Assessing the Incorporation of Racial Equity into Analytical and Modeling Practices in Transportation Planning

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16. Abstract

This report examines if and to what extent state-level transportation departments in four states incorporate race and equity considerations into transportation planning technical analyses and modeling practices, particularly for long-range transportation plans, and how such equity-infused practices can be improved. The research team examined relevant literature, reviewed statewide long-range transportation plans for California and three other states, consulted with other experts, and conducted interviews with scholars and knowledgeable agency staff and practitioners. The findings indicate widespread acknowledgement that racial disparities in transportation exist, and state agencies have expressed a strong commitment to redressing the inequalities. However, while there has been progress in creating analytical equity tools to assess transportation projects and programs, they lack standardization. There have also been few noticeable revisions to existing regional transportation planning models to incorporate equity, and the profession lags behind what is technically possible based on the work of academic researchers. Technical staff need better training in regard to equity issues and agencies should encourage greater collaboration between equity and analytical units to develop and improve frameworks to assess equity performance in plans, programs, and projects.

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Disclaimer

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List of Abbreviations

AASHTO   American Association of State Highway and Transportation Officials

APA   American Planning Association

CalSTA   California State Transportation Agency

CARB   California Air Resources Board

Caltrans   California Department of Transportation

CSF2TDM   California Statewide Freight Forecasting and Travel Demand Model

DMVT   Daily Vehicle Miles Travelled)

GHG   Greenhouse gases

MPO   Metropolitan Planning Organization

TAZ   Traffic analysis zone

TREDIS   Transportation Economic Development Impact System

TxDOT   Texas Department of Transportation

WSDOT   Washington State Department of Transportation

Executive Summary

Executive Summary

This research report examines if and to what extent state-level transportation departments in four states incorporate race and equity considerations into transportation planning technical analyses and modeling practices, particularly for long-range transportation plans, and how such equity-infused practices can be improved. The research project builds on the team's expertise by examining relevant literature, reviewing statewide long-range transportation plans for California and three other states, consulting with other experts and conducting interviews with knowledgeable agency staff and practitioners.

It is critically important to contextualize transportation practice within the large societal issue of systemic racism. Addressing racial injustices and inequalities within the transportation arena can be daunting, as they are the product of multiple factors: individual and collective prejudices; *de jure* or *de facto* discrimination; overt and implicit biases; and selective inclusion and exclusion of people, knowledge, values, and ideas. These elements can be deeply embedded within the transportation planning profession itself as an institution, at times appearing simply as racially neutral practices but nonetheless generating disparities in planning outcomes. However, systemic racism can also be the product of attitudes and practices that exist within the larger societal and economic context where transportation planning takes place. These outside structures and dynamics create pre-existing conditions which subsequently contribute to the production of disparities within transportation planning. Those outside factors can also limit or constrain practices within transportation intended to combat racism.[1] It may be impossible for the transportation planning profession to dismantle this complex societal web of racial inequality, but the profession can address specific issues and limitations within its own arena.

Transportation planners rely on sophisticated and complex regional and state travel models, in conjunction with land-use and economic models, to guide decisions about which plans, programs and projects to approve; however, those analytic practices can themselves be subject to implicit biases that impact modeling inputs, calculations and outputs. While it is fairly common to employ various metrics to determine whether proposed transportation investment may have a disparate impact on certain places and populations, particularly low-income and minority communities, there is a noticeable lack of standardization in their use. Moreover, these practices are often undertaken at a later stage of the planning process, typically in considering possible mitigation measures, *after* plans have been formulated, or projects approved, rather than being incorporated into the core modelling activities that are crucial to developing those plans, programs, and projects in the first place. Currently modeling practice however, lags behind what is technically feasible. This report looks at the

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[1] For example, university programs do not adequately train students in departments of urban planning and civil engineering on systemic racism, nor adequately train students in the social sciences and ethnic studies on transportation planning. Another factor in California is Proposition 209, which prohibits state agencies from implementing race-based programs and allocations such as affirmative action programs, although other laws do prohibit racial discrimination (Ong 1999).

state of the art in empirical and quantitative transportation analysis and modeling with regard to addressing racial equity, the prospects for incorporating race more directly into the initial stages of planning, and any significant organizational barriers to achieving that goal.

Key Findings and Recommendations

Findings

- The findings from the analysis (based on expert opinions, existing literature, and interviews) indicate that there is a widespread acknowledgement among transportation professionals that transportation racial disparities exist.

- California and Washington transportation agencies have expressed a strong commitment to redressing these inequalities, but their technical capacity and expertise to integrate equity in analytical and modeling practices is limited.

- Situating responsibility for addressing equity issues within the transportation organizations surveyed is in flux, with assigned units or staff still working on developing procedures.

- Most agencies use proxy measures of disproportionate impacts and benefits to assess plans, programs, and projects. There has been progress in efforts to create analytical equity tools that incorporated race, although there is a lack of standardization.

- There appear to have been few noticeable revisions to existing regional transportation models to incorporate equity, and the profession lags behind what is technically possible based on the work of academic researchers who have modelled the causes and consequences of systematic racial disparities.

- There is limited knowledge within analytical/modeling staff/units about the causes, consequences, and magnitude of systemic racism as technical staff express challenges operationalizing racial equity.

- There is minimal intersecting expertise between equity units and analytical/modeling units. Units tasked with advancing equity have little to no interactions with internal units responsible for modeling and projecting impacts of transportation decisions as racial equity analyses are conducted separately and in a separate unit from the lead analytical teams.

- The four state agencies contract their equity assessment work to outside consultants which suggests a lack of capacity to explicitly incorporate racial equity into modeling work.

- Analytical consulting firms are used to perform economic analysis for transportation plans, but the extent to which these firms have the capacity to integrate racial equity into technical practices remains unclear.

- Although CalEnviroScreen – an analytical tool used to identify communities that face multiple burdens of pollution and socioeconomic disadvantage – is widely used to analyze transportation projects

throughout the state, reliance on one general equity tool for different types of transportation projects presents challenges in aligning targeted communities with solutions to meet their needs.

- Some staff members believe that the lack of staffing diversity within public agencies is due in part to state measures like California Proposition 209 and Washington Initiative 200. Both measures prohibit affirmative action initiatives that could significantly support efforts to hire a workforce reflective of the communities transportation agencies work in.

- There are variations among states in implementing racial justice goals, with California performing relatively well but not consistently on the leading edge.

Recommendations

- Adopt best practices from other states and from other California agencies.

- Strengthen cross-agency interaction and collaboration with non-transportation departments, such as CARB, which are active in analyzing racial equity.

- Work with other state agencies and Metropolitan Planning Organizations (MPOs) to standardize definitions of disadvantaged populations and neighborhoods, transportation disparity indicators, and relevant performance metrics.

- Adequately fund research that assesses the implications of analytical techniques and models on racial equity.

- Work with vendors, and academics, to enhance the ability of current transportation models to incorporate racial differences, disparities, and behavior.

- Use workshops, and other educational techniques, to improve the knowledge of systemic racism in existing technical units and to build capacity to incorporate equity into transportation planning.

- Encourage collaboration between equity and analytical units to develop and improve frameworks to assess equity performance.

- Recruit and hire transportation analysts with the requisite knowledge and background on systemic racism.

- Work with universities and colleges to incorporate knowledge of systemic racism into transportation-related curriculum.

- Develop legislation, policies and procedures that specify general parameters on how analytical and modelling efforts on racial equity should be undertaken.

- Continuously monitor and evaluate progress in implementing the equity agenda.

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Chapter I: Introduction

This research report examines if and to what extent state transportation departments (DOTs) incorporate race and equity considerations into transportation planning technical analyses and modeling practices, particularly for long-range transportation plans, and how such equity-infused practices can be improved. The project focuses on transportation as an institution, and the organizational barriers and challenges to fully incorporate race into its modeling and planning practice. The study includes four states in depth: California, Texas, Illinois, and Washington. The latter state is of particular interest because it has demonstrated a strong commitment to equity.[2]

This project was conducted in support of a broad and ambitious effort to combat systemic racism in transportation planning in California.[3] California has made equity, and racial justice in particular, one of its major transportation goals (California State Transportation Agency 2020; California Department of Transportation 2020). David S. Kim, Secretary of the California State Transportation Agency (CalSTA) has stated that "CalSTA firmly embraces racial equity, inclusion and diversity (California State Transportation Agency 2020)." Caltrans (California Department of Transportation) is also committed to incorporating equity principles, best practices, and actions (California Department of Transportation 2020). At the national level, the Biden administration made similar commitments when nominating Pete Buttigieg, former mayor of South Bend, Indiana, to be the U.S. Secretary of Transportation. He has pledged to "work toward . . . racial equity (U.S. Department of Transportation 2021)."

This goal is both ambitious and challenging given the very daunting nature of the problem.[4] Racial injustices and inequalities within the transportation arena can be the product of multiple factors: individual and collective prejudices; *de jure* or *de facto* discrimination; overt and implicit biases; and selective inclusion and exclusion of people, issues, values, and ideas. These elements can be deeply embedded within the

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[2] Due to limited time and resources, the project does not conduct a technical assessment.

[3] Systemic racism is a controversial and debated concept. It is not accepted by some scholars, such as economist Thomas Sowell, who argue that the concept cannot be empirically proven. There is, of course, evidence of pervasive institutional racism in many sectors of society. A large body of published studies provide evidence of deeply embedded racism (overt, covert, and other forms) within particular institutions such as the judicial system, penal system, housing, labor market, environment and other arenas, based on both extraordinary and egregious examples as well as less intensive but widespread racist acts. Pervasiveness in multiple sectors, however, is only one element of systemic racism at the societal level. To prove society as a whole is systematically racist, it is necessary to demonstrate the existence of the inter-connection and interaction of multiple institutions to cumulatively produce racial stratification and reproduce racial inequality over time. Quantitative studies testing this aspect of systemic racism are rare because of data and methodological challenges. Ong and Gonzalez (2019) provide an example of how such a study can include transportation planning as a part of a web of inequality.

[4] This interpretation borrows heavily from ideas presented in Ong and Gonzalez (2019).

transportation planning profession itself as an institution, at times appearing as racially neutral practices but nonetheless generating disparities in planning outcomes. However, systemic racism can also be the product of attitudes and practices that exist within the larger societal and economic context where transportation planning takes place.

These outside structures and dynamics create pre-existing conditions which subsequently contribute to the production of disparities within transportation planning. For example, external factors such as discriminatory insurance and lending practices create systematic racial disparities in car ownership, and housing segregation generates systematic racial disparities in access to regional opportunities. Within the transportation planning arena, differences in vehicle ownership and residential location are typically taken as a given, as modal and housing "choice," which is used to construct travel models that underlie decisions to adopt specific plans, programs and projects (Ong and Stoll, 2007). Those outside factors can also limit or constrain practices within transportation intended to combat racism.[5] It may be impossible for the transportation planning profession to dismantle this complex societal web of racial inequality, but the profession can address specific issues and limitations within its own arena.[6]

This report summarizes findings from our review of relevant literature, discussions with academic experts, interviewers with agency staff and practitioners, and analysis of state long-range transportation planning documents. We offer a number of recommendations to improve racial equity in state transportation planning through better education of practitioners and planning students, and improvements to analytic and modelling procedures within agencies.

Approaching Systemic Racism

The first step in addressing the impacts of racism in transportation planning is for transportation practitioners to understand how racial bias can impact plans, programs, and projects. Agencies need staff whose role is to advance social justice within the organization, including diversifying hiring and contracting, and who can engage with and support those in analysis and modeling activities so they are better informed how institutional

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[5] For example, university programs do not adequately train students in departments of urban planning and civil engineering on systemic racism, nor adequately train students in the social sciences and ethnic studies on transportation planning. Another factor in California is Proposition 13, which prohibits state agencies from implementing race-based programs and allocations such as affirmative action programs, although other laws prohibit racial discrimination (Ong 1999).

[6] The American Association of State Highway and Transportation Officials (AASHTO) representing the professional transportation community has acknowledged the need for institutional change as an integral part of its commitment to social justice (American Association of State Highway and Transportation Officials 2020). One objective is "to develop competencies and create accountability for promoting equity, diversity, and inclusion to address racism and inequality." The American Planning Association (APA), home to a large number of transportation planners, also recognizes the need for systemic change, encouraging planners to: "develop and deliver tools, techniques, support and encouragement to planners tirelessly combating all forms of racism and inequity (American Planning Association 2020)."

racism can impact decision-making. In this report, we address institutional capacity and competence. This is done by examining whether technical staff in transportation agencies have access to knowledge about racial impacts and whether staff responsible for monitoring equity interact sufficiently with the analytical departments and, conversely, whether the analytical departments interact and share information with equity staff.

It is also important for planners to have the technical capacity to fully incorporate equity into analytical and modeling practice. The project addresses this by examining if the planners have the requisite analytical and modeling tools, including demographic and socioeconomic indicators and performance metrics, to assess the distribution of benefits and costs not only for plans but also for individual projects and programs, in order to address and remedy any unfair burdens on vulnerable groups and places. In this report we analyze whether those tools are available to planners, how they are being used, and what if anything can be done to improve them.

To fully address racism in transportation planning, it will not be sufficient in the end merely to develop *ad hoc* responses to disparate outcomes, although developing specific remedial projects and mitigation programs are necessary ingredients. Central to the concept of systemic racism is that racism can be built into the very structure and processes of the whole system, often in ways that are not obvious, or are simply taken as given. While planners rely on sophisticated and complex regional and state transportation models, in conjunction with land-use and economic models, to guide decisions, those practices can themselves be subject to implicit biases. This can be manifested in terms of what measurements, groups, metrics, inputs, and outcomes are included or ignored. The choices are not purely technical because they also involve value judgements of what is deemed important enough to incorporate. Planning practice can (and often does) mirror the broader pattern of social, political, and economic marginalization of people of color. Equity considerations should be present throughout the analytical and modelling activities that inform decisions about which projects to move forward, rather than merely to assess potential outcomes (and possible mitigation) after those decisions have essentially been made. For this to happen, transportation models must be as sophisticated about race as they are about other factors, and those who employ them should be able to recognize and rectify any shortcomings. In this report, we examine the state of the art in empirical and quantitative transportation analysis and modeling with regard to addressing equity, the prospects for incorporating race more directly into the initial stages of planning, and any likely barriers to achieving that goal.[7]

Research Sources

The project draws on four main sources of information. The first source is expert insight from key scholars including the Principal Investigator, and interviews with two consultants, regarding recent and current professional and scholarly analytical practices. The second source is a review of publications, also covering

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[7] It should be noted that this project does not conduct a technical assessment of analytical tools or transportation models. An example of such an assessment can be found in Ong, et al. (2018).

recent and current professional and scholarly analytical practices. The third source is a review of selected state long-range transportation planning documents. The final source includes interviews with key individuals (practitioners, managers, and decision makers). Additional information on these sources and analytical methods can be found in the subsequent chapters and appendices.

