Policy Memo

Accessibility measures for regional transportation planning

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To: Scott Haggerty, chair of governing Commission of Bay Area Metropolitan Transportation Commission

From: Shen Qu, Policy Advisor

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RE: Define and measure accessibility in Plan Bay Area 2050

Summary

Accessibility, the ease of reaching destinations, is a key land use and transportation performance measure(Boisjoly and El-Geneidy 2017b). The decision-making process should include clear accessibility objectives, definitions, and indicators in Plan Bay Area 2050. Some approaches and tools can promote achiving greater accessibility. The equity analysis of accessibility can help reducing the risks of social exclusion for vulnerable individuals *(Preston and Rajé, 2007, Lucas, 2012)*. Ultimately, the use of metrics in policy and practice is key to make progress toward the Bay Area long-range transportation and land use goals while preserving the character of its diverse communities and adapting to future population growth.

Background

Plan Bay Area 2050 is an integrated long-range transportation and land use plan developed and adopt by MTC and ABAG. Work on Plan Bay Area 2050 is expected to begin in August 2019 and focused update that builds upon the growth pattern and strategies developed in the original Plan Bay Area 2040 (adopted in July 2017) but with updated planning assumptions that incorporate key economic, demographic and financial trends from the last four years.

Re-examining the prior Plan's goals and targets is one of the first steps in updating Plan Bay Area in order to make them as meaningful as possible in measuring the Plan's performance. In the current 13 performance targets,[1] three goals are about 'Equitable Access'[2]. It is also

[1]The 13 performance targets are included in six categories: Climate Protection, Healthy and Safe Communities, Open Space and Agricultural Preservation, Equitable Access, Economic Vitality, and Transportation System Effectiveness.

[2]The three goals include: Decrease the share of lower-income residents' household income consumed by transportation and housing by 10%; Increase the share of affordable housing in PDAs, TPAs, or high-opportunity areas by 15%; Do not increase the share of low- and moderate-income renter households in PDAs,

a response to the most recent federal transportation bills – the Fixing America's Surface Transportation Act (FAST Act) that require Plan Bay Area to address 'accessibility and mobility of people and freight' (U.S. Department of Transportation, 2014).

However, the federal guidelines and prior plan doesn't define access explicitly. The terms accessibility and mobility are used as a vague term that does not reflect the ease of reaching various destinations and often are conflated, "misused", and "abused" in practice (Halden, 2011). Access to destinations does not translate into indicators that reflect accessibility in previous plans. Although the three targets are components of accessibility, they do not fully reflect access to destinations. In spite of access afordable housing, a broader range of destinations should be included.

The concept of accessibility has been a common element in the goals and objectives of transport plans Hansen (1959). It is one of the most comprehensive performance measures of land use and transportation systems (Boisjoly and El-Geneidy 2017a), which provides residents with greater access to a variety of opportunities, is associated with higher employment rates, greater transit use, and less greenhouse gas emissions *(Chen et al., 2008, Owen and Levinson, 2015b)*. It is not only to support and foster economic development through improved employment accessibility for deprived areas, but also to improve social inclusion and reduce social inequities.

Explicitly defining and measuring accessibility as the end goal of the transportation network would encourage the establishment of accessibility-based performance indicators to assess the overall benefits of potential investments, and help decision-making for MTC, ABAG, and local governments.

Definition

Accessibility, defined as the ease of reaching destinations, services, or activities; the distribution, character, or amount of activity around a given place; the choices that the built environment offers to travelers*(Preston and Rajé, 2007; Litman, 2013; Handy (2018))*. It is largely contingent on the spatial distribution of destinations, influenced by the distribution of residential, economic, cultural and social activities.

