Transportation Research Part A 113 (2018) 529–541

Contents lists available at ScienceDirect

Transportation Research Part A

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

Not so fast? Examining neighborhood-level effects of traffic congestion on job access

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ARTICLE INFO

Keywords:
Congestion
Job accessibility
Urban form
Travel speed

ABSTRACT

Traffic congestion powerfully influences urban transportation policy, particularly in regional planning where transportation projects are often prioritized and funded based on expected congestion relief benefits. Congestion is universally unpopular, and it is a short, intuitive leap from frustration with traffic to the belief that congestion is a major drag on connectivity to jobs and other opportunities and, in turn, economic vitality. While much work has focused on evaluating and relieving bottlenecks and project-level traffic delays, relatively little research has quantified the precise role of congestion in limiting access to destinations more broadly, with access defined here in terms of the travel time needed to reach potential destinations. Accordingly, this study (1) captures the precise trade-offs between peak-hour travel speed and job accessibility, and (2) estimates the greatest level of accessibility benefits that congestion relief could be expected to achieve. Using two different measures of employment access for the nine-county San Francisco Bay Area, we find that travel speeds play a surprisingly small role in determining the time it takes to access job sites. One's location vis-à-vis these job sites, by contrast, plays a much larger role in determining access. In other words, the most densely developed places typically offer the highest levels of access, despite typically higher levels of congestion. We also compare these rush hour job access metrics for the Bay Area with hypothetical congestion-free peak hour conditions and find that such a dramatic transformation would result in only modest increases in employment accessibility in much of the Bay Area. Although some housing-rich, job-poor suburbs would benefit disproportionately from the complete absence of peak-hour traffic, we conclude that (1) while congestion does impede regional accessibility, it does so to a far smaller degree than is commonly thought, and (2) while dense development is associated with slower adjacent peak-hour travel speeds, capping development and limiting densities in order to maintain or increase travel speeds may have deeply counterproductive effects on overall accessibility in regions.

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https://doi.org/10.1016/j.tra.2018.04.015
Received 4 January 2017; Received in revised form 5 February 2018; Accepted 18 April 2018
Available online 31 May 2018

1. Introduction

Traffic congestion remains, as ever, a driving force in urban transportation policy. In most metropolitan areas, commuters daily feel the pain of crawling along crowded boulevards and freeways and demand solutions from public officials. As a result, among all transportation problems, congestion garners significant professional attention from transportation planners and engineers, who have long relied on traffic-delay-focused measures of transportation system performance, like level of service (LOS). Regional transportation planning in the United States tends to emphasize congestion relief, and localities often compete for scarce funds earmarked for that purpose. While there is a movement afoot to define transportation system performance in more holistic terms (Elefteriadou et al., 2012; ICF International, 2011), regional and federal authorities continue to define well-performing roadways as ones that do not slow vehicles down much during peak periods (Davis, 2016a). Because drivers (quite plausibly) perceive that congestion delays their participation in economic and social activities for a given trip, it is a short, intuitive leap to assume that traffic slowdowns reduce economic activity more generally. Such intuition is buttressed by studies that aggregate and monetize the cost of traffic delays in terms of the opportunity cost of time spent in traffic, but do not account for the urban form context within which the congestion occurs (INRIX, 2015; Schrank et al., 2015).

Vehicle speeds and delays, which are mobility measures often used to prioritize transportation improvement projects and determine transportation spending allocations, paint at best an incomplete picture of how people and firms gain access to goods, services, labor, and customers in metropolitan areas. The emerging accessibility literature in transportation has emphasized that what matters to travelers is not speed itself, but the ease by which one can reach desired destinations – opportunities for work, shopping, socialization, and other activities (Grengs, 2010; Kawabata and Shen, 2006; Shen, 2007; Wachs and Kumagai, 1973). Travel speeds help to determine access, to be sure, but only in part; the proximity of origins and destinations, traveler perceptions of potential destinations and the ease or difficulty of traveling to them, as well as other individual, social, and spatial factors are important dimensions of access as well (Levinson and Krizek, 2005). This waxing literature on access, however, remains more developed conceptually than empirically, specifically as it pertains to the components of access and their implications for policy. In particular, few studies address how traffic congestion variably affects accessibility within a region, particularly in relation to its relationship with destination proximity and density.

To address this gap in the literature, we use data from the San Francisco Bay Area to empirically examine the role of traffic congestion in determining employment accessibility by assessing the neighborhood-level interrelationships among speed, proximity, and accessibility. In doing so we test for the capacity of congestion relief programs to boost accessibility: If we could actually "solve" our congestion problems and return speeds during peak hours to those that only occur during the middle of the night in large metros like the San Francisco Bay Area, how would accessibility to jobs actually change? Thus, we examine whether conventional wisdom about traffic congestion's pernicious effects still hold when framed in terms of accessibility. If so, we would expect to observe large positive effects on accessibility across a congested region like the San Francisco Bay Area if we were able to eliminate congestion.

Cities provide access to a wide range of economic activities, including firm-to-firm trade, knowledge spillovers, household-oriented services, and shopping. Yet workplace access, still primarily accomplished during peak travel hours, may be the economic activity most affected by traffic (Santos et al., 2011). Thus, in this article we analyze job access, from neighborhoods of origin to districts of employment. First, we statistically model job access across home locations as an outcome of both speed and proximity for traffic analysis zone (TAZ)-defined neighborhoods across the Bay Area. We explore varying specifications of the standard gravity model of access to account for both generalized employment access as well as access to information technology (IT) sector-specific employment, as specified through standard industrial classifications. Overall, we find that travel speeds in the Bay Area, despite observed delays relative to free-flow speeds, play only a small role in determining accessibility, particularly relative to the outsized effects of proximity. Put colloquially, job access in the Bay Area is determined principally by location, location, location.

Second, we examine how job access would change in neighborhoods across the region if, rather than traveling at congested peak-hour speeds, morning commuters could instead travel at speeds experienced during the sparsely traveled very early-AM hours (weekdays from 3 a.m. to 6 a.m.). Taking the current distribution of regional employment as a baseline, we again find only modest improvements in accessibility from effectively eliminating congestion; throughout the Bay Area, not a single neighborhood would transition from relatively low-access to relatively high access to employment opportunities. On the other hand, we do observe that some parts of the region are disproportionately affected (in terms of job access) by congestion. Even in these places, however, the elimination of congestion would fail to generate radical changes in accessibility; the most affected neighborhoods analyzed would still experience only middling accessibility levels (due to their distance from most jobs) upon elimination of congestion delays.

The comparatively modest role of travel speeds in determining job access may seem counter-intuitive to frustrated commuters and the people they elect, but at a larger scale these results help to explain why cities remain such economically productive places and the engines of global economic growth, despite their high costs and chronic traffic congestion.

2. Background

2.1. Congestion measurement and effects on transportation policy

Measuring roadway congestion has been an important part of transportation planning and engineering since the early years of professional practice, and as federal, state, and regional oversight of the transportation system has evolved in the U.S., accurate measures of road performance have become a critical part of evaluation, planning, and finance (Boarnet et al., 1998; Lomax et al., 1997). Congestion measurement is a core part of practice and has tended to emphasize two distinct scales of metrics: region-wide and