Organization of Report

The rest of the report is organized into several chapters and appendices. Chapter II examines the extent to which equity analyses have been adequately incorporated into current professional practice. Chapter III covers how equity has been incorporated into state level planning, both in California and selected other states. Chapter IV looks at institutional capacity to address equity issues including staff awareness of race and equity and organizational structure, and technical capacity to incorporate equity into data analysis and modelling practices. Chapter V summarizes our major findings and Chapter VI presents our recommendations for further actions to address or rectify shortfalls. Appendices A and B contain additional information on our research design and methods. Appendix C contains short biographies of experts who were consulted in the preparation of this report. Appendix D lists some transportation equity studies conducted by academic scholars.

Chapter II: State of Current Professional Analytical and Modelling Practice for Equity

This chapter summarizes the current state of analytical practices within transportation planning with respect to race. Where feasible, the review focuses on three components of the process: (1) collecting, updating, evaluating, refining, and integrating race and ethnicity into the data system;[8] (2) incorporating race into large regional or state transportation and associated models for projections and policy simulations; and (3) analyses of racial impacts when assessing measurable outcomes against objectives. All of these elements are essential to sound policies and impactful implementation, which should be guided by creditable empirical evidence and insights.

Our conclusions are based on a review of current academic literature, including research conducted by the project's principal investigator and his colleagues, which includes material related to race and transportation, research design and methods, and professional practice (e.g., technical guidebooks on equity).[9] A list of some of the relevant publications reviewed is presented in Appendix D. The literature review was supplemented with insights from discussions with lead author UCLA Professor Paul Ong, Professor Gian-Claudia Sciara (University of Texas, Austin) and Dr. Silvia R. González (UCLA Luskin Center for Innovation). We also received input from two transportation scholars specializing in equity modeling, Professor Alex Karner (University of Texas, Austin)[10] and Professor Tierra Bills (Wayne State University and UCLA).[11] Collectively, they have extensive first-hand experience conducting research related to transportation analytical practices and systemic racism (See brief bios in Appendix C). Our review indicates that the profession is making efforts to address race in analytical practices, but much more needs to be done, particularly in long-term transportation modeling.

Data Collection and Processing

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[8] The major categories are based on Directive No. 15 from the Office of Management and Budget within the Executive Office of the President issued in 1977 and revised in 1997. Along with the major racial categories, the directive also includes Hispanic origins as a major ethnic category.

[9] Publications were identified by searching through scholar.google.com using key terms (e.g., race transportation modeling, race transportation indicators, transportation planning equity, transportation equity modeling, causes of transportation inequity, racial inequality transportation, racial inequality car ownership).

[10] Interview by Paul Ong with Alex Karner, July 23, 2021. His assessment of the current analytical and modeling practices is generally consistent with the project's assessment.

[11] Interview by Paul Ong with Tierra Bills, July 29, 2021. Her assessment of the current analytical and modeling practices is generally consistent with the project's assessment.

Transportation analysis and modeling requires an extensive amount of detailed data. Most transportation planning agencies use the following data sources as input in their transportation, land-use and economic models: decennial enumeration, American Community Survey (ACS), census data and Census Transportation Planning Products (CTPP), and Longitudinal Employer-Household Dynamics (LEHD) program. These data sources cover the nation and are available to all transportation planning agencies. The U.S. Census Bureau conducts the decennial census every 10 years to count the number of people living in the United States. The enumeration is done in years ending in zero on April 1, although the actual collection spans several months. The count is constitutionally required and used primarily for reapportionment of Congressional House of Representative seats and for redistricting (redrawing of electorate boundaries) within states. Unlike other data sources, the decennial census is not based on a sample or subset of the population; nonetheless, there are known systematic biases in the count with people of color being disproportionately undercounted.[12] ACS is an ongoing national survey conducted by the U.S. Census Bureau to collect transportation, housing, demographic and socioeconomic data about the population. The ACS surveys about 2.5 percent of the population annually or 12.5 percent over 5 years. The ACS pools monthly response to report statistics down to the block group.[13] The LEHD program at the U.S. Census Bureau's Center for Economic Studies compiles information from states on workers using administrative records drawn from the Unemployment Insurance program and other administrative data on earnings data, place of employment and place of residents. The data includes information on race and other individual characteristics. LEHD provides information on commute patterns.[14] CTPP is a specialized tabulation of ACS data that includes aggregated information on demographic characteristics, home and work locations, and journey to work travel flows. The information is available for census tracts and traffic analysis zones (TAZ)."[15]

Along with the above national datasets, some agencies use specialized datasets. This includes household travel survey data. For example, Caltrans (in collaboration with MPOs) conducts the state-wide California Household Travel Survey (CHTS) every ten years, which provides detailed information about the socioeconomic characteristics and travel behavior. CHTS is used to calibrate travel-demand and inter-regional transportation models. The sample size prohibits direct estimates of characteristics for small geographies such as census

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[12] For additional information, see U.S. Census Bureau, "About the Decennial Census," https://www.census.gov/programs-surveys/decennial-census/about.html

[13] For additional information, see U.S. Census Bureau, "American Community Survey (ACS)," https://www.census.gov/programs-surveys/acs

[14] For additional information, see U.S. Census Bureau. "Longitudinal Employer-Household Dynamics," https://lehd.ces.census.gov/

[15] For additional information, see AASHTO, "CTPP Data," https://ctpp.transportation.org/ctpp-data-set-information/

tracts and TAZs. The last survey was conducted between 2010 and 2013.[16] A unique dataset available in California is CalEnvironScreen (CES), which is a data and mapping tool used by state, regional and local jurisdiction to identify communities most affected by pollution, including those generated by traffic. CES combines environmental and health information, along with information from the American Community Survey.[17] Another California source is the recently released prototype dataset on transportation disparities by census tracts. The data come from a project designed to better measure transportation disparities, and to understand the built environment as a contributing determinant of health. The project is funded by the California Air Resources Board (CARB). The dataset includes but not is limited to ownership of clean vehicles, vehicle miles traveled, availability of public transit and bikeways, access to employment, and traffic accident, along with demographic and socioeconomic information from ACS.[18]

Despite what appears to be a very extensive library of data for transportation analysis and modeling, our expertise, and the literature point to at least three issues related to incorporating race into those technical efforts. One, the available data are not fully utilized. Until recently, racial disaggregation was rarely done. There have been improvements, particularly in using the available information to identify disadvantaged communities and to conduct distributional analysis by race and ethnicity. These are, however, the "low hanging fruits," and we do not find evidence of significant improvements in transportation modeling. Two, there are gaps in the data that prevent transportation analysis and modeling to adequately examine the upstream causes and downstream outcomes of racial disparities associated with the transportation system. For example, it is necessary to augment existing transportation data with information on automobile lending and insurance to model inequality in vehicle ownership. Additional information is also needed to model how spatial and transportation mismatch adversely impact enrollment in early childhood education. (Details of both examples are discussed elsewhere in this chapter.) And three, the type of information collected and the method of data collection do not take into consideration the particular circumstances facing people of color. For example, many surveys and administrative records are done only in English, or in English and Spanish, and data collection does not adequately account for mistrust of the government.

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[16] For additional information, see Caltrans, "California Household Travel Survey," https://dot.ca.gov/programs/transportation-planning/economics-data-management/transportation-economics/ca-household-travel-survey

[17] For additional information, see California Office of Environmental Health Hazard Assessment "About CalEnviroScreen," https://oehha.ca.gov/calenviroscreen/about-calenviroscreen

[18] For additional information, see UCLA Center for Neighborhood Knowledge, "NEW: Prototype Transportation Disparities Mapping Tool," https://knowledge.luskin.ucla.edu/2021/05/14/prototype-transportation-disparities-mapping-tool/. Also see Ong, et al., 2021.

Modelling

The technical aspects of transportation planning activities can be categorized as modeling and non-modeling. Modeling relies on sophisticated data-driven tools to represent how cities and regions operate as a complex system, project the future, and simulate the outcomes and impacts of alternative transportation policies and plans. Modeling can be crucial to the development of transportation plans, programs, and individual projects. The modeling field has made incredible advances in the world of "big data," utilizing massive computing power and methodological improvements in computing to generate sophisticated dynamic models. Non-modeling efforts (discussed below) tend to be more descriptive and static, using fewer variables to generate assessments and evaluations. They are nonetheless useful in examining high-level outcomes of specific transportation projects and policies.

What appears to be particularly missing in current transportation practice are more statistically sophisticated, complex, and large-scale predictive and analytical models that incorporate race. These models are critical to transportation planning because they can quantitatively evaluate long-term racial outcomes under alternative policies and investments. Based on a summary of the literature and our expert opinion, these models should ideally incorporate at least the following characteristics:

1. Racially disaggregated components for major vulnerable populations (racial minorities, etc.)
2. Racially specific travel behavior (mode, distances, etc.)
3. Racially specific aspects of the spatial structure (e.g., availability of nearby resources and geographic access opportunities)
4. Causes of racial transportation disparities (e.g., discriminations, constraints)
5. Consequences of racial transportation disparities (e.g., health, income)
6. Forecasting racial housing patterns (e.g., segregation)
7. Racial dynamics and outcomes dues to major changes in the transportation system (e.g., gentrification due to transit infrastructure investments)
8. Above characteristics disaggregated to neighborhoods (e.g., by traffic analysis zones [TAZs])

As far as we can determine, no models have been developed by academic researchers which incorporate all of the above desirable elements. There are, however, models that incorporate one or more elements. As previously cited in the introduction, Ong and Stoll (2007) examine systematic inequality in automobile insurance premiums, which depresses vehicle ownership. Ong and Gonzalez (2019) update and refine that analysis by examining the structural factors that create racial inequality in automobile ownership, which is the single most important factor linked to mobility and spatial accessibility. Their model incorporates discriminatory insurance premiums, lending, and policing. Bills (2021) provides examples of how activity-based travel demand models can be improved by addressing racial biases in transportation data and racial differences in travel behavior due to systematic barriers to opportunities.[19] Wu, et al. (2019) examines the downstream

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[19] See also Bills and Walker (2017: 61-69).

safety consequences of alternative active-transportation policies using disaggregated racial data in an enhanced Integrated Transportation and Health Impact Model. Another example of modeling downstream implications of transportation inequality is Ong and Pech (2021), who find that the lack of access to private vehicles and nearby childcare lowers enrollment in early childhood education and care, after accounting for other factors. Philbrick, Torres and Reardon (2021) discuss the need to model future racial residential patterns, particularly in response to major governmental actions. They find that currently none of the agencies reviewed explicitly use race/ethnicity in their household location choice models. .

Although these publications illustrate what may be possible and/or desirable in modeling racial inequality in transportation, they also encounter data and methodological barriers to fully address the role of transportation in systemic racism. Modeling systemic racism requires examining the linkage and interaction between sectors (e.g., how transportation intersects simultaneously with employment, children's education, housing, health, the environment, and other societal arenas), and how inequality is reproduced over time and generations. Such a comprehensive modeling approach is likely to require considerable time and expertise, with substantial funding.

Unfortunately, professional modeling practices in public transportation agencies generally ignore racial impacts. For example, current modelling does not explicitly account for racial discrimination in employment, which affects "job generation and attraction" (the matching of workers and employers over space), a critical element in predicting travel demand. Nor does it model structural biases in lending and insurance barriers to automobile ownership, another key predictor of travel. Furthermore, most models assume that current residential patterns will persist despite changes in infrastructure investments, which runs contrary to how siting freeways, transit stations and other facilities can precipitate massive residential changes, such as gentrification or neighborhood decline. While tested technical approaches to examining these effects can be found in the academic literature, they do not appear to have been widely adopted within the profession. This appears to be due to inherent limitations within many existing transportation models (and associated land-use and economic models), which are unable to incorporate impacts from major infrastructure projects that contribute to gentrification and displacement in marginalized communities (Chapple, et al. 2017; Zuk 2015). These issues are not limited to race. There are similar data and modeling limitations in implementing sustainable community strategies, which often include an equity component (Ong, et al. 2018).

The typical approach in modeling future travel in regard to investment planning is to first use transportation and land-use models (without race or including race in a limited fashion) to forecast future likely changes in housing, economic activities, and travel by traffic analysis zones (TAZs). These travel demand models are not a "one-size-fits-all" analysis tools. They are typically developed for very specific purposes, and when additional analysis needs to be conducted it is referred to as "off model" analysis. This type of analysis will take some outputs from the travel demand model and incorporate them with other analysis tools. Due to limited data on race, it's next to impossible to build that in without a very comprehensive race database at the MPO or statewide level.

For some agencies, their initial modeling effort is to use the "off model" modules to supplement their transportation model. "Off model" refers to analytical routines that are done outside of the model as separate programs. They are used to distribute those projected changes onto current neighborhoods defined by race and/or socioeconomic status (e.g., predominantly African American, high poverty, etc.). "Off model" modules can also be used to assess model outputs to examine if the distribution of costs and benefits is equitable. The major limitation of this approach is that is does not conceptually treat race as systemic to the entire transportation system, and consequently does not operationally integrate racism directly into the core model. This exclusion means that the model ignores how race directly influences the underlying dynamics that shapes travel behavior and produces outcomes. Reliance on the "off model" approach implicitly treats race as a secondary phenomenon, after the outcomes are modelled. This approach is at best a temporary and partial solution until public agencies are able to incorporate race into the core transportation models.

Non-modelling analytic processes

We find that there has been more progress in non-modeling analysis, particularly in developing equity indicators and performance metrics (Caltrans Division of Research, Innovation and System Information 2021; Twaddell and Zgoda 2020a; Twaddell and Zgoda 2020b). Unfortunately, where efforts have been made to incorporate race and ethnicity into analyzing the impacts of proposed transportation investments, they tend to occur only *after* the scope or design of the proposed projects have been largely developed.