For individual, living in an area with high accessibility to jobs is associated with shorter trips, as is working in an area of high housing accessibility.9 For firms, high accessibility means that easy access to suppliers, workforce, customers, desirable environment, amenities, friendly government, etc. (Levinson and Krizek 2018, 111)

Accessibility is instrumental in explaining the spatial form and function of metropolitan areas. It is the "fundamental force for the relationship between transport and land use in a city and their impacts on city organization, development, and planning to achieve more sustainable outcomes."(Levinson and Krizek 2018, 22) Moreover, It's a goal that almost everyone can agree on to assess current conditions and proposed policies (Handy 2018).

TPAs, or high-opportunity areas that are at risk of displacement.

The accessibility measures

The accessibility measures related to the spatial distribution of opportunities. such as households, jobs, retail stores, health and other services.This metrics help policymakers to define regional transportation priorities.

- cumulative-opportunity measures: the availability of opportunities close by

cumulative-opportunity measures typically accounts for the number of opportunities that can be reached from a specific location using a specific mode within a travel costs threshold (Handy and Niemeier, 1997). For example, the number of jobs that are within 45 min of travel times by transit from a specific place (counting exchange opportunities within a defined geographic parameter).

cumulative-opportunity measures are easy to generate, interpret, and to communicate. they are most commonly used by policy-makers as they provide a comprehensive measure of the land use and transport system at the regional level (Dodson et al., 2007). and thus better suited for planning documents.

- gravity-based measure: the ease and worth of travel to destinations far away

The gravity-based measure discounts opportunities with a distance-decay function based on their travel costs (pitting the importance of given exchange opportunities against travel time impedances). The farther opportunities receive less weight than closer. This measure better reflects travel behavior as it accounts for the travelers' perceptions of time (Ben-Akiva and Lerman, 1979).

This measure is not directly expressed in terms of the number of opportunities, is more complex to generate, and more difficult to interpret and communicate (Geurs and van Wee, 2004; A. Owen and Levinson, 2014).

Integrating both cumulative-opportunity and gravity-based measure, including access to transport and to destinations, would provide a good indication of transport coverage, captures the performance of the land use and transportation systems, which better reflect the social and economic benefits (Banister, 2008, Koenig, 1980, Wachs and Kumagai, 1973).

- The evaluation of local/neighborhood accessibility.

Local accessibility is primarily determined by nearby activity (approximately one-half to one mile in residential areas). The destinations include to grocery stores, schools, hospitals, parks or public transport station. It is a reflection of the available oppotunities of jobs and services at the neighborhood levels.

Local accessibility is often associated with cycling and walking. distance thresholds are used instead of travel time thresholds (0.5 miles for walking). These appear to be appropriate measures of accessibility, as time is generally proportional to the distance travelled by bicycle or foot.

Local accessibility policy initiatives speak more to issues of mixing uses on a parcel or neighborhood scale, site design, and more directly, facilitating circulation patterns that

enhance walking, bicycling, and transit use.

Analysing future development scenarios in terms of their levels of accessibility could leverage MPOs' influence on municipal-level land-use decisions.

Such comparisons could help MPOs provide better information about the performance and the costs of different transportation-infrastructure and land-use scenarios.

Better information about the tradeoffs inherent in different development scnearios can help regions choose projects more objectively. How a new transport infrastructure improvement increases the accessibility, who and where can directly use the facility do matters.

Equity analysis

Equity analysis based on accessibility is about the environmental justice assessment, which evaluate whether there are any disproportionately high and adverse impacts on low-income and minority populations or communities of concern [^3]. It assesses the distribution of benefits and burdens on communities of concern in comparison to the rest of the region. It promotes proximity to services, amenities, and opportunity areas for specific vulnerable groups relatively the general population. It helps Plan Bay Area's objective to advance equity in the region. Equity analysis can include specific types of destinations, modes, jobs, social groups, or temporal fluctuations.

[^3] "Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

the accessibility to all jobs may not represent the opportunities that are available to different groups of populations. segment the accessibility analysis by socio-economic groups. such as income, level of education, gender and vehicle ownership affect one's abilities and needs to access destinations.

