

SB 743 Implementation: Challenges and Opportunities

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16. Abstract California's Senate Bill (SB) 743, enacted in 2013, marks a historic shift in how the traffic impacts of development projects are to be evaluated and mitigated statewide. To help achieve state climate policy and sustainability goals, SB 743 eliminates traffic delay as an environmental impact under the California Environmental Quality Act. State implementing guidelines for SB 743 instead require an assessment of vehicle miles traveled (VMT). The adoption of the guidelines sparked debate and raised far-reaching questions about development planning. Our research consisted of four parts. First, we considered how the state guidelines might be applied by analyzing travel patterns across and within California cities in relation to the guidelines. We also interviewed forty-three professional transportation consultants and regional and local planners to provide insights on SB 743 implementation. In addition, we carried out extensive case studies of San Francisco and Pasadena, where policies had already been adopted to align with SB 743. Finally, to help assess the technical challenges involved in SB 743 implementation, we tested two VMT estimation tools in common use and considered the practical challenges facing tool users. We find that SB 743 implementation is likely to present some transitional challenges for city planners, but the long-term prospects for improving transportation planning as a result of the law are promising.					
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TABLE OF CONTENTS

DISCLAIMER STATEMENT	i
FIGURES AND TABLES	v
EXECUTIVE SUMMARY.....	i
Dynamics of Senate Bill 743	ii
VMT patterns and perceptions of SB 743 by community type	ii
Policy and planning impacts: Long and short-run effects of SB 743	iv
Technical and legal concerns.....	vi
Tools-testing analysis	viii
Conclusion	ix
Chapter 1. INTRODUCTION	1
Chapter 2. UNDERSTANDING SB 743: HISTORICAL AND POLICY CONTEXT	5
California’s climate policies for reducing VMT.....	5
<i>Basics of Senate Bill 375</i>	6
<i>Limitations of SB 375 and the need for supportive policies</i>	6
<i>Recent developments in California climate policymaking to reduce VMT</i>	7
Assessing VMT reduction strategies.....	8
Chapter 3. BASICS OF SB 743 AND HOW IT MODIFIES CEQA REQUIREMENTS.....	13
CEQA’s role in the development process	13
<i>Basics of CEQA compliance</i>	13
<i>CEQA controversies</i>	15
<i>SB 743 and CEQA’s role in the development process</i>	17
Level-of-service standards.....	18
<i>Problems with LOS</i>	19
Provisions of SB 743	20
<i>Methods for estimating VMT</i>	21
<i>Recommended thresholds of significance</i>	21
<i>Provisions regarding plan-level thresholds</i>	23
<i>Some additional provisions</i>	23
<i>Mitigation</i>	24
Conclusion	24

Chapter 4. CHALLENGES AND OPPORTUNITIES OF SB 743 IMPLEMENTATION: FINDINGS FROM OUR QUALITATIVE RESEARCH	25
General perceptions of SB 743 and the shift from LOS to VMT.....	26
Technical aspects of VMT analysis under SB 743.....	29
<i>Tools for VMT analysis: the sketch tool option</i>	29
<i>Trade-offs between using sketch tools and travel demand models for VMT analysis</i>	30
<i>Tool combinations</i>	32
<i>Screening techniques as a technical solution</i>	33
<i>Comparing technical approaches by city type</i>	33
Legal concerns	34
<i>Legal concerns related to estimation of impacts and mitigation methods</i>	35
<i>Legal concerns about aligning plan- and project-level thresholds of significance</i>	35
Will SB 743 lead to better transportation planning? Connecting plan-level strategies to project review..	37
<i>Making the VMT-TDM-complete streets connection: Impact fees and TDM ordinances</i>	38
<i>Retaining LOS standards through “off-CEQA” provisions</i>	39
Conclusion	41
Chapter 5. SAN FRANCISCO AND PASADENA CASE STUDIES	42
San Francisco case study	42
<i>Motivations for San Francisco’s Transportation Sustainability Program</i>	43
<i>The “invest” component of the Transportation Sustainability Program</i>	43
<i>The “align” component of the Transportation Sustainability Program</i>	44
<i>The “shift” component of the Transportation Sustainability Program</i>	48
<i>Conclusion</i>	49
Pasadena case study.....	50
<i>Pasadena’s decision process</i>	51
<i>Conclusion</i>	54
<i>Addendum 1: Pasadena’s metrics for CEQA traffic analysis and mitigation</i>	55
<i>Addendum 2: Pasadena’s metrics for non-CEQA traffic analysis</i>	57
Chapter 6. TRAVEL AND LAND USE PATTERNS WITH IMPLICATIONS FOR SB 743 IMPLEMENTATION	58
Operationalizing OPR’s recommended thresholds of significance	58
Our methodology and data sources.....	59
Across-city housing growth and VMT patterns pertinent to SB 743	60
Within-city development patterns pertinent to SB 743	63
<i>Methodology for within-city analysis</i>	63
<i>Findings for within-city analysis</i>	64

Conclusion	68
Chapter 7. TESTING SKETCH TOOL VMT ESTIMATES BY LOCATION SETTING AND PROJECT ATTRIBUTES	71
Our method for comparing VMT estimates using two sketch tools	71
<i>The two sketch tools we tested</i>	72
<i>Defining project characteristics and settings</i>	74
<i>Location data inputs</i>	75
Differences in estimated project VMT by location setting	78
<i>Validity challenges</i>	80
Conclusion	85
Chapter 8. CONCLUSION	86
REFERENCES	87
APPENDIX A. Details on our tools-testing methodology	92

FIGURES AND TABLES

Figures

Figure 1. Average city-wide VMT per capita, for high-growth and low-growth cities (based on projected RHNA housing unit growth rates above or below the regional average rate), by MPO region.....62

Figure 2. Average VMT per capita by density category (population plus employment) and transit access, for cities in the MTC and SCAG regions.....65

Figure 3. Land breakdown in high growth share cities in the San Francisco Bay Area, based on transit access and average VMT per capita.....69

Figure 4. Land breakdown in high growth share cities in the Los Angeles region, based on transit access and average VMT per capita.....70

Figure 5. Estimates of per capita VMT for our hypothetical mixed use development project in different location settings, for Los Angeles and Orange Counties, using CalEEMod, MXD, and CSTDM data.....78

Figure 6. Estimates of per capita VMT for our hypothetical mixed use development project in different location settings, for portions of the San Francisco Bay Area, using CalEEMod, MXD, and CSTDM data.....79

Figure 7. Estimates of per capita VMT for our hypothetical mixed use development project in different location settings, for Los Angeles and Orange Counties, using different methods for measuring locational attributes in CalEEMod.....82

Tables

Table 1. Pasadena’s transportation performance metrics for CEQA review.....55

Table 2. Transportation metrics for non-CEQA project analysis in Pasadena.....57

Table 3. Shares of cities by MPO region with average VMT per capita above or below 85% of regional VMT per capita.....61

Table 4. Average city-wide VMT per capita, and distribution, of "high-growth versus low-growth" and "high VMT versus low VMT" cities, by MPO region.....63

Table 5. Proportion of land by density category for cities, by region.....64

Table 6. Average population-plus-employment density, by transit access, for TAZs in the MTC and SCAG regions.....64

Table 7. Average population-plus-employment density per square mile, in high-growth versus low-growth cities, by MPO region.....65

Table 8. Land area in high-quality versus low-quality transit areas, for high growth versus low growth cities, in MTC and SCAG regions	66
Table 9. “High-VMT” vs. “low-VMT” land area shares in “high-VMT” versus “low-VMT” cities in the four large MPO regions.....	66
Table 10. Land area in high-growth and all cities by VMT per capita “quasi-quintile,” for the four large regions	67
Table 11. Land area with below or above 85% regional average VMT per capita, by transit access, for cities in the MTC and SCAG regions.....	67
Table A1. Location setting matrix: Number of CSTDM TAZs by locational attribute category, with data available from US EPA’s Smart Location Database for calculating employment within a 30-minute transit trip	93
Table A2. CalEEMod transportation and land use mitigation measures that we operationalized and employed.....	95

EXECUTIVE SUMMARY

Among US states, California has been at the forefront nationally in developing systematic policies to combat climate change and promote sustainable development. This report considers one element of the state’s policy portfolio: recent changes made to the California Environmental Quality Act (CEQA) regarding how the traffic impacts of development projects must be analyzed and mitigated. Senate Bill (SB) 743, adopted in 2013, eliminated automobile delay as an environmental impact to be addressed under CEQA, and called for a different performance metric for assessing transportation impacts better suited to reducing greenhouse gas emissions (GHGs), promoting infill development, and encouraging multimodal transportation.

In December, 2018, the California Natural Resources Agency adopted guidelines for SB 743 implementation that had been developed by the Governor’s Office of Planning and Research (OPR). The guidelines recommend analysis of vehicle miles traveled (VMT) generated by development projects rather than analysis of traffic delay.¹ Local lead agencies responsible for implementing CEQA review, including city and county governments, must transition to the new approach by July 1, 2020. OPR also provided technical advice on how lead agencies can carry out VMT analysis.² Although this sort of technical guidance from OPR is only advisory, many local lead agencies follow it to help ensure that their review procedures are legally defensible.

This report focuses on identifying and describing issues and concerns that cities may experience when managing approvals of residential and mixed-use development projects under the new SB 743 guidelines. (The law also applies to commercial, office, and transportation projects, and other types of lead agencies such as regional planning agencies.) The report is based on research conducted mainly in 2016, using mixed qualitative and quantitative methods. The main goals of the project were to consider how localities may interpret and apply OPR’s guidance regarding identification of significant VMT impacts, how they might identify mitigation measures to apply, and how they perceive technical, legal, policy- and planning-related opportunities and challenges of SB 743 implementation.

