



# Civil rights guidance and equity analysis methods for regional transportation plans: a critical review of literature and practice



Alex Karner\*, Deb Niemeier<sup>1</sup>

Department of Civil and Environmental Engineering, University of California, One Shields Ave., Davis, CA 95616, United States

## ARTICLE INFO

### Keywords:

Race  
Travel behavior  
Planning practice  
Law  
Equity

## ABSTRACT

Metropolitan planning organizations typically undertake an analysis of regional transportation plan equity to comply with federal anti-discrimination law, most prominently Title VI of the 1964 Civil Rights Act. In this critical review, we examine the law, regulatory guidance, academic research, and agency practice pertinent to equity analysis. We find that recommendations are extensive but generally lack specificity and are rarely enforceable. In the absence of detailed guidance, practice has become dominated by a single method that has foundations in the spatial analysis of environmental exposures and the neighborhood effects literature. We argue that this method is not appropriate for the analysis of transportation investment benefits, in part because target populations must be defined *a priori* based on demographic thresholds for areal units rather than on the basis of exposure. Further, it does not represent the travel behavior of Title VI-protected populations adequately, most notably people of color. Newer travel demand modeling paradigms are capable of sidestepping methodological problems, and legacy models can be adapted and improved. However, agencies generally have not shifted from traditional methods and planners do not view race as a variable relevant to travel behavior. By relying on an analytical technique that is not likely to reflect the travel behavior of people of color, planning agencies reduce the likelihood that racially disparate outcomes will be identified and mitigated. Meaningful transportation equity analyses must include an assessment of both current and near-term conditions and provide racially specific outcomes, while seeking to mitigate inequities through programming decisions.

© 2013 Elsevier Ltd. All rights reserved.

## 1. Introduction

Civil rights and transportation equity are historically inseparable. Ensuring that different population segments and communities equitably share the costs and benefits of transportation investments continues to be a major challenge facing transportation planning. In part, this is because costs and benefits can be quantified in many different ways and their equitable distribution is subject to interpretation. Assertions of inequitable modal investment distributions have long been voiced by transit users, labor unions, and transportation advocates. These issues are often litigated and highlight disparities in transit funding between systems predominantly used by relatively affluent, white, suburban users and the systems predominantly used by relatively poor, minority, urban users (Bullard, 2004; Golub et al., 2013; Grengs, 2002; Pucher, 1982). Research has also identified inequities related to accessibility and transit service, which differ according to neighborhood characteristics (Grengs, 2010; Wells and Thill, 2012). Additionally,

people of color and low-income communities are often physically separated by transportation infrastructure and subsequently burdened with its negative effects (Mohl, 2004; Sanchez et al., 2003; Self, 2003).

Federal law and executive agency guidance dating to Title VI of the Civil Rights Act of 1964, combined with transportation planning's increasingly broad purview in the wake of the Intermodal Surface Transportation Equity Act of 1991's "planning factors," continue to increase the visibility of equity issues in transportation. With substantial concentrations of people of color and low income within their jurisdictions, metropolitan planning organizations (MPOs) are well poised to address equity (Sanchez and Brenman, 2007). As recipients of federal funding, MPOs must demonstrate compliance with Title VI and other guidance designed to mitigate adverse impacts on protected populations, including low-income people, people of color, and transit-dependent individuals, among others. Title VI mandates nondiscrimination on the basis of race, color, and national origin in programs that receive federal funds. Regional transportation plan (RTP) compliance with at least the spirit of Title VI is typically demonstrated by the preparation of an "equity analysis" of the investment strategy embodied in the RTP. Yet despite the regular completion of such equity analyses at MPOs since the late 1990s, transportation outcomes still show

\* Corresponding author. Tel.: +1 530 725 4285; fax: +1 530 752 7872.

E-mail addresses: [aakarner@ucdavis.edu](mailto:aakarner@ucdavis.edu) (A. Karner), [dniemeier@ucdavis.edu](mailto:dniemeier@ucdavis.edu) (D. Niemeier).

<sup>1</sup> Tel.: +1 530 752 8918; fax: +1 530 752 7872.

disparities on the basis of race and class (see [Gobillon et al. \(2007\)](#) for a review).

In this critical review, we discuss transportation law, regulatory guidance, and MPO practice and draw upon our experiences providing stakeholder feedback on and attending public meetings for the Metropolitan Transportation Commission's (MTC) 2013 RTP update. The MTC is the MPO for the nine-county San Francisco Bay Area and has often been at the vanguard of modeling innovations, equity and otherwise; [Amekudzi and Meyer \(2006, 49\)](#) highlight the MTC as producing "one of the best examples" of a regional equity analysis. This review sheds new light on the disconnect between equity analysis and outcomes. We show that there are no standards governing equity analyses but a particular method has taken root that is not suitable for the study of spatially distributed transportation benefits. We argue that appropriately addressing race and civil rights in a regional equity analysis requires that planners revisit longstanding methodological approaches obtained from aggregate, four-step, travel-demand models. We propose substantive improvements motivated by prior work on accessibility and space, transportation case law, and public input received by the MTC throughout the 2000s. This review should be useful for regional planning agencies interested in improving the correspondence between their analyses of equity and environmental justice and the lived experience of protected populations within their jurisdictions.

## 2. Evidence on race and travel

Race has been linked to travel behavior and transportation performance outcomes. A vast literature has emerged to document the "spatial mismatch" between black workers and jobs in the U.S. originally posited by Kain in the late 1960s ([Ihlanfeldt and Sjoquist, 1998](#); [Kain, 1968](#)). The spatial mismatch hypothesis posits that blacks in central city locations experience inferior employment outcomes because of suburbanization and decentralization of jobs, lower rates of residential mobility, housing and labor market discrimination, and lower accessibility due to location choice and mode availability ([Blumenberg and Manville, 2004](#); [Grengs, 2010](#); [Parks, 2004](#); [Raphael, 1998](#); [Taylor and Ong, 1995](#)). Recent work has extended these findings to other people of color (see, e.g., [Stoll and Covington, 2012](#)). Transportation planning studies have also linked increasing concentrations of minorities to decreasing accessibility and lower levels of transit service ([Grengs, 2001](#); [Wells and Thill, 2012](#)). The ultimate result is generally inferior transportation outcomes and a higher incidence of poverty and unemployment for workers of color in central city areas ([Gobillon et al., 2007](#)).

Different measures of transportation performance have been used to quantify spatial mismatch, including commute time, distance, and speed. The literature suggests that using any of these measures in isolation or highly aggregating results is not appropriate; context is vitally important and travel-related responses to urban form differ by group ([Giuliano, 2000](#)). [Ihlanfeldt and Sjoquist \(1998\)](#) point out that residential location choice is likely endogenous with respect to commute time for whites only. This means that whites more readily trade off increasing commute time for lower per-unit housing costs. [Taylor and Ong \(1995\)](#) found that white commuters from predominantly white areas commuted farther and longer than blacks and Latinos in those areas, while white commuters from predominantly minority areas experienced shorter (distance and time) commutes than blacks and Latinos. A study of Detroit, Michigan, analyzed the commute times of black and white workers employed at the same central business district location ([Zax, 1990](#)). Those results showed that black workers had shorter commute times, but this was because

of segregation-related constraints placed on blacks' residential mobility and location choice rather than an indicator of convenience or accessibility. In general, the study found that white workers' commute times increased with income, while black workers' did not.