These indices are most often descriptive and used for: (1) defining disadvantaged populations and places; (2) identifying needs and opportunities; (3) assessing distributions; (4) monitoring implementation, and (5) evaluating outcomes. Some of the indicators were developed outside of the transportation field but nonetheless are utilized in transportation planning. An example of the first function is CalEnviroScreen 3.0, an analytical tool used to identify disadvantaged communities that face multiple environmental and socioeconomic burdens for investment from the State's cap-and-trade program and can include transportation improvements (OEHHA 2017). As to the second, the California Air Resource Board's (CARB) proposed transportation disparities indices provide tract-level information relevant to place-specific needs and opportunities for disadvantaged neighborhoods (UCLA CNK 2020). CARB and Caltrans have developed data tools that have been used to examine the spatial distribution of new housing and employment, which can have implications for job commutes and economic opportunities for disadvantaged groups (Ong 2018). Many of the indicators can be used to monitor implementation and evaluate outcomes, and agencies often create project or policy specific performance metrics. Despite the progress in this area, it is important to note a lack of uniformity and widespread application. Many of these are in pilot or early efforts, and are heavily focused on transit, rather than transportation more generally. Moreover, we have not been able to identify any overall composite indicator that assesses the collective impacts of long-term plans.

Practitioner Capability

Based on our expertise and the available information, we believe that few practitioners (including statistical modelers, economists, data scientists, and policy analysts) have the appropriate training and educational background to understand the societal factors and processes that generate inequality and systemic racism.[20] Data and modeling limitations cited above compound the problem for practitioners.[21] Information gaps are evident and prevalent, based on the preliminary findings from a current project funded by the California Air Resource Board to develop indicators on transportation disparities (Ong, 2021; Ong et. al, 2021). At the same time, the literature and our expertise (along with insights from our interviews, which are discussed in Chapter IV in this report) find noticeable differences among agencies in their capability and capacity to address race, as well as willingness to incorporate race into analytical and modeling practices. Unfortunately, it is difficult to determine the underlying reason. There is likely to be more than one cause. Some of the explanations given by practitioners include the following: race does not matter, race is not sufficiently relevant, income is a sufficient substitute for race, the high cost and difficulties of modifying the model, and Proposition 209 prevents the use of race. Of course, not all practitioners share these views, and many believe that race should be explicitly integrated into the models. Additional systematic research, both quantitative and qualitative, is needed to fully understand the existing and embedded values, norms and behavior that have contributed to the absence of or resistance to incorporating race into the technical practices, particularly transportation modeling. Understanding these hurdles would help agencies to develop programs to better implement institutional change. In other words, some Metropolitan Planning Organizations (MPOs) are better able to address racial inequality than others are, and the former are potential models to emulate.

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[20] This is a comment we heard during some of the interviews for this project. We also came to the same impression based on our interaction with MPOs and state agencies through previous projects.

[21] This is based on interviews and discussions with MPOs as a part of previous studies reported in Chapple (2017), Suk (2015) and Ong (2018).

Chapter III: Role of Equity in State-Level Plans

This chapter focuses on how racial equity is incorporated in analytical and modeling work in statewide planning based on an assessment of long-range transportation planning documents required by the federal government, in comparison to those of three other states. While it is possible that other planning agencies employ race-equity practices that are not discussed in the published plans and supporting documents, these publications, nonetheless, provide insights into the significance placed on race equity.

There are federal requirements for long-range transportation planning for any state that receives highway and transit funding. States are required to prepare a statewide long-range transportation plan (23 CFR Section 450.214). The plan must consider overall social, economic, energy, and environmental effects of transportation decisions (including housing and community development effects and effects on the human, natural and manmade environments) (23 CFR Section 450.208). States must also address equity in underserved populations, environmental justice, the amended Title VI of the Civil Rights Act of 1964, equity-in-general, and the transportation planning process.

Long-term transportation planning in California is also governed by California Government Code Title 7 Division 1 Chapter 2.3 (Cal. Gov. Code §65070–65074). The law mandates the preparation of a statewide plan, known as the California Transportation Plan (CTP) meeting the federal requirements. The state code provides that the CTP takes into consideration environmental justice and seven other factors that may improve the well-being of transportation users (Cal. Gov. §65072.1(h)). The code does not, however, identify an explicit focus on racial equity or justice.

Modelling and analytical work in general must meet certain federal and state requirements. For example, technical and analytical documentation from transportation plans that will be used to support projects subject to the National Environmental Quality Act are required to meet the following criteria: "(1) articulating assumptions that are rational and up-to-date; and (2) data, analytical methods, and modeling techniques are reliable, defensible, reasonably current, and meet data quality requirements." (23 CFR Appendix A to Part 450). In California, transportation modeling must provide an estimate of the effects of modern and emerging technologies on infrastructure, access, and transportation systems over a 20-year horizon. Unfortunately, the prescribed technical requirements do not cover analytical and modelling efforts related to race. Neither the federal or state laws explicitly provide any guidance or mandates to incorporate racial equity into analytical and modeling practices. This exclusion, however, does not mean that states cannot do so.

To understand how equity is incorporated into long-range plans, we conducted a content analysis of the plans for 2050 and supporting documents published by the four states. We also compare *California Transportation Plan 2050* and *California Transportation Plan 2040* to determine if and how much has changed over the last decade.

A systematic checklist was established in the form of a matrix to determine whether racial equity is relevant in parts of the documents. All four state transportation plans were scanned and evaluated based on whether certain words or terms that denote equity were mentioned throughout the report and incorporated into their analytical work. We also included alternative words or terms that share similar meanings. For a description of the matrices and the full Equity Key Words list of those terms, see Appendix A.

Our findings indicate that two transportation planning reports from California, the *CTP 2050* and the "California Statewide Freight Forecasting and Travel Demand Model" (CSF2TDM) discuss race as a part of analytical work and modeling. *CTP 2050* utilizes race in several indicators and performance measures, which could be utilized to conduct distributional analyses and monitor the implementation and outcomes of projects. While the *CSF2TDM* discusses race as an input in their modeling, it is not apparent if and how racial factors and dynamics are incorporated into the models.

The rest of this chapter is organized into four parts: (1) an overview of racial equity elements in California's 2050 planning documents; (2) a summary of how race is discussed in relation to analytical and modeling practices; (3) a comparison of California's 2050 planning cycle to the previous 2040 planning cycle; and (4) a summary and comparison of California's plan to the three other states mentioned above. The planning documents reviewed are listed in Appendix A.

Equity in California 2050 Plan

Equity considerations in *CTP 2050* largely focus on socioeconomic status (disadvantaged communities, low-income households and communities, and environmental justice). Racial inequality is not explicitly defined in *CTP 2050* but many disparities that communities of color face are discussed throughout the report. Disadvantaged communities are central to the *Low Carbon Transit Operation Program* (*LCTOP*) because Assembly Bill 1550 requires investment plans to allocate 25 percent of funds to projects that benefit disadvantaged communities (A.B. 1550, 2016). An additional 10 percent must be allocated to projects where low-income households and communities are benefitted.[22] Race is not, however, a factor in the allocation formula. Further, this program is part of the California Climate Investments (CCI) program, which is funded by cap-and-trade dollars. At least 35 percent of CCI investments must be applied to disadvantaged communities and low-income communities and households. Environmental justice is addressed four times throughout *LCTOP*; however, it is mostly found in compliance statements for state and federal law requirements.

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[22] According to the legislation, low-income households "are those with household incomes at or below 80 percent of the statewide median income or with household incomes at or below the threshold designated as low income by the Department of Housing and Community Development's list of state income limits adopted pursuant to Section 50093, and low-income communities "are census tracts with median household incomes at or below 80 percent of the statewide median income or with median household incomes at or below the threshold designated as low income by the Department of Housing and Community Development's list of state income limits adopted pursuant to Section 50093."

Underserved communities are only mentioned once as an example population target for reducing transportation costs.

The *2020 Transit and Intercity Rail Program Guidelines* (*TIRCP*) aim to serve disadvantaged communities and low-income communities and households. *CCIs: Investment Targets for Agencies Administering FY 2020-21 Funds* prioritizes disadvantaged communities and low-income communities and households with a goal of investing in programs that reduce carbon emissions. The *Climate Action Plan for Transportation Infrastructure* (*CAPTI*) proposes policy recommendations to address racial equity, racial equality, race, people or communities of color, American Tribal Indians, disadvantaged communities, low-income communities, and environmental justice.

When equity is discussed, most of the planning documents reviewed by this project focus on environmental and economic measures of equity. Clear definitions of race, racial equity, and racial equality are absent from many of the reports. Many of the reports use similar alternative definitions of equity, which include environmental justice through VMT and greenhouse gases (GHG) reductions, transportation efficiency, affordability, and equity. The *CTP 2050 Technical Analysis* (*CTP 2050 Technical*), *CTP 2040 Technical Analysis* (*CTP 2040 Technical*), and *Co-benefit Assessment Methodology Travel Cost Savings* (*Travel Cost*) documents all use VMT reduction and "affordability equity" as metrics in their analytical work. *CTP 2050 Technical* uses affordability equity as a travel cost input; *CTP 2040 Technical* uses affordability equity with transit strategies being assessed across different household income groups, and *Co-benefit Assessment Methodology Travel Cost Savings* uses affordability equity as an input to assess overall cost of travel for users. *Sustainable Transit Equity Project* (*STEP*) also uses "affordability" as an alternative definition of equity, alongside VMT reduction. The *Transit and Intercity Rail Capital Program: Quantification & Methodology* (*TIRCP Technical*) and the *Low Carbon Transit Operation Program: Quantification & Methodology* (*LCTOP Technical*) use VMT as a metric in their modeling equations.

Equity in Analytical and Modeling Practices in California 2050 Plans

CTP 2050 is the only report to explicitly discuss analytical work related to racial equity, but does not address integrating race into models. Chapter 3, entitled "Our Transportation Vision *Policy Element*," contains a section dedicated to equity listing three objectives:

> 1. Improve transportation-related economic, environmental, and public health outcomes for disadvantaged communities,

> 2. Improve access to a range of high-quality, safe, and affordable mobility options within disadvantaged communities, and

3. Support disadvantaged communities in playing an active and direct role in transportation decision making.[23]

The equity section offers two performance measures that address race: "Access to destinations by income quintile and race" and "Transportation and housing cost burden by income quintile and race" (*CTP 2050*, 74). *CTP 2050* includes two performance measures that target low-income communities and disadvantaged communities: "Air-quality in low income and disadvantaged communities" and "Access to active modes in low income and disadvantaged Communities" (74). The report includes one performance measure aimed at VMT reduction ("Vehicle miles traveled per capita") but no reference to differences across racial groups (*CTP 2050*, 76).[24]

These primary indicators and metrics can be used to conduct analyses of distribution effects, often in relation to efforts to address environmental disparities: VMT per capita, congestion, traffic safety, and energy conservation. The data can be used in determining if there are an "equitable distribution of impacts" and "equitable distribution of access and mobility." In particular, the metrics can be used to assess whether disadvantaged or low-income communities receive a fair share of benefits and will not be overburdened by costs and externalities. The data can also be used to identify populations and places that should be prioritized for investments.

Unfortunately, there is no discussion about integrating race into travel demand, economic, or emissions modelling (CTP 2050, 83-87). *CTP 2050* offers recommendations or "Action Items" to promote equity, but there is nothing regarding how to improve analytical or modeling work on racial disparities and equity.

Seven technical documents from the California 2050 planning cycle that apply analytical and modeling work in project planning and/or modeling were also examined. *CSF2TDM* is the only technical one that discusses the use of race as an input to the travel demand model. Specifically, the document discusses how to allocate race data from the American Community Survey and data on post-secondary school enrollment to TAZs. (*CSF2TDM*, 2-2). However, the document is not clear how race data are used *within* the model, and race is not listed among the key socio-economic variables (SCF2TDM, 2-11 and 2-12). For example, race is not included as a factor in modeling mode choice nor trips. While racial considerations are not completely absent, they are not as prominently discussed in the planning documents as other socioeconomic and demographic factors, such as income and age.

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[23] Equity is often not well defined, and when definitions are available, they vary from document to document.

[24] There is some ambiguity in what should be the goal in terms of social justice. There is an inherent tradeoff. Increasing VMT would allow disadvantaged populations greater access to opportunities beyond their immediate neighborhood, but that would conflict with the broader goal of reducing VMT to address climate change. An ideal approach is to redistribute the reduced total VMT to equalize VMT-based accessibility between disadvantaged and advantaged groups.

Changes Between California's 2040 and 2050 Planning Cycles

We compared a number of documents for the two planning cycles to determine whether there had been any changes in the consideration of race or equity. We found that *CTP 2050* is an improvement over *CTP 2040* in several respects.

The *CTP 2040* used the California Statewide Travel Demand Model (CSTDM), CARB's emissions model, and the Transportation Economic Development Impact Software (TREDIS) to evaluate GHG reduction and economic development strategies. Of the four GHG reduction strategies outlined in the plan (demand management, mode shift, travel cost, and operational efficiency), an equity analysis scenario was developed only for the travel cost strategy using the CSTDM. Given that congestion and corridor pricing was calculated to increase travel cost, pricing and transit strategies were assessed to determine the impact on different income groups. When travel cost strategies were projected to result in improved transit services, mode shares for low-income private vehicle owners were estimated to decrease by four percent. Overall, the scenario concluded that impacts from travel cost strategies can be mitigated by increased transportation accessibility. However, the inputs used to calculate the equity outcomes are not included in the report. We conclude that racial equity was not meaningfully included in the analytical practices in the 2024 plan.

The *CTP 2050 Technical Analysis Element* incorporates more equity terms, but when it does, the terms are usually used superficially. Environmental justice is mentioned once as "emerging values and priorities" for the Technical Advisory Committee. There was no mention of disadvantaged communities, underserved communities, or ethnic or racial groups. Equity is included as a performance measure for Economic Impact Outcomes related to road user charges to reduce VMT. Equity is defined as an economic output for socioeconomic groups in terms of Household Transportation Costs, and Wage Effects. Although the TREDIS economic model includes a travel costs module with affordability equity indicators, the market access module and benefit costs module are largely used to observe impacts on industries and differences between regions rather than determine socioeconomic impacts of investments at the neighborhood level (24). Travel cost assessments defined in the *CTP 2040* are not mentioned or referenced. Moreover, it is difficult to determine from the documents how the travel cost calculations for *CTP 2050* differ from those in *CTP 2040*. Unfortunately, while *CTP 2050 Technical* takes equity into greater consideration than *CTP 2040 Technical*, neither provide any details on how racial factors and race dynamics are incorporated into the models to support policy recommendations and actions proposed in their main documents (*CTP 2050* and *CTP 2040*).