CEQA requires analysis of negative environmental impacts of development projects and plans, and, if feasible, mitigation (avoidance) of significant impacts. OPR’s technical advice for implementing SB 743 recommends identifying a “threshold” level of VMT for new development projects, above which each project’s VMT impact should be considered significant enough to warrant mitigation. For residential projects, OPR recommends a significance threshold set at 85% of either regional or city-wide average VMT per capita, whichever is higher. OPR’s recommendations also address transit access. Residential projects located within a half-mile of high-quality transit access can be “normally” considered to have a less-than-significant impact on VMT. OPR advocates the use of screening maps to distinguish geographic areas by their average VMT per capita, in comparison to the significance threshold, as a way to identify areas where more or less detailed environmental review may be necessary. Mitigation measures could include a number of strategies, such as improving transit service, or providing sidewalks and bicycle lanes.

¹ The revised CEQA guidelines are at <http://resources.ca.gov/ceqa/>.

² OPR’s technical advisory is available at <http://www.opr.ca.gov/ceqa/updates/sb-743/>

Our analysis and research was carried out in four parts. First, to consider how significance thresholds might be applied, we analyzed VMT patterns across and within California cities in relation to OPR’s proposed standards. We also conducted forty-three interviews, mainly in 2016, to gain insights from professional transportation consultants, regional planners, and local planners from a selected set of cities of three types: large central cities, SB 743 “policy innovator” cities, and cities expected to take on large shares of projected regional housing growth during the next decade. In addition, we prepared extensive case studies of SB 743 policymaking in two cities, San Francisco and Pasadena, where policies had already been adopted to align with SB 743. Finally, to help assess the technical challenges involved in SB 743 implementation, we tested two VMT estimation tools in common usage and considered the practical challenges facing tool users.

Dynamics of Senate Bill 743

To ensure that transportation impact analysis under CEQA supports state goals and policies for sustainable development, SB 743 eliminates use of “level of service” (LOS) standards for automobile traffic delay as an impact to be addressed under CEQA. Analyzing and mitigating LOS is a long-ingrained practice which has led to significant negative consequences for the environment. Cities apply LOS standards most often at the scale of individual roadway intersections. The practice has led to mitigations, such as roadway widening and reduction of development density, that can increase driving (VMT), work to the detriment of non-auto modes of travel, and undermine infill projects.

Reducing VMT is anticipated to produce multiple benefits, from lower GHGs to improved transport and energy efficiency, air and water quality, public health and safety, livability of neighborhoods, and open space conservation. These benefits may be possible from achieving more efficient land use and transportation patterns through compact, infill development and multi-modal transport improvements that allow people to drive less.

However, such VMT-reducing strategies can also entail costs, including for retrofitting infrastructure to support infill and multiple transport modes, and for managing public planning processes needed to grapple with community concerns about growth and change. These costs are likely to apply differently across different communities. Compared to LOS, using VMT reverses the calculus for determining which project and location types are most likely to generate significant transportation impacts under CEQA. Low-VMT areas, often containing compact development, mixed uses (such as housing, commercial, and office uses), and better transit, walking, and biking access than other areas, can now gain CEQA review streamlining benefits, while high-VMT areas, often with lower densities and greater car dependence, will require analysis and possibly mitigation.

VMT patterns and perceptions of SB 743 by community type

Our interview findings suggest that SB 743 is both evolutionary and revolutionary. It is evolutionary in aligning with current policy direction and planning goals already in place in many California cities that we investigated. Especially in urban coastal areas, many cities have built out their roadway capacity, and they have been trying to shift travelers away from automobiles to other modes, in order to manage travel demand. As demographic and market trends now increasingly favor more compact, transit-proximate

development, many cities have worked to coordinate infill projects with multi-modal transport improvements without relying on roadway widening.

Most city planners we interviewed, especially in coastal urban areas, welcomed the change from LOS to VMT analysis and mitigation that SB 743 had set in motion. Planners in many built-out communities reported frustration with traditional LOS standards, and many cities had already modified strict LOS standards, for example, by accepting highly-congested road conditions in central areas. But LOS standards can still cause problems, we heard, if projected impacts trigger community demands for more costly environmental review.

Planners that we interviewed from cities with lower-density, more auto-dependent development or experiencing less market interest in infill were generally less likely to express enthusiasm for the shift from LOS to VMT. Some planners from suburban areas and the Central Valley told us that they consider SB 743 to be more appropriate for the needs of “infill cities” than their own communities, in which new development is often expected to occur in low-density outlying areas, making some types of VMT mitigation contemplated in OPR’s guidance, such as extensive transit improvements, seem infeasible.

We analyzed spatial variation in VMT levels across much of the state using data from a household survey and a travel demand model, along with transit maps.³ Our findings add perspective to the question of how OPR’s guidance on significance thresholds could apply in different communities and regions. We studied cities with populations above 7500 (reflecting data limitations for smaller cities) in five regions: the Los Angeles, San Francisco Bay, Sacramento, and Sacramento metropolitan areas, and the eight-county Central Valley. We found that half (51%) of the cities studied had average per capita VMT exceeding the regional average (measured across all territory in each region). Following OPR’s technical advisory, these cities could adopt a significance threshold at 85% of their city average VMT per capita, rather than at 85% of regional average VMT per capita, and they might do so in order to reduce the amount of development potentially subject to more intensive analysis and mitigation. The population living in those cities represents only one-third of the population in all the cities we studied, but the fraction of developable land and future development demand in the cities is likely to be higher.

We also compared cities’ average per capita VMT to OPR’s designated regional threshold (85% of regional per capita VMT). This measure is pertinent to achievement of state climate policy goals. OPR justifies its regional threshold by pointing to recent research by the California Air Resources Board (CARB) indicating that a reduction of per capita VMT by 15% from current levels aligns with state climate policy goals. Furthermore, this measure is relevant to goals of Senate Bill 375, California’s regional planning law to promote efficient development patterns. Indeed, SB 743 was adopted in part to support SB 375. Under SB 375, Metropolitan Planning Organizations (MPOs) – transportation planning agencies in the state’s urban areas – must develop long-range regional transportation-land use plans capable of reducing GHGs (a trend line that closely matches VMT) by targeted amounts. For the state’s four largest regions, representing four-fifths of California’s population, recent MPO plans have aimed to reduce GHGs per capita from light-duty

³ Our analysis employed data from the California Household Travel Survey (CHTS) and the California Statewide Travel Demand Model (CSTDm), which provide information on Californians’ travel behavior. We also incorporated information on high-quality transit access using maps from the San Francisco Bay and Los Angeles areas.

vehicles by approximately 15 percent in 2035, compared to 2005 levels (similar to recent levels). CARB has called on the MPOs to achieve even deeper GHG reductions in future plans.

For these reasons, considering how city-level VMT maps on to OPR's regional threshold (set at 15 percent below, or in other words 85 percent of, the regional average) helps in evaluating the potential impact of SB 743 on achieving state climate goals. We found that three-quarters (78%) of the cities we studied have average per capita VMT above the regional threshold. This finding implies that, to the degree that new development resembles existing development in its VMT rates, regional plans under SB 375 may need to rely on a small share of cities to direct new development to low-VMT areas.

To investigate the question further, we evaluated within-city VMT patterns at the level of Transportation Analysis Zones (TAZs). Distinguishing "high-VMT" cities – those with average per capita VMT above 85% of the regional average – from "low-VMT" cities (those below), we found that in high-VMT cities, only a small fraction (12%) of TAZs as measured by their land area have VMT rates lower than the regional threshold. Within low-VMT cities, 70 percent of land area is lower than the threshold, and 30 percent is higher, indicating that development projects in these areas could exceed the regional significance threshold.

We were able to bring transit access into the analysis for the Los Angeles and San Francisco Bay regions. We found that a threshold based on 1/2-mile transit access, as recommended in OPR's technical advisory, provides no guarantee of low VMT for existing development in these metro areas. About one-third of land area with high-quality transit access in the San Francisco Bay region, and more than half (58%) of such land area in the Los Angeles region, has average VMT above the regional threshold.

We also analyzed VMT patterns based on projected housing growth rates, distinguishing "high-growth" from "low-growth" cities using information from adopted Regional Housing Needs Assessment (RHNA) plans, which are developed by the MPOs and which must be consistent with their plans developed under SB 375. In two regions, the Los Angeles and especially the Sacramento area, more growth is expected to occur in high-VMT than low-VMT cities, and as a result, these regions can be expected to require more attention toward mitigation. In the other two largest regions, high-growth cities have relatively lower average VMT per capita rates than do low-growth cities. For the Sacramento area, this pattern was further corroborated when considering within-city (not across-city) VMT patterns; in this region, more land area within high-growth cities is distributed, as compared to cities overall, into low-VMT neighborhoods than high-VMT neighborhoods. The opposite pattern was evident for the other three regions.

The patterns we observed reflect the degree to which each MPO has adopted a concentrated growth strategy in its regional plan under SB 375. To the extent that the regional plans accurately indicate where actual growth will take place on the ground, our findings suggest that the Sacramento area, among the four large regions studied, will require the most VMT mitigation under SB 743, because more growth, relatively speaking, is expected to occur in higher-VMT areas than in the other regions.

Policy and planning impacts: Long and short-run effects of SB 743

Planners that we interviewed from all types of cities raised questions about technical, legal, policy-related, and political challenges they might face in implementing SB 743 – not surprising given that the law calls on

these planners to shift from the long-ingrained LOS metric to a new approach. Feeling somewhat unsure about how to set legally defensible thresholds for measuring significant VMT impacts and how to implement mitigation requirements, planners in most cities we investigated were in a “wait-and-see” mode, saying that they did not intend to develop implementation methods for SB 743 until after adoption of final guidelines by the state’s Natural Resources Agency.

Many planners said that their anticipated short-term approach for implementing SB 743 would simply be to attempt to apply OPR’s recommendations for project-level review. Cities can employ estimation methods already in common use for purposes such as determining greenhouse gas impacts of development projects and plans, in order to determine project-level VMT impacts. Over the long run, some consultants and planners indicated, SB 743 could prompt more thorough-going change, however. Over time, many cities will likely revisit their transportation policies so as to integrate SB 743 requirements in a manner suited to local conditions and preferences.