Spatial mismatch is a regional phenomenon; as the regional transportation planning and policy body, the MPO has a role to play in its mitigation. While some of the causes of spatial mismatch cannot be addressed by an MPO, like housing and labor market discrimination, others can, including the provision or encouragement of affordable housing and public transit in and near job centers that are matched to the skill and income levels of black workers. In order to develop effective strategies, a planning agency needs to spatially distinguish the information derived from their decision-making tools, including travel-demand models, and better link this information to race/ethnicity. Yet research on travel behavior rarely considers race/ethnicity as an independent variable ([Giuliano, 2003](#)). Several studies do show an independent effect of race/ethnicity, even when controlling for traditional influences on travel behavior including income, family structure, land use, and accessibility ([Chung et al., 2001](#); [Giuliano, 2000, 2003](#); [Johnston-Anumonwo, 2000](#); [Kawabata and Shen, 2007](#); [Kockelman, 1997](#); [Liu, 2000](#)).

In light of the spatial mismatch literature and evidence on the independent effect of race/ethnicity on travel behavior, the role of regional equity analysis becomes clear from a civil rights perspective: a regional equity analysis should be able to capture the extent to which racial dynamics operate in a given region, disproportionately affect people of color and other protected populations, and seek to mitigate them. The situation is complicated because existing law and regulatory guidance is not sufficiently prescriptive, vis-à-vis the findings of the literature summarized above, to ensure meaningful and actionable equity analyses.

## 3. Law and guidance for equity analysis

In principle, ample law and regulatory agency guidance exists to conduct an equity analysis of RTPs. In practice, however, specific recommendations and clear analysis requirements for MPOs are lacking. President Clinton's 1994 Executive Order 12898 (EO 12898) mandated that the achievement of environmental justice be made a part of every federal agency's mission and specifically identified low-income populations as a protected group. Environmental justice was to be achieved by "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of . . . programs, policies, and activities on minority populations and low-income populations" ([Clinton, 1994, 7629](#)). The U.S. Department of Transportation (DOT) operationalized EO 12898 with an Environmental Justice Strategy in 1995 and Proposed and Final Environmental Justice Orders in 1995 and 1997, respectively ([USDOT, 1997](#)). While environmental justice was often addressed at the project level, Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) officials issued a joint memorandum in 1999 affirming that "while Title VI and EJ concerns have most often been raised during project development, it is important to recognize that the law also applies equally to the processes and products of planning" ([FHWA/FTA, 1999, 1](#)).

Guidance for planning agencies has generally been issued by the FTA. The Urban Mass Transportation Administration (now FTA) had issued Title VI-related guidance prior to the DOT orders, including guidance for MPOs ([UMTA, 1988](#)). FTA revised the UMTA guidance in 1998 with a new circular that increased specificity vis-à-vis MPOs ([FTA, 2007](#)). The circular prescribed that "MPOs should have an analytic basis in place for certifying compliance with Title

VI” and that possible analyses could include demographic profiles, identification of the benefits and burdens of transportation investments for different groups with mitigation, or simply “a metropolitan planning process that identifies the needs of low-income and minority populations” (FTA, 2007, VIII-1). The FTA updated its circular in 2007, and again in 2012, at that time creating separate Title VI and environmental justice guidance, acknowledging that there are some circumstances where analysis could be required for one but not the other or where prescribed actions to address disparate impacts could differ (FTA, 2012a,b).

Although the FTA’s 2012 circulars are substantially more detailed than previously, with respect to guidance for MPOs, public comments requested additional clarity and specificity. For example, attorneys, equity advocates, and academics requested that MPOs be required to certify the compliance of local agencies operating within the region lest the planning process become “infected by discrimination in the decisions of other agencies that the MPO incorporates into its plans” (Public Advocates, 2011, Attachment B: 14).

Transportation authorizations have also served to broaden both the responsibilities of MPOs and the “planning factors” they must consider (Dilger, 1992; Handy, 2008). Transportation planning agencies use these laws and subsequent guidance to develop regional equity analyses, but none of the above creates a legal basis for assessing compliance with specific provisions, nor prescribes specific analytical standards or methods. For example, a 2012 FHWA order states that “This directive should not be construed to create any right to judicial review involving the compliance or noncompliance with this directive by FHWA, its officers, or any other person” (FHWA, 2012a, 2). The FHWA has suggested that MPOs improve modeling capabilities to characterize the travel behavior of communities of color and low-income, but has not specified how they should assess the incidence of benefit and burden in those populations (FHWA, 2000).

The lack of specific guidance has resulted in a situation where the completion of any analysis is considered sufficient for compliance. Sanchez et al. (2003, 36) note that “states receiving federal funds, in most cases, simply submit a single-page document assuring their compliance with Title VI requirements, including DOT regulations, without any accompanying evidence to support their assurance.” MPO practice for compliance varies, but may include similar assurances, descriptions of public participation efforts, and summaries of analyses completed (e.g., MTC, 2010a,b; PSRC, 2012). Although there is wide variation in the types of analyses that are considered sufficient for Title VI purposes, the combination of vague guidance and a lack of enforcement has resulted in the proliferation of a particular approach that draws heavily from traditional environmental justice analysis of spatially inequitable environmental exposures and the literature on neighborhood effects.

## 4. Equity analysis in practice

### 4.1. The traditional approach

While necessary, general principles alone are not sufficient to guide the equity analysis of regional plans. In practice, an equity analysis requires making difficult but empirically significant tradeoffs about which there are no established guidelines or standards (Cambridge Systematics, 2002). This wide latitude is both the cause and effect of very little systematic analysis directed at developing rigorous methods for equity analysis. Notable exceptions are two reports commissioned by the National Cooperative Highway Research Program (NCHRP) on environmental justice assessment (Cambridge Systematics, 2002; Forkenbrock and

Sheeley, 2004). These differ somewhat in emphasis, with the 2002 and 2004 reports focusing on plan- and project-level analyses, respectively.

Included as part of the 2002 report are the results from interviews with practitioners representing 15 state departments of transportation, 22 MPOs, and three transit agencies. In response to questions about activities undertaken to address environmental justice, respondents most frequently pointed to expanded public involvement efforts, although some indicated an emphasis on building analytical capacity. Specifically, some MPOs responded that they were gathering data to identify the locations of target populations, developing indicators to measure the impacts of their plans, and developing tests of disproportionate impact distributions (Cambridge Systematics, 2002). This three-step procedure closely tracks a similar approach described in the 2004 report for assessing transportation project impacts, and largely reflects regional agency practice (Forkenbrock and Sheeley, 2004). Combining the two yields the following standard practice:

- (1) *Define target populations*: Identify target populations based on their overall proportion of traffic analysis zone (TAZ) population. TAZs that contain above a threshold percentage (e.g., greater than 30% low-income residents) are identified as representing the target population. TAZs not meeting these thresholds are defined as the non-target population. Exceptions to the geographic identification of target populations are rare, but occasionally occur (Pfeffer et al., 2002).
- (2) *Define equity metrics*: Identify metrics on which the equity performance of the plan is to be assessed. These can include measures of transportation system *benefits* including accessibility to jobs or other highly valued destinations, travel time, and safety, among others, or *impacts* including air pollution and noise.
- (3) *Assess equity*: Determine whether the results demonstrate equity. This is not straightforward because of the existence of differing conceptions of equity (Duthie et al., 2007; Khisty, 1996; Martens et al., 2012). The approach often used for plan-level analyses is to determine whether forecasted changes in metrics from the base year to the forecast year using a travel-demand model are similar for the target population compared to the non-target population. That is, if a 10% reduction in travel time is realized by higher-income groups, then a 10% reduction in travel time should be realized by lower-income groups for the plan to be equitable, regardless of the base year distribution.