Based on our assessment, it would be fair to state that there are improvements between the two cycles in terms of analyzing race. As discussed in the previous section, the current plan includes discussions of race, racial justice, and racial disparities, and utilizes indicators and performance measures to analyze impacts and distribution by race. There is no clear evidence that race is adequately incorporated into transportation models. Both reports discuss at length transportation planning with considerations for American Tribal Indians, low-income communities, underserved communities, environmental justice, and VMT reduction.

Equity in Other State Plans

We also compared the most recent state long-range plans and supporting documents from Texas, Illinois, and Washington to those for California to assess and contextualize how California is performing and to identify potential best practices. We found that like California, Washington utilizes race in analytical work, but in addition includes racial equity in its modeling efforts. Texas and Illinois generally do not give as much attention or priority to race and racial disparities and do not incorporate them into their analytical work.

Texas

We reviewed four transportation planning documents from the Texas Department of Transportation (TxDOT): the *Texas Transportation Plan 2050* (*TTP 2050*), *Statewide Transportation Report (TTP 2050 STR)*, *Transportation Planning and Programming*, and the *Statewide Long-Term Plan-Transportation Planning and the Environment 2021-2025* (*SLRTP*). *TTP 2050* is the Texas long-range transportation plan. *TTP 2050 STR* includes analysis of each goal in the *TTP 2050*. *Transportation Planning and Programming* is reviewed and updated at the start of each fiscal year and discusses modern processes for transportation planning and programming. *SLRTP* focuses on laws, programs, and strategies for mitigating impacts on the environment. Both long-range 2050 transportation plans from California and Texas use VMT reduction and DMVT (Daily Vehicle Miles Travelled) reduction respectively as performance measures in their analytical work. Their sections on civic engagement and public participation express an intention to incorporate people from a diverse set of backgrounds, such as low-income communities, underserved communities, and minority populations, into their planning process. One supporting document from Texas, *Transportation Planning and Programming*, discusses how "Economically Disadvantaged Counties" should be incorporated into the planning process. *SLRTP*, while not a project planning or modeling document, discusses environmental justice for minority and low-income populations.

Unlike California, Texas does not incorporate race or other demographic indicators into their analytical work. The only applicable performance measure used in *TTP 2050* is VMT reduction. The report highlights that increased VMT is associated with an increase in automobile accidents and fatalities and includes performance measures for "Historically Underutilized Businesses (HUB) Attainment" and "Disadvantaged Business Enterprises (DBE) Attainment" but does not establish metrics for disadvantaged communities, underserved communities, or low-income communities. Overall, our assessment and opinion are that race, communities of color, and American Tribal Indians are mentioned superficially.

Illinois

We reviewed four documents from the Illinois Department of Transportation (IDOT): *Long Range Transportation Plan Introduction* (*LRTP Introduction*), *Long Range Transportation Plan Livability Chapter* (*LRTP Livability*), *FY 2022-2027: Proposed Highway Improvement Program* (*PHIP 2022-2027*), and *Statewide Planning & Research Funds Fiscal Year 2021 Program Guidance* (*SPRF 2021*).

The listed *LRTP Introduction* performance goals are economic improvement, enhancing livability, improving mobility, ensuring resiliency, and supporting stewardship. *LRTP Livability* includes six "livability" principles and

five objectives. The principles are to (1) provide more transportation options, (2) expand equitable and affordable housing, (3) improve economic competitiveness, (4) support existing communities, (5) ensure that government policies and investments are aligned and leveraged, and (5) invest in neighborhoods that are clean, secure, and walkable. The objectives are to (1) enhance collaboration between local and regional transportation agencies and IDOT, (2) promote projects that improve Illinois' livability, (3) improve transportation efficiency, (4) strengthen existing procedures and policies that target under-served communities, and (5) promote environmental stewardship and energy through sustainable transportation planning. *PHIP 2022-2027* performance goals align directly with the *LRTP Introduction*; the report anticipates that the program will improve, preserve, and reconstruct state infrastructure. *SPRF 2021* is the framework for transportation planning project funds and eligibility requirements.

Like California's 2050 planning documents, Illinois' *LRTP Livability* include objectives and performance measures that address underserved communities and environmental justice.[25] Performance measures for underserved communities include the number of outreach programs, accommodating policies and practices, and affordable transportation modes directed at underserved populations (*LRTP Livability*, 40). Also, *SPRF 2021* prioritizes projects that benefit disadvantaged communities.

There are notable differences though. In all four IDOT documents assessed, race and ethnicity were brought up only once in an *LRTP Livability* principle: "Promote equitable, affordable housing. Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation" (*IDOT Livability*, 27). *IDOT Introduction* and *PHIP 2022-2027* do not include any applicable equity indicators. Much like Texas, the Illinois planning documents that we examined do not include any sub-criteria from our Equity Key Words list. *SPRF 2021* prioritizes projects that benefit "economically disadvantaged/economically distressed communities" (*SPRF 2021*, 6); California often refers to these populations as "low-income communities" but its usage varies across agencies.

Washington

Our final assessment focuses on Washington. Two transportation planning documents from the Washington Department of Transportation were analyzed: the *Washington Transportation Plan: 2040 and Beyond* (*WTP 2040*) and *The Highway System Plan's Approach to Equity* (*HSP 2040*). *WTP 2040* is a long-range transportation plan with goals that include economic vitality, preservation, safety, mobility, environment and health, and stewardship. *HSP 2040* takes a more analytical approach with a goal of appropriating state funds to address "communities of color, limited English proficiency, low-income communities, and persons with disabilities" (2).

California and Washington are similar in that *HSP 2040*'s modeling focuses on bringing environmental justice to communities of color and low-income communities. The report draws from two maps that serve as data

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[25] *LRTP Livability* recommends the development of livability measures in order to prioritize non-highway projects for funding. The plan suggests that the prioritization process should utilize performance outcomes for analytical work, policy priorities, environmental justice, equity concerns, and other factors (35).

sources for racial and ethnic demographics, communities of color, racial disparities, and environmental justice. The data related to environmental justice is to be used in Washington's *Highway System Plan* and will serve as a criterion for project selection. The report offers a definition of racial equity and how it can be applied to transportation planning. *HSP 2040* ensures that low-income rural communities and tribal lands are addressed in an equitable manner. American Tribal Indians are discussed at length in both *HSP 2040* and California's 2050 planning documents. Both *CTP 2050 and WTP 2040* aim to expand broadband access for underserved communities.

The two states differ in the following ways. *WTP 2040* does not have performance measures that utilize race or other applicable demographic indicators. The report lists recommendations (under the heading Support System Safety Statewide) aimed at expanding automobile crash data to better understand racial disparities. The report also recommends the development of a "Transportation Equity Analysis toolkit" to explore transportation investments and laws and their impacts on marginalized communities. While *HSP 2040* lists the inputs and data sources they use in their modeling, the report does not provide any information as to what modeling analysis tools they use or what the quantitative results are. Equity is defined in *WTP 2040* as "distribution of impacts across race and economic status — benefits and costs — and whether that distribution is fair" (*WTP 2040*, 68). Beyond that definition, racial equity is not explored. *HSP 2040* approaches analytical work much differently than other states. It is the only modeling document to utilize maps in their analysis and incorporate both environmental justice and communities of color as inputs. VMT reduction is not discussed at-length in either report.

Chapter IV: Equity in Transportation Planning Practice

Introduction

The previous chapters find that to date racial equity has only been incorporated to a limited extent in analytical and modeling practices and in state-level plans. Going forward, even if better analytical techniques can be adopted or developed, their ultimate effectiveness will depend on how well a diverse staff is prepared to employ them and interpret their results. This chapter reports on current state agency efforts to incorporate racial differences and disparities into advanced analytical work and long-term modeling. The chapter looks at institutional capacity and organizational structure of state agencies for addressing equity issues. It is structured around five key questions:

1. How is racial equity incorporated and embraced by transportation departments?
2. Organizationally, where are racial equity activities and staffing located?
3. How knowledgeable are equity staff/units about analytical and modeling techniques and practices?
4. How knowledgeable are analytical and modeling staff/units about systemic racism (specifically the causes, patterns, and consequences of racism, both in society generally and within transportation)?
5. How do racial-equity staff/units interact with the analytical and modeling staff/units around analytical aspects racial equity?

Our findings are based on a total of 21 semi-structured interviews with key staff and others from the CalSTA and Caltrans, along with key practitioners in two other state transportation agencies, the Washington State Department of Transportation (WSDOT) and Texas Department of Transportation (TxDOT).[26] We also interviewed individuals from the California Air Resource Board (CARB) to gain insight into inter-agency collaboration, which is required by Senate Bill 375.[27] The interview list was created through a snowball approach in which agency practitioners suggested other people at their agency or others to interview for the study. The interviews were conducted remotely through Zoom, and the interviews averaged around one hour. More details about the methodology and interview protocol are in Appendix B. While the interviews provided

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[26] Although the Illinois Department of Transportation was to be included in the study, we were unable to schedule interviews with representatives from the agency.

[27] The Sustainable Communities and Climate Protection Act of 2008 sets investment targets to reduce greenhouse gas emissions from the transportation sector which disproportionately impacts disadvantaged communities of color. See bill language at: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200720080SB375, accessed September 1, 2021.

valuable insights, some of our interpretations may not be generalizable given the limited number of interviewees.

How state transportation departments incorporate racial equity in practice

Overall, CalSTA and Caltrans share a strong commitment to integrate racial equity within agency operations. Both agencies are committed to identifying and implementing measurable actions through cross-agency collaboration. This commitment builds on CalSTA Secretary David Kim's objective to create unifying principles of racial equity, inclusion and diversity as the foundation for achieving a more accessible transportation network for California.[28] The Secretary stated "The California State Transportation Agency (CalSTA) strongly condemns systemic racism and discrimination in all forms, including those historically entrenched in transportation…To that end, CalSTA firmly embraces racial equity, inclusion and diversity. (California State Transportation Agency, 2020)". This position is also echoed by the California Department of Transportation. In December 2020, Caltrans Director Toks Omishakin, stated that the Department "recognizes our leadership role and unique responsibility in State government to eliminate barriers to provide more equitable transportation for all Californians. This understanding is the foundation for intentional decision-making that recognizes past, stops current, and prevents future harms from our actions. (California Department of Transportation, 2020)".

Some of the activities undertaken by other states may be worthwhile considering for California. In terms of expressed commitment to equity, racial justice has long been a standing priority for WSDOT with the launch of its Diversity, Equity, and Inclusion office in 1965. Today, equity represents a major focus throughout the entire state of Washington. Key initiatives began when Washington's legislature created the Environmental Justice Task Force in 2019 to strengthen the state's role in addressing issues of race, equity, diversity, and inclusion (WSDOT 2021a). WSDOT then led an effort by the American Association of State Highway and Transportation Officials (AASHTO) to adopt a Resolution Addressing Race, Equity, Diversity, and Inclusion in November 2020. In 2021, the Legislature enacted the HEAL Act, which directs state agencies to implement recommendations from the Environmental Justice Task Force. Additionally, the Governor created the State Office of Equity earlier this year, to work with all agencies in developing equity and inclusion plans to increase access to equitable opportunities, bridge opportunity gaps and reduce disparities (Gov. Jay Inslee 2021). Under Secretary of Transportation, Roger Millar, the WSDOT Strategic Plan presents a bold agenda to address equity gaps to deliver safe and reliable transportation options for all communities as well as attract and retain a skilled and diverse workforce.

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[28] CalSTA is an umbrella agency that includes the Board of Pilot Commissioners, California Highway Patrol, California Transportation Commission, Department of Transportation (Caltrans), Department of Motor Vehicles, High-Speed Rail Authority, Office of Traffic Safety, and New Motor Vehicle Board.

WSDOT practitioners highlighted three key areas that frame the agency's current efforts: inclusion, practical solutions, and workforce development (Jackie Bayne interview, 4/26/21). The Office of Equal Opportunity is currently working with the Center for Business and Economic Research team at Western Washington University, to conduct a study on historical investments and policy decisions to evaluate how investments were allocated and if project distribution was equitable, including along racial lines. Researchers reviewed a series of real estate purchases and traffic flow datasets to develop insights about land use changes over time as well as to unpack the decision-making process for funding infrastructure projects (James McCafferty interview, 4/22/21). The research team is also tasked with reviewing workforce hiring practices including identifying any disparities within the pay structure to support the agency's key initiative of cultivating a workforce that reflects the communities they serve. The study would review how salaries compare across staff members in various departments within the agency. Given that affirmative action is no longer permissible under Initiative 200,[29] the office of equal opportunity plans to have a diverse interview panel as part of the hiring process.

To create a more inclusive workplace, WSDOT has actively put together a training toolkit and resources to educate staff on matters such as unconscious bias, workplace microaggressions and systemic racism just to name a few (WSDOT 2021b). Interviewees mentioned the agency is highly focused on addressing equity as an internal practice. For instance, a diversity advisory group was established to support leadership and develop an anti-racism plan as part of the ongoing commitment to the AASHTO resolution.

Texas stands in sharp contrast to Washington and California. TxDOT does not appear to take a lead in addressing racial equity, but is willing to do what is mandated and/or funded. In the past few months, TxDOT has taken efforts to advance equity in response to the national discourse on racial health disparities for communities near transportation systems and the shift in federal funding requirements to address racial equity. Freight transportation planners are conducting a small survey regarding the state's multimodal freight network, population demographics and environmental concerns to provide baseline information on the potential impacts of future freight highway network projects (Driemeier interview, 5/4/21). The study will inform the state's 2021 freight mobility plan by identifying roadways within the network that are in proximity to disadvantaged communities.

Our analysis illustrates varying commitment to racial equity across both states, ranging from enthusiastically embracing to just following required mandates. For instance, WSDOT showed enthusiasm and self-directed efforts to actively seek ways to implement racial-equity goals, exploring and assessing "best practices," seeking innovations, etc. While TxDOT pursued actions that are required by law or state decision makers, and what could be funded.

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[29] Washington Initiative 200 is a measure that prohibits public institutions from discriminating or granting preferential treatment based on race, sex, color, ethnicity, or national origin in the areas of public education, public employment, and public contracting.

