Transportation Research Part A 46 (2012) 684–695

Contents lists available at SciVerse ScienceDirect

Transportation Research Part A

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

A justice-theoretic approach to the distribution of transportation benefits: Implications for transportation planning practice in the United States

Karel Martens [a,*], Aaron Golub [b,1], Glenn Robinson [c,2]

[a] Institute for Management Research, Radboud University Nijmegen, Nijmegen, P.O. Box 9108, NL-6500 HK Nijmegen, The Netherlands
[b] School of Geographical Sciences and Urban Planning and School of Sustainability, Arizona State University, P.O. Box 875302, Tempe, AZ 85287-5302, USA
[c] School of Engineering and Institute for Urban Research, Morgan State University, 1700 East Cold Spring Lane, Baltimore, MD 21251, USA

ARTICLE INFO

Article history:
Received 9 June 2010
Received in revised form 12 December 2011
Accepted 5 January 2012

Keywords:
Justice
Equity
Access
Walzer
Rawls

ABSTRACT

Transportation improvements inevitably lead to an uneven distribution of user benefits, in space and by network type (private and public transport). This paper makes a moral argument for what would be a fair distribution of these benefits. The argument follows Walzer's "Spheres of Justice" approach to define the benefits of transportation, access, as a sphere deserving a separate, non-market driven, distribution. That distribution, we propose, is one where the maximum gap between the lowest and highest accessibility, both by mode and in space, should be limited, while attempting to maximize average access. We then review transportation planning practice for a priori distributional goals and find little explicit guidance in conventional and even justice-oriented transportation planning and analyses. We end with a discussion of the implications for practice.

1. Introduction

Transportation planning decisions inevitably yield benefits which vary across different communities within an urban area. Much thought and effort has gone into understanding and addressing these differences (see: Forkenbrock and Schweitzer, 1999; Schweitzer and Valenzuela, 2004, for great syntheses of the issues along a variety of dimensions, and e.g., Beatley, 1988; Davis and Jha, 2011; Hine, 2008; Hodge, 1995; Mann, 2004; Sanchez et al., 2003; Taylor and Norton, 2009, for insightful discussions of a variety of equity aspects). The starting point for this paper is the observation that: (1) there is no clear definition, in practice or theory, of what constitutes a fair distribution of benefits from transportation investments; and (2) no standards, goals or performance measures exist, against which agencies can measure progress or success in the distribution of transportation benefits.

As we will show, in current transportation planning practice, distributional goals are either not stated at all, are implied but unclear, or, when stated explicitly, are not based on a well-developed moral argument. The aim of this paper is to develop such an argument, i.e. to develop a well-founded justice-theoretic approach to the distribution of transport-related benefits. To the best of our knowledge, such an attempt has not yet been made in the literature. Because of its normative character, defining such a justice approach is inevitably controversial. While we understand the difficulty in implementing

* Corresponding author. Tel.: +31 24 361 2740; fax: +31 24 361 1841.
E-mail addresses: K.Martens@fm.ru.nl (K. Martens), Aaron.Golub@asu.edu (A. Golub), Glenn.Robinson@morgan.edu (G. Robinson).
[1] Tel.: +1 480 365 2791; fax: +1 480 965 8313.
[2] Tel.: +1 443 885 3085; fax: +1 443 885 8274.

0965-8564/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
doi:10.1016/j.tra.2012.01.004

a strong normative vision in policy and practice, we feel an adequate theoretical exploration of such a vision is needed. This is our aim; to begin an explicit and, we hope, fruitful discussion on transport and justice. From here, perhaps the community of transportation planners, engineers and other stakeholders can engage in a more concrete and explicit resolution of exactly what is a just outcome for transportation investments.

The theoretical framework developed in this paper builds on Walzer's 'Spheres of justice' (Walzer, 1983) and Rawls' 'A theory of justice' (Rawls, 1971). Following Walzer's argument, we focus on access as the prime benefit distributed through transport projects. Taking inspiration from Rawls, we claim that a justice approach to transport implies a maximum gap in access level between the best-off and worst-off group in society. Using this justice framework, we then evaluate the current state of transportation practice for its implicit (or sometimes explicit) distributional aims – including both conventional approaches and those specifically addressing justice issues based on the framework of the Civil Rights Act of 1964 and the subsequent rulings incorporating "environmental justice" considerations in transportation planning. We look more specifically at the equity analysis performed by the Metropolitan Transportation Commission (San Francisco Bay Area) for its implicit and explicit justice norms. We conclude with some broad comments on practice and posit changes required to reduce discrepancies found between the proposed theory and practice.

As mentioned, our exploration here focuses on the distribution of the benefits generated by transportation (investment) projects. The equally important issues of the distribution of transport-related burdens and transport-related costs, as well as fair participation in decision-making, can be subject to a similar treatment perhaps in a later discussion. While it can be debated whether it is fruitful at all to separate benefits from costs, we do so in order to make important first steps in this debate. Perhaps in further work all sides of the issue can be considered together.

2. Walzer's 'Spheres of Justice'

Scholars of social justice have hardly paid any attention to the field of transport. At best, scholars have dealt with it in the sidelines of their argument (e.g., Rawls, 1971, p. 290; Michelman, 1973, p. 980; Walzer, 1983, p. 115; Sadurski, 1985, p. 161). Scholars in the field of transport, in turn, have explored some of the implications of the major theories of social justice, such as Rawls' theory of justice (e.g. Beatley, 1988) or utilitarianism (Khisty, 1996). While we feel that the application of existing social justice approaches to transport is a good starting point, it does not provide an answer to the key question of why a distributive approach is called for in transportation in the first place.

To begin such an inquiry, we rely on Walzer's 'Spheres of Justice' conceptualization to provide such a theoretical foundation for a distributive approach to transport. Walzer's approach starts from the conceptualization of society as a distributive community, in which people produce a variety of goods that are subsequently shared, divided and exchanged in specific ways (Walzer, 1983). Walzer claims that goods differ in terms of the social meaning members of society attach to them. He stresses that goods "cannot be idiosyncratically valued. (...) Goods in the world have shared meanings because conception and creation [of goods] are social processes" (Walzer, 1983, p. 7). Similarly, Lessig defines social meaning as 'the semiotic content attached to various actions, or inactions, or statuses, within a particular context' (Lessig, 1995, p. 951). The social meaning of a good is the result of a process of social construction, in which certain associations related to a particular good become uncontested and taken-for-granted. And precisely because the meaning of goods is a social construct, goods may have different meanings in different societies. This leaves open the possibility for individuals or particular groups to point at latent or subversive meanings, as well as the possibility of unintended or even deliberate change in the social meaning of a particular good (Lessig, 1995). Furthermore, Lessig underscores that social meanings do not only shape how people perceive particular goods, but that 'they are also tools – means to an end' (Lessig, 1995, p. 956). What is important for our purposes, is Walzer's argument that, given the different social meanings goods can obtain, there can be no single distributive criterion by which all goods are to be made available to members of society. Rather, goods with distinct social meanings should be distributed in a way corresponding to that (dominant) social meaning.