The RTP equity analysis has become a focal point for equity stakeholders providing input during plan updates. Both agencies and advocates have tended to place outsize importance on the selection of equity metrics or the definition of target populations. Several additional but often unexamined considerations are also highly relevant, including: How do different target populations, metrics, and definitions of equity affect the results of the analysis? Does the population definition adequately capture the dimensions of inequity by race and class noted above? Moving immediately to indicator or population definition without considering these more fundamental questions risks putting the cart before the horse.

### 4.2. Ecological and categorical flaws

The three-step approach draws heavily from traditional environmental justice analysis and the literature on neighborhood effects. The environmental justice approach is exemplified in the canonical 1987 report *Toxic Wastes and Race in the United States* (Chavis and Lee, 1987). The report investigated the siting of toxic waste landfills in the United States, finding that the numerical

concentration of toxic waste facilities in zip-code areas was strongly associated with race while controlling for a host of covariates. With locally undesirable land uses like landfills or stationary sources of air pollution, citizens living within some proximity to the site are similarly burdened. Comparing the demographics of geographic units close to a site with others that are further away is a sensible method for demonstrating disparities in the location of such facilities, and thus equity.

Although the selection of areal units always requires care and can affect findings (see, e.g., Most et al., 2004), the methods of traditional environmental justice analysis are potentially applicable to some regional studies of transportation impacts like air pollution near roads, noise, or vehicle-miles-traveled density. These analyses match demographics to environmental exposure; exposed and unexposed demographics represent logical comparison groups. However, applying these same methods to assess regional benefits is not likely to be appropriate.

Because there is no relevant exposure, for the analysis of transportation benefits, target populations must be defined *a priori* based on demographic thresholds for areal units using insights from the neighborhood effects literature (see Sampson et al. (2002) for a review). This work links concentrated disadvantage, including proportion of individuals in poverty and proportion of single-parent households, to health and social outcomes, including low birth weight and educational attainment. Combining insights from research on environmental justice and neighborhood effects led to the creation of an “environmental justice community” saddled with concentrated disadvantage and potentially exposed to unjust levels of environmental burdens. Efforts to define such communities systematically have been fraught with difficulty (Holifield, 2004, 2012).

Some guidance is available for identifying these communities. In 1997, the Council on Environmental Quality (CEQ, 1997, 25) released a document discussing threshold selection for minority populations. It stated that minority populations were to be identified where either the population exceeded 50% or where the proportion of the population was “meaningfully greater” than the minority population in general or at another unit of geographic aggregation. In the proposed version of its 2012 environmental justice circular, the FTA referenced the CEQ report and cautioned recipients not to “artificially dilute or inflate” the affected minority and/or low-income population when selecting the appropriate unit of geographic analysis” (FTA, 2011, 6). Despite this caution, no guidance is provided for determining whether dilution or inflation is indeed a problem. FHWA guidance also states that small concentrations of people of color and low-income people can bear disproportionate impacts that must be mitigated (Cambridge Systematics, 2002; FHWA, 2012b). The California Department of Transportation has also promulgated guidance (Caltrans, 2003). It referenced the CEQ thresholds and also emphasized flexibility in adapting “the regulatory definitions of low-income and minority in order to conduct a meaningful analysis” (Caltrans, 2003, 67).

It has also become common to identify target populations using combinations of demographic factors, including proportions of people of color, low-income, recent immigrants, single-parent households, and other indicators of disadvantage defined *a priori*. For example, Foth et al. (2013) used a composite indicator of four metrics of “social disadvantage” to categorize and compare accessibility and transit travel time between census tracts in Toronto. The MTC used a similar approach in its 2013 RTP equity analysis (MTC/ABAG, 2013).

Implicitly, thresholds and composite indicators should reflect the travel behavior of their component groups; however, the assumption that thresholds or composite indicators are meaningful is rarely challenged. But, as noted by Duthie et al. (2007, 11), “use of the geographic unit as a proxy for the group unit does

not work well for groups that do not congregate spatially.” In other words, a population identified using thresholds will not, by definition, accurately represent individual members of target populations. To the extent that groups do not congregate spatially, performance indicators will be less accurate. This approach to population definition results in an ecological flaw, wherein group performance (e.g., that of low-income people) will be inferred from the performance for groups of areal units (e.g., all units with >30% low-income people). From a civil rights standpoint, if a composite indicator includes a racial measure, in addition to others, the calculated performance result cannot be said to reflect the travel behavior of people of color; the correct interpretation is that the measure reflects some unspecified combination of the travel behaviors of members of each of the component populations combined with other residents of each areal unit.

As an example of the mismatch between areal units and group outcomes, Taylor and Ong (1995) showed that black and white residents residing in predominantly minority communities had very different commute times and distances. Differences between racial groups residing in the same neighborhood may be larger than differences between groups of areal units meant to represent minority populations. Greater access to job opportunities in the city center for white high-salaried workers who also live in those zones will tend to obscure less access to suburban job opportunities for central-city people of color. Differences in automobile ownership will also radically affect one’s interaction with the transportation system. Fig. 1 shows the geography of accessibility (the relative ease with which jobs can be accessed from an origin to all destinations) in the San Francisco Bay Area for automobile and transit, using modeled travel data provided by the MTC for 2005. The maps vividly illustrate why a traditional analysis is inappropriate: accessibility differs according to characteristics and choices of individuals and households (individual accessibility) as opposed to the larger geographic unit (place accessibility) (Kwan, 1998). This distinction was noted by geographers in the early 1970s (Hanson and Kwan, 2008), and while it has not entered into transportation planning practice, improved definitions of accessibility are available that are calculable using readily available MPO data (see, e.g., Golub et al., in press). Only aggregating performance indicators at the Census tract- or TAZ-level using thresholds will tend to obscure the differences between individuals and their spatial locations, generating results of questionable value.

#### 4.3. The treatment of race

Since Title VI is the only environmental justice-related law that creates enforceable legal rights, reliable analyses that include race are vital. However, there are competing forces within transportation planning that forestall comprehensive racial analyses. In general, race is implicitly considered using geographic thresholds, but this approach is subject to the limitations described earlier. The absence of the explicit consideration of race from equity analyses has been justified using different arguments. Data or methodological constraints on forecasting race are often cited. A senior planning staff member at the Sacramento Area Council of Governments (SACOG) put it this way during an interview conducted for a related research project in early 2012,

“right now our forecasting models don’t include ethnicity and that’s critical for doing the analysis of the future that the [social equity] groups are asking for . . . It’s a pretty complex question when you get into the science behind it because you need to forecast each group’s birth rate, their mortality rates, the immigration to the region, so it’s one that we’re moving up on our radar.”