Cities pursuing multimodal “complete streets” and infill development strategies will benefit from coordinating such strategies with project-level analysis under SB 743, according to our interviewees. Without a coordinated approach, ad hoc project-level VMT mitigation strategies could meet resistance, we heard, as project sponsors may resist VMT mitigation requirements, for example, if they can argue that a project is otherwise consistent with the city’s General Plan. Coordinated, city-wide policies to reduce VMT can include multi-modal impact fees tied to long-term capital facilities improvement plans, and transportation demand management (TDM) ordinances that apply to new development. Some planners insisted that only when a city connects these dots – connecting VMT analysis to an impact fee ordinance for sustainable transport and a TDM ordinance – can it maximize the potential for VMT reductions.

Meanwhile, most of the cities we spoke with also plan to continue to employ LOS standards—either as an element in certain required CEQA analyses, such as for evaluation of safety and access, or in response to resident concerns about road congestion. To use LOS as a basis for applying conditions of development approval, some cities may revisit their transportation policies, for example, to ensure that LOS standards adopted in the General Plan support non-CEQA-based mitigation fees under provisions of the state’s Mitigation Fee Act.

Thus, while it is possible for cities to utilize ad hoc project-level techniques for VMT analysis, our interviews and case studies suggest most cities would benefit from aligning transport policies including for CEQA review through a coordinated approach. As described in our case studies, San Francisco and Pasadena adopted systematic approaches that enable a focus on multimodal network capacity-building, as opposed to just project-specific mitigations. Systematic planning can address the challenges of designing efficient multi-modal networks, not just addressing impacts at isolated locations on a project-by-project basis, as done in traditional LOS analysis.

It is in this sense that SB 743 may prove to be more fundamentally transformative, over the long term, as many cities are prompted to revisit their General Plans, Specific Plans, impact fees, impact analysis guidelines, and other plans and policies, so as to connect and align plan- and project-level review and mitigation in a consistent way. If instead, cities retain LOS standards while also employing OPR’s VMT thresholds on an ad hoc project-level basis, they may encounter policy conflicts in practice. In such cases,

cities can issue “Statements of Overriding Consideration” under CEQA to allow projects to go forward even if environmental review demonstrates that significant negative VMT impacts will occur. However, even to facilitate this option, cities would likely benefit from revisiting their General Plan policies, because firmly established policies can provide a safer legal harbor for issuing such statements.

Potential future benefits from planning coordination will come with a price, however, in the form of time and effort required for community planning and policy innovation, such as for General Plan updates or development of TDM ordinances. Many cities lack resources for such planning efforts. Thus, even as most planners and consultants we interviewed recognize inadequacies of the current LOS-based mitigation system, they also recognize that work must be undertaken if they are to systematically shift direction.

Technical and legal concerns

One area of uncertainty noted by planners in implementing SB 743 was how to identify and apply legally defensible techniques for estimating VMT impacts of development projects. Legal uncertainty is an endemic concern for CEQA practitioners, given that CEQA is a “self-executing” statute, meaning that its enforcement depends on public litigation or the threat of it. For this reason, legal uncertainties voiced about SB 743 can be seen as reflecting the law’s newness and lack of testing in the courts, rather than any specific attributes of the law itself or its implementing guidelines.

On the one hand, city planners and transportation consultants noted that VMT estimation methods are already in common use, such as in travel demand models and sketch tools used for estimating greenhouse gas impacts of development projects and plans. Furthermore, VMT analysis is significantly less arduous and costly than traditional LOS analysis, they told us. However, planners also noted that they lack experience in conducting VMT analysis and especially in assessing VMT-related mitigation benefits at the project level, for which standardized methodologies are less well-developed.

Cities must choose which technical methods to use in light of both legal defensibility and affordability, and we sought to determine if a consensus might be emerging on preferred methods. Our findings suggest that the choice of methods varies across communities according to type of project, development patterns, and resources available. On one end of the spectrum, cities can use publicly-available “sketch tools” for estimating VMT from development projects; these spreadsheet tools are relatively easy to use and low-cost. For certain purposes, in particular for analysis of small projects, some experts contend that sketch tools are the most appropriate method. On the other end, to evaluate impacts of large projects within a wider context of transportation-land use interactions in urban areas, our interviewees generally consider travel demand models to be more accurate. The state’s MPOs all use complex travel demand models, and all the cities we investigated use sub-sets of their MPO’s regional model (or more accurately, they hire consulting firms who do so).

Some planners indicated they may combine the use of sketch tools and travel demand models, designating use of demand models for plan-level analysis and threshold identification, as well as for certain large projects, but utilizing sketch tools for smaller projects. The City of San Jose adopted an approach to SB 743 implementation in 2018 that follows this approach.

The choice of tools will also likely vary depending on how cities' land use patterns conform to OPR's recommended analytical thresholds of significance. We found that planners in cities with large swathes of contiguous territory falling below OPR's recommended significance thresholds were attracted to the map-based screening technique recommended by OPR as a basis for radically simplifying VMT analysis under SB 743. San Francisco and Oakland have pursued this approach. By contrast, we found that in cities with variegated (spotty) territory in terms of high quality transit access and high-VMT versus low-VMT areas across town, planners were more likely to be interested in developing good sketch tools for project-level VMT analysis and mitigation evaluation. These planners felt that broad-brush screening techniques to simplify VMT estimation would be difficult to employ in their cities, and they were searching for effective project-level tools appropriate for varying circumstances. These cities included Los Angeles and San Jose.

One city we investigated, Pasadena, invested considerable effort into upgrading its city-wide model to a level sensitive enough to evaluate project-level impacts under SB 743. This effort allowed the city to link plan-level to project-level analysis and mitigation, using its demand model in conjunction with adopted project-level standards for both VMT and traditional LOS, alongside other metrics. Cities interested in using a demand model to integrate plan- and project-level review, and to implement multiple performance metrics, might consider Pasadena as a model. However, we also heard that resource constraints may inhibit other cities from upgrading demand models in this fashion, as the cost could be as high as \$1 million.

Communities also have legal issues to address in interpreting OPR's guidance for integrating plan-level and project-level review. OPR's guidance indicates that, for "land use plans" (including general plans, area plans, or community plans), lead agencies should determine whether proposed new land uses would exceed the recommended VMT thresholds in aggregate. For individual land use projects, lead agencies are also directed to determine whether a project is "consistent" with the regional transportation plan developed by the MPO. Standardized procedures for determining consistency with MPO plans have not been completely ironed out, however. Furthermore, plan and project consistency may not always align in practice. For example, a lead agency may determine that a local plan achieves aggregate targets to help reduce VMT, but some contemplated projects within that plan are high-VMT, while others are low-VMT. In that case, a project might be deemed to be consistent with the regional and local plans, but inconsistent with OPR's recommended project-level thresholds. While it might be entirely appropriate to apply different metrics to plans versus projects, the possibility of inconsistent significance determinations may pose challenges.

Such legal questions and concerns are hardly unusual for a new set of requirements related to inherently complicated issues for CEQA review. Furthermore, CEQA provides substantial discretion to, and does not require perfection from, lead agencies in determining significance thresholds, evaluation techniques, and feasibility of mitigation. Nevertheless, lead agencies pay close attention to the CEQA guidelines as a benchmark to help ensure legal defensibility, and areas of confusion are sometimes litigated.

MPOs are providing a valuable forum for localities to address the sort of practical and legal questions about SB 743 compliance that we have noted, and many planners we interviewed hope they will continue to do so. We heard about MPO-led discussions on innovative joint strategies, such as for off-site mitigation. MPOs can thus facilitate policy innovation, not just information-sharing on best practices.

Tools-testing analysis

As an additional component of our quantitative analysis, we tested two VMT estimation sketch tools in common use. We compared results for a hypothetical project with a given set of characteristics, placed in varied location settings, allowing us to investigate practical questions and challenges arising for a lay practitioner in choosing among tools, employing them, and determining validity of results.

We tested CalEEMod, a statewide land-use emissions sketch tool developed by the California Air Pollution Control Officers Association. We also tested MXD, or the Mixed Use Trip Generation Model, a spreadsheet tool developed by consultant firm Fehr & Peers for the US Environmental Protection Agency. We defined a neighborhood-type matrix representing the range observable in the Los Angeles and San Francisco Bay regions when categorizing TAZs according to three measures: population-plus-employment density, distance to the nearest central business district, and access to high-quality transit. We then developed additional TAZ-level measures for built-environment characteristics that the tools require as inputs. MXD data inputs were more difficult to obtain and limited our geographic coverage.

Comparing results using the tools, we found very different VMT estimates for the same stylized mixed use development project. Overall, VMT per capita estimates from MXD for the Los Angeles region ranged between 74 and 333 percent higher, depending on location setting, than CalEEMod estimates. The difference was smaller in the Bay Area, but still significant. This finding is consistent with other recent research comparing the same two tools, but it was also counter to our expectations: the MXD model was created to capture internal trips in mixed use developments, which should presumably mean it would predict fewer trips, not more.

We also found substantially different VMT per capita estimates for our stylized project based on location attributes. Using CalEEMod, for the Los Angeles area, the estimated VMT per capita for the project, when set in the lowest-density, non-transit-access, furthest-from CBD location setting we tested, was nearly four times higher than for the same project set in the highest-density CBD location with good transit access. Using MXD, the spread was narrower, as was the spread of estimates using either tool for locations in the San Francisco Bay Area.

These findings point to a few conclusions. First, the two tools produce very different results, and suggest that agencies might be more likely to choose CalEEMod if they are trying to produce a lower VMT estimate for a given project. They might also do so because MXD data input demands were more constraining – harder to obtain, and more limited in coverage.