Building on the social meaning attached to particular goods, Walzer then develops the concept of 'distributive spheres' (not to be confused with the "public sphere" or "private sphere"). He argues that goods to which society does not ascribe distinct social meanings, or whose distribution is unproblematic, like e.g. necklaces, music CDs, or luxury yachts can be distributed through the market, where the distribution is determined by the principle of free exchange in combination with individuals' ability and willingness to pay for a particular good. In contrast, goods to which a particular society ascribes a distinct social meaning are to be taken out of the sphere of free exchange. Such goods 'deserve' their own distributive sphere, which is characterized by two basic features. First, it would require a distributive principle different from market exchange, ranging, for example, from equality to distribution based on need (Trappenburg, 2000). Second, a distributive sphere should be autonomous from other goods' spheres. According to Walzer, injustice occurs if spheres are not autonomous. The distribution should be based on "internal reasons" only, i.e. linked only to the social meaning of that particular good.

If these principals are not followed, one good or set of goods can become dominant and determine the distributions in other spheres of distribution. Typically, in many societies, money and power are the goods which tend to dominate other distributive spheres, and struggles over e.g. the provision of free education are most often struggles against the dominance of money and power in this 'sphere'. Ultimately, autonomy among spheres guarantees what Walzer terms 'complex equality': a situation in which inequalities within spheres may exist, but in which the autonomy of distributive spheres guarantees that inequalities will not compound across several goods.

Though Walzer's approach is certainly not without critics (see e.g., Dworkin, 1983; Teuber, 1984; Fabre, 2007), its strength lies in the theoretical foundation it provides for political reality in modern societies, as it may provide guidance for a just distribution of a wide variety of goods: 'When meanings are distinct, distributions must be autonomous' (Walzer, 1983, p. 10). If the benefits of transportation can be defined as having a distinct social meaning, then a distributive approach, distinct from market exchange, to transport benefits can be justified. Below, we explore these issues for transportation justice.

2.1. The social meaning of the transport good

The literature on transport and justice addresses the distribution of a wide diversity of transport-related goods. This includes the distribution of road and gasoline taxes (Altshuler, 1979); transit investments and subsidies (Cervero, 1981; Hodge, 1988); road user charges (Richardson and Bae, 1999); transit service (Murray and Davis, 2001; Rucker, 1984); and accessibility (Purvis, 2000). This diversity underlines the critique of Dworkin (1983): the demarcation of the social meaning of most goods is not a straightforward issue. The discussion below is an attempt to demarcate a social meaning of the transport good that might be widely shared in modern, industrialized, societies. As was mentioned earlier, we limit the discussion to transport-related benefits and ignore transport-related burdens, in part because the latter has received more attention in the literature on transport and equity (e.g., Feitelson, 2002; Forkenbrock and Schweitzer, 1999; Schweitzer and Valenzuela, 2004).

There can be no doubt that the social meaning of the transport good has changed tremendously since the industrial revolution. In pre-industrial societies, transport was primarily a matter of walking. Space was organized around the particularities of transport by foot; distances were short, and necessities of life were located within walking distance of most homes. Only a small fragment of society could afford regular travel by horse or horse-drawn carriages. Life was strongly ordered, following a rhythm according to day, week, season and year (van der Stoep, 1995). In these societies, transport probably acquired a twofold social meaning. It was, on the one hand, hardly perceived as a good, but rather taken-for-granted, as a natural extension of life itself. On the other hand, it was associated with power and the powerful, those who had the ability to travel at a substantially higher speed and over larger distances with relative ease than the vast majority of the population.

The social meaning of the transport good changed tremendously during the era of industrial development. One of the cultural outcomes of the process of modernization has been the desire to break the 'tether of physical friction'. As a result, transport came to be associated with discovery, progress, economic development, and Western supremacy (Harvey, 1990; Couclelis, 1996; Sager, 2005). Moreover, with the ascent of private, individualized, motorized transport, the social meaning of transport changed even more dramatically. It became to be associated with widely cherished values in Western society like freedom, independence, adventure and open-mindedness, as well as escape and autonomy (Zeitler, 1999, pp. 21–22; Lomasky, 1997). At the same time, the importance of transport also increased, as the dominance of the motorcar resulted in a vast dispersal of urban functions over space, eliminating walking as a feasible alternative for most trips. Especially because of the motorcar the 'urban environment has 'unbundled' territorialities of home, work, business and leisure that historically where closely integrated, and fragmented social practices ...' (Urry, 2004, p. 28). The social meaning of transport thus became simultaneously associated with two sets of values, one centered on the values of freedom and autonomy, and the other related to the functional dimension of transport, i.e. its role in enabling people to engage in desired activities.

These two overarching conceptualizations of transport benefits can be found in the transport literature as potential mobility and access (e.g., Garb and Levine, 2002; Vigar, 1999). Potential mobility, often simply referred to as mobility, refers to the ease with which a person can move through space (e.g., Sager, 2005). Access, in turn, refers to the ease with which a person can reach destinations from a given location in space, and reflects the latter social meaning of transport (see e.g., Farrington and Farrington, 2005; Dong et al., 2006; Niemeier, 1997). There can be no doubt that potential mobility has prevailed as an operational proxy of the social meaning of the transport good driving much of the practice of transportation planning over the past decades. Furthermore, because especially the private car is strongly associated with the values of freedom and autonomy (even though the freedom of the car is dependent on government provided infrastructure and services), this dominant social meaning has enabled governments to direct investment towards road building. In Lessig's terms: governments have traded 'on standing social meanings to advance state ends' (Lessig, 1995, p. 957).

While we feel that potential mobility can be seen as the dominant proxy of the social meaning of the transport good, we argue that this social meaning is increasingly contested in current society, at least within academia (e.g., Vigar, 2002) and increasingly among government officials (Preston and Rajé, 2007). Moreover, the conceptualization of the transport good as potential mobility is at odds with the functional dimension of transport, which is of key importance for people to fulfill one's needs and desires. The availability or un-availability of transport shapes people's life opportunities (Lucas, 2006) – it determines whether a person can take advantage of education and health services, can access job markets (Ihlanfeldt and Sjoquist, 1998; Ong and Blumenberg, 1998) and thus advance economically, can keep in contact with friends or family, or whether she/he can enjoy leisure and recreational facilities (Frank et al., 2006). This functional dimension of transport should be more important in guiding transportation planning practices than the mere notions of freedom and independence. Even more, we agree with Sheller and Urry (2000)) that the focus on potential mobility has brought freedom and independence for a large part of the population, but at the expense of the freedom of a car-less minority. Hence, in what follows, we will focus on access as the appropriate social meaning of the transport good.

It is the strong interrelationship between access and people's life opportunities that suggests that transport not only has a distinct social meaning in current societies, but also should be set apart from regular goods and distributed in a separate

sphere according to distributive principles that are derived from the social meaning of the good. In the next section, we discuss these possible distributive principles.

2.2. A most just distribution: the maximax guiding principle

Most scholars of justice agree, at least since Aristotle, that the distributive principle of equality can be perceived as the 'default' criterion for the distribution of goods over members of society (e.g., Kolm, 1996). Smith (1994), for instance, argues that the challenge for scholars of social justice is to provide convincing justifications for a deviation from the criterion of equality. Lacking such arguments, Smith upholds, equality remains as the only correct way to distribute a good. Shrader-Frechette (2005) refers to this as the principle of prima facie political equality. Indeed, many transport scholars agree with the notion that social justice pertains to some aspect of equality (Banister, 1994; Hine, 2008). Following this line of argument, we posit that access should be distributed equally – that is, distributed evenly over people irrespective of the differences between those people – *unless* convincing arguments can be provided for another way of distribution.

Walzer explicitly states that the distribution of a good with a socially distinct meaning should be guided solely by internal reasons only, i.e. be derived from its social meaning. Therefore, the explorations below start from the delineation of the transport good as access and the intrinsic interrelationship between access and people's life opportunities. Furthermore, the argument builds on the particularities of the transport good, specifically on the dynamic interplay between transport and land use, as these particularities also provide crucial demarcation points in search for an adequate principle for the distribution of the transport good.