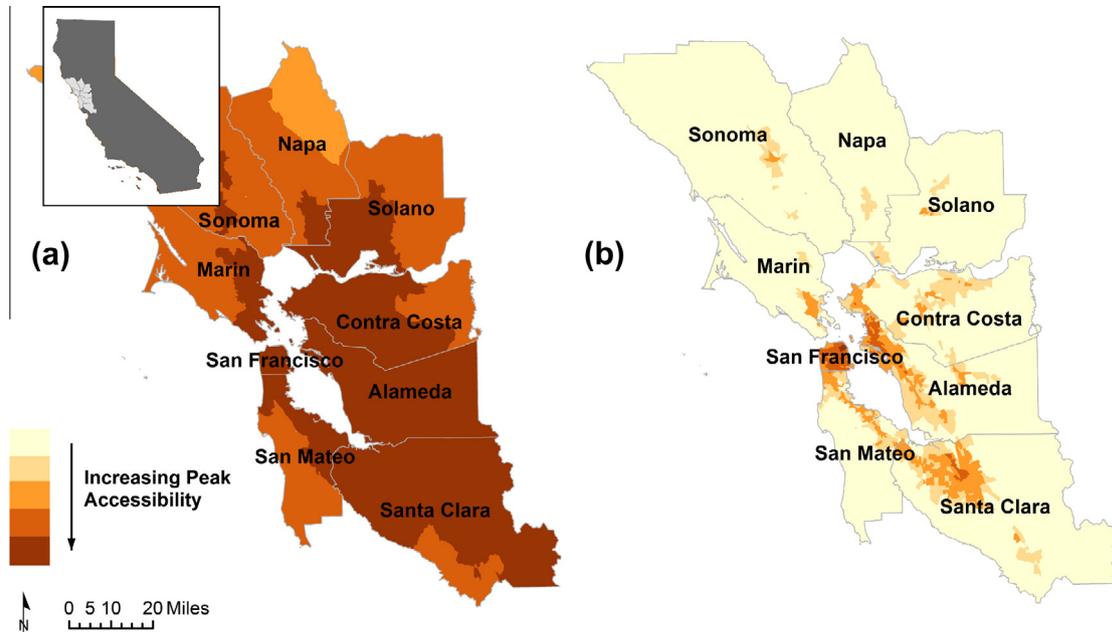


Fig. 1. Peak-period automobile (a) and transit (b) accessibility to all jobs for the nine-county San Francisco Bay Area, 2005. Plotted values for each TAZ were calculated as a proportion of the greatest observed peak automobile accessibility. The five categories correspond to increments of 0.2 ranging from 0 (least accessible) to 1 (most accessible).

Similarly, at a public meeting on the capabilities of MTC's travel-demand model for equity analysis conducted in June, 2011, an MTC planner stated simply that, "we don't feel like we understand what role race plays [in travel behavior] well enough to include it in our models, so we don't." Later in the same meeting, the planner argued further that race is only a proxy for other more readily observable variables like income and family structure, so the forecasting of racial demographics was actually not necessary. Specifically, the staff member stated, "I would think that issue would be pretty minor – that would be pretty far down my list of concerns at our efficacy of predicting the future."

Some planners have also argued that race should not be considered as a component of a transportation equity analysis. Litman and Brenman (2012, 4) make a distinction between "demographic" characteristics that are "often ambiguous... such as race and age" and "functional" statuses like poverty and disability. They argue that emphasizing functional statuses can help build support for efforts to achieve social equity by not alienating "people who feel that their interests are undervalued, such as low-income people who lack minority status." However, eliminating race from the discussion risks alienating people of color, who bring vitally important diversity and perspectives to regional decision making in the face of MPO boards that generally do not reflect the diversity of their constituencies (Sanchez and Wolf, 2007). From the same public meeting at the MTC noted earlier, one representative of the MTC's Policy Advisory Council reacted strongly to the staff's decision to omit race from modeling efforts,

"We would all agree that ... within the past 10 years at least, more African Americans are unemployed than any other group ... If you make the [modeling] assumptions colorblind, you will not capture what I'm talking about. And so I really think you have to reconsider [using] colorblind models or scenarios to make recommendations."

Race, poverty, ability, and any other category of interest can be assessed in the same equity analysis but by relying on analytical techniques that are not likely to reflect the travel behavior of people of color and actively arguing against the inclusion of racial variables in equity analysis, planning agencies reduce the likelihood

that racially disparate outcomes will be identified and mitigated. These findings also suggest an important manner in which public agencies contribute to racially disparate impacts without racist intent – what has been termed "racism without racists" (Bonilla-Silva, 2003). Intentional discrimination is quite difficult to prove, but the legal claims of private individuals under Title VI and its implementing regulations require that standard to demonstrate a violation in the wake of the Supreme Court's 2001 decision in *Alexander v. Sandoval* (Laufer, 2002). Plaintiffs in *Darensburg v. Metropolitan Transportation Commission* (2011) unsuccessfully alleged that the MTC's regional transit expansion plan, which emphasized investments in rail transit over local bus service, intentionally discriminated against the mostly minority riders of Alameda-Contra Costa Transit (AC Transit). In his opinion concurring with the court's ruling in favor of the MTC, Ninth Circuit Judge John T. Noonan stated that, "An individual bigot may be found, perhaps even a pocket of racists. The notion of a Bay Area board bent on racist goals is a specter that only desperate litigation could entertain" (*Darensburg v. Metropolitan Transportation Commission*, 2011, 524).

While we agree that analytical decisions based on data constraints or a lack of understanding do not provide evidence of racial animus, we also note that the absence of racist intent is not evidence that racially disparate outcomes have been eliminated. The history of transportation planning indicates that particularly lasting decisions regarding the placement of highway and fixed-guideway transit infrastructure were racially motivated (Bayor, 1988; Connerly, 2002; Self, 2003). Moreover, post-World War II freeway construction likely facilitated white flight to the suburbs, contributing to still lingering patterns of segregation (Massey and Denton, 1993). In sum, past decisions undertaken by individuals and supported by institutions continue to shape policies and patterns of transportation funding, despite the absence of racist intent on the part of contemporary planners (Golub et al., 2013).

In the contemporary era, racism rarely manifests through intentional individual acts (Bonilla-Silva, 2003; Pulido, 1996; 2000). Much more relevant is systemic or institutional racism that unfolds over time and space as a result of a variety of individual decisions, policies promulgated by various levels of government and carried out by bureaucracies, and the unique conditions and incentives

produced by changing economic arrangements. The result of these conditions is a set of racially disparate impacts that cannot be traced back to an individual act fueled by the intent to discriminate. In an analysis of historical land use, development, and pollution impacts in Southern California, Pulido (2000) observed that a disparate impact is but one piece of evidence of inequality and begs the larger question – how were whites able to distance themselves from industrial pollution and from people of color? In the case of transportation equity, what conditions have generally led to more favorable transportation, work, and home location outcomes for whites over time? Part of the explanation is the presumed unimportance of race for assessing travel behavior outcomes, and the inadequate treatment of race in equity analyses. Precisely because Title VI jurisprudence sets an incredibly high bar for plaintiffs, transportation planning practice would be well-served by developing equity analysis methods that move beyond current approaches and proactively seek to achieve equitable outcomes. It is to these approaches that we now turn.

