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Transportation Planning and Regional Equity: History, Policy and Practice

September 2012

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Transportation Planning and Regional Equity: History, Policy, and Practice

By

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B.A.Sc. (University of Toronto) 2006
M.S. (University of California, Davis) 2008

DISSERTATION

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Abstract

This dissertation investigates regional transportation planning in California from 1967 through the contemporary era, identifying advocates for regional equity as important actors for achieving desired planning outcomes including climate change mitigation. It begins with the creation of the California Department of Transportation (Caltrans). Replacing its predecessor organization in 1973, the creation of Caltrans was thought to signal the beginning of multimodalism in state transportation policy. Opposition from the public and the legislature to this new direction led to the establishment of regional transportation planning organizations that actually located authority at the local (city and county) level. California's transportation policy goals embodied in the contemporary Senate Bill (SB) 375 are similar to those of the 1970s – reducing vehicle-miles traveled through the promotion of compact urban forms – but the institutional arrangements established in the 1970s make progress difficult to achieve. Regional equity advocates are emerging as an important constituency in this fraught planning landscape. Buoyed by foundation funding and federal legislation enacted beginning with Title VI of 1964's Civil Rights Act, these advocates are seeking to ensure that agencies meet planning goals where the law is insufficiently prescriptive. A key method by which advocates access the planning process is through the "equity analysis" of regional transportation plans. A critical review of equity analysis practice reveals standard methods that are not responsive to public input and do not take advantage of recent developments in activity-based travel demand modeling. Improved methods are proposed that are developed in collaboration with equity advocates. Although these improvements will not ensure equitable outcomes, they are more likely to highlight existing inequities, more accurately reflect the concerns of advocates, and could be deployed nationwide.

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One does not complete a doctoral program without accumulating a number of academic and personal debts. I wish to thank those who opened my eyes to the inherent beauty and potential of civil engineering: Michael P. Collins and Paul Gauvreau. Later mentors at the University of Toronto, Willem Vanderburg and Heather MacLean, encouraged me to consider more than then the immediate design task. Under their guidance I learned to consider the broader effects of engineering activities on human life and the environment. Coffee with Reihane Marzoughi and Antonio Antonopoulos, then at the Center for Technology and Social Development, were also particularly influential in this regard.

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Academic life is not all academics, of course. My partner, Kaya de Barbaro, has continually provided essential emotional support, research consulting services, and excitement. Neither my work nor my non-work life would be the same without her.

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List of acronyms

AB	Assembly bill
ABAG	Association of Bay Area Governments
BPR	Bureau of Public Roads
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CHC	California Highway Commission
CMA	Congestion management agency
CMP	Congestion management plan
COG	Council of governments
CTC	California Transportation Commission
DEIR	Draft environmental impact report
DOT	Department of Transportation
EIR	Environmental impact report
EO	Executive order
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GHG	Greenhouse gas
GMD	Gini mean difference
HOV	High occupancy vehicle
HUD	US Department of Housing and Urban Development
ISTEA	Intermodal Surface Transportation Efficiency Act
MAP-21	Moving Ahead for Progress in the 21st Century
MCAC	Minority Citizens Advisory Committee
MPO	Metropolitan Planning Organization
MTC	Metropolitan Transportation Commission
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
REWG	Regional Equity Working Group
RTEP	Regional Transit Expansion Program
RTIP	Regional transportation improvement program
RTP	Regional transportation plan
RTPA	Regional transportation planning agency
SACOG	Sacramento Area Council of Governments
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SB	Senate bill
SCS	Sustainable communities strategy
SGC	Strategic Growth Council
SJV	San Joaquin Valley

STIP	State transportation improvement program
STPP	Surface Transportation Policy Project
TAZ	Traffic/Transportation analysis zone
TDA	Transportation Development Act
TIP	Transportation improvement program
TRANSDEF	Transportation Solutions Defense and Education Fund
UMTA	Urban Mass Transportation Administration
VMT	Vehicle-miles traveled

INTRODUCTION

The "region" has emerged as the favored scale at which to enact comprehensive transportation and land use planning. Beginning with efforts undertaken in the early 20th century, a series of federal and state laws and the work of business and non-profit advocacy organizations have consistently emphasized the transcendence of municipal boundaries for achieving growth management, integrating land use and transportation planning, and mitigating inequities between urban and rural, inner city and suburb, and thereby achieving economic prosperity.[1]

California's first-in-the-nation climate change legislation, the California Global Warming Solutions Act of 2006 (AB 32) requires greenhouse gas (GHG) emissions reductions to result from the coordination of transportation and land use planning.[2] These reductions are expected to stem from a companion bill, the Sustainable Communities and Climate Protection Act (SB 375). Passed in 2008, SB 375 requires metropolitan planning organizations (MPOs) to achieve per-capita reductions in transport GHG emissions by producing a new component of the regional transportation plan – a sustainable communities strategy (SCS). The SCS must lay out a long term strategy for reducing vehicle-miles traveled, ostensibly by planning for increased housing density near high quality transit, mixed land uses, and other transportation policies like pricing.

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[1] Stephanie Pincetl, "The Regional Management of Growth in California: A History of Failure," *International Journal of Urban and Regional Research* 18, no. 2 (1994); Manuel Pastor et al., *Regions That Work: How Cities and Suburbs Can Grow Together* (Minneapolis, MN: University of Minnesota Press, 2000); Scott A. Bollens, "In through the Back Door: Social Equity and Regional Governance," *Housing Policy Debate* 13, no. 4 (2002).

[2] CARB, "Climate Change Scoping Plan: A Framework for Change," (Sacramento, CA: California Air Resources Board, 2008); ———, "California Greenhouse Gas Inventory for 2000-2008," http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_00-08_2010-05-12.pdf.

MPOs are regional transportation planning agencies whose primary responsibility is to periodically adopt and update a short-term transportation improvement program and a long-range regional transportation plan that includes an overall vision for the interactions between public transit, highways, aviation, maritime shipping, and non-motorized modes. First established during the 1960s as a precondition for receiving federal transportation funding and gradually endowed with additional authority through state and federal legislation, the MPO still does not lend itself to authoritative decision making in the integrated transportation and land use arena. Parochialism generally prevails on MPO governing boards as they are composed of local elected officials that find it difficult to take regional actions that would contravene their local interests and state legislation has generally empowered the county under the guise of the region since the late 1970s.[3] Further, changes in transportation finance that have resulted in an increased reliance on bonded debt and local sales tax initiatives administered by counties make it difficult for comprehensive regional plans to be enacted.[4] The contrasting emphases of state and federal legislation with respect to planning authority also work against each other. Since the Intermodal Surface Transportation Act (ISTEA) of 1991, the federal government has

[3] Paul G. Lewis and Mary Sprague, *Federal Transportation Policy and the Role of Metropolitan Planning Organizations in California* (Sacramento, CA: Public Policy Institute of California, 1997); Arthur Nelson et al., "Metropolitan Planning Organization Voting Structure and Transit Investment Bias: Preliminary Analysis with Social Equity Implications," *Transportation Research Record* 1895(2004); Elisabeth R. Gerber and Clark C. Gibson, "Balancing Regionalism and Localism: How Institutions and Incentives Shape American Transportation Policy," *American Journal of Political Science* 53, no. 3 (2009).
[4] Todd Goldman and Martin Wachs, "A Quiet Revolution in Transportation Finance: The Rise of Local Option Transportation Taxes," *Transportation Quarterly* 57, no. 1 (2003).

favored the empowerment of regional governments while trends at the state level have emphasized subregional structures.[5]

This indictment of MPOs bodes ill for SB 375,[6] yet an additional factor is also highly relevant and is increasing the importance and visibility of the region and therefore the likelihood that SB 375's goals will be met. Social movements for regional equity have become increasingly vocal since the early 1990s, drawing attention to the production of inequality across regions resulting in part from differential investments in transportation systems patronized by people of color riders, the location and quantity of affordable housing produced, segregation and associated reductions in residential mobility, and gentrification and displacement resulting from transit oriented development.[7] Drawing inspiration from earlier movements for environmental justice that emphasized the disproportionate environmental and quality of life burdens faced by communities of color and low-income,[8] these movements are scaling up their advocacy and their analysis in an attempt to build vertical power or the ability to have meaningful input into the decisions that affect their lives. Vertical power is defined in reference to horizontal power which

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[5] Elisa Barbour, *Metropolitan Growth Planning in California, 1900-2000* (San Francisco, CA: Public Policy Institute of California, 2002).
[6] See, e.g., Deb Niemeier, Ryken Grattet, and Thomas Beamish, "Kicking the Can Down the Road: Blueprinting for Climate Change," (Working paper, 2011).
[7] Joe Grengs, "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, no. 2 (2002); Manuel Pastor, Chris Benner, and Martha Matsuoka, *This Could Be the Start of Something Big: How Social Movements for Regional Equity Are Reshaping Metropolitan America* (Ithaca, NY: Cornell University Press, 2009); Stephanie Pollack, Barry Bluestone, and Chase Billingham, "Maintaining Diversity in America's Transit-Rich Neighborhoods," (Dukakis Center for Urban and Regional Policy, 2010); Aaron Golub, Tom Sanchez, and Richard Marcantonio, "Race, Space and Struggles for Mobility in the East Bay of the San Francisco Bay Area," (Working paper, 2012).
[8] Eileen McGurty, *Transforming Environmentalism: Warren County, PCBs, and the Origins of Environmental Justice* (New Brunswick, NJ: Rutgers University Press, 2007).

emphasizes collaboration between groups at the same level of authority; for example civil society actors like non-profits as opposed to state actors like MPOs.[9]

As the governmental manifestation of the region, MPOs have become a favored target for these advocacy efforts of regional equity actors, but despite over a decade of activism, these actors continue to encounter substantial difficulty in achieving their goals. This dissertation explains these difficulties with reference to the history of regional planning institutions in California, and the lack of prescribed standards by which to analyze the equity of regional transportation plans despite the requirement under federal law that MPOs not discriminate in their funding allocations.

Chapter 1 describes efforts undertaken by the state of California in the early 1970s to engender a multimodal state department of transportation that would implement a statewide transportation plan. Regional reformers at that time struggled with their desire to maintain control of transportation planning at the state-level in contrast to the emerging legislative priorities of the National Environmental Policy Act that demanded more local participation. A series of concrete policy initiatives led by the California Department of Transportation (Caltrans) to reform transportation planning were met with disdain from the legislature and the public, faith in engineers to solve urban problems had been dashed, and the region was signaled as the appropriate level of government to solve urban problems by the California legislature in 1979 with the passage of Assembly Bill 402. The locus of planning authority that emerged at this time was labeled regional but

[9] Margaret Weir, Jane Rongerude, and Christopher K. Ansell, "Collaboration Is Not Enough: Virtuous Cycles of Reform in Transportation Policy," *Urban Affairs Review* 44, no. 4 (2009).

actually reflected a consolidation of power at the county level, a trend that continued with subsequent state transportation policy actions until SB 375.

Chapter 2 covers developments in transportation policy after 1977 and continuing until SB 375, bridging the gap between Chapter 1 and the remainder of the work. Importantly, the trend toward empowering local transportation agencies begun in Chapter 1 continued into the 1990s. Chapter 2 explains why, despite enjoying relatively less authority than local agencies, MPOs became a focal point for advocacy efforts. Federal law that broadened the purview of MPOs and expanded opportunities for public participation combined with the intransigence of local agencies, the continuing vision of the region as a decision making arena free from parochialism, and the need for a regional scale to describe inequity all contributed to this emphasis.

SB 375 also turns toward the region, despite the traditional state focus on subregional entities, but it offers no substantive reform of the underlying planning institutions. As Weir points out, a piece of legislation like SB 375 is only the first step towards reform.[10] A constellation of other factors must come together to support the policy otherwise it will not succeed. In the case of SB 375, foundation funding from The California Endowment and other state foundations, a series of Sustainable Communities awards overseen by the US Departments of Transportation and Housing and Urban Development as well as the Environmental Protection Agency, and an increasingly sophisticated group of regional equity advocates including Urban Habitat, Public Advocates, Inc., TransForm, and ClimatePlan are all functioning as indispensable components of the process of reform in transportation and land use policy in the state.

[10] Ibid.

Chapter 2 closes by describing the barrier to the efforts of these groups by the instrument prescribed for the implementation of SB 375 – travel demand models. In order to comply with SB 375, agencies must demonstrate their compliance with a per capita greenhouse gas emissions target for two future years. As a result, much effort has been placed on improving the behavioral realism of modeled estimates. Some observers have even cited limitations with existing models as the primary barrier to successful SB 375 implementation.[11] Because of the importance of models for SB 375, and their historic importance in transportation planning, these models are also used to assess the equity of regional transportation plans.

Chapter 3 provides a comprehensive review of the MPO's role in achieving equity outcomes and the law and executive agency guidance that MPOs must follow when analyzing their regional plans including Title VI of the 1964 Civil Rights Act that mandates nondiscrimination on the basis of race at agencies that receive federal funding. The chapter finds that in the absence of specific guidance, agencies have developed approaches based on traditional environmental justice analysis that studies the demographics exposed to locally undesirable land uses. These are generally not appropriate for the study of regional transportation plans. Because of the complexity of travel demand models, however, regional equity advocates have previously accepted the agency's framework and their input has been generally limited to providing input on the particular metrics used by the agency. These groups are demanding more information and analysis focused on the identification of racial disparities and mitigation of current

[11] See, e.g., Juan Matute, "Measuring Progress toward Transportation GHG Goals," (UCLA Luskin Center Working Paper, 2011).

inequities, consistent with recent analyses that argue for an explicit and normative definition of equity to guide regional agency practice.[12] A focus on future year forecasts at the agencies distracts from measures that could be undertaken using base year data to reflect differences in racial outcomes and to improve equity analyses.

Chapter 4 employs travel demand modeling data obtained from the Metropolitan Transportation Commission and their 2013 RTP/SCS *Plan Bay Area* to test the implications of Chapter 3. Traditionally advocates have accessed the decision making process via public participation – attending public meetings and workshops, submitting written comments that were often ignored. The work summarized in Chapter 3 is based on the principles of action research wherein research questions and results are iteratively developed and shared with the beneficiaries of the work.[13] The results were shared in a series of memoranda submitted to Public Advocates, Inc. a civil rights law firm.[14]

By comparing the results from disaggregate activity-based data to those based on geographic aggregations, the results elucidate the shortcomings of traditional analysis techniques. Specifically, combining multiple protected populations (e.g. transit dependent populations, people of color, seniors) under a single geographic definition is likely to obscure critical differences between groups. Further, the standard approach combines all modes to report a single regional average. This method is unlikely to reflect important differences by mode and within specific transit modes. Relevant litigation is discussed in

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[12] Karel Martens, Aaron Golub, and Glenn Robinson, "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, no. 4 (2012).
[13] See, e.g, Hilary Bradbury and Peter Reason, "Action Research: An Opportunity for Revitalizing Research Purpose and Practices," *Qualitative Social Work* 2, no. 2 (2003).
[14] Appendix B contains copies of all such memoranda.

Chapter 3 that also emphasizes the importance of distinguishing between modes in the analysis.

Chapter 4 ends by proposing a new method for the equity analysis of regional plans that relies on reducing inequities. An example is provided for commute time by local bus. In the analysis, those zones with relatively high demand and high commute time by local bus are identified and can be targeted for mitigation. Additionally, a regional measure is proposed, the Gini mean difference, which provides an indication of the disparity in commute time. Alternative scenarios that minimize the Gini mean difference will tend to result in more equitable distributions of commute time, circumventing problems associated with relying on a single estimate of the mean value of an indicator for the entire region.

Proposing novel methods capable of overcoming identified analytical difficulties is one manner in which the impasse between regional equity advocates and transportation planning agencies can be overcome. Additionally, in light of the disconnect between the rhetorical goals for regional planning and its reality, independent analysis of regional data seems vital for increasing the agency accountability, overcoming the region-county incentives outlined in Chapter 1 and elsewhere and providing a check on analyses conducted for SB 375.

The results of this dissertation will be relevant far beyond California's borders. Regional transportation planning agencies interested in improving the correspondence between their analysis of equity and environmental justice and the lived experience of protected populations within their jurisdictions will benefit from the travel demand analysis developed in this work. Broadening their public input on equity analysis beyond

indicators and metrics, equity advocates will also find the results useful. The gaps in the literature highlighted by the legal analysis and sensitivity analysis of travel demand modeling data will be of interest to legal scholars studying transportation, civil rights, and environmental justice and practicing and academic engineers conducting analysis with advanced travel demand models. In late 2011 the Federal Transit Administration conducted a listening tour and is revising its guidance on environmental justice and Title VI analysis; the US Environmental Protection Agency is also soliciting feedback on a document that links smart growth and environmental justice.[15] It is expected that the findings described in this dissertation will also be relevant to such efforts.

[15] Federal Transit Administration, "FTA Information Sessions: Proposed Title VI and Environmental Justice Circulars," http://www.ftainformationsessions.com/; US Environmental Protection Agency, "Creating Equitable, Healthy, and Sustainable Communities Strategies for Advancing Smart Growth, Environmental Justice, and Equitable Development (Draft)," http://www.epa.gov/dced/pdf/2012_0208_creating-equitable-healthy-sustainable-communities.pdf.

CHAPTER 1: THE REGION OR THE STATE? CALIFORNIA TRANSPORTATION PLANNING, 1967-1977

INTRODUCTION

On November 23, 1976, representatives of the California Business and Transportation Agency and the State Transportation Board held a public meeting on a proposed statewide transportation plan at the Los Angeles Convention Center. Testimony was heard from 86 individuals representing varied interest groups: elected officials, private business, public agencies, academics, organized labor and private citizens, among others. Reactions to the plan were generally strong. David Grayson, speaking on behalf of the Automobile Club of Southern California, testified that his organization viewed the plan as a "proposal for radical change" and a "blatant proposal to tax motorists out of the private automobile." Testimonies from local and regional government officials simultaneously expressed confusion about the relationship of their transportation plans to the state's and concern that the state sought to maintain too much authority over transportation decision making.[1]

Yet, only three years earlier, the state affirmed its authority over transportation policy and signaled its desire to achieve a multimodal transportation system when Governor Ronald Reagan signed Assembly Bill (AB) 69 into law. Following the emergence of state departments of transportation throughout the US, AB 69 abolished the Division of Highways and created the California Department of Transportation (Caltrans). This new

[1] California State Archives, Business and Transportation Agency Records, State Transportation Board - California Plan Hearing and Workshops - Comments at Los Angeles Hearing on Policy (1 of 2), F3842:917, "Comments of the Automobile Club of Southern California Delivered by David Grayson, p. 1; Testimony of the Southern California Association of Governments Delivered by Ralph B. Clark, p. 3; Testimony of Los Angeles City Councilman John Ferraro, p. 3; All Delivered to the State Transportation Board on November 23, 1976"; Ray Hebert, "Critics Assail State Transportation Plan," *Los Angeles Times*, 24 November 1976.

agency was thought to signify "the end of the state's emphasis on freeways and the start of a new era for other ways to move people."[2] The emphasis on state-level institutions continued a tradition begun in 1916 with the Federal-Aid Road Act,[3] but the move to deemphasize freeway construction was entirely novel and came in response to nationwide "freeway revolts," the nascent environmental movement, and the fiscal realities confronting highway construction in the 1960s.[4]

After a brief overview of pre-1967 activities, this chapter employs previously unused primary source material to trace the history of California transportation planning from 1967-1977. This period encompasses the time when Caltrans, the State Transportation Board and other public entities aggressively pursued novel policies and transportation institutions in the state were fundamentally transformed. In addition to the creation of Caltrans, efforts included the creation of strong regional planning agencies, the preparation of three statewide transportation plans, the conversion of mixed flow lanes to high occupancy vehicle (HOV) lanes in Santa Monica, and a Caltrans six year capital expenditure program that reduced emphasis on automobile capacity expansion. In each case, one actor attempted to make practice consistent with stated policy and the goals of multimodalism. In all cases, that actor was rebuffed – planning authority was not

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[2] _____, "Transportation Dept. In Business Today," *Los Angeles Times*, 1 July 1973. Hawaii created the first state department of transportation in 1959, the US Department of Transportation was organized in 1966, and by 1974 23 states created their own departments while another 12 had legislative proposals or studies ongoing regarding the formation of such departments. See Harry R. Hughes, "Emerging State Departments of Transportation," *Transportation Research Record* 524(1974).

[3] Bruce E. Seely, *Building the American Highway System: Engineers as Policy Makers* (Philadelphia: Temple University Press, 1987), 46-48.

[4] See, e.g.,Mark H. Rose, *Interstate: Express Highway Politics, 1939-1989* (Knoxville, TN: The University of Tennessee Press, 1990), 105-08; Brian D. Taylor, "Public Perceptions, Fiscal Realities, and Freeway Planning: The California Case," *Journal of the American Planning Association* 61, no. 1 (1995); Raymond A. Mohl, "Stop the Road: Freeway Revolts in American Cities," *Journal of Urban History* 30, no. 5 (2004); Katherine M. Johnson, "Captain Blake Versus the Highwaymen: Or, How San Francisco Won the Freeway Revolt," *Journal of Planning History* 8, no. 1 (2009).

transferred to the region in the face of local government opposition, no statewide plan or statement of policy was adopted by the legislature and the HOV conversion was reverted in response to strong opposition from motoring Angelinos, and Caltrans's ability to develop its own program was hamstrung by the legislature with the passage of AB 402 in 1977.

Paradoxically, although the freeway revolt indicated a widespread opposition to new urban freeway construction nationwide, California citizens could not countenance the new multimodal policies promulgated by the state – the reputation of state highway engineers and their parent institutions across the US had been irreparably tarnished during the construction of the urban Interstates,[5] and the rebranding of highway departments as multimodal departments of transportation appeared not to sufficiently repair their image. Local government actors and advocates for regional governance that had been largely ignored during the planning of the Interstate system in the 1940s were able to leverage this public opposition to begin to institutionalize the "region" as the appropriate level at which to conduct transportation planning.[6] The governing boards of these regional agencies were composed largely of local elected officials, however, ensuring local influence over regional planning.

Since the late 1970s, both California and the federal government have increased their reliance on the regional planning apparatus, with the unexpected consequence of

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[5] Rose, *Interstate*, 115-17.

[6] Although the Federal-Aid Highway Act of 1962 required transportation planning to be undertaken by metropolitan planning organizations in urbanized areas that exceeded 50,000 in population, the state still maintained considerable influence over their activities. Subsequent developments such as those described in this chapter were necessary for their ascendancy. See Todd Goldman and Elizabeth Deakin, "Regionalism through Partnerships? Metropolitan Planning since ISTEA," *Berkeley Planning Journal* 14(2000): 48-50; Nelson et al., "Metropolitan Planning Organization Voting Structure," 1.

forestalling the achievement of new state-level goals like climate change mitigation. Legislative initiatives as of the late 2000s show California in a renewed attempt at statewide planning. Senate Bill (SB) 391, passed in 2009, proposes nearly identical statewide planning goals for Caltrans as AB 69 (with the addition of greenhouse gas reduction targets), but the intervening events described in this chapter indicate that the state is in even a weaker position than previously to meet them. The conclusions elaborate on the implications for contemporary practice during the most recent round of apparent policy innovation.

TRANSPORTATION PLANNING AT THE DIVISION OF HIGHWAYS

Beginning in 1927 and continuing until the formation of Caltrans in 1973, the Division of Highways was the agency responsible for constructing and maintaining California's state highways. This arrangement was consistent with a federal effort emanating from the Bureau of Public Roads (BPR) to establish strong state highway departments capable of implementing highway programs based on engineering expertise supported by sound data rather than political considerations.[7]

Prior to the late 1930s, state highway engineers throughout the US focused exclusively on rural highway construction. By 1939, the BPR had called awareness to the increasing magnitude of urban and intercity traffic, foreshadowing a shift in focus to urban construction.[8] As late as 1944, responsible parties for urban construction had not been decided. City planners across the country had prepared urban expressway plans as

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[7] Seely, *Building the American Highway System*, 46-48.
[8] U. S. Bureau of Public Roads, *Toll Roads and Free Roads* (Washington, DC: United States Government Printing Office, 1939), 90-95; David W. Jones, *California's Freeway Era in Historical Perspective* (Berkeley, CA: Institute of Transportation Studies, 1989), 159.

far back as the 1930s that saw transportation systems as multimodal and inextricably linked to urban form, but they were unable to fund them, instead relying on limited state and federal aid to construct individual segments.[9] Their plans generally differed sharply from the approach advocated by highway engineers that emphasized vehicle throughput, cost-effectiveness and safety, while ignoring the effects of transportation infrastructure on land use.[10] Brown illustrates this contrast with reference to the output of Harland Bartholomew and Robert Moses, two influential planners during the early- to mid-20th century.[11] While Bartholomew's plans "took account of the potential influence of streets and highways on development patterns, neighborhood structures, and downtown property values" Moses "built … highways without reference to a larger city plan."[12] For Moses, traffic congestion was the primary urban problem and highways the immediate solution. For Bartholomew, urban renewal was of primary importance. In this view, residents of a city should enjoy access to the central business district whether by automobile or transit and highways were sited only after consideration of projected land uses and population distributions rather than to maximize throughput.

In 1941, President Roosevelt appointed the interdisciplinary National Interregional Highway Committee, on which Bartholomew served, to advise the Congress on an improved interregional system capable of meeting postwar travel demand and

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[9] Jeffrey Brown, "A Tale of Two Visions: Harland Bartholomew, Robert Moses, and the Development of the American Freeway," *Journal of Planning History* 4, no. 1 (2005).
[10] Jones, *California's Freeway Era*, 200; Rose, *Interstate*, 56-60; Jeffrey R. Brown, Eric A. Morris, and Brian D. Taylor, "Planning for Cars in Cities: Planners, Engineers, and Freeways in the 20th Century," *Journal of the American Planning Association* 75, no. 2 (2009).
[11] Brown, "A Tale of Two Visions: Harland Bartholomew, Robert Moses, and the Development of the American Freeway."
[12] Ibid., 11,19.

employment needs.[13] Their report, *Interregional Highways,* released in 1944 contained a substantial urban component – 9,500 miles of the proposed 39,000 mile system – but did not recommend specific locations.[14] Planners on the committee suggested tasking state highway engineers with routes leading into the city; but once entered a "metropolitan authority" should develop "an adequate thoroughfare plan to provide for all traffic needs."[15]

Metropolitan authorities were not created and the planning perspective was ignored as funding became available to construct the system. California's Collier-Burns Act of 1947, subsequent state legislation in 1953, and the Federal-Aid Highway and Federal Highway Revenue Acts of 1956 all substantially increased highway funding, accelerating construction accordingly.[16]

Each legislative act reinforced existing institutional arrangements and control of highway development by state highway departments. The Collier-Burns Act transferred all Los Angeles expressways to the state highway system[17] and the 1956 Federal-Aid Act emphasized the tradition of federal-state cooperation, designating all freeway construction responsibilities (those in urban areas and not) to state highway departments.

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[13] Seely, *Building the American Highway System*, 181; Rose, *Interstate*, 19-21; Earl Swift, *The Big Roads* (New York: Houghton Mifflin Harcourt, 2011), 140.

[14] Including 4,470 miles of main urban section and 'auxiliary' circumferential routes that would 'not exceed 5,000 miles' National Interregional Highway Committee, *Interregional Highways* (Washington, DC: United States Government Printing Office, 1944), 5,52.

[15] Ibid., 56.

[16] An Interstate system not to exceed 40,000 miles had been designated in the 1944 Federal-Aid Highway Act based on the recommendation of *Interregional Highways.* The 1956 Acts increased the system to 41,000 miles and provided $24.8 billion over 13 years at a 9:1 federal to state funds matching ratio. See Edward Weiner, *Urban Transportation Planning in the United States: History, Policy, and Practice* (New York: Springer, 2008), 26-28. On the California legislation, see Jones, *California's Freeway Era*, 191-95, 239-41.

[17] Brian D. Taylor, "When Finance Leads Planning: Urban Planning, Highway Planning, and Metropolitan Freeways in California," *Journal of Planning Education and Research* 20, no. 2 (2000).

The share of total highway revenue collected by the federal and state governments increased from 68% to 81% from 1947 to 1965.[18] Thus, the route selection decisions for the Interstate system were eventually carried out entirely by state highway engineers in consultation with the BPR. Both local elected officials and planners were ignored.[19] Designs would be identical in both urban and rural areas: limited access with geometry appropriate for high speeds.[20]

As the country entered the 1960s, the desirability of continued freeway development and the effectiveness of state highway engineers were increasingly called into question as the Interstate program, especially its urban segments, confronted new fiscal and social realities.[21] Inflation had reduced the purchasing power of the gas tax despite increasing vehicle-miles traveled, real construction costs were rapidly increasing, and the "freeway revolt" had seen San Francisco reject several previously planned routes.[22] In 1968, California's Legislative Analyst highlighted the inability of the Division of Highways to consider alternatives to highway construction – alternatives it viewed as vital for solving peak period congestion by more effectively coordinating freeways, local roads and public

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[18] Federal Highway Administration, *Highway Statistics: Summary to 1965* (Washington, DC: U. S. Government Printing Office, 1967)., Table HF-201.
[19] Gary T. Schwartz, "Urban Freeways and the Interstate System," *Transportation Law Journal* 8(1976); Taylor, "When Finance Leads Planning."
[20] Jonathan L. Gifford, "The Innovation of the Interstate Highway System," *Transportation Research Part A: General* 18, no. 4 (1984).
[21] Lewis and Sprague, *Federal Transportation Policy*, 14-16; Mohl, "Stop the Road," 674-80.
[22] From 1950 to 1960, real federal gas tax receipts approximately tripled. From 1960 to 1970 they increased by 20% and by 1975 the tax's purchasing power had receded approximately to its value in 1960. See Federal Highway Administration, *Highway Statistics: Summary to 1985* (Washington, DC: U. S. Government Printing Office, 1987)., Table FE-205. See also Taylor, "Public Perceptions, Fiscal Realities, and Freeway Planning."; Johnson, "Captain Blake Versus the Highwaymen."

transit.[23] The Division had also been criticized for mismanaging excess right-of-way, and its relevance had been questioned as the Interstate system neared completion.[24] An organization whose primary purpose had been the construction of highways had to refine its management practices and broaden its goals and expertise. Turning to a broader conception of transportation planning and multimodalism – akin to the urban expressway plans of the 1930s and the recommendations of *Interregional Highways* – was an attempt to satisfy these goals.

"THE START OF A NEW ERA FOR OTHER WAYS TO MOVE PEOPLE": CREATING CALTRANS, 1967-1973

The move to reorganize the Division of Highways began in 1967 when Gov. Reagan formed a "Task Force Committee on Transportation." The Task Force was to both take stock of existing transportation problems and to recommend new institutional arrangements capable of completing and implementing a statewide, multimodal transportation plan. Ultimately, the Task Force made several recommendations including the creation of a State Transportation Board, regional transportation planning districts, a transportation planning office and the development of a statewide transportation policy.[25] All of the Task Force's recommendations were eventually realized. AB 974, passed in 1969, established the State Transportation Board to advise the administration on transportation policy; AB 326 established the Office of Transportation Planning and

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[23] California State Archives, Senator Randolph Collier Papers, Highways and Transportation Files, 1939-1976., Governor's Task Force on Transportation Folder, LP229:636, "Transportation Planning and Finance, the State Role, Statement of Legislative Analyst, December 19, 1968", 2,10.

[24] Commission on California State Government Organization and Economy, "Preliminary Findings of Subcommittee on California Division of Highways Excess Right of Way," (Sacramento, CA, 1972), 2-4; Anonymous, "Local and Regional Planners Gain the Upper Hand as State Reorganizes to Meet Future Transit Needs," *California Journal* 4, no. 3 (1973).

[25] Governor's Task Force on Transportation, "Report of the Governor's Task Force on Transportation," (Sacramento, CA: State of California, 1968), 35-39.

Research; and the Transportation Development Act of 1971 (TDA) established a set of collectively exhaustive regional transportation planning agencies (RTPAs) in the state from existing, largely voluntary, councils of government (COGs) and metropolitan planning organizations composed of local government representatives. County transportation commissions were established where no previous organization existed.

A proposal for a state department of transportation was not prepared until September, 1971. That year, the State Transportation Board recommended the creation of a department of transportation that would provide "total transportation planning capability" with the "responsibility for performing and integrating transportation planning for all modes."[26] This organization would plan specific system elements of statewide significance, while ensuring that regional and local proposals were consistent with state goals.[27] In other words, planning authority would be dictated by the significance of the facility, tempered by an overarching state interest against which all projects would be evaluated.

In his state of the state address in 1972, Gov. Reagan mentioned the establishment of a state DOT as a priority, and AB 69 was passed by the legislature and signed by the governor later that year. Carried by Democratic Assemblyman Wadie Deddeh, the bill created Caltrans by merging the Department of Public Works (which contained the Division of Highways) with the Department of Aeronautics and the Office of Transportation Planning and Research. To achieve balance in the state's transportation network, the bill outlined revised priorities for transportation consistent with the

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[26] Caltrans Library and History Center, Department History, 1972 (Creation of D.O.T.) Folder, "Maintaining California's Leadership in Transportation, September 30, 1971", IV-1.
[27] Ibid.

emerging highway critiques. Its first priority was to encourage public transit in urban areas and high speed modes for interregional travel. Its second priority remained implementation and maintenance of the state highway system. The bill also required Caltrans to develop a statewide transportation plan that would incorporate regional transportation plans (RTPs) created by the RTPAs, realizing the final recommendation of the Task Force on Transportation. This plan was to be transmitted to the State Transportation Board by January 1, 1976.

Motivations for Caltrans

Historians differ on the drivers of the department's creation. William McGowan has suggested that the creation of Caltrans appealed to Gov. Reagan because of the power vested in the new position of Caltrans director – an appointee.[28] Previously the executive branch exercised little authority over transportation policy since the powerful position of chief engineer was selected from within the Division of Highways. David Jones and Brian Taylor argue that the problems associated with extending freeways into urban areas necessitated the creation of a single agency with multimodal transportation planning expertise capable of evaluating and implementing alternatives to highway construction.[29]

The view that internalizing such expertise was required to move the Division of Highways forward is supported by management-level Division employees. Department of Public Works Chief of Transportation Planning, William Schaefer, describes the

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[28] William P. McGowan, "Fault-Lines: Seismic Safety and the Changing Political Economy of California's Transportation System," *California History* 72, no. 2 (1993): 174.

[29] David W. Jones and Brian D. Taylor, "Mission and Mix: A Study of the Changing Tasks and Staffing Requirements of the California Department of Transportation," (Berkeley, CA: Institute of Transportation Studies, 1987), 34. Raymond Mohl motivates the creation of the US Department of Transportation in 1966 in similar terms. See Mohl, "Stop the Road," 680-81.

transition to a department of transportation as predominantly stemming from a desire to involve the state in other modes.[30] Larry Wieman, Principal Engineer with the Division of Highways Urban Planning Department, concurs, stating that the formation of Caltrans was an opportunity for the organization to "get involved in more things—have more of an impact on the State of California." At the same time, he acknowledged that the change would not affect "probably 95% of the employees in the Department."[31]

The press and other observers also questioned whether the change would have an effect on Department operations or whether it was simply an effort at maintaining the organization and its 18,000 employees, by far the largest contingent in the merged department.[32] Inaugural director James A. Moe defended Caltrans against that accusation in the *Los Angeles Times* stating that, "People have a right to wonder if it isn't … just a change in name. But most of us are eager to get into broader transportation ideas."[33]

A related and important consideration that seemed to drive the creation of Caltrans was the potential to access newly available and flexible sources of state and federal funding for non-highway modes.[34] The Urban Mass Transit Assistance Acts of 1964 and 1970 made federal funds available for transit capital projects.[35] California's TDA

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[30] Caltrans Library and History Center, Oral History Interview, July 10 and 17, 1990, "Highway Recollections of William E. Schaefer", 36.
[31] Caltrans Library and History Center, Oral History Interview, March 21, 1990, "Highway Recollections of Larry Wieman", 18. In comparison, the new division of mass transportation had an initial staff of 30. See Anonymous, "Local and Regional Planners Gain the Upper Hand."; Hebert, "Transportation Dept. In Business Today."
[32] Anonymous, "Local and Regional Planners Gain the Upper Hand."
[33] Hebert, "Transportation Dept. In Business Today."
[34] California State Archives, California State Assembly Transportation Committee Records, AB69 Bill File, LP131:16-22, "Assembly Committee on Transportation Summary of AB 69, April 6, 1972", 3; Ross D. Eckert, "California Transportation Planning: Examining the Entrails," (Los Angeles, CA: International Institute for Economic Research, Original Paper 19, 1979).
[35] Daniel Baldwin Hess and Peter A. Lombardi, "Governmental Subsidies for Public Transit," *Public Works Management & Policy* 10, no. 2 (2005).

extended the sales tax to gasoline and set aside 1/4% whose proceeds were to be used for local transit operations.[36] In 1973, President Nixon signed a Federal-Aid Highway Act which for the first time allowed states to shift funds proposed for Interstate spending to public transportation projects and granted local jurisdictions the ability to delete unwanted Interstate routes.[37] Creating a multimodal transportation agency would give the state an opportunity to consider non-highway alternatives, addressing the concerns voiced in the 60s, while simultaneously ensuring access to new funding sources.

Regional or statewide authority: AB 69's unanswered question

The reasons for the creation of Caltrans are relatively clear, but the legislative compromises required to operationalize the new department necessitated concessions among legislators and major transportation stakeholders. Ultimately, major changes to planning institutions were not undertaken and local government actors were successful at staving off the creation of a regional level of planning authority. There are multiple indications that negotiations over AB 69 were protracted, difficult, and focused on re-visioning the state's role in transportation planning while avoiding past pitfalls – namely, the failure to complete 1959's 12,400 mile freeway and expressway plan. In a memo to members of the Assembly Transportation Committee during AB 69 negotiations, consultant to the committee Sid McCausland asked, "How can the Legislature assure itself that the cost of preparing a state transportation plan will not be wasted?" He also stated that "the planning process has always been a failure, because we have never had a

[36] Brian D. Taylor, "Unjust Equity: An Examination of California's Transportation Development Act," *Transportation Research Record* 1297(1991).
[37] Weiner, *Urban Transportation Planning*, 78-9.

real commitment to implement and enforce our plans."[38] Members of the Assembly Transportation Committee, including Deddeh and John Foran, proposed a solution: further empower the newly created RTPAs by devolving planning authority from the state to the regions and provide them with the ability to implement those plans.[39]

Questions related to devolution would become a focus of the legislative debate. When AB 69 was under consideration in the Assembly Ways and Means Committee, amendments empowering RTPAs were lobbied for by "anti-highway, pro-regionalism" elements who agreed with Deddeh and Foran. These elements were likely similar to those advocating for the creation of comprehensive regional planning agencies in other parts of the state. For example, in the Bay Area in the early 1970s, proposals to create a comprehensive planning agency with responsibility for air quality, transportation and land use, and water quality were supported by "hardline environmentalists."[40] These agencies would be overseen by directly elected regional representatives as opposed to local government officials. According to Revan Tranter, the fourth executive director of the Association of Bay Area Governments (ABAG), officials of local government were viewed as too closely tied to development interests and more likely to turn a blind eye to sprawl-inducing land use decisions.[41]

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[38] California State Archives, California State Assembly Transportation Committee Records, AB69 Bill File, LP131:16-22, "Memo from S. Mccausland to AB 69 Project Team, May 29, 1972", 1.
[39] Ibid., 2.
[40] "Bay Area Regionalism Oral History Interview with Revan Tranter," Metropolitan Transportation Commission, http://www.mtc.ca.gov/news/video/regionalism/tranter.htm.
[41] Ibid.

The amendments empowering regions were subsequently rescinded in the Senate and planning authority was retained at the state level.[42] In multiple correspondences with state Senator Randolph Collier, local officials expressed displeasure with the statewide planning aspects of the amendments and unease regarding the empowerment of regional agencies. Chair of the Senate Transportation Committee for 20 years, Senator Collier received letters from local officials like the Director of Sonoma County's public works department, expressing concern that the "recognition of the regional agency" would be the "first step in diluting the responsibilities of the local entities." These officials requested the creation of county directors of transportation who would advise RTPAs, an amendment that was adopted in AB 69's language.[43]

Members of the Legislature also expressed concern about providing regional governments with control over transportation planning, which resulted in section 13991 of AB 69. In lieu of defining intergovernmental relationships outright, this section required the State Transportation Board to issue a report containing recommendations on local, regional, and statewide transportation responsibilities including provisions to ensure that "local communities will have adequate control over … future transportation development" and to advise on whether RTPAs with implementation and planning responsibilities should be created. The Board's final report urged consensus between multiple levels of government, but recommended strong regional agencies in urban areas that would be responsible for both land use and transportation planning, echoing the

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[42] Sidney McCausland, "Along for the Ride: People, Politics & Transportation: California-Style," (Sacramento, CA: California Legislature, Assembly Committee on Transportation, 1974), 11-12.
[43] California State Archives, Senator Randolph Collier Papers, Highways and Transportation Files, 1939-1976., Transportation Agency 1952-1975 Folder, LP229:746, "D. B. Head to Randolph Collier, November 13, 1972, p. 1; Randolph Collier to D. B. Head, December 20, 1972", 1.

recommendations of *Interregional Highways* nearly three decades earlier. These agencies would have effective veto power over local projects that did not conform to regional plans.[44] To ensure that the state's multimodal goals for transportation as stated in AB 69 were met, the State Transportation Board would establish guidelines for regional planning that required the analysis of a "full range of modal alternatives [including] new technology, noncapital alternatives and improved management of existing facilities rather than new construction" and "consideration of ways to bring land use and transportation into balance."[45]

In its report, the Board suggested retaining the existing RTPA structure for the near future.[46] However, they did not rule out the possibility that an ideal form of regional agency would be created with the characteristics noted above.[47] Surprisingly, the report was largely silent on the composition of the governing boards of regional agencies. It noted only that the body should be "responsive to the people of [the] region in regard to their interests and needs."[48] This ambiguity did not stop groups representing local officials like the County Supervisors Association of California and the County Engineers Association from commenting that the recommendations were an attempt to usurp "some

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[44] State Transportation Board, "Summary of Findings and Conclusions on State, Regional and Local Roles and Responsibilites in Transportation," (Sacramento, CA: Business and Transportation Agency, 1973), 4.
[45] Ibid., 8-9.
[46] The creation of both voluntary councils of government and stand-alone transportation planning agencies accelerated in California during the 60s. See Lewis and Sprague, *Federal Transportation Policy*, 36. Additional designations like RTPA were often layered on top of the existing ones. See Linda Wilshusen, "The Effect of Government Organization on Coordination of Transportation and Land Use Planning: The Role of California's Regional Transportation Planning Agencies," in *71st Annual Meeting of the Transportation Research Board* (Washington, DC, 1992), 4-5. Also see note 6 above.
[47] State Transportation Board, "Summary of Findings," 4.
[48] Ibid., 3.

of the existing responsibilities of city and county officials."[49] Caltrans remained neutral in the dispute, stating that the Department would accede to the final structure decided upon by the Legislature and local governments.[50]

Since the report did not carry the force of law, the responsibilities of each level of government were temporarily left unchanged; Caltrans would retain the authority previously enjoyed by the Division of Highways but would consult with existing RTPAs; largely voluntary associations of regional governments governed by local elected officials. But the State Transportation Board had indicated its preference for strong regional agencies responsive to transportation policy set by the state to implement AB 69. Local officials had indicated their resistance to this idea and ensured that no new regional level of authority was created. This unresolved debate would reemerge during the statewide transportation planning efforts required by AB 69 during the 1970s. Ultimately, the influence of local governments would prove decisive in the reorganization of planning institutions that occurred in the late 1970s.