It may be obvious that in contemporary society, the distribution of access is far from equal. Access levels between individuals differ substantially, whether in terms of space, mode availability or income. The level of access a person may experience is strongly related to three characteristics. First, space is an important determinant of access, as the location of a person's residence has a strong impact on access to various opportunities (Naess, 2006). Second, mode availability, and especially car ownership or, more broadly, availability, strongly shapes a person's level of access (e.g., Benenson et al., 2010; Ong and Blumenberg, 1998; Taylor and Ong, 1995; Sanchez et al., 2003). Third, and interrelated, income has a substantial influence on level of access, given the cost related to every trip and a person's ability to pay (e.g. Levinson, 2010). Following the 'default' status of the principle of equality, the question is whether people should have equal level of access, irrespective of space, mode or income considerations? Below, we turn to this question for space and mode availability. We leave the treatment of justice in access in relation to income differences to a later discussion, as it concerns issues of transport pricing rather than the benefits of investments in transportation infrastructure and services.

2.3. The distribution of access in space

Let us first consider equal distribution of access in relation to space. While philosophical arguments may suggest that equality is called for, insights from research into the dynamics of space suggest that equal distribution in this respect is impossible to achieve. Theoretical modeling studies have shown that, even if starting from an even distribution of opportunities over space, and hence equality of access, centers will rapidly develop over time as a consequence of the advantages of spatial proximity (e.g., Puu, 2005). In other words, space by its very nature is divided into center and periphery and not every point on a plane can be equidistant from the important centers of opportunities. As a result, inequality in access to life opportunities is inevitable. Transport policies cannot correct the differences between center and periphery; they would at best redefine or reinforce the relationship between them. While this is not a normative argument against distribution according to equality, it does underscore that the principle of equality is hardly suited to guide the distribution of access in practice. More precisely, this observation suggests that equality of access cannot be achieved across-the-board and that a non-equal distribution must be proposed explicitly.

Rawls proposes four distributive principles as reasonable alternatives to the principal of equality (Rawls, 1971; see also Frohlich and Oppenheimer, 1992). These principles are: (1) maximizing the average access level; (2) maximizing the average access level with a floor constraint for the minimum; (3) maximizing the average access level with a range constraint; and (4) maximizing the lowest level of access (Rawls' "difference principle"). Could any of these serve as a guiding principle for the distribution of access? When looking at the options, the first of these criteria (maximizing the average level of access) seems to be of little relevance, as averages hardly guide the actual distribution of the transport good over population groups – the principal issue of justice with which we are concerned. Rawls' difference principle (maximizing the lowest level of access), in turn, also has its problems when applied to the transport good. Rawls developed this criterion for "primary goods" – income and wealth – arguing that inequalities are only acceptable if they maximize the prospects of the representative worst-off man. That is, Rawls' theory allows differences in income and wealth, provided that these differences, through motivational factors, do not only result in a better working economy and, hence, in a larger overall output, but also in a higher level of income and wealth for the worst-off person. It seems unlikely that a comparable mechanism could be at work in the transport system. More precisely, it seems unclear how differences in access levels would increase the 'total access level' for a particular society and how these differences would subsequently benefit the person with the lowest access level (i.e., the worst-off person from a transport perspective).

This brief analysis suggests that two principles remain as possibly relevant for the distribution of space-related access: (1) maximizing the average level of access with a floor constraint for the minimum; and (2) maximizing the average level of

access within a defined maximum range constraint. The difference between these two principles is significant. The second criterion (called "maximax," referring to maximizing the average while observing a maximum gap) defines the height of the floor constraint in relation to the maximal level of access experienced by the most accessible community. This criterion is thus 'inflation' robust – the floor constraint will be automatically adjusted in accordance with changing levels of access. The first criterion lacks such an adaptive mechanism, implying that the floor constraint will have to be re-assessed whenever substantial changes in access levels occur across-the-board.

Concluding, the maximax principle would guarantee that access is maximized, while ensuring that an acceptable level of access is ensured for all population groups, irrespective of location. In this way, the transport system can be continuously improved while no area or neighborhood will be left behind. In comparison to the equality principle, the maximax criterion does not demand uniformity and is thus in line with the inevitable differences in access created by space. Given this feature, the maximax principle seems to be a practically applicable principle to guide the distribution of space-related access levels within a separate distributive sphere. Note that the actual application of the maximax principle is by no means a straightforward issue. For instance, both the floor and the ceiling may be outliers and be comprised of a limited number of households only, while large groups may fall out of range defined by the maximax principle and are thus also entitled to improvements in access levels, just like the households at the 'bottom'. Practical application may therefore require additional analyses that provide insight into the distribution of access levels over different population groups through some type of dispersion measure, such as the well-know Gini coefficient (Delbosc and Currie, 2011).

2.4. Distribution of access by mode availability

Mode availability is a second key characteristic that will shape an individual's access level. Hence, the question is whether equality of access should be guaranteed irrespective of people's mode availability? Starting from the social meaning of the transport good – access as a necessary prerequisite to fully participate in society and to fulfill life opportunities – there seem to be few reasons to deviate from the default principle of equality. However, it could be argued that not every person requires the same level of access to achieve both, i.e. to participate fully in society or to fulfill life opportunities. For some, full participation in society may require a high level of mobility and hence access (e.g. a doctor making house calls), while others may be able to achieve their life opportunities with relatively low levels of access (e.g. a writer working from home). Whether or not they have access to an automobile, large differences in access levels would be acceptable from this perspective.

These large differences in required access levels suggest that a need-based approach would be appropriate for the distribution of access by mode availability. According to this principle, it is fair that different persons experience different levels of access, as long as these disparities match the differentiation in social needs (e.g. Sen, 1973). While the need criterion may appeal to some, its application to the field of transport is extremely problematic. On top of the general objections against a need-based approach to distribution (e.g. Kolm, 1996), Cass et al. (2005) argue that the increasing importance of social networks in current lifestyles challenges the assumption that social needs, for e.g. food, clothing or health care, can be easily translated into well-defined travel needs. Rather, the need to physically access social networks results in a dispersed pattern of travel needs that can hardly be captured through regular transport analysis. Furthermore, it should be noted that one of the key tools to improve people's access levels – transport infrastructure projects – are provided to collectives rather than individuals, and for the long-term rather than the short-term. As a result, the current needs of individuals are of little relevance in the distribution of access through transport infrastructure. The needs of collectives, such as neighborhoods and entire commute sheds, now and in the future, are what motivate planning. Since population structures of urban areas can and will change over time, the consequence would be that near identical levels of transport service would have to be provided to each and every neighborhood. Hence, our conclusion is that the criterion of need lacks distinctive force to guide the distribution of access in relation to mode availability (see also Apparicio and Seguin, 2006).

Does this imply that the principle of equality should guide the distribution of access by mode availability? It could be argued that perfect equality in access levels is not a necessary condition to guarantee that a person has an acceptable range of life opportunities (see Daniels' (1985) "normal opportunities range"). In other words, certain differences in access levels could be deemed acceptable, as long as a certain 'basic' level of access is guaranteed. This basic level should guarantee sufficient access to destinations that are of key importance for people's life opportunities: employment centers, health services, education, recreational facilities, as well as family and friends. However, in line with the critique on the principle of need, it will be extremely difficult to determine what constitutes a sufficient level of access for the low-mobile groups that avoids a reduction in life opportunities. This implies that the distributive principle 'maximizing the average level of access within a floor constraint' is difficult to apply, without making extremely precarious normative judgments. In contrast, the maximax principle introduced before ('maximizing the average level of access within a defined maximum range constraint') may avoid detailed normative judgments about what constitutes a sufficient level of access. While it will be difficult to determine an acceptable range, the principle at least provides a clear and empirical anchor point as the basis for political debate (i.e. the highest level of access). This suggests that, as in the case of space-related access, the most defensible principle to guide the distribution of mode-related access links the lowest to the highest access level.