Measures of generalized costs (including financial and time costs). These measures better reflect the total costs of travel as they include both financial and time burdens. is closer to reality and can also provide an insight on fare structures and trip affordability. address the financial constraints that vulnerable individuals may face.

Increasing accessibility by transit, cycling and walking can contribute to achieving broader environmental, economic and social goals. Such as the percentage of people or jobs that are within 0.5 mile of a public transport station.

Time restrictions also play an important role in determining accessibility. These include land use, transport and individual constraints such as (opening hours, schedule of services, job starting time)

More options

More efforts are needed to effectively implement accessibility-based approaches. The utility-based measures capture the economic benefits provided by changes in the network. Utility-based measures account for most components of accessibility and can be included in traditional cost-benefit analysis (van Wee, 2016). Other dimensions of accessibility such as affordability, transfer and digital connectivity Lyons and Davidson (2016) should not be neglected in metropolitan transportation plans and should come up as the aspects of accessibility objectives. Accessibility maps and metrics provide an overview of the land use and transportation network, are useful tools to communicate gaps and thus helps decision-makers, planners and the general population to better grasp the impacts of transportation investments.

Conclusion

Plan Bay Area 2050 sets a roadmap for future transportation investments and will identify what it would take to accommodate expected growth. Accessibility, the ease of reaching destinations, allows capturing the complex interactions between land use and transportation systems while providing a social perspective on transportation planning.

Setting clear accessibility requirements for transportation planning processes and planning documents could provide greater transparency and foster the inclusion of accessibility aspect in the decision-making process. Integrating Plan Bay area 2050 goals with accessibility-focused performance measures could help MTC make better decisions about the selection and prioritisation of transportation infrastructure. (Boisjoly and El-Geneidy 2017b)

Notes

References

distinguishing Accessibility and Mobility

travel is a derived demand *(Goldman and Gorham, 2006; Grengs et al., 2010; Halden, 2002; Handy and Niemeier, 1997; Levine et al., 2012).* people travel to places where they can meet their daily needs, not simply to move about. the purpose of most travel is about the destination, not the journey.

accessibility focuses on reaching destinations, the end goal of a transportation network, focused on making it easier for individuals to reach destinations where they can meet daily needs such as work, recreation, socialising, shopping, and other forms of social exchange *(Martens, 2015; Miller, 2005).*

Mobility is concerned with how easy it is to travel. focuses on travel speeds. Improvements in mobility alone are not sufficient to ensure improvements in accessibility. (Proffitt et al. 2019)

Planning for accessibility, Land use policies designed to bring destinations within walking distance of residential areas. may not even require retrofitting neighborhoods. For example, transit services that link specific groups of users to their desired destinations, such as reverse commute programs and other client-based transport services, Efforts like these reduce the need to drive,.25

it facilitates the evaluation of tradeoffs between land use, transportation and social needs. By combining aspects of land use and transportation into a single measure, accessibility focuses attention on the performance of the system as a whole rather than on just segments of the transportation network.

the clear distinction between mobility and accessibility indicators. Interestingly, accessibility and mobility are included as two distinct goals with different criteria and methodologies,

Having shorter travel times does not necessarily equate to having access to a larger number of destinations. Furthermore, as discussed by Litman (2013), strategies aiming at increasing traffic speed may in some cases lead to an overall reduction in accessibility. In sum, increased mobility does not always result in increased accessibility (Halden, 2011, Levine et al., 2012).

'traditional transport planning, which tends to focus on improvements to the transport system that facilitate mobility, without considering the access needs that drive travel behaviour' (Chapman and Weir, 2008: 7).

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).