"THE PLAN IS DEAD – LONG LIVE THE PLAN": FUMBLING TOWARD MULTIMODALISM

Statewide planning, 1973-77

Caltrans began its official operations on July 1, 1973. As directed under AB 69, the new department was to prepare a statewide transportation plan to be submitted to the State Transportation Board. Two progress reports were required before the final plan was transmitted from the Board to the Legislature by January 1, 1976. While Jeffrey Brown

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[49] Caltrans Library and History Center, AB69 Reorganization Study Folder, "DOT Informational Memo No. 5 from A.N. Dunham, May 17, 1963", 1.
[50] Ibid.

points out that some form of statewide transportation planning had been ongoing in California since the late 19th century, the document envisioned by AB 69 was fundamentally different than any the state had prepared before.[51] Prior to AB 69, the plans were "systems" plans – largely lists of transportation projects. In addition to describing the existing system and proposing an improvement and operations program, the statewide plan of the early 70s was to contain a statement of transportation goals, objectives, and policies for all modes against which alternatives would be evaluated and from which programs would be developed. When Edmund G. (Jerry) Brown, Jr. became governor in January, 1975, his new transportation appointees also expressed a desire for policies to inform programs.[52] Additionally, as mentioned above, the Caltrans-prepared draft statewide plan did not adequately integrate regional efforts. The failure of Caltrans to adequately address these two components – a statement of policy and the integration of state and regional plans – led the Board to reject the draft plan in the winter of 1975 despite the general support of local governments and highway interests.[53]

The Board summarized their objections in an 80 page memo containing multiple appendices, but there were earlier signs that rejection was likely.[54] In submitting Caltrans's second progress report to the legislature in December, 1974, the Board

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[51] Jeffrey Brown, "Statewide Transportation Planning: Lessons from California," *Transportation Quarterly* 56, no. 2 (2002).
[52] William S. Weber, "Development of the California Transportation Plan: 1973-1977," *Transportation Research Record* 677(1978).
[53] Cf. Ray Hebert, "Experts Attack State Plan to Reduce Cars, Highways," *Los Angeles Times*, 29 August 1975; Weber, "Development of the California Transportation Plan," 63.
[54] California State Archives, Business and Transportation Agency Records, State Transportation Board Committee Files - Planning, May-Dec 1975, F3842:907, "State Transportation Board Issue Memo, STB-35, October 16, 1975".

indicated that the statewide plan needed more of a policy orientation.[55] The Board felt that the plan should evolve from the required goals, policies, and objectives to well-formulated alternatives that would permit informed decision making. Instead, in the words of one board member, the plan simply provided different "combinations of expenditures and types of hardware" and lacked well-formulated alternatives.[56]

The integration of state and regional plans was also poorly addressed. An opinion on the consistency of the Caltrans plan with California law from attorney general Evelle J. Younger noted that the draft made no effort to integrate the regional plans.[57] Indeed, volume two of the draft simply attaches each of the 41 regional plans together with no integrative text, noting only that there may be inconsistencies between regional plans and the state plan.[58] For the Board, the key issue for the state-regional relationship was "how the spending proposals in the regional plans relate to State views on how transportation resources should be spent."[59] In other words, will the regional plans meet statewide goals if implemented? The Caltrans draft did not answer this question.

To address these shortcomings, the Board took over preparation of the statewide plan, delegating responsibility to a group of consultants: the Statewide Plan Task Force. The rapid turnaround evidenced by the Board in rejecting the Caltrans plan and almost immediately resuming planning activities was reflected in a rueful card sent by

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[55] "Transmittal Letter from Thomas H. Huges to James R. Mills and Leo T. Mccarthy, December 27," (Sacramento, CA: California Transportation Plan Progress Report, 1974).
[56] Eckert, "California Transportation Planning," 17.
[57] California State Archives, Business and Transportation Agency Records, State Transportation Board Committee Files - Planning, May-Dec 1975, F3842:907, "Evelle J. Younger to William S. Weber, September 17, 1975".
[58] Caltrans, "California Transportation Plan Volume 2: Regional Transportation Plan Summaries," (Sacramento, CA, 1975).
[59] "State Transportation Board Issue Memo, STB-35", 51.

McCausland, who was now interim Caltrans director, to Division of Transportation Planning employees that stated "the plan is dead – long live the plan."[60] The Board had already been actively following up on their Section 13991 report described above. They discussed various alternative arrangements that would allow the state to exercise authority by setting policy priorities, while creating powerful regional governments that could implement plans consistent with the state's vision.

Having initially failed to enact the regional planning apparatus that they viewed as necessary, now the Board assumed full control of the planning process to achieve what they viewed as necessary for AB 69 implementation. The Board's efforts to redefine relationships between planning entities were stymied by the public response to not only their statements of transportation policy but also contemporaneous efforts by Caltrans to implement HOV lanes in Los Angeles. Opposition from the general public, as opposed to local government representatives was the decisive factor in these cases. Two documents were authored by the Task Force, both were endorsed by the Board, but neither was adopted by the Legislature. The documents were intended to serve as the statutorily required policy element of the California Transportation Plan that could guide more detailed program and project-level plans at the state and regional level.

Preparation of these documents overlapped with several supportive Caltrans actions following the naming of a new director, Adriana Gianturco, on March 15, 1976. That same day, two mixed flow lanes (one in each direction) along the Santa Monica freeway (Interstate 10) were converted to three-person HOV lanes during the morning and

[60] "Highway Recollections of Larry Wieman", 30.

afternoon peak periods. The "diamond lanes," as they became known, were to be the first of three one year HOV trial programs around the state.[61]

Problems were evident soon after the lanes were implemented. The Los Angeles Times devoted extensive reporting and editorial space to the project. While some of it was initially positive – describing the benefits realized by those who chose to carpool[62] – it quickly became more negative in tone as congestion on surrounding surface streets worsened, and the accident rate on the freeway rose.[63] These factors led to increasing public opposition to the project.

The experiment lasted only five months, until August, 1976, before US District court judge Matt Byrne issued an order stating that the project should have completed a full Environmental Impact Statement instead of receiving a Categorical Exclusion.[64] By this time, Caltrans staff acknowledged that converting a lane from mixed flow to HOV should not have been the first demonstration attempted and that future HOV projects were likely in jeopardy because of the ultimately negative public reaction.[65] Staff had apparently underestimated the public's commitment to the multimodal transportation policy envisioned by AB 69. The diamond lanes had a negative effect in terms of travel time on the majority of motoring Angelinos commuting on the Santa Monica freeway. The public was not willing to countenance this perceived encroachment. Several years earlier, in 1973, the US Environmental Protection Agency had proposed draconian transportation

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[61] Adriana Gianturco, "Diamond Lanes: No "Plot" against Public," *Los Angeles Times*, 24 June 1976.
[62] John Kendall, "Diamond Lane Greeted by Raves, Pans," *Los Angeles Times*, 16 March 1976.
[63] Ray Hebert, "The Diamond Lane: Newest Caltrans Bust," *Los Angeles Times*, 23 March 1976.
[64] California State Archives, State Government Oral History Program, "Oral History Interview with Adriana Gianturco, March 2 - May 5, 1994"; ———, "Diamond Lane Demise May Halt Other Projects," *Los Angeles Times*, 15 August 1976.
[65] ———, "Diamond Lane Demise May Halt Other Projects."

control measures including gasoline rationing to meet air quality goals. Those measures met the same fate as the diamond lanes and likely contributed to the negative response that that project received.[66]

The first statewide plan prepared by the task force was released in October, 1976, shortly after the diamond lanes pilot was halted. The negative experience with the diamond lanes undoubtedly colored public response to the statewide plans.[67] The first plan was criticized for its advocacy of full cost pricing for transportation to be implemented by various user fees.[68] This principle appeared to stand in opposition to Gov. Brown's stance on new taxes and led to widespread public opposition.[69] One commentator described the plan as "social engineering" and an attempt to get "people out of their cars and into buses and mass transit."[70] Others echoed these sentiments.[71] In response, a second policy element was completed in March, 1977 that reduced the emphasis on pricing, but it also was not adopted by the legislature despite Board support.[72] Both plans emphasized the relationship between land use and transportation and the necessity of growth management strategies to incentivize compact urban forms, echoing the urban expressway plans of the 1930s. Because of the plan's demonstrated potential for controversy, "the fact that [it] had to be adopted by a certain date was in fact

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[66] Tom McCarthy, *Auto Mania: Cars, Consumers, and the Environment* (New Haven, CT: Yale University Press, 2007), Chapter 10.
[67] Thomas H. Crawford, "Our Transportation Plan: The $64-Million Misunderstanding," *Cry California* 12, no. 2 (1977).
[68] California Transportation Plan Task Force, "California Transportation Plan - Policy Element," (Sacramento, CA: State Transportation Board, 1976).
[69] Crawford, "Our Transportation Plan: The $64-Million Misunderstanding."
[70] Bill Craven, "Just Some Social Engineering," *Vista Press*, 10 December 1978.
[71] Dick Barrett, "An Assault on Drivers," *San Jose News*, 15 December 1976; Thomas D. Elias, "Elected Officials Fighting State's Transportation Plan," *Santa Barbara News Press*, 10 December 1976.
[72] California Transportation Plan Task Force, "Recommended Statewide Transportation Goals, Policies and Objectives," (Sacramento, CA: State Transportation Board, 1977).

ignored" and the Board was unable to gain traction on its ideas for changes to California's transportation policies and related changes to planning institutions.[73]

Both Caltrans and the State Transportation Board attempted to enact a transportation policy consistent with the multimodal goals of AB 69 in the mid-1970s. Both efforts were opposed by the public and failed as a result. Although the Section 13991 report recommended the creation of strong regional agencies to achieve multimodal objectives, no substantive changes were made to planning authority during this time.

The six year program, 1976-77

Caltrans also attempted to implement policy change by challenging the California Highway Commission (CHC) over the adoption of a six year highway program. Both Caltrans and its predecessor Division of Highways had previously worked in collaboration with the CHC to develop a multi-year highway program. There was no mechanism in place to deal with disagreement. The six year program developed by Caltrans in 1976 projected a higher ratio of maintenance and rehabilitation to new construction than had been evidenced in the past, but was also fiscally constrained under the assumption that there would be no new sources of transportation revenue.[74] Fiscal constraint was apparently necessary, again, to comply with Gov. Brown's stance on taxation and to put the department on firm financial footing; Caltrans had been embroiled in cost-cutting measures including layoffs and reductions in capital expenditures

[73] "Oral History Interview with Adriana Gianturco", 198.
[74] ibid., 224-26; Commission on California State Government Organization and Economy, "A Study of the California Department of Transportation," (Sacramento, CA, 1977), 60.

throughout the early 1970s. Accordingly, a number of capacity increasing projects that had previously been programmed were removed from the Caltrans program.[75]

The CHC responded by proposing its own program that included the removed projects, increasing the total cost by $1 billion.[76] "Powerful constituent groups" advocating for the omitted projects, likely local government representatives in whose jurisdictions the projects were located, also began to pressure legislators.[77] The CHC chair wrote to the attorney general in late 1976 requesting clarification of Caltrans's and CHC's roles and duties for transportation planning and finance.[78] The attorney general opined that the CHC did not have the authority to recommend a long-range program to Caltrans, so the historically friendly relationship between these two organizations destabilized.[79]

The public, local governments, and the legislature rebuked AB 69 as they reacted to the implications of a statewide plan and program that would meet its goals. The six year program had given the public and lawmakers a picture of transportation investments in the absence of new revenue and "few if any … [liked] what they saw."[80] The implementation of low-capital solutions – embodied in the diamond lanes – also aroused public anger. Moreover, the public was unable to separate the six year improvement program from the State Transportation Board's two failed plans. In this environment of

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[75] California State Archives, California Highway Commission Records, Administrative Files, Relationship: Department of Transportation and CHC Folder, R245:02, "William E. Leonard to Evelle J. Younger, December 1, 1976".
[76] _____, "A Study of the California Department of Transportation," 61.
[77] Dan Walters, "Highway Budget Fight Seen," *Sacramento Union*, 25 April 1977.
[78] "William E. Leonard to Evelle J. Younger, December 1, 1976".
[79] "Oral History Interview with Adriana Gianturco", 205-34.
[80] California State Archives, California State Assembly Transportation Committee Records, AB 402 Bill File, LP330:3, "Assembly Transportation Committee Hearing on AB 402, March 15, 1977", 3.

confusion and frustration at state agency actions, the legislature chose to both simplify and assert more control over transportation programming while simultaneously empowering local governments to do the same virtually ensuring that the regional level of authority envisioned by the Board would not be achieved.

FRUSTRATION, CONFUSION AND RETRENCHMENT: AB 402

The failure of the statewide planning effort, public reaction to the diamond lanes, and disagreements between the CHC and Caltrans led directly to the passage of AB 402, the Transportation Reform Act of 1977. There were numerous, often divergent motivations stated for this bill. In a letter to his colleagues, announcing AB 402 and calling for supporters, the bill's author, Assemblyman Walt Ingalls, cited concern about the direction of the state transportation program and "recent controversies involving the state transportation plan, the various boards and commissions, and the Department of Transportation."[81] With AB 402 he sought to "make the State transportation planning, funding, and policy-making process more understandable to the public and its elected officials."[82] Simplifying the process would involve redefining transportation planning responsibilities.

The State Transportation Board performed an early legislative analysis of AB 402.[83] Recalling the problems associated with AB 69's ambiguity, they criticized the March 10, 1977 draft bill for failing to explicitly define the relationships between local, regional, and statewide plans and programs. The Board reiterated their previously held view that

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[81] California State Archives, California State Assembly Transportation Committee Records, AB 402 Bill File, LP330:3, "Walter M. Ingalls to All Members of the Legislature, February 3, 1977", 1.
[82] California State Archives, California State Assembly Transportation Committee Records, AB 402 Bill File, LP330:3, "News from the Office of Assemblyman Walter M. Ingalls, February 3, 1977", 1.
[83] California State Archives, California State Assembly Transportation Committee Records, AB 402 Bill File, LP330:3, "State Transportation Board Office, Legislative Analysis of AB 402, March 10, 1977".

the state should maintain responsibility for providing the policy direction to which RTPAs would adhere during their plan and program development. Officials from local and regional jurisdictions again differed with the Board. The Southern California Association of Governments, for example, argued that fixed guideway projects funded using Proposition 5 revenue should be exempt from state review, and that projects funded locally should not have to be consistent with higher-level plans.[84] Ingalls agreed that the state's role in planning should be diminished. In correspondence with City of Burbank mayor Newton Russell, the assemblyman assured the mayor that local interests would be protected under AB 402. He stated that the bill "basically [does] away with the concept of the state plan" and reinforces "the programming and planning authority of the County Transportation Commission in Los Angeles by requiring the new California Transportation Commission to abide by the local commission's priorities relative to the state highway program except in those cases where there is an overriding state interest involved."[85]

As signed by Gov. Brown on September 27, 1977, AB 402 represented the legislature's response to the efforts of Caltrans and the State Transportation Board to implement AB 69. The bill created the California Transportation Commission (CTC) as the single body which would advise the state on all transportation-related matters. The CHC and the State Transportation Board were abolished. It also replaced the statewide

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[84] Proposition 5 was approved by California voters in 1974. It amended the California constitution to allow state gas tax revenues to be used for planning and capital expenditures related to fixed guideway transit facilities, pursuant to state review of projects. See California State Archives, California State Assembly Transportation Committee Records, AB 402 Bill File, LP330:3-3A, "W.O. Ackermann, Jr. To Walter Ingalls, March 14, 1977"; "9 Propositions to Be Decided by Voters in June 4 Primary," *Los Angeles Times*, 21 March 1974.

[85] California State Archives, California State Assembly Transportation Committee Records, AB 402 Bill File, LP330:3-3A, "Walter Ingalls to Newton R. Russell, June 24, 1977", 2.

plan with a biennial report to be prepared by the CTC. The biennial report substantially differed from the plan envisioned under AB 69. A statement of goals, policies and objectives was no longer required. AB 402's most important effect on transportation planning, however, was to devolve authority to RTPAs.[86] RTPAs would now define their goals, policies and improvement priorities independent of the state by creating an RTP and a regional transportation improvement program (RTIP).[87] The RTIP would include only projects funded in whole or part by state funds and would be combined with Caltrans's proposed projects into a Statewide Transportation Improvement Program (STIP) to be approved by the CTC. Finally, it placed program-level authority for Caltrans's budget with the legislature and created a new revenue stream by increasing truck weight fees.

The chaptered version of the bill still contained an inherent contradiction with respect to planning authority. As described by Adriana Gianturco as she lobbied Governor Brown to veto AB 402, the bill expected regional agencies composed almost entirely of local officials to deal with transportation issues in a regional manner.[88] The difficulties presented by this contradiction appear to be well-founded. The boards of regional agencies are staffed mostly by local elected officials, who are appointed to serve the region. They are often unwilling to support regional actions that may contravene their local interests.[89] In this environment, statewide and regional goals for transportation and

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[86] Reno Giordano, "Statutory Policy and Financing from 1977 through 2006: Thirty Years of California Transportation Legislation" (Unpublished M.S. thesis, University of California, Davis, 2007), 7-8.
[87] Bob Datel, "The Evolution of Transportation Planning in California," *Transportation Research Record* 1014(1985); Giordano, "Thirty Years of California Transportation Legislation", 8-9.
[88] "Oral History Interview with Adriana Gianturco", 235-42.
[89] Elisabeth Gerber and Clark Gibson found that the propensity to support regional priorities varied according the composition of metropolitan planning organization boards in the United States. Boards with a

land use are given short shrift, effectively devolving authority to subregional entities.[90] This result was actively hoped for by local government interests during the intervening period between the passage of AB 69 and AB 402, as described above.

In many ways, the RTPA was the location for planning authority necessary to diffuse the tensions left unresolved by AB 69. The state would no longer be able to impose its policies and goals on lower levels of government, and local officials would find the regional governing bodies they comprised receptive to local priorities. When local and regional interests did not agree, local governments could simply opt out, citing the advisory nature of regional planning agencies and their "home rule" authority over local land use.[91] Alternatively, they could obtain funding at least partially from locally-imposed sales taxes.[92] This latter option tends to impart projects with momentum, often exempting them from regional cost benefit analysis or compliance with the goals of higher levels of government.

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higher proportion of local elected officials (as opposed to non-elected professionals including engineers and planners) were more likely to fund local projects. In their sample of the 100 largest MPOs, 76% of board members were elected officials. See Gerber and Gibson, "Balancing Regionalism and Localism." See also Wilshusen, "The Effect of Government Organization on Coordination of Transportation and Land Use Planning: The Role of California's Regional Transportation Planning Agencies."; Scott A. Bollens, "Fragments of Regionalism: The Limits of Southern California Governance," *Journal of Urban Affairs* 19, no. 1 (1997): 118-19.

[90] Lewis and Sprague, *Federal Transportation Policy*, 65,92-93.

[91] Because of the overlapping designations applied to many of California's regional agencies, Stephanie Pincetl's insights on regional Councils of Government apply to RTPAs as well. See Stephanie P. Pincetl, *Transforming California: A Political History of Land Use and Development* (Baltimore, MD: The Johns Hopkins University Press, 1999), 144; Louise N. Dyble, "The Defeat of the Golden Gate Authority: A Special District, a Council of Governments, and the Fate of Regional Planning in the San Francisco Bay Area," *Journal of Urban History* 34, no. 2 (2008).

[92] Amber E. Crabbe et al., "Local Transportation Sales Taxes: California's Experiment in Transportation Finance," *Public Budgeting & Finance* 25, no. 3 (2005).

CONCLUSION

The legislative consensus embodied in AB 69 represented California's first attempt to address emerging transportation issues in the wake of the 1960s crisis in transportation finance and the desire for multimodalism. Subsequent events indicate that 1970s transportation organizations – the State Transportation Board and Caltrans – took the multimodal mandate seriously by creating policy documents and de-emphasizing new freeway construction in favor of low- and no-capital alternatives. The failure of these state-level efforts to blaze a new path in transportation planning is represented in the legislature's response – AB 402. Under AB 69, the state was signaled as the appropriate level at which to enact a comprehensive transportation policy. State failure in that effort led to the rejection of its authority and devolution to California's regions.

After a period of reduced resources and emphasis during the 1980s (see further discussion in Chapter 2),[93] regional agencies enjoyed a renaissance in the 1990s with the federal Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. ISTEA endowed MPOs nationwide with increased programming authority, solidifying the regional emphasis put in motion by AB 402.[94] ISTEA, like AB 69, required the preparation of a statewide plan and California legislation (SB 391) passed in 2009 requires this plan to achieve GHG emissions reductions in the transportation sector. Very modest reductions resulting from reduced automobile dependence and concomitant land

[93] Bruce D. McDowell, "The Metropolitan Planning Organization Role in the 1980s," *Journal of Advanced Transportation* 18, no. 2 (1984).
[94] Caltrans, "California Transportation Plan 2025," (Sacramento, CA: Office of State Planning, 2006), A1.

use changes are proposed relative to those from advanced vehicle and fuel technologies.[95] This outcome stems from the origins of regional devolution discussed in this article: devolution was undertaken in part in response to public opposition to some of the most efficient and cost-effective methods for reducing transportation's energy use and incentivizing compact urban forms, including HOV lane conversions and user charges. The removal of these options from consideration explains the relative share of transportation GHG emission reductions attributed to land use change and technology embodied in California law. Further, local government representatives were able to effectively intervene during the critical formative years of regional transportation governance in California – leaving an indelible mark on the resultant institutions. Regional efforts are now focused on building consensus and providing some policy incentives with the hope of enrolling local support for statewide climate goals in the transportation sector[96] and regional governments rarely consult state plans when setting priorities.[97] If the state is to meet even its relatively modest non-technology transportation GHG goals, it must revisit its transportation planning institutions. Yet the experience of the last 40 years of transportation policy (approximately from 1970 to 2010) indicates that major institutional shifts are unlikely. Transportation infrastructure is mature, the diminishing funds available are being increasingly allocated to maintenance and operation of the existing system ensuring that massive expansions in lane-miles are not

[95] Initially, land use changes accounted for 10% of transportation reductions by 2020. These were later reduced to account for 6% of the total. See CARB, "Climate Change Scoping Plan: A Framework for Change."
[96] Niemeier, Grattet, and Beamish, "Kicking the Can Down the Road: Blueprinting for Climate Change."
[97] Brian D. Taylor and Lisa Schweitzer, "Assessing the Experience of Mandated Collaborative Inter-Jurisdictional Transport Planning in the United States," *Transport Policy* 12, no. 6 (2005).

likely to be undertaken. The incentive for a wholesale revision of planning institutions seems low.

The remainder of this dissertation examines the potential for civil society actors – advocates for environmental justice and regional equity – to function as reformers in the transportation arena. The analysis indicates that transportation advocates are playing an increasingly important role in the state's transportation policy in lieu of substantive changes to its governing institutions.

ILLUSTRATIONS FOR CHAPTER 1

Figure 1 Governor Reagan (seated) signs AB 69 into law, December 10, 1972.

Immediately above Reagan's right shoulder is Assemblyman Wadie Deddeh. To Deddeh's immediate right are Sid McCausland and state Senator Randolph Collier. Reproduced by permission of the Caltrans Library and History Center.

Figure 2 Inaugural Caltrans director James Moe (far right) during the installation of signage designating the new California Department of Transportation, July, 1973.

Reproduced by permission of the Caltrans Library and History Center.

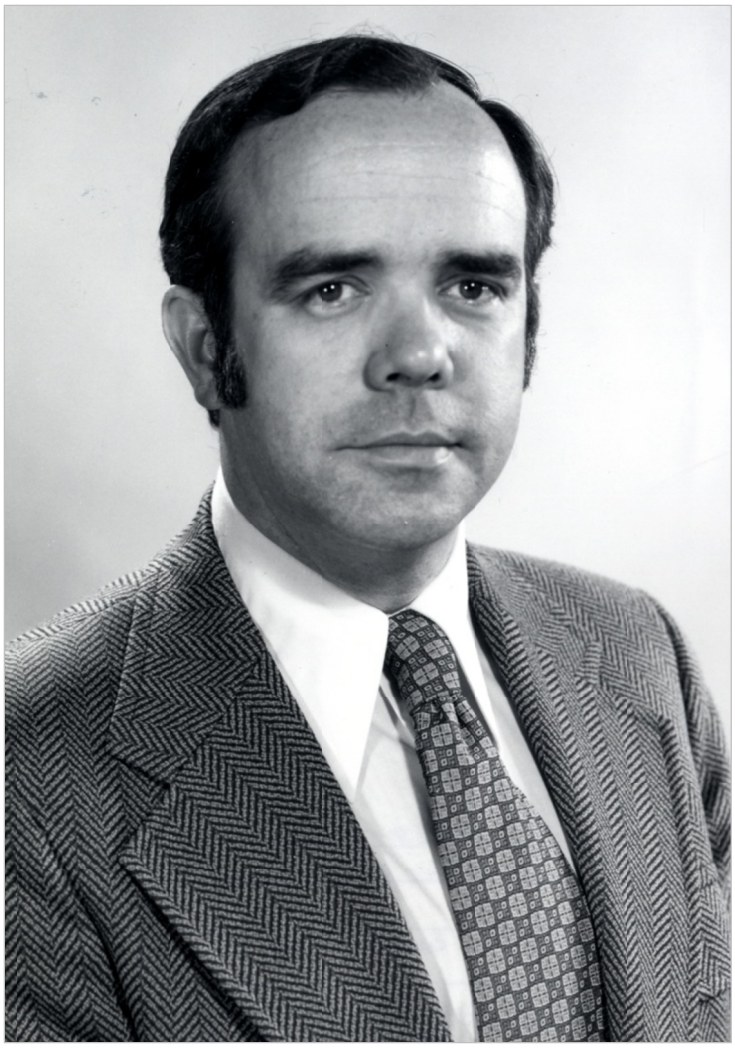

Figure 3 Sid McCausland was a consultant to the Assembly Transportation Committee during AB 69 negotiations.

He would later serve as interim director of Caltrans from August, 1975 until March, 1976. Reproduced by permission of the Caltrans Library and History Center.

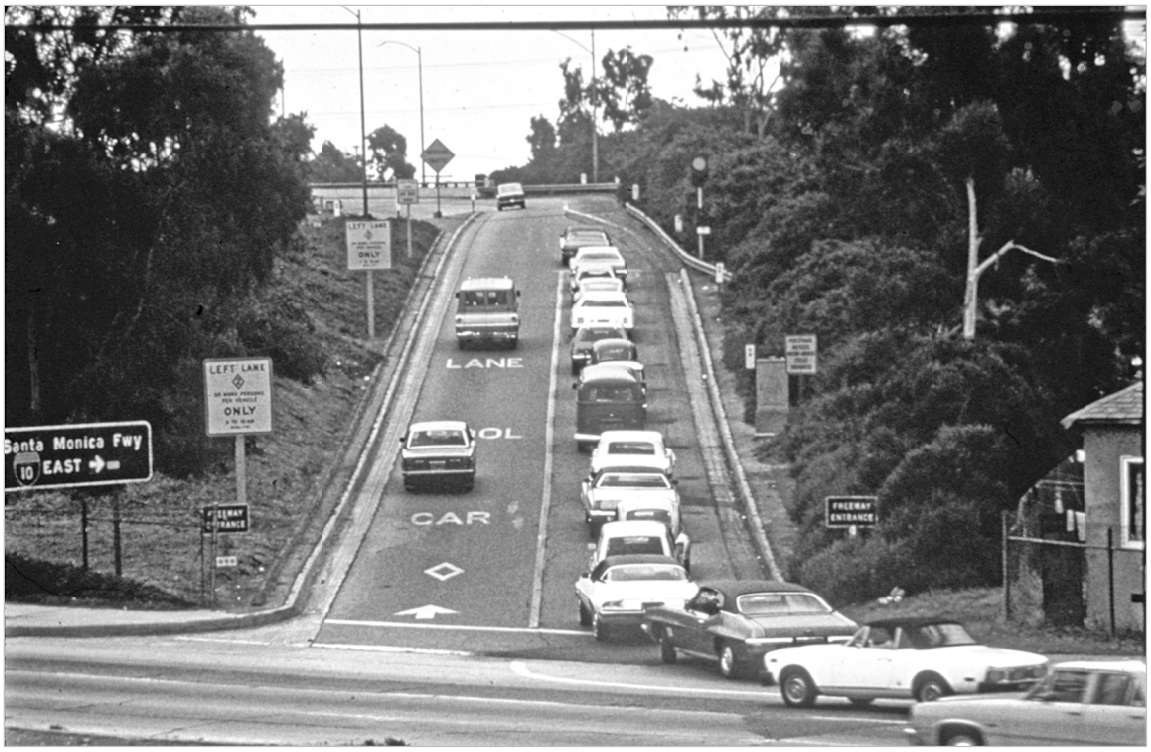

Figure 4 Single-occupancy vehicles queue at a ramp-metered entrance to Interstate 10 during the experimental diamond lane program.

Reproduced by permission of the Caltrans Library and History Center.

Figure 5 Adriana Gianturco served as Caltrans director from 1976 until 1983.

This period includes the implementation of the Santa Monica freeway diamond lanes and the dispute with the California Highway Commission. Reproduced by permission of the Caltrans Library and History Center.

CHAPTER 2: MPOS, REGIONAL EQUITY, AND SB 375

INTRODUCTION

After presiding over the formation of Caltrans and implicitly advocating a supra-local locus of transportation planning authority as governor, President Reagan later scaled back federal support for regional planning efforts in transportation and land use.[1] During the 1980s, regional planning agency activities were characterized largely by entrepreneurialism focused on inventing and innovating data and analytical services that could be provided to member governments rather than promulgating policy.[2] By the late 1980s, regionalism was enjoying a renaissance as metropolitan change foregrounded the connections between city and suburb and the concomitant patterns of inequity they entailed.[3] The trend towards devolution in transportation planning begun during the 1970s continued in California during this time, with new financial instruments and state law favoring the transportation planning authority of subregional entities. At the same time, federal law sought to empower regional governments, broaden their purview, and increase opportunities for public participation in transportation planning.

Despite the renewed regional emphasis these planning organizations were dogged by a certain obscurity, their relationships with other levels of government were often undefined, and they were not established to democratically represent the geographic areas they were intended to serve. Writing specifically about councils of government (COGs) – voluntary associations of local governments that often assumed transportation planning

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[1] McDowell, "The Metropolitan Planning Organization Role in the 1980s."; Lewis and Sprague, *Federal Transportation Policy*, 32-34.
[2] Robert W. Gage, "Sector Alignments of Regional Councils: Implications for Intergovernmental Relations in the 1990s," *The American Review of Public Administration* 22, no. 3 (1992).
[3] Ibid.; Andrew E. G. Jonas and Stephanie Pincetl, "Rescaling Regions in the State: The New Regionalism in California," *Political Geography* 25, no. 5 (2006).

responsibilities and the metropolitan planning organization (MPO) designation – and special districts, Pincetl notes that they are generally not

> constituted to be accountable to the public at large [or] organized to act as democratically representative bodies. As such, they are viewed with suspicion by the public, or unknown, thus not in any way contributing to constructing a favourable impression of regional-level institutions.[4]

Despite relative obscurity and lesser authority vis-à-vis state and local governments, as of the early 2010s, regional agencies were a key component of California's climate change mitigation effort in the transportation sector under SB 375 and a focal point for the advocacy efforts of civil society actors in California focused on achieving regional equity. Drawing inspiration from the environmental justice movement which emphasized the disproportionate environmental and quality of life burdens faced by communities of color and low-income,[5] regional equity advocates have been drawing attention to the production of inequality across regions resulting from differential investments in transportation systems patronized by people of color riders, the location and quantity of affordable housing produced, gentrification and displacement resulting from transit oriented development, and health effects related to the air quality impacts of transportation infrastructure.[6]

With a geographic emphasis on the San Francisco Bay Area and reference to secondary academic sources, primary legal documents and agency records, and

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[4] Pincetl, "The Regional Management of Growth in California," 262.
[5] Luke W. Cole and Sheila R. Foster, *From the Ground Up: Environmental Racism and the Rise of the Environmental Justice Movement* (New York: New York University Press, 2001); David Naguib Pellow and Robert J. Brulle, *Power, Justice, and the Environment* (Cambridge, MA: The MIT Press, 2005); McGurty, *Transforming Environmentalism*.
[6] Grengs, "Community-Based Planning as a Source of Political Change: The Transit Equity Movement of Los Angeles' Bus Riders Union."; Pastor, Benner, and Matsuoka, *This Could Be the Start of Something Big*; Pollack, Bluestone, and Billingham, "Maintaining Diversity."; Golub, Sanchez, and Marcantonio, "Race, Space and Struggles for Mobility."

interviews with stakeholders,[7] this chapter explains the advocacy focus on regional agencies despite their limited decision making authority and describes how SB 375 and past experience engaging with the formal public participation process at regional agencies are shaping transportation advocacy in the early 2010s. The broader set of goals and geographic scope encompassed by regional versus local government made the former more amenable to advocacy efforts focused on achieving equity between jurisdictions that transcended the boundaries of individual cities and counties. Additionally, transportation projects developed outside of a regional planning process and increasingly funded by local sales tax measures have proven particularly difficult to challenge. In this environment, regional advocacy appears to offer a greater chance for success.

However, public participation as required by law and as practiced by the regional agencies has proved to be unsatisfying to advocates. For example, in 2006 an advisory committee at MTC proposed the adoption of four environmental justice principles at the agency. The ensuing debate illustrates the limitations of public participation, specifically the differing conceptions of public participation and its effects held by the agency and advocates.

Past experience with these limitations is changing advocacy efforts under SB 375. Such efforts have evinced an increasing sophistication; buoyed by foundation funding directed toward regional advocacy, federal grants, and partnerships with academics of the sort described in Chapter 4, advocacy organizations are playing an important role in SB

[7] Gleaned from a larger series conducted for a related research project as documented in UC Davis SB 375 Project Team, "Social Equity and SB 375: Regional Action Paper," (Davis, CA: Resources Legacy Fund, 2012). Eight interviews were conducted with regional equity stakeholders including agency staff, advocates, and transportation modelers between November, 2011 and March, 2012.

375 implementation. These organizations are increasing their proficiency with the technical methods of transportation planning, are making increasingly specific analytical requests of agency staff, and are being invited to provide input on agency decisions outside of the formal public participation process.

The roles of regional agencies and advocates are mutually constitutive. While SB 375 signals the state's renewed emphasis on the region for achieving integrated transportation and land use planning, it does not fundamentally alter the institutions of planning. In this environment, regional agencies require increased legitimacy to enable the achievement of their new goals. Advocacy organizations are providing that increased legitimacy, ensuring that agencies meet their obligations under the (largely voluntary) provisions of SB 375.

LOCAL AND REGIONAL GOVERNANCE IN TENSION

The MPO has emerged as a favored location at which to lobby for changes to transportation investment priorities.[8] Of course, the MPO is but one component in a complex chain of transportation decision making. While they are required to ensure nondiscrimination in their allocation of funding and to monitor the compliance of their subrecipients with Title VI, the extent of their authority is directly in tension with that of local governments. As described in Chapter 1, regional planning organizations began to emerge in the 1950s and 60s, initially as COGs and often in response to legal provisions that allowed voluntary regional governments to exist instead of mandatory governments that would potentially usurp some local government responsibilities. For example, the COG for the nine county Bay Area, the Association of Bay Area Governments (ABAG),

[8] Golub, Sanchez, and Marcantonio, "Race, Space and Struggles for Mobility."

was formed as a voluntary association whose plans and recommendations would be non-binding precisely to take advantage of such legal provisions.[9]

The 1962 Federal-Aid Highway Act required transportation planning to be undertaken in urbanized areas that exceeded 50,000 in population as a condition for receiving federal funding and in many cases COGs assumed these responsibilities.[10] Despite an increasing emphasis on local and regional control at this time, states still retained significant authority over transportation planning. Subsequent legal actions were necessary for the eventual ascendancy of the region in transportation planning. The Intermodal Surface Transportation Act (ISTEA), passed by the federal government in 1991, is often cited as a turning point.[11] According to Dittmar, the first highway bill after the Interstate era embodied "the concept that transportation should contribute to building a more sustainable society" as opposed to the simply the provision of mobility.[12] To accomplish this goal, ISTEA empowered regions by giving MPOs direct authority over some transportation funding for the first time.[13] The California legislature had to take action to exempt these new ISTEA funds from the statewide formulas that had previously governed the distribution of federal transportation dollars. However, not all of the funds were directed towards MPOs. In California's enabling legislation, some funds were

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[9] Dyble, "The Defeat of the Golden Gate Authority: A Special District, a Council of Governments, and the Fate of Regional Planning in the San Francisco Bay Area."
[10] Goldman and Deakin, "Regionalism through Partnerships? Metropolitan Planning since ISTEA."
[11] TRB, *Conference on Institutional Aspects of Metropolitan Transportation Planning* (Williamsburg, VA: Transportation Research Board, 1995).
[12] Hank Dittmar, "A Broader Context for Transportation Planning: Not Just an End in Itself," *Journal of the American Planning Association* 61, no. 1 (1995): 7.
[13] Robert Jay Dilger, "ISTEA: A New Direction for Transportation Policy," *Publius: The Journal of Federalism* 22, no. 3 (1992): 74; Lewis and Sprague, *Federal Transportation Policy*, 2.

suballocated directly to county agencies in Southern California and the Bay Area, effectively bypassing both the state and MPOs in those regions.[14]

With this increased access to funding came additional responsibilities. In addition to the traditional planning goals of safety and mobility, new goals were added to MPO activities in the form of 15 "planning factors" that included the consideration of goods movement, system preservation, energy conservation, land use effects of transportation investments, and the overall social, environmental, and economic effects of transportation investments.[15] This broadened scope has persisted in subsequent transportation authorizations.[16]

Broadening regional transportation planning's purview was explicitly advocated for by newly formed stakeholder groups. For example, many of the more progressive policies enacted in ISTEA were spearheaded and lobbied for by the Surface Transportation Policy Project (STPP). The STPP was formed in 1990 as a coalition of over 100 extant organizations specifically to "ensure that transportation policy and investments help conserve energy, protect environmental and aesthetic quality, strengthen the economy, promote social equity, and make communities more liveable."[17] The provisions of ISTEA fully embodied a regional approach to transportation planning, the ability to flex funds between different modes, and the consideration of transportation-related impacts that had only occasionally been studied by previous generations of transportation engineers.

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[14] _____, *Federal Transportation Policy*, 69-71.
[15] Ellen Schweppe, "Legacy of a Landmark: ISTEA after 10 Years," *Public Roads* 65, no. 3 (2001).
[16] Susan Handy, "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, no. 2 (2008).
[17] Donald H. Camph, "Transportation, the ISTEA, and American Cities," http://www.transact.org/report.asp?id=22.

In seeking to transcend transportation planning's traditional emphasis on capacity expansion, ISTEA also created new opportunities for public involvement, specifically for historically underrepresented groups.[18] The primary role of advocacy organizations in the design of the legislation and expanded opportunities for public participation have engendered a network of advocacy organizations whose particular relationships with other organizations in a geographic area have in part determined whether ISTEA implementation can be considered successful.[19]

Efforts to empower regional transportation planning agencies at the federal level have often conflicted with California's policies that have tended to effectively devolve authority to local jurisdictions, often under the guise of regional government, as described in Chapter 1.[20] The state's county congestion management agencies (CMAs) offer an important case in point. CMAs were endowed with planning and finance authority as part of the "Transportation Blueprint for the 21st Century" – a package of transportation policy initiatives that included legislation and ballot propositions adopted between 1989 and 1990.[21] As part of the blueprint, two major bond issues were approved by California voters as Propositions 111 and 108 in June, 1990. Proposition 111 doubled the gasoline tax, increased truck weight fees, and Proposition 108 issued bonds to be used for capital expenditures on rail transit. To access the new revenues, CMAs were required to produce congestion management plans (CMPs). CMPs were to contain a number of prescribed components including level of service standards for highways and transit and an analysis

[18] Dittmar, "A Broader Context for Transportation Planning."
[19] Weir, Rongerude, and Ansell, "Collaboration Is Not Enough."
[20] Barbour, *Metropolitan Growth Planning in California*, 82.
[21] Giordano, "Thirty Years of California Transportation Legislation".

of local land use plans and a capital improvement program that would not result in a violation of adopted standards.[22] The improvement program developed by the CMA would then be forwarded to the RTPA for inclusion in the regional transportation improvement program.

In areas of the state with single county MPOs, like much of the San Joaquin Valley, CMA responsibilities were subsumed by existing RTPAs, but in multi-county urbanized areas, CMAs became an increasingly important part of the planning process, lending an additional local voice to the regional planning process.[23] Assembly Bill 2419 passed in 1996 and rescinded the requirement for the existence of CMAs, leading to their dissolution in some single county MPO districts. CMAs were generally retained in multi-county MPO areas. For example, in the Bay Area, each of the nine counties under the jurisdiction of MTC has retained their CMA.

Subsequent actions in California have further empowered local agencies. SB 45, passed in 1997, established two programs under the State Transportation Improvement Program (STIP), the Interregional Transportation Improvement Program (ITIP) and the Regional Transportation Improvement Program (RTIP). RTPAs are responsible for programming 75% of STIP funds through the RTIP, while the California Department of Transportation programs the remaining 25% through the ITIP.[24] Similar regional and state funding shares have been implemented even when they differ from federal guidance. For example, a California law (ABX3 20) altered the distribution of stimulus funding for highways disbursed under the American Recovery and Reinvestment Act in

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[22] Andy Nash, "California's Congestion Management Program," *ITE Journal* 62, no. 2 (1992).
[23] Barbour, *Metropolitan Growth Planning in California*, 75-76.
[24] Giordano, "Thirty Years of California Transportation Legislation", 72-73.

2009 to a 62.5/37.5 regional/state split from the original 30/70.[25] Although the change in funding allocations engendered by SB 45 would appear to strengthen regional planning agencies, Barbour argues that counties were the primary beneficiaries.[26] SB 45 allocated all of the RTIP funding by a county-based formula, effectively removing the opportunity for MPOs to advocate for regional projects. Instead, local agencies proposed projects to the regions for inclusion in their plans. The practical effect of California legislation since the events described in Chapter 1 is that local governments still maintain considerable authority in project selection, prioritization, and finance vis-à-vis MPOs. The precarious position of MPOs in general is emphasized by Goldman, who states that "MPOs act primarily to accommodate the decisions already made by a complex constellation of higher-and lower-level governments."[27] Further, MPO organizational structure and trends in transportation finance have made it difficult for MPOs to wield authority in project selection.

In terms of organization, MPOs typically maintain a professional staff of planners and engineers that conduct analysis for and report to a board composed largely of elected officials that represent the local governments (cities and counties) that comprise the region.[28] Because the board members are elected by local constituencies, they still represent their interests and find it difficult to undertake regional actions that would

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[25] Alex Karner and Deb Niemeier, "Transportation Spending under the American Recovery and Reinvestment Act in California" (paper presented at the 90th Annual Meeting of the Transportation Research Board, Washington, DC, January 23-27, 2011).
[26] Barbour, *Metropolitan Growth Planning in California*, 80-82.
[27] Todd Goldman, "Transportation Tax Ballot Initiatives as Regional Planning Process," *Transportation Research Record: Journal of the Transportation Research Board* 1997(2007): 10.
[28] Lewis and Sprague, *Federal Transportation Policy*, 7ff.

contravene local interests.[29] Additionally, MPOs are often structured with a one government one vote structure that gives smaller governments outsize influence over the planning process.[30] The relationship between MPO membership and regional vs. local investment decisions has been tested empirically. Gerber and Gibson demonstrated that MPO boards containing higher numbers of professionals and managers (including, for example, representatives from state departments of transportation, the Federal Highway Administration, and other non-governmental agencies) were more likely to fund projects that crossed jurisdictional boundaries, their operationalization of a regional focus.[31] In a study of 20 out of the nation's 50 largest MPOs, Nelson and colleagues have shown that MPO voting structure may lead to the overrepresentation of suburban constituents, resulting in reduced investments in transit, all else equal.[32]

Trends in transportation finance in the United States have entailed a shift from user fees like the gasoline tax, tolls, licensing fees, and vehicle registration charges to sales taxes and bonded debt.[33] Increasing the gas tax has become very difficult; it is currently a per-gallon as opposed to per-cost tax, and increasing vehicle efficiency has contributed to the decoupling of revenues from use of the highway system. The result has been a decline in the purchasing power of gas tax revenue in California and repeated funding "crises" in transportation finance. From 1970 to 2000, state gasoline tax revenue per vehicle-miles traveled declined by 24% in constant dollars. At the same time, highway construction

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[29] Barbour, *Metropolitan Growth Planning in California*, 85.
[30] Nelson et al., "Metropolitan Planning Organization Voting Structure."
[31] Gerber and Gibson, "Balancing Regionalism and Localism."
[32] An initial plan to study all 50 largest MPOs was abandoned due to data constraints. See Nelson et al., "Metropolitan Planning Organization Voting Structure."
[33] Jeffrey Brown et al., "The Future of California Highway Finance," (Berkeley, CA: California Policy Research Center, 1999).

costs have increased dramatically since the early 1970s,[34] increasing the urgency with which alternative financing mechanisms were sought.[35]

The increasingly favored financial instrument nationwide has been voter approved, locally administered (typically by the CMA) sales taxes whose revenue is tied to lists of specific transportation projects. Local tax measures have become especially popular in California. Since first employed to fund regional transit under the aegis of the Southern California Rapid Transit District in Los Angeles County in 1964, these taxes have become the state's fastest growing source of transportation revenue.[36] The benefits of such sources are obvious: they can ensure that locally desired transportation projects receive (at least partial) funding, and this activity occurs outside of the regional transportation planning process.[37] Once partial funding has been acquired, matching funds at the state and local level are much easier to secure, and the apparent voter-supported nature of the projects associated with local transportation dollars makes them particularly tenacious and they are often adopted into regional transportation plans (RTPs) without debate or a determination of their consistency with other regional transportation policy goals. This has the additional effect of limiting the differences between alternative planning scenarios since sales tax-funded projects must often be included as a component of every analyzed case.