Before concluding, another issue regarding mode-related access has to be addressed in relation to the particularities of the transport system. Unlike e.g. education or health services, which are provided both by the government and through the market, virtually all forms of access require some form of government intervention and investment. That is, while

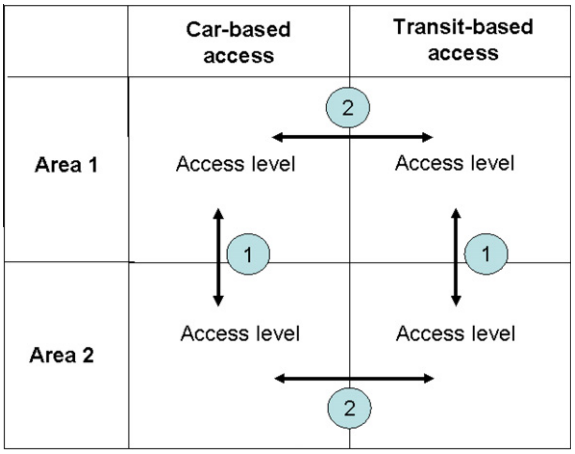

Fig. 1. Necessary comparisons of access levels following the 'double' maximax principle. Numbers are explained in the text.

households may invest in a higher level of access through the purchase of an automobile, the value of this investment in terms of improved access ultimately depends on government investments in car-related infrastructures and services. What may be the moral basis for investment in government funds in a higher level of access for a certain group only? The answer to that question would be that such a higher level of provision through the government is only acceptable if the car-owners fully cover the expenses for this higher level of access. It is questionable whether this is currently the case for car owners, certainly if one includes the external costs related to car infrastructure and use (see Jakob et al., 2006; Delucci, 2007; Litman, 1997). Whatever the current situation in this respect, this brief argument suggests that some inequality in the distribution of access by mode availability is acceptable if two conditions apply: (1) if the minimum level of access is sufficient to guarantee that a person has an acceptable range of life opportunities; and (2) if access levels above the minimum level are financed by the recipients of that higher level.

Based on these conditions, again a maximax principle is outlined for the distribution of mode-related access levels. The maximax criterion combines the goal of maximum average access across modes, with a limit on the maximal gap between the worst-off and the best-off in terms of access levels. In this way, an acceptable level of access is ensured for all population groups, irrespective of mode availability. Fig. 1 summarizes the argument. Following the discussion outlined above, for both space and mode availability the maximax principle applies. Ideally, transport investment programs should guarantee that: (1) the gap between the areas or neighborhoods with the lowest and the highest level of access should remain within a predefined range (space-related or inter-neighborhood equity – comparison 1); (2) the gap between car-owning and car-less households residing *in the same area or neighborhood* should remain within a predefined range (mode-related or intra-neighborhood equity – comparison 2); while (3) aiming to achieve the highest possible average access level across all neighborhoods and mode-related groups. Given existing gaps in access levels (see e.g., Shen, 1998; Hess, 2005; Kawabata and Shen, 2006; Kawabata, 2009; Benenson et al., 2010), the application of this set of distributive principles to actual practice means that transport investment programs may need to generate disproportionate benefits for low-mobile groups in order to be considered *fair* transport investment programs.

In the next section, we explore the distributive principles of transportation planning practice in the United State in an effort to compare it with our theoretical proposal.

3. State of practice in the United States

The distribution of the benefits of transportation, access, is addressed in several ways in transportation planning practice. We will first look at conventional planning approaches, and then at approaches which follow explicit distributional goals. We will then highlight one of the more advanced distributional analyses – the equity analysis of the regional transportation plan carried out by the Metropolitan Transportation Commission (MTC) of the San Francisco Bay Area.

3.1. Conventional transportation planning

Looking first at roadway planning, by and large the dominant approach to access distribution is through the active maintenance of levels of service (mobility). Congestion delays are reduced or stabilized through roadway investments or operations improvements in areas of the road network where demand exceeds capacity and travel speeds are degraded or are projected to degrade based on forecasted travel (Johnston, 2004; McNally, 2000). The more a traveler utilizes these improved networks, the more access benefits they reap. These approaches do vary by place, and it is well documented that access through automobile-based mobility is strongly focused on suburban to city and suburb to suburb travel (Cervero, 2004;

Sanchez et al., 2003). This means, in effect, that the most mobile who make greater demands on the road network will be the beneficiaries of future investments because of the congestion they cause (Martens, 2006).

Historical processes of urban segregation and social containment resulting from job, housing and lending discrimination left many low-income and minority residents concentrated in central cities (e.g., Bayor, 1988; Mohl, 1993; White, 1982). The barriers posed by the costs of automobile ownership in combination with public transportation systems ill-equipped to service center-city to suburban trips, resulted in a well-documented spatial mismatch (Ihlanfeldt and Sjoquist, 1998), sometimes called "automobile mismatch" (Ong and Blumenberg, 1998). These populations, who are relatively less mobile and will pose fewer demands on the road network, will benefit less from road investments than the most mobile. In effect, the gap between the least and most mobile is likely to grow under a mainstream transport planning process focused on congestion mitigation (Martens and Hurvitz, 2011). This distributional ethic is hardly ever discussed explicitly.

In keeping with its distributionally-vague approach, roadway planning follows a de facto "Kaldor-Hicks" improvement process, according to which infrastructure investment is acceptable if there are positive net benefits within a cost-benefit framework. The benefits reaped by some can *in theory* compensate for the losses of other groups (Rietveld, 2003). Sometimes a stronger standard is invoked whereby every group, usually defined by income level, must receive at least some benefits from the plan. Both of these approaches leave distributional issues unclear, as most of the access gains may fall to those with already high levels of access or to only those with access to vehicles.

Considering public transportation, there are two logics of benefit distribution at work – one catering to the least mobile, and one attempting to solve regional congestion problems typically caused by the most mobile. The first is the provision of a basic (in many places, minimal) level of service availability for low-income and minority populations (Polzin et al., 2002; Sanchez, 2008). Availability refers to the ability of a person to use the system spatially, through physical proximity to the transport network and stops and stations, or temporally, in that the service is provided at the right frequencies or times of day. Note that system availability does not guarantee access to (desired) destinations. Part of the effort to provide this minimal service is focused on "gap closure", by attempting to add transit investments at the margin which serve the most pressing access needs, such as reverse commuting through the federally supported Job Access and Reverse Commute (JARC) program and other welfare to work programs, paratransit, schedule extensions or owl services (Cervero, 2004).

The other logic for transit investments is to use higher performance systems to address regional congestion issues. Services, such as express bus, regional rail and commuter rail systems, are developed for commuters and higher income populations for peak-hour, mostly work trip, accessibility needs. Here, access levels by car and public transport are somewhat related to each other: when the access level of the most mobile is threatened (due to congestion, etc.), the access level of the least mobile (those without a car) may be improved by the new transit investments. Sometimes, however, the transit investments made to serve the most mobile hardly benefit the least mobile (Mann, 2004).