Planning for mobility has taken on the meaning of making it easier to get around. This focus on the ease of traveling along the transport network itself (rather than focusing on the ease of reaching destinations) has aligned well with modern planning paradigms; road building has been the most popular solution to congestion. These paradigms prize the planning-for-mobility perspective because it accommodates growing levels of travel and increases the potential for movement.

conventional practice in transportation planning has employed a 'predict and provide' model that focuses the majority of funding and planning attention on expanding roadway capacity. (Levinson and Krizek 2018, 22)

performance metrics that focus on roadway congestion as experienced by automobile drivers *(Ewing, 1993; Handy, 2005; Krizek and Levinson, 2010)*, with higher vehicle speeds the 'fundamental criterion for success' *(Levine et al., 2012: 158)*. Speed-based metrics include roadway level of service (LOS), peak-period delay, traffic volume/road capacity, travel time/speed, vehicle hours of travel, the duration of peak-period congestion, and others

(Ewing, 1996; Transportation Research Board, 2010). Even high-occupancy toll lanes, the most common demand-management strategy used in the USA, are typically added as new capacity, only rarely replacing existing highway travel lanes *(Ewing and Proffitt, 2016)*. Planning for higher travel speeds that facilitate longer and often more frequent trips is the mobility paradigm.

improving mobility – via automobile, transit, or any other travel mode – means facilitating faster travel speeds so individuals can reach more destinations in a given travel time, improving proximity means shortening distances between trip origins and destinations so individuals can reach a satisfactory number of exchange opportunities even if they travel more slowly. In other words, neighbourhoods, cities, and metro areas can be made more accessible by reducing travel distances as well as by facilitating faster travel. The advantage of planning for accessibility versus planning solely for (auto)mobility is that the former allows for a comparison of the tradeoffs among financial, environmental and human health and wellbeing concerns when making decisions about land use and transportation.

Accessibility does not depend on good mobility.Some places such as San Francisco downtown have good accessibility despite having poor mobility (severe traffic congestion). The Residents live within a short distance of all needed and desired destinations. the travel times between destinations are relatively short, even if travel speeds are low.

In the suburban areas of Bay Area, transit service is relatively sparse and destinations are generally beyond walking distance, leaving residents with no option but to drive. the practice of planning is largely mobility-dependent, and car-dependent and has deteriorated levels of accessibility. As traffic levels invariably increase in these areas, accessibility ultimately declines for all modes.

(Proffitt et al. 2019) increasingly tight budgets and a growing awareness that it simply is not possible for regions to pave their way out of congestion do seem to be pushing many MPOs to look for alternatives to expanding roadway capacity. Improving accessibility by coordinating land-use and transportation rather than an exclusive focus on automobility is one such alternative.

multi-criteria analyses

accessibility indicators should systematically be included in multi-criteria analyses.

it offers an alternative to mobility-based decisions and potentially provide greater transparency in the decision-making process (Halden, 2011). Furthermore, national and regional authorities can require local authorities to address accessibility in their project analysis. One especially effective way of doing so is by including accessibility criteria in the selection process of projects,

One of the most systematic and transparent way to inform decision-making is by including accessibility indicators into multi-criteria analyses. a multi-criteria analysis was conducted to compare the projects submitted by local jurisdictions and to select the ones to be included

in the RTP. to conduct a prioritization of the projects to assess the effectiveness of various modelling scenarios.

The accessibility indicators included in the multi-criteria analyses range from broad questions to specific quantified metrics, which influence the flexibility of the analysis. For example, Transport for London defines clear specific accessibility metrics, for example the change in the number of jobs accessible by public transport within 45 minutes travel time (see Table 1). These access to jobs metrics are relatively easy to generate and to interpret. Accordingly, they foster the inclusion of accessibility indicators that adequately reflect the ease of reaching destinations. Furthermore, given their specific nature, they are easy to communicate as exemplified in the plan: "Implementing the schemes will increase the employment catchment area of central London (the number of people within 45 minutes of central London employment) by almost 25 percent." (p.74).

An intermediate way of defining accessibility indicators is by attributing scores (from 1 to 3 for example) based on specific guidelines. This approach has the advantage of defining clear weights associated with accessibility criteria, thus providing greater transparency.

quantified metrics provide more specific guidelines that directly reflect the ease of reaching destinations. However, they provide lower flexibility and might not adequately reflect the outcomes of the different investments.

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