The tenacity of sales tax-funded projects was confirmed during the environmental review process for MTC's 2005 RTP. In August 2001, several Bay Area environmental

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[34] Zairen Luo, "Price Index for Selected Highway Construction Items," (Sacramento, CA: California Department of Transportation, 2012).
[35] Caltrans, "California Transportation Plan 2025," 27.
[36] Crabbe et al., "Local Transportation Sales Taxes."
[37] Goldman and Wachs, "A Quiet Revolution in Transportation Finance."

non-profit organizations sued the Bay Area Air Quality Management District, the Metropolitan Transportation Commission (MTC), and the California Air Resources Board (CARB) regarding their 2001 Ozone Attainment Plan, specifically citing their failure to adopt a supporting environmental impact report (EIR) and transportation control measures sufficient to reduce volatile organic compounds by 26 tons per day.[38] A settlement agreement was reached in March, 2004 that required MTC, *inter alia*, to test an EIR alternative designed by the Transportation Solutions Defense and Education Fund (TRANSDEF) a non-profit transit advocacy organization based in the Bay Area.[39]

The "TRANSDEF Smart Growth Alternative" substantially revised land use assumptions to place more households near high quality transit, reduced the number of in-commuters traveling to work from counties outside of the Bay Area, included pricing incentives to increase the attractiveness of transit, and deleted 261 projects that were included in the project alternative, many of which were funded by local sales tax measures.[40] This last result drew substantial criticism from both MTC and CMAs. Robert McCleary, Executive Director of the Contra Costa Transportation Authority (the CMA for Contra Costa County), articulated his agency's objections by making reference to the inability of MTC to exclude projects funded through sales tax measures:

> The TRANSDEF alternative proposes to modify or eliminate projects that are already committed, and over which MTC has little or no authority. This is especially true for projects to be funded using funds from the various county sales tax measures. Many,

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[38] Communities for a Better Environment, Transportation Solutions Defense and Education Fund (TRANSDEF) v. Bay Area Air Quality Management District, Metropolitan Transportation Commission, California Air Resources Board. Superior Court of California, County of San Francisco. Case No. 323849.
[39] The settlement agreement also details the specific claims made as part of the lawsuit. See Settlement Agreement and Release, March 4, 2004. Available at: http://mtcwatch.com/pdfiles/3-04_TRANSDEF.htm.
[40] Full details of the alternative are included in the EIR appendices for the 2005 RTP. See Dyett & Bhatia, "Transportation 2030 Plan: Final Environmental Impact Report," (Oakland, CA: Metropolitan Transportation Commission, 2005), Appendix D.1.

> if not most, of those projects were specifically named in the sales tax measures and sales tax authorities are unlikely to or prohibited from eliminating those projects. Our authority fully intends to pursue all of the projects outlined in both our current and new measure, including the projects eliminated in the TRANSDEF alternative.[41]

CMAs representing Alameda, Marin, San Francisco, and Solano also submitted comments expressing very similar concerns.[42] Although the TRANSDEF alternative was found to be environmentally superior under the California Environmental Quality Act (CEQA), MTC affirmed the objections of the CMAs in preparing its statement of overriding considerations allowing the adoption of the project even though it entailed significant and unavoidable environmental impacts.[43] A similar RTP scenario focused on increasing transit investment and locating jobs and housing near high quality transit had been modeled by MTC in 1994 at the behest of the Regional Alliance for Transit (RAFT), another coalition of nonprofit organizations.[44] The development of alternative scenarios for the 2013 regional transportation plan/sustainable communities strategy (RTP/SCS) has also been an important strategy for the advocacy organizations participating in that process.[45]

Subregional governments have generally enjoyed increasing authority over transportation finance and project selection since the events described in Chapter 1

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[41] Letter from Robert McCleary to Ashley Nguyen, Re: Authority Comments on Draft Environmental Impact Report for the Transportation 2030 Plan for the San Francisco Bay Area, December 27, 2004. A copy of the letter is included with the full EIR. See ibid., Chapter 3.
[42] Ibid.
[43] Although CEQA does not require the adoption of the environmentally superior alternative, a statement of overriding considerations must be prepared if the adopted project will result "in the occurrence of significant effects which are identified in the final EIR but are not avoided or substantially lessened." See CEQA guidelines, California Code of Regulations Title 14, §15093; ibid., Appendix B.
[44] Stuart Cohen, "Warning Signs: The Bay Area's Collision Course with Sprawl and How Smart Growth Can Help," (San Francisco, CA: Bay Area Transportaiton and Land Use Coalition, 1999), 8-9.
[45] See, e.g., Letter from ACCE Riders for Transit Justice et al. to Mark Green and James P. Spering. June 9, 2011.

through their representation on MPO boards, the establishment of county-level transportation planning agencies in multi-jurisdiction MPO areas like Southern California, the Bay Area, and Sacramento, and the implementation of local sales tax initiatives as a transportation finance mechanism. Yet advocates for regional equity, engaging in formalized systems of public participation, have continued to emphasize regional governments as important sites for activism. Part of the explanation for this emphasis lies in the seeming intransigence of local decision making and the broader purview of regional agencies as compared to local planning organizations. As the TRANSDEF case illustrates, even when confronted with the regional impacts of their local investment decisions, decision makers at agencies like CMAs that are often responsible for the implementation of sales tax measures insist on the sovereignty of decisions made at that level of governance. This sovereignty has been cultivated in the years following state dominance in transportation planning that began its decline during the course of events described in Chapter 1 supported by state legislation, trends in transportation finance, and the active engagement of affected entities in the public process, as described above.

MPOs are mandated to consider a suite of impacts related to their investment decisions under federal law. The goals of advocates related to regional equity and environmental justice readily map onto these requirements that were themselves shaped by advocacy efforts at the federal level. Further, the region offers the promise of a decision making arena free of parochialism where transportation issues that cross municipal boundaries can be discussed and resolved without regard to the geographic affiliation of individual projects or dollars. In this regional vision, transportation dollars

would flow to their highest cause. This was the vision espoused by the State Transportation Board when they recommended strong regional agencies guided by policies from the state in the 1970s (Chapter 1).

As discussed further in Chapter 3, the law holds MPOs accountable for some of the actions of their subrecipients. As aggregators and distributors of funding passed down from the federal government, MPOs offer a greater return on advocacy investment. Rather than distributing resources among several more local planning organizations, advocating at the regional level allows advocates to focus their activities on one agency but potentially affect decisions made at local governments.

Although the regional focus for advocacy is sensible, it does not ensure success. The next section provides a brief history of environmental justice advocacy at MTC and describes an effort to formalize the recognition of environmental justice principles at that agency. The case illustrates the limitations of formal methods of public participation, the primary method that advocates use to access the public process, and how advocacy strategies are changing in response.

PUBLIC PARTICIPATION AT THE METROPOLITAN TRANSPORTATION COMMISSION

Regional equity advocates and other interested members of the public as well as those from business and government access the planning process through formalized public participation. The concept of participation as a necessary component of decision making is firmly enshrined in administrative law, informing virtually all federal and state agency rulemaking activity.[46] While transportation planning organizations are not rulemaking

[46] Cornelius M. Kerwin, *Rulemaking* (Washington, DC: CQ Press, 1999).

agencies themselves, they receive guidance from such agencies and generally adhere to "notice and comment" decision making principles involving the production of important documents in draft form and the reception of input from the public for a period of time before adopting a final version. The effectiveness of public participation is often judged differently by agency staff and members of the public and this can be attributed to different conceptions of participation. Agencies often view an open and accessible public process as evidence that equity or environmental justice has been achieved whereas movement participants view public participation as a means to affect outcomes.

MTC's actions have consistently equated participation with social equity and environmental justice. In 2007, during the preparation of Transportation 2035, the 2009 RTP update, MTC's now defunct Minority Citizens Advisory Committee (MCAC) proposed four environmental justice principles for MTC's adoption. The final principles were phrased as actions that MTC could undertake to "ensure that Environmental Justice is effectively incorporated into all of the Metropolitan Transportation Commission's planning, decision making, funding and operations."[47] The four principles included 1) the creation of an empowering public process, 2) the collection of data to facilitate the analysis of inequities in transportation funding, 3) changing discretionary investment decisions to mitigate such inequities as are found, and 4) the mitigation of disproportionate project effects prior to being approved for funding. At a full meeting of the commission on March 22, 2006, MTC approved the first two principles, with some

[47] MCAC, "MCAC Proposed Environmental Justice Principles," http://apps.mtc.ca.gov/meeting_packet_documents/agenda_649/Proposed_EJ_Principles.doc.

modifications, and recommended further study on the question of transportation inequity to inform potential later adoption of the final two principles.

On January 5, 2007, MTC Executive Director Steve Heminger reported on the findings of a joint subcommittee composed of members of the MCAC and the Bay Area Partnership.[48] Membership of the latter body includes representatives from all transportation and environmental protection agencies in the Bay Area. The joint subcommittee analyzed funding data representing five possible definitions of transportation equity: urban vs. suburban/rural, transit vs. roads, race and income, transit dependent households, and transit operators. Despite the joint subcommittee voting 5-3 that findings were inequitable and the full MCAC voting 14-1 to support all four principles,[49] Heminger stated that, "Absent a clear definition, it is difficult to determine (a) whether and to what extent inequities in funding exist; and (b) what should be done to redress that inequity—and the sufficiency of the response."[50] Rather than proposing a working definition, staff ultimately suggested seeking additional sources of revenue rather than the adoption of the third and fourth environmental justice principles. The first two principles are still cited by MTC as guiding policy in their most recent Title VI compliance report.[51]

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[48] Letter from Steve Heminger to MTC Legislation Committee Re: Environmental Justice (EJ) Principles. January 5, 2007.
[49] Testimony of Raphael Durr, Chair of the MCAC, at a meeting of MTC's Legislation Committee. January 12, 2007.
[50] Letter from Steve Heminger to MTC Legislation Committee Re: Environmental Justice (EJ) Principles. January 5, 2007., p. 6.
[51] MTC, "Response to the Federal Transit Administration Circular 4702.1A Regarding Title VI of the Civil Rights Act of 1964: MTC 2010 Compliance Report," (Oakland, CA: Metropolitan Transportation Commission, 2010), 40.

Then-MCAC chair Raphael Durr suggested that one reason for failing to adopt the final two principles was either the threat of future litigation or the consequences of an ongoing lawsuit against MTC.[52] This is sensible since the latter two principles related to outcomes that must be achieved; if the final two principles had been adopted but future actions were found to be in violation, MTC would have placed itself at risk of litigation. That MTC favored the creation of a public process (principles 1 and 2) rather than linking that process to equitable outcomes (principles 3 and 4) highlights the different perceptions of agencies and advocates in the realm of public participation and its purpose.

Public participation efforts at MTC and ABAG during the early 2010s indicate a similar emphasis on creating an open public process at the agency. In 2010, MTC and ABAG applied for a sustainable planning grant from the Strategic Growth Council (SGC).[53] These planning grants were authorized by California voters in 2006 with the passage of Proposition 84, and include increasing housing affordability and the promotion of equity and public health among its program objectives.[54] In their grant application, the agencies stated that the promotion of equity would come from the "engagement of equity interest groups in the SCS dialogue to ensure that their needs are evaluated in policy discussions…These partners will help ABAG and MTC ensure that a diverse group is involved in the SCS policy discussion."[55] Similarly, MTC's public

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[52] It is not clear from the testimony which sense is meant, but MTC was sued in early 2005 by a class of transit users alleging a discriminatory impact from MTC's investment policies. The case, Darensburg v. MTC, and its implications are discussed further in Chapter 3. See Testimony of Raphael Durr, Chair of the MCAC, at a meeting of MTC's Legislation Committee, January 12, 2007.
[53] ABAG/MTC, "One Bay Area: A Community Strategy for a Sustainable Region," http://www.sgc.ca.gov/docs/funding/grantee_3010/3010-519_MTCBay_Area_ABAG.pdf.
[54] Strategic Growth Council, "Sustainable Communities Planning Grant and Incentive Program," (Sacramento, CA: Department of Conservation, Division of Land Resource Protection, 2011), 2.
[55] ABAG/MTC, "One Bay Area: A Community Strategy for a Sustainable Region."

participation plan for SCS development stated that the SGC funds would be used for "public participation activities in low-income communities and communities of color" among other SCS-related tasks.[56] Other groups composed of equity stakeholders were also formed for SCS development. The Regional Advisory Working Group was established to provide guidance to regional agencies on SCS development. Its membership includes representatives of local transportation agencies, public works departments and advocacy organizations (business, housing, environmental, and environmental justice). The Regional Equity Working Group (REWG) was formed from members of two extant MTC stakeholder groups in early 2011, the Regional Advisory Working Group and the Policy Advisory Council's Equity & Access subcommittee. The purpose of the REWG was to identify and provide "advice on the major equity issues in the region from a diverse range of community and professional perspectives."[57]

This understanding of participation as the sole measure of justice is challenged by the environmental justice movement. Schlosberg has described three components necessary for justice: involvement in decision making processes, the equitable distribution of outcomes, and the recognition of environmental justice perspectives.[58] Recognition refers to whether environmental justice organizations and stakeholders are thought to have valuable knowledge and experiences relevant to include in decision making. This tripartite understanding of justice is consistent with the approach taken by the

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[56] MTC, "Public Participation Plan for the San Francisco Bay Area," (Oakland, CA: Metropolitan Transportation Commission, 2010), 62.
[57] Memo from Ann Flemer and Ezra Rapport to MTC Planning Committee and ABAG Administrative Committee Re: Plan Bay Area: Alternative Scenarios. July 6, 2011.
[58] David Schlosberg, "Reconceiving Environmental Justice: Global Movements and Political Theories," *Environmental Politics* 13, no. 3 (2004).

environmental justice movement, embodied in the often-heard phrase "We speak for ourselves."[59] Luke Cole and Sheila Foster elaborate further stating that "those who must bear the brunt of a decision should have an equal and influential role in making the decision."[60] In other words, participation is not sufficient for justice; the opportunity to affect outcomes is also required. This is generally not possible if the perspectives of environmental justice or regional equity actors are not recognized as valuable and authoritative.

If these standards for public participation are not met – allowing for deliberation and an equal and influential role in decision making – the potential for conflict emerges. While participation and engagement are necessary to achieve environmental justice, participation alone does not lead to just outcomes. The history of the environmental justice movement in California has been particularly fraught. On the one hand the state enjoys some of the strongest legal and regulatory protections for environmental justice populations in the country, yet efforts to include representatives from people of color and low income communities and advocacy organizations have often met with failure.[61] As described in the next section, regional equity advocates engaged in the formal SB 375 public participation efforts at MTC are seeking to extend their efforts beyond mere participation by linking the outcomes of equity analyses to decision making at the MPO.

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[59] Cole and Foster, *From the Ground Up*.
[60] Ibid., 106.
[61] Schlosberg, "Reconceiving Environmental Justice."; J.K. London, J. Sze, and R.S. Liévanos, "Problems, Promise, Progress, and Perils: Critical Reflections on Environmental Justice Policy Implementation in California," *UCLA Journal of Environmental Law and Policy* 26, no. 2 (2008); Fraser M. Shilling, Jonathan K. London, and Raoul S. Liévanos, "Marginalization by Collaboration: Environmental Justice as a Third Party in and Beyond CALFED," *Environmental Science & Policy* 12, no. 6 (2009); Jonathan London et al., "Racing Climate Change: Collaboration and Conflict in California's Global Climate Change Policy Implmentation," (Working paper, 2012).

SB 375 AND VIRTUOUS CYCLES OF REFORM

After decades of transportation policy emphasizing subregional entities, SB 375 signals the California legislature's desire to empower regions and to increase the consistency between transportation and land use planning, but it offers no substantive reform of the underlying planning institutions. As Weir points out, a piece of legislation like SB 375 is only the first step towards reform.[62] A constellation of other factors must come together to support the policy; otherwise it will not succeed. Both reworking governing arrangements and creating constituencies with a stake in the policy's continuation can create what Weir terms a "virtuous cycle of reform." Regional equity advocates are playing a key role in the implementation of SB 375 and are thus contributing to this cycle. There are being supported in this regard by substantial financial commitments from charitable foundations directed specifically towards regional (as opposed to local) advocacy.

Financial support has been deployed to advance the efforts of advocates and planning agencies by foundations and the federal government. The Funders Network for Smart Growth and Livable Communities, a nonprofit membership organization, conducted a survey of foundations actively supporting activities related to smart growth, transportation and land use planning, and climate change in California.[63] Out of 47 survey invitations, 22 completed an online survey and 16 agreed to a phone interview. The survey identified $17 million in funds for fiscal year 2009-10 disbursed by these organizations to grantees. Surveyed foundations included The California Endowment, the

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[62] Weir, Rongerude, and Ansell, "Collaboration Is Not Enough."
[63] Funders' Network for Smart Growth and Livable Communities, "Foundation Investments to Advance Smart Growth in California: Who Is Funding, Where and Potential for Collaboration," (Coral Gables, FL, 2011).

Hewlett Foundation, and Surdna Foundation, among others. Many of these foundations were crossing issue boundaries and drawing links between transportation, land use, and related issues. For example, the California Endowment, a health foundation whose mission includes promoting "fundamental improvements in the health status of all Californians" is creating links between healthy communities and the type of transportation and land use planning envisioned by SB 375.[64] The existing network of advocacy organizations is also benefitting from this level of funding with Urban Habitat, Public Advocates, Inc., TransForm, ClimatePlan, and Breakthrough Communities, among others, all receiving support through the efforts of the funders.

In 2009, the US Environmental Protection Agency, Department of Transportation, and Housing and Urban Development (HUD) formed the Partnership for Sustainable Communities. The partnership's goals are to coordinate federal investments in housing, transportation, and environmental protection to realize synergies. One example program is the Sustainable Communities Awards overseen by HUD that distributed $96 million in 2011. MTC was the recipient of one such regional planning grant worth $5 million. These grants are intended to "support regional planning efforts that integrate housing, land-use, economic and workforce development, transportation, and infrastructure developments in a manner that empowers regions to consider how all of these factors work together to create more jobs and economic opportunities."[65] MTC's grant was awarded to create a "Bay Area Regional Prosperity Plan" intended to expand low- and middle-income job and housing opportunities near high quality transit.

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[64] The California Endowment, "About Us," http://www1.calendow.org/Article.aspx?id=134.
[65] Gregory Gonzalez, "HUD Announces 2011 Sustainable Communities Awards," http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2011/HUDNo.11-274.

This funding is undoubtedly helping advocacy organizations to engage with agencies on SB 375 implementation, often going beyond their traditional advisory or participant roles to instead function as indispensable components of the reform process, holding agencies to their SB 375 goals and ensuring that stringent targets are established throughout the state where the law itself is insufficiently prescriptive or otherwise falls short. Direct grants to agencies can also be used to develop analyses that would not previously have been completed.

The lessons learned from past experience with MTC and the changes made in response are also increasing the sophistication of advocacy efforts. The result is a coalition of advocacy organizations increasing their understanding of the technical aspects of planning and decision making and making increasingly specific analytical requests of agency staff. These actions are increasing the vertical power of advocates, but gaps still remain between modeling tools, their analytical results, and decisions made at the board level. Advocates recognize these gaps and are increasingly calling for different types of analyses as well as a decreased emphasis on certain tools.

Evidence that regional equity advocates are expanding beyond their traditional role as participants is provided in the activities of the REWG. Established specifically to provide input to agency staff on the regional analysis conducted to determine whether the RTP/SCS is equitable, the REWG demonstrated an unwillingness to provide the type of input prescribed by MTC. As will be covered further in Chapters 3 and 4, the regional equity analysis is conducted based on outputs from a regional travel demand model and the results are used to demonstrate the MPO's compliance with federal nondiscrimination

law and as an outreach tool. MTC has conducted such equity analyses since the late 1990s.[66]

Travel demand models can appear impenetrable to lay observers,[67] and are seen as a barrier to public participation by some advocates. Although SB 375 has directed substantial energy and financial resources towards improving travel demand models, a regional equity stakeholder active on the REWG sees very little difference between advanced travel demand models and their forebears. She explains:

> Whether it's an activity-based or a four step model it's still a highly technical model that feels like a black box that is not accessible for public participation especially by the most impacted communities. I think that held true before and still does…because there's such a heavy reliance on outputs of models or results of model analysis to guide this decision making process as being the only objective marker on which these decision makers can rely. Instead of really being able to look at the status of current conditions and existing disparities as something that is also objective and could guide their decision making. Somehow it's just embedded in this process and it's been very hard to shake loose the hold that technical travel models play.[68]

The REWG met monthly and meetings were facilitated by one or more members of MTC staff. Throughout the process advocates continued to voice concern at the lack of analysis of existing disparities, calling for a shift from long term forecasts to more near-term "snapshot"-like analyses better capable of informing short term investment decisions.[69] An additional concern for REWG members was what they perceived as a lack of feedback between equity analysis results and decision making at the commission

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[66] Thomas Sanchez, "Expert Report of Prof. Thomas W. Sanchez," (http://www.publicadvocates.org/document/expert-report-of-prof-thomas-w-sanchez-filed-april-1-2008).
[67] Edward Beimborn and Rob Kennedy, "Inside the Blackbox: Making Transportation Models Work for Livable Communities," (Citizens for a Better Environment and The Envrionmental Defense Fund, 1996).
[68] Interview conducted on November 21, 2011. Notes and recording in possession of the author.
[69] The Snapshot Analysis developed out of feedback received on the equity analysis conducted as part of the 2009 RTP update, Transportation 2035, and was meant to provide information on relatively current conditions of the transportation network, impacts on protected populations and to be updated frequently and thus used as a guide for policy. See MTC, "Snapshot Analysis Development Report," (Oakland, CA: Metropolitan Transportation Commission, 2010)..

level. This seems to be a general trend with regional equity analyses. Sanchez and Wolf, in a review of the equity analysis practices of 50 MPOs concluded that "Overall, it was unclear in nearly all cases how the results of MPO equity analyses could be used as feedback in the transportation planning and decision-making process."[70] Transportation advocates, attorneys, public health officials, and academics have raised similar concerns to MTC staff throughout the process. Summarizing these thoughts via email one such group stated[71] that

> We are interested in drilling down to a city or neighborhood level for the Equity Analysis metrics to understand how individual neighborhoods or communities are impacted, specifically which communities will be most burdened and which will most benefit from the Preferred Scenario.

Also that,

> modeling forecasts for a 25-30 year horizon raises serious uncertainties and often inaccurately portray the real-life impacts experienced by Bay Area communities. Given that the RTP is revisited and adopted every four years, we request that information about 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 Targets Analysis, be disaggregated into five-year increments.

These concerns echo public comments submitted by environmental justice organizations and transportation advocacy non-profits to MTC over the past three RTP cycles.[72] A 1998 letter from Bay Area stakeholders requests that MTC analyze "which income levels and neighborhoods will benefit from … planned investments" and suggests that improving transit accessibility for vulnerable communities should be the region's top

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[70] Thomas W. Sanchez and James Wolf, "Environmental Justice and Transportation Equity: A Review of MPOs," in *Growing Smarter: Achieving Livable Communities, Environmental Justice, and Regional Equity*, ed. Robert D. Bullard (Cambridge, MA: MIT Press, 2007), 262.
[71] Email from Lindsay Imai, Parisa Fatehi-Weeks, Rajiv Bhatia, and Alex Karner to Jennifer Yeamans, March 12, 2012.
[72] RTPs completed in 2001, 2005 (Transportation 2030), and 2009 (Transportation 2035).

priority.[73] In 2004, the MCAC wrote to MTC's planning and operations committee regarding the Transportation 2030 equity analysis.[74] In part the letter requests air quality analysis in individual communities of concern as well as a "micro-level analysis of communities of concern in addition to macro-level generalizations."

Specific analysis methods and tools, including travel demand models, are embedded in the equity analysis process. Clearly, the specific methods chosen are contested. Advocates have challenged the agency's methods, arguing that emphasizing future year projections does not reflect their concerns about extant inequity. The use of models at all to represent these concerns is also problematic. During the preparation of the draft environmental impact report (DEIR) for MTC's RTP/SCS *Plan Bay Area*, the agency shifted to an integrated travel demand-land use modeling framework, combining MTC's activity-based travel model with UrbanSim, a microsimulation based model that predicts land use changes in response to policies like zoning and urban growth boundaries as well as the timing and location of transportation infrastructure changes.[75] Neither travel demand nor land use models were developed with equity-focused policies in mind. Indeed, the first urban transportation studies that employed early travel demand models resulted in highway-focused plans; transit was considered a lesser priority and transportation policies like pricing or regulatory changes were not considered.[76]

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[73] Letter on Civil Rights, Equity, and Transportation to MTC Executive Director Lawrence D. Dahms. April 17, 1998.
[74] Letter from the Minority Citizens Advisory Committee to MTC Planning and Operations Committee regarding Comments on the Transportation 2030 Equity Analysis Report. December 10, 2004.
[75] Paul Waddell et al., "Microsimulation of Urban Development and Location Choices: Design and Implementation of UrbanSim," *Networks and Spatial Economics* 3, no. 1 (2003).
[76] Weiner, *Urban Transportation Planning*, 26.

Regional equity advocates participating in the preparation of the CEQA-required alternatives analysis for the DEIR were invited to provide input in the design of an "equity maximizing" scenario. Despite a plethora of policy ideas focused on increasing affordable housing provision near high quality transit, preventing displacement of existing low-income residents in areas projected to receive transit investments, and managing gentrification, advocates had to contend with the abilities of the model to reflect these policies.[77] Correspondence between what was imagined and what was possible to model was low.[78] To the extent that the results of the DEIR analysis are used to guide decision making, they will be deficient because they will not embody the effect of policies not represented within the modeling framework. This realization points to the need for the acknowledgement of model limitations at the agency.

CONCLUSION

This chapter has described the changing nature of transportation planning since the events of Chapter 1. While federal legislation has tended to empower regional governments, legislation at the state level has tended to empower subregional entities. Federal law has mandated increasing public participation, however, and in the wake of 1991's ISTEA, advocacy organizations proliferated, often forming a key component of policy reform especially where the law was insufficiently prescriptive. Advocates focused on the region because of the intransigence of local governments, its broader

[77] Memorandum Re: Equity, Environment, and Jobs (EEJ) Alternative. June 28, 2012.

[78] The author attended two DEIR scoping meetings at ABAG headquarters during June, 2012 specifically convened by the agency to receive input from advocates on the DEIR equity maximizing scenario. Since ABAG still only acts in an advisory capacity with respect to land use policies enacted by its member agencies, the correspondence between what was imagined and what was possible to implement was also low. This was true not only for the land use policies suggested by advocates but the policies included in each of the DEIR scenarios as well.

purview than local planning agencies, and its central role as an aggregator and distributor of transportation funds.

These organizations have become increasingly unsatisfied with traditional avenues of public participation and have demanded that agencies study alternative planning scenarios that are both more ambitious in terms of assumptions about shifts in transportation investment priorities but may also result in increasing equity and reduced environmental injustices. Further, they have pressed agencies on the link between such analysis and decision making and encouraged a focus on existing disparities as opposed to future year forecasts. In the decades following ISTEA, advocacy organizations have become an important voice for reform in transportation and land use policy, but limitations presented by analysis methods and modeling tools are challenging to overcome.

Federal legislation like Title VI of 1964's Civil Rights Act mandates that agencies receiving federal funding not discriminate on the basis of race in their funding practices and programs. As recipients of federal funding, compliance with Title VI is a key concern at MPOs and the types of analyses sought by advocates is often conducted under the aegis of Title VI. The next chapter of this dissertation reviews civil rights law, executive agency guidance, and regional agency practice for equity analysis. The results show that there is no standard approach, and traditional methods are likely to obfuscate inequity. The final chapter proposes new methods for equity analysis responsive to the stakeholder concerns summarized above and which take advantage of a new generation of travel demand models.

CHAPTER 3: A REVIEW OF CIVIL RIGHTS GUIDANCE AND EQUITY ANALYSIS METHODS FOR REGIONAL TRANSPORTATION PLANS

INTRODUCTION

Transportation equity refers to the incidence of benefit and burden of transportation investment and policy and investment decisions.[1] Federal law and guidance dating to Title VI of the Civil Rights Act of 1964 combined with changes to transportation planning practice ushered in by the Intermodal Surface Transportation Equity Act of 1991 (ISTEA) have increased and continue to increase the visibility of equity issues in transportation. Foundations, non-profit advocacy organizations, attorneys, and academic researchers have contributed to a growing body of knowledge, but there remains a need for a standard approach that reflects the concerns of advocates highlighted in Chapter 2 and takes advantage of emerging activity-based travel demand models. This chapter describes shortcomings in the analytical tools and methods that transportation planning agencies use to assess the equity of their transportation plans and suggests a new strategy that is directly responsive to the concerns of equity stakeholders and consistent with the law and other guidance.

Over the past 30 years, equity across transportation modes and their users has been of the utmost importance for transit users, labor unions, and more recently advocates for transportation justice.[2] Using Title VI as the overarching legal framework, these actors

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[1] See, e.g., Todd Litman, "Evaluating Transportation Equity," (Victoria, BC: Victoria Transport Policy Institute, 2011).

[2] John Pucher, "Discrimination in Mass Transit," *Journal of the American Planning Association* 48, no. 3 (1982); Grengs, "Community-Based Planning as a Source of Political Change: The Transit Equity Movement of Los Angeles' Bus Riders Union."; Robert D. Bullard, "The Anatomy of Transportation Racism," in *Highway Robbery: Transportation Racism & New Routes to Equity*, eds. Robert D. Bullard,

have consistently highlighted disparities in transit funding presided over by transportation planning agencies that prioritize investment in transit systems predominantly used by relatively affluent, white, suburban users over the systems predominantly used by relatively poor, minority, urban users. One prominent result is that as transit use has grown in recent years, ridership has come primarily from this latter group, while transit investments have flowed primarily to the former group. This divergence suggests that greater ridership gains and concomitant transit-related benefits including potential reductions in congestion and vehicle-miles traveled (VMT) could be realized if investments instead flowed to the communities currently dependent on transit and most likely to use it for the majority of their trips.[3]

Although modal equity has received the majority of legal attention, other equity issues are also highly relevant. In California, near-road air quality and health impacts are disproportionately borne by low-income citizens of color; and school-aged children exposed to near-road impacts are three times more likely to be of color than white.[4] These results raise important considerations regarding the siting of both schools and affordable housing. Additionally, a vast literature has emerged to document the "spatial mismatch"

Glenn S. Johnson, and Angela O. Torres (Cambridge, MA: South End Press, 2004); Golub, Sanchez, and Marcantonio, "Race, Space and Struggles for Mobility."

[3] Mark Garrett and Brian D. Taylor, "Reconsidering Social Equity in Public Transit," *Berkeley Planning Journal* 13(1999); Joe Grengs, "The Abandoned Social Goals of Public Transit in the Neoliberal City of the USA," *City* 9, no. 1 (2005); Brian D. Taylor and Kendra Breiland, "Transit's Dirty Little Secret: The Divergence of Public Policy and Transit Use by the Poor" (paper presented at the 90th Annual Meeting of the Transportation Research Board, Washington, DC, 2011).

[4] Robert B. Gunier et al., "Traffic Density in California: Socioeconomic and Ethnic Differences among Potentially Exposed Children," *Journal of Exposure Analysis and Environmental Epidemiology* 13, no. 3; Douglas Houston et al., "Structural Disparities of Urban Traffic in Southern California: Implications for Vehicle-Related Air Pollution Exposure in Minority and High-Poverty Neighborhoods," *Journal of Urban Affairs* 26, no. 5 (2004); Douglas Houston et al., "Proximity of Licensed Child Care Facilities to Near-Roadway Vehicle Pollution," *American Journal of Public Health* 96, no. 9 (2006).

between black workers and jobs.[5] The spatial mismatch hypothesis posits that there are more jobs per capita in white areas than in black areas. While some of the causes of this mismatch are outside of the purview of a metropolitan planning organization, like housing and labor market discrimination, others are not, like the provision of affordable housing and public transit in and near job centers matched to the skill and income levels of black workers.

The siting of transportation infrastructure also exhibits race and class dimensions and can thus be interpreted as an instance of transportation inequity.[6] In Atlanta, the construction of the Downtown Connector and I-20 along with the Atlanta-Fulton County stadium effectively eliminated low-income black and white neighborhoods alike during the 1950s and 60s.[7] In Oakland, redevelopment was more explicitly racialized when West Oakland, the city's primary African-American area, was declared "blighted" *in toto* by the city's planning commission in the early 1950s.[8] The eventual siting of three freeways encircling West Oakland and overhead Bay Area Rapid Transit infrastructure had the paradoxical effect of further isolating the neighborhood from emerging business centers in San Francisco and downtown Oakland.[9] These histories of injustice understandably loom large in contemporary debates over transportation planning in the American city.

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[5] Ihlanfeldt and Sjoquist provide an accessible review of this work. Keith R. Ihlanfeldt and David L. Sjoquist, "The Spatial Mismatch Hypothesis: A Review of Recent Studies and Their Implications for Welfare Reform," *Housing Policy Debate* 9, no. 4 (1998).
[6] Thomas Sanchez, Rich Stolz, and Jacinta S. Ma, "Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities," (Cambridge, MA: The Civil Rights Project at Harvard University, 2003), 19-21.
[7] Larry Keating, *Atlanta: Race, Class, and Urban Expansion* (Philadelphia, PA: Temple University Press, 2001), 91-95.
[8] Robert O. Self, *American Babylon: Race and the Struggle for Postwar Oakland* (Princeton, NJ: Princeton University Press, 2003), 137-39.
[9] Ibid., 153.

As described in Chapter 2, California's 2008 law, the Sustainable Communities and Climate Protection Act, also known as Senate Bill 375 (SB 375), has become a catalyst for the organizing efforts of regional equity advocates. SB 375 adds a new component to the regional transportation plan (RTP), the sustainable communities strategy (SCS). Through their SCSs, California's metropolitan planning organizations (MPOs) will demonstrate their compliance with the policy goal of reducing the rate at which greenhouse gas emissions increase with population. Combined with the short-term transportation improvement program (TIP), these three documents establish a region's combined transportation and land use vision and link that vision to transportation projects, land use plans, and nominal greenhouse gas emissions reductions. Because the SCS has the potential to substantially reshape the urban form but does SB 375 does not contain provisions that ensure equitable outcomes, equity advocates have raised concerns about gentrification and displacement, transportation affordability, and transit mode investment priorities.[10]

As recipients of federal funding, MPOs must demonstrate compliance with Title VI and other guidance designed to mitigate adverse impacts on low-income populations. Title VI mandates nondiscrimination on the basis of race at agencies that receive federal funding. The RTP's compliance with at least the spirit of Title VI and related guidance is typically demonstrated by the preparation of an "equity analysis" of the investment strategy embodied in the RTP. This chapter conducts a review of law, federal agency guidance, and MPO practice and finds that there are no standards governing equity

[10] See, e.g., Urban Habitat, "6 Wins for Social Equity Network and the Regional Transportation Plan," http://urbanhabitat.org/tj/campaigns/sixwins.

analyses. Moreover, the approaches typically employed draw heavily from traditional environmental justice analyses which are not appropriate for the study of transportation investments. Advanced travel demand models are replacing their four step progenitors and carry the promise of improved analysis, but we find that discussions of race are conspicuously absent from these analyses, raising potential issues with Title VI compliance.

This chapter will be useful for regional planning agencies and county congestion management agencies (CMAs) interested in improving the correspondence between their analysis of equity and environmental justice and the lived experience of protected populations within their jurisdictions. It is also timely: in late 2011 the Federal Transit Administration conducted a listening tour and is revising its guidance on environmental justice and Title VI analysis; the US Environmental Protection Agency is also soliciting feedback on a document that links smart growth and environmental justice.[11] It is expected that the findings described herein will be relevant to such efforts.

EQUITY ANALYSIS OVERVIEW

Law and guidance

RTP compliance with Title VI has typically been demonstrated through the development of a regional equity analysis. While the incidence of benefit and burden associated with individual transportation projects is also relevant, the analysis of regional transportation plans to determine the equity of a region's investment strategy is

[11] Federal Transit Administration, "FTA Information Sessions: Proposed Title VI and Environmental Justice Circulars."; US Environmental Protection Agency, "Creating Equitable, Healthy, and Sustainable Communities Strategies for Advancing Smart Growth, Environmental Justice, and Equitable Development (Draft)."

conceptually distinct from those activities. FHWA and FTA administrators issued a joint memorandum in 1999 affirming that "while Title VI and environmental justice 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."[12] The purpose of a regional equity analysis is to determine whether the benefits and burdens of a transportation plan are equitably distributed, i.e. that no demographic group is denied a fair share of benefits from transportation investments or saddled with an unfair share of its burdens. Executive agencies have affirmed this purpose.

President Clinton's 1994 Executive Order 12898 (EO 12898) required that the achievement of environmental justice be made a part of every federal agency's mission and specifically referred to low-income populations as a protected group.[13] Environmental justice was to be achieved by "identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

The US Department of Transportation operationalized EO 12898 with an Environmental Justice Strategy in 1995 and Proposed and Final Environmental Justice Orders in 1995 and 1997, respectively. The order was meant to provide guidance to the Department and its operating administrations regarding the implementation of EO 12898 and encouraged the use of existing avenues including the National Environmental Policy

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[12] Federal Highway Administration/Federal Transit Administration, "Implementing the Title VI Requirements in Metropolitan and Statewide Planning," (Washington, DC: US Department of Transportation, 1999).

[13] William J. Clinton, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," http://www.epa.gov/region1/ej/pdfs/exec_order_12898.pdf.

Act (NEPA) and Title VI for achieving environmental justice rather than the creation of new requirements.[14]

The order prescribed that DOT would avoid discriminatory outcomes by identifying and evaluating the effects of its programs and policies with regard to "environmental, public health, and interrelated social and economic effects," propose measures to mitigate any adverse effects it found, consider alternatives to preferred proposals, and facilitate public involvement from environmental justice populations. In the event that disproportionately high and adverse impacts were found, the offending action could only proceed if a substantial need existed for that program. The order also specified that low-income and minority populations should be considered whether in geographic proximity or if they were geographically dispersed or transient.

FHWA issued Directive 6640.23 on December 2, 1998.[15] This directive effectively restated the DOT order without adding additional content or interpretation. The Urban Mass Transportation Administration (now FTA) had issued Title VI-related guidance prior to the DOT order, and it included guidance for MPOs that pass through formula grant funds.[16] FTA revised the UMTA guidance in 1998 with a new circular that increased the specificity of guidance for MPOs.[17] The circular prescribed that "MPOs should have an analytic basis in place for certifying compliance with Title VI" and that

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[14] Department of Transportation, "Department of Transportation (DOT) Order to Address Environmental Justice in Minority Populations and Low-Income Populations," *Federal Register* 62, no. 72 (1997).
[15] Federal Highway Administration, "FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Order 6640.23)," (Washington, DC, 1998).
[16] See, e.g., Urban Mass Transportation Administration, "Title VI Program Guidelines for Urban Mass Transportation Administration Recipients (UMTA C 4702.1)," (Washington, DC: US Department of Transportation, 1988).
[17] Federal Transit Administration, "Title VI and Title VI-Dependent Guidelines for Federal Transit Administration Recipients (FTA C 4702.1A)," (US Department of Transportation, 2007).

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."[18]

FTA updated its circular in 2007 and again in 2012, at that time creating separate Title VI and environmental justice guidance.[19] While the two requirements often overlap, there are some circumstances where analysis could be required for one but not the other or where the actions prescribed in the event that a disparate impact is found could differ.[20] Importantly, while Executive Order 12898 requires the identification of disproportionately high and adverse health or environmental effects, Title VI requires only the identification of a disparate impact resulting from the use of federal funds that entails a much wider scope of possible adverse effects including a denial or delay in the reception of benefits.[21] Under Title VI, agencies must have a "substantial legitimate justification" to undertake a discriminatory action, meaning that mitigation is not possible. Under Executive Order 12898, mitigation and the identification of alternatives that would reduce impacts are possible. The evaluation of transportation plans typically includes at least a discussion of both Title VI and environmental justice since the theoretical considerations are similar in both cases.

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[18] Ibid., VIII-1.
[19] ———, "Environmental Justice Policy Guidance for Federal Transit Administration Recipients - Proposed Circular FTA C 4703.1," (US Department of Transportation, 2011); ———, "Title VI Requirements and Guidelines for Federal Transit Administration Recipients - Proposed Circular FTA C 4702.1B," (US Department of Transportation, 2011).
[20] ———, "Proposed Circular 4703.1," 35-38.
[21] ———, "Proposed Circular 4702.1B," I-2.

FHWA updated its environmental justice guidance in 2012, but it contains no substantive changes from the 1998 document.[22] FTA is likely more active than FHWA in promulgating guidance for at least three reasons. First is the historical significance of public transit as a civil rights issue reaching back to the late 19th century with the Supreme Court's Plessy v. Ferguson decision that codified "separate but equal" services for white people and people of color.[23] Homer Plessy was arrested for violating the Louisiana's Separate Rail Car Act by sitting in the "whites only" car.[24] Second is the nature of transit in comparison with highways. After the construction of a highway, individual motorists operate private vehicles and the state maintains the road using tax revenue. Lane-miles of roads are generally not eliminated after construction, and the highway system in the US, with some notable exceptions, is relatively mature – vast increases in highway capacity will generally not be undertaken. On the other hand, public transit is both constructed and operated by the state. Service changes, both expansions and contractions, are the norm. Transit-dependent populations are more likely to be of color and low-income than drivers, so the potential for disparate impact is always present. Third, agencies that receive a single dollar from FTA are bound to comply by its circulars in all of their activities. MPOs, especially those operating in large jurisdictions, are likely to receive both FHWA and FTA dollars, so duplicate guidance and oversight is generally unnecessary.

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[22] Federal Highway Administration, "FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Order 6640.23A)," (Washington, DC: US Department of Transportation, 2012).
[23] *Plessy v. Ferguson,* 163 US 537 (1886).
[24] Bullard, "Anatomy of Transportation Racism."

FTA's proposed 2011 circulars are substantially more detailed than they were previously with respect to guidance for MPOs, but the lion's share of recommendations apply to transit operators for whom specific analytical methods and technical assistance are provided related to the analysis of transit service and fare changes.[25] In comments on the proposed 2011 environmental justice and Title VI circulars, attorneys, transportation justice advocates, and academics suggested that FTA increase the clarity with which they prescribed responsibilities for MPOs.[26] The comments refer more to MPO responsibilities as aggregators of plans passed up from local agencies. Specifically, the comments request that the MPO certify the compliance of local agencies within the MPO jurisdiction with Title VI lest the regional planning process become "infected by discrimination in the decisions of other agencies that he MPO incorporates into its plans."[27] This monitoring would extend beyond those activities for which the MPO directly passed through funds.

