plan (Greater Sydney Commission, 2018; NSW Government, 2012; Transport for London, 2006). Canadian cities, however, have been slow to adopt the concept; while their plans mention access to transit, only the discussion paper for the updated "Big Move" for Toronto contains a metric for access to jobs by transit, with goals similar to the London plan (Metrolinx, 2016). Similarly, in the United States, only a few cities have adopted accessibility goals and performance metrics in their regional transport plans (Proffitt et al., 2017). Accessibility planning practice thus remains limited across North America.

### 2.2. Transport, accessibility and urban development

A large body of literature has focused on establishing a theoretical framework between transport and subsequent land use patterns and urban development. Kain (1962) and later Alonso (1964) extended the model developed by von Thünen representing land value as a function of distance to a central business district, and argued that land values in turn influence land use patterns. The bid-rent theory developed by Alonso (1964), and later extended by many other scholars (see for example Anas and Moses (1977); Mills (1967)), offers households a trade-off between transport cost and rent, resulting in higher land values for more central locations. The area with the highest accessibility attracts

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