## 5. Towards meaningful equity analysis

In order to move beyond traditional equity analysis methods, in this section we describe actions that, if implemented, could dramatically improve the ability of regional planning agencies to address questions of civil rights and racial disparities that accrue slowly over time and space. In addition to the theoretical arguments provided in the previous section, both the Darenburg case and public input received by the MTC since 1998 motivate these recommendations that are related to demographic thresholds and disaggregation, years of analysis and geographic scope, and the determination of equity.

### 5.1. Demographic thresholds and disaggregation

The representation of protected populations using the typical demographic thresholds or cross-tabulations of results based on synthetic populations is one area where several improvements can be implemented. At a minimum, sensitivity analyses using different areal units, threshold definitions, and composite indicators should be conducted to determine the effect of changing each of these properties on equity outcomes. The point is not to adjust units or thresholds until an equitable or inequitable result is found; rather, the *effect of or direction associated with* changing these factors must be incorporated into the analysis and discussed along with the other results. Multiple group permutations should be considered (Levinson, 2002). For example, instead of presenting a single metric of accessibility that is compared between the target and non-target population, a sensitivity analysis would show how accessibility changes as a function of the concentration of people of color in a census tract or TAZ.

While sensitivity analyses could be undertaken using four-step model data, activity-based models increasingly are being used in practice. Work in the early 2000s on equity analysis predicted that the adoption of activity based models would improve transportation equity analysis precisely because these more advanced models would allow the analysis of population segments independent of their geographic location. Moreover, proponents argued that increased behavioral realism allowed better representation of the unique travel patterns associated with low-income and of color populations (Cambridge Systematics, 2002; Forkenbrock and Sheeley, 2004).

Activity based model outputs are wholly disaggregate; they obviate the need to use geographic thresholds. Litman (2002) has noted that disaggregate analyses generally will be more accurate than those calculated based on arbitrary requirements for group

membership, and several academic studies have relied on disaggregate representations of target populations (Bills et al., 2012; Castiglione et al., 2006; Rodier et al., 2010). However, none of these studies considers racial groups, despite their obvious relevance in light of Title VI and environmental justice guidance. Although agency staff have argued that race either need not be included to predict travel outcomes or is too difficult to include, not doing so circumvents the purpose of an equity analysis, which is to assess the benefits and burdens of transportation investments on people of color, low-income people and, potentially, other protected groups. Regardless of whether the racial variable is necessary or desirable for its predictive power, it must be included so that the analysis results can be properly contextualized. In an activity based model, it would be no more difficult to assign race to base-year synthetic population members than it currently is to assign the number of household vehicles or children.

Changing how demographic thresholds are selected and applied would mitigate the ecological and categorical flaws endemic in the traditional approach. It also has the potential to improve the treatment of race by establishing its separation from other protected groups.

### 5.2. Analysis years and geographic scope

Planners have argued that race has both an ambiguous relationship with travel behavior and that forecasting racial demographics is difficult. However, ample racial data are available in the base year and could be employed to guide decision making. In addition to multiple sources available from the U.S. Census, individual agencies have conducted detailed demographic surveys of their populations. Both the MTC and SACOG have prepared reports regarding “lifeline” transit service – those routes vital for linking transit-dependent and low-income individuals to essential destinations. Similar analyses could be undertaken to identify gaps in service for transit-dependent people of color. The MTC has also completed a “Snapshot” analysis of current conditions in the Bay Area that identifies *existing* disparities in communities of concern relative to the region (MTC, 2010c). Both of these data sources could be used to guide RTP development and inform programming decisions embodied in the transportation improvement program (TIP) with the goal of mitigating racial disparities.

The TIP is a list of all transportation projects to be undertaken over a six-year period and is updated by an MPO every two years. Whereas the RTP establishes a long-term vision for the region, the TIP operationalizes that plan in the short term. Presently, the MTC performs a single aspatial equity analysis of its entire TIP every two years (MTC, 2012). Two categories of projects, highway and transit, are considered, but projects are not analyzed individually. The aspatial analysis assumes that benefits for all highway projects and transit projects flow to demographic groups at the county and transit-operator level, respectively, in proportion to their vehicle-miles traveled and ridership. For example, if 30% of Bay Area Rapid Transit (BART) trips are made by people of color, the analysis allocates \$0.30 of each dollar invested in BART to minority populations. Summing over all transit operators facilitates a comparison between the proportion of total transit trips taken by people of color and the proportion of monetary benefits enjoyed. The assumptions on which this analysis lies are demonstrably false; most problematically, transportation benefits accrue to users based on their spatial location and the likelihood that a particular facility will serve their needs, not according to values of mean ridership.

A better approach would be to employ the wealth of available data regarding current highway facility usage and transit ridership, both modeled and revealed. As each TIP is developed, logical groups of synergistic projects could be created and modeled to assess changes on travelers proximate to key access points (e.g.,

interchanges or transit stations). Demographic profiles and metrics of travel behavior better matched to the TIP period are likely to reflect existing disparities with a relatively higher degree of certainty. Using such approaches, equity would be judged by the extent to which lifeline services receive funding or existing disparities are mitigated in the short term.

Supplementing the standard, long-range forecasting approach with nearer-term analyses allows for adaptive responses that can help to guard against unexpected incremental inequities that lock in larger effects, potentially improving the analytical treatment of race. Conducting these types of analyses would also serve to increase responsiveness to public input. For example, comments on the MTC's 2009 RTP equity analysis indicated too little focus on the identification and mitigation of existing inequity (MTC, 2009, 48). During the 2013 RTP update, participants in an equity working group convened by MTC (Imai et al., 2012) requested that,

“information about [the] MTC's transportation improvement program (what projects will be funded in the RTP and when), as well as the results of the corresponding Equity and [performance measures] Analysis, be disaggregated into five-year increments.”

### 5.3. Definition and determination of equity

Even with good implementation of the earlier suggestions, the working definition of equity employed by an agency can influence whether analysis results demonstrate equity or inequity. In many cases, the way in which equity is defined is unstated. As Martens et al. (2012) note, in typical regional equity analyses, base year or existing disparities in a particular indicator are considered to be unimportant, as long as the change from the base year to the forecast year is similar for the target and non-target populations. For example, if planned transportation improvements increase access to low-income jobs by 10% for the target population and 9% for the non-target population from the base year to the forecast year, each group has received some benefit and the improvements could be considered equitable. In this approach, starting disparities are not accounted for, and there is no standard for identifying a future disparate impact. Since an RTP generally forecasts increasing jobs and population, accessibility benefits typically will accrue to all population segments, ensuring that the commonly employed definition of equity is of questionable utility (Sanchez, 2008).

One means of improving how we define equity is to use the approach of Martens et al. (2012), which relies on theories of justice to support a “maximax” criterion to guide investments that would maximize average access while limiting the maximum gap in accessibility between the lowest- and highest-accessibility groups. One way to operationalize equity in this approach would be to use measures of dispersion like the Gini mean difference (GMD) to provide a single summary statistic across the entire population (see Levinson (2002) for an application of Gini-type metrics).