On the other hand, we encountered difficulties in using CalEEMod that might pose a challenge for practitioners in determining validity of results. We experimented with a series of methods for accounting for locational attributes in CalEEMod, all of which might be considered appropriate, but which produced substantially different VMT estimates. Some of the confusion traces to lack of clarity in CalEEMod technical documentation for how to avoid “double-counting” benefits, if and when a user substitutes known, locally specific data on trip attributes (vehicle trip lengths, rates and trip purpose splits), for default values built into the tool operation. OPR recommends this practice, but we found that it was not easy to determine,

based on technical guidance available for CalEEMod, how to properly account for location and project attributes for which introducing local data on trip attributes might serve as a proxy.

This concern, among others we encountered in using CalEEMod, suggests that users may be confused about how to produce valid results. Overall, our results indicate that tool choice and project setting substantially influence VMT estimation, and that sketch tools can present practical challenges for lay practitioners that may not be simple to overcome. It will be important for practitioners to understand limitations and vagaries of tool mechanisms to account for their strengths and limitations.

Conclusion

Challenges and opportunities of SB 743 implementation are significant. Our investigation indicates that, in the short run, application of techniques for VMT analysis in line with OPR's guidance may not pose a great challenge for most cities, although mitigation analysis could be more demanding. Over the long run, the opportunities and challenges of aligning community plans and policies with SB 743 are more substantial. Our interviews suggest that SB 743 may induce many localities to revisit transportation plans and policies, possibly leading to more coordinated approaches, but also requiring effort and resources to accomplish.

Currently, a transition period is underway toward SB 743 implementation, prompting many questions from practitioners but also leading to planning and policy innovations in some communities. A great benefit likely to be gained from SB 743 is the development of new analytical techniques, knowledge, and information-sharing about costs and benefits of VMT reduction strategies. Over time, the SB 743 process will likely lead to development of more refined analytical strategies, which will then become embedded in policy, planning, and finance in communities across the state, as was the case with LOS.

SB 743 heralds and supports a wider shift in transportation planning toward greater support for sustainable approaches. As such, SB 743 also enters into the wider context of sometimes highly contested growth politics in California, in which infill and multi-modal transport strategies can sometimes raise public objections. Given that CEQA is deeply embedded in development decision-making, SB 743 may have far-reaching effects, advancing deliberation about effective development pathways across all communities.

However, various obstacles must be overcome to realize this vision. In addition to political resistance in some communities toward some VMT-reducing strategies, the main obstacle we heard about was lack of resources for local planning. Resource constraints inhibit the ability of many cities to develop sophisticated new policies and techniques under SB 743. The more that state and regional agencies can do to assist localities in the process, the more benefits may accrue from SB 743. The recommendations that we heard from our interviews regarding how state and regional agencies can help touched mainly upon the following factors: identifying legally defensible metrics and methodologies for determining thresholds of significance and mitigation impacts; understanding which tools are best for which circumstances, e.g. for area-wide assessment versus for small projects; and cataloguing experiences and procedures adopted in "policy-innovator" cities such as San Francisco and Pasadena.

Chapter 1. INTRODUCTION

No California planning law affects development decisions more than the California Environmental Quality Act (CEQA) (Fulton and Shigley, 2012). CEQA requires analysis, and, if feasible, mitigation (lessening) of significant negative environmental impacts of development projects and plans. For decades, state CEQA guidelines have indicated that effects of development upon automobile speed and throughput (delay) constitute adverse impacts to be analyzed and mitigated under the law, using a “level of service” (LOS) measure. In this manner, CEQA has worked to support widespread implementation of LOS standards, even though it is questionable why auto delay should be considered an environmental impact to be reduced. LOS standards might more appropriately be considered as harmful to the environment, because the standards can lend support to strategies such as roadway widening that induce more driving (and thus greenhouse gas emissions and other pollutants) and work to the detriment of environmentally friendly travel modes.

Concerns about LOS led the state legislature to adopt Senate Bill (SB) 743 in 2013 in order to align CEQA traffic analysis more closely with the state’s policy goals for sustainable development, more specifically, for reducing greenhouse gases and promoting infill development and multi-modal transport options. The Governor’s Office of Planning and Research (OPR) then initiated a multi-year consultation process to develop new CEQA guidelines on traffic analysis, pursuant to SB 743. In December, 2018, the California Natural Resources Agency adopted new guidelines, developed by OPR, recommending analysis of vehicle miles traveled (VMT) generated by development projects rather than analysis of traffic delay. Local lead agencies responsible for implementing CEQA review, including city and county governments, now have until July 1, 2020 to transition to the new approach. OPR also provided a technical advisory on how lead agencies can apply VMT analysis in practice.

From the perspective of many communities in the state, SB 743 might be seen as providing long-overdue support for strategies already underway to revitalize downtown zones and encourage use of multiple modes, not just automobiles. OPR’s recommended approach to SB 743 implementation (described in its technical advisory) eases review and mitigation requirements for projects in low-VMT areas, often characterized by dense land uses and transit proximity. But SB 743 could be seen as more challenging and transformative in communities where compact (multi-unit or attached) development and multi-modal transport strategies have not been considered either feasible or politically popular. OPR’s advisory recommends mitigation of high-VMT projects in high-VMT areas, often characterized by low-density, car-dependent development patterns.

Our report assesses the transition from LOS to VMT analysis and mitigation under CEQA which SB 743 has put into motion. More specifically, the report evaluates opportunities and challenges of SB 743 implementation for cities in their role as local “lead agencies” responsible for CEQA review as a condition of development approvals in their jurisdictions. We consider technical, legal, political, fiscal, financial, planning, and policy-related aspects of compliance. Although SB 743 applies to residential, commercial, office, mixed-use, and transportation projects, our report focuses on residential and mixed-use projects only. By narrowing our focus to one type of project, for one type of lead agency (cities), we can more easily consider variation in impacts and reactions across different communities. The report also places the new

law within the larger context of transportation and land use planning practice in California, as well as the state's climate policy agenda, so as to better evaluate its promise and potential pitfalls.

At a narrow practical level, one of our research objectives was to evaluate technical aspects of SB 743 implementation, in particular, to consider how cities as lead agencies are likely to approach VMT analysis – using what tools and procedures, and with what standards for validity of results. The latter question will be influenced by legal concerns because CEQA is a “self-executing” statute, depending upon litigation by the public, and the threat thereof, to enforce its provisions. Although the state government (OPR, in particular) provides guidance for conducting CEQA review, lead agencies maintain discretion to select methods for determining whether environmental impacts are significant, subject to the law's requirement that the determination must be based on “substantial evidence” able to withstand any possible “fair argument” challenge that a “substantial adverse change in physical conditions” could occur. Questions of technical validity will inevitably link to questions of legal validity because of the newness of the law, the lack of well-developed consensus on standardized techniques for analysis and mitigation, and the flexibility provided to localities for determining implementation approaches.

Other significant questions about SB 743 implementation are related more to policy and politics, such as how localities will identify thresholds of significant VMT levels for purposes of project review and mitigation, and whether localities will continue to use LOS standards on a non-CEQA basis. Use of LOS is embedded in local planning, even aside from CEQA compliance; for example, many General Plans (community-wide plans) and Specific Plans (area plans) contain LOS standards. Furthermore, the widespread practice of using CEQA as a basis for requiring developers to pay traffic mitigation fees for impacts of development projects raises the question of whether and how communities will alter impact fees. Understanding how and whether communities aim to substitute VMT for LOS, or instead to integrate and utilize both measures, can help elucidate larger transitions underway in community approaches to transportation planning.

A related set of questions about SB 743 implementation addresses the connection between project-level and plan-level strategies. City planners will likely need to go further than just considering how to implement VMT analysis and mitigation at the project level, and consider in addition how SB 743 affects and supports or conflicts with broader transportation planning goals and policies of the community. Some localities may seek to align VMT analysis and mitigation with revised General Plan-based goals and policies, as well as mitigation strategies, to support the objective of reducing VMT. Other localities may choose to revisit their plans and policies mainly to maintain use of LOS on a non-CEQA basis and to ensure that LOS-based and VMT-based standards are reconciled in practice.

OPR guidance links project and plan analysis by recommending that review of land use projects (and in early OPR drafts, also land use plans) include a determination of “consistency” with regional plans conducted under provisions of Senate Bill (SB) 375. Adopted in 2008, SB 375 calls for Metropolitan Planning Organizations (MPOs) – federally-mandated transportation planning agencies in urban regions – to develop integrated transportation and land use plans capable of reducing regional GHGs by mandated, targeted amounts over the 20+-year duration of the plans. An interesting question for our research was how practitioners might interpret this guidance.

Another interesting question was how local approaches to implementing SB 743 might vary depending on community type, for example, depending on whether a community expects and desires more development, and whether market-feasible new development generates high or low VMT, compared to recommended significance levels. Cities like San Francisco where most territory is “low-VMT,” falling below OPR’s recommended regional threshold for determining significant effects requiring mitigation, can take advantage of significant streamlining for project-level review recommended in OPR’s technical guidance, which can simplify policy options. Meanwhile, cities with more variegated (spotty) territory in terms of VMT patterns across different parts of town, or where residents seek to maintain LOS standards at least in some parts of town, may prefer an approach oriented to fine-tuned analysis and mitigation at the project level to address different conditions in different areas.

Thus, SB 743 opens up a series of questions for localities to consider, about how and whether to integrate VMT analysis into their broader planning vision. The degree to which localities choose to revisit and reframe transportation goals and mitigation techniques is open to question, however. SB 743 may foster, but it does not require, a policy- and plan-based approach to transportation analysis and mitigation.

Because cities can take various approaches to SB 743 implementation, studying early-stage implementation by innovator cities, and considering the perceived challenges and opportunities that other cities anticipate, should be of interest to local planners, state policymakers, and academics seeking to understand how to re-orient transportation planning to promote sustainability goals. This research also informs an understanding of the role of CEQA in influencing local actions to support state goals for GHG reduction and compact, efficient development patterns.