Organizational Responsibility for Addressing Equity

One sign of the commitment to prioritizing racial justice can be seen in where responsibility for addressing equity is located organizationally. The evolving organizational structure within CalSTA and Caltrans is an indication that efforts to refine the state agency are in flux but aim to effectively include equity operationally. For the purpose of this report our analysis is based on the current organizational structure, which may change in the near future. As a state-level cabinet agency, CalSTA is a small group comprised of executive staff including the Secretary of Transportation, Undersecretary, deputy secretaries, and senior advisors who oversee eight state transportation departments, boards, and commissions, including Caltrans. Currently, the Deputy Secretary for Transportation Planning is responsible for taking lead on equity initiatives at CalSTA. Given that CalSTA's deputy secretaries have limited staffing, much of CalSTA's equity work is staffed by Caltrans as they have an Office of Race and Equity (CORE) that is tasked with providing leadership and guidance towards the advancement of racial equity throughout the department's internal and external operations (Barnea interview, 7/20/21).[30]

Caltrans practitioners highlighted three main goals to describe efforts to improve how institutional practices integrate equity in agency operations: data collection, community engagement and historical knowledge (Ward-Waller interview, 5/18/21). CORE is taking the lead on the development of an equity index designed to include a wide range of indicators and metrics to strengthen the inclusion of social equity during the decision making process and improve final outcomes of transportation projects and to prioritize projects that provide the greatest social equity benefit. CORE aims to accomplish these objectives by weighting equity and standard performance indicators to guide varying analyses for decision making and within individual program requirements.

Community engagement is also a large part of Caltrans equity work. Caltrans aims to rebuild community trust with disadvantaged communities through increased stakeholder engagement activities to carefully consider equitable improvements and accessibility projects that will meet the community's needs. This initiative is largely carried out through a series of listening sessions in which practitioners receive community feedback on which equity initiatives to prioritize.

Another key aspect of rebuilding trust with the community is developing better internal guidance on equity by training and creating a workforce that is representative of the communities Caltrans serves. To achieve these goals, CORE has developed a framework to deliver accessible training materials on racial equity principles through internal "lunch and learn" sessions to increase awareness among the staff. CORE is also coordinating with the Equal Employment Opportunity unit to implement a hiring panel to increase workplace diversity. The

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[30] CORE evolved from a multi-year effort to address racial inequities within the transportation sector. In 2018, Caltrans sent a cohort of headquarters staff to participate in the Government Alliance on Race and Equity ((GARE), now referred to as the Capital Collaborative on Race and Equity (CCORE)), a large nationwide network of government advocates working to achieve racial equity (Caltrans 2021). The cohort developed Caltrans' first Race and Equity Plan (REAP) in collaboration with the Caltrans Alliance on Race and Equity Solutions (CARES), an internal working group formed in 2019.

pilot program will consist of diverse staff members across various departments who will take part in implicit bias and diversity inclusion training to improve recruitment, hiring, and contracting practices.

CalSTA's commitment towards equity is also motivated by a framework that aligns state transportation infrastructure investments with state climate, health and equity goals (CalSTA 2021). CalSTA and its departments focus on identifying funding sources to use for active transportation plans for disadvantaged communities. Executive staff is currently leading a process to prioritize transit and intercity rail investments by leveraging state and federal grant opportunities to support equitable transit-oriented development projects. Additionally, CalSTA is also considering tasking CORE with guiding internal efforts to educate and train staff on racial equity and solutions.

In the state of Washington, equity initiatives are divided between three separate divisions. The Office of Equal Opportunity is largely focused on closing the equity gap for funded projects as well as evaluating practices to increase staff diversity. The Multimodal Planning and Data Divisions and the Regional Transit Coordination unit both focus on incorporating equity into analytical work. The former integrates equity principles in the development of highway systems plans, while the latter largely focuses on environmental justice approaches to equity (Bayne interview, 4/26/21).

In Texas the only equity initiatives appear to be located within the Freight Planning Branch. Our interviewee indicated they were unaware of other equity related study/planning efforts within TxDOT (Dreimeir interview, 5/4/21). We attempted to interview other staff within the agency, but we were only able to connect with people in this unit.

Equity Planners' Knowledge Base

The staff overseeing California's equity initiative are highly aware of the need for empirical and quantitative information to inform how equity is assessed within transportation projects and have a plan to build the required analytical tools to fill the knowledge gap. Their analytical expertise seems to derive from external joint efforts, as practitioners we interviewed highlighted attending advisory and technical assistance meetings with other agencies was a common practice. For instance, an interviewee mentioned adopting and modifying CalEnviroScreen to improve internal program evaluations. This suggests some level of analytical knowledge within the equity unit. However, the overall extent of their technical capacity is unclear. Equity staff appear to be aware of current activities to gather equity-based data but have limited technical knowledge about how that data is used to inform transportation decisions.

Analytical and Modeling Practitioner's Knowledge Base

Knowledge of systemic racism within analytical/modeling staff/units appears limited, as members of analytical units expressed challenges operationalizing the concept of equity. Practitioners are keen to develop practices to further integrate equity, but those efforts are hindered by the lack of expertise (Thurston interview, 4/19/21). When asked to describe how racial equity is addressed in current practices, particularly as it pertains to the *California Transportation Plan 2050*, staff indicated they drew on the knowledge of individuals across the agency to identify which populations to include in the assessment.

Given WSDOT's recent efforts to actively educate staff on racial equity issues, their analytical/modeling staff are also starting to grapple with how to best integrate equity. However, similar to California, the extent of their technical capacity and capability to analyze equity for infrastructure projects seems hindered by the lack of tools. This is largely because analytical units are not equipped with modeling tools tailored to measure and evaluate the agency's current objectives. Without a state-based model that can be modified with equity indicators, practitioners rely on external resources such as the Federal Highway Authority modeling tools for project analysis (Jewkes interview, 5/10/21). The analytical units are considering a sketch modeling tool as initial steps towards spatially analyzing transit projects as well as to evaluate additional factors such as VMT and GHG to understand and map statewide accessibilities and disparities.

Similar to Washington, TxDOT is taking initial steps to operationalize equity by developing a tool to spatially analyze transportation projects in relation to disadvantaged communities. To conduct freight equity and mobility studies, practitioners are working with a consulting firm to develop a mapping tool to determine thresholds when communities are in close proximity to infrastructure projects (Dreimeir interview, 5/4/21). This effort suggests that the unit itself lacks the capacity and analytical expertise to further integrate equity in existing modeling work itself.

How Equity Staff/Units and Analytical and Modeling Staff/Units Interact

While equity is a key focus within CalSTA and Caltrans (as well as transportation agencies in other states), equity units have limited to no interactions with internal modeling units. Currently, there are no identifiable plans to establish collaboration between the two units to bridge equity gaps in modeling practices. When asked to describe how the equity unit interacts with the internal modeling units, both practitioners in both units seemed unfamiliar with each other's upcoming projects. Caltrans' equity planners indicated that guidance for the development of an equity index is largely provided by external agencies. The primary models Caltrans uses to assess socioeconomic trends as well as monitor and evaluate transportation infrastructure projects — particularly the California Statewide Freight Forecasting and Travel Demand Model (CSF2TDM) and Transportation Economic Development Impact System (TREDIS) — do not incorporate equity indicators and therefore are not equipped to support the agency's efforts to prioritize or measure the equity outcomes of infrastructure projects. Although the models are separate tools designed to integrate seamlessly and perform robust transportation and economic analysis, practitioners use supplemental techniques including research, institutional knowledge, and qualitative methods to produce the equity elements featured in the *CTP2050* that could not be modeled using these tools (Thurston interview, 4/19/21).

The interviews indicate some interaction with non-transportation agencies. For example, the analytical units at the California Air Resource Board (CARB) have worked with Caltrans to improve how models account for induced travel demand and the impacts of transportation projects on surrounding communities, particularly disadvantaged neighborhoods. This effort contributes to the iterative changes of the GHG reduction targets in ways to reflect the agency's ongoing commitment to environmental justice. One valuable tool is CalEnviroScreen, which can be used to target the California Climate Investment program to promote equity. Although this tool is widely used for various transportation projects throughout the state, one CalSTA interviewee noted that utilizing one general equity tool for different types of transportation projects presents challenges in aligning targeted communities with solutions to meet their needs (Moosavi interview, 5/9/21). Other equity methods are necessary to properly evaluate how future transportation projects represent choices and constraints imposed on disadvantaged communities.

In Washington state, interactions between the equity and analytical units both internally and externally were found to occur quite often. For instance, practitioners in the multimodal planning and data division indicated the equity approach to the 2021 Highway Systems Plan was based on the recommendations from the Environmental Justice Task Force and discussions with WSDOT's Office of Equal Opportunity and Environmental Services Office. Additionally, with the passage of the HEAL Act directing agencies to address health disparities throughout their work, the Washington Department of Health developed a tool to map health disparities for agencies to use across the state (Gillman interview, 5/26/21). The Regional Transit Coordination team highlighted that the tool will significantly shift how the unit implements equity in transportation projects and plans to use the tool as one of the measures for developing and coordinating equity strategies with metropolitan planning organizations.

The interview with Texas staff did not yield any insights into how equity units interact with the analytical/modeling units.

Chapter V: Summary of Findings

Compared to the other states, California agencies have demonstrated a strong commitment to addressing equity, but the ability to integrate equity in analytical and modeling practices is limited, particularly regarding modeling. In relative terms, California is performing well compared to the two other states in the study. We suspect that California is probably among the leaders in pursuing a racial equity agenda, although more research covering more states is needed before reaching such a conclusion. But it is also clear that California is not necessarily the leading state because Washington has been as or more aggressive in pursuing a racial equity agenda. This can be seen as an opportunity to learn from other state transportation departments.

Similarly, recent and future efforts to create a more diverse workforce implicitly — and sometimes explicitly — acknowledge that there is lack of diversity, and in particular people with expertise and knowledge regarding institutional and organizational barriers to incorporating equity into planning and analytical activities (Cid interview, 5/6/21). The lack of diversity within public agencies may be due to state measures like California Proposition 209[31] and Washington Initiative 200. Both measures prohibit affirmative action initiatives that could significantly support efforts to hire a workforce reflective of the communities transportation agencies work in.

There appears to be widespread acknowledgement that transportation racial disparities exist, and the state has expressed a strong commitment to redressing the inequalities as shown in state documents from the most recent planning cycle, and the statements gathered from many transportation staff. CalSTA and Caltrans explicitly acknowledge the importance of addressing inequalities by adopting practices to evaluate transportation projects that include identifying vulnerable populations, developing equity indicators, and conducting distributional analyses.

Most agencies in the four states use proxy measures of environmental disparity and descriptive analysis of disproportionate impacts and benefits from transportation projects and programs. We find that there has been progress in adopting and utilizing race/ethnicity data to help identify marginalized and vulnerable populations and places and creating relevant indicators and performance metrics (for non-modeling analytical practices), and applying those assessment tools to investments across neighborhoods and places. These have been applied to both mainstream transportation elements (e.g., transit, access) and to associated elements (e.g., air pollution). The progress in non-modeling analytical practices is evident when comparing California's 2040 and 2050 planning documents, but in our opinion, there is still a substantial need for further development. One

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[31] Proposition 209 prohibits public agencies from using race, ethnicity, or gender as the basis for public employment, public contracting and public education and creates a significant challenge to implementing a racial equity/justice workforce agenda. However, it is possible to specify the type of knowledge and expertise required for positions.

frequent comment we encountered is a lack of standardization and a need for further refinement of those tools.

On the other hand, there appears to be little noticeable revisions to standard regional transportation modeling to explicitly include racial factors and dynamics. The profession lags behind what is technically possible based on the works of academic researchers.

Overall, internal capacity to measure equity analytically and develop modeling approaches vary as analytical staff often has limited knowledge about the causes, consequences, and magnitude of systemic racism. Racial equity analyses are often conducted separately and in a separate unit from the lead analytical teams, and those units tasked with advancing equity have little to no interactions with internal units responsible for modeling and projecting impacts of transportation decisions. Moreover, agencies often outsource part of the analytical work to consultants, indicating departments lack the capacity and expertise to internalize all aspects of modeling practices, and to incorporate equity considerations. However, those consultants face many of the same challenges such as data limitations and the general lack of equity-based models.

Situating institutional responsibility for addressing equity within transportation organizations is in flux, with assigned units or staff still working on developing procedures. This raises a question about whether equity responsibility should be centralized or decentralized. One could argue that both are desirable, but there are resource and practical constraints. Another organizational issue are the challenges in coordinating across units, particularly where there are separate equity and analytical/modeling units. Greater interaction is necessary because equity units do not have deep technical proficiency, and analytical/modeling units do not have deep knowledge of systemic racism.

Finally, there are variations between California and the three other states we analyzed in implementing racial justice goals and incorporating race into their professional practices. California appears to perform relatively well, with expressions of strong commitments from its leaders. We also found a willingness among analytical staff to support efforts to incorporate equity.[32] At the same time, other states like Washington are known to be more innovative in addressing systemic racism, and their efforts could be considered "best practices."[33] Still, progress across states in improving analytical and modeling practices is spotty.

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[32] An example of this is the current support provided by Caltrans' Planning and Policy Research unit to identify historical harm done to communities of color through freeway projects. Acknowledging past injustices is a necessary step for restorative justice.

[33] Washington and Minnesota are often considered early advocates of racial equity in transportation planning. Our interviews with Washington staff members indicate that this claim has validity. Puget Sound Regional Council, which includes Seattle, has a reputation for being an equity leader among MPOs.

Chapter VI: Conclusion and Recommendations

This report provides information and insights that could inform CalSTA and Caltrans' goal of transforming their agencies to promote racial fairness and equity in their investments, projects, programs, and policies. Eliminating systemic racism in transportation planning requires changes to fundamental norms, values, and practices to eliminate disparities in programs, allocations, and project outcomes. Professional analytical and modeling practices are core elements of the planning practices; therefore, these practices must be transformed so that racial equity is fully incorporated.

Not surprisingly, given that many of the commitments to racial justice are recent, incorporating equity into the institution and professional practice is at a very early stage, and best characterized as a work in progress.

The following recommendations are focused on concrete steps that can be implemented over the next year or two to enhance and strengthen the analytical and modeling capability and capacity of transportation agencies as a part of implementing a racial justice agenda (albeit not sufficient by themselves). Most are designed to contribute to institutional changes within planning agencies, both for California and other states. As mentioned early, these institutional improvements are critical to achieving the state's long-term ability to formulate and execute effective and fair policies, plans, funding, and programs. CalSTA and Caltrans should:

Adopt "best practices" from outside state agencies such as Washington, which has had a long history of addressing racial inequality, with a very active pro-equity staff. That state appears to have a longer history of active engagement with disadvantaged communities, and staff appears to be more willing to take self-generated initiatives to promote social justice. Both of these are probably due to a conducive institutional culture, which should be investigated in greater detail.