Transportation authorizations have also served to broaden both the responsibilities of MPOs and the "planning factors" they must consider.[28] The Intermodal Surface Transportation Efficiency Act (ISTEA) brought considerations of the health, economic, and social effects of transportation investments within the ambit of planning agencies, expanded opportunities for public participation, and endowed MPOs with certain authorities additional to those they had previously enjoyed.[29] Programs geared towards mitigating adverse impacts and improving mobility for protected populations have also

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[25] See, e.g., Federal Transit Administration, "Proposed Circular 4702.1B," Appendix K.
[26] Public Advocates, "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.
[27] Ibid., Attachment B, 14.
[28] Handy, "Regional Transportation Planning in the US."
[29] TRB, *Conference on Institutional Aspects of Metropolitan Transportation Planning*.

been undertaken. For example, in the spirit of Executive Order 12898, the notion of low-income individuals as an additionally protected population was codified in the Transportation Equity Act for the 21st Century (TEA-21) which included programs specifically for low-income city residents and welfare recipients.[30] The Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) passed in 2005 continued to emphasize the broadening of transportation planning evidenced by the earlier bills.[31] A two-year transportation bill to replace the expired SAFETEA-LU was enacted in July, 2012 entitled Moving Ahead for Progress in the 21st Century (MAP-21). One goal of the Act was to expedite project delivery by increasing the number of projects not subject to environmental review; a side effect of this decision is likely to be the reduction of opportunity for public participation in decision making. Additionally, language describing the benefits of public transit that were included in SAFETEA-LU was struck out in MAP-21 indicating a potential backpedalling by the Congress relative to prior law.[32]

Transportation planning agencies use this law and guidance to develop regional equity analyses, but none of the above creates a legal basis for assessing compliance with specific provisions or prescribes specific analytical standards or methods. For example, the 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

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[30] Sanchez, Stolz, and Ma, "Moving to Equity."; Lisa Schweitzer and Abel Valenzuela, "Environmental Injustice and Transportation: The Claims and the Evidence," *Journal of Planning Literature* 18, no. 4 (2004).
[31] Handy, "Regional Transportation Planning in the US."
[32] Federal Transit Administration, "Chapter 53 of Title 49, United States Code, as Amended by MAP-21," (Washington, DC: US Department of Transportation, 2012).

FHWA, its officers, or any other person."[33] FHWA has suggested that MPOs improve modeling capabilities to characterize the travel behavior of communities of color and low-income,[34] but has not been specific on how they should characterize the incidence of benefit and burden in those populations.

The lack of specific guidance has resulted in a situation where the completion of *any* analysis is considered sufficient for compliance. Sanchez et al. state 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."[35] An effect of the lack of guidance is a comparative dearth of civil rights complaints fielded by FHWA relative to other executive agencies. Although there is wide variation in the types of analyses that are considered sufficient for Title VI and environmental justice purposes, the combination of vague guidance and a lack of enforcement has led to the proliferation of a type of analysis that draws heavily from an approach influenced by traditional environmental justice studies. It is to this approach that this dissertation now turns.

EQUITY ANALYSIS IN PRACTICE

The traditional approach

The guidance summarized above provides rather general principles for the equity analysis of regional plans. Contrary to Deka, these analyses are routinely undertaken, and by all accounts the principles of environmental justice appear to be valued by planning

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[33] Federal Highway Administration, "FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Order 6640.23A)."
[34] ———, "An Overview of Transportation and Environmental Justice," http://www.fhwa.dot.gov/environment/ej2000.pdf.
[35] Sanchez, Stolz, and Ma, "Moving to Equity," 36.

agencies;[36] however, implementing an equity analysis requires making difficult but empirically significant tradeoffs about which there are no established guidelines, standards, or practices.[37] As a result, analyses often contain statements regarding the lack of prescribed standards.[38] This wide latitude is both the cause and effect of very little systematic analysis directed at developing appropriate analytical methods for such analysis.[39] Notable exceptions are two reports commissioned by the National Cooperative Highway Research Program (NCHRP) on environmental justice assessment.[40] These differ somewhat in emphasis, with the 2002 and 2004 reports focusing on plan-level and project-level analyses, respectively. Neither report conducts analysis that compares outcomes based on different approaches to equity analysis, but each provides an assessment of methods in use at the time, including potential shortcomings.

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,

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[36] Devajyoti Deka, "Social and Environmental Justice Issues in Transportation," in *The Geography of Urban Transportation*, eds. Susan Hanson and Genevieve Giuliano (New York, NY: The Guilford Press, 2004).
[37] Cambridge Systematics, "Technical Methods to Support Analysis of Environmental Justice Issues," (Washington, DC: National Cooperative Highway Research Program, 2002), 2-2.
[38] See, e.g., Council of Fresno County Governments, "Fresno Council of Governments Environmental Justice Plan," (Fresno, CA, 2009), 4.
[39] An additional reason might simply be the undervaluing of such analyses on the part of regional agency staff with limited time available to complete plans and all statutorily required analyses.
[40] Cambridge Systematics, "Technical Methods to Support Analysis of Environmental Justice Issues."; David J. Forkenbrock and Jason Sheeley, "Effective Methods for Environmental Justice Assessment," (Washington, DC: National Cooperative Highway Research Program, 2004).

developing indicators to measure the impacts of their plans, and developing tests of disproportionate impact distributions.[41] 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 current as of mid-2012.[42] Combining the two yields the following:

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 of these residents are identified as representing the target population. For example, as of 2012, the Metropolitan Transportation Commission's (MTC) most recent definition of the target population includes TAZs with 70% people of color and/or 30% low-income (defined as less than 200% of the federal poverty level).[43] 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.[44]
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

[41] Cambridge Systematics, "Technical Methods to Support Analysis of Environmental Justice Issues," 4-4.
[42] Forkenbrock and Sheeley, "Effective Methods for Environmental Justice Assessment," 6-7.
[43] There are additional definitions for other target populations including limited English proficiency/low educational attainment and low mobility communities. See Jennifer Yeamans, "Alternative Scenarios Equity Analysis: Target Population Definitions Memo, August 3, 2011," (Metropolitan Transportation Commission).
[44] See, e.g., Nancy Pfeffer et al., "Environmental Justice in the Transportation Planning Process: Southern California Perspective," *Transportation Research Record: Journal of the Transportation Research Board* 1792(2002).

destinations, travel time, and safety, among others, and also burdens including air pollution, noise,

3. **Assess equity**: Determine whether the results demonstrate equity. This is often not straightforward because of the existence of differing conceptions of equity.[45] The approach often used for plan-level analyses is to determine whether forecasted changes in metrics from the base year to the forecast year 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.

Advocacy strategies

The RTP equity analysis has become a focal point for the organizing and advocacy efforts of regional equity actors, as described in Chapter 2. However, in these efforts, advocates have tended to place an outsize importance on addressing the design of metrics, listed as point two in the synopsis of a typical equity analysis above.[46] An additional but often unexamined consideration is also highly relevant. Namely that the

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[45] C. Khisty, "Operationalizing Concepts of Equity for Public Project Investments," *Transportation Research Record: Journal of the Transportation Research Board* 1559(1996); Jen Duthie, Ken Cervenka, and S. Waller, "Environmental Justice Analysis: Challenges for Metropolitan Transportation Planning," *Transportation Research Record: Journal of the Transportation Research Board* 2013(2007); Martens, Golub, and Robinson, "A Justice-Theoretic Approach."

[46] Human Impact Partners has proposed an extensive set of metrics for use in SCS development (see http://www.climateplan.org/wp-content/uploads/2011/07/Metrics-1-pager-7_11_11.pdf). The US Environmental Protection Agency also lists the development of indicators as a priority for its "Sustainable and Healthy Communities Research" (see http://www.epa.gov/ord/priorities/sustainablecommunities.htm). Interest in developing metrics extends well beyond the SCS, reaching back to the beginning of the "sustainability" movement in the mid-1970s. See Judith E. Innes and David E. Booher, "Indicators for Sustainable Communities: A Strategy Building on Complexity Theory and Distributed Intelligence," *Planning Theory & Practice* 1, no. 2 (2000): 174.

analytical methods used to calculate indicators and to assess their performance relative to a baseline or between alternatives must also be theoretically sound. Moving immediately to indicator definition without considering the larger analysis and policy framework within which that indicator will operate risks putting the cart before the horse.

The emphasis on indicators is understandable because input on the other components is often circumscribed and many different metrics have been used in regional equity analysis. The 2002 NCHRP report found that measures of accessibility, travel, time, transit service quality, and project proximity, among others, had been used. The report raises two important points regarding metrics. First, environmental justice stakeholders felt that modeled results did not adequately represent their experience of transportation inequity. Second, a specific operationalization of accessibility – proximity to transportation infrastructure – is misleading. Using proximity assumes that all residents proximate to a transportation project benefit from it in equal measure; however, this ignores the reality of transportation burdens and also differential means to access a project. For example, those who use a new high occupancy toll facility would be substantially different from those who use a new local bus line, even if they were located along similar rights-of-way. For this reason the report recommends that *users* of a project should be identified rather than their geographic zones. This can be accomplished using travel modeling data. For example, examining travel time outcomes for zones or households proximate to a project both before and after modeled project implementation. Developing metrics without regard for their implementation is not likely to lead to informative results.

Innes and Booher discuss additional methods for developing useful metrics.[47] Three points from their work are particularly salient here. First, indicators are not useful in and of themselves; rather, their utility comes from the process of their development and from the learning and change that occurs among decision makers and stakeholders during this time. As illustrated during the discussion of the proposed environmental justice principles at MTC in Chapter 2, however, the differential authority of governing boards versus advisory committees or other participants can determine outcomes. Relatedly, useful indicators must be clearly associated with policies or sets of actions so that the learning that occurred during development becomes embodied in policy. Finally, indicators must be available that respond to the pertinent system in real time, creating a situation where short-term changes can be implemented based on new results. If these latter two conditions are not met, use of the indicators will not lead to substantive change within a system regardless of the specific phenomenon they intend to measure. In general, neither of these conditions is satisfied in regional equity analyses because the analysis results do not directly inform policy or investment decisions[48] and analytical techniques are based on traditional environmental justice analysis that employs a static conception of inequity that relies on past rather than future data.

Traditional environmental justice analysis is generally not appropriate for assessing the full suite of disparate impact and benefit claims in transportation planning. The traditional approach is exemplified by the canonical report *Toxic Wastes and Race in the*

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[47] Ibid.
[48] Sanchez, "Expert Report of Prof. Thomas W. Sanchez," 32-33; Sanchez and Wolf, "Environmental Justice and Transportation Equity: A Review of MPOs."; Adjo A. Amekudzi et al., "Impact of Environmental Justice Analysis on Transportation Planning," (Atlanta, GA: Georgia Department of Transportation, 2011).

United States commissioned by the United Church of Christ in 1987.[49] 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 suite of covariates. With locally undesirable land uses like toxic waste landfills or stationary sources of air pollution, citizens living within some proximity to the site are similarly burdened. Comparing the demographics in 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.[50] The results of this report spawned the use of similar methods to study the relationship between environmental burdens and demographics in areas around the world and have been applied specifically to assess the negative impacts of transportation projects.[51]

Shortcomings with the traditional approach

While potentially applicable to some regional studies of transportation burden like air pollution near roads, noise, or density of vehicle-miles traveled, applying traditional environmental justice analyses to regional benefits rests on a subtle change in method. Rather than defining a target population in proximity to a hazard, target populations must

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[49] Benjamin E. Chavis and Charles Lee, "Toxic Wastes and Race in the United States," (New York, NY: Commission for Racial Justice: United Church of Christ, 1987).

[50] Although the geographic units and buffer zones around the facility must also be selected with care. See Michael T. Most, Raja Sengupta, and Michael A. Burgener, "Spatial Scale and Population Assignment Choices in Environmental Justice Analyses," *The Professional Geographer* 56, no. 4 (2004); Isabel Victoria et al., "Environmental Justice Concentration Zones for Assessing Transportation Project Impacts," *Transportation Research Record: Journal of the Transportation Research Board* 1983(2006).

[51] See Mohai et al. for a recent review of studies using related methods: Paul Mohai, David Pellow, and J. Timmons Roberts, "Environmental Justice," *Annual Review of Environment and Resources* 34, no. 1 (2009). For example applications to transportation project assessment, see David J. Forkenbrock and Lisa A. Schweitzer, "Environmental Justice in Transportation Planning," *Journal of the American Planning Association* 65, no. 1 (1999); Jayajit Chakraborty, "Evaluating the Environmental Justice Impacts of Transportation Improvement Projects in the US," *Transportation Research Part D: Transport and Environment* 11, no. 5 (2006).

be defined a priori based on demographic thresholds. The assumption that such thresholds are meaningful is rarely challenged, but as noted by Duthie and colleagues, "use of the geographic unit as a proxy for the group unit does not work well for groups that do not congregate spatially."[52] In other words, the population identified using a threshold approach is not likely to represent individual members of that population accurately.

Adapting methods of geographic aggregation used to study the impacts of locally undesirable land uses or the impacts of individual transportation projects using thresholds is not appropriate for the study of the equity of *regional* transportation investments, especially in the nine county Bay Area, unless appropriate modifications are made. The 2002 NCHRP report also discusses the problems associated with specific analytical approaches and options for reducing their severity. Target population definition in particular has received substantial attention, but comparative assessments that vary the target population definition to determine the effect on outcomes have not been forthcoming. This section discusses shortcomings with both target population definition and the assessment of equity. Differing conceptions of equity have appeared in the literature, but the implications for their use in practice have also not been discussed.

In 1997, the Council on Environmental Quality (CEQ) released a document discussing the selection of thresholds for minority populations in its interpretation of Executive Order 12898.[53] They stated that minority populations were to be identified where either their share of the overall population exceeded 50% or where their proportion

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[52] Duthie, Cervenka, and Waller, "Environmental Justice Analysis," 11.
[53] Council on Environmental Quality, "Environmental Justice Guidance under the National Envrionmental Policy Act," (Washington, DC: Executive Office of the President, 1997), 25.

of the population was "meaningfully greater" than that of the minority population in general or at another "appropriate unit of geographic analysis."[54] In their 2011 proposed environmental justice circular, FTA describes a process for identifying minority and low-income populations that makes reference to the CEQ report.[55] While the circular applies mostly to project-level assessments, their target population recommendations are relevant more generally. Specifically, they caution FTA recipients to not "'artificially dilute or inflate' the affected minority and/or low-income population when selecting the appropriate unit of geographic analysis."[56] Despite this caution, no guidance is provided for determining whether dilution or inflation is indeed a problem. One strategy would be to test different geographies and threshold definitions to determine how outcomes are affected. Geographers have labeled a similar phenomenon as the modifiable areal unit problem wherein a changing geographic definition can change the outcome of an analysis.[57] For this reason, Amekudzi and Dixon recommend that any environmental justice assessment method include a sensitivity analysis on different areal units.[58] The point is not to adjust the unit until an equitable or inequitable result is found; rather, the *effect* of modifying the unit must be incorporated into the analysis and discussed along with the other results.

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[54] Ibid.
[55] Federal Transit Administration, "Proposed Circular 4703.1."
[56] Ibid., 6.
[57] Most, Sengupta, and Burgener, "Spatial Scale and Population Assignment Choices in Environmental Justice Analyses."; Ming Zhang and Nishant Kukadia, "Metrics of Urban Form and the Modifiable Areal Unit Problem," *Transportation Research Record: Journal of the Transportation Research Board* 1902(2005).
[58] Adjo A. Amekudzi and Karen K. Dixon, "Development of an Environmental Justice Analysis Methodology for Georgia Department of Transportation's Multimodal Transportation Planning Tool" (paper presented at the 8th Conference on the Application of Transportation Planning Methods, Corpus Christi, TX, April 22-26, 2001).

Specific legal interpretations and policy guidance provided in the 2002 report have not been widely reported or adopted in practice. Most relevant for target population definition is the report's discussion of FHWA guidance stating that small concentrations of people of color and low-income people can bear disproportionate impacts that must be mitigated.[59] The implication is that those populations not captured by thresholds must also be assessed. Additionally, the same guidance states that low-income and minority populations should not be "presumptively combined" in an environmental justice analysis. Strategies used for target population definition are discussed extensively but none are assessed for compliance with the FHWA guidance.[60]

Further, thresholds are not necessarily appropriate for the study of regional transportation system benefits, operationalized using accessibility, for example. The spatial distribution of accessibility depends on some factors that are relevant to a particular geography including proximity to a high-quality transit stop, the degree to which land uses are mixed, the quality of the pedestrian environment, etc., but other important decisions regarding travel behavior are not entirely spatial and instead depend upon the characteristics of individual households.

A simple example will illustrate this point. Figure 6 shows the geography of accessibility in the San Francisco Bay Area for automobile and transit. The accessibility measure was computed as an input to MTC's automobile ownership model,[61] and

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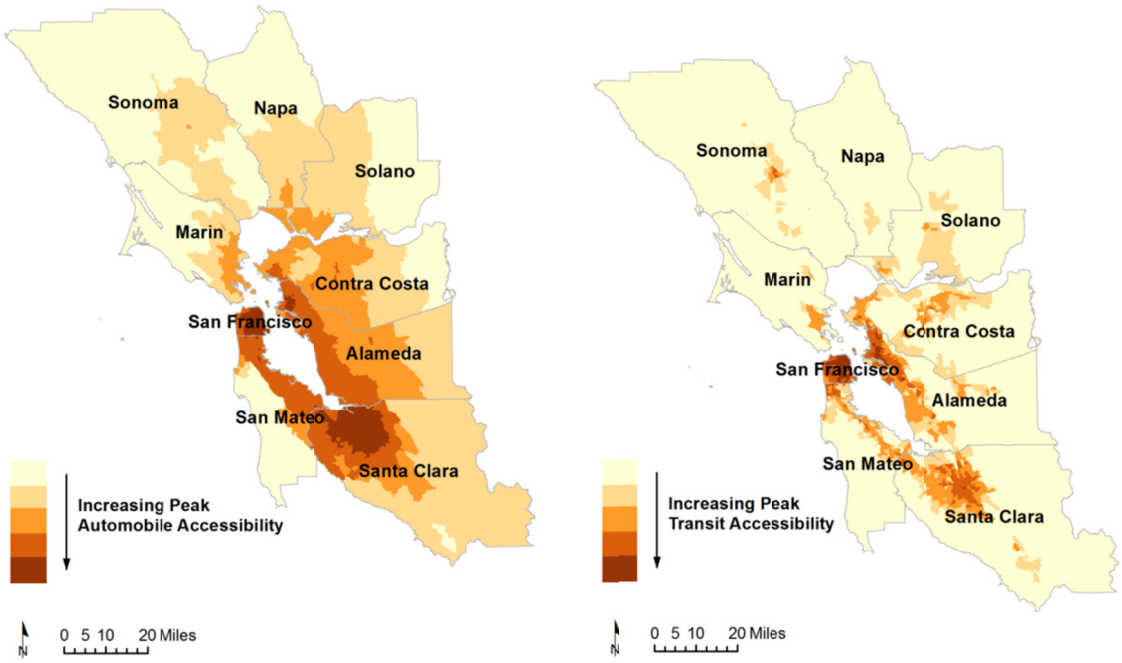
[59] Cambridge Systematics, "Technical Methods to Support Analysis of Environmental Justice Issues," 3-10; Federal Highway Administration, "The Facts - Nondiscrimination: Title VI and Environmental Justice," http://www.fhwa.dot.gov/environment/environmental_justice/facts/index.cfm.
[60] Cambridge Systematics, "Technical Methods to Support Analysis of Environmental Justice Issues," 4-12 – 4-19.
[61] Details available in MTC, "Travel Model Development: Calibration and Validation (Draft)," (Oakland, CA: Metropolitan Transportation Commission, 2011), 24,44.

represents the mode-specific ease with which jobs are reachable from an origin zone to all destination zones. For the purposes of Figure 6, similar magnitudes of accessibility have been grouped into five categories. The scale of automobile and transit accessibilities is identical. The maps vividly illustrate why a traditional environmental justice analysis is inappropriate: there are properties of a location that differ according to characteristics of individuals and households as opposed to its larger geographic unit. Specifically, individuals living within the same geographic unit (e.g., census tract) will have radically different interactions with the transportation system depending upon whether they own or have access to one or more vehicles. Although to the extent practical, individuals likely self-select into residential locations that facilitate the transportation choices they would like to make,[62] residential mobility may be restricted precisely for the protected populations under study in an equity analysis. Historic discrimination in housing markets, increasing median incomes that accompany gentrification, and the spatial manifestation of racism that generally allows whites to distance themselves from undesirable land uses and people of color without resorting to intentionally discriminatory individual acts are variously likely to work against freedom of choice in housing for low-income people and people of color.[63] Using a single threshold definition to classify geographic areas into one of two categories – target and non-target – will obscure differences between families that

[62] See, e.g., Xinyu Cao, Susan Handy, and Patricia Mokhtarian, "The Influences of the Built Environment and Residential Self-Selection on Pedestrian Behavior: Evidence from Austin, TX," *Transportation* 33, no. 1 (2006); Xinyu Cao, Patricia L. Mokhtarian, and Susan L. Handy, "Examining the Impacts of Residential Self-Selection on Travel Behaviour: A Focus on Empirical Findings," *Transport Reviews* 29, no. 3 (2009).
[63] Laura Pulido, "Rethinking Environmental Racism: White Privilege and Urban Development in Southern California," *Annals of the Association of American Geographers* 90, no. 1 (2000).

reside in those zones on dimensions relevant to transportation analysis and will generate results of questionable value.



(a) **(b)**

Figure 6 Automobile (a) and transit (b) accessibility, 2005.

Determining whether the results indicate inequity is another vital step in any equity analysis, yet the working definition of equity employed by an agency is typically unstated. Martens et al. note that in typical regional equity analyses, base year or existing disparities in a particular indicator are considered by the conducting agency to be unimportant, as long as the change in the future year forecast is similar for target and non-target populations.[64] These analyses summarize the change in the average value of a given metric between the base and forecast year or for the future year no-build vs. build scenarios. For example, if planned transportation improvements increase access to low-

[64] Martens, Golub, and Robinson, "A Justice-Theoretic Approach."

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 had some benefit distributed to them. Since the target population apparently received more of the benefit, the traditional approach would indicate that there is no equity concern regardless of the actual disparity in access. Even if both population segments had received benefits, but the target population had a lower value of the metric than non-target populations, the result might still have been considered acceptable. There is no standard for identifying disparate impact. Since an RTP generally forecasts increasing jobs and population, it is not difficult to demonstrate that accessibility benefits accrue to all population segments in this manner.[65]

Martens et al. refer to this approach as a proportionality criterion and argue that it is inconsistent with theories of justice developed by John Rawls and Michael Walzer.[66] In these theories, deviations in the distribution of a good from strict equality must be justified. Using accessibility as a key metric, the authors acknowledge that perfect equality of access is both impossible because of differences in space, mode availability, and income, and unnecessary because different levels of access for different people can still lead to equality of life opportunities. As a result, they recommend that transportation plans should employ a "maximax" criterion to guide investments and to assess equity that would maximize average access while limiting the maximum gap in accessibility between the lowest- and highest-accessibility groups. Under such a criterion, alternative

[65] Sanchez, "Expert Report of Prof. Thomas W. Sanchez," 47.
[66] See also Khisty, "Operationalizing Concepts of Equity for Public Project Investments."

plans would be assessed based on the extent to which they reduced inequities across space and across mode.

One way to operationalize inequity would be to use measures of dispersion like the Gini mean difference and the standard deviation to provide a single summary statistic that measures inequity across the entire population, sidestepping many of the difficulties associated with geographic aggregation. Gini-related metrics have experienced some use in transportation analysis but have not been used in practice.[67] Another way would involve agencies actively seeking out inequities in the base year and redressing them. Some observers have described this approach as the true purpose of an equity analysis.[68] Such an approach would also be responsive to stakeholder feedback. Comments on MTC's 2009 RTP equity analysis indicated too little focus on existing inequity and feedback delivered to MTC on equity analyses conducted during 2012 in support of the 2013 RTP/SCS has been similar.[69] MTC's implicit definition of equity as a proportional distribution of costs and benefits in the RTP forecast year likely accounts for these concerns. The approach described in Chapter 4 explicitly incorporates existing inequities by reducing gaps in equity metrics between target and non-target populations. Rather than deeming a scenario equitable if it results in generally similar improvements for different groups, it would be deemed equitable if its investment priorities were aimed at

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[67] David Levinson, "Identifying Winners and Losers in Transportation," *Transportation Research Record: Journal of the Transportation Research Board* 1812(2002); Alexa Delbosc and Graham Currie, "Using Lorenz Curves to Assess Public Transport Equity," *Journal of Transport Geography* 19, no. 6 (2011). This approach is further elaborated upon in Chapter 4.

[68] Sanchez, "Expert Report of Prof. Thomas W. Sanchez."; Golub, Sanchez, and Marcantonio, "Race, Space and Struggles for Mobility," 20.

[69] MTC, "Equity Analysis Report: Transportation 2035 Plan for the San Francisco Bay Area," (Oakland, CA: Metropolitan Transportation Commission, 2009), 48.; Email from Lindsay Imai, Parisa Fatehi-Weeks, Rajiv Bhatia, and Alex Karner to Jennifer Yeamans, March 12, 2012.

maximizing access for target populations while reducing disparities in access across space and across modes.

Work in the early 2000s on equity analysis predicted that the adoption of activity-based models would decrease the severity of problems associated with these traditional analysis approaches. Benefits were associated with the ability to analyze individual population segments independent of their geographic location and the increased behavioral realism associated with the models allowing for the manifestation of unique travel patterns associated with low-income and of color populations.[70] However, published work on environmental justice analysis appearing in both the grey and peer-reviewed literature has not fully implemented these basic recommendations, and although the adoption of activity-based models has fostered new analytical techniques these generally have not been adopted by agencies simultaneous with model updates.

Empirical studies and regional agency practice

The documentation of four step model-based equity analyses is common.[71] Studies conducted by agencies or as part of a regional planning process typically highlight the public process associated with developing an analysis of model outputs and highlight the results or the specific features of a model.[72] Exercises have also been undertaken where model inputs have been shaped with input from environmental justice stakeholders and

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[70] Cambridge Systematics, "Technical Methods to Support Analysis of Environmental Justice Issues," 5-9; Forkenbrock and Sheeley, "Effective Methods for Environmental Justice Assessment," 169,82.
[71] Federal Highway Administration/Federal Transit Administration, "Communitylink 21, Regional Transportation Plan: Equity and Accessibility Performance Indicators," http://www.fhwa.dot.gov/environment/ejustice/case/case4.htm; ———, "MPO Environmental Justice Report: Mid-Ohio Planning Commission," http://www.fhwa.dot.gov/environment/ejustice/case/case7.htm.
[72] Charles Purvis, "Data and Analysis Methods for Metropolitan-Level Environmental Justice Assessment," *Transportation Research Record: Journal of the Transportation Research Board* 1756(2001).

that extend the typical indicators used to include compensating variation, or a measure of the disutility of travel that can be calculated by income group.[73] Despite the theoretical attractiveness of these measures, namely that they combine the monetary and time costs of travel into a single metric, they have not been widely adopted.[74]

Equity analyses undertaken at regional planning agencies that use travel demand models are largely similar to those cited above; however, agencies often have limited modeling or in-house analytical capacity, so off-model approaches are sometimes employed. California's San Joaquin Valley (SJV) offers an important case study location. Transportation governance in the SJV is shared between eight single county MPOs, all of which will be among the last to adopt sustainable communities strategies to comply with SB 375 in 2014. Substantial resources have been devoted to updating travel demand modeling capacity in the region. In the late 2000s, each county had some portion of its travel model updated and in 2010 the eight counties were jointly awarded a $2.5 million grant from California's Strategic Growth Council to improve their modeling capabilities in order to facilitate compliance with SB 375.[75]

Each SJV MPO conducted an equity analysis of their 2011 RTPs. Table 1 summarizes characteristics of the MPOs and their analyses and indicates a wide variation

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[73] Robert A. Johnston, Shengyi Gao, and Michael Clay, "Modeling Long-Range Transportation and Land Use Scenarios for the Sacramento Region, Using Citizen-Generated Policies," (San Jose, CA: Mineta Transportation Institute, 2005); Jason Lemp and Kara Kockelman, "Anticipating Welfare Impacts Via Travel Demand Forecasting Models," *Transportation Research Record: Journal of the Transportation Research Board* 2133(2009).

[74] Caroline Rodier and Robert Johnston, "Method of Obtaining Consumer Welfare from Regional Travel Demand Models," *Transportation Research Record: Journal of the Transportation Research Board* 1649(1998).

[75] Council of Fresno County Governments, "Valley Modeling Projects," http://www.fresnocog.org/valley-modeling-projects-0.; Letter from Cynthia Bryant to Mike Bitner. April 30, 2010.

in analytical sophistication that largely tracks county population.[76] Larger counties have additional resources to conduct planning activities. The three largest counties, Fresno, Kern, and San Joaquin, are the most explicit in their analysis with the two largest using outputs from their travel demand model to quantitatively assess equity and commissioning separate environmental justice plans to inform the development of analytical methods. Fresno County developed a separate environmental justice plan that was then incorporated by reference into the 2011 RTP.[77] Fresno and Kern apply geographic thresholds, define performance metrics and then demonstrate similar changes for the target and non-target populations. Despite the use of travel demand models in their analyses, the SJV work contains a number of shortcomings that are endemic in regional equity analysis.

Table 1 Summary of San Joaquin Valley equity analyses conducted for 2011 RTPs.

County	Population (2010)	Target population thresholds	Travel demand model used?
Fresno	930,450	60% higher than county average on one of four categories[a]	Yes
Kern	839,631	Areas with higher than average concentrations of target populations[b]	Yes
San Joaquin	685,306	60% people of color or 20% low-income	No
Stanislaus	514,453	-	No
Tulare	442,179	-	No
Merced	255,793	-	No
Kings	152,982	-	No
Madera	150,865	-	No

[a]Low-income, non-white, senior, and disabled populations.
[b]Low-income, minority, elderly, and disabled populations.

These shortcomings include:

[76] This discussion draws from additional work by the authors on analysis methods in the San Joaquin Valley. A full summary is included as Appendix A.
[77] Council of Fresno County Governments, "Environmental Justice Plan."

- the assertion of threshold definitions and the combination of protected populations under a single definition to define environmental justice areas;
- metrics based on geographic zones such as travel time from environmental justice areas to job centers or proximity to transportation investments rather than those based on households;
- accessibility metrics based on theoretical destinations (e.g., number of jobs accessible by a 30 minute transit trip), rather than actual trips;
- no normative basis for the equity determination, leading to a situation where any result can be considered equitable;
- map-based or qualitative analyses that are not reproducible, low-fidelity maps or maps referred to but not included in the document
- discussions of burdens almost uniformly absent except for brief discussions of noise and air quality.

Most troubling for the SJV given its perennial problems with air pollution is the almost universal absence of modeled emissions or air quality as a performance metric. Several of the SJV RTPs state that their plans are intended to relieve congestion, implying that no separate air quality analyses should be necessary. The following statement from the San Joaquin Council of Governments is typical:

> Modeling results indicated that the completion of these proposed projects is likely to help ease congestion, thus reducing air pollutant emissions from vehicles idling and constantly accelerating/decelerating. Therefore, the neighborhoods that contain these projects may initially experience some negative impacts in local air quality due to the projects, especially during the construction period, but in the long run, the local air

quality in these areas will benefit from the better traffic flow and less localized pollutant emission.[78]

The analyses also cite the air quality conformity of the entire plan, as required by the Clean Air Act. But the veracity of a conformity determination is circumscribed by the modeling framework used. Increasing transportation capacity is likely to increase vehicle-miles traveled,[79] and the near-road air quality impacts of transportation projects must be assessed independent of congestion mitigation.[80] Existing models in use at MPOs are generally ill-equipped to assess these two effects.[81]

Activity-based travel demand and integrated transportation and land use models offer a promising way forward, but there is nothing inherent in these models that necessitates a different analysis approach. While academic and peer-reviewed studies employing advanced models for assessing equity outcomes have generally progressed beyond methods developed for the four step model, these methods have not diffused to practice even where activity-based models have been deployed. Rodier et al. demonstrated an application of an integrated travel demand-land use modeling framework to equity

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[78] San Joaquin Council of Governments, "2011 Regional Transportation Plan: The Future of Mobility for San Joaquin County," (Stockton, CA, 2011), 8-19.

[79] Gilles Duranton and Matthew A. Turner, "The Fundamental Law of Road Congestion: Evidence from US Cities," *American Economic Review* 101, no. 6 (2011).

[80] The near road impacts of a proposed congestion mitigation projects were at issue in litigation in 2004 when the Sierra Club sued the FHWA and the Nevada Department of Transportation to prevent the expansion of US 95 near Las Vegas, NV. The resultant settlement agreement entailed near-road monitoring and mitigation in the corridor. See Federal Highway Administration, "Settlement Agreement between Sierra Club and US DOT/Nevada DOT," http://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/near_road_study/setagree.cfm.

[81] Michael Replogle, "Clean Air and Transportation: Vital Concerns for TEA-21 Reauthorization," (Testimony before the US Senate Committee on Environment & Public Works, 2003).

analysis in the Sacramento Area Council of Governments (SACOG) region.[82] The results demonstrated that additional economic performance indicators were possible in that framework including changes in rents and wages due to transportation investments. These were then stratified by income category. Castiglione et al. applied the disaggregate microsimulation travel demand model for San Francisco County to an equity analysis, identifying target populations for low-income, zero vehicle, female-headed, and single parent *households* rather than geographic areas.[83] Additional work validating the use of the San Francisco model against observed travel behavior of low-income individuals has been undertaken as well.[84]

Activity-based model approaches can alleviate some of the problems noted with the traditional approach. For example, none of the activity-based model equity studies relied on geographic aggregation. However, all equity studies cited above relied on an understanding of equity based on proportional changes between two scenarios in a future year or from the base year to the future year rather than one based on reducing gaps in transportation outcomes. Additionally, no comparative assessment has been undertaken of geographic aggregation and household level analysis. Further, none of the activity-based model studies attempted to analyze racial demographics. The absence of race from these studies stems from a number of reasons which are addressed below.

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[82] Some of the techniques developed by Rodier et al. can also be applied to four step models. Caroline Rodier et al., "Equity Analysis of Land Use and Transport Plans Using an Integrated Spatial Model," (San Jose, CA: Mineta Transportation Institute, 2010).
[83] Joe Castiglione et al., "Application of Travel Demand Microsimulation Model for Equity Analysis," *Transportation Research Record: Journal of the Transportation Research Board* 1977(2006).
[84] Tierra Bills, Elizabeth Sall, and Joan L. Walker, "Activity-Based Travel Demand Models and Transportation Equity Analysis: Research Directions and an Exploration of Model Performance," *Transportation Research Record: Journal of the Transportation Research Board* (In press).

RACE AND LITIGATION: IMPLICATIONS FOR EQUITY ANALYSIS

The absence of race from activity-based analyses has been justified using several different arguments. Data constraints on forecasting race are often cited for this absence. In an interview conducted for a related research project, a senior staff member at SACOG stated that

> right now our forecasting models don't include ethnicity and that's critical for doing the analysis of the future that the 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 in-migration to the region, so it's one that we're moving up on our radar.[85]

In a public meeting on the capabilities of MTC's travel demand model for equity analysis conducted in June, 2011, Principal Transportation Planner/Analyst David Ory argued that race is only a proxy for other more readily observed variables like income and family structure so the forecasting of racial demographics was actually not necessary.[86] Specifically, Ory 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." This statement is likely true; if the only purpose of transportation planning were to predict the future state of the transportation system, variables like income and family structure would be far more important than race. However, the statement misses the purpose of an equity analysis: to assess the benefits and burdens of transportation investments on people of color, low-income, and potentially other protected groups. Regardless of whether the racial variable is necessary or desirable for its predictive

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[85] Interview conducted in January, 2012. Notes and recording in possession of the author.
[86] Public meeting at MTC headquarters, Oakland, CA, June 6, 2011. Notes and recording in possession of the author.

power, it must be included so that the analysis results can be properly classified and tabulated.

Both agency arguments err on a more fundamental detail. 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 US Bureau of the Census, individual agencies have conducted detailed demographic surveys of their populations. Both MTC and SACOG have prepared reports regarding "lifeline" transit service – those routes vital for linking transit dependent individuals to essential destinations. MTC has also completed a "snapshot" analysis of current conditions in the Bay Area that identify *existing* disparities.[87] Both of these data sources could be used qualitatively and quantitatively to guide RTP development and on a shorter time scale could inform the preparation of the TIP.

The TIP is a list of all transportation projects to be undertaken over a four year period and is updated by an MPO every two years. Whereas the 30 year plan establishes a vision for the region, the TIP operationalizes that plan in the short term. For this reason, emphasizing the future year forecast is a red herring – demographic profiles better matched to the TIP period are likely to reflect disparities on existing populations of color and low-income. It is precisely because of the inability to forecast future year demographics that race must be included as a population variable in the base year and used to summarize analysis results.

As a practical matter, omitting race on the basis of technical constraints may also function to shield agencies from litigation. Although litigation is not necessarily a

[87] MTC, "Snapshot Analysis Development Report."

desirable outcome, it has sometimes been the only avenue available to environmental justice advocates for redressing inequities.[88] Since Title VI is the only environmental justice-related law that creates enforceable legal rights, reliable analyses that include race are vital.[89] There is a competing force in transportation planning and in broader conceptions of race and racism that works in the opposite direction. The history of racism in transportation planning is an uncomfortable truth for contemporary transportation planners, leading some to argue that race should not even be considered as a component of an equity analysis. For example, Litman and Brenman 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."[90]

These distinctions need not be mutually exclusive. A properly conducted equity analysis should assess effects on both low-income and people of color. Further, eliminating race from the discussion risks alienating people of color, for whom race continues to be a vitally important variable. From the same public meeting at MTC cited above, Frank Robertson, representing MTC's Policy Advisory Council, reacted strongly to staff's decision to omit individual racial characteristics from the analysis.

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[88] Cole and Foster, *From the Ground Up*; Jonathan London et al., "Racing Climate Change: Collaboration and Conflict in California's Global Climate Change Policy Arena," *Global Environmental Change* (submitted).
[89] See, e.g., discussion in Federal Transit Administration, "Proposed Circular 4703.1," 37.
[90] Todd Litman and Marc Brenman, "A New Social Equity Agenda for Sustainable Transportation," (Victoria, BC: Victoria Transport Policy Institute, 2012), 4.

> We would all agree that African American residents of San Francisco … in the past five to seven years … migrated to other parts of the Bay Area … [and] within the past 10 years at least, more African Americans are unemployed than any other group … If you make the assumptions colorblind, you will not capture what I'm talking about. And so I really think you have to reconsider the fact that you're going to use colorblind models or scenarios to make recommendations.[91]

According to Bullard, "racism continues to be a central factor in explaining the social inequality, political exploitation, social isolation, and the poor health of people of color in the United States."[92] Efforts to eliminate race from the discussion or to argue for its unimportance, as described by Robertson, in explaining outcomes are a manifestation of a phenomenon described by Pulido wherein racism is only identified as such if racial disparities are found to be the outcomes of malicious acts undertaken by individuals. This narrow understanding of racism denies the existence of racisms operating at scales that are larger than individual decisions.[93] In Pulido's analysis, an observed disparate impact is but one piece of evidence that begs a larger question – how is it that whites are able to distance themselves from industrial pollution and from people of color? In the case of transportation equity, how have whites acted to secure favorable transportation outcomes and how do those patterns persist? The denial of a racial dimension of travel behavior and therefore the prevention of its analysis is one manner in which that occurs. This phenomenon has been investigated in the San Francisco Bay Area in particular and can be read in the final decision of the Ninth Circuit Court of Appeals in Darensburg *v.*

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[91] Public meeting at MTC headquarters, Oakland, CA, June 6, 2011. Notes and recording in possession of the author.
[92] Bullard, "Anatomy of Transportation Racism," 19.
[93] Pulido, "Rethinking Environmental Racism," 12.

Metropolitan Transportation Commission, a case that alleged discriminatory funding practices at MTC in violation of US civil rights law.[94]

Darensburg v. Metropolitan Transportation Commission

Darensburg alleged intentional discrimination resulting from MTC's investment decisions in violation of the Fourteenth Amendment to the US Constitution, Title VI and California law similar in spirit to Title VI and was filed in 2005.[95] The initial complaint was filed in federal court for the Northern District of California in April, 2005 and the Ninth District Court of Appeals delivered its final decision in January, 2011.[96] The complaint alleged that MTC's facially neutral funding policies had the effect and intent of discriminating against people of color since they comprise a disproportionate share (relative to their share of the total Bay Area population) of bus riders and that bus projects were subjected to more stringent performance criteria than rail projects. The complaint references MTC resolutions 3357 and 3434. Resolution 3357 established performance criteria by which transit capital projects proposed for the regional transit expansion program (RTEP) would be evaluated including two primary criteria: 1) improving mobility in the Bay Area's most congested travel corridors and 2) providing additional transit options for commuter travel.

Ultimately, 14 rail and four bus projects were proposed for inclusion in the RTEP with total capital costs of $10.1 billion and $1.5 billion, respectively. The final RTEP

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[94] Golub, Sanchez, and Marcantonio, "Race, Space and Struggles for Mobility."
[95] Including California Government Code §11135 *et seq*.
[96] The discussion of Darensburg draws from the initial complaint and published decisions of the trial court and the Ninth Circuit Court of Appeals: Darensburg v. Metropolitan Transportation Commission, Second Amended Complaint for Injunctive and Declaratory Relief, November 1, 2007, Case No. C-05-1597; Darensburg v. Metropolitan Transportation Commission, 611 F. Supp. 2d 994 (N.D. Cal 2009); Darensburg v. Metropolitan Transportation Commission, 636 F.3d 511 (9th Cir. 2011).

embodied in Resolution 3434 included 19 projects with a total cost of $10.5 billion. Among others, funded projects were proposed by Bay Area Rapid Transit (BART) (five projects, $5.3 billion), Caltrain (three projects, $1.1 billion), and AC Transit (two projects, $241 million). Amendments to the RTEP were adopted in 2006 and included increased total funding for all five BART projects, reduced funding for two Caltrain projects, and minor changes to the AC Transit projects.

The decision of the trial court was in favor of MTC and that decision was affirmed on appeal. The trial court found that petitioners demonstrated prima facie discrimination with respect to MTC's decisions related to Resolution 3434. Under Title VI the alleged discrimination is lawful if the agency provides a "substantial legitimate justification" for same. In this case, the court highlighted various competing interests at work in establishing transportation policy and the restrictions placed on the use of different funding sources. Specifically with reference to Resolution 3434, the court argued the included rail projects would contribute to a number of transportation policy goals including increasing system connectivity, mitigating sprawl and encouraging investment in urban areas. Additionally, MTC pointed to its reliance on its Bay Area Partnership Board for setting policy. The Partnership Board contains representatives from all of the region's transit operators, congestion management agencies, cities and counties, as well as the Bay Area Air Quality Management District and the Federal Transit Administration.

The appellate court overturned the trial court's finding of discrimination, arguing that the use of historical ridership data to demonstrate a disparate impact was logically unsound. Specifically, the court highlighted the possibility that a rail-centered transit expansion plan may benefit riders of color and in the absence of a more precise measure

of patronage demographics on future systems, "no court could possibly determine whether MTC's long-term expansion plan will help or harm the region's minority transit riders."[97] Additionally, affirming the unimportance of race, Circuit Court 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."[98]

Whereas Darensburg relied upon an analysis of regional spending priorities, advocates for low-income people and people of color have also challenged individual projects on discrimination grounds. A group of Bay Area advocates also filed an administrative complaint in late 2009 with the Federal Transit Administration alleging violations of Title VI and Executive Order 12898 related to BART's proposed Oakland Airport Connector – a BART extension that would provide a high-speed link to Oakland International Airport.[99] Federal funding was revoked for the project in that case, potentially because of the lower burden of proof required for an administrative complaint as opposed to a federal legal challenge.