The findings in this report are based on quantitative and qualitative research methods used to address the specific research questions presented below. Qualitative findings are based on public document review and 43 interviews conducted in 2016 and 2017 with regional and local planners, and transportation and CEQA experts working for private consulting firms. Quantitative research findings are based on analysis employing multiple data sources, including two public use datasets with information on travel patterns of Californians, namely the California Statewide Travel Demand Model (CSTDm) and the California Household Travel Demand Survey (CHTS). In addition, some findings are based on investigating the operation of two publicly available “sketch tools” for determining project-level VMT estimates.

The research aimed to address the following specific questions:

- What, if any, challenges are local agencies likely to experience in applying OPR recommendations for conducting VMT analysis under SB 743, for example, in identifying and measuring thresholds of significance and appropriate mitigation measures, and in integrating project- and plan-level analysis?
- Which tools and methods are lead agencies likely to want to use for VMT analysis under SB 743, and why?
- What technical, legal, policy-related, and political challenges and opportunities are city lead agencies likely to face in implementing SB 743 for analysis of land use projects? For example, will cities seek to retain use of LOS standards going forward, and if so, how will they do so on an “off-CEQA” basis?

- How is SB 743 likely to be interpreted and applied depending on community and project types (distinguishing, for example, communities with different levels of growth and VMT patterns, and large versus small projects)?
- How will local lead agencies interpret and apply OPR’s guidance on ensuring “consistency” of local projects with regional plans developed under SB 375, and for aligning OPR’s recommended significance threshold for local plans with its recommended threshold for local projects? Will local lead agencies seek to connect project-level implementation to local plans (e.g. General Plans) and regional plans? If so, how and why?
- What implementation assistance do local lead agencies seek from state and regional agencies?
- What are practical challenges that lay practitioners may encounter when employing VMT estimation sketch tools for analyzing development projects?

The report proceeds as follows. The first three chapters describe the policy context of SB 743, in particular the state’s climate and sustainability policies related to transportation and land use, and the problems posed by traditional auto LOS standards which led to passage of SB 743. Basics of SB 743 implementation, as outlined in OPR’s guidance document, are also described. Research findings are presented beginning in the fourth chapter, which discusses findings from our interviews touching on technical, legal, policy-related, and political challenges and opportunities of SB 743 implementation as they were perceived by our interviewees. Given that OPR’s guidance for SB 743 implementation had not yet been officially adopted at the time of our interviews in 2016, our findings are necessarily somewhat speculative, reflecting questions raised by interviewees as much as answers about intended implementation methods.

Our fifth chapter should interest California planners considering SB 743 implementation methods for their communities. In it, we present in-depth case studies of two leading-edge cities – San Francisco and Pasadena – that have adopted CEQA metrics and procedures consistent with SB 743. Even planners in cities with very different conditions and policy priorities may benefit from considering how these two cities negotiated legal and practical questions of SB 743 compliance.

The final two chapters of the report present results of quantitative analysis. The sixth chapter evaluates land use and transport patterns in California cities in connection to VMT significance thresholds recommended by OPR, in order to determine where VMT impacts may be deemed to be most significant. The seventh chapter focuses on tools-testing, specifically by comparing VMT estimation results for a hypothetical development project placed in varied location settings, employing two sketch tools in common use in California for estimating project-level trip-making and VMT impacts. We aimed to investigate practical challenges associated with selecting and employing such sketch tools.

Chapter 2. UNDERSTANDING SB 743: HISTORICAL AND POLICY CONTEXT

SB 743 better aligns CEQA with the state’s climate policy goals, by working to reduce VMT and associated GHGs. But SB 743 calls for more than GHG reduction; it aims to shape development in specific ways. The bill’s legislative intent calls for “new methodologies under the California Environmental Quality Act...for evaluating transportation impacts that are better able to promote the state’s goals of reducing greenhouse gas emissions and traffic-related air pollution, promoting the **development of a multimodal transportation system**, and providing clean, efficient access to destinations” (SB 743, Section 1 (a)(2)) (emphasis added). Going further, it calls for “more appropriately balance[ing] the needs of congestion management with statewide goals related to **infill development, promotion of public health through active transportation**, and reduction of greenhouse gas emissions” (SB 743, Section 1 (b)(2)) (emphasis added). This chapter provides a context for understanding the adoption of SB 743 in connection to the state’s climate and sustainable development policies for transportation, and the potential benefits and costs of policy measures to reduce VMT of the sort that SB 743 supports.

California’s climate policies for reducing VMT

For the past decade, California has been implementing the most ambitious set of climate policies of any US state. Assembly Bill (AB) 32, adopted in 2006, called for reducing GHGs in the state to 1990 levels by 2020. Then in 2016, Senate Bill (SB) 32 was adopted to extend the state’s GHG reduction target beyond 2020, codifying the goal of a 40% reduction by 2030. This target puts the state on a trajectory to meet the even more ambitious goal of reducing GHGs by 80% by 2050 – a goal ratified in Executive Order S-3-05, signed in 2005 by Governor Arnold Schwarzenegger, to align with GHG reduction levels called for by international climate scientists from developed nations.⁴

Tasked with overseeing implementation of the state’s climate policies, the California Air Resources Board (CARB) produced a “Scoping Plan” in 2008, updated in 2017, to outline implementation strategies across all sectors of the California economy. For the transportation sector, responsible for 39% of the state’s GHG emissions (and even more when fuel extraction and refining are figured in) (CARB, *California Greenhouse Gas Emission Inventory by Economic Sector*, 2017), CARB has called for three main reduction strategies. Two are technologically oriented, aimed at improving fuel and vehicle efficiency, and the third comprises conservation-oriented “demand-side” strategies aimed at reducing vehicle miles traveled and vehicle use (reducing demand for driving) (CARB, *Scoping Plan*, 2008 p. C-55-57). This third component is deemed essential to ensure that projected growth in VMT does not overwhelm GHG benefits resulting from technology and system efficiency measures alone (CARB, 2018a, pp. 4,5).

SB 743 is one element in the state’s demand-side policy approach for reducing VMT. It explicitly aims to support implementation of Senate Bill 375, a trail-blazing regional planning law passed in 2008, also geared to reducing GHGs through integrated planning for transportation and land use. It is important to

⁴ This GHG reduction goal was re-affirmed in 2012 for the transportation sector, in Executive Order B-16-12, signed by Governor Edmund (Jerry) Brown, Jr.

understand the workings of SB 375 as context for evaluating SB 743 procedurally, politically, and practically. SB 743 and SB 375 are connected in both legislative intent and procedural implications.

Basics of Senate Bill 375

To help achieve its demand-side policy component for reducing transportation GHG emissions, California adopted Senate Bill 375 in 2008. SB 375 calls for reducing emissions through “changed land use patterns and improved transportation” (S.B. 375 §1 [c]). The law calls for action by Metropolitan Planning Organizations (MPOs) – federally mandated regional transportation planning agencies in urban areas with populations of 50,000 or more. Under SB 375, each of the state’s 18 MPOs must develop and implement a Sustainable Communities Strategy (SCS) as part of its periodically updated long-range (20+ year) transportation investment and policy plan (called a Regional Transportation Plan or RTP). The SCS is a projected long-term “development pattern...integrated with the transportation network, and other transportation measures and policies,” which is designed to achieve specific GHG reduction targets assigned by the California Air Resources Board (CARB) (California Government Code §65080 [b] [2] [B] [vii]). Following a two-year consultation process, in 2010, CARB adopted official per capita GHG reduction targets from light-duty vehicles for each MPO region to achieve by 2020 and 2035; for the four largest MPO regions, the targets for 2035 were for approximately 15% (with small variations by MPO).⁵

SB 375’s central premise lies not only in the GHG reduction mandate for MPO plans, but also in procedural requirements for transport-land use planning integration. SB 375 called for state guidelines (adopted in 2010) for MPO technical analysis of transport and land use policy options for efficient development.⁶ SB 375 also instituted plan consistency requirements between RTPs and the Regional Housing Needs Assessment (RHNA) process, California’s “fair share” method for ensuring that localities facilitate adequate housing for all income levels. Councils of Government (COGs), which coincide with California’s MPOs in most cases, administer RHNA plans for the state, periodically allocating to each local jurisdiction its “fair share” of projected regional housing need for accommodation through appropriate zoning. SB 375 aligns RTP and RHNA schedules, calls for consistent results, and stiffens compliance requirements. SB 375 also contains another performance mandate favoring compact growth in requiring that each RTP/SCS accommodate enough housing for all projected population and workforce growth over the plan’s duration within the region (a “no-spillover” provision) (California Government Code §65080[b][2][B][ii, iii]).

Limitations of SB 375 and the need for supportive policies

The ambitions of SB 375 are high compared to the means afforded to achieve them, making enactment of supportive policies such as SB 743 important for the law’s success. MPOs face institutional challenges for

⁵ The state’s four largest MPOs, representing 82% of the state’s population, are: the Southern California Association of Governments (SCAG), in the 6-county Los Angeles metropolitan area; the Metropolitan Transportation Commission (MTC), in the 9-county San Francisco Bay area; the San Diego Association of Governments (SANDAG), in the single-county San Diego metropolitan area; and the Sacramento Area Council of Governments (SACOG), in the 6-county Sacramento area.