In this approach, future year scenarios would be judged equitable if improvements in that indicator (e.g., reductions in the GMD) did not come at the expense of worsening conditions for underserved populations. One way to ensure improvements would be to identify inequities in the base year and redress them in an RTP, and as a means for adapting each TIP to changing circumstances. Since programming decisions ultimately locate or improve transportation systems located in space, this would involve targeting investments to specific locations for maximum equity impact. Some observers have described this approach as the true purpose of equity analyses (Golub et al., 2013; Holifield, 2004; Sanchez, 2008). Here, the *a priori* identification of communities based on neighborhood effects-type indicators would be appropriate to

ensure that investments flow to areas of concentrated disadvantage. Alternately, measures of individual accessibility could be employed based on either modeled travel behavior or travel survey data (Geurs and van Wee, 2004; Kwan and Weber, 2003). Páez et al. (2010, 2012) demonstrate how such metrics can be calculated and mapped for particular disadvantaged groups, highlighting parts of the region with relatively inferior transportation outcomes. To the extent that improvements are targeted to such areas, more equitable systems will emerge.

Adopting a definition of equity that includes reducing disparities in performance measures will dramatically improve the practice of equity analysis. Ecological and categorical flaws are sidestepped because determining equity does not rely on arbitrarily dividing a region into two groups of areal units. In order to ensure improvements in the metric, MPOs actually will have to target investments to particular areas. This approach would also be responsive to public input because it explicitly seeks to redress existing inequity.

## 6. Conclusions

One of the most significant gaps in transportation planning is the lack of a coherent and rigorous framework within which equity analyses can be conducted. This paper fills that gap by bringing together major research from disparate fields in a critical review of transportation plan equity analysis. With reference to relevant law and regulatory agency guidance, we find that in the absence of detailed guidance on how to conduct equity analysis, transportation planning agencies have developed simple methods to study the impact of undesirable land uses on vulnerable populations; however, because of the differences between measures of transportation system benefits (e.g., mobility and accessibility) and land-use impacts, these methods are not insightful and do not readily identify inequities, either current or forecasted.

Further, we find that transportation planning agencies have not implemented theoretical advances from transport geography relating to the measurement of accessibility or taken full advantage of the computational and data-rich potential of activity based models. These failures have implications for the analysis of civil rights and equity. As a result, existing methods cannot be used to ensure that performance results reflect the experiences of disadvantaged populations in a region, nor can they ensure that mitigating actions will have the desired effect.

Future work should test empirically the suggestions proffered in this paper using both four-step and activity based travel-demand model output. These analyses will identify those aspects of regional equity analysis most in need of revision. Implementing the recommendations described herein, including short-term analyses aligned with the TIP period using data on race, and using the results to guide transportation investment decisions, has the potential to move the needle on transportation equity, consistent with relevant transportation law and guidance. The likelihood of progress depends critically upon better linking improved analytical results to decision making (Holifield, 2004; Innes and Gruber, 2005) and fostering critical thinking regarding race among transportation planners and the public.

The public plays an important role in the achievement of transportation equity, and public participation forms the cornerstone of MPO environmental justice strategy (e.g., DVRPC, 2010; MTC, 2010a). But precisely what role the public plays when arcane, technical issues of transportation and equity modeling are at issue is as yet unclear. Soliciting public input on alternative project designs including number of lanes, alignment, and mitigations is sensible; individuals can draw from their experiences with the transportation system to inform their participation. Similarly, members of

the public generally can lend their input to broad packages of choices embodied in regional transportation scenarios.

The public is less well-suited to provide input on specific analytical decisions related to transportation performance analysis. At the MTC, members of the public requested additional analyses of existing inequity, but did not make specific recommendations or requests regarding threshold definition and the treatment of race, for example. The technical and expert nature of travel-demand modeling forecloses important forms of participation, yet regional transportation planning and decision making relies heavily on model results. The onus thus falls on regional planners to ensure that analytical practices are current and results meaningful. According to Brenman and Sanchez (2012), this requires results that reveal new conclusions rather than justify those that are predetermined.

This article indicates, however, that prevailing methods of equity analysis are more likely to obfuscate than to reveal and that there are no standards for agencies to follow in order to complete a rigorous equity analysis. Although the MTC has received analytical recommendations over several RTP cycles – for example, to identify existing disparities – its methods did not change. These findings suggest a need for new models of transparency and accountability. Openly sharing data and code generated during regional planning would relieve pressure on agency staff to conduct the analyses demanded by the public, allowing researchers the opportunity to complete them. Under this open-source model, academics could collaborate with interested members of the public to provide supplementary analyses in addition to those created by the agency, enhancing the integrity and openness of the public process and contributing to a fruitful dialogue on transportation equity.

## Acknowledgements

The research was supported in part by The California Endowment and the Sustainable Transportation Center at the University of California, Davis. The latter organization receives funding from the U.S. Department of Transportation and the California Department of Transportation, through the University Transportation Centers program. The views expressed herein are the authors' alone and do not reflect those of any agency. The authors thank Jonathan London, three anonymous reviewers, and Associate Editor David Keeling for helpful comments on the paper.