Darensburg and the Oakland Airport Connector complaint raise larger questions regarding MPO practices vis-à-vis equity analysis. Despite the completion of equity analyses dating to 1998, intentional discrimination was alleged at MTC. This is partially an artifact of the Supreme Court's 2001 decision Alexander v. Sandoval that found

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[97] Darensburg v. Metropolitan Transportation Commission, 636 F.3d 511 (9th Cir. 2011), 515.
[98] Ibid., 524.
[99] Urban Habitat Program v. Bay Area Rapid Transit District. Complaint Under Title VI of the Civil Rights Act of 1964 and Executive Order 12898.

individuals are unable to bring disparate impact claims under Title VI.[100] Instead, individuals may only file civil suits to redress intentional discrimination. Allegations of disparate impact must be filed through the responsible executive agency. MTC has conducted equity analyses of its regional plans since 1998 and its 2010 Title VI compliance report notes that their previous equity analyses were recognized as best practices by FHWA and FTA.[101]

How can this disconnect between litigation alleging discriminatory impacts and analysis that has consistently shown no inequity in investment priorities or performance metrics at the MPO be explained? The remainder of this dissertation addresses this question. Part of the explanation lies in the often unclear link between the results of the equity analysis and decision making.[102] Another important component lies in the particular analytical techniques employed by the agency to assess the equity of its plans, the definitions of equity they embody, and their assumptions about race. In expert testimony for the Darensburg litigation, Tom Sanchez provided a wide-ranging critique of MTC's equity analysis and travel demand modeling practices to that date, identifying numerous shortcomings and an unclear influence of public input.[103] Chapter 4 employs activity-based travel demand modeling data to further address these claims.

CONCLUSION

This chapter fills an important gap in the literature by conducting a critical review of transportation plan equity analysis. We review relevant federal law and executive agency

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[100] Alexander v. Sandoval, 532 US 275 (2001).
[101] MTC, "MTC 2010 Compliance Report," 40.
[102] Sanchez and Wolf, "Environmental Justice and Transportation Equity: A Review of MPOs."; Amekudzi et al., "Impact of Environmental Justice Analysis on Transportation Planning."
[103] Sanchez, "Expert Report of Prof. Thomas W. Sanchez."

guidance and finds that in lieu of specific provisions for equity analysis, transportation planning agencies have relied on methods developed 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 undesirable land use impacts, these methods are not appropriate.

While the Ninth Circuit may have been correct about the ability to forecast the future impacts on different racial demographics, they erred when they stated that racist outcomes only manifest from individually racist acts. The history of transportation and land use planning is replete with examples of actions that were benign in intent but discriminatory in outcome. Transportation equity stakeholders have also called attention to current conditions and have highlighted the importance of analysis that categorizes racial impacts. Both of these analyses are within the reach of most MPOs.

It is possible that even when the suggestions promulgated in this chapter are adopted that conclusions regarding the equity of transportation plans will not be changed. For this reason, Chapter 4 applies these insights to travel demand modeling data produced from an activity-based model of the San Francisco Bay Area maintained by MTC. That study finds that indeed the equity analysis methods employed at that agency (unintentionally or not) obfuscate equity outcomes. Taken together these two studies suggest a wholesale revision of the equity analysis of regional transportation plans is in order. Implementing these recommendations and using the results to guide transportation investment decisions has the potential to move the needle on transportation equity, consistent with the laws and guidance discussed herein.

CHAPTER 4: INNOVATIONS IN THE EQUITY ANALYSIS OF REGIONAL TRANSPORTATION PLANS

INTRODUCTION

As described in Chapter 3, analysis of regional transportation plan equity – who benefits from and who is burdened by transportation investments – has been informed by analytical methods developed for traditional environmental justice analysis. Yet this approach was developed to analyze the impacts of locally undesirable land uses and is generally not appropriate for the assessment of transportation investment benefits that are typically widely dispersed in space. There remains a need for a comprehensive assessment of the performance of standard methods. This chapter describes shortcomings in the analytical tools and methods that transportation planning agencies use to assess the equity of their transportation plans and suggests new strategies that are responsive to the concerns of equity stakeholders and consistent with the law and other guidance.

We employ travel demand modeling data gleaned from the nine county San Francisco Bay Area's activity-based travel demand model to propose a new method for the definition of target populations and to calculate the equitability of alternative transportation and land use scenarios. No study prior to this date has systematically evaluated the relevance of agency equity analysis practices in terms of federal law nor examined in-depth the implications of a new travel demand modeling paradigm for such analyses.

DATA AND METHODS

Action research

The research framework and particular questions addressed in this chapter were developed in consultation with civil rights attorneys and transportation justice advocates

participating in the *Plan Bay Area* regional transportation plan/sustainable communities strategy (RTP/SCS) development process. This type of collaborative approach has been termed "action research" and reconceptualizes the relationship between researcher and subject, allowing both parties to collaborate on research design and interpretation to resolve a problematic situation.[1]

Rather than a particular research method, action research[2] describes an epistemology that questions distinctions typically drawn between objectivity/subjectivity, theory/application, and researcher/subject.[3] As described by Bradbury and Reason, action research is motivated by real world problems, is developed in partnership with stakeholders, works *with* rather than *on* people, and "leaves infrastructure in its wake."[4] Through an iterative and collaborative process, the research participants formulate questions, act on the situation, analyze the results and reflect before taking further action.[5] The end result is some infrastructure—altered institutions, a revised policy, or new tools—that will persist in the absence of the particular research effort.

For this study, the motivation was mitigation of the conflict that has characterized the relationship between environmental justice advocates and the Metropolitan

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[1] S. Kindon, R. Pain, and M. Kesby, eds., *Participatory Action Research Approaches and Methods* (New York: Routledge,2007).

[2] The research approach described below is known by several names, each with slightly different connotations. See Frank Fischer, *Citizens, Experts, and the Environment* (Durham, NC: Duke University Press, 2000)., pp. 174-5; S. Kindon, R. Pain, and M. Kesby, "Participatory Action Research: Origins, Approaches and Methods," in *Participatory Action Research Approaches and Methods*, eds. S. Kindon, R. Pain, and M. Kesby (New York: Routledge, 2007). The general goals described here are common to all of the approaches.

[3] Bradbury and Reason, "Action Research: An Opportunity for Revitalizing Research Purpose and Practices."

[4] Ibid., 156.

[5] Yoland Wadsworth, "What Is Participatory Action Research?," http://www.scu.edu.au/schools/gcm/ar/ari/p-ywadsworth98.html.

Transportation Commission (MTC) over the past several regional plan updates[6] by providing technical assistance to attorneys and advocates. The history of tension between these two groups was documented in Chapter 2. Because of the technical nature of travel demand model-based equity analyses, bringing the expertise of academics with travel modeling expertise to bear on the problem in collaboration with advocates offered the promise of enhancing the ability of advocates to provide meaningful input. Working most directly with Public Advocates, Inc. a nonprofit civil rights law firm that also conducts policy advocacy in the areas of affordable housing, education, and transportation equity, the results developed in this chapter were shared in real time with that organization in a series of memoranda that subsequently informed their public comments on the equity analysis and other aspects of the RTP/SCS[7] (see Appendix B for copies of all memoranda).

In addition to direct collaboration with equity advocates, a number of training sessions were also held with advocates to enhance capacity across the state more generally with respect to travel demand models. Such events were held in Fresno on October 6, 2011 and October 26, 2011. Presentations by the author focused on travel demand modeling and transportation and land use planning basics. A presentation on March 3, 2012 to the Ditching Dirty Diesel Collaboration focused on preliminary results from this chapter and implications for other regional equity analyses. The memoranda precipitated several changes to MTC's proposed equity analysis approaches, and

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[6] Sanchez, "Expert Report of Prof. Thomas W. Sanchez."; Urban Habitat, "Transportation 2035 Equity Analysis Preliminary Results: Critique and Recommendations," ([Memo on file with author], n.d.).

[7] In addition to comments on the equity analysis, memoranda were prepared on the equity implications of MTC's proposed project performance assessment methods and the potential for affordable housing provision to result in reduced vehicle-miles traveled (VMT), in support of SB 375's goals.

advocates have generally valued the access to technical analysis that the collaboration has provided.

Travel demand modeling

Activity-based travel demand modeling data were provided by MTC, the metropolitan planning organization (MPO) for the nine county San Francisco Bay Area. Activity-based models offer substantial advantages over four-step models because, in general, they: 1) embed the notion that the demand for travel is derived from the demand for activities, which are themselves spatially and temporally dispersed, 2) use the "tour" as the fundamental unit of analysis 2) are able to consider within-household dynamics and joint travel decisions, ensuring that tours are consistent across mode choice and in light of shared trips, and 3) simulate the individual travel decisions, linking traveler demographics to observed travel.[8] The MTC travel demand model simulates long-term choices (automobile ownership and usual work and school destination choice) and daily travel patterns for an entire synthetic population of the Bay Area. The model outputs are vehicle volumes on all links and transit ridership on all lines that have been represented in the transportation network, as well as all tour and trip characteristics (origin, destination, and mode choice) by simulated individual and household. Activity-based models promise enhanced behavioral realism, offering the possibility that simulated individuals will respond more realistically to policy, land use, and transportation network

[8] Staffan Algers, Jonas Eliasson, and Lars-Göran Mattsson, "Is It Time to Use Activity-Based Urban Transport Models? A Discussion of Planning Needs and Modelling Possibilities," *The Annals of Regional Science* 39, no. 4 (2005); Peter Vovsha et al., "Design Features of Activity-Based Models in Practice: CT-RAMP Experience," in *90th Annual Meeting of the Transportation Research Board* (Washington, DC, 2011).

changes and that more accurate estimates of greenhouse gas (GHG) emissions will result, as hoped for by SB 375.[9]

These data were used to test and validate the findings of Chapter 3 regarding threshold definition and equity assessment. Data were available for five modeled year 2035 scenarios and a base year 2005 scenario that were used to test alternative land use and transportation investment scenarios during the development of the RTP/SCS. Provided data included all modeled outputs from the activity-based travel demand model including trip tables, loaded networks, and synthetic populations.

To investigate the effect of differing threshold definitions on travel behavior outcomes, we conducted a sensitivity analysis on key analysis parameters using commute time data from MTC's travel demand model. Additionally, we compared travel behavior estimates derived from geographic aggregations with those developed from household-level estimates. For consistency with MTC practice, we defined the commute trip using the primary origin and destination from all *tours* with a work purpose. These origins and destinations correspond to the home and work traffic analysis zone (TAZ), respectively, and ignore intermediate stops. Modeled, mode-specific, travel time skims were used to determine a round trip travel time for each commute trip in each simulated scenario. This approach to defining commute time ensures that calculated values reflect simulated choices in the travel demand model as opposed to other, more general, approaches that calculate travel times from a particular origin to all possible work destinations. Since the

[9] Algers, Eliasson, and Mattsson, "Is It Time to Use Activity-Based Models."; Matute, "Measuring Progress toward Transportation GHG Goals."

purpose of this analysis is to assess the suitability of various approaches to target population definition, we restricted the analysis to the 2005 base year.

To facilitate analysis, model outputs were post-processed into SQLite databases that were then queried using the R package for statistical computing.[10] Data on demographics were taken from the US Census Bureau's American Communities Survey, 2005-2009 five year estimates to ensure consistency with MTC practice.[11] Data on geographic boundaries were taken from the Metropolitan Transportation Commission.[12]

RESULTS AND DISCUSSION

The traditional approach: Defining communities of concern using demographic thresholds

As part of *Plan Bay Area,* MTC is conducting a series of equity analyses using travel demand modeling outputs and additional data sources.[13] As described in Chapter 3, such analyses typically rely on geographic thresholds to define target populations. In this approach a threshold value is set (e.g. 70% people of color) and applied to geographic units (e.g. census tracts). Those units that meet the threshold are included in a "target" population and those that do not are included in a "non-target" population. These two groups then form the basis of a comparison.

In principle, an activity-based model obviates the need to rely on demographic thresholds to define target populations. In discussions of proposed target population

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[10] R Development Core Team, "R: A Language and Environment for Statistical Computing," (Vienna, Austria: R Foundation for Statistical Computing, 2011).
[11] US Census Bureau, "American Community Survey," http://www.census.gov/acs/www/.
[12] Metropolitan Transportation Commission, "Maps & Data," http://www.mtc.ca.gov/maps_and_data/GIS/data.htm.
[13] MTC, "Plan Bay Area Equity Analysis Overview and Equity Analysis Scorecard," http://www.onebayarea.org/pdf/EquityAnalysisOverview.pdf.

definitions, staff describes both the possibility of examining populations of interest defined using geographic thresholds, but also comparing individual members of target and non-target populations on each performance metric, referring to each as "geographic-based" and "population-based" definitions, respectively.[14] This original proposal included assessing both definitions for communities of concern, low-engagement communities with limited English proficiency and low educational attainment, and low-mobility communities.[15] In other words, low-mobility communities would have been defined and assessed twice, first by combining all TAZs that exceed a threshold for zero vehicle households into one group and second by combining all zero vehicle households individually into one group. This approach would have avoided presumptively combining target populations, but was not adopted.

In later writing, staff summarized their evolving approach to target population definition. The changes implemented by staff to the definition exemplify the lack of prescribed standards for regional transportation equity analysis. In an August, 2011 memo staff compare two approaches to target population definition, but do not make reference to, or speculate upon, how either definition would affect the outcomes calculated in the final analysis.[16] The thresholds recommended in that memo were based on two principles: that thresholds should be "round numbers that are easy to understand and interpret" and that resultant target populations should "capture roughly 40% of the

[14] Memo from Jennifer Yeamans to Equity Working Group Re: Identifying Communities of Concern and Other Relevant Equity Populations. May 4, 2011, Attachment A.
[15] Memo from Equity Working Group Staff to Equity Working Group Re: Draft Equity analysis Framework for Alternative Scenarios. June 2, 2011, Attachment A.
[16] Memo from Jennifer Yeamans to Equity Working Group Re: Alternative Scenarios Equity Analysis: Target Population Definitions. August 3, 2011.

region's total population and tracts." These same principles were then used to justify the selection of this method, creating a circular argument.

In response to comments from Regional Equity Working Group (REWG) members based on memoranda presented in Appendix B, staff revised the final target population definition.[17] In explaining the new definition, staff stated that their new approach shifted from "defining *multiple target communities* across a range of demographic and socioeconomic characteristics to identifying *communities with multiple overlaps of target population concentrations*" (emphasis in original). The goal for the revised definition was to identify a *small* proportion of the total Bay Area population, rather than the 40% specified previously. The final method for selecting communities of concern used the eight demographic categories listed in Table 2.[18] To identify communities of concern, MTC followed a two-step process. First, all TAZs were included that met both thresholds one and two. These are the traditional race and income identifiers for communities of concern used in MTC's past regional plans.[19] Next, all TAZs where four or more disadvantage factors overlapped were identified, including factors one and two. Rather than defining multiple target communities, staff identified communities where multiple target populations overlap, presumptively combining population groups without discussion of the probable effect on outcomes.

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[17] Memo from Jennifer Yeamans to Equity Working Group Re: Revised Framework for Equity Analysis of Alternative Scenarios. September 8, 2011.
[18] MTC, "Plan Bay Area: Technical Summary of Preferred Scenario Equity Analysis Methodology," (Oakland, CA: Metropolitan Transportation Commission, 2012).
[19] See, e.g., ———, "T2035 Equity Analysis."

Table 2 Disadvantage factors used by MTC for their equity analysis.

	Disadvantage factor	Threshold (%)
1	Minority population	70
2	Low-income population[a]	30
3	Population with a disability	25
4	Single-parent families	20
5	Limited English proficiency population	20
6	Cost-burdened renters	15
7	Zero-vehicle households	10
8	Seniors 75 and over	10

[a]Low-income population is defined using 200% of the US Census definition based on household size and income.

As shown in Table 3, defining communities of concern in this manner results in the identification of 1,372,777 Bay Area residents, approximately 21% of the total population.[20] Deploying other disadvantage factors in addition to race and income added only 293,622 members to the target population. This is because groups based on factors other than race and income rarely achieve the threshold concentrations for inclusion. While there are compelling reasons to believe that racial segregation has concomitant effects on health, transportation, and other societal outcomes,[21] there is little reason to believe that single parent families would tend to concentrate in an area such that they would achieve a 25% concentration of the total population in a zone and that they would

[20] The values calculated here differ slightly from those reported by MTC. This inconsistency results because census tracts do not directly correspond to TAZs (the region contains 1,405 tracts and 1,454 TAZs), but tract data must be converted to TAZ data for consistency with travel demand modeling outputs. The method chosen here was to apportion the population in the larger geographic unit to the smaller geographic units that compose it on the basis of shares of land area. MTC performs a similar transformation, but details are not forthcoming. The report only states that the 305 identified tracts were "corresponded to" 323 TAZs which is somewhat greater than the 315 TAZs identified here. See ———, "Plan Bay Area: Technical Summary of Preferred Scenario Equity Analysis Methodology," 2.

[21] John F. Kain, "Housing Segregation, Negro Employment, and Metropolitan Decentralization," *The Quarterly Journal of Economics* 82, no. 2 (1968); David M. Cutler and Edward L. Glaeser, "Are Ghettos Good or Bad?," *The Quarterly Journal of Economics* 112, no. 3 (1997); Rachel Morello-Frosch and Russ Lopez, "The Riskscape and the Color Line: Examining the Role of Segregation in Environmental Health Disparities," *Environmental Research* 102, no. 2 (2006).

evince unique travel behavior on that basis.[22] Indeed, the 315 identified TAZs that compose the set of communities of concern capture 70,000 single parent households and omit 155,300. In all other instances, identified communities of concern contain fewer members of the target population than the remainder of the region (Table 4).

Table 3 Total population and TAZs in protected populations.[a]

	Included population	TAZs
Greater than 30% low-income and greater than 70% people of color	1,079,144	240
Four or more disadvantage factors but not part of the 30/70 set	293,622	75
Total communities of concern	1,372,777	315
Remainder of the region	5,577,998	1,139

[a]Data from the 2005-2009 5 year American Community Survey.

More problematically, because the link between some of the included disadvantage factors and travel behavior is unclear, including the additional 293,622 residents in the target population is likely to confound conclusions about the equity of the RTP/SCS on any of the individual demographic groups. In other words, there is no reason to believe, and the agency never makes the case that the travel needs of single parent families, low-income individuals, people of color, and the other four disadvantage factors are at all similar. Even the combination of race and income thresholds is of questionable utility. If the inclusion of low-income travelers obscures the effects of the transportation plan on residents of color, the results from any equity analysis will not be appropriate for use for evidence of Title VI compliance, for example.[23] Further, in the final analysis, MTC only separated low-income households from non-low-income households in one instance, to

[22] Duthie and colleagues raise a similar set of issues. See Duthie, Cervenka, and Waller, "Environmental Justice Analysis," 11.

[23] MTC has used previous RTP equity analyses employing these race and income thresholds to indicate its commitment to nondiscrimination. See MTC, "MTC 2010 Compliance Report," 40-41.

analyze housing and transportation affordability. For the five other proposed equity metrics, MTC compared only communities of concern to the remainder of the region – the approach they had employed before developing an activity-based model.[24]

Table 4 Number of target population members in communities of concern and remainder of the region.

	Disadvantage factor	Threshold (%)	Total in communities of concern	Total in remainder of region
1	Minority population	70	1,120,000	2,660,000
2	Low-income population[a]	30	608,000	936,000
3	Population with a disability	25	317,000	790,000
4	Single-parent families	20	70,000	155,300
5	Limited English proficiency population	20	269,000	345,000
6	Cost-burdened renters	15	84,200	156,000
7	Zero-vehicle households	10	93,800	140,000
8	Seniors 75 and over	10	71,500	338,000

[a]Low-income population is defined using 200% of the US Census definition based on household size and income.

Examining the effectiveness of the threshold approach

This section conducts a sensitivity analysis on the threshold definitions. The figures discussed here all take a similar form. The x-axis represents either the number of disadvantage factors or a particular demographic threshold. Moving from left to right increases the restrictiveness of the threshold definition so that fewer total people are included in the target population. The y-axis is the equity indicator under study, in this case commute travel time. Two lines are plotted, one that indicates the performance of the target population on the indicator in question (dashed line) and one that indicates the performance of the remaining non-target population on that indicator (solid line). As an example, in Figure 7, a value of four on the x-axis indicates that the target population,

[24] For the final alternative scenarios equity analysis see ———, "Plan Bay Area Equity Analysis Overview and Equity Analysis Scorecard."

when defined as TAZs with four or more disadvantage factors or meeting both low-income and race thresholds, has a mean commute time of 25.6 minutes. For the TAZs that have fewer than four disadvantage factors and do not meet both low-income and race thresholds the commute time is 26.8 minutes.

As the number of disadvantage factors required to be included in the target population increases, the mean commute time decreases somewhat (dashed line in Figure 7), reaching a minimum between four and five, but then it increases again as disadvantage increases. The mean commute time of the non-target population decreases steadily as the number of disadvantage factors used to define the target population increases. At all points, the line representing the target population is below the non-target population, meaning that either there is no inequity in commute time, or this method is incapable of capturing it. This result illustrates the difficulty of using highly aggregate data to represent the travel behavior of widely differing groups. If the combination of equity indicator and disadvantage factor truly represented disadvantage, we would expect the dashed line to be monotonic over the plotted range. The combination arises from combining populations with different travel behavior into one overall population and also grouping together different modes to generate a single mean value.

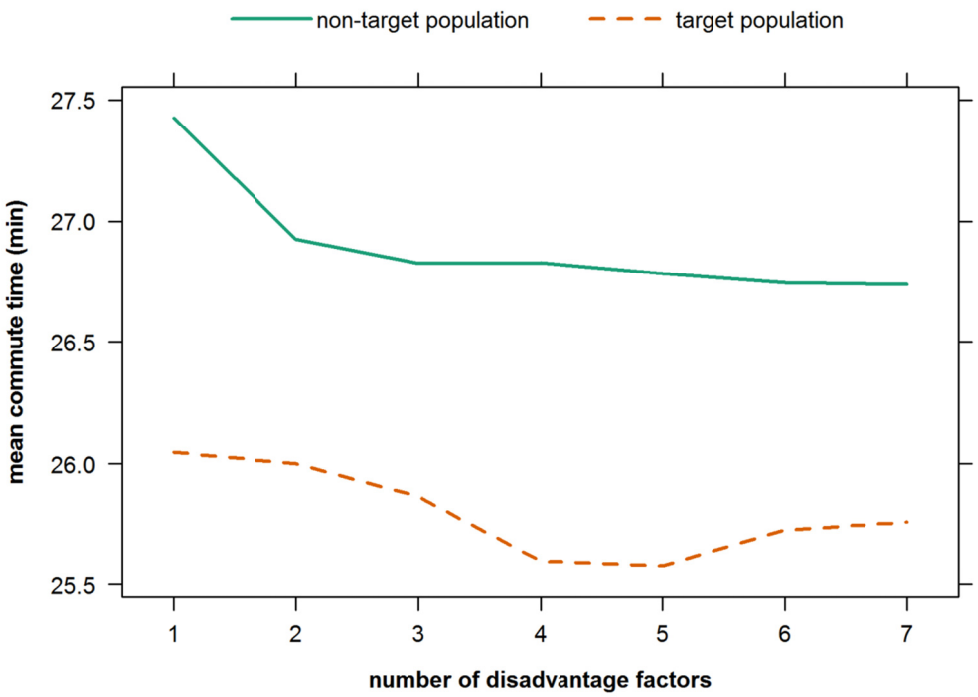

Figure 7 Relationship between number of disadvantage factors and mean commute time, 2005.

How well does Figure 7 reflect the travel behavior of individual protected groups? It is difficult to examine the effects of individual thresholds on equity performance indicators because the disadvantage factors selected exist only at low concentrations throughout the Bay Area. Concentration of people of color is a notable exception. Demographic changes occurring in California and throughout the US indicate that the racial composition of the country is changing rapidly. By 2050, people of color will comprise the largest demographic group in the country, with whites representing 47% in 2050, down from 67% in 2005.[25] According to the 2005-2009 5-year American Community Survey estimates, in the Bay Area people of color already outnumbered whites, representing 55% of the total population.

[25] Passel, Jeffrey S. and D'Vera Cohn, "US Population Projections: 2005-2050," (Washington, DC: Pew Research Center, 2008), 9.

The realization of a numerical majority does not immediately improve transportation outcomes for people of color and several studies indicate that people of color experience inferior transportation outcomes to their white counterparts. Using the 2001 National Household Transportation Survey data, Pucher and Renne demonstrated that race was strongly associated with transit use, with blacks and Latinos relying much more heavily on transit than whites.[26] Other work has shown that racial differences persist even when controlling for income. Liu presents evidence indicating that whites travel more than people of color and white men in particular make more trips and generate more person-miles than any other demographic group when controlling for income and land use (urban and rural).[27] Kockelman estimated mode choice models using the 1990 Bay Area Travel Survey and found that people of color were less likely to travel by car and more likely to take non-motorized modes, while controlling for income, distance, occupation, and a number of land use variables.[28] More travel can be viewed as a superior outcome when undertaken by choice; for example, high-income workers choosing longer commutes to access suburban amenities and higher quality housing and schools. On the other hand, a zero vehicle urban household undertaking a long commute by transit to a suburban workplace because they cannot afford vehicle ownership and a suburban home would be an inferior outcome. Because of differences in transit use based on race, income, vehicle

[26] John Pucher and John L. Renne, "Socioeconomics of Urban Travel: Evidence from the 2001 NHTS," *Transportation Quarterly* 57, no. 3 (2003).
[27] Feng Liu, *Environmental Justice Analysis: Theories, Methods, and Practice* (Boca Raton, FL: Lewis Publishers, 2000), 300-01.
[28] Kara Kockelman, "Travel Behavior as Function of Accessibility, Land Use Mixing, and Land Use Balance: Evidence from San Francisco Bay Area," *Transportation Research Record* 1607(1997).

ownership, and land use characteristics, transportation metrics must generally be disaggregated by mode to allow meaningful interpretation.

The relatively high absolute numbers of people of color in the Bay Area allows us to test the effect of increasing the people of color threshold on commute time (Figure 8). The results show that as the threshold increases, commute time generally decreases gradually until the thresholds get very high. At each location in the plot, the target population has a lower mean commute time than the non-target population. Since lower commute times are generally viewed as positive, Figure 8 could be interpreted as an indication that the Bay Area's overall transportation network is functioning well for its residents of color.

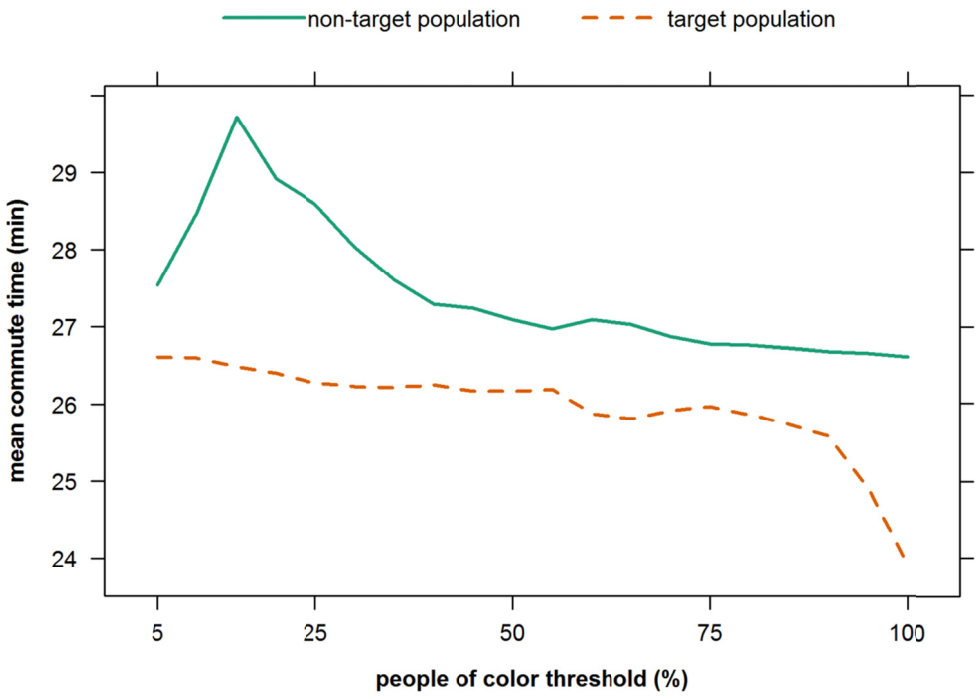

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Figure 8 Relationship between people of color threshold and mean commute time, 2005.

However, empirical evidence on travel behavior by racial groups specifically links *transit* disadvantage to increasing racial thresholds. In a study of bus service in four

American cities, Wells and Thill identified an independent effect of the racial composition of census tracts and their access to bus service.[29] As the proportion of people of color in a tract increased, bus accessibility decreased. Grengs studied accessibility by bus to grocery stores in Syracuse, NY and found that TAZs with high proportions of black residents were disproportionately located in areas of low-accessibility.[30] Martens et al. also argue that equitable transportation policies would disproportionately benefit the least mobile (i.e. transit dependent individuals).[31] In light of this evidence, grouping all commute times together may not reveal important information about the travel behavior of disadvantaged groups.

To address this issue, commute time can also be disaggregated by mode. This disaggregation would be responsive to public input received by MTC during the development of the equity analysis. Figure 9 illustrates the relationship between increasing the people of color threshold for target population definition and mean commute time by local bus. TAZs that have high concentrations of people of color endure longer commutes by bus than TAZs that have low concentrations of people of color. This relationship holds from a 20% threshold onward, and after the 25% threshold is met the difference between the target and non-target population commute time varies between 3.5 and 4 minutes. The maximum difference at of 9.8 minutes is realized at 100% people of color but represents only four TAZs. As a guide for policy responsive to

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[29] Kirstin Wells and Jean-Claude Thill, "Do Transit-Dependent Neighborhoods Receive Inferior Bus Access? A Neighborhood Analysis in Four U.S. Cities," *Journal of Urban Affairs* 34, no. 1 (2012).
[30] Joe Grengs, "Does Public Transit Counteract the Segregation of Carless Households? Measuring Spatial Patterns of Accessibility," *Transportation Research Record: Journal of the Transportation Research Board* 1753(2001).
[31] Martens, Golub, and Robinson, "A Justice-Theoretic Approach."

environmental justice principles including the mitigation of disproportionately high and adverse effects of policies and programs, Figure 9 is more useful than reliance on a point measure that may not accurately reflect the travel behavior of the population (although it still obscures that travel behavior to some extent because of its aggregate nature). Reducing this disparity depends either upon improving transit service or providing housing near these workers' jobs. Because MTC's synthetic population does not include a racial variable, analyses like those shown in Figure 9 can supplement or replace those that combine the travel behavior of several groups into a single metric.

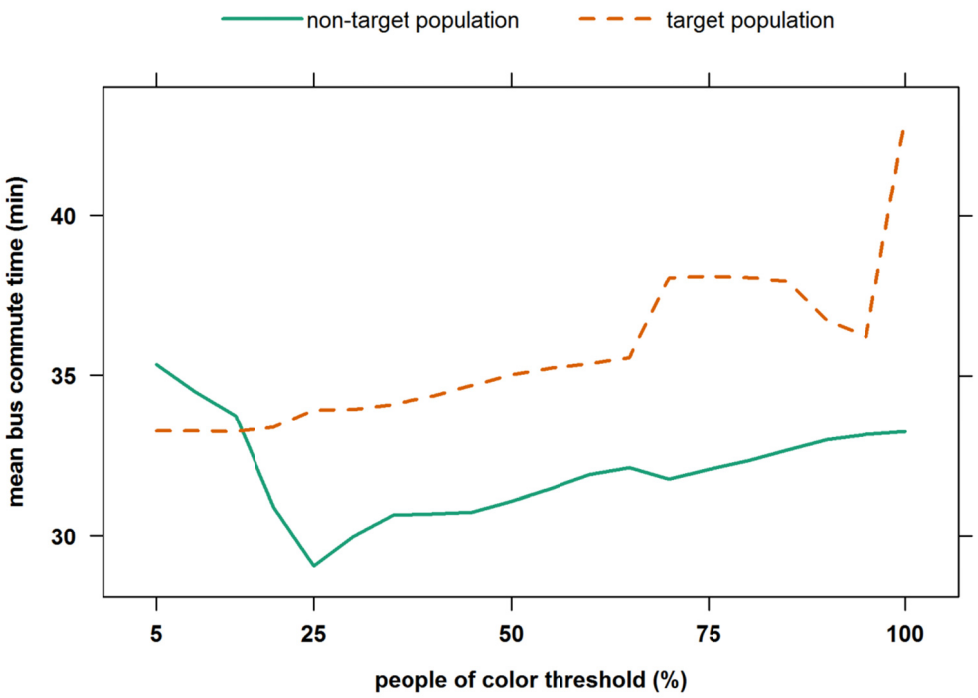

Figure 9 Relationship between people of color threshold and mean commute time by local bus, 2005.

Even when disaggregated by mode, the disadvantage factor approach obscures the patterns shown in Figure 9. As a further illustration of this phenomenon, Figure 10 plots the mean commute time by local bus according to the number of disadvantage factors used to define the target and non-target populations. At four factors, the value selected by

MTC for the *Plan Bay Area* equity analysis, the target population has a shorter commute time by local bus than the non-target population. The line representing the commute time for the target population crosses over the non-target population after exceeding five factors to show a higher commute time. Additionally, the maximum value of 35.9 minutes for commute time by local bus when the target population is defined using disadvantage factors is lower than all of the mean times in Figure 9 for thresholds greater than 70%. Arbitrarily defining population thresholds and combining disadvantaged groups can affect the determination of equity, as shown in Figure 10.

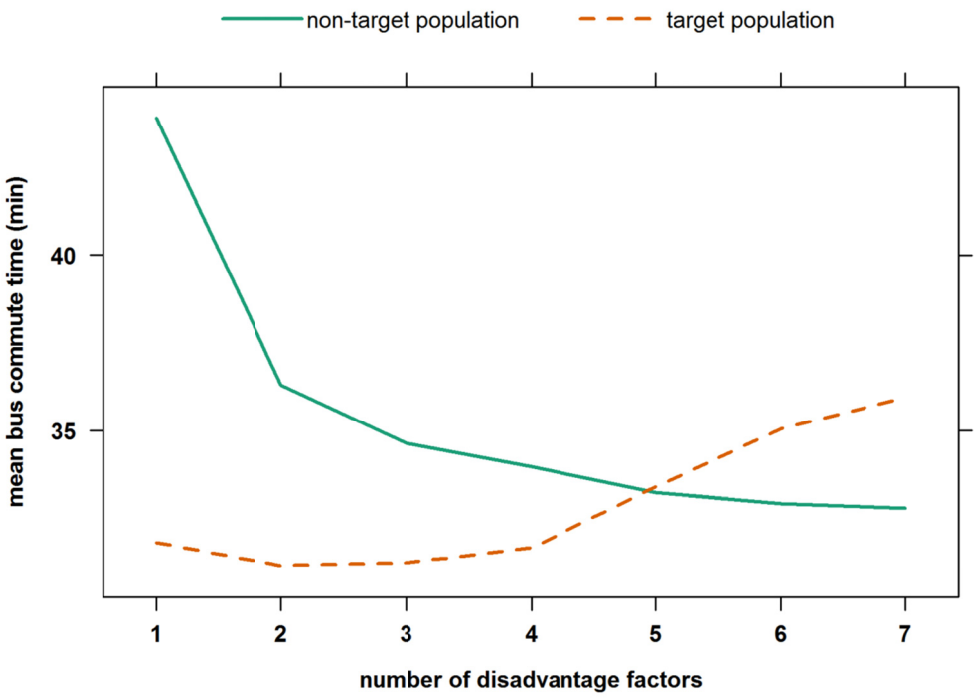

Figure 10 Relationship between number of disadvantage factors and mean commute time by local bus, 2005.

Household-level analysis

Some of the results discussed in the previous section arise because the behavior of different types of travelers is aggregated to arrive at a single mean value. Table 5 summarizes two measures for the geographically aggregated travel behavior of each

target population group on the basis of the threshold level defined by MTC as well as the overall mean for communities of concern and for the overall region. All communities of concern, when defined in this way, have lower or equal average commute times compared to the region as a whole, but generally much higher transit mode shares. The threshold approach appears to be capturing some variation in travel behavior, but since thresholds include members of the target populations in low quantities relative to members of the non-target population, it is unclear the extent to which these values actually reflect the travel behavior of the disadvantaged group.

Table 5 Mean commute time and transit mode share (modeled) by individual disadvantage factor, 2005.

	Disadvantage factor	Threshold (%)	Commute time (min)	Transit mode share (%)
1	Minority population	70	25.9	13.1
2	Low-income population	30	25.8	16.9
3	Population with a disability	25	25.7	20.1
4	Single-parent families	20	26.3	14.3
5	Limited English proficiency population	20	24.6	18.4
6	Cost-burdened renters	15	25.4	19.2
7	Zero-vehicle households	10	26.2	26.9
8	Seniors 75 and over	10	26.6	14.5
	Comparison group			
	Overall communities of concern		25.6	18.8
	Overall region		26.6	12.7

The unique properties of activity-based travel demand models facilitate the comparison of at least two of these groups to their disaggregate representation. Because automobile ownership and income are two strong predictors of travel behavior, members of the synthetic population and their households are assigned values on these variables. The characteristics of these groups, unadulterated by aggregation, can then be compared to their representation in the disadvantage factor and threshold approaches. Table 6 shows the mean commute time for zero vehicle and non-zero vehicle households by

mode, based on the choices and characteristics (including synthetic home and work locations) of individual households within the 2005 synthetic population, and Table 7 shows the mean commute time for low-income households by mode, based on the choices and characteristics of individual households within the 2005 synthetic population.

Table 6 Mean commute time (min) for zero vehicle households and non-zero vehicle households (modeled) by mode, 2005.

	Zero vehicle households	Non-zero vehicle households
All modes[a]	37.1	26.1
Carpool	30.6	25.7
Non-motorized	19.5	16.4
Walk to local bus	34.2	32.6
Walk to BART	59.6	45.9
All transit trips	44.0	49.6

[a]For zero vehicle households, "all modes" does not include drive alone since it is not available to them in mode choice.

In MTC's equity analysis for the alternative scenarios prepared by staff in December, 2011 two mean values are reported for the metric of commute time for a 2005 base year and each of the five alternative scenarios.[32] One value is reported for communities of concern and one for the remainder of the region. As Tables 6 and 7 indicate, such an aggregation is of questionable policy value. A threshold approach for characterizing the travel behavior of TAZs containing at least the threshold share of zero vehicle households (ZVHs) shows a mean commute time of 26.2 minutes, and a transit mode share of 26.9% (Table 5). In contrast, enumerating individual ZVHs and using their modeled mode choice shows that their mean commute time is 37.1 minutes averaged across all modes (Table 6) and their modeled transit mode share is 66.7%.[33] There is also wide variation in transit modes that is obscured by taking an overall mean. The mean time for walk to local bus, walk to BART, and all transit trips together is 34.2, 59.6, and 44.0 minutes,

[32] MTC, "Plan Bay Area Equity Analysis Overview and Equity Analysis Scorecard."
[33] Calculated from the 2005 base year travel model data.

respectively. Further, while ZVHs show longer transit commute times than non-ZVHs for walk to local bus and walk to BART, when aggregated over all transit modes, non-ZVHs appear to have longer average commutes. This result occurs because non-ZVHs are able to choose drive-to-transit paths, which increases the mean. Neither aggregating over all modes nor aggregating over all transit modes appears to provide an accurate representation of the travel behavior of ZVHs. If ZVHs enjoyed the same mean commute time as non-ZVHs for walk to bus and walk to BART, they would save an average of 5,860 person-hours per day. The aggregate disadvantage factor approach and the corresponding equity analysis give little insight into how MTC should adjust policies to mitigate observed inequities between ZVHs and other Bay Area households.

Similar patterns in commute time are evident for low-income households (Table 7). Walk to local bus and walk to BART trips tend to be longer than for non-low-income households, but these differences switch direction when aggregated over all modes or over all transit modes or relying upon a threshold approach. The addition of driving alone as a possible mode shows that low-income households experience drive alone commutes that are 4.1 minutes shorter than for non-low-income households. While this is an indicator that low-income commuters are well-served by the highway network, it also demonstrates the problematic nature of relying on commute time (and, implicitly, *shorter* commute time) as an indicator of equity.

Table 7 Mean commute time (min) for low-income households and non-low-income households (modeled) by mode, 2005.

	Low-income households	Non-low-income households
All modes	24.2	26.8
Drive alone	19.5	23.6
Carpool	23.1	26.1
Non-motorized	17.1	17.1
Walk to local bus	34.9	33.0
Walk to BART	52.4	49.9
All transit trips	46.3	48.4

Ihlanfeldt and Sjoquist point out that the choice of residential location is likely endogenous with respect to commute time for whites only.[34] This means that whites more readily trade off increasing commute time for lower per unit housing costs. In a study of Detroit, Michigan, Zax analyzed the commute times of black and white workers employed at the same central business district location.[35] His results showed that black workers had shorter commute times, but that 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, he found that white commute times increased with income, while blacks' commute times did not. The lower observed commute times for low-income households than for higher income households reported in Table 7 may reflect similar dynamics. Table 8 shows mean commute times and transit mode share by income quintile. There is a large increase in commute times for driving between income quintile two and three with a maximum difference between quintiles of 4.9 minutes or 25% of the lowest value. For transit, there is a similar absolute increase between quintiles two and three, but the maximum difference is proportionally much smaller. The maximum difference of 5.2 minutes between income quintiles four and two

[34] Ihlanfeldt and Sjoquist, "Spatial Mismatch Hypothesis," 854.
[35] Jeffrey S. Zax, "Race and Commutes," *Journal of Urban Economics* 28, no. 3 (1990).

corresponds to 12% of the minimum value. Transit mode share declines as income rises. Overall, Table 8 suggests that higher income households are choosing longer commutes by automobile while lower income households are locked into longer commutes by transit, again demonstrating that longer or shorter commute times cannot be unambiguously assumed positive or negative.

Table 8 Mean commute time and transit commute mode share by income quintile, 2005.[a]

	Income quintile 1 (< 24,000)	Income quintile 2 (24,000 – 51,000)	Income quintile 3 (51,000 – 80,000)	Income quintile 4 (80,000 – 126,000)	Income quintile 5 (>126,000)
All driving (min)	20.0	20.8	24.2	24.9	24.4
All transit (min)	46.0	45.1	49.0	50.3	48.6
Transit mode share (%)	17.8	13.9	12.6	11.9	11.8

[a]Quintiles are calculated based on the incomes of the entire synthetic population, not only commuters.

Traditional transportation equity analysis that uses a single threshold to define target populations and combines different protected groups can obscure differences that emerge when results are disaggregated by group and by mode. For groups like people of color, where concentrations can vary between very low and very high across geographic areas, and segregation can have a dramatic effect on transportation outcomes,[36] examining trends in equity metrics as the threshold value changes can provide valuable information about inequity. Where possible, fully disaggregating populations like ZVHs and low-income households can also be undertaken and will yield different results from their aggregate representation. Once inequities are identified, policy options within the purview of the MPO should be targeted toward mitigation. This mitigation should consist

[36] Ihlanfeldt and Sjoquist, "Spatial Mismatch Hypothesis."

of reducing inequities from the base year to the forecast year.[37] One approach for operationalizing these reductions is discussed in the next section.

NEW METHODS FOR EQUITY ANALYSIS

Disaggregating by mode and household were shown above to generate different results than when results were first aggregated at the TAZ-level on the basis of disadvantage factors and then presented. This section presents two additional techniques that could be employed to assess equity. Neither carries the disadvantages associated with geographic aggregation. The first develops a regional-level indicator of the equity of commute time using travel times for individual commutes, but could be applied to any other transportation performance metric. This high-level metric is well-suited to rapidly comparing the potential equity implications of alternative transportation and land use scenarios such as those prepared during the course of an environmental impact report. It could be paired with the household-level, or threshold-varying approaches described above to identify whether inequity exists within a particular alternative or when viewing alternative in comparison with one another.