⁶ SB 375 calls for MPOs to analyze land use and transport interactions, modal splits, maintenance and rehabilitation needs of transport facilities, and accessibility and equity measures, so as to “assess the effects of policy choices, such as residential development patterns, expanded transit service and accessibility, the walkability of communities, and the use of economic incentives and disincentives” (Senate Bill 375 §1[g]).

achieving planning integration. They act as coordinators of transportation projects and plans initiated by federal, state, and local agencies, and they lack direct authority over land use policymaking, which in California, as in the rest of the nation (with limited exceptions), has been delegated by state governments to localities (cities, and, in unincorporated areas, county governments). SB 375 explicitly states that no aspect of its provisions should be understood as abrogating local control of land use decision-making. With governing boards composed mainly of local officials representing their local constituencies, MPOs' governing structure fosters consensus-building among localities within each region, but also makes it hard for MPOs to impose policy directives upon unwilling localities (Sciara, 2017). MPOs can direct some transportation funds to encourage SB 375-supportive land uses, but such strategies are limited to resources under their direct control. Most projects coordinated in RTPs are initiated and funded from federal, state, and local sources, however, which are not under MPO control. In California, MPOs directly control only 15% of capital funds in RTPs, on average (Rose, 2011).

These institutional challenges facing MPOs point to the importance of a favorable framework, if SB 375 is to succeed, of wider policies and market incentives supporting the law's objectives. In the years immediately following SB 375's passage, however, some important tools that had supported infill development and multi-modal mobility strategies were constrained or removed, such as state funds for transit operations, and redevelopment authority for local governments, which was eliminated in 2012.⁷ Perhaps not surprisingly, while post-SB 375 MPO plans have aimed to achieve better performance than pre-SB 375 plans for key metrics of location and transport efficiency (namely reduction in regional VMT per capita, and growth in multi-family housing share and non-auto transport mode share), the shift has been more incremental than dramatic (Barbour, 2015, 2016).

Lack of adequate incentives and support for compact development has posed an Achilles heel for implementing SB 375 plans. Many stakeholder participants in regional plan development under SB 375 raised concerns, in comment letters and legal challenges, about the feasibility of envisioned infill strategies in post-redevelopment California (Barbour, 2015). Recent surveys of localities conducted by OPR indicate that most responding jurisdictions address infill development in their General Plans, and they report using a variety of tools, including, in particular, density bonuses, reduced parking requirements, and coordination of environmental review (OPR, 2017 *Annual Survey Results*). Nevertheless, localities also point to barriers to achieving infill development, in particular, lack of adequate infrastructure and transit funding, and parcel assembly problems (OPR, 2012). One research study concluded that infill growth targets in the San Francisco region's SCS would be hard to achieve without further policy action at multiple levels (EPS, 2015).

Recent developments in California climate policymaking to reduce VMT

The question of how to reduce transport-related GHGs and provide policy support for SB 375 is becoming more pressing as the state takes on the challenge of achieving more ambitious climate policy goals ratified in SB 32. CARB approved a new *Scoping Plan* in 2017, outlining measures needed to meet the SB 32 GHG reduction target, described as the most ambitious in North America. The proposed measures included more stringent SB 375 reduction targets.

⁷ Redevelopment authority, based on use of tax-increment financing, had provided local governments with over \$5 billion in tax revenue annually, and was the main tool localities used for downtown renovation projects, as well as for funding affordable housing, with a 20% set-aside required for this purpose (LAO, 2012).

In 2018, after negotiating with the MPOs, CARB adopted a GHG reduction target of 19% per capita by 2035, from 2005 levels, for the four largest MPOs. To justify this more aggressive target, compared to the original target adopted in 2010, CARB highlighted recently adopted state policies and programs that support SB 375 objectives, including SB 743. Although the target is more aggressive than CARB had originally adopted in 2010, it also 6% lower (less aggressive) than the reduction level that CARB stipulated in its 2017 Scoping Plan update as necessary to support the SB 32 goal. To address the gap, CARB committed to ongoing deliberations with the MPOs on new policy measures for consideration, including state-level policies which the MPOs contend will be necessary if more aggressive reductions are to be achieved (CARB, 2018b).⁸

Later in 2018, CARB released a report to the state legislature on progress by the MPOs in achieving SB 375 goals (CARB, 2018a). The report concluded that, “California is not on track to meet greenhouse gas reductions expected under SB 375” (ibid, p. 3). This conclusion was based on CARB’s evaluation of twenty-four data-supported indicators, of which the most concerning was an estimated, ongoing rise in VMT and GHGs per capita starting after 2013, after the economy had started improving. Transport-related GHGs are higher than projected in MPO plans, and going in the wrong direction. CARB’s report also identified various barriers to SB 375 success, one being local zoning and permitting practices that constrain housing production and/or make it more expensive.

Thus, negotiations and debates are underway on inter-governmental roles and responsibilities under SB 375. The debates are sometimes contentious, but they also underscore a growing awareness that coordinated action at multiple levels of government will be needed if California is to achieve its climate goals. SB 743 is one component in the growing suite of state policies enacted to help support SB 375 and state goals for sustainable development. Before considering, in the next chapter, how SB 743 fits into the wider policy equation, we first discuss academic research findings on potential effectiveness, benefits, and costs of strategies to reduce VMT – the sort of strategies contemplated by SB 375 and SB 743.

Assessing VMT reduction strategies

SB 375 and SB 743 aim to foster more efficient development patterns as a means to reduce GHGs and achieve other co-benefits for the economy, environment, and social equity. OPR’s SB 743 implementation advisory document recommends numerous mitigation strategies for reducing VMT, including improving access to transit; increasing project density and mix of uses; incorporating affordable housing; limiting parking supply; and providing transport demand management (TDM) amenities such as car-sharing, bike-sharing, and transit pass programs.

But how effective have these sorts of strategies proved to be in reducing VMT, and with what costs and benefits? This section considers findings from academic research on this question.

⁸ During negotiations on revising the VMT reduction targets, the four large MPOs wrote a letter to CARB in which they stipulated certain state actions as necessary if more aggressive reductions are to be achieved, including road and parking pricing; mileage-based user fees; dedicated funds for multimodal transport; and “direct support for SCS implementation” through state incentives for infill. The MPOs’ letter is available at https://www.arb.ca.gov/cc/sb375/big_4_target_recommendation_may_2017_v2.pdf

Potential benefits from reducing VMT may be substantial for reducing GHGs and improving air and water quality, energy efficiency, public health and safety, livability of neighborhoods, conservation of open space, and private and public cost savings for transportation, among other gains (Fang and Volker, 2017). CARB's updated *Scoping Plan* highlights, in particular, goals for air quality and public health to be gained from SB 375 plans. These potential benefits are associated with more efficient transport patterns that may be achieved from compact, transit-accessible development, combined with providing access to multiple transport modes.

Research on costs of reducing VMT is less well-developed (Stevens, 2017). Costs include overcoming barriers to infill development that can make it harder to build than greenfields development, such as for managing parcel assembly over time, and for rehabilitating infrastructure in built-up urban areas. Other costs may be political, in the form of organizing lengthy public engagement processes to address concerns arising from proposals for community change. Planners sometimes face complex and conflicting demands from residents and community stakeholders; for example, even as rising traffic congestion in built-up areas leads many city residents to support facilities for non-auto modes (such as bike paths) that provide alternatives to driving, other residents may oppose the re-allocation of street space from car use to other modes (Henderson, 2011). Even as the inadequacies of traditional mobility strategies have become apparent to many planners, the contours of a new paradigm to replace it remain contested. SB 743 does not alter the political reality that strategies with wider environmental benefits, such as infill development, sometimes come with unwelcome local costs, such as increases in localized traffic congestion.

Cities working to enhance multi-modal options and support infill development are at the cusp of a shift underway in the dominant transportation planning paradigm, away from the main traditional emphasis on providing for auto-mobility through roadway improvement, toward improving accessibility to destinations instead (such as by providing for greater physical proximity of travel destinations in denser settings with mixed land uses, or by providing access to efficient transport modes) (Banister, 2008; Handy, 2008; Santos et al., 2010). Planners have become aware of the effects of "induced demand," in which increased roadway capacity is quickly used up as travelers switch modes, travel schedules, and routes to take advantage (Downs, 1992). Research indicates that adding capacity to roadways not only fails to alleviate congestion, it also increases VMT, especially in the long run (Handy, 2015).

To improve transport options in built-up urban areas, planners and policymakers have increasingly sought to provide for "complete streets" that can better accommodate multiple modes including transit, walking and cycling. In 2008, California adopted a Complete Streets Act which requires that local government General Plans (comprehensive plans) be updated to "plan for a balanced, multimodal transportation network that meets the needs of all users of streets, roads, and highways" (Government Code §65302(b)(2)(A)). Complete streets call for "context-sensitive" solutions in which trade-offs among needs of users of multiple modes are to be considered and balanced (Slotterback and Zerger, 2013; Laplante and McCann, 2008). Recent survey data from OPR indicates that more than two-thirds of California cities have an adopted, in-progress, or planned bicycle master plan, and more than half have an adopted, in-progress, or planned complete streets plan (calculated from OPR, *2017 Annual Planning Survey Results*).

Emphasizing accessibility as a goal for transportation policy also inevitably draws attention to land use patterns and policy, by implicitly highlighting the connections between desirable land uses and ease of

travel between them. Some research confirms that shorter travel distances in high-density urban areas contribute more to overall accessibility and, in turn, to economic productivity, than do higher speeds attainable in low-density urban areas (Levine et al., 2012; Mondshein et al., 2015; Osman et al., 2016). Proximity and connectivity may be enhanced through local and regional strategies to coordinate transport and land use more carefully, even if more compact development also reduces travel speeds. Meanwhile, demographic and market trends have increasingly come to favor compact development near transit.

What sort of land use strategies can reduce VMT the most? Much research has attempted to discern the relative influence of various elements of the built environment upon travel behavior, including VMT. Studies have assessed, for example, the elasticity of demand for trips by car versus other modes, and the elasticity of distance traveled (VMT), in connection to various aspects of land use that have been called “D” characteristics, including density, diversity (mix of uses), design (such as street amenities and connectivity), distance to a transit stop, and destination accessibility (in particular, transport network connectivity). (Elasticities measure the percent change in the dependent variable of interest associated with a one percent change in the independent, explanatory variable of interest.)