This bifurcation in public transport planning can lead to tensions when funding gets shuffled between services for low income groups and for commuters (Mann, 2004), but in most places, this dual system survives because of the overarching goals of both minimal welfare for the poor and car-less, and regional congestion and air quality management. The main conclusion from practice is that the distribution of access benefits between places and between modes is not considered explicitly, but results from an ad hoc system of improvements (or sometimes downgrading) which tend to favor, over time, improving services for the most mobile. While average access levels grow, so does the gap in access levels between the most and least mobile (Fig. 2).

3.2. Explicit justice-oriented transportation planning

Following the adoption of a series of directives relating to environmental quality and environmental justice (EJ) based on the Civil Rights Act of 1964, the distribution of access has received more explicit attention in (metropolitan) transportation planning practice. In line with the underlying environmental justice considerations laid down in the various documents, transportation planning most often invokes either: fostering participation of groups traditionally marginalized in the transportation planning process, preventing undue burdens from exposure to the externalities of transportation systems, or insuring the distribution of benefits among various communities. For a more complete discussion, see Cairns et al. (2003), Cambridge Systematics (2002), Forkenbrock and Sheeley (2004), and American Association of State Highway and Transportation Officials (AASHTO, 2009). Given our focus on access, we limit the discussion below to ways in which the distribution of transport benefits is addressed in practice.

Civil rights and EJ legislation related to transportation require transport authorities to relate to justice from the standpoint of "protected classes" – those populations, low-income or minority, who are legally protected under the several overarching legislations. Title VI of the Civil Rights Act states that: "No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." The National Environmental Protection Act codified procedures for the exploration of impacts from transportation projects and public involvement in project planning. Executive Order 12898 (1994), entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," effectively expanded the definition of "protected classes" to include low-income populations, which would be significant for transportation equity issues (42 U.S.C. §4321). Following this order, both the Department of Transportation (DOT) and Federal Highway Administration (FHWA) adopted Environmental Justice directives to clarify the importance of addressing disproportionate impacts at the federal agency level (Department of Transportation, 1997; FHWA, 1998) and the Metropolitan Planning level (FHWA and FTA, 1999).

Since we are interested in the benefits of transportation, access, we will focus on the treatment of benefits in these directives. Unfortunately, we find little clear guidance. The DOT directives explain that environmental justice in transportation incorporates three principles: (1) avoid, minimize, or mitigate disproportionate burdens of transportation; (2) ensure the full and fair participation by all stakeholders; and (3) prevent the denial of, reduction in, or significant delay in the receipt of *benefits* by minority and low-income populations (FHWA, 2009 – authors' emphasis). Additional mentions are made of distributions of benefits in other parts of the FHWA guidance. While clearly the directives aim to generate attention for the distribution of benefits from transportation investments, no explanation is made of what acceptable distributions would be, and a particular distribution is not required to satisfy EJ rules. Again, from FHWA, here referring to the distribution of funding for transportation projects: "Consistent with the U.S. DOT Order on Environmental Justice... adverse impacts should be mitigated.... Beyond this mitigation requirement, there is no presumed distribution of resources to sustain compliance with the Environmental Justice provisions." (FHWA, 2009). The directive thus does not establish standards for deciding how to measure the distribution of access improvements generated by a transportation plan, nor how to determine whether a particular distribution is fair.

The NCHRP Project 8-36 (11) report, "Technical Methods to Support Analysis of Environmental Justice Issues" reviewed the state of practice of how MPOs measure and mitigate any disproportionate benefits or impacts (Cambridge Systematics, 2002). The study surveyed 15 state DOTs, 22 MPOs and three transit agencies about their efforts to measure and mitigate environmental justice issues in their activities. While most agencies incorporate educational and public involvement activities, and some attempt to develop measures of access benefits, only two (see below) attempted to define what it would mean to 'prevent the denial of, reduction in, or significant delay in the receipt of benefits' in terms of access. It should be noted that South Coast Association of Governments carried out a similarly advanced equity analysis but is not reviewed in the report (Pfeffer et al., 2002).

The NCHRP report presents the methodology employed by Florida's DOT as a 'typical approach' to evaluating distributive impacts in the planning of transport projects. The Florida DOT handbook states that disproportionate impacts should be dealt with, by identifying the potential population that might be affected by the transportation project, comparing the distribution of potential impacts on different populations, and reviewing results with members of the potentially impacted population. The handbook, however, 'does not identify a specific means of testing disproportionality, aside from the use of judgment by the analyst in consultation with the community' (Cambridge Systematics, 2002, pp. 4–32). With no standard for comparison, a growing gap would probably be deemed (politically) acceptable, so long as most groups receive some share of the benefits and no group experiences a decrease in access levels.

Two of the MPOs in the Cambridge Systematics survey (Cambridge Systematics, 2002) indicated that they have taken steps toward defining disproportionate differences in benefits from a quantitative standpoint: the Metropolitan Transportation Commission (MTC) in the San Francisco Bay Area (discussed below) and Sound Transit in Seattle. Sound Transit in Seattle calculated the percentage of total project benefits (travel time savings, accessible jobs) accruing to minority (or low-income) population groups, and then compared that percentage to the total percentage of minority (or low-income) population in the study area. If the amount of benefit accruing to the minority/low-income population was at least one standard deviation greater than the percentage of minority/low-income population in the study area, the difference was determined to be significant. While it is understandable to measure differences in burdens in such a way to direct mitigation efforts, it was unclear how differences in access levels were used to shape policy regarding transport investments (Cambridge Systematics, 2002, pp. 4–34 to 4–35). For instance, Sound Transit did not explicate the consequences if the

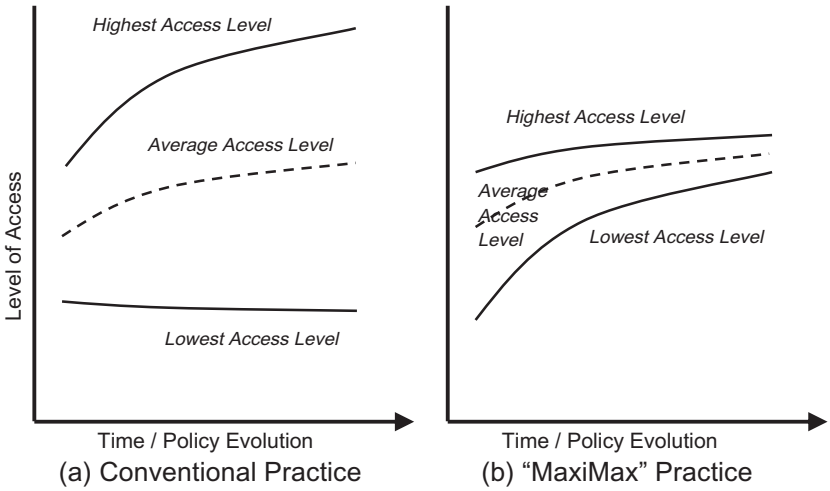

Fig. 2. Comparing consequences for access levels of best- and worst-off population groups of (a) conventional transportation planning practice, and (b) application of the maximax principle.

equity analysis were to show that minority/low-income population would receive less project benefits than their share in the total population. The approach implicitly seems to take proportionality as the criterion to assess the fairness of benefit distributions, thereby perpetuating the status quo in access differentials between various population groups. Note that the proportionality criterion is widely applied by MPOs in the assessment of the distribution of transport-related burdens like noise and air pollution (see Bullard and Johnson, 1997; Davy, 1997).