The second approach is useful for informing mitigation once inequity is identified using the Gini approach, stakeholder feedback, or other regional indicators. It highlights potentially problematic areas that are likely to be affecting the performance of regional equity indicators and targets them for improvements. The example described below targets areas with high commute times by local bus and high proportions of people of color residents. Rather than using geographic thresholds to group all areas that exceed a certain value, this analysis uses a threshold at the end to identify high-priority sites for

[37] Martens, Golub, and Robinson, "A Justice-Theoretic Approach."

action, recognizing that transportation investment and policy decisions are ultimately spatial rather than focused on particular demographic groups.

Alternative scenario selection

Definitions of equity have been contested, with agencies generally adopting an unstated proportionality criterion for equitable results and advocates calling attention to existing inequities and their mitigation. MTC has argued that it is difficult to define equity; however, as discussed in Chapter 3 a compelling conception of equity can be operationalized by reducing gaps in performance metrics between demographic groups. Alternately, the equity of an overall distribution can be quantified. The Gini coefficient is a well-accepted measure of population inequality which varies from a perfectly equal income distribution (zero) to a perfect concentration of income with one individual (one).[38] Lower Gini coefficients are by definition more equitable since they indicate a situation in which members of a population have similar outcomes. Although the Gini coefficient is commonly used to calculate income inequality, in principle it can be applied to any metric manifested by members of a population. In transportation analysis, Delbosc and Currie used the Gini coefficient to quantify the equity of transit level of service in Melbourne, Australia and Levinson demonstrates an application to ramp metering.[39]

A measure closely related to the Gini coefficient is the Gini mean difference (GMD);[40] instead of a dimensionless coefficient, the GMD represents the average absolute difference between two people in a population and takes the units of the metric

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[38] World Bank, "Poverty Analysis - Measuring Inequality," http://go.worldbank.org/3SLYUTVY00.
[39] Levinson, "Identifying Winners and Losers in Transportation."; Delbosc and Currie, "Using Lorenz Curves to Assess Public Transport Equity."
[40] See, e.g., Shlomo Yitzhaki, "Gini's Mean Difference: A Superior Measure of Variability for Non-Normal Distributions," *Metron - International Journal of Statistics* LXI, no. 2 (2003).

of interest. For commute time, the units of the GMD will be minutes. If the gap grows from the base to the forecast year, the GMD will increase. It is calculated as shown in equation 1,

$$\text{Gini mean difference} = \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n}|y_i - y_j| \qquad (1)$$

where *n* is the size of the total population and *y* references some attribute of individual *i* or *j*, for example commute time in minutes. All differences between all members of the grouped population are tabulated. The result indicates the average difference between two population members on the attribute of interest.

Use of the GMD can be illustrated with the following hypothetical example. There are two population groups: 10,000 members of a high income group and 10,000 members of a low-income group. The groups experience mean commute times in the base year (2005) of 30 and 24 minutes, respectively. Projected transportation improvements for 2035 and supporting modeling indicate that commute times decrease for both groups to 27.5 and 22 minutes, respectively.[41] The low-income group saves 2.5 minutes on their commute, on average, while the high-income group saves 2 minutes. Both experience equivalent percentage decreases (approximately 8%). According to the proportionality criterion, since the low-income group apparently benefits more than the high-income group, the scenario is equitable on this metric. However, as Figure 11 illustrates, relying solely on the mean to represent the experience of a relatively heterogeneous group is problematic since the *spread* of the distribution, measured by the standard deviation, may

[41] Travel times were generated by sampling from lognormal distributions with location and scale parameters μ and σ, respectively: 2005 low-income, lnN(3.29,0.216); 2035 low-income, lnN(3.28,0.251); 2005 high-income, lnN(3.16,0.1655); 2035 high-income, lnN(3.08,0.1357).

also change. In the figure, although many low-income residents experience reduced commute times in the forecast year, many others experience much longer times. The mean has decreased for the low-income group, but its standard deviation has increased. The result is that the forecast distribution of travel times is *less equitable* than the base year even though the traditional approach would conclude that the underlying scenario was equitable.

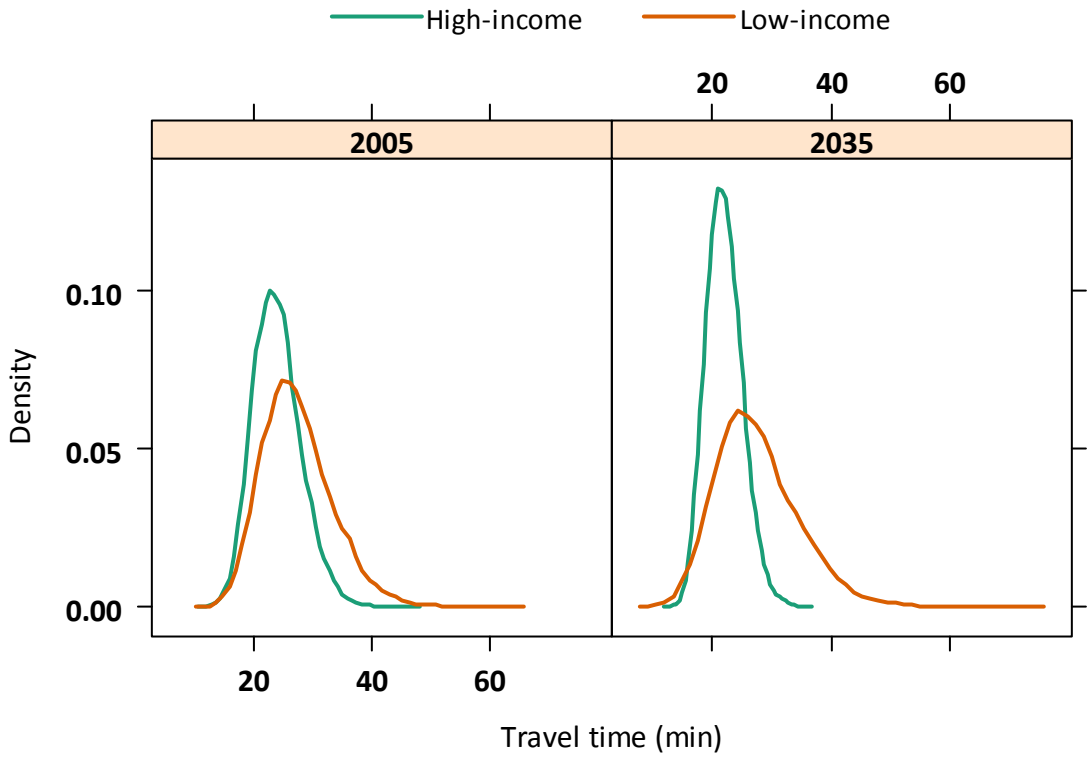

Figure 11 Hypothetical travel time distribution in the base year and forecast year for two income groups.

GMDs for this hypothetical example are summarized in Table 9. For the overall population, the mean difference increases from 2005 to 2035. This overall increase is composed of a decrease for high-income residents and an increase for low-income residents. Thus the planned improvements do not improve equity measured as the

average difference in travel time across the population. This result occurs despite a decrease in average travel times for both groups.

Table 9 Summary of Gini mean difference for each population group by year.

Population group	Size of group	Gini mean difference (minutes) 2005	2035
Low-income	10,000	3.30	3.87
High-income	10,000	2.25	1.691
Combined	20,000	2.94	3.20

The GMD can be easily calculated and is readily applicable to making decisions between alternative transportation and land use scenarios typically employed during SCS development. The development of such alternatives finds its origins in "blueprint" planning principles.[42] Blueprint planning refers to the creation of an integrated transportation and land use plan through the development of scenarios on which stakeholders achieve consensus. A key element of blueprint planning is the development of transportation and land use scenarios that can be presented to the public and other stakeholders for input and refinement. The alternative scenarios blueprint planning exercise was a cornerstone of MTC's public participation plan for *Plan Bay Area*.[43] When a preferred transportation and land use plan was adopted at a special meeting of the MTC and ABAG Executive Board, staff emphasized the extensiveness of public outreach involved with the plan, noting that the agencies had conducted two telephone polls, 19 public meetings, and outreach to local communities, among other activities.[44]

[42] Elisa Barbour and Michael Teitz, "Blueprint Planning in California: Forging Consensus on Metropolitan Growth and Development," (San Francisco, CA: Public Policy Institute of California, 2006).
[43] MTC, "Public Participation Plan," 50-51.
[44] ABAG/MTC, "Preferred Land Use and Transportation Investment Strategy," (Presentation to the ABAG Executive Committee and MTC Commission, May 17, 2012), 5.

For the SCS alternatives, MTC and ABAG paired five land use scenarios with two transportation investment scenarios to arrive at five total scenarios (Table 10).[45] Land use scenarios 1 and 2 were not based on reasonable planning assumptions regarding housing growth. Land use scenarios 3 and 4 concentrate housing and job growth in areas well-served by transit, with scenario 4 increasing the proportion of total growth accommodated in such areas by a small amount. Land use scenario 5 shows growth more evenly distributed throughout the entire Bay Area, similar to past trends. The T2035 transportation scenario used the investment package from the previous RTP and core capacity transit focused on increasing transit service while scaling back some highway investments but was not fiscally constrained.

Table 10 *Plan Bay Area* alternative scenarios.

	Land use scenario	Transportation scenario
1	Initial Vision	T2035
2	Core capacity	Core capacity transit
3	Focused Growth	Core capacity transit
4	Constrained core capacity	Core capacity transit
5	Outward growth	T2035

GMDs for each of the alternative scenarios and a base year are summarized in Figure 12. Values are calculated for low-income residents, higher income residents, and overall. In general higher income residents have similar GMDs to the overall value since there are comparably fewer low-income residents in the synthetic population. As shown in the figure, the GMD provides a readily interpretable indicator of equity as well as a comparison across scenarios. The results show the GMD increasing for all groups from the base year to every forecast scenario, and the value for low-income residents

[45] MTC, "Plan Bay Area Scenario Analysis and Targets Scorecard," http://www.onebayarea.org/pdf/ScenarioAnalysisOverview.pdf.

increasing more than the overall GMD. This result indicates a potential problem with the equity of the long-range plan, since the GMD for low-income residents increases faster than the overall GMD and for higher income residents. This result may reflect the influence of income on mode choice. As increasingly attractive transit options are made available in the forecast year, low-income residents will be more likely than higher income residents to own fewer automobiles and to shift to transit. Transit trips will still, in most cases, exceed the time required to complete the same trip by automobile, and since automobile trips are shorter for lower income residents (Table 8), GMD will tend to increase. Of course, because the GMD measures relative differences, the opposite interpretation is also possible: that the automobile becomes more attractive in the forecast year for some proportion of low-income residents while many remain locked into longer transit trips.

As a decision making tool, the GMD is agnostic with respect to the source of changes in its magnitude from the base to the forecast year. It should therefore be combined with other measures like changes in mode share by income group to judge the desirability of alternative scenarios. GMDs could also be calculated for transportation costs, non-commute travel time, travel time by users of a particular transit agency or within a particular jurisdiction, or any other indicator of interest and used to supplement the findings based on travel time alone. Using Figure 12 to evaluate the alternative scenarios on commute time equity by income group, constrained core capacity and outward growth appear to perform best and initial vision appears to perform worst. Constrained core capacity and outward growth show the most similar GMDs between low and higher income groups, both differing by 0.16 minutes. The transit and smart growth emphasis of

the constrained core capacity scenario and the automobile-focused outward growth scenarios result in similar equity implications judging by commute time equity alone as hypothesized above. To the extent that reduced VMT is also a policy goal, constrained core capacity will be superior. The GMD might also be used as a check on decisions already made, or to eliminate alternatives such as the initial vision scenario (difference between low and higher income groups of 0.6 minutes) from further consideration.

Demonstration of this well-accepted metric for inequality in the transportation realm challenges staff's assertion that it is too difficult to determine what constitutes an equitable outcome.[46] Because this quantification is difficult does not mean that it should not be attempted. The GMD also has the advantage of linking the use of facilities with investment. As demonstrated above for the Snapshot analysis, equity analyses often focus simply on service levels or potential accessibility even though travel models by definition link transportation supply and demand. The GMD links both in a metric that is easy to understand.

Measures of statistical dispersion like the GMD can provide a single summary statistic that measures inequity across the entire population, sidestepping many of the difficulties associated with geographic aggregation and comparisons noted above, or they can be applied to different population groups to provide valuable information in addition to the mean. Statistics like the mean difference calculated on the overall population should be used to supplement geographic and household based comparisons since looking specifically at those population groups is clearly of interest to stakeholders.

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[46] See, e.g., Letter from Steve Heminger to MTC Legislation Committee Re: Environmental Justice (EJ) Principles. January 5, 2007.

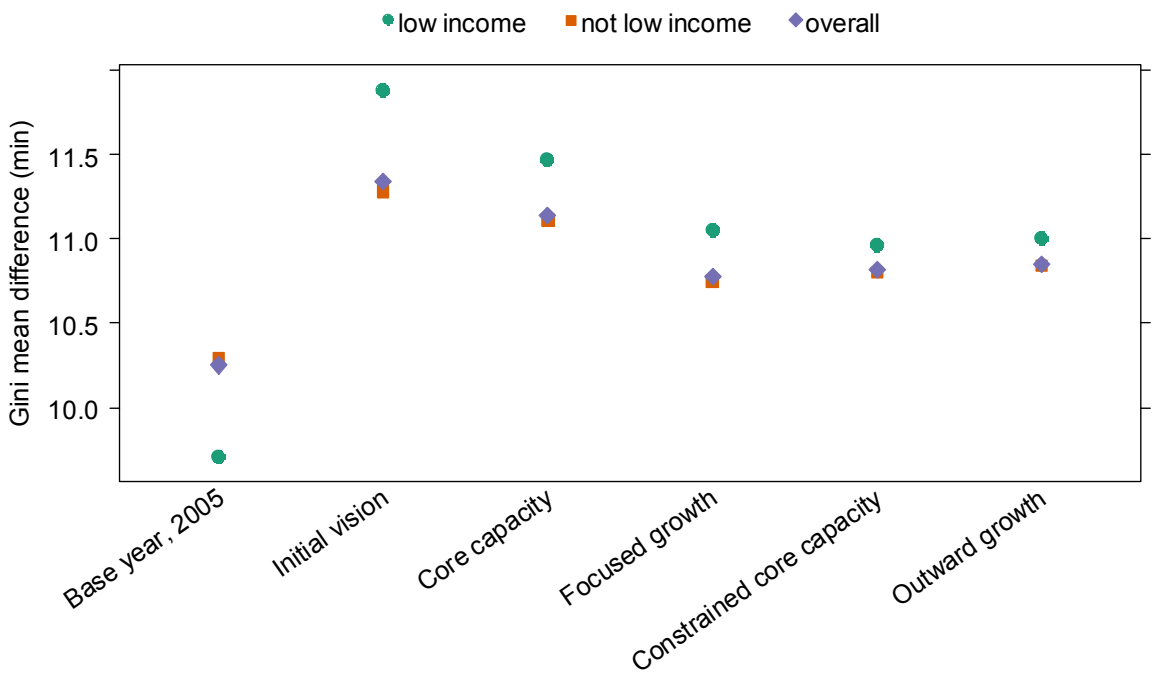

Figure 12 Gini mean difference for commute time and two income groups by *Plan Bay Area* alternative scenario.

Identifying mitigation options

If inequity is identified using a regional indicator or based on stakeholder feedback as in the Bay Area, additional actions are necessary to identify mitigation options. Grengs developed an intuitive accessibility indicator as the proportion of "vulnerable households" in a TAZ that could be used for such a purpose.[47] Because of the travel data used, households and population were assumed uniformly distributed within each TAZ. Vulnerable households were defined as those with no vehicle access lying outside of walking distance (0.25 mi) to a bus line that serves a grocery store combined with 50% of those households with no vehicle access lying within the buffer. Including this second category ensured that access to groceries by bus was not equated with access by car. One

[47] Grengs, "Measuring Spatial Patterns of Accessibility."

result from this analysis is a map that highlights areas with high proportions of vulnerable households. If a goal of a transportation policy were to increase accessibility of vulnerable households to grocery stores, these areas could be targeted for improved bus service.

This insight can be generalized in the case of an RTP to identify priority locations for investment. Aggregating results at the regional level generally obscures critical local details. The five alternative *Plan Bay Area* scenarios were evaluated at the regional level. This analysis showed that the effects of transportation investments on greenhouse gas (GHG) emissions and other performance targets were limited: per capita GHG emissions differed by at most 0.4 percentage points between build and no-build model runs.[48] This lack of differentiation between modeled scenarios shifts attention from the region to the local (or TAZ) level for assessing the equity and performance effects of planned transportation investments.

Such a local analysis could involve maps created to respond to the concerns voiced by equity advocates and other stakeholders during public participation dating back to 1998 and described in Chapter 2.[49] This approach would create a link between perceived inequity, analytical methods, and investment decisions. The goal of this analysis would not be to determine that a particular plan was equitable, but rather to demonstrate to interested members of the public that policy and investment decisions were being

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[48] Staff Presentation to MTC Planning Committee and ABAG Administrative Committee. "Plan Bay Area Scenario Results." December 9, 2011.

[49] See, e.g., Letter on Civil Rights, Equity, and Transportation to MTC Executive Director Lawrence D. Dahms, April 17, 1998.; Letter from the Minority Citizens Advisory Committee to MTC Planning and Operations Committee regarding Comments on the Transportation 2030 Equity Analysis Report, December 10, 2004.

targeted to specific locations, modes, and routes such that equitable outcomes would be ensured.

The remainder of this section proposes a localized, TAZ-level regional equity analysis that does not result in a final aggregation of data. This analysis is similar to MTC's "Snapshot" analysis that employs regional data to calculate 13 measures to create a series of maps intended to inform the region's progress toward equity.[50] However, none of the snapshot measures are linked to modeled tours or trips, so their implications are difficult to interpret. For example, one of the maps shows access to essential destinations by 30-minute transit trip (Figure 13), largely replicating the spatial patterns of accessibility shown in Figure 6. The map combines all transit modes and is not linked to modeled travel behavior, making it difficult to identify areas that would benefit from improved transit service. What is missing is how the spatial distribution of low-income and transit dependent households interacts with the map. None of the snapshot measures makes this link.

[50] MTC, "Snapshot Analysis for Communities of Concern," http://www.mtc.ca.gov/planning/snapshot/.

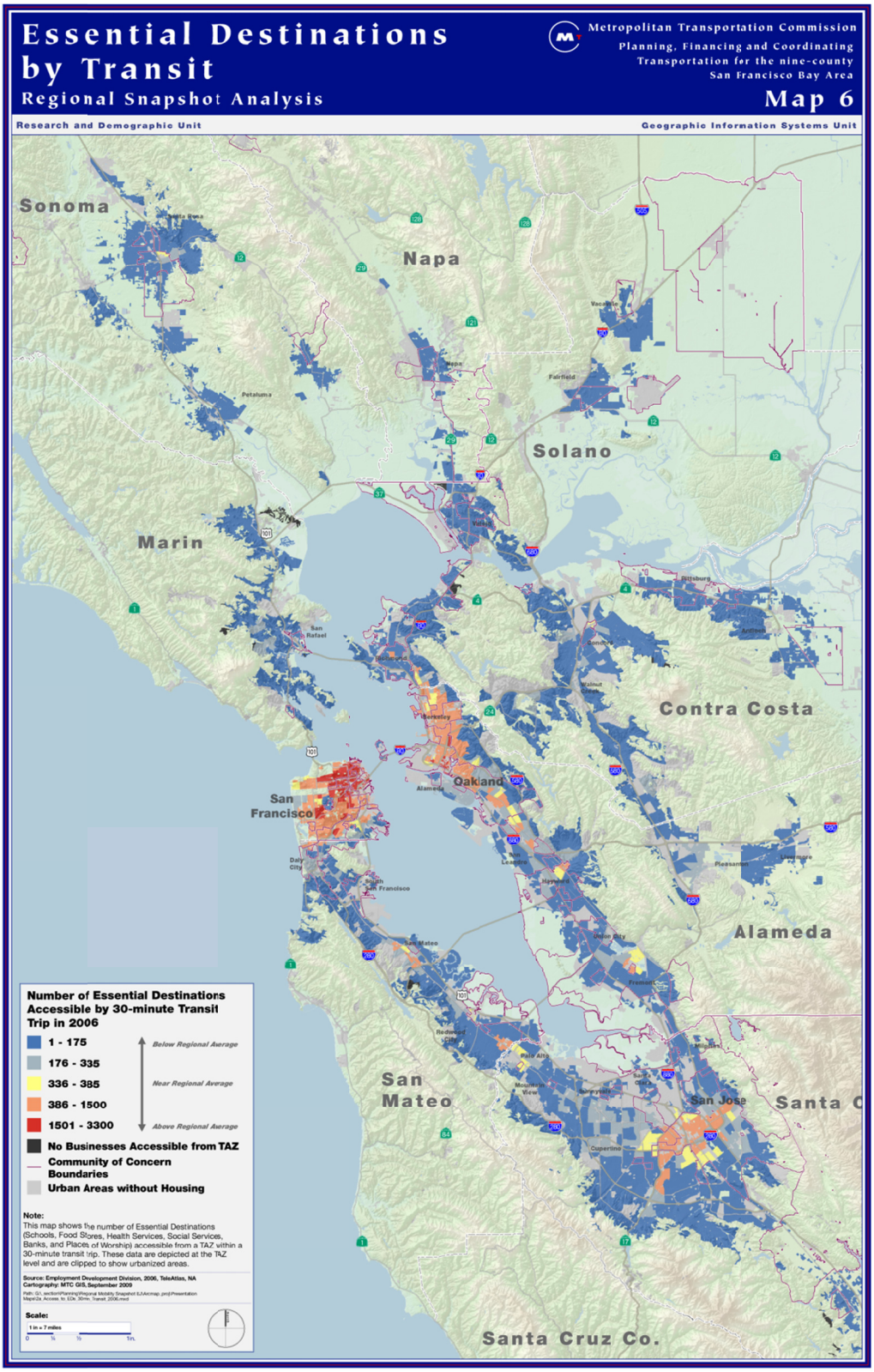

Figure 13 Access to essential destinations by transit from MTC's Snapshot analysis.

Figure 14 illustrates one possibility for an improved snapshot. It links the location of bus service with manifest travel behavior undergirded by incomes, family structures, and automobile ownership. Using 2005 data ensures that current inequities are reflected in the analysis and match performance indicators to actual demographics. The map shows the spatial distribution of bus commute times as evidenced by simulated travel behavior in the base year of 2005. Quintiles of bus commute times are shown; clearly, bus commuters in San Francisco, Berkeley, Oakland, and parts of San Jose enjoy the shortest journeys to work while bus commuters in the rest of the inner Bay Area generally have much longer trip times. This type of map can be further refined to highlight areas with high potential for growth in bus ridership – areas that have high demand for service because of demographics but where service is currently not sufficient to ensure short trip times. To the extent that improving bus service is a planning goal, such maps can be used to target areas for improvement.

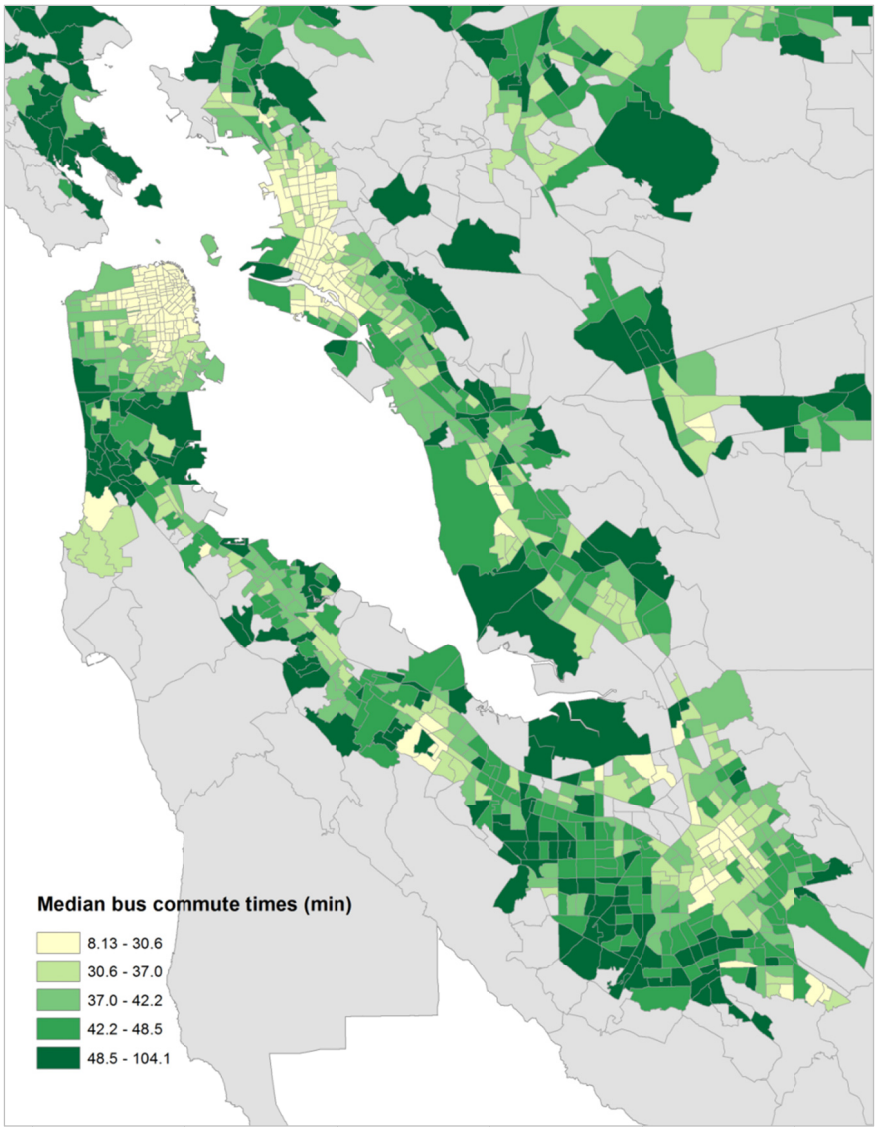

Figure 14 Quintiles of median bus commute time by TAZ for the inner Bay Area, 2005. No bus commute trips were undertaken in TAZs plotted grey.

One possibility for further refining the map proceeds as follows in comparison with a similar method for drive alone commuters, to illustrate the differences between these two groups of commuters and to allow for the possibility that modeled drive alone commuters are disadvantaged as well. Table 11 summarizes regional characteristics for all commute

tours with chosen modes of walk to local bus and drive alone.[51] Average commute time, total number of tours, and mode shares were calculated for each TAZ. The median commute time by the chosen mode, number of tours, and median mode share by TAZ are summarized in the table. Table 12 compares demographics in TAZs that exceed these median values for bus commute time, number of tours, and mode share. TAZs so identified will be referred to as "high demand." These results show that high demand TAZs for the bus commute have higher concentrations of people of color and low-income relative to TAZs that exceed the median values for drive alone and relative to the regional average, suggesting that there is an issue of equity related to long bus commutes that is not similar to long drive alone commutes.

Table 11 Regional summary statistics for drive alone and walk to local bus, 2005.

		Regional summaries (across all TAZs)		
Mode	Tours	Median one-way commute time (minutes)	Median number of tours	Median mode share (%)
Walk to local bus	109,347	43.2	37	2.4
Drive alone	1,516,460	21.9	1003	61.0

Further evidence supporting the different implications for these two groups of commuters is shown illustrated in Table 13 that looks only at high demand TAZs. Drive alone is an attractive option for those currently walking to local bus in high demand TAZs; switching modes would save the median commuter approximately 30 minutes. On the other hand, local bus is not an attractive option for those currently driving alone. Residents of high demand bus TAZs are locked into long bus commutes because of a

[51] Identified tours had a listed tour purpose as work and the primary origin and destination were used, ignoring trip-chaining on the commute trip. This method is consistent with MTC's definition of commute trips (personal communication with D. Ory, March 9, 2012).

combination of income constraints and lack of access to an automobile. It is important to note that the differences shown in Table 13, when aggregated over the entire region for all commute tours, are largely obscured by the high proportion of drive alone commute tours. For the 2005 base year, 58% of commute tours used drive alone. Commute length is therefore only a meaningful indicator of equity if it is disaggregated by mode.

Table 12 Characteristics of "high demand" TAZs exceeding the medians from Table 11.

Mode	Number of TAZs	Mean proportion of households living below 200% of the US census-defined poverty line (%)[a]	Mean proportion of people of color (%)
Walk to local bus	139	24	62
Drive alone	31	17	41
Across the region	1,454	23	54

[a]Using the 2010 thresholds in constant year 2000 dollars. See: http://www.census.gov/hhes/www/poverty/data/threshld/index.html

Since high demand bus TAZs have higher concentrations of people of color relative to overall TAZ-level demographics and there is a link between increasing concentrations of people of color and increasing commute times by local bus, it is important to look further at race. Filtering Table 12's TAZs using a 70% people of color threshold, the same used for the *Plan Bay Area* equity analysis, results in 49 remaining TAZs for walk to local bus and 1 remaining TAZ for drive alone. Since virtually all of the drive alone TAZs are eliminated with this filter, we can conclude that the longest drive alone commutes are generally not borne disproportionately by people of color.

Table 13 Median commute time by TAZ type and mode, 2005.

	TAZ Type	
Mode	High demand drive alone (min)	High demand walk to local bus (min)
Drive alone free/pay	31.7	15.65
Walk to local bus	47.2	44.7

The 49 remaining high demand bus TAZs are located exclusively in San Mateo, Santa Clara, Alameda, and Contra Costa counties. They are shown in Figure 15. These TAZs

offer poor mobility by local bus, yet modeled residents use local bus in high absolute numbers and disproportionally to their population representation. With better local transit service, higher demand across all population segments might emerge. If the assessment of transportation plan equity were based on reducing gaps between transportation modes, bus service could be improved specifically in these areas. These types of maps offer immediate utility for planning purposes, unlike those developed for MTC's snapshot analysis that offer no clear implications and present data unlinked from actual travel behavior.

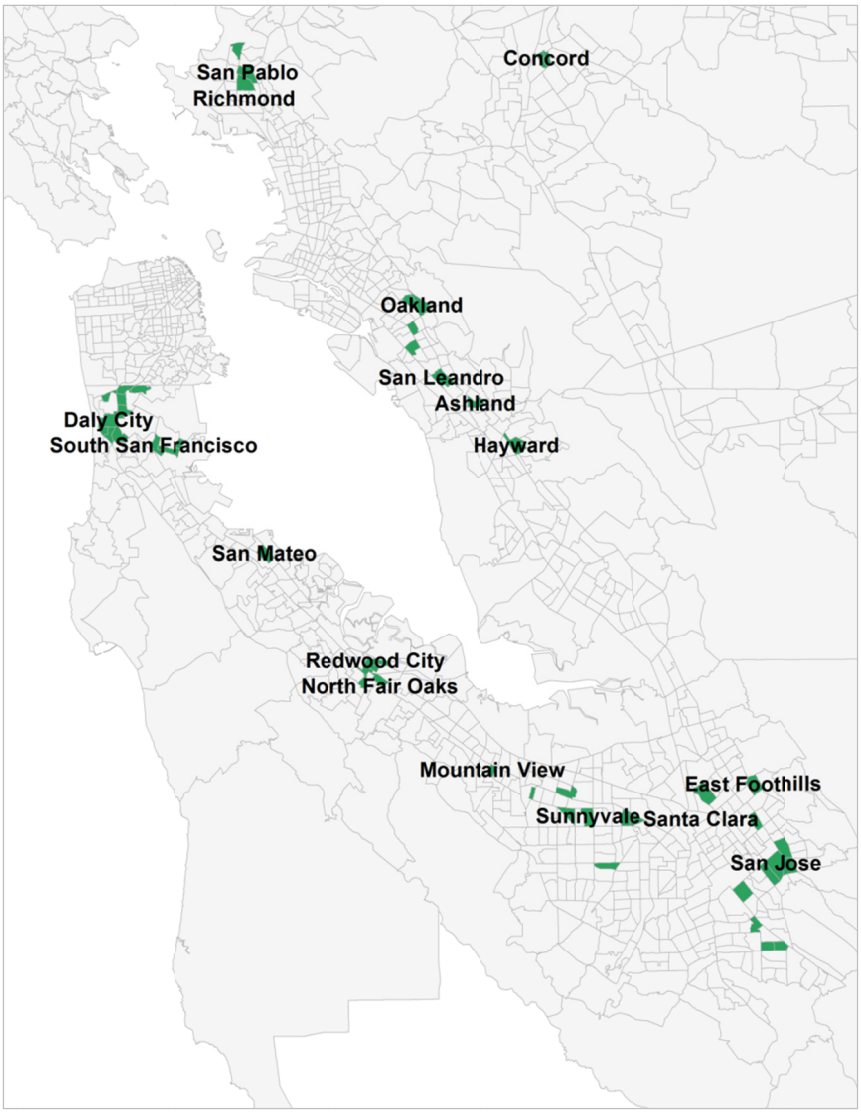

Figure 15 Identified high demand and high bus commute time by TAZ (shaded green) for the inner Bay Area, 2005.

CONCLUSION

Contemporary transportation models being developed to increase behavioral fidelity should not simply be applied to equity analysis in the manner developed for four step models. New methods must be developed to take full advantage of their new functionality. Using data from MTC's activity-based travel demand model we develop two such methods that circumvent shortcomings associated with earlier approaches while

incorporating feedback from equity stakeholders. The methods focus on existing inequities and provide a clear link to policy decisions at the MPO.

The implications for equity analysis are relevant to transportation planning agencies that must comply with Title VI and related guidance and for public participants in regional planning. The results shift emphasis from specific indicators and metrics to underlying analytical methods. For example, combining different protected groups under single definitions of "target populations" tends to obscure differences between those groups that are only elicited when evaluated individually. This has important implications for race-based analysis. Although some studies have been undertaken that employ activity-based models to examine individual populations of interest like low-income households, race has been conspicuously absent as an organizing variable. We demonstrate its importance by showing that increasing spatial concentrations of people of color lead to poorer transportation outcomes for commute times by local bus. Finally, the GMD was demonstrated as an appropriate metric for the analysis of regional plans. Future work should extend its application to other performance measures.

This study is unique in that no prior work has performed a sensitivity analysis on the thresholds used to define target populations, nor combined activity-based model outputs that simulate the travel behavior of individuals and families with those evidenced by the threshold approach. We focused on commute travel time as an indicator of transportation system performance because it was used by MTC in their equity analysis and because it links transportation supply with local demographics like income, family structure, and automobile ownership. Related work on other indicators could also be undertaken including analysis of important non-work destinations. As described above, using

commute time alone carries important limitations. Travel time varies widely depending on mode choice, and this longer commutes by automobile are often chosen (especially by higher income groups) to access higher quality housing. Increasing or decreasing travel times can be considered either positive or negative depending on the context. For this reason, finer-grained analyses that examine income groups and specific modes must be conducted, carefully interpreted, and combined with other metrics.

SUMMARY AND CONCLUSIONS

This dissertation has investigated components of regional transportation planning in California from 1967 through the contemporary era and identified advocates for regional equity as important actors in achieving desired planning outcomes like climate change mitigation. The perceived failure of post-war planning overseen by highway engineers necessitated a different approach to transportation planning than had been undertaken in the post-war era. California and other states appeared to adopt the ideal of multimodalism by forming departments of transportation and leading the charge for changes to planning practice, but were rebuffed by an irate public and legislature that were alarmed by the rapid pace of change and potential effects on travel behavior.

In this environment, regional institutions were proposed as an antidote to the state-level authority that had characterized past planning regimes. However, the regional agencies that emerged in the late 1970s in California were actually a manifestation of local (city and county) interests. Statewide transportation policy in the late 1980s and a fiscal environment increasingly reliant on bonded debt and locally administered sales taxes doubled down on the local level of authority, in contrast with federal direction in ISTEA and subsequent transportation authorizations.

SB 375 represents the California legislature's re-emphasis on the region, by requiring MPOs to meet greenhouse gas reduction targets in their jurisdictions. Because the law is weak in terms of enforcement and because there are no provisions in the bill to ensure equitable outcomes, advocates for regional equity are emerging as key SB 375 constituents, holding planning agencies to account where the law is insufficiently prescriptive. These advocates build on a foundation provided by previous movements for

environmental justice yet the distribution of environmental hazards forms only a small component of their concerns. Instead they focus on the equity of transportation investments, affordable housing, gentrification and displacement, and civil rights. These new issue areas create problems for transportation planning agencies that generally prefer to rely on decision-making tools developed for a previous era of transportation policy, namely travel demand models. Even though these tools are evolving to deal with the imperatives of climate change, the concerns of advocates are not easily integrated into the new framework as is clear with MTC's use of UrbanSim for the environmental review of *Plan Bay Area.*

In this technical environment, connections between academic researchers and advocates appear essential for achieving equitable outcomes.[1] The action research described in this dissertation offers one example for the form this connection could take through engagement with transportation planning in real time.[2] Through a review of previous equity analysis efforts, academic research, law and guidance, public comments submitted by advocates on previous plans, and direct collaboration with the same groups, fundamentally new approaches for equity analysis were proposed that take advantage of developing travel demand modeling methods. Not limited to the particular cases under study, these methods could be employed by regional agencies interested in increasing the correspondence of their plans with the lived experiences of protected populations within

[1] Gwen Ottinger and Benjamin Cohen, "Environmentally Just Transformations of Expert Cultures: Toward the Theory and Practice of a Renewed Science and Engineering," *Environmental Justice* 5, no. 3 (2012).
[2] Carl Mitcham, "A Historico-Ethical Perspective on Engineering Education: From Use and Convenience to Policy Engagement," *Engineering Studies* 1, no. 1 (2009).

their jurisdiction. Revisions were suggested that redefine target populations, consider race as an important demographic category, and examine inequities in the base year.

The research documented in this dissertation will be of interest to those investigating transportation sustainability and the relationship between engineering expertise, transportation finance, regional politics, and movements for regional equity. The work addresses gaps in the literature on California history by documenting Caltrans's early years, the challenges faced by that agency, and how the response to their policies shaped transportation planning institutions and later possibilities. Scholarship on the importance of movements for regional equity is affirmed, but we suggest that regional travel demand and land use models represent a previously unidentified barrier to their progress.

Importantly, ongoing regulatory work at the US Department of Transportation, and the public participation efforts of equity advocates will be important beneficiaries of this work. While previous equity efforts have focused on improving the extensiveness of public participation efforts or crafting lists of specific indicators for an equity analysis, Chapters 3 and 4 indicate that these foci obfuscate the question of whether results are meaningful. Regional equity analyses must conduct sensitivity analyses on threshold definitions, must not presumptively combine protected populations or transportation modes, and should include an analysis of existing inequities. Although these improvements will not ensure equitable outcomes, they represent an improvement over existing analysis techniques passed down from traditional environmental justice analysis and are thus an important contribution to the transportation planning literature.

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APPENDIX A: REVIEW OF EQUITY MODELING PRACTICE IN THE SAN JOAQUIN VALLEY

Review of environmental justice and equity analysis methods in the San Joaquin Valley[1]

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Overview

This document provides a summary and analysis of the environmental justice and equity analyses performed as part of all 2011 regional transportation plans (RTPs) completed by the eight metropolitan planning organizations (MPOs) in the San Joaquin Valley (SJV). It also discusses supplementary environmental justice-specific documents produced by two MPOs.

These MPOs will be the next major contingent to prepare their sustainable communities strategies as required under SB 375. Transportation advocacy efforts are under-developed in the SJV because of a historical emphasis on labor, air quality, and pesticide regulations. Additionally, the perception and reality of the SJV as mostly rural makes many of the transportation policies proposed for SB 375 compliance seem unsuitable for implementation there. On the other hand, although recently projected to slow, the SJV's population will increase from about 4 million today to 7.5 million by 2050. According to population projections from the California Department of Finance, six of the top 10 fastest-growing counties in the state from 2010 to 2050 will be in the SJV.[3]

The analysis methods used by each MPO are summarized in Table 1. The table is ordered by the population served by the planning organizations and also includes thresholds used to define environmental justice (or "target") populations in a particular geographic unit and whether the regional travel demand model was used to develop performance indicators for the analysis. The two largest MPOs (Fresno and Kern) explicitly defined target populations and used travel-related measures in their analyses. Smaller MPOs also demonstrated sophisticated analytical methods, however, often using off-model approaches to quantify impacts (see, e.g., analyses

[1] This document is a work in progress. Please send comments and suggestions to the corresponding author via email and share the link freely: http://goo.gl/qjdDz.
[2] Corresponding author.
[3] California Department of Finance. "Interim Population Projections for California and its Counties 2010-2050." http://www.dof.ca.gov/research/demographic/reports/projections/interim/view.php

for San Joaquin and Madera counties). While not always informative or reproducible, such analyses at least acknowledge shortcomings associated with traditional environmental justice analyses.

Table 1 Overview of SJV environmental justice/equity analyses.

County	Population (2010)	Target population thresholds	Travel demand model used?
Fresno	930,450	60% higher than county average on one of four categories[a]	Yes
Kern	839,631	Areas with higher than average concentrations of target populations[b]	Yes
San Joaquin	685,306	60% people of color or 20% low income	No
Stanislaus	514,453	-	No
Tulare	442,179	-	No
Merced	255,793	-	No
Kings	152,982	-	No
Madera	150,865	-	No

Note: Missing data (dash) indicates either no threshold definition or ambiguous method used.
[a]Low income, non-white, senior, and disabled populations.
[b]Low income, minority, elderly, and disabled populations.

Overall, the environmental justice assessments conducted for the 2011 RTPs showed very sparse evidence of inequity. The summary below argues that these findings are not necessarily valid because of the nature of the individual analyses. As MPOs often point out, there is no prescribed standard by which to conduct an environmental justice analysis.[4] As a result of this lack of specific guidance, very little emphasis has been paid to crafting meaningful methods. As the discussion below shows, improvements could be made in at least the following areas:

- Threshold definitions for target populations should be calibrated to elicit suspected or observed differences in travel behavior between environmental justice and non-environmental justice populations.
- Performance indicators should be based on characteristics of individual travelers rather than the geographic zone within which environmental justice populations are concentrated. Using geographic zones can lead to counterintuitive results where environmental justice populations appear to benefit from but are in fact burdened by transportation investments.
- Characteristics of actual trips should be used to gauge performance (e.g. average non-commute travel time) as opposed to theoretical accessibility (e.g. average travel time to all job centers).

[4] For example, the 2009 environmental justice report prepared by Fresno COG states that MPOs are granted “considerable latitude … regarding implementation of environmental justice principles into the planning process” (p. 4).

- Purported congestion mitigation and air quality benefits of capacity increasing projects must be analytically quantified considering the impacts of induced demand and impacts on near-road air quality, not simply asserted.
- Qualitative map-based analyses and other qualitative analyses must be reproducible, and should be supplemented with quantitative analysis since the extent to which different population groups are affected by multiple projects is not clear using maps alone.[5] Maps must be accessible in documents and legible. Data should be made readily available as has been partially undertaken by the Metropolitan Transportation Commission.
- The assessment of equity or the normative basis for an equity determination is never discussed. This leads to a situation where any result can be considered equitable.[6]
- In no instance was the environmental justice analysis used to decide between alternative scenarios; rather, it was used to assess investment decisions that had already been made. A link between regional analysis and decision making has generally been lacking but would vastly improve the legitimacy of environmental justice efforts at transportation planning agencies.[7]

Forthcoming work from the authors is further developing these ideas. The remainder of this document discusses the environmental justice and equity analysis methods of each SJV MPO, with links to the 2011 RTP and other key documents.