Adopt "best practices" from other state agencies and MPOs. At least one MPO has a more sophisticated transportation model, and its main consultant has expressed an interest in improving the model. Strengthen cross-agency interaction and collaboration with non-transportation departments, such as CARB, which is also very active in analyzing racial equity, which includes transportation elements.[34]

Work with other state agencies and MPOs to enhance data systems, and to standardize definitions of disadvantaged populations and neighborhoods, transportation disparity indicators, and relevant performance metrics. One concrete example is the transportation disparities data project funded by CARB, which has much to offer to California's transportation agencies.

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[34] We are aware of and have participated in recent and current efforts to coordinate inter-agency efforts around transportation and land-use planning to meet climate-change goals. There should be a formal multi-agency workgroup focusing on racial equity that includes outside experts, community stakeholders and justice advocates.

Fund research that assesses the implications of analytical techniques and models on racial equity.

Work with academics to enhance the ability of transportation models (and associated regional land-use and economic models) to incorporate racial differences, disparities, and behavior. The benchmark should be what is feasible based on published research and expert advice from scholars conducting cutting edge research.

Build capacity in existing units that helps staff develop expertise on systemic racism and its relationship to transportation planning. This includes sponsoring workshops, and other educational opportunities, for modeling staff to improve their knowledge of systemic racism. This should include research experts with demonstrated and deep understanding of both professional practice and proven innovative empirical and quantitative methods that explicitly incorporate race.

Encourage collaboration between equity and analytical units to develop and improve frameworks to assess equity performance in future transportation plans.

Recruit and hire transportation analysts with the requisite knowledge and background on systemic racism.

Work with universities and colleges to incorporate knowledge of systemic racism into the curricula in urban planning, civil engineering, and other transportation related fields, based on input and guidance from academic, professional and community stakeholders, so that transportation agencies will be able to recruit and hire analysts with training related to systemic racism.[35]

Develop legislation, policies and procedures that specify general parameters for incorporating equity considerations into analytical and modelling efforts. An example is the requirement for CARB to regularly evaluate and report on progress that has been made in meeting climate-change goals. Another example is the federal government's modeling requirements for MPOs and state agencies regarding data quality and acceptable methods. A similar checkoff list could be developed for modeling systemic racism.[36]

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[35] This is not the same as requiring students to accept the societal arguments of critical race theorists. It is to give students an understanding of the existence of racism, the forms it takes, relevant empirical studies, and methodological tools for equity analyses.

[36] This is not the same as allocating resources or setting up programs based solely on race, which is prohibited by Proposition 209. Disparity and equity analysis are ways to prevent *de facto* discrimination, which is prohibited by law. Analytical and statistical methods have been used to identify discriminatory outcomes in employment and housing. There are also elements of required equity analyses in some of climate-change legislation.

Continuously monitor and evaluate progress in implementing efforts to incorporate equity-analytical practices in their organizations, to diffuse effective practices through training to improve the capabilities of existing staff.[37]

The above steps are important and helpful, but certainly are not sufficient to bring about the necessary institutional changes to actualize a racial justice agenda. It will take years, perhaps decades, to eradicate racial inequality from transportation planning. While the transportation profession must put its own house in order, it should do so as a broader societal effort. Systemic racism is, after all, pervasive, appearing in multiple arenas (e.g., the labor market, housing, education). Regardless of how daunting the challenges, the struggle is integral to bending the trajectory of history towards justice.

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[37] One important lesson from the War on Poverty campaign is that even the well-intended policy fails without successful implementation (Pressman and Wildavsky 1984).

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Appendix A: Document Analysis Methodology

This appendix provides information on the documents analyzed, the method of analysis, and additional findings not in Chapter III.

Method: Content Analysis

We use an abbreviated content-analysis approach to assess the documents.[38] Our goal was not to analyze the entire document, but instead to identify where and how equity is discussed in the documents. The assessment began with a scan of the selected documentation with an intent of determining the goals, outcomes, and analytical procedures utilized in the reports. A word search for key terms was performed. Each instance of the key terms, along with the context of which they were discussed or applied, were noted by our team. A secondary scan took place in order to find terms that may serve as substitutes, complements, or alternatives to *racial equity*.

We used key and relevant terms that are associated with equity, particularly those related to race. Some terms were not used throughout the process when they proved to be too ambiguous. The initial list of terms included but were not limited to:

- Human Categorization

  - race
  - ethnicity
  - ethnic and/or racial groups
    - (e.g., African Americans, Black Latinos, Native Americans, etc.)
  - people and/or communities of color
  - American Tribal Indians and/or indigenous peoples and/or Native Americans

- Equity Key Words

  - racial equity
  - racial equality
  - racial justice
  - racial disparities

- Equity Alternative Words

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[38] For description of content analysis, see Hsieh and Shannon (2005), pp. 1277-1288. For application to transportation planning, see Bista, Hollander, and Situ (2021), pp. 1-11.

- ○ disadvantaged communities
- ○ underserved communities
- ○ low-income households and/or communities
- ○ marginalized communities
- ○ minority populations
- ○ environmental justice
- ○ vehicle miles traveled (VMT) reduction

After identifying where the search terms were located, we then evaluated the content in terms of the planning process, and subjectively assessed their importance. To gain an overview, we utilize a three-tier matrix tool system to record our observations. (See below for illustrative and generalized examples.) There are two matrices for each state: the first matrix determines the occurrence of race and equity in the report; the second matrix determines the extent to which equity is applied in analytical work. The state matrices are ordered by population size. For this project, we were particularly interested in if and how racial equity is articulated in analytical and modeling practices.

For the first matrix, colors record our judgment: dark blue represents in-depth, light cyan represents neutral, light blue represents superficial; the square is left blank if the sub-criterion is not mentioned. If a planning document incorporates any sub-criteria from "Human categorization" and "Equity Key Words" into their descriptive work or analytical work, it is shaded. The second matrix records the number of equity indicators from the sub-criteria ("Human Categorization," "Equity Key Words," "Equity Alternative Words") that are utilized in analytical work. If a planning document incorporates any sub-criteria from "Human categorization" and "Equity Key Words" into their analytical work, it is shaded.

Document Evaluation Matrices

Figure A.1. Evaluation Matrix for Equity Key Words

DOT Name	Report	Equity Key Words								
		Public Transit	Private Vehicle	Enviro Justice	DACs	Low Income	Under-served	Ethnic Racial Group	Stated Goal	Guided by Regulation
DOT for a state	Document 1									
	Document 2									
	Document 3									

DOT Name	Report	Scope of Equity Analytical Practice				
		Project Selection and Prioritization	Modeling Scenario Planning	Monitor Performance	Outcome Evaluation	Performance Measures
DOT for a state	Document 1					
	Document 2					
	Document 3					

State Planning Documents Reviewed

The 2050 transportation planning documents and supporting documents were identified through web searches and subsequent research, review of websites for state departments of transportation (CalTrans, TxDOT, WSDOT, and IDOT), and input from stakeholders. Along with the main 2050 plans, we also included supporting documents that include technical and equity-related reports when they are available. We also reviewed working drafts, which are not listed.

California

Low Carbon Transit Operation Program

California Department of Transportation. *FY 2020-2021 Low Carbon Transit Operations Guideline*. 2020, https://dot.ca.gov/-/media/dot-media/programs/rail-mass-transportation/documents/lctop/2021-03-lctop-fy20-21-final-guidelines-a11y.pdf

Transit and Intercity Rail Capital Program

California State Transportation Agency. *2020 Transit and Intercity Rail Capital Program Guidelines*. Oct. 2019, calsta.ca.gov/-/media/calsta-media/documents/tircp-2020-final-guidelines.pdf

CCIs: Investment Targets for Agencies Administering FY 2020-21 Funds

California Air Resources Board. *California Climate Investments: Investment Targets for Agencies Administering FY 2020-21 Funds*. Apr. 2021, https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/priority_targets_fy2021_revised.pdf

California Transportation Plan 2050

California Department of Transportation. *California Transportation Plan 2050*. Feb. 2021, https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/ctp-2050-v3-a11y.pdf

California Transportation Plan 2040

California Department of Transportation. *California Transportation Plan 2040*. June 2016, https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/f0004899_ctp2040_a11y.pdf

Climate Action Plan for Transportation Infrastructure

California State Transportation Agency. *Climate Action Plan for Transportation Infrastructure*. March 2021, https://calsta.ca.gov/-/media/calsta-media/documents/capti-2021-calsta.pdf

Supporting Documents

Low Carbon Transit Operation Program: Quantification & Methodology

California Air Resource Board. *Quantification Methodology: California Department of Transportation Low Carbon Transit Operations Program*. Dec. 2020, https://ww2.arb.ca.gov/sites/default/files/classic/cc/capandtrade/auctionproceeds/caltrans_lctop_finalqm_20-21.pdf

Transit and Intercity Rail Capital Program: Quantification & Methodology

California Air Resource Board. *Quantification Methodology: California Department of Transportation Transit and Intercity Rail Capital Program*. Oct. 2019, https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/calsta_tircp_finalqm_cycle4.pdf

Sustainable Transportation Equity Project

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Co-benefit Assessment Methodology Travel Cost Savings

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Table A.1. California Transportation Records

Transportation Plan	Findings
Low Carbon Transit Operation Program	*Race, racial equity, and racial inequality are not defined or mentioned in the LCTOP. It is not operationalized in analytical work. Equity in the form of disadvantaged communities, low-income communities and/or low-income households, and environmental justice were operationalized in analytical work.* Project eligibility prioritizes disadvantaged communities with a reduction in GHG emissions. Priority populations are central to the project selection process. The outcome evaluation is based on a questionnaire; equity is one of three evaluations and is ranked "LOW None or 1; MEDIUM 2 or 3; HIGH 4 or more". Performance is monitored through a semi-annual progress report and Caltrans must describe how the projects are in compliance with AB 1550 and SB 535.
Transit and Intercity Rail Capital Program	*Race and racial equity are not defined in the TIRCP. It is not operationalized in analytical work. Racial inequality is not defined in the TIRCP. Equity in the form of disadvantaged communities, low-income communities and/or low-income households, and geographic equity were operationalized in analytical work. Environmental justice was not mentioned but is used in evaluation criteria.* Project applications must provide a map of the project location with disadvantaged communities, low-income communities, and/or low-income households noted, along with a detailed explanation as to how these populations will benefit from the project. The detailed explanation and map are used in project evaluation. Secondary evaluation criteria states that public health should improve in disadvantaged communities, low-income communities, and/or low-income households, and an air quality report should be submitted. Project selection will consider these criteria, along with how well the project will incorporate geographic equity and how beneficial it will be to disadvantaged and/or low-income communities. These benefits must be detailed in a quarterly project report as well.
CCIs: Investment Targets for Agencies Administering FY 2020-21 Funds	*Race and racial equity are not defined in the CCI. It is not operationalized in analytical work. Racial inequality is not defined in the CCI. Equity in the form of disadvantaged communities, low-income communities, and low-income households were operationalized in analytical work.*

Transportation Plan	Findings
CTP 2050	*The term race, people of color, and communities of color are used throughout the report. Race is also referred to in the broad term of social equity. While race is not given a definition, it is used in the Demographic Trends page (32) where it lists the racial and ethnic diversity of California.* **Race is used as a performance measure in "Access to destinations by income quintile and race" and "Transportation and housing cost burden by income quintile and race"**. *Racial inequality is not given a proper definition, but the report lists many disparities that communities of color experience.* *In the report, some compliments to race include social equity, environmental justice Alternative definitions of race in the CTP 2050 analytical work include: road pricing, land use, rail plan, telework, VMT.*
CTP 2040	*Race is not given a proper definition but is exemplified through the Demographic Trends (55) where it lists the racial and ethnic diversity of California. Racial equity is not defined or mentioned in the CTP 2040. It is not operationalized in analytical work. Racial inequality is not defined in the CTP 2040. Alternative definitions of equity include: GHG emissions, VMT, Trips, GSP, VHD, Income, Mode Split, demand management, travel cost, and operational efficiency.*
Climate Action Plan for Transportation Infrastructure	Restates the state's commitment to and goal for social and racial equity. More explicit statements regarding partnering with communities and advocates, establishing "Transportation Equity and Environmental Justice Advisory Committee(s)," and developing and utilizing equity indicators to prioritize and evaluate projects. Nothing on long-term transportation modeling.

Table A.2. California Transportation Reports' Technical/Financial Elements

Transportation Plan (Technical Element)	Findings
Low Carbon Transit Operation Program: Quantification & Methodology	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include: VMT, efficiency (input to determine project prioritization).* • LCTOP largely provides funding guidelines for GHG and job co-benefit projects receiving money from the Greenhouse Gas Reduction Fund (GGRF). The

Transportation Plan (Technical Element)	Findings
	quantification methodology was developed in part to estimate and avoid GHG emissions generated from transit operations and capital projects. Among the fourteen indicators used in the LCTOP benefits calculator, nine environmental equity indicators related to GHG emissions, along with efficiency, VMT equity indicators. • Of the 15 projects eligible to request GGRF funding under LCTOP, (as listed below) 80 percent are related to new transit service or increased ridership. • The scope of the analytical practice is largely focused on project selection and prioritization.
Transit and Intercity Rail Capital Program: Quantification & Methodology	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include: VMT (input to determine project prioritization).* • The TIRCP quantification methodology provides guidance to estimate GHG reduction and avoidance from transit capital projects. TIRCP Benefits calculator tool was developed to forecast outcomes, inform, and track outcomes of each project selected to receive funding from GGRF. • Eligible projects for funding are new transit, system improvements, cleaner vehicles, energy/fuel reduction for intercity, commuter, train, bus ferry, shuttle, and vanpool transit system modes of transportation. • Of the eligible projects, system improvements and fuel/energy reduction include vehicle miles traveled reduction as an equity variable to calculate project benefits.
Sustainable Transportation Equity Project Co-benefit Assessment Methodology Travel Cost Savings	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include affordability, VMT and environmental justice equity (inputs to determine project prioritization).* • The STEP benefits calculator was developed to provide guidance for estimating GHG emission reduction from clean transportation projects. The STEP benefit calculator can also be used to estimate total project "GHG emissions reductions per dollar of GGRF funds requests." • Of the nine input variables used to determine project eligibility, **affordability** (travel cost savings) and VMT equity indicators are considered along with five **environmental equity indicators** (GHG emissions).