Overall, studies have found that most land use characteristics, when considered individually, show small associations with travel behavior, compared to socioeconomic characteristics of individuals (Ewing and Cervero, 2010; Stevens, 2017). The built environment factor generally found to have the strongest association with vehicle distance traveled is destination accessibility (ibid), sometimes measured simply as distance to downtown. For transit, destination accessibility depends on the presence of highly interconnected networks.

In spite of this research, little can be said with precision about VMT impacts of specific policy measures that can be taken at the local level (Salon et al., 2012). Three factors make estimating the effect of local policy actions on VMT difficult: the indirect relationship between these actions and VMT; the lack of data collection conducive to estimating policy effects; and the difficulty in implementing robust research designs (ibid). The estimated effects of land use factors, which have been studied the most, tend to be relatively small, considered individually. Policies targeting VMT more directly (e.g. to promote telecommuting, or employer-based trip reduction programs) report large effect sizes, but most of these estimates apply only to individuals who voluntarily opt in. Direct estimates of the effect on VMT of pricing strategies (such as for parking) and non-auto mode enhancements are generally lacking (ibid).

Nevertheless, findings from high-quality research indicate that local policy actions can affect VMT significantly (ibid). One clear insight is the importance of accessibility to jobs, and by implication jobs-housing balance; the effect of employment accessibility on VMT appears to be related to the large contribution of longer trips (ibid). This finding highlights the potential value of providing housing in job-rich areas with good multi-modal transport access.

Furthermore, the influence of built environment factors on transport should not be considered only in isolated fashion in space or time. While the influence of any single land use characteristic upon travel behavior may be small, when considered in isolation, the combined effect of various land use factors can be more significant. Bento et al. (2005) found that predicted VMT for people living in Boston was 25% lower than for people with the same socioeconomic characteristics in Atlanta, reflecting multiple built-

environment variables that distinguish urban form in those two cities. Efforts to significantly alter the built environment in targeted areas can substantially alter travel patterns, suggesting that policy impacts can accumulate (Van Wee and Handy, 2014). Land use patterns take decades to change on the ground, and can be hard to reverse; therefore although sustained policy direction may be required to achieve benefits, they could be cumulatively substantial (Boarnet, 2010).

Research also suggests that combining strategies can sometimes reduce demand for driving synergistically – in other words, by more than the sum of effects of the strategies considered individually (Boarnet, 2010; Burbank, 2009; Greene and Plotkin, 2011; Rodier, 2009). To reduce VMT, a combination of “push” and “pull” strategies is often advocated, such as by applying pricing approaches to reduce the cost-attractiveness of driving, in combination with transit expansion and support for active transport modes, to provide alternatives to driving (Banister, 2008). Land use policymaking fits into this equation, for example through zoning or incentives to promote TOD near transit stops and along transit corridors, to reduce “free” parking provision near transit, and to improve regional transit accessibility by facilitating more efficient feeder routes and links to other modes, such as through “first-mile last-mile” pedestrian and bicycle amenities (Salon et al., 2012).

Climate policy scholarship has underscored the value of adopting synergistic demand-side strategies for reducing GHGs from transportation. While most such scholarship emphasizes the importance of technology-forcing strategies as the main pathway for reducing GHGs, at least in the short term (within the next 15-20 years), many researchers also call for demand-side strategies to be incorporated into the climate policy portfolio, if deep GHG reductions are to be achieved on the order called for by scientists and embodied in California’s adopted climate goals (Burbank, 2009; Cambridge Systematics, 2009; Creyts et al., 2007; Greene and Plotkin, 2011; U.S. DOT, 2010). Climate policy analysts call for demand-side measures to reduce spiraling VMT, and because carbon-neutral transportation technology will be costly to provide.

Different levels of government may be better suited to implementing various elements of the demand-side policy portfolio. The federal and state governments are the most appropriate levels for adopting large-scale technology-forcing policies, such as CAFÉ standards for vehicle efficiency, and for broad-based taxation like gas taxes or mileage fees. On the other hand, the local and regional scales are appropriate for fine-tuned coordinated strategies for transit, active transport, and TOD, although the federal and state governments could support such efforts.

The importance of fine-tuning localized strategies is confirmed by research indicating that the impact of land use on travel is characterized by thresholds at the neighborhood scale, indicating that single elasticity estimates are unlikely to be very useful. Boarnet and co-authors (2011) found that the elasticity of VMT with respect to employment accessibility ranged from statistically insignificant to greater than one across quintiles of employment accessibility in the Los Angeles region. Salon (2014) corroborated the presence of neighborhood-type effects in an extensive study combining data from five travel surveys conducted in California between 2000 and 2009 (Salon, 2014). After controlling for household selection of residential neighborhood type, as well as household and individual demographic characteristics, the author estimated VMT by neighborhood type, and found large differences: the highest-VMT neighborhood type had three times the average VMT as the lowest.

Thus, academic research on VMT impacts of local and regional transportation and land use policies, of the sort envisioned in SB 375 and SB 743, indicates that significant VMT reductions can be obtained, especially through applying context-sensitive, synergistic strategies over a sustained period of time. Research findings on relative impacts on VMT of different land use factors suggest that policies to improve transport network connectivity and that enhance job access might be the most effective.

The next question is whether and how SB 375 and SB 743 can work to foster such strategies. SB 375 has promoted robust planning processes that integrate regional and local strategies, at least on paper. However, SB 375 has suffered from an implementation gap, especially regarding the need for adequate incentives for inducing local development choices conducive to regional plan goals. CARB's recent, critical assessment of SB 375 progress to-date confirms that Californians cannot feel sanguine about the law's capacity to reduce GHGs as expected – at least not without stronger state-level policy and program support conducive to achieving the law's objectives.

The effectiveness of the SB 375 planning process will be further challenged, moving forward, by disruptive, hard-to-predict trends such as proliferation of transportation network companies (TNCs) and autonomous vehicles (AVs). Increased vehicle availability, reduced time spent driving, and lower vehicle operating costs in shared platforms could increase VMT absent new regulations.

In this context, can SB 743 significantly alter development choices to support SB 375 implementation and reduce VMT? The report now turns to considering goals and provisions of SB 743.

Chapter 3. BASICS OF SB 743 AND HOW IT MODIFIES CEQA REQUIREMENTS

To understand SB 743, it is important to understand how CEQA operates generally, and for traffic analysis in particular, to ascertain how SB 743 alters the situation. SB 743 not only introduces a shift in traffic analysis under CEQA, it also addresses some long-standing complaints about CEQA in general, by emphasizing location efficiency within a wider-than local context. These topics are addressed in turn in this chapter, which first describes and discusses the role and basic procedures of CEQA, then the operation of level of service (LOS) standards embedded in CEQA review for many decades, and then provisions of SB 743.

CEQA's role in the development process

CEQA is an integral part of development planning in California (Fulton and Shigley, 2012). Passed in 1970 as a state counterpart to the National Environmental Policy Act (NEPA), CEQA requires that public agencies with permitting authority identify the potentially significant negative environmental impacts of proposed development projects and plans, and then mitigate those impacts when feasible. Like much of California planning law (including General Plan law, for example), CEQA is largely procedural, such that local governments retain broad authority and discretion to determine substantive policy goals and objectives in the planning process (ibid). CEQA calls for an information-gathering and dissemination process intended to inform policymakers and the public about consequences of development choices. Required CEQA procedures, such as posting public notices, providing public comment periods, and preparing agency responses to comments, help to “daylight” project proposals and plans (BAE Urban Economics, 2016). By incorporating scientific information and public input into a systematic evaluation process, it is hoped that better-informed decisions and greater public accountability will result.

Basics of CEQA compliance

Public agencies with discretionary approval authority must comply with CEQA for each "project," which is defined as an activity undertaken by a public agency, or by a private entity subject to public agency discretionary approval, that may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment. Most proposed physical developments in California, as well as land use plans and regulations (e.g. General Plans, Specific Plans, and zoning ordinances), are subject to CEQA unless an exemption applies. Given that local governments control most land use decisions under the “police power” delegated to them by the state, most CEQA activity is undertaken by local governments as the designated “lead agency” for CEQA reviews.

The CEQA review process follows a series of steps. First, the lead agency determines if a project is subject to CEQA and no exemption applies. If so, then the lead agency prepares an Initial Study, providing a preliminary analysis to determine if there is a potential for significant impacts. To assist lead agencies in determining whether a project may have significant impacts, the state’s CEQA Guidelines Appendix G includes a sample Initial Study form which presents questions regarding a range of potential impacts that an agency may consider. Topics include environmental considerations such as biology, greenhouse gas

emissions, and air and water quality, along with impacts on the built environment, such as traffic, views, noise, and public service infrastructure. Some of the latter impacts might better be deemed social and economic impacts than strictly environmental. The Initial Study, as well as all further CEQA analysis, must also consider a project's potentially significant "cumulative impacts," in relation to impacts from other projects and over time.

The lead agency next uses findings from the Initial Study to determine whether further environmental review is warranted (if prepared; we heard that some agencies go straight to preparing a full Environmental Impact Report rather than complete an Initial Study). The lead agency must determine which of the following review documents to prepare next: 1) a Negative Declaration, if the lead agency determines that there is no substantial evidence, in light of the whole record, to support a fair argument that the project may have a significant impact on the environment, or 2) a Mitigated Negative Declaration, if potential significant impacts are identified and the lead agency adopts revisions to the project that either eliminate all significant impacts, or reduce them to less-than-significant levels, or 3) an Environmental Impact Report (EIR), if the Initial Study finds that there is a fair argument that substantial evidence indicates that significant effects may occur. An EIR must provide detailed information about a project's anticipated impact on the environment, consider feasible ways to mitigate significant adverse environmental effects, and examine project alternatives that could feasibly lessen the impacts.