Council of Fresno County Governments

2011 RTP:http://www.fresnocog.org/files/RTP/2011%20RTP%20Final/RTP%20FINAL.zip
2009 Environmental justice plan: http://www.fresnocog.org/sites/default/files/publications/FINALEJReportMay09_1.pdf

Fresno COG's 2011 RTP provides an overview of the agency's approach to environmental justice (pp. 2-9 - 2-14). The overview describes public outreach efforts, four grants received through a Caltrans program, and specific efforts directed at engagement with the Native American community. As part of its outreach efforts, and its attempt to implement federal guidance on Title VI and environmental justice,Fresno COG convened an environmental justice task force. The task force had ongoing meetings from March 2004 to February 2005 to prioritize and guide issues of concern that would later be operationalized in an environmental justice analysis (p. 10 of the environmental justice plan). In May, 2009, Fresno COG adopted an Environmental justice plan that includes a quantitative analysis of environmental justice developed with input from the task force. Since no separate environmental justice analysis is conducted for the 2011 RTP, the remainder of this discussion references the 2009 plan.

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[5] Cambridge Systematics. "Technical Methods to Support Analysis of Environmental Justice Issues." Washington, DC: National Cooperative Highway Research Program, 2002, p. 4-19.

[6] See further discussion in Martens, Karel, Aaron Golub, and Glenn Robinson. "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, no. 4 (2012): 684-95; Khisty, C. "Operationalizing Concepts of Equity for Public Project Investments." Transportation Research Record: Journal of the Transportation Research Board 1559 (1996): 94-99.

[7] Sanchez, Thomas W., and James Wolf. "Environmental Justice and Transportation Equity: A Review of MPOs." In Growing Smarter: Achieving Livable Communities, Environmental Justice, and Regional Equity, edited by Robert D. Bullard. Cambridge, MA: MIT Press, 2007.

According to the report

> The Task Force played a key role in defining the target population, identifying the needs of the target population and developing appropriate measures for gauging the regional burden and benefits of transportation system investments on the target population. (p. 7)

In other words, the task force shaped the environmental justice analysis. The final analysis is remarkably similar to that of Kern COG, described below, but Kern's report was released in 2003. This discussion focuses on the areas in which Fresno's analysis differs from Kern's.

Target populations were defined using four disadvantaged populations: low income, non-white, senior, and disabled populations. Traffic analysis zones with populations 60% higher than the county average on any individual demographic were identified as environmental justice zones (EJ zones). Staff also experimented with 50% and 70% thresholds but found them too permissive and restrictive, respectively. The total number of TAZs identified in this manner was not described, and the maps included at the end of the plan are of extremely low resolution, making interpretation difficult (see p. 29 ff.).

The system criteria to measure were identical to those chosen by Kern COG, but their operationalizations were sometimes slightly different. The seven measures were:

- Accessibility: Average AM peak trip time by mode to job centers, drive alone, carpool, transit
- Mobility: Average PM peak period trip time to all TAZs in the county, drive alone, carpool, transit
- Cost-effectiveness: Person-miles of travel on roadway and transit projects per $1,000 of investment
- Equity: Compare proportions of zonal investments to zonal passenger-miles of travel
- Reliability: Proportion of total VMT operating at level of service E or worse
- Consumer satisfaction: Change from 1998 to 2030 in average trip delay on roadway projects
- Safety: Change from 1998 to 2030 on property damage, injury and fatal accident rates

Each measure was calculated for EJ zones and all zones (representing the county average) in 1998, 2030 build, and 2030 no build. The results were further disaggregated into the Fresno-Clovis sphere of influence, the remainder of the county, and overall county results.

The report concludes that "programmed transportation investments in Fresno County result in fair distribution of impacts and benefits … when comparing environmental justice TAZs and non-environmental justice TAZs in Fresno County" (p. 26). However, the analysis contains several shortcomings that question the validity of this conclusion.

First, the mobility and accessibility metrics are based upon theoretical trips with destinations at major job centers (called accessibility) and every traffic analysis zone in the region (called mobility). These trips are not necessarily made by travelers in the model and so presenting results based on them can be misleading. An example will serve to demonstrate this effect. Since low income travelers take transit more readily than higher income travelers because of generally lower values of time, examining actual transit trips is of vital importance. Fresno COG's analysis simply reports the average travel time by transit to job centers or to all other traffic analysis zones (pp. 20, 22). Simply showing that the same level of transit service is available in EJ zones and all other zones is not particularly informative, but that is the current approach used. The average actual commute time by transit from EJ zones and all other zones to actual commute destinations would be a far more meaningful measure than that currently used.

Another problem stems from the use of geographic areas, instead of individual travelers, to define environmental justice impacts.[8] The performance measure for consumer satisfaction, total trip delay (the difference between free flow and congested travel time) is quantified at a traffic analysis zone-level, yet residents of EJ zones may or may not be contributing to or experiencing those delays in proportion to travelers from other zones, or travelers that are not members of protected populations. The measure should instead be hours of delay experienced by members of environmental justice populations, or hours of delay experienced for trips *originating from* environmental justice zones. Similar comments hold for the quantification of reliability (total vehicle-miles traveled at level of service E or worse) and cost-effectiveness (passenger miles-traveled per $1,000 invested). Each of these measures needs to be assessed on an individual or household basis, or for trips that originate, not simply pass through, EJ zones. This is especially true for the cost-effectiveness measure; a costly piece of transportation infrastructure placed in an EJ zone that is inaccessible to the local population would tend to increase this metric's performance.[9]

The environmental justice plan also contains some rhetorical innovation. In particular the document prescribes goals for each individual measure (pp. 14-15) that establishes the changes in metrics that will lead to a determination of equity. Two in particular are unique. The goals for mobility and accessibility are to "bring services for environmental justice populations up to countywide average" (p. 14). The notion of using an equity analysis to reduce gaps between the services provided to EJ zones and the rest of the county is consistent with contemporary scholarship on environmental justice in transportation.[10] However, the flaws mentioned above in the analytical methods preclude the identification of such gaps. Technical shortcomings with modeling frameworks could be circumvented by reorienting the focus to current conditions and addressing problems identified by the community through surveys or focus groups.

Kern Council of Governments

2011 RTP: http://kerncog.org/cms/transportation/rtp
2003 Environmental justice report: http://kerncog.org/docs/transportation/EnvironmentalJusticeReport.pdf

Kern COG's approach to environmental justice analysis was shaped by an environmental justice task force formed in mid-2002.[11] The task force apparently provided input on all aspects of the environmental justice analysis including defining target populations, establishing transportation system criteria, and operationalizing those criteria into goals and measures. The importance of public information and participation is cited several times in both the 2003 report and the 2011 RTP.[12]

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[8] This is generally a limitation of the four step travel demand model employed by Fresno COG at the time that the analysis was undertaken. That said, measures such as total trip delay within EJ zones lose meaning within a four step framework and should generally not be used.
[9] A recent example as of 2012 from the San Francisco Bay Area that fits this description is the Oakland Airport Connector. For further details, see http://urbanhabitat.org/tj/oac/1-20-10.
[10] Martens, Karel, Aaron Golub, and Glenn Robinson. "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, no. 4 (2012): 684-95.
[11] Kern Council of Governments. "Environmental Justice Report." Bakersfield, CA, 2003.
[12] In the 2003 report, see pp. 6-9, 32. In the RTP, see p. 1-3 and Appendix C.

The methods used in both the 2003 report and the 2011 report to perform a quantitative assessment of environmental justice overlap substantially, but one difference is the target population definition. In the 2003 report target populations were defined as traffic analysis zones where greater than 200 individuals were present in at least one out of four of the following demographics: low income, non-white, seniors, and transit disabled.[13] For the RTP, census block groups with "higher than average concentrations of the target populations were identified and mapped" (p. 2-13), although no maps of target populations are presented in the document. Although unstated, it seems that an above average concentration of any of the four target populations would qualify for classification as an environmental justice zone. Summary statistics are not provided for proportions of the population identified in either the 2003 report or the 2011 RTP, so the overall interpretation of the analysis approach is difficult.

Staff provide a qualitative description of the threshold selection approach in the 2003 report that elucidates the subjective nature of threshold definition (pp. 9-10). Maps showing the concentrations of each target population, but not the final selected environmental justice block groups, are presented in Appendix A of the report. Initially selecting a person count threshold of 50 on any of the four target populations, they determined that

> such a small number included every inhabited portion of Kern County. Relying on that data would have diluted the analysis too significantly for it to be useful. Using the high-end concentration of 500 excluded too many neighborhoods that staff knew from Census data included environmental justice populations. (p. 9)

Finally settling on a threshold of 200 individuals, staff note that

> At a mid-range scenario of 200, a clearer picture of which neighborhoods in Kern County constituted "environmental justice (EJ) populations" emerged. Far from excluding rural households, the new maps showed significant concentrations of EJ populations outside urban centers, but near major transportation facilities, such as State Routes 46 and 178. Raising the concentrations painted a better picture of those transportation facilities most significantly employed by EJ populations. (p. 10)

Since the target population definition is likely to affect the analytical outcome - namely the determination of equity - it must be completed analytically. More precisely, since the existence of an environmental justice and transportation equity movement presupposes differences between the transportation system experienced by different demographic groups, thresholds should be established that elicit that difference. Performance measures must be the beginning of this analysis. For example, if non-work trips are identified as problematic for low income people, a measure of non-work travel time, or access to vital destinations (medical, food, etc.) should be developed. Thresholds should then be selected so that a difference in non-work travel time between demographic groups is apparent. Alternately, particularly challenging non-work trips could be identified by the affected communities and projects and programs developed to address those in particular. In either case, an a priori threshold definition risks obscuring important differences that may actually exist and prevent the analysis of regional plans from demonstrating movement towards or away from these goals.

[13] "Transit disabled" is not fully defined in either of the reports cited here, but seems to inconsistently reference zero vehicle households, persons with disabilities, and those without access to high quality transit. Fresno COG also refers to "transit disabled" populations, but later maps present concentrations of persons with disabilities (Maps 6-8 in the 2009 environmental justice plan) and discussion cites disabled persons (p. 10 in the 2009 environmental justice plan). Presumably transit disabled refers only to disabled populations, at least in the Fresno COG case.

Notwithstanding the difference in target population definition, both reports reach similar conclusions, stated in precisely the same manner: “the transportation model indicates that, with few exceptions, Kern COG has and will continue to divide its resources equitably, with no single population group suffering disproportionate and adverse effects from agency activity” (2011 RTP p. 2-24, 2003 EJ report p. 32). The RTP concludes that, “considering all the analyses as a whole ... the 2011 RTP meets the Federal Title VI environmental justice requirements by ensuring that all of the population is subject to proportionate benefits and detriments” (p. 2-24).The remainder of this discussion therefore focuses on the most recent analysis.

The environmental justice analysis is nested within the performance measures analysis conducted for the 2011 RTP (pp. 2-10 - 2-26). Performance measures used for environmental justice assessment were as follows (Table 2-3):

- Mobility: average peak travel time, transit and auto
- Accessibility: average travel time to job centers, transit and auto
- Reliability/congestion: average hours spent in congestion
- Reliability/safety: total number of injury accidents
- Efficiency/cost-effectiveness:Transportation investments per passenger-mile traveled
- Livability: Average hours of delay
- Equity: Compare proportions of zonal investments to zonal passenger-miles of travel

In most cases, these performance measures were calculated for 2006, 2035 build, 2035 no build for traffic analysis zones identified as the target population (EJ zones) and compared to the countywide average performance.

With one exception, the analysis concludes that EJ zones perform as well or better than the countywide average in the forecast year, or in terms of changes from the base year to the forecast year. The single measure that appears to perform worse is the equity measure for transit. Specifically, staff calculate the investment in transit per passenger-mile traveled in EJ zones and for the county as a whole. Although not described, it seems that staff allocated transit projects to individual zones and then total passenger-miles traveled in each zone then report the average. The presence of a transportation facility in a zone does not mean that individuals residing in that zone will benefit from it; in fact, often the opposite is true. Further, transit lines typically cross many zones - if an EJ zone will be well-served by a transit project that crosses several non-EJ zones, that benefit should also be captured. In this case, direct outputs from the travel demand model would be more useful than aggregate measures of investment equity.

Air quality is also briefly discussed, with staff noting that, since the RTP conforms to federal air quality standards, there will be no degradation in air quality. As mentioned elsewhere, this determination ignores the realities of induced demand and local (near-road) air quality.

San Joaquin Council of Governments

2011 RTP: http://www.sjcog.org/programs-projects/Transportation_files/RTP.htm

Chapter 8 of the RTP is devoted entirely to the discussion of environmental justice and includes a sophisticated discussion of the issues presented by traditional threshold-based analyses. The

chapter discusses the regulatory background, data sources, and regional trends in people of color and low income populations. Quantitative analyses were conducted at a household-level and at a census block group level using demographic thresholds. Thresholds for environmental justice communities were established at 60% people of color or 20% low income. These were selected to be "slightly above the county average of approximately 53% minority and nearly 18% below poverty level" (p. 8-3). 186 out of 390 census block groups were identified in this manner.

In the discussion of threshold selection, staff discuss the shortcomings of the threshold approach. They note that 46% of the total 2000 population and 48% of all block groups are included within the environmental justice population using their threshold definition and that 71% of those identified residents were not low income and 27% were white. Further, the report notes that 25% and 27% of people of color and low income, respectively, lived outside of identified areas.

The analysis proceeded in three states:

1. A household-level financial analysis quantifying per capita transportation investments by income category and project type
2. A census block group level analysis of road project accessibility
3. A census block group level analysis of bus project accessibility
4. A qualitative assessment of access to low income jobs
5. A qualitative assessment of air pollution impacts
6. A qualitative assessment of noise impacts
7. A qualitative assessment of economic impacts
8. A qualitative assessment of community cohesion impacts

Parts four through seven rely upon the notion that capacity expanding projects aimed at congestion relief will improve air quality, reduce noise, and improve the economic competitiveness of the region. Given the growth potential of the region, adding highway capacity will not necessarily lead to improvements in regional or local (near-road) air quality because of induced demand.[14] Rather, the interplay between increased capacity, growth, travel demand, and air quality must be assessed in an integrated modeling framework or at least using off-model post-processing techniques. Part eight simply explains that community cohesion is a subjective concept and that most of the highway projects included in the RTP are unlikely to result in major displacement.

Parts one through three represent more typical environmental justice assessment approaches, although part one is particularly significant in that it identifies an inequitable RTP impact. Mode shares taken from the Census Transportation Planning Package for the journey to work were used to allocate transportation investments from five categories[15] to low income and not-low income households.[16] The mode share figures are not presented, nor are the total number of commuting households, so it is not possible to reproduce the analysis without further information. However, the conclusions as stated by staff are clear. The results show that

[14] Duranton, Gilles, and Matthew A. Turner. "The Fundamental Law of Road Congestion: Evidence from US Cities." American Economic Review 101, no. 6 (2011): 2616-52.

[15] Bus transit, roadway maintenance, roadway expansion, rail, bike/pedestrian.

[16] A similar analysis was undertaken in the Southern California Associaion of Governments (SCAG) region for their 2001 RTP. See Pfeffer, Nancy, Frank Wen, Hasan Ikhrata, and James Gosnell. "Environmental Justice in the Transportation Planning Process: Southern California Perspective." Transportation Research Record: Journal of the Transportation Research Board 1792 (2002): 36-43.

transportation investments are disproportionately skewed towards higher income travelers.

To counter this analysis, further examinations of highway and bus expenditures are conducted using a “proximity analysis” that “assumes ... accessibility is enhanced by proximity to the proposed project” (p. 8-12). This analysis considered highway projects to be accessible if they went through or were adjacent to identified environmental justice census block groups, as defined above. In contrast to the household-level analysis, the proximity analysis shows that transportation investments are equitable between environmental justice and non-environmental justice areas. As further evidence of this fact, the report noted that the number of zero vehicle households had declined from 2000 to 2008 - a trend that is likely to work against the climate change goals embodied in SB 375.

A related analysis was conducted for bus transit. The proportion of funding for each of the nine transit operators in San Joaquin County was compared to the percentage of the environmental justice population served by them. The Stockton metropolitan area skewed the analysis, receiving 63% of but transit investments and containing 77% of the environmental justice population. Staff indicated that this analysis showed that environmental justice areas receive more of a benefit from transit investments than was suggested by the household level analysis, but they did not present comparable statistics for non-low income households residing in each jurisdiction. Additionally, higher income travelers taking interregional commuter buses operated by the San Joaquin Regional Transit District are different travelers whose bus commute needs should be assessed separately from those of local commuters. Staff noted this distinction but do not carry through its implications for analysis (p. 8-12).

Importantly, no quantitative measures using a travel demand model were presented that test the RTP’s assertion that proximity is equivalent to access. Travel demand models perform reasonably well at determining individual tradeoffs between time and cost in the selection of travel mode. Travel outcomes by income group could be tested for identified environmental justice zones to determine whether all income groups benefit similarly from the investment. Finally, proximity also equates to burden. Any analysis that examines proximity should also assess the degree to which the host populations are burdened by transportation investments.

Stanislaus Council of Governments

2011 RTP: http://www.stancog.org/pdf/rtp/2011/final-rtp-appendices-2011.pdf

The regional environmental justice analysis is described on pages 86-87. US census data from 2000 was prepared that illustrated geographic concentrations of the following groups:

- Female head of household
- Greater than 65 years of age
- Disabled population
- Population below the poverty level
- Minority population

Proposed road projects were overlaid on these base maps and were assessed qualitatively for disparity. The analysis concludes that, “A visual evaluation of the maps does not reveal noticeable trends or patterns of disproportionate impact. The geographic distribution of transportation improvements throughout the County appears relatively balanced” (p. 87). The maps are presented in Appendix J (page 235 of the pdf). This analysis supports StanCOG’s

conclusion that “all of StanCOG’s plans, projects, and programs, including the RTP, comply with and attempt to exceed the requirements of environmental justice and all associated Federal and State requirements” (p. 86).

Any quantitative analysis would improve this approach since the results of the qualitative analysis are impossible to reproduce. Further, map-based visual analyses are inherently misleading: spatial representations do not necessarily comport with important demographic features like population sizes. Indeed, census geographic boundaries are based on included population, so large but sparsely populated geographic areas appear to have outsize importance in a simple visual assessment.

Tulare County Association of Governments

2011 RTP: http://www.tularecog.org/rtp.php

Policy guidance was adopted that describes the agency’s commitment to Title VI and EO 12898 (p. 2-14). An environmental justice performance measure was “considered as TCAG evaluated each capacity-increasing project proposed by the local agencies” (p. 3-23). The performance measures are listed on Table 3-6. The proposed measure for “Equity/Environmental Justice - Economic Well-Being” is “Create a balance in transportation investments by income group, ethnicity, and age.” The operationalization of this measure is not further discussed.

Public outreach to environmental justice communities, tribal governments, and resource agencies is also discussed (p. 6-42). A workshop held in early 2007 is described as a “great success with good attendance of the targeted stakeholders.”

Merced County Association of Governments

2011 RTP: http://www.mcagov.org/pdfs/2010/RTP/RTP.pdf

Performance measures were used to evaluate five alternative RTP investment scenarios. The results are described in the text on page 35 (Table 13) and in Appendix F. The measures include an equity criterion operationalized as “% of minority and low income populations potentially impacted by transportation investments” (page 147 of the pdf). Table 13 in the main text (page 37 of the pdf) defines the unit as “persons” and reports values ranging from 1,542 to 1,954. No discussion of these results is provided. It is possible that a GIS was used to map buffer zones and tabulate the number of low income and people of color populations included in the vicinity of planned (or existing, or both) transportation projects; but these values are not meaningful without some reference or comparison to regional values.

Appendix B to the RTP is the public participation plan (beginning on p. 109 of the pdf). It includes discussion of Title VI and EO 12898 as well as a list of strategies for involving environmental justice communities in the regional planning process (p. 122 of the pdf).

Kings County Association of Governments

2011 RTP: http://www.kingscog.org/rtp.html

Chapter 4: The Regional Highway System includes a mostly qualitative discussion of the environmental justice implications of three highway projects (pp. 4-57 - 4-62). The assessments present maps of the proposed alignments and discuss the demographics surrounding two of the three projects (SR 198 Expressway and 19th Avenue & 198 Interchange Project). The third project (12th Avenue Interchange) includes no discussion of demographics. Based on the qualitative analysis, no environmental justice problems concerns are noted. It is unclear why these specific projects were chosen. There is no analysis of the RTP as a whole.

Appendix V includes a letter from the Caltrans District 6 Native American Liaison recommending "that Environmental Justice be addressed within the Policy Element so it has an overall effect throughout the document rather than only within the Regional Highway System section" (p 477 of pdf). KCAG's response indicates that additional language was added to the policy element (p. V-6). This additional language apparently includes the following text:

> KCAG employs an environmental justice approach to its public participation policy and procedures and welcomes community comment and guidance in its transportation planning and decision making process. (p. 3-2)

Madera County Transportation Commission

2011 RTP: http://www.maderactc.org/pdf_files/RTP/Final%202011%20RTP.pdf

MCTC devoted an entire chapter of their 2011 RTP to environmental justice and equity analysis (Chapter 7: Environmental Considerations and Environmental Justice). The chapter contains extensive discussion of past public participation efforts for the 2001, 2004, and 2007 RTP updates. An equity analysis for the 2011 RTP is also discussed (p. 7-8 ff.).

The analysis considers investment equity on the basis of five arbitrarily defined areas (mutually exclusive and collectively exhaustive) of Madera County. The report states that,

> Once the Census information for race and income were imported into the MCTC Geographic Information Systems (GIS) database, staff was able to identify racial and income characteristics of the county. Based on these characteristics, staff demarcated block groups into five target areas to analyze equity of the 2011 RTP [*sic*]. (p. 7-9)

The actual manner in which staff demarcated the block groups is not stated. Demographic profiles of each area are discussed. The five areas range from 15.3% people of color to 72.7% people of color and from 4% to 52% of the county population. Target areas 1 and 3 are defined as the environmental justice areas since they contain greater than 50% people of color. Additionally, area 3 is identified as having a substantial proportion of low income residents.

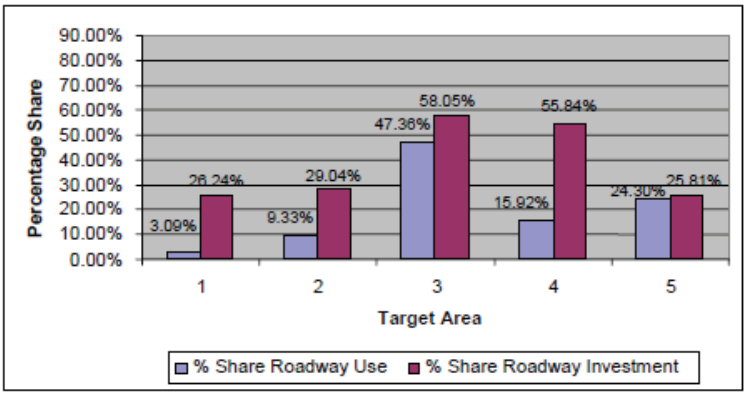
Staff then assigns “project benefits” arbitrarily to one or more regions, with some justification. For example, staff state that

> any capacity increasing or rehabilitation project located on Highway 41 near Avenue 12 will not only benefit residents in target area IV, but will benefit residents in target area V as well, since Highway 41 is the main thoroughfare to the mountain communities. Similarly, improvements made to Highway 99 will benefit all communities located on the valley floor since it is a primary travel corridor for Madera County residents. Benefit of Highway 99 projects is therefore assigned to target areas I, II, III and IV. (p. 7-14).

Roadway-emphasis, bus transit, and bicycle/pedestrian infrastructure are assessed separately.

Since benefits can be assigned to more than one area, all areas show greater percentage benefits for roadway emphasis projects (operationalized as % share of road investment) than their share of use. (See Figure 7-3 from p. 7-16 below.)

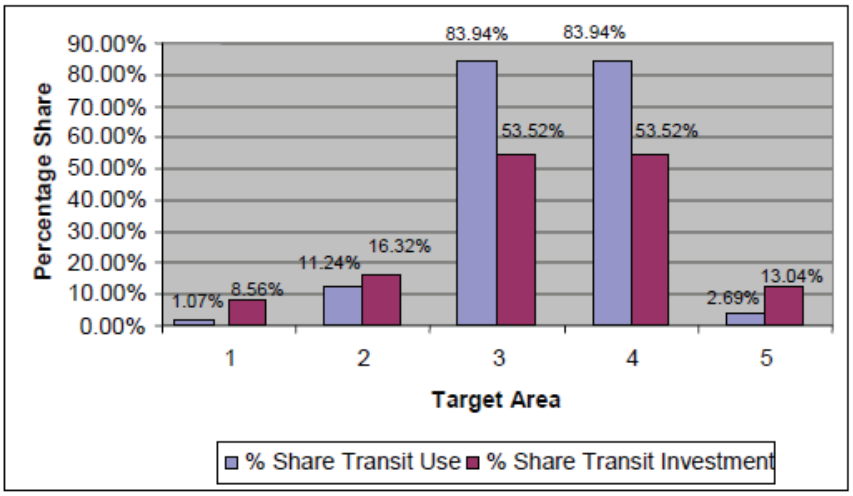
Figure 7-3: Percentage Share of Roadway-Emphasis Projects by Target Area



This analysis leads the report to conclude that “target area III, which is characterized by low income and racial minority populations, derives significant benefit from roadway-emphasis investment” (p. 7-16). However, simply because a project is located within an area does not mean that all residents of that area benefit from that project. Historically, low income and of color populations have been substantially burdened by transportation investments located in their neighborhoods while comparably white and affluent residents have enjoyed the benefits. Further, low income residents of area 3 are likely to have lower rates of automobile ownership than higher income residents. The MCAC analysis does not consider the *use* of projects, but only their geography.

Bus transit projects are similarly analyzed (Figure 7-4 from p. 7-17 below). Using a similar interpretation as that for roadway emphasis projects would indicate inequity - residents of area 3 do not receive investments in proportion to their share of transit use. Here staff changes their definition of equity to argue that since areas 3 and 4 have the highest proportions of transit ridership and they also enjoy the highest proportion of transit investments, the strategy is equitable.

Figure 7-4: Percentage Share of Transit Use and Investment by Target Area



Finally, air quality impacts are discussed. Staff state that

> The projects included in this RTP are intended to alleviate existing congestion and improve the level of service (LOS) for the roadway system. The completion of these proposed projects is likely to help congestion, thus reducing air pollutant emissions from vehicle idling and constantly accelerating and decelerating. (p. 7-19)

This statement is not supported by recent evidence on induced demand and the health effects of near-roadway air quality.

APPENDIX B: MEMORANDA PREPARED FOR PUBLIC ADVOCATES, INC.

MEMORANDUM

TO:	Parisa Fatehi-Weeks, Public Advocates
FROM:	Alex Karner and Deb Niemeier, Department of Civil and Environmental Engineering, UC Davis
DATE:	August 8, 2011
RE:	MTC's Proposed Equity Analysis Framework for the Sustainable Communities Strategy Alternative Scenarios

A. Introduction

To comply with federal law and other guidance, metropolitan planning organizations (MPOs) in general and the Metropolitan Transportation Commission (MTC) in particular have been conducting equity analyses of their long range transportation plans. The goal of such an analysis is typically to ensure that "minority and low-income communities in the region share equitably in the Plan's benefits without bearing a disproportionate share of the burdens."[1]

Consistent with California's Senate Bill (SB) 375,[2] MTC has been conducting its current regional plan update with the goal of demonstrating a 15% per capita reduction of greenhouse gas (GHG) emissions by 2035 through the development of a sustainable communities strategy (SCS). Since many of the most promising methods for achieving these reductions include the promotion of "smart growth" principles including increasing public transit accessibility, residential density, and the use of non-motorized modes, the process has thrown a number of equity concerns into sharp relief. For example, how will funds allocated to local and regional public transit modes and operators be prioritized? Will increasing residential densities gentrify existing communities of color and/or low-income? Will increases in the use of non-motorized modes reflect increasing accessibility or decreases in mode availability?

To answer these and similar questions and to compare the performance of different land use and transportation scenarios in terms of their equity effects, MTC has proposed an "Alternative Scenarios Equity Analysis."[3] This memorandum reviews MTC's proposal, focusing primarily on its transportation elements. We also reference the equity analyses completed for the Initial Vision Scenario (IVS) and the Transportation 2035 (T2035) regional plan. A summary of the recommendations is included in section D. While MTC's methods are consistent with the types of traditional equity analyses conducted as part of regional planning, the state of knowledge about equity trade-offs is not fully reflected in the analysis proposal. There are a number of ways in which the MTC analysis could innovate to address shortcomings with the existing approach and to take full advantage of MTC's recent deployment of an activity-based travel demand model.

[1] Metropolitan Transportation Commission, "Equity Analysis Report: Transportation 2035 Plan for the San Francisco Bay Area," (Oakland, CA, 2009).
[2] Statutes of 2008, Chapter 728.
[3] Described most recently in: Jennifer Yeamans and Marisa Raya, "Alternative Scenarios Equity Analysis: Performance Measures and Analysis Framework Memo, August 3, 2011."

B. The traditional approach to equity analysis

Although MPOs are required to ensure that the benefits and burdens of their plans are distributed equitably, there is no prescribed standard by which to perform the analysis.[4] In lieu of specific guidance, the traditional approach taken in regional transportation analyses proceeds in three stages as follows:

1. **Define target populations:** Identify target populations by calculating the percentage of travel analysis zone (TAZ) residents that are of color or low-income. TAZs that contain above a threshold percentage of these residents are included. MTC's current definition of the target population includes TAZs with 70% people of color and/or 30% low-income (defined as less than 200% of the federal poverty level).[5] The zones not meeting these thresholds are defined as the non-target population.
2. **Define equity metrics**: Identify metrics on which the equity performance of the plan is to be assessed. The five metrics proposed for assessing equity in the MTC's alternative scenarios in the SCS are: housing and transportation affordability, displacement, jobs-housing fit, vehicle emissions of particulate matter, and non-commute travel time.
3. **Assess equity**: Determine whether forecasted changes in the metrics from the base year to the forecast year are similar for the target communities as compared to the non-target communities. 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.

This approach, when conducted appropriately, will provide insight on whether the average benefits and average costs of the long range plan are distributed equitably across the various population groups. For example, if similar average travel time savings accrue to target and non-target populations from the base to the forecast year, the plan will be judged equitable. However, the particular assumptions made at each stage of the analysis will inevitably affect the conclusions reached. The remainder of this memorandum provides recommended changes to MTC's proposed methods to ensure that its results will most accurately reflect the conditions faced by target populations in the Bay Area.

C. Specific comments on MTC's Proposed Alternative Scenarios Equity Analysis

1. Definition of target populations

The selection of thresholds for target populations has the potential to drastically alter the results of the equity assessment. If the demographics within a given TAZ are not relatively homogeneous, the potential for identifying important differences between the target and non-target populations will be reduced. T2035 defined "communities of concern" as TAZs with 70% minority or 30% low-income residents, resulting in the identification of 33.2% and 33.4% of the region's total population and TAZs, respectively.[6] Defining the unit of analysis as the TAZ has substantial drawbacks. For example, the T2035 communities of concern did not include 44% of the Bay Area's low-income and 49% of its people of color residents. Similarly, using 2005-2009

[4] National Cooperative Highway Research Program, "Effective Methods for Environmental Justice Assessment," (Washington, DC: Transportation Research Board of the National Academies, 2004), 1.
[5] There are additional definitions for other target populations including limited English proficiency/low educational attainment and low mobility communities. See: Jennifer Yeamans, "Alternative Scenarios Equity Analysis: Target Population Definitions Memo, August 3, 2011."
[6] Metropolitan Transportation Commission, "T2035 Equity Analysis," 8-10.

American Community Survey data but the same thresholds, the proposed Alternative Scenarios Equity Analysis would not include 40% of the Bay Area's low-income and 44% of its people of color residents.[7] These excluded individuals are instead considered as part of the non-target population.

With an activity-based model, there is no longer a need to use such coarse geography to identify target populations. The proposed Alternative Scenarios Equity Analysis partially recognizes this fact, identifying low-income households (as opposed to low-income TAZs) as the unit of analysis on four out of five equity metrics.[8] However, the analysis continues to rely on multiple geographic units that are unnecessary. For example, staff has proposed characterizing low-mobility communities as those with threshold proportions of individuals greater than five years of age with a disability, greater than 75 years of age, and zero-vehicle households. Since the activity-based model enumerates a synthetic population in the base year and the forecast year, why not simply define target populations based on these household- or individual-level characteristics directly when possible?

One variable that is readily available as output from the model which would avoid problems with geographic aggregation is mode choice. Martens et al.[9] argue that between group comparisons should be completed by mode for basic equity analyses (e.g. comparing travel time for auto users to that of transit users). There is also precedent for such a comparison. The difference between high- and low-income non-auto users' travel times was analyzed in the IVS.[10] However, this comparison would not have controlled for high-income households switching to auto in the forecast year. The key comparison should be between auto and non-auto users, where changes in travel times between the base and the forecast years would reflect modal differences and differences in investment priorities. An equitable scenario in this case would be one in which transit users experience a reduced *mobility and accessibility gap* relative to auto.[11] Ideally, disaggregated results will be reported for all transit modes, but at the minimum, tours that include at least one local bus trip should be analyzed.

In certain cases, geographic (i.e., TAZ) aggregation is necessary because of the availability of forecast year data. Racial demographics will not be forecast, for example,[12] but they are available in the base year from census data. To validate the use of larger geographic units in the forecast year, staff should compare an analysis using household-level racial demographics to the TAZ-level analysis of communities of concern. This comparison will show the extent to which the two units of analysis differ in their results and will contextualize the forecast year results derived from TAZ-level units. This type of analysis should be completed for all base year groups for which changes will not be forecast (e.g. limited English proficiency/limited educational attainment households).

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[7] Derived from: Yeamans, "Target Population Definitions Memo," Table A.
[8] All except for vehicle emissions. See: Equity Working Group Staff, "Draft Equity Analysis Framework Update Memo, July 8, 2011."
[9] Karel Martens, Aaron Golub, and Glenn Robinson, "A Justice-Theoretic Approach to the Distribution of Transportation Benefits: Implications for Transportation Planning Practice in the United States," Working Paper 10-001 (2010).
[10] Association of Bay Area Governments and Metropolitan Transportation Commission, "Plan Bay Area Initial Vision Scenario," (Oakland, CA, 2011), 43.
[11] See further discussion of operationalizing the "gap" below in section C.3.
[12] David Ory, Presentation to Equity Working Group Meeting on Model Capabilities, June 29, 2011.

If the TAZ-based threshold approach is maintained, the effect of varying the threshold definition should be investigated. Staff have pointed out that the thresholds were designed to "capture roughly 40% of the region's total population and census tracts"[13] but do not elaborate on why 40% was chosen. As this number decreases and the definitions of target population become more restrictive, fewer non-target population members will be included in any given geographic area. Rather than arbitrarily defining a threshold, there should be a rationale for choosing the value. Thresholds should be chosen to maximize the number of members of the target population that are captured while minimizing the presence of non-target members. How the population of included and excluded members of the target population change should be central to the analysis. That is, unless thresholds are carefully considered, the thresholds will predetermine the results. A logical approach to clearly defining groups that are more or less homogeneous should be outlined.

As an alternative to choosing individual metrics and arbitrary cutoffs to identify target populations, the Center for Regional Change (CRC) at UC Davis has developed an index of opportunity (for transit oriented development) and one of vulnerability that can be calculated at the census tract level which combines a number of component indicators readily available from existing data. Most relevant for identifying target populations for equity analysis is the "vulnerability index" calculated for each census tract and indicating that tract's relative position in the region with respect to indicators like overcrowding, single-parent households, vacant units, and unemployment, among others.[14] The indicators were generated in consultation with stakeholders in the Sacramento region, where the Sacramento Area Council of Governments (SACOG) is using both the vulnerability and opportunity index to assess regional transit priority areas.

The use of a measure like the vulnerability index would also lend theoretical credibility to the use of geographic zones because properties of that zone comprise the metric as opposed to only properties of the individuals that reside within it. Stated differently, the vulnerability index reflects conditions in a TAZ for *all* residents. Using socioeconomic thresholds ties characteristics of some households to a geographic zone which do not necessarily hold across all households in that zone.

2. <u>Definition of equity metrics</u>

Vehicle emissions

The nine county Bay Area is in nonattainment for $PM_{2.5}$ and this pollutant has also been identified as responsible for premature deaths. The mobile source contribution to $PM_{2.5}$ is particularly low – 9% in 2008 – compared to that of combustion and other industrial and commercial sources – accounting for a combined 55% of the Bay Area's $PM_{2.5}$ emissions.[15] Similarly, the mobile source contribution to PM_{10} in the Bay Area is 6%. Since the regional-scale component of PM mass concentrations are so high, the reasons for assessing mobile source emissions in this regard are unclear. Even if the mobile source contribution dropped to zero, Bay Area residents would still be exposed to high concentrations of this pollutant.

[13] Yeamans, "Target Population Definitions Memo," 1.
[14] Bidita Tithi and Chris Benner, "Technical Paper for Vulnerability and Opportunity Indices Calculation," (Davis, CA: Center for Regional Change, University of California, 2011).
[15] Bay Area Air Quality Management District, "Base Year 2008 Bay Area Emissions Inventory Summary Report," (San Francisco, CA, 2011).

Use of pollutants that are known to have a high mobile source component including NO_X and mobile source air toxics like 1,3-butadiene and benzene, would likely be more informative and would more closely reflect health risks associated with mobile source emissions. Further, as staff note, emissions estimates do not equate to air quality or health outcomes, largely because exposure varies throughout the day in time and space.[16] Here again the activity-based model offers the potential to improve the analysis. Since five different time periods are modeled and individual locations and traffic volumes are known for each of those time periods, a daily emissions exposure inventory could be calculated for each individual. This approach would improve upon the practice of using the residence as the relevant location for exposure estimates. Additionally, the use of forecasted emissions is almost always uninformative because technological advancements are assumed to dominate any reductions gained as a result of vehicle-miles traveled reductions. T2035 showed vast reductions in exposure to mobile source air toxics in both communities of concern and the rest of the Bay Area.[17] Assessing changes in emissions exposure using the methods described below in section C.3 would ensure that the disparity in emissions exposure between target and non-target groups is getting smaller.

Non-Commute Travel Time/Jobs-Housing Fit

The use of travel time in the proposed equity analysis is an improvement over T2035's use of generalized accessibility measures like number of low-income jobs accessible in 30 minutes by transit; however, both commute and non-commute travel times should be investigated. Most recently, staff has indicated that commute travel will be "analyzed implicitly in the Jobs-Housing Fit measure"[18] yet the description of that measure describes only methods to derive income based on employment location. There is no mention of commute time or distance. Commute time and distance should be key metrics used to assess jobs-housing fit. If jobs-housing fit improves, mean commute time/distance and variability should decrease in general from the base to the forecast year. How will this information be incorporated into the proposed metric? More detail is needed before we can assess whether the jobs-housing fit measure will include the information needed regarding commute trips that would justify its exclusion from a separate analysis.

As mentioned above, the analysis should compare target/non-target populations and modal users. Staff note that neither specific types of trips nor modes can be assessed using the proposed non-commute travel time measure.[19] While this is strictly true because staff have defined the metric to include all modes, this is not because of model limitations. More explanation is needed as to why greater distinction is not possible to undertake. With the travel model output, it should be straightforward to break out all trip and mode types included in the model. This type of summary should be completed, especially showing results for local bus users. MTC's statement in this regard is perplexing: that all modes will be considered together because "low-income travelers use a wide-variety of travel modes."[20] To the extent that accessibility varies by mode, aggregating travel times across modes will simply provide less useful information about transit

[16] Equity Working Group Staff, "Draft Equity Analysis Framework Update Memo, July 8, 2011."; K. Sexton and P.B. Ryan, "Assessment of Human Exposure to Air Pollution: Methods, Measurements and Models," in *Air Pollution, the Automobile and Public Health*, ed. A. Y. Watson, R. R. Bates, and D. Kennedy (New York: National Academy Press, 1988).
[17] Metropolitan Transportation Commission, "T2035 Equity Analysis," 38-40.
[18] Yeamans and Raya, "Performance Measures and Analysis Framework Memo," 5.
[19] Equity Working Group Staff, "Draft Equity Analysis Framework Update Memo, July 8, 2011."
[20] Yeamans and Raya, "Performance Measures and Analysis Framework Memo," 6.

dependent individuals. This problem is compounded by the shortcomings noted above in section C.1 where low-mobility residents are grouped with others in their community that are not mobility constrained. They should be assessed individually.

The absence of race from the discussion is also problematic. Of the three reasons listed justifying the use of non-commute travel time for all modes on the basis of low-income, do the same results hold for different racial groups?[21] If not, the justification is dubious, since the comparison will be made for all target populations relative to non-target populations.

3. Assessment of equity

While the traditional approach of identifying target populations and assessing differential plan effects enjoys wide-ranging support,[22] it does not reflect the current state of knowledge and has many weaknesses.[23] The key issue is that the traditional approach to equity analysis does not assess the overall statistical distribution of equity metrics across the population or across subgroups. Rather, it summarizes the change in the *average* value of a given metric between the base and forecast year. For example, if planned transportation improvements increase access to low-income jobs by 10% for the target population and 9% for the rest of the Bay Area, each group has had some benefit distributed to them. Since the target population apparently received more of the benefit, the traditional approach would indicate that there is no equity concern. Even if both population segments had received benefits, but the target population had a lower value of the metric than the rest of the Bay Area, the result might still have been considered acceptable; there is no accepted standard difference beyond which the disparity in benefit change would be deemed unacceptable. Since a regional transportation improvement program generally results in reduced travel time throughout the region, and because population and jobs are projected to increase in the future, it is not difficult to demonstrate that benefits accrue to different population segments. This is particularly true if the target populations have been defined to include large portions of the Bay Area, as demonstrated above.

Stakeholder feedback from T2035's equity analysis indicated too little focus on existing inequity.[24] MTC's implicit definition of equity as the distribution of costs and benefits resulting from the regional transportation improvement program accounts for this shortcoming. The approach described below explicitly incorporates existing inequities by reducing gaps in equity metrics between target and non-target populations. Rather than deeming a scenario equitable if it results in generally similar improvements for different groups, it would be deemed equitable if it reduces gaps in chosen metrics between target and non-target populations.

Consider the following hypothetical example. There are two population groups: 10,000 members of a high income group and 10,000 members of a low-income group. The groups experience mean commute times in the base year (2005) of 30 and 24 minutes, respectively. Projected transportation improvements for 2035 and supporting modeling indicate that commute

[21] Ibid., 5-6.
[22] See, e.g., FHWA/FTA, "Communitylink 21, Regional Transportation Plan: Equity and Accessibility Performance Indicators," http://www.fhwa.dot.gov/environment/ejustice/case/case4.htm; FHWA/FTA, "MPO Environmental Justice Report: Mid-Ohio Planning Commission," http://www.fhwa.dot.gov/environment/ejustice/case/case7.htm.
[23] Martens, Golub, and Robinson, "Justice-Theoretic Approach."
[24] Metropolitan Transportation Commission, "T2035 Equity Analysis," 48.

times decrease for both groups to 27.5 and 22 minutes, respectively.[25] The low-income group saves 2.5 minutes on their commute, on average, while the high-income group saves 2 minutes. Both experience equivalent percentage decreases (approximately 8%). According to state of the practice, since the low-income group apparently benefits more than the high-income group, the scenario is equitable on this metric. However, as Figure 1 illustrates, relying solely on the mean to represent the experience of a relatively heterogeneous group is problematic since the *spread* of the distribution, measured by the standard deviation, may also change. In the figure, although many low-income residents experience reduced commute times in the forecast year, many others experience much longer times. The mean has decreased for the low-income group, but its standard deviation has increased. The result is that, in many ways, the forecast distribution of travel times is *less equitable* than the base year even though the traditional approach would conclude that the underlying scenario was equitable.