Transportation Plan (Technical Element)	Findings

	• Projects eligible for funding include active-transportation, fixed-route transit, and shared mobility (pg. 4)
	    ○ Active-Transit: bicycle, pedestrian, and street infrastructure (i.e., crosswalks and sidewalks.
	    ○ Fixed Route Transit: transit station, transit right-of-way, transit operation improvements etc.
	    ○ Shared Mobility: car share, rideshare, vanpooling etc.
	• Targeted populations, community needs, and equity thresholds are not defined or included in the benefit calculations.

CTP 2050: Technical Analysis Element	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include affordability equity (travel costs inputs were included in analytical work).* The CTP 2050 Technical Analysis does not incorporate many equitable terms into their report, and when they do, the terms are usually superficial. Environmental justice was mentioned once as "emerging values and priorities" for the Technical Advisory Committee. There was no mention of DACs, underserved communities, or ethnicities or racial groups. Equity is found as a performance measure for Economic Impact Outcomes related to road user charges to reduce VMT. **Equity is defined as an economic output for socioeconomic groups in terms of Household Transportation Costs, and Wage Effects.** Although the TREDIS economic model includes the travel costs module with affordability equity indicators, the market access module and benefit costs module are largely used to observe impacts on industries and differences between regions rather than determine socioeconomic impact of investments at the neighborhood level (pg. 24). Travel cost assessments defined in the CPT 2040 are not mentioned or referenced. Difficult to determine if the CTP 2050 travel cost assessments are iterations from previous calculations.
CTP 2040: Technical Analysis Element	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include affordability equity (transit strategies were assessed across different household income groups).* Analysis to evaluate GHG reduction and economic development strategies were conducted using California Statewide Travel Demand Model (CSTDM), CARBs emissions factor and vision model, and the Transportation Economic Development

Transportation Plan (Technical Element)	Findings
	Impact Software (TREDIS). Of the three GHG reduction strategies outlined in the plan (demand management, mode shift, travel cost, operational efficiency), an equity analysis scenario was developed for the travel cost strategy using the CSTDM. Given that congestion and corridor pricing was calculated to increase travel cost, pricing and transit strategies were assessed to determine the impact on different income groups. When travel costs strategies were observed in relation to improved transit services changes to mode shares for low-income private vehicle owners decreased by 4 percent. Overall, the scenario concluded impacts from travel cost strategies can be mitigated by increased transportation accessibility. However, inputs used to calculate the equity outcomes are not included in the report. Racial equity is not meaningfully included in the analytical practices.
California Statewide Freight Forecasting and Travel Demand Model	*CSF2TDM* is the only technical document in the California 2050 planning cycle that utilizes race as part of their analytical practices. The report uses "Race breakdown" data along with other variables from the American Community Survey's 2015 Population Targets as an input for "Socioeconomic Data'' modeling (*CSF2TDM*, 2-2). Ethnicity in the traffic analysis zone (TAZ) level is used as a person-level control variable. The report determined the TAZ level by pulling data on race and ethnicity in post-secondary school enrollment from the Fall 2015 school enrollment survey and comparing that with the coordinates of each institution. The resulting map shows the county-level school enrollment density from 2015 (*CSF2TDM*, 2-6).
Co-benefit Assessment Methodology Travel Cost Savings	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include affordability equity (inputs to assess overall cost of travel for users).* • "Travel cost savings refers to a change in the overall cost of travel for users of the transportation system who receive a subsidy for travel (e.g., transit voucher) or switch travel modes (e.g., switch from driving a car to riding mass transit, biking, or walking) as a result of a California Climate Investments project." • "Co-benefit Assessment Methodologies are intended for use by administering agencies, project applicants, and/or funding recipients to estimate the outcomes of California Climate Investments." • Eligible projects for funding include:

Transportation Plan (Technical Element)	Findings

	o Mode shift projects- ("Projects that result in users switching their mode of travel)
	           ■ Transit service expansion, infrastructure, or voucher
	           ■ Active-transportation infrastructure such as crosswalks and sidewalks
	       o Travel Subsidy (reduce cost of travel)
	           ■ Car share, rideshare or vanpooling type mobility options
	           ■ Affordable Housing, transit-oriented development.
	• Relevant travel cost equity indicators used in calculations include VMT, Transit fare, Number of trips funded by voucher, cost per mile.

Table A.3. Texas Transportation Reports

Transportation Plan	Findings
Texas Transportation Plan 2050	*Racial equity is not defined or operationalized in analytical work. The report prioritizes private vehicle ownership and infrastructure expansion to rural areas. This was found in the stated goals, regulation, outcome evaluations, and performance measures. Project selection also included public transit. Performance measures were found included under-served communities (Historically Underutilized Businesses (HUB) Attainment) and disadvantaged communities (Disadvantaged Business Enterprises (DBE) Attainment).*
2050 Statewide Transportation Report	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include: VMT (to attain regional equity).*
Transportation Planning and Programming	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include disadvantaged communities and low-income communities, bundled together as "Economically Disadvantaged County" (project selection).*

Transportation Plan	Findings
Statewide Long-Term Plan-Transportation Planning and the Environment 2021-2025	*Racial equity is not defined or operationalized in analytical work. Alternative definitions of equity include environmental justice, underserved communities, and low-income populations.*

Table A.4. Washington Transportation Reports

Transportation Plan	Findings
Washington Transportation Plan: 2040 and Beyond	***How is race and racial equity defined? What are the metrics or goals? Is it operationalized in analytical work?*** *Race and racial equity are not defined. There is no analytical work in this report.* ***How is racial inequality defined? What disparities are considered?*** *Racial inequality is not defined. Race in the context of racial inequality is used in a long-term strategy recommendation to the Support System Safety Statewide about "racial disparities in traffic safety" (p. 49).* ***Are there other definitions of equity as a compliment or substitute?***
The Highway System Plan's Approach to Equity	***How is race and racial equity defined? What are the metrics or goals? Is it operationalized in analytical work?*** *Race and racial equity are not explicitly defined in the report but are referenced in the* <u>*GARE Racial Equity Toolkit*</u>*. The report uses the toolkit as a six-step data analysis tool. One goal is to balance state investments in a way that "Protects and improves health, safety, and accessibility outcomes for overburdened populations, especially communities of color, populations with limited English proficiency, low- income communities, and persons with disabilities" (p. 2).*

Transportation Plan	Findings
	How is racial inequality defined? What disparities are considered? Racial inequality is not defined. Disparities used in the analysis include the <u>Environmental Health Disparities Map</u> (p. 4) and the Statewide Accessibility Gap Maps (p. 4). **Are there other definitions of equity as a compliment or substitute?** Complement: environmental justice (to inform project selection criteria). Substitute: service equity improvements (to evaluate and measure reductions in disparities).

Table A.5. Illinois Transportation Reports

Transportation Plan	Findings
Long Range Transportation Plan Introduction	**How is race and racial equity defined? What are the metrics or goals? Is it operationalized in analytical work?** Race, racial equity, and racial inequality are not defined or operationalized in analytical work. **How is racial inequality defined? What disparities are considered?** **Are there other definitions of equity as a compliment or substitute?** Complement: underserved communities, private vehicle ownership, and environmental justice. Substitute:
Long Range Transportation Plan Livability Chapter	**How is race and racial equity defined? What are the metrics or goals? Is it operationalized in analytical work?** Race, racial equity, and racial inequality are not defined.

Transportation Plan	Findings
	How is racial inequality defined? What disparities are considered? ***Are there other definitions of equity as a compliment or substitute?*** *Complement: underserved communities, private vehicle ownership, and environmental justice.* *Substitute:*
FY 2022-2027: Proposed Highway Improvement Program	*Race, racial equity, and racial inequality are not defined or operationalized in analytical work.*
Statewide Planning & Research Funds Fiscal Year 2021 Program Guidance	*Race, racial equity, and racial inequality are not defined.* *Complement: Geographic diversity and disadvantaged, economically distressed community (inputs for project prioritization).*

Appendix B: Interview Methodology

Introduction

To gain additional insights for this report, we conducted a series of semi-structured interviews with key staff and other stakeholders about how equity is or is not incorporated into the operations of the state transportation agencies in California (CalSTA, Caltrans, CARB), Texas (TxDOT), Washington (WSDOT) and Illinois (IDOT). The following section summarizes the interview approach, information about the agencies interviewed and the key questions used for this study.

The intended interviewees for each state agency were staff members focused on transportation equity or analytical modeling practices. Organizational charts were used to identify and select staff within planning or research units. Since these agencies are large, we interviewed people in related departments or external stakeholders to collect insight from different perspectives. The project team initially interviewed CalSTA agency executive staff, which oversees transportation-related departments within the state. We then assessed and revised the approach for the remaining agencies. The sample was created through a snowball effect in which agency practitioners suggested other people at their agency or others to interview for the study.

In reviewing the organizational charts of the four states we found, equity unit locations within agencies vary, ranging from planning and modal departments to the freight transportation branch. Compared to the other three states, Caltrans has a single dedicated equity unit within the planning and modal programs department to support the agency's initiatives. WSDOT equity focus is dispersed between three departments, the office of equal opportunity, multimodal department and delivery, and mega programs & urban mobility & access. While TxDOT current initiatives derive from the freight transportation branch. We were unable to determine where the equity unit is located within IDOT.

Overall, we interviewed twenty-one practitioners across six transportation agencies and a research institution: California State Transportation agency, California Department of Transportation, California Air Resource Board, Washington Department of Transportation, Texas Department of Transportation, United States Department of Transportation and the Center for Business and Economic Research at Western Washington University. Despite our outreach attempts, we were unable to get in contact with staff at the Illinois Department of Transportation (Table B.1). includes more information about the staff members that were interviewed.

An interview guide was designed to pose questions about their scope of work, and professional input about the future of equity practices in analytical work. These interview guides were designed to understand current opportunities and challenges related to incorporating racial equity in modeling practices. The meetings were conducted remotely through Zoom and the interviews averaged around one hour.

Interview Guide

The project builds on protocols previously used to inventory and assess MPOs in California on their data and modeling practices. (Those projects have been supported by California Air Resources Board and Caltrans.) The project modified the research design and method by asking questions related to racial equity, along with questions related to organizational structure and interactions among units, and to analytical practices. The questions listed below merely cover potential topics, and the procedure is not rigid nor mechanical. The approach is more conversational, allowing the interviewees the opportunity to pursue items they deem to be important.

INTERVIEW GUIDE FOR PRACTITIONERS IN CALIFORNIA
1. How does your department determine equity performance metrics for projects?
2. How does your department interact with the modeling units?
3. How does your department determine equity performance metrics for infrastructure investments?
4. What type of modeling is grounded in monitoring the outcome of distribution of benefits and what forms does it take?
5. Can you share any documents about the transportation models?
6. How does Caltrans collaborate with other agencies on developing the same or similar analytical techniques in guiding the selection of projects and investments?
7. Are there other people or departments we should contact as it relates to the project?
8. Are you in contact with other equity-oriented teams in TX, WS, or IL?
9. Anything in this project we should highlight to support your work

INTERVIEW GUIDE FOR PRACTITIONERS IN WASHINGTON
1. Can you tell us a little more about the equity initiatives at WSDOT?
2. How does WSDOT determine equity performance metrics for infrastructure investments?
3. How does your office work with the transportation modeling unit?
4. Do you work with consultants for analytical work?
5. Are there other performance measures the department looks at to determine how populations fare?
6. Where do you think the department is headed regarding equity in transportation planning?
7. Can you share any documents about your transportation models?
8. Anything else you would like to share to help inform our project?

INTERVIEW GUIDE FOR PRACTITIONERS IN TEXAS
9. Can you tell us a little more about the equity initiatives at TxDOT?
10. How does TxDOT determine equity performance metrics for infrastructure investments?
11. How does your office work with the transportation modeling unit?
12. Do you work with consultants for analytical work?
13. Are there other performance measures the department looks at to determine how populations fare?
14. Where do you think the department is headed regarding equity in transportation planning?
15. Can you share any documents about your transportation models?
16. Anything else you would like to share to help inform our project?

IRB Application (Select Relevant Parts, Original Questions in Italics)

Key personnel and study staff below

1. *Principal Investigator:*

   a. Name: Paul Ong

   b. Principal Investigator UCLA Department: School of Public Affairs

   c. Protocol's UCLA Home Department: School of Public Affairs

2. *If there will be other types of personnel working directly under the PI's supervision on aspects of the study, provide their name, title and institution, indicate their responsibilities, training and qualifications and complete Item 2.1. Please also indicate, if applicable, whether that person will obtain consent, manage device accountability, have access to personally identifiable information and/or have access to the code key.*

   a. *Name, title, institution:*

   Chelsey Bryant, Master of Urban and Regional Planning student, UCLA

   b. *Study role(s): e.g., conduct interviews/surveys, recruit participants, obtain consent, review records, etc.:*

   Will analyze data from agency reports, synthesize literature and write-up findings.

Type of Study Review

1. *Indicate the level of risk involved with this study.*

   Minimal risk or no known risks

2. *Indicate the type of review that you are requesting for this study.*

   Certificate of Exemption from IRB review

3. *Is this a COVID-19 research proposal that falls under the following scope:*

   No

Lay Summary and Keywords

1. *Provide a brief lay summary describing this study. (limit 500 words).*

   This project will assess documents related to transportation analysis and modeling to evaluate if racial equity is incorporated and if incorporated how. The project examines these practices in four states:

California, Texas, Illinois, and Washington. The project will collect the relevant documents through literature search (e.g., Google Scholar), agency websites, and also information about documents and professional practices from key individuals. The project will produce a publicly available report summarizing the assessment of documents and professional practices. Keywords include:

List three to five keywords describing this study (separate the words with commas). The keywords may be used for identifying certain types of studies. Transportation modeling, transportation analysis, racial equity

Is this study conducted or supported by HHS (e.g., the National Institutes of Health, Centers for Control and Prevention, etc.)? No

Privacy and Confidentiality

1. ***Privacy: How will the investigator maintain privacy in the research setting(s)? (e.g., interviewing participants in a room or area where conversations cannot be overheard by others, or conducting medical procedures in an examination room, or behind a curtain in an emergency room).***

   The discussion will be conducted by secure video conferencing software or telephone. Participants can schedule the meeting for a time that allows them to talk in privacy and can choose the location where they take the call/video to ensure privacy. Participants can choose which option, telephone or video call, they prefer.