## References

- Amekudzi, A., Meyer, M., 2006. Considering the environment in transportation planning: review of emerging paradigms and practice in the United States. *Journal of Urban Planning and Development* 132 (1), 42–52.
- Bayor, R.H., 1988. Roads to racial segregation: Atlanta in the twentieth century. *Journal of Urban History* 15 (1), 3–21.
- Bills, T., Sall, E., Walker, J.L., 2012. Activity-based travel demand models and transportation equity analysis: research directions and an exploration of model performance. *Transportation Research Record* 2320, 18–27.
- Blumenberg, E., Manville, M., 2004. Beyond the spatial mismatch: welfare recipients and transportation policy. *Journal of Planning Literature* 19 (2), 182–205.
- Bonilla-Silva, E., 2003. *Racism without Racists*. Rowman & Littlefield, New York.
- Brenman, M., Sanchez, T.W., 2012. *Planning as if People Matter: Governing for Social Equity*. Island Press, Washington, DC.
- Bullard, R.D., 2004. The anatomy of transportation racism. In: Bullard, R.D., Johnson, G.S., Torres, A.O. (Eds.), *Highway Robbery: Transportation Racism and New Routes to Equity*. South End Press, Cambridge, MA, pp. 15–32.
- Caltrans (California Department of Transportation), 2003. *Environmental Justice in Transportation Planning and Investments – Desk Guide*. Caltrans, Sacramento, CA.
- Cambridge Systematics, 2002. *Technical Methods to Support Analysis of Environmental Justice Issues*. National Cooperative Highway Research Program, Washington, DC.
- Castiglione, J., Hiatt, R., Chang, T., Charlton, B., 2006. Application of travel demand microsimulation model for equity analysis. *Transportation Research Record* 1977, 35–42.
- Chavis, B.E., Lee, C., 1987. *Toxic Wastes and Race in the United States*. Commission for Racial Justice: United Church of Christ, New York.
- Chung, C., Myers Jr., S.L., Saunders, L., 2001. Racial differences in transportation access to employment in Chicago and Los Angeles, 1980 and 1990. *The American Economic Review* 91 (2), 174–177.
- Clinton, W.J., 1994. Federal actions to address environmental justice in minority populations and low-income populations. *Federal Register* 59 (32), 7629–7633.
- Connerly, C.E., 2002. From racial zoning to community empowerment: the Interstate Highway System and the African American community in Birmingham, Alabama. *Journal of Planning Education and Research* 22 (2), 99–114.
- CEQ (Council on Environmental Quality), 1997. *Environmental Justice Guidance under the National Environmental Policy Act*. Executive Office of the President, Washington, DC.
- Darensburg v. Metropolitan Transportation Commission, 2011. 636 F.3d 511 (9th Circuit).
- Dilger, R.J., 1992. ISTEA: a new direction for transportation policy. *Publius: The Journal of Federalism* 22 (3), 67–78.
- Duthie, J., Cervenka, K., Waller, S., 2007. Environmental justice analysis: challenges for metropolitan transportation planning. *Transportation Research Record* 2013, 8–12.
- DVRPC (Delaware Valley Regional Planning Commission), 2010. *Planner's Methodology*. DVRPC, Philadelphia, PA.
- FHWA (Federal Highway Administration), 2000. *An Overview of Transportation and Environmental Justice*. <<http://www.fhwa.dot.gov/environment/ej2000.pdf>> (accessed 08.07.13).
- FHWA (Federal Highway Administration), 2012a. *FHWA Actions to Address Environmental Justice in Minority Populations and Low-income Populations (Order 6640.23A)*. U.S. Department of Transportation, Washington, DC.
- FHWA (Federal Highway Administration), 2012b. *Nondiscrimination: Title VI and Environmental Justice*. <[http://www.fhwa.dot.gov/environment/environmental\\_justice/facts/index.cfm](http://www.fhwa.dot.gov/environment/environmental_justice/facts/index.cfm)> (accessed 08.07.13).
- FHWA/FTA (Federal Highway Administration/Federal Transit Administration), 1999. *Implementing the Title VI Requirements in Metropolitan and Statewide Planning*. U.S. Department of Transportation, Washington, DC.
- FTA (Federal Transit Administration), 2007. *Title VI and Title VI-dependent Guidelines for Federal Transit Administration Recipients (FTA C 4702.1A)*. U.S. Department of Transportation, Washington, DC.
- FTA (Federal Transit Administration), 2011. *Proposed Circular FTA C 4703.1: Environmental Justice Policy Guidance for Federal Transit Administration Recipients*. U.S. Department of Transportation, Washington, DC.
- FTA (Federal Transit Administration), 2012a. *Circular FTA C 4702.1B: Title VI Requirements and Guidelines for Federal Transit Administration Recipients*. U.S. Department of Transportation, Washington, DC.
- FTA (Federal Transit Administration), 2012b. *Circular FTA C 4703.1: Environmental Justice Policy Guidance for Federal Transit Administration Recipients*. U.S. Department of Transportation, Washington, DC.
- Forkenbrock, D.J., Sheeley, J., 2004. *Effective Methods for Environmental Justice Assessment*. National Cooperative Highway Research Program, Washington, DC.
- Foth, N., Manaugh, K., El-Geneidy, A.M., 2013. Towards equitable transit: examining transit accessibility and social need in Toronto, Canada, 1996–2006. *Journal of Transport Geography* 29, 1–10.
- Geurs, K.T., van Wee, B., 2004. Accessibility evaluation of land-use and transport strategies: review and research directions. *Journal of Transport Geography* 12 (2), 127–140.
- Giuliano, G., 2000. Residential location differences in people of color. In: Batelle (Ed.), *Travel Patterns of People of Color*. U.S. Department of Transportation, Washington, DC, pp. 91–136.
- Giuliano, G., 2003. Travel, location and race/ethnicity. *Transportation Research Part A: Policy and Practice* 37 (4), 351–372.
- Gobillon, L., Selod, H., Zenou, Y., 2007. The mechanisms of spatial mismatch. *Urban Studies* 44 (12), 2401–2427.
- Golub, A., Marcantonio, R.A., Sanchez, T.W., 2013. Race, space, and struggles for mobility: transportation impacts on African Americans in Oakland and the East Bay. *Urban Geography* 34 (5), 699–728.
- Golub, A., Robinson, G., Nee, B., in press. Making accessibility analyses accessible: a tool to facilitate the public review of the effects of regional transportation plans on accessibility. *Journal of Transport and Land Use* 6 (3).
- Grengs, J., 2001. Does public transit counteract the segregation of careless households? Measuring spatial patterns of accessibility. *Transportation Research Record* 1753, 3–10.
- Grengs, J., 2002. Community-based planning as a source of political change: the transit equity movement of Los Angeles' bus riders union. *Journal of the American Planning Association* 68 (2), 165–178.
- Grengs, J., 2010. Job accessibility and the modal mismatch in Detroit. *Journal of Transport Geography* 18 (1), 42–54.
- Handy, S., 2008. Regional transportation planning in the US: an examination of changes in technical aspects of the planning process in response to changing goals. *Transport Policy* 15 (2), 113–126.
- Hanson, S., Kwan, M.-P., 2008. Introduction. In: Hanson, S., Kwan, M.-P. (Eds.), *Transport: Critical Essays in Human Geography*. Ashgate, Burlington, VT, pp. xiii–xv.
- Holifield, R., 2004. Neoliberalism and environmental justice in the United States Environmental Protection Agency: translating policy into managerial practice in hazardous waste remediation. *Geoforum* 35 (3), 285–297.
- Holifield, R., 2012. The elusive environmental justice area: three waves of policy in the U.S. Environmental Protection Agency. *Environmental Justice* 5 (6), 293–297.