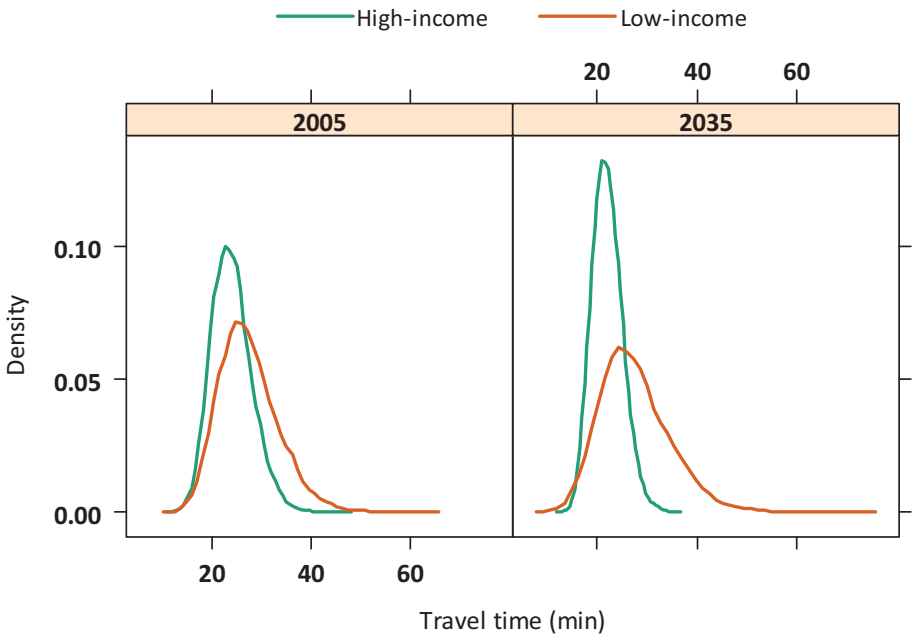

Figure 1 Hypothetical travel time distribution in the base year and forecast year for two income groups.

The mean travel time for all 20,000 high- and low-income travelers decreases from 25.8 to 24.7 minutes from 2005 to 2035, but the gap between the most and least mobile commuters has grown, as evidenced by the increase in standard deviation from 5.4 to 6.0 minutes. Both the overall gap and the gap within a population group can be measured in various ways, but one simple and intuitive metric is known as the Gini mean difference.[26] This metric represents the average absolute difference between two people in a population. If the gap grows from the base

[25] Travel times were generated by sampling from lognormal distributions with location and scale parameters μ and σ, respectively: 2005 low-income, lnN(3.29,0.216); 2035 low-income, lnN(3.28,0.251); 2005 high-income, lnN(3.16,0.1655); 2035 high-income, lnN(3.08,0.1357).

[26] The Gini mean difference is related but not equivalent to the Gini coefficient.

to the forecast year, the mean difference will increase. Several of the proposed equity analysis metrics are amenable to the calculation of the Gini mean difference including housing and transportation affordability, vehicle emissions, and non-commute travel time. It is calculated as follows,

$$\text{Gini mean difference} = \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n}|y_i - y_j|$$

Where *n* is the size of the total population and *y* references some attribute of individual *i* or *j*, in this case commute time in minutes. All differences between all members of the grouped population are tabulated. The result indicates the average difference between two population members on the attribute of interest. For the hypothetical example described above, the Gini mean differences are summarized in Table 1. For the overall population, the mean difference increases from 2005 to 2035. This overall increase is composed of a decrease for high-income residents and an increase for low-income residents. Thus the planned improvements do not improve equity measured as the average difference in travel time across the population. This result occurs despite a decrease in average travel times for both groups.

Measures of statistical dispersion like the Gini mean difference and the standard deviation can provide a single summary statistic that measures inequity across the entire population, sidestepping many of the difficulties associated with geographic aggregation and comparisons noted above, or they can be applied to different population groups to provide valuable information in addition to the mean. Statistics like the mean difference calculated on the overall population should be used to supplement geographic and household based comparisons since looking specifically at those population groups is clearly of interest to stakeholders.

Table 1 Summary of Gini mean difference for each population group by year.

Population group	Size of group	Gini mean difference (minutes)	
		2005	2035
Low-income	10,000	3.30	3.87
High-income	10,000	2.25	1.691
Combined	20,000	2.94	3.20

D. Summary

Incorporating the suggestions described above and summarized below will undoubtedly lead to a more informative equity analysis, providing stakeholders with the data and results that they need to make informed decisions regarding the Alternative Scenarios. The suggestions described in this memo are:

1. **Definition of target populations**
   i. Compare groups based on both socioeconomic factors and mode choice. Ensure that results are shown with transit modes disaggregated and that target population definitions do not pre-determine results.
   ii. Use household level characteristics instead of geographic areas (e.g., TAZs) when defining target populations. Where household-level data are not available in the forecast year, validate the geographic aggregation by comparing a household level analysis to a TAZ-level analysis in the base year.

iii. Explain why 40% of the Bay Area must be included in the target population.
iv. Consider the use of metrics that use attributes of the geographic zone if that level of analysis is preferred over the household, like the CRC's vulnerability index.

2. **Definition of equity metrics**
   i. Consider the use of pollutants that are more directly attributable to mobile sources and consider time and space variation of exposure.
   ii. Clarify the jobs-housing fit metric and provide commute travel time as a separate indicator disaggregated by mode.

3. **Assessment of equity**
   i. Consider measures that reflect statistical dispersion in addition to the mean when making conclusions regarding scenario equity. One appropriate additional measure is the Gini mean difference; another would be to calculate compensating variation which relies on the logsum and is directly related to consumer welfare.

E. References

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Yeamans, Jennifer, and Marisa Raya. "Alternative Scenarios Equity Analysis: Performance Measures and Analysis Framework Memo, August 3, 2011."

MEMORANDUM

TO:	Parisa Fatehi-Weeks, Public Advocates
FROM:	Alex Karner and Deb Niemeier, Department of Civil and Environmental Engineering, UC Davis
DATE:	September 30, 2011
RE:	Updates to MTC/ABAG's Equity Analysis Framework

A. Introduction

This memo comments on MTC/ABAG's recent update to their equity analysis framework for Plan Bay Area as summarized in two documents circulated by planning staff.[1] The impetus for the updates was provided, at least in part, by an August 10 memo submitted by members of the One Bay Area Equity Working Group (EWG). The updated framework incorporates some of the suggestions made in the previous memo, including changes to proposed equity measures; however, the update does not adequately address three key issues that were raised in the August 10 memo:

- Activity-based model use in equity assessment
- Target population definition
- Determination of equity

After noting the incorporated changes, the remainder of this memo briefly describes these three issues and their importance for equity assessment.

B. Incorporated changes

Staff has made several changes to the proposed equity measures. These respond directly to concerns raised in previous correspondence. The newly included VMT density is a much more meaningful indicator of exposure to transportation emissions than emissions of $PM_{2.5}$ and PM_{10}. Commute time is also now included as a performance measure but it appears that it will not necessarily be disaggregated by transit mode. In the current conditions overview document circulated at the September 14 EWG meeting, staff indicates that travel time by mode by income group is "not an equity performance measure." Given the difficulty of conducting meaningful comparisons by race and the strong racial dimension of transit use by mode, disaggregate commute time results should be presented for all transit modes.

C. Activity-based model use in equity assessment

Different transportation decisions are made with different time horizons and other factors in mind. The choice of where to live is made far less often than the choice of where to eat lunch. The choice to drive your child to school might be informed by where you work or the other things you have to do that day. Similarly, the choice of whether and how many automobiles to own likely depends on where you live, the amenities you enjoy close by and your job location. Previous transportation modeling paradigms ignored many of these important interactions.

MTC is fortunate in that it has recently developed a state-of-the-art activity-based model that represents these diverse behaviors by explicitly modeling household- and individual-level

[1] Materials included in the September 14, 2011 Equity Working Group meeting packet and the "Alternative Scenarios Equity Analysis Performance Measures" memo dated September 6, 2011.

interactions and interdependencies regarding location and transportation choices. This model represents a vast improvement over the previous four step modeling paradigm. The proposed equity analysis framework has not been modified to take advantage of the unique capabilities of the activity-based model. Specifically, the availability of household- and individual-level travel data eliminates some of the need to rely solely on aggregate geographies (e.g., tracts and TAZs) in analysis.

This potential allows for a much more robust evaluation of equity, providing a means for developing a deeper understanding of the impacts of system improvements on target populations. This capability should result in a more complete picture of the equity effects of the sustainable communities strategy.

D. <u>Target population definition</u>

In response to comments that the previous definition of target populations was too inclusive, staff has proposed a new approach that looks at the intersection of up to eight "disadvantage factors" that identify protected populations according to various thresholds within a census tract. They have recommended defining the target population to include areas where four or more of the factors overlap. This approach still does not propose overall goals for, or approaches to, threshold or group selection For example, MTC and ABAG have indicated that they are interested in identifying the region's most vulnerable communities. Left open are the questions: how do the proposed factors and thresholds accomplish this? Would a different set of factors or higher/lower thresholds perform better than the proposed approach? We previously suggested[2] that any method to select geographies

> should be chosen to *maximize the number of members of the target population that are captured while minimizing the presence of non-target members*…unless thresholds are carefully considered, the thresholds will predetermine the results. A logical approach to clearly defining groups that are more or less homogeneous should be outlined. [emphasis added.]

The emphasized approach would lead to a smaller overall comparison group and would reduce the number of non-target individuals that are included within it. Staff's new approach to target population definition also results in the identification of a smaller portion of the Bay Area's population, but does not necessarily result in a more meaningful comparison because arbitrary thresholds are retained in the analysis.

Selecting arbitrary thresholds for inclusion can produce counterintuitive results. The first three rows of Table 1 compare staff's new approach to target population definition with two other approaches: one that identifies census tracts with both 70% people of color and 30% low-income residents (intersection), the other that identifies census tracts with either 70% people of color or 30% low income (union). The results show that the 70/30-intersection approach generally results in better identification of target individuals within the target population – i.e., the number of target group members present for every member of the non-target group is higher than for the disadvantage factor approach. One reason for this result is that many of the disadvantage factors identify census tracts using low threshold values and therefore incorporate many non-target individuals into the target population.

[2] August 8, 2011 memo from Karner and Niemeier to Parisa Fatehi-Weeks. "MTC's Proposed Equity Analysis Framework for the Sustainable Communities Strategy Alternative Scenarios."

For example, tracts with female-headed families with children (FHFs) are identified using a 15% threshold, creating a target population with 63,906 FHFs and 231,216 non-FHFs. The non-target population has 97,968 FHFs and 1,225,048 non-FHFs. i.e., the number of FHFs in the non-target population is larger than in the target population and the number of non-FHFs in the target population is larger than the number of FHFs. This result highlights the problems with conducting a spatial analysis of populations that may not have a strong spatial component and also using low thresholds for inclusion.

The last two rows of Table 1 also contain the results for stricter target population definitions: greater than or equal to five disadvantage factors, and an 80/40-intersection. While the 80/40 results contain fewer total members of the target population, they are located in areas with much higher people of color concentrations, representing a more homogeneous group for comparison against the non-target population. These results indicate that simply adding in additional factors without adjusting the threshold values does not necessarily improve the analysis. In the future, staff should state their goals for target population definition and follow an approach that helps to meet those goals.

Additionally, it would also be helpful to see how different target population definitions affect performance on the equity metrics. Given the great potential for the target population definition to affect the outcomes, these definitions must be prepared in concert with results from the metrics. One approach would be to adjust the thresholds until differences in modeled outcomes between target and non-target populations are elicited in the base year. Results from the Bay Area Travel Survey or the California Statewide Household Travel Survey could be used to identify the magnitude of differences in some indicators (e.g. non-commute travel time) that should be expected. These thresholds could then be used in the forecast year to determine whether observed inequities are mitigated.

Table 1. Comparison of approaches to population definition, effect on people of color inclusion in target population.

Population definition approach	People of color (captured % of total people of color)	Non-people of color (captured % of total non-people of color)	Number of target group/Number of non-target group	Mean concentration of people of color in included tracts
≥ 4 "disadvantage factors"	973,735 (25.7)	229,874 (7.3)	4.2	80.2
70/30 threshold, intersection	935,328 (24.7)	145,486 (4.6)	6.4	86.7
70/30 threshold, union	2,121,806 (56)	647,208 (20.4)	3.3	75.9
≥ 5 "disadvantage factors"	664,398 (17.5)	113,719 (3.6)	5.8	84.4
80/40 threshold, intersection	511,655 (13.5)	49,301 (1.6)	10.4	91.3

An alternative approach to target population definition was identified in subsequent discussions between staff and EWG members. This approach would keep all tracts that meet the thresholds for people of color and low-income (i.e., Title VI tracts). This may or may not result in an improved comparison group. If these two factors are required but any *other* tracts with four

or more overlapping factors are allowed to qualify in the target population, the target population will be diluted because of the relatively low thresholds for inclusion on several of the other categories, as demonstrated above for FHFs.

To the extent that the identified target population contains non-target individuals and vice versa, it will be more difficult to perform an adequate assessment of equity. However, it is possible that the threshold approach results in a meaningful comparison. The advantages of the activity-based model noted above can help to determine whether this is the case. All relevant population data for the base year are available. At least income and vehicle ownership will be forecasted. Mode choice will also be forecasted and could serve as an imperfect proxy for a racial analysis. Blacks are far more likely than other racial groups to take transit, especially bus.[3] Recent immigrants, who are overwhelmingly non-white, form carpools among friends and family far more readily than white native born Americans.[4] Staff should complete an analysis using *both* the threshold/factor approach and the household-level approach described above in section C. Differences in the results should be discussed. If they are similar, the threshold approach is capturing relevant differences in target populations. If they are very different, the threshold approach should be revisited.

E. Determination of equity

We previously suggested changing the overall equity analysis approach from a comparison of average changes in equity indicators in the forecast year for target and non-target populations to a more robust analysis of the distributions of key metrics like travel times. The average value can be misleading if the distribution is skewed, and even improvements in the average value of a measure like commute time for target and non-target groups can result in an increasing gap or disparity.

In the discussion of target population, staff's September 14 response summarizes this recommendation as, "The approach is too simple; we should use Gini coefficients or other approaches that allow us to look at all the data, not a share based on proportions." Staff's response is that, "…the analysis methodology should balance analytical robustness with the ability to communicate understandable results clearly to stakeholders, including members of the public." The response implies that the use of a Gini mean difference, as suggested in our memo of August 8 would be difficult for the public and stakeholders to understand. Simplicity should not be the sole consideration for equity analysis. Results based on means can be prepared by staff for the public and other stakeholders while additional data using different metrics are prepared for closer scrutiny by transportation professionals and others interested in equity.

Additionally, our suggestion of using the Gini mean difference emerged from an understanding of equity that is shared by stakeholders and the public; namely that the concept of equity can be framed as closing the gap in transportation performance measures between target populations and the rest of the Bay Area, as opposed to simply looking at whether the benefits and costs of transportation infrastructure development are close to equivalent across population groups. The mean difference represents the average difference in travel time between members

[3] Pucher, J. and J. L. Renne "Socioeconomics of urban travel: Evidence from the 2001 NHTS." Transportation Quarterly **57**(3): 49-77.
[4] Blumenberg, E. and M. Smart (2010). "Getting by with a little help from my friends…and family: Immigrants and carpooling." Transportation **37**(3): 429-446.

of a population. Higher values indicate increasing disparities. This single value carries much more information relevant to equity than changes to the mean travel time.

While staff has not yet responded to this fundamental critique, their 09.02.2011 version of the proposed equity measures now includes the text “What is the extent of any current and future-year disparity between target and non-target populations.” Staff must clarify how the disparity will be assessed and whether reducing disparities will be a performance criterion for the alternative scenarios. We suggest changing the text to “Which scenario reduces the extent of any future year disparity relative to the base year the most?” The Gini mean difference is one way that this disparity can be quantified.

MEMORANDUM

TO:	Parisa Fatehi-Weeks, Public Advocates
FROM:	Alex Karner and Deb Niemeier, Department of Civil and Environmental Engineering, UC Davis
DATE:	October 13, 2011
RE:	Effect of MTC/ABAG's updated target population definition

A. Overview

This brief memo summarizes some of the effects of staff's updated target population definition for the equity assessment framework.

B. Effect of the "disadvantage factor" approach

Staff have proposed identifying the target population at the tract level[1] using a 70% people of color/30% low income intersection and adding additional tracts that contain four or more "disadvantage factors" that identify tracts containing populations of individuals or households that exceed a threshold concentration. These populations are (thresholds in parentheses): limited English proficiency individuals (20%), zero vehicle households (10%), seniors (10%), disabled people (25%), female headed households with children (15%), and households paying greater than 50% of their income on rent (15%).

There are 231 census tracts identified using the 70/30 intersection rule, and 23 additional tracts identified using the four or more disadvantage factor rule. Table 1 below shows demographics in these 23 additional tracts. The "target" and "non-target" columns capture how many people in the 23 tracts do/do not have the characteristic listed in the row, respectively. The "number of tracts" column indicates how many tracts out of the 23 reach the threshold for inclusion. All of these people will be included in the "target" population for the equity assessment.

Table 1 Summary of 23 tracts with greater than four disadvantage factors.

	Non-target	Target	Number of tracts
People of color	28,942	51,204	2
Low-income people	34,124	41,937	21
Limited English proficiency individuals	63,061	13,557	9
Zero vehicle households	18,914	17,138	23
Seniors	72,977	7,169	6
Disabled people	55,016	24,251	22
Female headed households with children	10,162	2,123	15
Rent burdened households	26,673	7,979	20

Even when the number of tracts is high (e.g., low-income people, zero vehicle households, disabled people, rent burdened households), a large number of non-target people and households

[1] To be converted later to the traffic analysis zone (TAZ)-level.

are added to the target population. This effect occurs because of the relatively low thresholds used to identify tracts.

The demographics for the 231 70/30 intersection tracts are shown below in Table 2. Again, non-target is the number of people that do not have the characteristic listed in the row. All of these people will be identified as the "target" population for the equity assessment.

Table 2 Summary of 231 tracts that contain greater than 70% people of color and greater than 30% low-income people.

	Non-target	Target
People of color	145,486	935,328
Low-income people	569,854	495,390
Limited English proficiency individuals	762,769	221,728
Zero vehicle households	280,852	53,988
Seniors	1,032,342	48,472
Disabled people	772,597	245,486
Female headed households with children	180,334	43,921
Rent burdened households	266,556	60,741

Table 2 shows that the size of the target population is less than the non-target population for all groups except people of color. The relatively high people of color threshold (70%) is responsible for this result. Table 3 shows the number of target population members included for each non-member under the 70/30 intersection rule and the 70/30 intersection + 4 factor rule (first two columns of the table). These results are shown for the 231 + 23=254 identified target tracts.

The ratio of target to non-target is generally low. The values increase slightly and sometimes not at all when adding in the tracts with four or more disadvantage factors. The ratio for people of color decreases when adding in the four disadvantage factors indicating that the people of color population is diluted slightly by the four factor approach. I also calculated the same values for the overall non-target population (i.e. the tracts that do not fall into the 70/30 intersection or 70/30 + 4 factor) in the third column of the table below. You can see that the 70/30 approaches are clearly superior for people of color and low-income, and do marginally better for all other groups except seniors.

Table 3 Number of target population members included for each non-target member under different threshold rules.

	70/30	70/30 + 4 factors	Overall non-target
People of color	6.43	5.66	0.936
Low-income people	0.87	0.89	0.217
Limited English proficiency individuals	0.29	0.28	0.075
Zero vehicle households	0.19	0.24	0.082
Seniors	0.05	0.05	0.065
Disabled people	0.32	0.33	0.193
Female headed households with children	0.24	0.24	0.092
Rent burdened households	0.23	0.23	0.089

C. Absolute representation

A final way to look at the effect of the revised target population definition is to assess the absolute numbers of members of the target populations that are identified in the target

comparison group for the equity assessment. Table 4 shows the total number of target population members identified in the target group for equity assessment using the 70/30 intersection + 4 factor rule (column 1) and those that remain unidentified (column 2). The people captured in column two exhibit the characteristic of interest, but are not captured because they do not reside in a tract that meets the requisite threshold. Far more individuals of the target populations are not captured than those that are, using the threshold approach. The assumption implicit embedded in the threshold approach is that when the geographic concentration of these individuals reaches a certain value, they become the individuals for whom it is necessary to compare equity outcomes. This assumption has not yet been justified; to do so would require further analysis.

Table 4 Number of people who are members of the target population that are identified and not identified.

	Target (identified)	Target (not identified)
People of color	986,532	2,798,837
Low-income people	537,327	1,014,838
Limited English proficiency individuals	235,285	378,421
Zero vehicle households	71,126	162,948
Seniors	55,641	353,584
Disabled people	269,737	837,096
Female headed households with children	46,044	115,830
Rent burdened households	68,720	171,743

MEMORANDUM

TO:	Parisa Fatehi-Weeks, Public Advocates
FROM:	Alex Karner and Deb Niemeier, Department of Civil and Environmental Engineering, UC Davis
DATE:	January 25, 2012
RE:	Project performance assessment equity considerations

A. Overview

This memo comments on the equity assessment being conducted in conjunction with the project performance assessment for Plan Bay Area. Several attempts have been made to assess the relationship of proposed projects and equity goals including:

- "Equity considerations on the project level" dated 10/29/11. This document shows project performance on three of the 10 Plan Bay Area performance measures related to equity (PM in CARE communities, adequate housing, and housing and transportation affordability).
- "Sample benefit distribution results (DRAFT) – subset of projects" dated 10/28/2011. This document appears to summarize aggregate, regional-level performance measures resulting from simulating the performance of each project using the travel demand model.
- A series of seven "Equity maps" dated 1/11/12. These maps illustrate the locations of proposed projects, communities of concern, and the performance of the projects on the three selected equity metrics.

These efforts are a promising step forward. Below, we summarize additional ideas that can be incorporated into the project-level equity assessment to increase the value of the information they contain.

B. Recommendations

1. Identify smaller geographic areas for performance assessment

In the "Sample benefit distribution results" staff has apparently summarized the travel demand modeling results prepared for the project assessment but separated into two income groups (i.e. low-income and all others). These results were generated by executing portions of the travel demand model that include representations of individual projects to simulate their effect. Unfortunately, when aggregated at the regional level, most of the changes in performance metrics (e.g., travel time, costs, number of trips) due to the projects are less than one percent. This is not surprising, since all but the largest projects are likely to affect a large enough number of Bay Area residents to register at such a level of aggregation.

Instead, staff may consider focusing on those communities affected by the project more directly and summarizing the performance measures for them alone. One approach would be to include travelers that live or work in traffic analysis zones (TAZs) that can access the proposed project directly (i.e. that contain a transit stop or interchange associated with the project). Assigning these TAZs would ensure that the assessment of benefits as associated with the communities that are burdened with the project rather than the region as a whole. Once these TAZs are identified, two approaches follow:

1. Again disaggregate TAZ residents into low-income and high income for analysis. The smaller overall population and increased likelihood that residents will use nearby facilities will produce more meaningful results.
2. Maintain existing definitions of communities of concern and compare performance metrics for communities of concern and non-communities of concern affected by the project.

This approach would have the benefit of also allowing an assessment of benefits and impacts without requiring the manual examination of every project to determine access.[1] Rather than assuming that a project serves a community of concern simply because it allows access in principle, identifying affected TAZs would facilitate the analysis of TAZ-level changes in performance indicators as a result of a project. For a rail transit expansion, this approach would allow us to determine whether the new transit line is priced out of reach of members of affected communities of concern: do their performance measures show similar changes to non-communities of concern who also have access to the rail line? If they do, then a given community can be said to be served by the project.

2. Differentiate "service" from impact

The difference between "service" and impact should also be acknowledged. For example, a community may be equally served in terms of mobility and accessibility by a highway and transit expansion; however, the impacts associated with each are not equal. For equivalent person-miles of travel, highways will generally entail greater exposure to noise and pollution relative to transit for adjacent communities. This disparity will increase if transit operations use alternative fuels like electricity. The difference is partly acknowledged by the "PM in CARE communities" performance metric, but should be extended to include a broader demographic analysis of affected communities.

Rather than using a TAZ-level analysis, staff could use smaller census geography to compare the demographics of different buffer zones emanating from a project to determine whether a stark difference exists between those who are closest to a proposed improvement and those who are further away. These results will suggest fruitful areas for mitigation activities or indicate that more detailed analysis is required to quantify the magnitude of noise and emissions impacts, for example.

3. Use available data to generate informative off-model analyses

Finally, off-model analyses can be employed to ensure that the region is expending its transportation dollars equitably. Ample data are available on the existing demographics of mode choice. These are often presented at the level of a transit system or individual lines.[2] Existing demographic profiles from these surveys could be used to estimate future ridership demographics in the event of the expansion of an existing facility or service. In the event that an entirely new line or service is proposed, data on similar service might be employed, or the change in mode share at the TAZ-level resulting from the new facility (defined in a similar manner to number 1

[1] Manual examination may still be necessary in the event that the travel model has difficulty representing a particular project.

[2] See, e.g., Public Research Institute. "2008/2009 on-Board Rider Survey - System-Wide Results: Alameda-Contra Costa Transit District." San Francisco, CA, 2010; Gdobe Research. "MTC Transit Passenger Demographic Survey." 2007.

above) could be combined with census demographics in that TAZ to estimate the characteristics of the new ridership. This type of analysis would ensure that all Bay Area residents share equitably in the benefits of transportation investments.

MEMORANDUM

TO: Parisa Fatehi-Weeks, Public Advocates

FROM: Alex Karner and Deb Niemeier, Department of Civil and Environmental Engineering, UC Davis

DATE: May 24, 2012

RE: Alternative scenarios, affordable housing, and vehicle-miles traveled in the Bay Area

A. Introduction

Under SB 375, California's metropolitan planning organizations (MPOs) must reduce per capita greenhouse gas (GHG) emissions, primarily by coordinating transportation and land use planning in an effort to pair compact growth with high quality transit. This coordination is embodied in the sustainable communities strategy – a new component of the regional transportation plan that provides not only a vision for the future transportation system but also signals the kinds of land uses needed to achieve reductions in vehicle-miles traveled (VMT).

The potential for gentrification and displacement to occur in urban spaces simultaneous with the pursuit of otherwise laudable environmental goals is now well-documented.[1] Recent work has identified ways in which the process of gentrification and the demographic changes it elicits actually work against environmental goals. These studies consistently find evidence of growing affluence in neighborhoods that receive improved transit service, including increasing proportions of college graduates, rising median incomes, higher automobile ownership, and reduced transit mode share.[2] The research on racial demographic effects is more mixed, with some studies concluding that local transit investments lead to a reduction in proportions of people of color,[3] and others finding no evidence of changing racial demographics.[4] As one example, an analysis of Canada's three largest cities found that while gentrification was associated with increases in non-motorized mode share, it was also associated with decreases in public transit and carpool use. Most problematically, the mode share for "auto as driver" was also associated positively with gentrification.[5] Taken together, these studies suggest that merely producing dense, mixed use developments well-served by transit is not enough to reach the policy goals of reducing VMT and thus GHG emissions.

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[1] Sarah Dooling, "Ecological Gentrification: A Research Agenda Exploring Justice in the City," *International Journal of Urban and Regional Research* 33, no. 3 (2009); Noah Quastel, "Political Ecologies of Gentrification," *Urban Geography* 30, no. 7 (2009).

[2] Matthew E. Kahn, "Gentrification Trends in New Transit-Oriented Communities: Evidence from 14 Cities That Expanded and Built Rail Transit Systems," *Real Estate Economics* 35, no. 2 (2007); Stephanie Pollack, Barry Bluestone, and Chase Billingham, "Maintaining Diversity in America's Transit-Rich Neighborhoods," (Dukakis Center for Urban and Regional Policy, 2010); Kara S. Luckey, "Assessing the Effectiveness of Approaches to the Allocation of Low-Income Housing Tax Credits in Proximity to Rail Transit" (paper presented at the 91st Annual Meeting of the Transportation Research Board, Washington, DC, 2012).

[3] ———, "Approaches to the Allocation of LIHTCs".

[4] Pollack, Bluestone, and Billingham, "Maintaining Diversity."

[5] Martin Danyluk and David Ley, "Modalities of the New Middle Class: Ideology and Behaviour in the Journey to Work from Gentrified Neighbourhoods in Canada," *Urban Studies* 44, no. 11 (2007).

As part of its equity analysis for the current regional plan update, known as *Plan Bay Area*, the Metropolitan Transportation Commission (MTC) reports that there will be substantial displacement pressures on "communities of concern" in the Bay Area in future years.[6] Specifically, MTC's analysis identifies concentrations of overburdened renters in traffic analysis zones (TAZs)[7] where greater than 15% of housing units are occupied by renters paying more than 50% of their income on housing. TAZs that meet these thresholds and are projected to grow by more than 30% by 2035 are considered at risk of increased displacement pressure. The MTC analysis results show that 30% to 40% of the base year's overburdened renters in communities of concern are at risk compared to 7% to 10% in the remainder of the region.

MTC has also identified that the proposed transportation investment and land use strategies get only part of the way toward the 2035 GHG emissions reduction goal. There is a five percentage point gap remaining that MTC is proposing to address through a series of transportation policy measures. Despite MTC's own analysis on displacement risk, discussions around bridging this gap have focused almost exclusively on achieving additional per capita GHG reductions through policy initiatives like the promotion of electric vehicles.[8] In focusing on vehicle technology, MTC overlooks an important opportunity: affordable housing can be an effective tool for meeting GHG emissions reductions while simultaneously meeting a number of other objectives by reducing other VMT-related externalities including congestion costs, deaths and injuries from collisions, and public health costs like obesity.

The remainder of this memo uses travel modeling data produced by MTC to quantify differences in travel behavior by income categories. We argue that equitable housing distributions that provide options for residents of different income levels can be an effective VMT reduction strategy.

B. <u>Income, automobile ownership and VMT</u>

The Association of Bay Area Governments (ABAG) has noted that residents of affordable housing drive less and own fewer cars than those who do not live in affordable housing.[9] Precisely how much less they drive can be identified with the travel demand modeling data developed for the alternative *Plan Bay Area* scenarios using low-income status as a proxy for affordable housing residence.[10] Table 1 shows vehicle ownership and VMT per capita at the household level when looking at income effects for both 2005 and future years. Consistent with SB 375, all future scenarios suggest that households, on average, will own fewer vehicles and

[6] MTC, "Plan Bay Area Equity Analysis Overview and Equity Analysis Scorecard," http://www.onebayarea.org/pdf/EquityAnalysisOverview.pdf.
[7] A unit of geography used to model travel approximately equivalent to a census tract.
[8] See discussion at the May 11, 2012 joint meeting of the MTC Planning Committee and the ABAG Administrative Committee. Out of $685 million budgeted to help MTC reach its 2035 GHG emissions reduction target, 60% is directed at electric vehicle subsidization.
[9] Association of Bay Area Governments, "Myths & Facts About Affordable and High-Density Housing," http://www.abag.ca.gov/services/finance/fan/housingmyths2.htm.
[10] Five alternative scenarios were designed for Plan Bay Area comprising two transportation investment scenarios paired with two land use scenarios. The first two, Initial vision and Core capacity, assume unlimited resources for housing development in the Bay Area. The latter three are based upon realistic planning assumptions regarding the total amount of housing growth that can be accommodated in the region. Each varies slightly in precisely where growth is located. Further information is available at: http://www.onebayarea.org/pdf/ScenarioAnalysisOverview.pdf.

that VMT per capita across all income groups will decline. However, as expected, we find that vehicle ownership and VMT per capita increases as household incomes increase.

Table 1 Comparison of modeled scenarios – Automobile ownership and VMT per capita by income.

	Average vehicles per household				
	Income quintile 1 (< 26,000)[a]	Income quintile 2 (26,000 – 52,000)	Income quintile 3 (52,000 – 80,000)	Income quintile 4 (80,000 – 124,000)	Income quintile 5 (> 124,000)
Base year, 2005	1.010	1.533	1.821	2.10	2.15
Initial vision	0.947	1.447	1.738	2.01	2.09
Core capacity	0.917	1.445	1.742	2.01	2.08
Focused growth	0.948	1.493	1.795	2.06	2.11
Constrained core capacity	0.942	1.487	1.790	2.06	2.11
Outward growth	0.988	1.521	1.815	2.08	2.12
	Average VMT per capita				
Base year, 2005	8.78	13.27	17.13	19.15	19.65
Initial vision	8.09	12.18	15.40	17.30	18.20
Core capacity	7.91	12.22	15.48	17.26	17.99
Focused growth	7.76	11.94	15.07	17.02	17.83
Constrained core capacity	7.69	11.84	14.98	16.95	17.83
Outward growth	8.07	12.24	15.35	17.27	18.00

[a]Quintile bounds are calculated for each scenario, so the values that define each category are approximate.

The empirical evidence of gentrification discussed earlier suggests that median income levels and vehicle ownership are likely to rise in areas where transit service improves, and these increases have been linked to increasing risk of gentrification and displacement.[11] In future years, MTC has identified that transit service improvements will be focused largely on priority development areas (PDAs) – those areas targeted to receive streamlined environmental review for housing projects with densities conducive to frequent transit service. Using data provided by MTC, we classified 195 TAZs as being part of a PDA and compared the median incomes for PDA and non-PDA areas.[12] Table 2 shows that median income across the PDAs increase faster than in the non-PDAs and faster than the entire region from the base year to each of the future year scenarios. The results are consistent with MTC's equity analysis: PDAs will likely experience gentrification and increasing displacement risk as *Plan Bay Area* is implemented.

[11] Pollack, Bluestone, and Billingham, "Maintaining Diversity."
[12] A TAZ was considered to be part of a PDA if greater than 50% of its area overlapped part a PDA classified as "planned" and "final" in the GIS layer (according to the attributes PlanStatus and ABAGStatus, respectively).

Table 2 Median income, 2000$.

	PDAs	Non-PDAs	Entire region
Base year, 2005	43,800	68,200	65,000
Initial vision	48,000	67,000	64,400
Core capacity	50,000	68,000	65,000
Focused growth	48,310	68,000	65,000
Constrained core capacity	48,600	68,000	65,000
Outward growth	48,200	68,010	65,200

The gentrification literature discussed in the introduction also suggests that new residents in gentrifying areas will be less likely to take transit and more likely to own greater numbers of automobiles than previous residents. We can test this prediction by comparing low-income households to all other households in PDAs and non-PDA TAZs in terms of VMT per capita (Table 3). As we might expect, VMT per capita decreases from the base year when compared to each forecast scenario for both low-income and all other households. That is, households in PDAs have substantially lower VMT per capita than the rest of the region in both the base and forecast years. The critical aspect to this analysis, however, is that the rate at which low-income households reduce VMT per capita is slightly higher than all other households in both PDAs and non-PDAs in all future year scenarios (final row of Table 3). Automobile ownership results show similar, across the board reductions for PDAs, with low-income households owning fewer automobiles than all other households in both PDAs and the remainder of the region. Locating residents in PDAs is clearly an important strategy for achieving SB 375's GHG targets, but the future year non-low income households generally do not reduce driving or automobile ownership as much as low-income households.

Table 3 Comparison of modeled scenarios – VMT per capita.

	VMT per capita (PDAs)		VMT per capita (other TAZs)	
	Low-income households[a]	All other households	Low-income households[a]	All other households
Base year, 2005	5.51	11.04	9.54	18.72
Initial vision	5.11	10.23	8.70	17.29
Core capacity	4.78	9.87	8.54	17.20
Focused growth	4.88	9.96	8.42	16.85
Constrained core capacity	4.94	9.89	8.40	16.82
Outward growth	5.07	10.26	8.64	17.05
	Average reduction relative to 2005 (%)			
	10.0	9.0	10.5	9.0

[a]Low-income households classified according to the US Census definition[13] based on household size and income threshold. Consistent with MTC practice, 200% of the threshold is used.

One caveat is that these results may not fully represent market dynamics that will result from improved transit service, since the allocations of different household types by income are established prior to running the travel model. In addition, representations of travel behavior are

[13] US Census Bureau, "Poverty Data - Poverty Thresholds," http://www.census.gov/hhes/www/poverty/data/threshld/index.html.

based upon cross-sectional analysis sometimes extending as far back as 1990.[14] The gentrification literature argues that subsequent "waves" of gentrifying individuals bring with them different travel behaviors; these behaviors would tend to transcend classification based upon income alone to include difficult-to-quantify properties such as politics, ideologies and values.[15] Later waves are potentially less inclined to reduce automobile ownership and VMT than are earlier waves. These factors are generally not included in a travel demand model. For this reason, the travel model results might underestimate the VMT per capita and automobile ownership figures expected to result in future years in gentrifying, transit rich areas.

C. Links between affordable housing and VMT

It seems self-evident that affordable housing should not just be placed anywhere. More equitable distributions of housing can be expected to lead to lower VMT per capita based on the land uses likely to surround mixed income communities and also because of the relationships between VMT and income noted above. We can quantify the equitability of a housing distribution using the Gini coefficient. The Gini coefficient is a well-accepted measure of population inequality which varies from a perfectly equal distribution of some good (zero) to a perfect concentration of that good with one individual or group (one).[16] Those TAZs with more equitable housing distributions (where there are equal numbers of each household type by income) will have Gini coefficients closer to zero, while those with inequitable distributions will have Gini coefficients closer to one.

Table 4 summarizes the VMT per capita for each future year scenario and the base year according to quintiles of the Gini coefficient calculated at the household level.[17] Each column represents the average VMT per capita for households representing 20% of the total in each scenario. Housing distributions become increasingly inequitable moving from left to right in the table. The results clearly indicate that TAZs with more equitable housing distributions have lower VMT per capita. Further analysis reveals that the TAZs with the highest Gini coefficients (most inequitable) disproportionately represent households in the highest income groups. For the initial vision scenario, the TAZs with the most inequitable housing distributions (i.e. Gini quintile 5) had an average of 51% of total households in the highest income category and only 10% in the lowest income category. TAZs that had the most equitable housing distributions (i.e. Gini quintile 1) had an average of 23% of households in the highest income category and 20% in the lowest.

To the extent that median incomes rise in PDAs and similarly transit rich areas in the urban core in forecast years, VMT per capita is likely to increase. Maintaining and improving the equitability of the housing distribution is one method that MPOs can use to ensure that per capita VMT remains as low as possible. These results indicate that developing more equitable distributions of affordable housing should be included alongside other methods proposed by MTC to meet its SB 375-mandated GHG reduction target.

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[14] MTC, "Travel Model Development: Calibration and Validation (Draft)," (Oakland, CA: Metropolitan Transportation Commission, 2011).

[15] Danyluk and Ley, "Modalities of the New Middle Class: Ideology and Behaviour in the Journey to Work from Gentrified Neighbourhoods in Canada," 2197-98.

[16] World Bank, "Poverty Analysis - Measuring Inequality," http://go.worldbank.org/3SLYUTVY00.

[17] Quantities of housing types in each of four income categories based on ABAG modeling are used as input into MTC's travel model for future years. Observed data on income distribution are used for the base year.

Table 4 VMT per capita by scenario and Gini coefficient quintile.

	Increasingly inequitable housing distribution →				
	Gini quintile 1	Gini quintile 2	Gini quintile 3	Gini quintile 4	Gini quintile 5
Base year, 2005	14.91	15.10	15.10	17.50	19.03
Initial vision	12.98	13.71	14.35	15.40	18.10
Core capacity	13.11	13.34	14.25	15.66	17.88
Focused growth	12.73	13.22	14.30	15.11	17.59
Constrained core capacity	12.66	13.25	13.93	15.12	17.66
Outward growth	12.85	13.65	14.25	15.70	17.77

One could argue that the differences identified in Table 4 are entirely the result of income effects. We would expect the same results if low-income housing units are disproportionately concentrated in TAZs with low Gini coefficients. To check this hypothesis, we estimated a preliminary spatial autoregressive error model of the logarithm of total VMT at the TAZ level. The modeling results are located in the appendix. The independent variables include, among others, the total number of housing units in the lowest two income categories; this allows us to estimate the effect of affordable housing provision on total VMT (and thus GHG emissions). The interpretation of the estimated coefficient on affordable housing shown in the appendix is that a one percent increase in housing units occupied by the lowest income groups is associated with a 0.07 percent decrease in TAZ-level VMT, all else equal. Said another way, the provision of affordable housing within a TAZ has a high probability of being independent of the income level within that same TAZ and the other variables included in the model. This result suggests that an equitable housing distribution results in lower VMT.

D. Conclusion

This memo and MTC's own analysis indicate that gentrification and displacement of low-income residents are likely outcomes in areas expected to receive transit investments over the course of *Plan Bay Area*. We present evidence correlating inequitable housing distributions with higher VMT, suggesting that investment in affordable housing can help to meet SB 375's GHG reduction goals while mitigating the risk of gentrification and displacement. Additional transportation policies proposed to achieve GHG targets should not be myopically focused on transportation technology. Strategies such as affordable housing provision can help to meet SB 375's goals while mitigating other transportation externalities.

E. References

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Danyluk, Martin, and David Ley. "Modalities of the New Middle Class: Ideology and Behaviour in the Journey to Work from Gentrified Neighbourhoods in Canada." *Urban Studies* 44, no. 11 (2007): 2195-210.

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Appendix

The travel data used to estimate the model shown in Table A 1 were obtained from MTC. Demographic data were also assembled from the 2005-2009 American Community Survey maintained by the US Census.

Table A 1 Spatial error model on the logarithm of total TAZ-level VMT for the 2005 base year.

Variable	Coefficient estimate	Standard error[a]
log(median income)	0.01700	0.00354***
log(housing units in the lowest two income categories)	-0.0647	0.00815***
log(total people of color)	-0.01859	0.00861*
log(total zero vehicle households)	-0.0240	0.00448***
log(total workers)	0.0985	0.01340***
log(total population)	0.993	0.01870***
log(total acreage)	0.0370	0.00519***
Peak transit accessibility[b]	-0.0371	0.00315***
Peak non-motorized accessibility[b]	-0.0475	0.00351***
Lambda (spatial error term)	0.1258	0.00256***
Number of observations = 1441		
Pseudo R^2 (Nagelkerke) = 0.96		

[a]Significance is indicated by the following convention: p < 0.001 ***, p < 0.01 **, p < 0.05 *

[b]Transit and non-motorized accessibilities are outputs from the travel demand model and are in relative units. They are included merely as controls.

APPENDIX C: COPIES OF DOCUMENTS

Chapters 2 through 4 of the dissertation cite memoranda and correspondence that are not readily available. A listing appears below. Copies of these documents can be accessed at http://goo.gl/d5mJt.

1998

- Letter on Civil Rights, Equity, and Transportation to MTC Executive Director Lawrence D. Dahms. April 17, 1998.

2004

- TRANSDEF Settlement Agreement and Release, March 4, 2004.
- Letter from the Minority Citizens Advisory Committee to MTC Planning and Operations Committee regarding Comments on the Transportation 2030 Equity Analysis Report. December 10, 2004.

2007

- Letter from Steve Heminger to MTC Legislation Committee Re: Environmental Justice (EJ) Principles. January 5, 2007.
- Testimony of Raphael Durr, Chair of the MCAC, at a meeting of MTC's Legislation Committee, January 12, 2007.
    - The relevant part of the testimony begins about 38 minutes into the recording.

2010

- Letter from Cynthia Bryant to Mike Bitner. April 30, 2010.

2011

- Memo from Jennifer Yeamans to Equity Working Group Re: Identifying Communities of Concern and Other Relevant Equity Populations. May 4, 2011, Attachment A.
- Memo from Equity Working Group Staff to Equity Working Group Re: Draft Equity analysis Framework for Alternative Scenarios. June 2, 2011, Attachment A.
- Letter from ACCE Riders for Transit Justice et al. to Mark Green and James P. Spering. June 9, 2011.
- Memo from Ann Flemer and Ezra Rapport to MTC Planning Committee and ABAG Administrative Committee Re: Plan Bay Area: Alternative Scenarios. July 6, 2011.

- Memo from Jennifer Yeamans to Equity Working Group Re: Alternative Scenarios Equity Analysis: Target Population Definitions. August 3, 2011.
- Memo from Jennifer Yeamans to Equity Working Group Re: Revised Framework for Equity Analysis of Alternative Scenarios. September 8, 2011.
- Staff Presentation to MTC Planning Committee and ABAG Administrative Committee. “Plan Bay Area Scenario Results.” December 9, 2011.

2012

- Email from Lindsay Imai, Parisa Fatehi-Weeks, Rajiv Bhatia, and Alex Karner to Jennifer Yeamans, March 12, 2012.
- Memorandum Re: Equity, Environment, and Jobs (EEJ) Alternative. June 28, 2012.