2. ***Confidentiality: If the protocol will collect and maintain identifiable data, explain how the planned safeguards to maintain confidentiality of identifiable data and data security are appropriate to the degree of risk from disclosure.***

   There will be no audio files recorded from the conversations. If necessary and depending on the length of the conversation, notes of the information provided will be taken and stored on encrypted Google Drive cloud storage, in a folder that can only be accessed by the approved, trained study staff above via their passworded UCLA Google accounts with two-factor authentication.

Study Summary- Research Study

1. **Specific Aims: Indicate the purpose of the research, specifying the problems and/or hypotheses to be addressed.**

   The purpose of this project is to assess documents related to transportation analysis and modeling to evaluate if racial equity is incorporated and if incorporated how. The project examines these practices in four states: California, Texas, Illinois, and Washington. The project will collect the relevant documents through literature search (e.g., Google Scholar), agency websites, and also information about documents and professional practices from key individuals. The project will produce a publicly available report summarizing the assessment of documents and professional practices.

The project's results will help identify potential actions to enhance the capability and capacity of state transportation departments to integrate race and inequality into their technical and analytical practices. This project will facilitate this institutional improvement by assessing the efforts in the four states.

2. *Background and Significance: Provide a summary of the background for this study and explain how it will contribute to existing knowledge.*

Analyzing modeling efforts is important because technical practices indicate how equity is integrated in transportation policy. The findings will provide a baseline understanding to improve current equity practices which will trace and estimate racial impacts from major infrastructure projects.

3. *Research Design and Methods: Describe in detail the design and methodology of the study.*

Task 1: Critical Literature Review

Project staff will undertake a literature review on the topic of transportation modeling and equity. The project will synthesize the findings and identify key studies with relevant results for the other tasks below.

Task 2: Analyze technical documents including the types of input data and modeling practices.

To assess the degree of equity on transportation in California, project staff will analyze what datasets are used by public agencies and identify potential gaps in the set of variables used in the transportation models.

Task 3: Project Discussions

After assessing the degree of equity on transportation practices, the project team will conduct conversations with staff and stakeholders in relevant departments. The project team will contact the California State Transportation agency staffers, which oversees transportation-related departments within the state. We will also contact transportation agencies in three other states, Texas, Washington, and Illinois. For the Texas Department of Transportation, Washington State Department of Transportation, and Illinois Department of Transportation we will contact relevant staff members who conduct the modeling exercise. The project will ask about infrastructure projects, equity guidelines, results, and other publicly available or requestable information related to the transportation models, not about the staffer themselves. In other words, the practitioner isn't the subject of the interview; the transportation models are the project's focus.

The project does not involve human subject research and therefore is exempt. This research only includes interactions involving discussions, in which any disclosure of the staffers' responses outside the research would not reasonably place the staffer at risk of criminal or civil liability or be damaging to the staffer's financial standing, employability, educational advancement, or reputation.

Task 4: Development of Policy Recommendations

From the results of all the prior tasks, the project team will develop a series of recommendations on how transportation agencies in California can adopt best practices for an equitable transportation agenda. These policy responses will be actionable and tailored to the unique context of equity and transportation in California, as informed by the project discussions.

Task 5: Final Report and Policy Brief

The project team will develop and submit a final report that details all aspects of this research project. The team will also produce and submit a policy brief that summarizes the most significant findings.

Characteristics of the Study Population

1. *Is this an observational or ethnographic study for which the number of participants observed or interviewed cannot be determined in advance.*

   No

2. *If you answered "no" to item 1.0, indicate the maximum number of study participants you hope to enroll:*

   Approximately 15 staffers

3. *How many participants do you expect you will need to recruit, consent and/or screen to meet the target number above?*

   20 potential staffers

4. *Indicate the specific inclusion criteria for enrollment of each of the groups of research participants in this study. If there are any inclusion criteria based on gender, pregnancy/childbearing potential, race, ethnicity, or language spoken, explain the nature of and scientific rationale for the inclusions.*

   Civil servants/staff at relevant public agencies with knowledge of the agency's technical practices around equity at four state agencies, California Department of Transportation, Texas Department of Transportation, Washington Department of Transportation, Illinois Department of Transportation— plus one or two other agencies whose technical practices are particularly interesting, successful, or helpful to share.

5. *Indicate the specific exclusion criteria for each of the groups of research participants in this study. If there are any exclusion criteria based on gender, pregnancy/childbearing potential, race, ethnicity, or language spoken, explain the nature of and scientific rationale for the exclusions.*

   Not meeting the criteria above

6. *How (chart review, additional tests/exams for study purposes, etc.), when and by whom will eligibility be determined?*

Eligibility for the discussion will be determined by the principal investigator's judgment, based on the criteria above and recommendations from agency leadership as to which staff to contact.

Characteristics of Study Population

1. *Indicate the age range of the study participants.
18 years or older

2. *Indicate if any of the following populations/specimens will be specifically recruited/obtained for the study.
Adults who are competent to give informed consent

3. * Is it possible that there may be non-English speakers enrolled in this study or children whose parents are non-English speaking?
No

Risk & Benefits

1. *Are there any potential direct benefits (physical, psychological, social, or other) to study participants?*

No

2. *Describe the potential benefits to society including the importance of the knowledge to be gained.*

Analyzing how race and equity are integrated in transportation models is important because existing models are unable to identify, trace and estimate racial impacts from major infrastructure projects. The findings will provide a baseline understanding of current equity practices which will in turn identify both challenges and opportunities for enhancing performance metrics and implementing transportation modeling practices.

3. *RISKS/BENEFIT ANALYSIS: Indicate how the risks to the participants are reasonable in relation to anticipated benefits, if any, to participants and the importance of the knowledge that may reasonably be expected to result from the study: The importance of this project to best address race and equity in transportation technical and analytical practices should accord great weight to the study's societal benefits.*

The transportation agencies will benefit themselves from the results of the study and the best practices found, as they do their own work. The relatively low reputational risk described above should be outweighed substantially by these benefits.

4. *Indicate the alternatives to participating in this study.*

All types of studies-- Chose not to participate in this study

Recruitment Methods

1. *Please upload copies of your recruitment materials below. This includes advertisements, flyers, internet postings, recruitment scripts and* <u>*letters/emails*</u>*.*

2. *If you have indicated that study participants will be recruited with advertisements/flyers (Section 18.1/Item 1.0), please indicate the type of media that will be used (e.g., newspaper, radio, internet, etc.) and/or where information will be posted or distributed. Direct Recruitment*

3. *If you have indicated that participants will be recruited through direct contact (Section 18.1/Item 1.0), please provide the following information:*

    a. *- A description of how, when, and where initial contact would be made (e.g., in a public setting, in a waiting room, via a phone call, via a letter, via the internet, etc.)*

    b. *- If applicable to the study, indicate how the potential research participant's privacy will be maintained.*

    c. *- Who will make the contact (e.g., the investigator, a patient's physician, etc.)*

Potential participants will be e-mailed by the Principal Investigator or research team members asking them to participate in a discussion. These contacts will be done via e-mail, which is secure and private.

4. *Recruitment Letters and Emails:*

    If you have indicated that recruitment letters will be distributed to participants (Section 18.1/item 1.0), please indicate who will send out the recruitment letter (i.e., will it be the investigator or other persons who have authorized access to the information), how inquiries will be handled, and if there will be follow-up contacts.

The Principal Investigator or research team members will e-mail potential staffers and will respond to any resultant inquiries by e-mail. They may also send follow-up e-mails before or after the discussion to clarify items, etc.

5. *Referrals*

    If you have indicated that study participants will be identified from referrals (Section 18.1/item 1.0), please indicate the source of the referral (e.g., friends, other participants, healthcare providers) and how the referral will be elicited.

Agency practitioners may suggest other people at their agency or others to have a conversation with the research team; the research team will ask them for suggestions.

Table B.1. Interviewees

California			
Name	**Agency**	**Title**	**Date**
Avital Barnea	CalSTA	Deputy Secretary, Transportation Planning	April 8, 2021
John Thurston	Caltrans	Branch Chief, Statewide Long-Term Planning	April 19, 2021
Darwin Moosavi	CalSTA	Deputy Secretary, Environmental Policy and Housing Coordination	April 29, 2021
Amar Azucena Cid	Caltrans	Program Manager, Office of Race and Equity	May 6, 2021
Nicole Dolney	CARB	Branch Manager, Air Quality Planning and Science	May 11, 2021
Carey Knecht	CARB	Supervisor, Sustainable Transportation and Communities	May 11, 2021
Jeanie Ward-Waller	Caltrans	Deputy Director, Transportation Planning and Modal Programs	May 18, 2021
Washington			
Name	**Agency**	**Title**	**Date**
James McCafferty	Western Washington University	Director of Center for Business and Economic Research	April 22, 2021
Jackie Bayne	WSDOT	Policy Manager, Office of Equal Opportunity	April 26, 2021
Jeremy Jewkes	WSDOT	Highway System Plan Manager, Multimodal Planning and Data Division	May 10, 2021
Kyle Miller	WSDOT	Transportation Planner, Statewide Planning Office	May 10, 2021
Karena Houser	WSDOT	Transportation Planner, Statewide Multimodal Planning	May 10 , 2021
Larry Watkinson	WSDOT	Deputy Director, Office of Equal Opportunity	May 10, 2021
Celeste Gillman	WSDOT	Deputy Director, Regional Transit Coordination Division	May 18, 2021
Lisa Ballard	WSDOT	Integration Planner, Regional Transit Coordination Division	May 18, 2021
Phillip Harris	WSDOT	Light Rail and Access Integration Planner	May 18, 2021
Zachary Howard	WSDOT	Transit Coordination Planner	May 18, 2021
Dan Hoyt	WSDOT	Planning Manager, Regional Transit Coordination Division	May 18, 2021

Texas			
Name	**Agency**	**Title**	**Date**
Kale Driemeier	TxDOT	Freight, Trade & Connectivity Section, Transportation Planner	May 4, 2021
Sondra Johnson	TxDOT	Freight Transportation Planner	May 4, 2021
United States			
Name	**Agency**	**Title**	**Date**
Florence Chen	USDOT	Special Assistant for Policy	April 5, 2021
Illinois Department of Transportation (unresponsive)			
Name	**Agency**	**Title**	**Date**
Holly Bieneman	IDOT	Chief, Bureau of Planning	n/a
LaDonna Rowden	IDOT	Acting Chief, Bureau of Research	n/a

Appendix C: List of Experts Consulted

Professor Paul Ong, Director of the UCLA Center for Neighborhood Knowledge (CNK). has a doctorate in economics. His research focuses on the urban spatial structure, race and economic inequality, and urban labor market disparities. Professor Ong and his colleagues have done seminal work on spatial-transportation mismatch and racial inequality. He has served on advisory committees or as a technical advisor for federal, state, regional and local agencies. He currently works with the Air Resource Board to develop neighborhood-level indicators on transportation disparities. He is also leading the COVID-19 Equity Research Initiative to analyze how the crisis has reproduced and exacerbated systemic inequalities for people of color and the poor.

Professor Gian-Claudia Sciara (University of Texas) is a nationally recognized expert on transportation funding and decision making, particularly at the regional scale. She has led key assignments for state transportation departments, including an award-winning work for Caltrans on Statewide Advance Mitigation Funding and Financial Strategies. She was the lead researcher for the interviews and survey of MPOs in California.

Dr. Silvia R. González (UCLA) is senior researcher for community-based and environmental equity at UCLA's Luskin Center for Innovation. She brings extensive experience as a researcher and consultant with nonprofit, community-based, and government organizations on projects related to neighborhood change and gentrification, anti-displacement policies, environmental equity, and climate planning. She is an expert in multi-level spatial modeling of racial disparities. Dr. Gonzalez has collaborated with CNK and UCLA's Latino Policy & Politics Initiative on projects examining multiple dimensions of racial inequality.

Professor Tierra Bills (Wayne State University and UCLA) is a national recognized scholar with expertise on the socioeconomic impacts of transportation decisions. Her research includes equity analysis, travel behavior modeling, community-based data collection and transportation-performance measurement. Dr. Bills uses an activity-based travel-demand modeling approach to investigate individual and household-level transportation-equity effects. Her goal is to generate insights to enhance transportation systems to provide more equitable returns to society.

Professor Alex Karner (University of Texas) His research critically examines transportation planning practice to achieve progress towards equity and justice. He conducts research on accessibility, civil rights and environmental justice, and travel demand modeling that incorporates race/ethnicity. He collaborates extensively with community stakeholders to identify pressing research needs and improve conditions in communities experiencing transportation disadvantage.

Appendix D: Examples of Transportation Equity Studies

Authors	Summary
Bills et al. (2012)	The study explores how well activity-based models capture heterogeneity across target groups.
Bills & Walker (2017)	This paper shows that distributional comparisons are useful for equity analysis of large transportation improvements relative to average measures.
Caggiani et al. (2017)	The paper discusses limitations with the Transportation Network Design Problem (TNDP) and proposes to include flexible equity constraints as a performance indicator.
Camporeale et al. (2019)	The paper investigates the application of a two-step method (starting candidate route set and optimal candidate route set generation) to the public transport network design, to understand the correlation between overall costs of transit systems and the level of equity.
Delbosc & Currie. (2011)	This study discusses the use of the Gini index to assess equity of public transit service.
Dixit et al. (2021)	This study highlights the role of transit network design in determining the equity outcomes of travel time and fare paid in a network.
Karner & Golub (2019)	This chapter develops and tests a proposed method to assess the equity impacts of a transportation investment program.
Legrain, et al. (2016)	This article examines if job location and job type concentration (using a gravity approach method) correlate with transit use for low-wage workers.
Ong and Pech, 2021	This paper examines how spatial and transportation mismatch lowers enrollment in early childhood programs for children in disadvantaged households.
Ong and Gonzalez (2019)	This book includes a chapter examining the causes of transportation racial disparity and the impact on employment.
Ong and Stoll (2007)	This article examines systematic inequality in automobile insurance premiums, where rates are higher in disadvantaged neighborhoods even after accounting for risk and other factors.
Rowangould, et al. (2016)	This article presents three approaches to identifying environment-justice communities.
Welch (2013)	The article examines whether subsidized housing programs achieve major policy objectives of providing equitable transit access to vulnerable groups.
Wu, et al. (2019)	This article presents a method to model health equity in active transportation planning.

(Placeholder page, to be replaced by UCLA ITS in final outline)