When the state of practice is compared to the maximax approach, the following pictures ensue (Fig. 2). On the left side of the figure, the conventional practice produces rising access for the most mobile, with a rising average, but with a likely growing gap between those with the highest and the lowest level of access. Those least mobile would likely experience declining access as land uses may reorganize around the changing mobility patterns (e.g. spatial mismatch problem). On the right, the maximax approach shows how more investments benefiting low-access populations would help them "catch up" to some extent with the most mobile, closing the difference up until the predefined maximal acceptable gap, similarly raising the average access levels for everyone, while possibly also benefiting those with the most access.

3.3. The equity analysis of the Metropolitan Transportation Commission (MTC)

The Metropolitan Transportation Commission (MTC) serving as the MPO in the San Francisco Bay Area has systematically carried out one of the more advanced environmental justice analyses in the country of a regional transportation plan (Cambridge Systematics, 2002; MTC, 2001; MTC, 2004; MTC, 2009; Purvis, 2000). Using its regional travel model, MTC attempts to measure access impacts for "communities of concern" (defined as minority and low-income neighborhoods) resulting from their 25-year investment plan and compare that to a "no-plan" scenario, along with other variations of the plan. The overall conclusion was that communities of concern benefit from the investment plans. Specifically, the analyses found that after the project investment, communities of concern were "more accessible" to jobs by both transit and automobile than without the project. It also claimed that, separately by automobile and transit, the urban communities of concern had higher levels of access to jobs than other communities. The 2004 analysis concludes: "When looking at the aggregate level across the Transportation 2030 alternatives, communities of concern appear to share in the benefits of the transportation investments without bearing a disproportionate share of the burdens compared to the remainder of the Bay Area" (MTC, 2004, p. ES2).

There are three main problems with this conclusion. First, while the analyses do an excellent job of comparing neighborhoods (space-related equity), in this case grouped by demographics, they avoid intermodal comparisons (mode-related equity). The intermodal disparity in access is quite profound and reported directly in the analyses. For example, with the 2005 Regional Transportation Plan investment, communities of concern in urban areas have access to roughly 140,000 jobs within 30 min by public transit, and 800,000 jobs within 30 min by automobile (MTC, 2004, p. 5–3). Similar results are found for other destinations and for comparisons of communities in suburban locations. The 2009 analysis shows 75,000 low-income jobs are accessible by automobile, compared to only 18,000 jobs by public transit. No mention is made of the likelihood of car ownership of different communities in this analysis. So, while drivers from communities of concern and other neighborhoods have similar accessibilities in theory, and may, in theory, benefit from investments, this approach fails to point out the significant difference between access to automobiles in communities of concern and wealthier communities. This means that even if communities of concern have more jobs accessible by automobile, we cannot conclude that they actually have access to these jobs as we do not know whether they have access to an automobile to use the improved road network. Without a clear measure of the actual automobile access in the community, their actual access to jobs is still unknown. It is implied in this approach that so long as communities could access the higher-performance road network, the result is fair. A second problem with these analyses is that it has no stated goal for any of the comparisons – what differences between the accessibility of communities are acceptable, and why? There is no goal or standard by which MTC determines a plan is equitable, so any improvements seem acceptable. Third, the analysis focuses on increments: the communities are more accessible to jobs than before. The expected increase in job density would likely increase a community's access to jobs, even without any investments. Without a clear goal, focusing on increments assumes the existing distributions are acceptable and just need some slight modifications, while again, a standard for success is not clear.

4. Conclusions: implications for planning practice in the United States

The literature and practice on environmental justice and transport has traditionally focused on transport-related burdens and participation in decision-making processes. In this paper, we have focused specifically on the distribution of access provided by transportation investment projects. Arguably, improvement in access levels is the most important benefit conveyed through transport infrastructure and services.

We have provided a philosophical argument that has identified a set of principles that, in our opinion, should guide a just distribution of transport investments and services. The criterion states that, ideally, transport investment programs should guarantee that: (1) the gap between the areas or neighborhoods with the lowest and the highest level of access should remain within a predefined range (space-related or inter-neighborhood equity), (2) the gap between car-owning and car-less households residing *in the same area or neighborhood* should remain within a predefined range (mode-related or intra-neighborhood equity), while (3) aiming to achieve the highest possible average access level across neighborhoods and mode-related groups. While still formulated in abstract terms, we feel that these equity principles can be used to shape the practice

of transportation planning. The principles suggest, first of all, that transportation planning authorities should focus on the analysis of access levels, at least in addition to the analysis of congestion. Second, it implies that authorities should compare access levels across areas and modes and determine which population groups are worst-off and/or fall below the access level derived from the maximax principle. Third, it would require transport agencies to search for cost-effective solutions to improve the accessibility levels of the target groups (see Ferguson et al. (2012) for a methodology for planning such improvements in the public transport system). These solutions could subsequently be added to a regional investment package, together with projects that aim to reduce congestion and/or increase traffic safety.

This is only a brief discussion on the possible consequences for practice of the equity framework developed here. Obviously, additional work needs to be done to develop the framework and assess the full extent of the consequences for practice. Yet, in our opinion, the application of the 'maximax' principle over time would result in a reduction of the existing gaps in access between various population groups, ultimately resulting in a transport system that provides a level of access that enables each member of society to fulfill his or her life opportunities. This would be a most just approach, considering the importance of access in determining life chances.

None of the typical approaches to justice taken by MPOs and other transportation agencies in the United States comes close to this ideal set of principles. Most agencies all but ignore the distribution of transport-related benefits in the evaluation of plan alternatives. Only a few authorities actually measure or invoke the distribution of access. These authorities, even those with the most sophisticated analysis techniques, however, fail to define a well-founded goal against which to assess the results of the analysis. As a result, they tend to be satisfied if communities of concern, like EJ communities or low-income neighborhoods, experience some improvement in their level of access, mostly to jobs. The consequence is that even in the jurisdictions carrying out an equity analysis, transport investment programs are accepted that hardly address the existing gaps in access levels. Thus, in some cases, the gap between the least and most accessible might continue to grow, even when there is attention to equity.

The limited and poorly defined attention to the distribution of access can in part be related to the existing environmental justice legislation and related guidelines, as they do not provide clear guidance for carrying out such an equity analysis. Furthermore, there are virtually no examples on which MPOs or others could build. There is some previous thinking on this subject, however. For instance, Martens (2006) shows how accessibility increments for low-accessible communities could be more explicitly accounted for and more highly valued within both traditional cost-benefit analysis and the four-step travel demand models, as a way of moving forward to closing accessibility gaps. Indeed, there are a range of excellent recommendations towards improving planning procedure to address equity (e.g., Sanchez, 2008; Sanchez et al., 2003; Robinson, 2008; Martens, 2011). We are arguing here for a definition of that vision alongside understanding strategies for achieving that vision.

While we realize that still many questions remain unanswered in the approach outlined here, we hope that this discussion will assist MPOs in developing a more systematic and well-founded equity analysis of transport-related benefits in the future. Implementing a maximax "ethic" or "vision" in planning would be a long-term goal, like free, basic education for all was a long-term goal when it was proposed at the end of 19th century. Its radical nature at the time did not stop people from taking it as the goal – and indeed, throughout much of the developed world, it has now been achieved and is considered basic policy. Hopefully, the introduction of a social justice approach into transportation planning will, over time, also result in a more fair distribution of such an important social good as access.