- Ihlanfeldt, K.R., Sjoquist, D.L., 1998. The spatial mismatch hypothesis: a review of recent studies and their implications for welfare reform. *Housing Policy Debate* 9 (4), 849–892.
- Imai, L., Fatehi-Weeks, P., Bhatia, R., Karner, A., 2012. Email to Jennifer Yeamans, MTC (Personal Communication, March 8).
- Innes, J.E., Gruber, J., 2005. Planning styles in conflict: the metropolitan transportation commission. *Journal of the American Planning Association* 71 (2), 177–188.
- Johnston-Anumonwo, I., 2000. Commuting constraints on black women: evidence from Detroit, Michigan. *The Great Lakes Geographer* 7 (2), 66–75.
- Kain, J.F., 1968. Housing segregation, Negro employment, and metropolitan decentralization. *The Quarterly Journal of Economics* 82 (2), 175–197.
- Kawabata, M., Shen, Q., 2007. Commuting inequality between cars and public transit: the case of the San Francisco Bay Area, 1990–2000. *Urban Studies* 44 (9), 1759–1780.
- Khisty, C., 1996. Operationalizing concepts of equity for public project investments. *Transportation Research Record* 1559, 94–99.
- Kockelman, K., 1997. Travel behavior as function of accessibility, land use mixing, and land use balance: evidence from San Francisco Bay Area. *Transportation Research Record* 1607, 116–125.
- Kwan, M.-P., 1998. Space-time and integral measures of individual accessibility: a comparative analysis using a point-based framework. *Geographical Analysis* 30 (3), 191–216.
- Kwan, M.-P., Weber, J., 2003. Individual accessibility revisited: implications for geographical analysis in the twenty-first century. *Geographical Analysis* 35 (4), 341–353.
- Laufer, J.A., 2002. Alexander v. Sandoval and its implications for disparate impact regimes. *Columbia Law Review* 102 (6), 1613–1658.
- Levinson, D., 2002. Identifying winners and losers in transportation. *Transportation Research Record* 1812, 179–185.
- Litman, T., 2002. Evaluating transportation equity. *World Transport Policy & Practice* 8 (2), 50–65.
- Litman, T., Brenman, M., 2012. A New Social Equity Agenda for Sustainable Transportation. Victoria Transport Policy Institute, Victoria, BC.
- Liu, F., 2000. *Environmental Justice Analysis: Theories, Methods, and Practice*. Lewis Publishers, Boca Raton, FL.
- Martens, K., Golub, A., Robinson, G., 2012. A justice-theoretic approach to the distribution of transportation benefits: implications for transportation planning practice in the United States. *Transportation Research Part A: Policy and Practice* 46 (4), 684–695.
- Massey, D.S., Denton, N.A., 1993. *American Apartheid: Segregation and the Making of the Underclass*. Harvard University Press, Cambridge, MA.
- Mohl, R.A., 2004. Stop the road: freeway revolts in American cities. *Journal of Urban History* 30 (5), 674–706.
- Most, M.T., Sengupta, R., Burgener, M.A., 2004. Spatial scale and population assignment choices in environmental justice analyses. *The Professional Geographer* 56 (4), 574–586.
- MTC (Metropolitan Transportation Commission), 2009. *Equity Analysis Report: Transportation 2035 Plan for the San Francisco Bay Area*. MTC, Oakland, CA.
- MTC (Metropolitan Transportation Commission), 2010. *Public Participation Plan for the San Francisco Bay Area*. MTC, Oakland, CA.
- MTC (Metropolitan Transportation Commission), 2010b. *Response to the Federal Transit Administration Circular 4702.1A Regarding Title VI of the Civil Rights Act of 1964: MTC 2010 Compliance Report*. MTC, Oakland, CA.
- MTC (Metropolitan Transportation Commission), 2010c. *Snapshot Analysis Development Report*. MTC, Oakland, CA.
- MTC (Metropolitan Transportation Commission), 2012. *Draft 2013 TIP Investment Analysis: Focus on Low-income and Minority Communities*. <[http://www.mtc.ca.gov/funding/tip/2013/5\\_TIP\\_Investment\\_Analysis\\_Report.pdf](http://www.mtc.ca.gov/funding/tip/2013/5_TIP_Investment_Analysis_Report.pdf)> (July 8, 2013).
- MTC/ABAG (Metropolitan Transportation Commission and Association of Bay Area Governments), 2013. *Draft Equity Analysis Report*. MTC/ABAG, Oakland, CA.
- Páez, A., Scott, D.M., Morency, C., 2012. Measuring accessibility: positive and normative implementations of various accessibility indicators. *Journal of Transport Geography* 25, 141–153.
- Páez, A., Gertes Mercado, R., Farber, S., Morency, C., Roorda, M., 2010. Relative accessibility deprivation indicators for urban settings: definitions and application to food deserts in Montreal. *Urban Studies* 47 (7), 1415–1438.
- Parks, V., 2004. Access to work: the effects of spatial and social accessibility on unemployment for native-born black and immigrant women in Los Angeles. *Economic Geography* 80 (2), 141–172.
- Pfeffer, N., Wen, F., Ikhata, H., Gosnell, J., 2002. Environmental justice in the transportation planning process: southern California perspective. *Transportation Research Record* 1792, 36–43.
- PSRC (Puget Sound Regional Council), 2012. *Title VI Plan*. PSRC, Seattle, WA.
- Public Advocates, 2011. *Comments of 30 Organizations and Prof. T. Sanchez et al. On FTA Title VI and EJ Circulars*. <<http://publicadvocates.org/document/comments-of-30-organizations-and-prof-t-sanchez-et-al-on-fta-title-vi-and-ej-circulars>> (accessed 08.07.13).
- Pucher, J., 1982. Discrimination in mass transit. *Journal of the American Planning Association* 48 (3), 315–326.
- Pulido, L., 1996. A critical review of the methodology of environmental racism research. *Antipode* 28 (2), 142–159.
- Pulido, L., 2000. Rethinking environmental racism: white privilege and urban development in southern California. *Annals of the Association of American Geographers* 90 (1), 12–40.
- Raphael, S., 1998. The spatial mismatch hypothesis and black youth joblessness: evidence from the San Francisco Bay Area. *Journal of Urban Economics* 43 (1), 79–111.
- Rodier, C., Abraham, J.E., Dix, B.N., Hunt, J.D., 2010. *Equity Analysis of Land Use and Transport Plans using an Integrated Spatial Model*. Mineta Transportation Institute, San José, CA.
- Sampson, R.J., Morenoff, J.D., Gannon-Rowley, T., 2002. Assessing “neighborhood effects”: social processes and new directions in research. *Annual Review of Sociology* 28, 443–478.
- Sanchez, T., 2008. *Expert Report of Prof. Thomas W. Sanchez*. <<http://www.publicadvocates.org/document/expert-report-of-prof-thomas-w-sanchez-filed-april-1-2008>> (accessed 08.07.13).
- Sanchez, T., Brenman, M., 2007. *The Right to Transportation: Moving to Equity*. APA Planners Press, Chicago, IL.
- Sanchez, T., Stolz, R., Ma, J.S., 2003. *Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities*. The Civil Rights Project at Harvard University, Cambridge, MA.
- Sanchez, T.W., Wolf, J., 2007. Environmental justice and transportation equity: a review of MPOs. In: Bullard, R.D. (Ed.), *Growing Smarter: Achieving Livable Communities, Environmental Justice, and Regional Equity*. MIT Press, Cambridge, MA, pp. 249–272.
- Self, R.O., 2003. *American Babylon: Race and the Struggle for Postwar Oakland*. Princeton University Press, Princeton, NJ.
- Stoll, M.A., Covington, K., 2012. Explaining racial/ethnic gaps in spatial mismatch in the US: the primacy of racial segregation. *Urban Studies* 49 (11), 2501–2521.
- Taylor, B.D., Ong, P.M., 1995. Spatial mismatch or automobile mismatch? An examination of race, residence and commuting in US metropolitan areas. *Urban Studies* 32 (9), 1453–1473.
- UMTA (Urban Mass Transportation Administration), 1988. *Title VI Program Guidelines for Urban Mass Transportation Administration Recipients (UMTA C 4702.1)*. U.S. Department of Transportation, Washington, DC.
- USDOT (U.S. Department of Transportation), 1997. *Department of Transportation (DOT) order to address environmental justice in minority populations and low-income populations*. *Federal Register* 62 (72), 18377–18381.
- Wells, K., Thill, J.-C., 2012. Do transit-dependent neighborhoods receive inferior bus access? A neighborhood analysis in four U.S. cities. *Journal of Urban Affairs* 34 (1), 43–63.
- Zax, J.S., 1990. Race and commutes. *Journal of Urban Economics* 28 (3), 336–348.