Acknowledgements

The ideas developed in this paper are partly the result of two separate research projects on equity and transportation, one funded by the Volvo Research and Educational Foundations, and the other by the Federal Transit Administration, Transportation Equity Research Program Phase II Work Plan, Cooperative Agreement MD-26-8001-00. The authors would like to thank the anonymous reviewers as well as the journal editor for valuable comments, which have helped to considerably improve the paper.

References

Altshuler, A., 1979. The Urban Transportation System. MIT Press, Cambridge, MA.

American Association of State Highway and Transportation Officials (AASHTO), 2009. The Center for Environmental Excellence by the American Association of State Highway and Transportation Officials "Environmental Justice" Webpage.

Apparicio, P., Seguin, A.-M., 2006. Measuring the accessibility of services and facilities for residents of public housing in Montreal. Urban Studies 43, 187–211.

Banister, D., 1994. Equity and acceptability questions in internalising the social costs of transport. Proceedings of Internalizing the Social Costs of Transport, Paris, pp. 153–173.

Bayor, R., 1988. Roads to racial segregation: Atlanta in the twentieth century. Journal of Urban History 15, 3–21.

Beatley, T., 1988. Equity and distributional issues in infrastructure planning: a theoretical perspective. In: Stein, J.M. (Ed.), Public Infrastructure Planning and Management. Sage, Newbury Park, pp. 208–226.

Benenson, I., Martens, K., Rofé, Y., Kwartler, A., 2010. Public Transport Versus Private Car: GIS-based Estimation of Accessibility Applied to the Tel Aviv Metropolitan Area. The Annals of Regional Science, pp. 1–17.

Bullard, R., Johnson, G. (Eds.), 1997. Just Transportation: Dismantling Class Barriers to Mobility. New Society Press, Branford.

Cairns, S., Greig, J., Wachs, M., 2003. Environmental Justice and Transportation: A Citizen's Handbook. Institute of Transportation Studies, University of California Berkeley, Berkeley, CA.

Systematics, Cambridge., 2002. NCHRP Project 8–36 (11): Technical Methods to Support Analysis of Environmental Justice Issues. National Academy Press, Washington, DC.
Cass, N., Shove, E., Urry, J., 2005. Social exclusion, mobility and access. Sociological Review 53, 539–555.
Cervero, R., 1981. Efficiency and equity impacts of current transit fare policies. Transportation Research Record: Journal of the Transportation Research Board 799, 7–15.
Cervero, R., 2004. Job isolation in the US: narrowing the gap through job access and reverse-commute programs. In: Lucas, K. (Ed.), Running on Empty: Transport, Social Exclusion and Environmental Justice. The Policy Press, Bristol.
Couclelis, H., 1996. The death of distance. Environment and Planning B: Planning & Design 23, 387–389.
Daniels, N., 1985. Just Health Care. Cambridge University Press, Cambridge.
Davis, C., Jha, M.K., 2011. A dynamic modeling approach to investigate impacts to protected and low-income populations in highway planning. Transportation Research Part A: Policy and Practice 45, 598–610.
Davy, B., 1997. Essential Injustice. Springer, Wien/New York.
Delbosc, A., Currie, G., 2011. Using Lorenz curves to assess public transport equity. Journal of Transport Geography 19, 1252–1259.
Delucci, M., 2007. Do motor-vehicle users in the US pay their way? Transportation Research Part A: Policy and Practice 41, 982–1003.
Department of Transportation USA (DOT), 1997. DOT Order 5610. 2. Department of Transportation Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Published February 3, 1997.
Dong, X., Ben-Akiva, M.E., Bowman, J.L., Walker, J.L., 2006. Moving from trip-based to activity-based measures of accessibility. Transportation Research Part A: Policy and Practice 40, 163–180.
Dworkin, R., 1983. Reply to Michael Walzer. The New York Review of Books 30.
Fabre, C., 2007. Justice in a Changing World. Polity Press, Cambridge, UK.
Farrington, J., Farrington, C., 2005. Rural accessibility, social inclusion and social justice. Towards conceptualisation. Journal of Transport Geography 13, 1–12.
Feitelson, E., 2002. Introducing environmental equity dimensions into the sustainable transport discourse: issues and pitfalls. Transportation Research Part D: Transport and Environment 7, 99–118.
Ferguson, E.M., Duthie, J., Unnikrishnan, A., Waller, S.T., 2012. Incorporating equity into the transit frequency-setting problem. Transportation Research Part A: Policy and Practice 46, 190–199.
FHWA (Federal Highway Administration), 1998. Order 6640.23 entitled FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. <http://www.fhwa.dot.gov/legsregs/directives/orders/6640_23.htm>.
FHWA (Federal Highway Administration) and FTA (Federal Transit Administration), 1999. Memorandum on Implementing Title VI Requirements in Metropolitan and Statewide Planning. <http://www.fhwa.dot.gov/environment/ejustice/ej-10-7.htm> (accessed 14.10.09).
FHWA (Federal Highway Administration), 2009. Environmental Justice web site, The Facts – Questions and Answers on Environmental Justice. <http://www.fhwa.dot.gov/environment/ejustice/facts/index.htm> (accessed 12.12.09).
Forkenbrock, D.J., Schweitzer, L.A., 1999. Environmental justice in transportation planning. Journal of the American Planning Association 65, 96–111.
Forkenbrock, D.J., Sheeley, J., 2004. Effective methods for environmental justice assessment. National Cooperative Highway Research Program, National Research Council/Transportation Research Board.
Frank, L.D., Sallis, J.F., Conway, T.L., Chapman, J.E., Saelens, B.E., Bachman, W., 2006. Many pathways from land use to health: associations between neighborhood walkability and active transportation, body mass index, and air quality. Journal of the American Planning Association 72, 75–87.
Frohlich, N., Oppenheimer, J.A., 1992. Choosing Justice: An Experimental Approach to Ethical Theory. University of California Press, Berkeley, CA/Los Angeles, CA/Oxford.
Garb, Y., Levine, J., 2002. Congestion pricing's conditional promise: promotion of accessibility or mobility? Transport Policy 9, 179–188.
Harvey, D., 1990. The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change. Blackwell, Malden, MA/Oxford.
Hess, D.B., 2005. Access to employment for adults in poverty in the Buffalo–Niagara region. Urban Studies 42, 1177–1200.
Hine, J., 2008. Transport and social justice. In: Knowles, R., Shaw, J., Docherty, I. (Eds.), Transport Geographies: Mobilities, Flows and Spaces. Wiley-Blackwell, Malden/Oxford.
Hodge, D.C., 1988. Fiscal equity in urban mass transit systems: a geographical analysis. Annals of the Association of American Geographers 78, 288–306.
Hodge, D.C., 1995. My fair share: equity issues in urban transportation. In: Hanson, S. (Ed.), The Geography of Urban Transportation. second ed. The Guilford Press, New York/London.
Ihlanfeldt, K., Sjoquist, D., 1998. The spatial mismatch hypothesis: a review of recent studies and their implications for welfare reform. Housing Policy Debate 9, 849–892.
Jakob, A., Craig, J.L., Fisher, G., 2006. Transport cost analysis: a case study of the total costs of private and public transport in Auckland. Environmental Science & Policy 9, 55–66.
Johnston, R., 2004. The urban transportation planning process. In: Hanson, S., Giuliano, G. (Eds.), The Geography of Urban Transportation. third ed. The Guilford Press, New York/London.
Kawabata, M., 2009. Spatiotemporal dimensions of modal accessibility disparity in Boston and San Francisco. Environment and Planning A 41, 183–198.
Kawabata, M., Shen, Q., 2006. Job accessibility as an indicator of auto-oriented urban structure: a comparison of Boston and Los Angeles with Tokyo. Environment and Planning B: Planning and Design 33, 115–130.
Khisty, C.J., 1996. Operationalizing concepts of equity for public project investments. Transportation Research Record: Journal of the Transportation Research Board 1559, 94–99.
Kolm, S.-C., 1996. Modern Theories of Justice. MIT Press, Cambridge, MA.
Lessig, L., 1995. The regulation of social meaning. The University of Chicago Law Review 62, 943–1045.
Levinson, D., 2010. Equity effects of road pricing: a review. Transport Reviews: A Transnational Transdisciplinary Journal 30, 33–57.
Litman, T., 1997. Policy implications of full social costing. Annals of the American Academy of Political and Social Science 553, 143–156.
Lomasky, L.E., 1997. Autonomy and automobility. The Independent Review 2, 5–28.
Lucas, K., 2006. Providing transport for social inclusion within a framework for environmental justice in the UK. Transportation Research Part A: Policy and Practice 40, 801–809.
Mann, E., 2004. Los Angeles bus riders derail the MTA. In: Bullard, R., Johnson, G., Torres, A. (Eds.), Highway Robbery: Transportation Racism and New Routes to Equity. South-End Press, Cambridge.
Martens, K., 2006. Basing transport planning on principles of social justice. Berkeley Planning Journal 19, 1–17.
Martens, K., 2011. Substance precedes methodology: on cost-benefit analysis and equity. Transportation 38, 959–974.
Martens, K., Hurvitz, E., 2011. Distributive impacts of demand-based modelling. Transportmetrica 7, 181–200.
McNally, M.G., 2000. The four-step model. In: Hensher, D.A., Button, K.J. (Eds.), Handbook of Transport Modelling. Pergamon, Oxford, pp. 35–52.
Michelman, F.I., 1973. In pursuit of constitutional welfare rights: one view of Rawls' theory of justice. University of Pennsylvania Law Review 121, 962–1019.
Mohl, R.A., 1993. Race and space in the modern city: interstate-95 and the black community in Miami. In: Hirsch, A., Mohl, R.A. (Eds.), Urban Policy in Twentieth-Century America. Rutgers University Press, New Brunswick, New Jersey, pp. 100–158.
MTC, 2001. Environmental Justice Report for the 2001 Regional Transportation Plan for the San Francisco Bay Area.
MTC, 2004. Transportation 2030 Equity Analysis.
MTC, 2009. Equity Analysis Report for the Transportation 2035 Plan.
Murray, A.T., Davis, R., 2001. Equity in regional service provision. Journal of Regional Science 41, 577–600.

Naess, P., 2006. Accessibility, activity participation and location of activities: exploring the links between residential location and travel behaviour. Urban Studies 43, 627–652.
Niemeier, D.A., 1997. Accessibility: an evaluation using consumer welfare. Transportation 24, 377–396.
Ong, P., Blumenberg, E.A., 1998. Job access, commute and travel burden among welfare recipients. Urban Studies 35, 77–93.
Pfeffer, N., Wen, F.H., Ikhrata, H.M., Gosnell, J.R., 2002. Environmental justice in the transportation planning process – Southern California perspective. Transportation Research Record: Journal of the Transportation Research Board 1792 (Sustainability and Environmental Concerns in, Transportation 2002), 36–43.
Polzin, S.E., Pendyala, R.M., Navari, S., 2002. Development of time-of-day–based transit accessibility analysis tool. Transportation Research Record: Journal of the Transportation Research Board 1799, 35–41.
Preston, J., Rajé, F., 2007. Accessibility, mobility and transport-related social exclusion. Journal of Transport Geography 15, 151–160.
Purvis, C.L., 2000. Data and analysis methods for metropolitan-level environmental justice assessment. Transportation Research Record: Journal of the Transportation Research Board 1756, 15–21.
Puu, T., 2005. On the genesis of hexagonal shapes. Networks & Spatial Economics 5, 5–20.
Rawls, J., 1971. A Theory of Justice. Harvard University Press, Cambridge, MA.
Richardson, H.W., Bae, C.C., 1999. The equity impacts of road congestion pricing. In: Button, K.J., Verhoef, E.T. (Eds.), Road pricing, traffic congestion and the environment. Edward Elgar Publishing, Cheltenham.
Rietveld, P., 2003. Winners and losers in transport policy: on efficiency, equity and compensation. In: Hensher, D.A., Button, K.J. (Eds.), Handbook of Transport and the Environment. Elsevier, Amsterdam/San Diego, pp. 585–601.
Robinson, G., 2008. Environmental justice and transportation toolkit. Baltimore Region Environmental Justice in Transportation Project, vol. 1. Baltimore.
Rucker, G., 1984. Public transportation: another gap in rural America. Transportation Quarterly 38, 419–432.
Sadurski, W., 1985. Giving Desert its Due: Social Justice and Legal Theory. D. Reidel Publishing Company, Dordrecht.
Sager, T., 2005. Footloose and Forecast-free: Hypermobility and the Planning of Society. European Journal of Spatial Development September 2005, 1–23.
Sanchez, T.W., 2008. Poverty, policy, and public transportation. Transportation Research Part A: Policy and Practice 42, 833–841.
Sanchez, T.W., Stolz, R., Ma, J.S., 2003. Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities. Cambridge, MA.
Schweitzer, L., Valenzuela, A., 2004. Environmental injustice and transportation: the claims and the evidence. Journal of Planning Literature 18, 383–398.
Sen, A.K., 1973. On Economic Inequality. Clarendon Press, Oxford.
Sheller, M., Urry, J., 2000. The city and the car. International Journal of Urban and Regional Research 24, 737–757.
Shen, Q., 1998. Location characteristics of inner-city neighborhoods and employment accessibility of low-wage workers. Environment and Planning B: Planning and Design 25, 345–365.
Shrader-Frechette, K.S., 2005. Environmental Justice: Creating Equality, Reclaiming Democracy. Oxford University Press, Oxford/New York.
Smith, D.M., 1994. Geography and Social Justice. Blackwell, Cambridge.
Taylor, B.D., Norton, A.T., 2009. Paying for transportation: what's a fair price? Journal of Planning Literature 24, 22–36.
Taylor, B.D., Ong, P., 1995. Spatial mismatch or automobile mismatch? An examination of race, residence and commuting in US metropolitan areas. Urban Studies 32, 1453–1473.
Teuber, A., 1984. Bookreview of spheres of justice by Michael Walzer. Political Theory 12, 118–123.
Trappenburg, M., 2000. In defence of pure pluralism: two readings of Walzer's spheres of justice. The Journal of Political Philosophy 8, 343–362.
Urry, J., 2004. The 'system' of automobility. Theory, Culture & Society 21, 25–39.
van der Stoep, J., 1995. Mobiliteit ondervraagd. Filosofie & Praktijk 16, 145–153.
Vigar, G., 1999. Transport for people: accessibility, mobility and equity in transport planning. In: Greed, C.H. (Ed.), Social town planning. Routledge, London, pp. 90–101.
Vigar, G., 2002. The Politics of Mobility: Transport, The Environment and Public Policy. Spon Press, London.
Walzer, M., 1983. Spheres of Justice: A Defense of Pluralism and Equality. Basic Books.
White, D., 1982. The black sides of Atlanta: a geography of expansion and containment, 1970–1870. Atlanta Historical Journal 26, 208–213.
Zeitler, U., 1999. Grundlagen der Verkehrsethik. Logos Verlag, Berlin.