The determination whether environmental impacts are significant or less-than-significant is at the heart of CEQA compliance. The state's CEQA Guidelines define a "threshold of significance" to mean "an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant" (CEQA Guidelines § 15064.7(a)). Agencies may adopt their own thresholds, or rely on thresholds recommended by other agencies, "provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence" (Id. at subd. (c)). Substantial evidence means "enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached" (Id. at § 15384). Thresholds of significance are not a legal safe harbor under CEQA; rather, they are a starting point for analysis.

In the case of a Negative Declaration or Mitigated Negative Declaration, once public comments have been received, the lead agency may approve the project, provided it finds, on the basis of the whole record, that there is no substantial evidence to support a fair argument that the project will have a significant effect on the environment. Otherwise, an EIR must be prepared, and to lawfully certify an EIR and approve a project, a lead agency must adopt measures that avoid or lessen, to the maximum extent feasible, all significant environmental impacts. In order to justify approving a project with known significant impacts, for which mitigation to a level of insignificance is infeasible, the agency must make a specific finding that economic or other project benefits override the environmental impacts. In this case, the lead agency must prepare a Statement of Overriding Considerations, which shows the agency's rationale in balancing competing public objectives. For private projects, the lead agency must complete and certify the final EIR within one year after the agency accepts the completed application, with a 90-day extension permitted upon request.

Over the years, the legislature has adopted various laws that attempt to simplify the CEQA process for projects aligned with state policy priorities, including for infill, TOD, and affordable housing projects. These changes to CEQA requirements aim to expedite environmental review or to carve out exemptions. In addition, the state has provided “tiering” provisions, which allow for streamlined project-level review to be based on environmental documents prepared at the plan level (e.g. in Specific Plans). Tiering provisions are discussed in more detail below.

CEQA controversies

CEQA provides substantial benefits for California in ensuring that development projects are scrutinized for environmental impacts and are responsive to community goals and values, such as for environmental justice (BAE Urban Economics, 2016). However, CEQA has also attracted controversy throughout its nearly 50 years because no other state law relates as intimately to the development process and public concerns about growth (Fulton and Shigley, 2012). Some issues that we heard about regarding SB 743 implementation, in particular regarding legal uncertainty, reflect these endemic concerns raised about CEQA implementation more generally.

Developers have long complained about costs of legal conflict and delay in complying with CEQA, including indirect costs of uncertainty, which may be more consequential than actual time and money spent on reviews (ibid; BAE Urban Economics, 2016; Barbour and Teitz, 2005). Uncertainty exacerbates fears about litigation, prompting lead agencies to “bullet-proof” environmental impact reports (EIRs) with extensive documentation.

Uncertainty about length and cost of CEQA review has been attributed to a number of causes. One potential cause is the law’s flexible language on substantive standards for determining significance of effects. The State Bar referred to the legal standard for determining significance of environmental impacts (namely, whether a “fair argument” can be made that a “substantial change in physical conditions” will occur) as a judgment call that varies with setting (State Bar, 1995; also see Fulton and Shigley, 2012, who note that, “to a great extent, significance [under CEQA] is in the eye of the beholder”). Deference to local lead agency discretion under CEQA can also add to uncertainty. Even though the state publishes guidelines for CEQA compliance, lead agencies retain discretion to determine whether impacts are significant, and how to mitigate, subject to the legal standards of the law. Localities may approve projects in spite of adverse effects, and weigh costs and benefits of environmental mitigation differently, so project applicants may face inconsistent requirements across jurisdictions.

A frequent complaint has been that CEQA provides opportunity for project opponents to delay approvals (Fulton and Shigley, 2012; BAE Urban Economics, 2016). CEQA is the most litigated planning law in the state (Fulton and Shigley, 2012). Some research has indicated that fears of litigation by lead agencies are pervasive, yet evidence also indicates that most projects do not result in EIRs, and only a very small share end up in court (BAE Urban Economics, 2016; Barbour and Teitz, 2005). The influence of litigation fears cannot be measured only by the number of actual lawsuits filed, however.

In judging CEQA reviews, the courts tend to scrutinize procedural compliance, while also deferring to lead agencies’ discretion under the law to determine goals and standards (Fulton and Shigley, 2012). In doing

so, “the courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure” (CEQA Guidelines 15151). In any case, erecting barriers to court challenges could weaken CEQA benefits, given that the law’s only enforcement mechanism is through citizen legal challenge. Instead, addressing ambiguity in substantive standards might be a more useful route for addressing concerns about legal uncertainty, because this ambiguity can provide would-be petitioners with footholds to challenge projects (Thomas, 1993).

In addition to complaints about CEQA coming from developers, some planners and environmentalists have also raised concerns about the law’s role in the planning process. In particular, CEQA has long been accused of meshing poorly with long-range, comprehensive planning (see Barbour and Teitz, 2005, for an overview of literature). (SB 743 promises to address some of these concerns; see the next section.)

CEQA is meant to connect to wider-than-local perspectives through requirements for evaluating cumulative impacts, alternatives, and growth-inducing impacts of proposed projects. But compliance with these requirements is widely considered difficult and weak, with legal defensibility considered confusing even to experts (Olshansky, 1996a; Shigley, 1999, 2002, 2003; Sargent et al., 2004; Fulton and Shigley, 2012).

To address concerns about ad hoc, uncoordinated CEQA review, the state legislature passed reforms starting in the 1980s and 1990s to encourage tiering, that is, “front-loading” environmental review as much as possible at the scale of community plans, which can then serve as a framework for subsequent review of individual projects.⁹ However, the bridging of project and plan level review has been easier in theory than practice (Fulton and Shigley, 2012). Survey data from 2002 indicate that less than half of cities had made use of tiering through each of the three main mechanisms available then (OPR, 2003). Obstacles to more widespread use of tiering noted by practitioners include legal, procedural, and financial concerns (Barbour and Teitz, 2005).

More recently, various CEQA exemptions and streamlining provisions have been provided for infill projects located near transit, including in SB 375 and SB 743. However, some observers have deemed these provisions also to be of limited use because the criteria have been tightly limited in scope (Fulton and Shigley, 2012).

Concerns about the effectiveness of cumulative impacts analysis and tiering relate to CEQA’s localized focus. Some observers have argued that CEQA gets things fundamentally backwards when it comes to addressing impacts at a wider-than-local scale, by operating primarily at the local project level (Landis et al., 1995; Olshansky, 1996 a and b). In this view, problems such as traffic congestion, air pollution, and habitat deterioration benefit from coordinated, long-term, regional strategies that identify how local mitigation

⁹ Tiering has been defined as the coverage of environmental effects in an EIR prepared for a policy, plan, program, or ordinance, enabling narrower or site-specific EIRs to incorporate by reference the discussion in any prior EIRs so as to concentrate on the environmental effects capable of being mitigated or that were not analyzed as significant effects in the prior EIR. Specific tiering mechanisms include Program EIRs and Master Environmental Impact Reports. In general, tiering may be used for a later project when the lead agency determines that it is consistent with the program, plan, or ordinance for which the prior EIR was planned or certified, is consistent with applicable local land use plans and zoning, and is not subject to conditions requiring a subsequent EIR. Project EIRs need not examine those effects that were previously mitigated or avoided or examined sufficiently so as to be capable of being avoided by site-specific revisions or conditions for approval.

measures fit into a larger framework (Landis, et al., 1995; Sargent et al., 2004). CEQA has generally not been explicitly integrated with regional strategies that trade off increases in negative effects in one geographic area or for one environmental impact in exchange for corresponding reductions in another.

As it is, some local project mitigations have been counterproductive, viewed at a wider scale. Traffic analysis under CEQA using LOS standards has been a prime example. Lowering a residential project's density, for example, might help mitigate traffic congestion considered at the local scale, but only compound the problem, considered regionally, if development is pushed to outlying areas, putting more traffic on the road. Similarly, addressing localized traffic congestion through road widening could compound regional congestion if induced demand leads to higher VMT.

A number of planners we spoke with noted that that ideally, CEQA should operate as an implementation tool for planning decisions made at a wider scale – for the community and the region as a whole. Without a plan to guide CEQA review, it is more likely to be ad hoc and/or redundant across projects, they told us. At the community scale, CEQA should help ensure that goals and standards set out in General Plans and Specific Plans are carried out in an environmentally responsible way. However, many California cities have not kept their General Plans up-to-date; in 2017, the average age of circulation and land use elements in General Plans in California cities was more than 10 years old (based on calculations from data in OPR's *2017 Annual Planning Survey Results*).

Past research indicates that many times more money is spent on an annualized basis by local jurisdictions for CEQA review than is spent on General Plan updates (Olshansky, 1996a). The question of who pays helps explain why. Costs for CEQA review are recouped from project applicants – private developers, in the case of most projects – while costs for General Plan updates are paid from local government general funds. This financial reality may help ensure that more day-to-day planning activity is directed toward CEQA review than comprehensive planning. From this perspective, CEQA can become “the tail that wags the dog” of good planning practice (Fulton and Shigley, 2012) – a comment we heard repeated more than once during our interviews. This critique points more to the need for strengthening comprehensive planning capacity than for weakening CEQA review requirements, however.

These concerns have led some observers to criticize CEQA's influence in sustainability planning. Veteran planning and CEQA analysts William Fulton and Paul Shigley note, for example, that “CEQA's goal of avoiding or minimizing all impacts to the environment actually runs counter to many notions of smart growth and sustainable development, which often concentrate development – and therefore environmental impacts of development – in a specific area” (Fulton and Shigley, 2012).

To accomplish goals of SB 375, efficient development, viewed through a regional lens, is imperative. SB 743 promises to re-orient CEQA toward supporting regional objectives for efficient transportation and land use, and in so doing, to also address some of the complaints raised by planners, discussed above, about CEQA's role in sustainability planning. The next section considers why this might be so.

SB 743 and CEQA's role in the development process

Our assessment indicates that CEQA review can significantly influence development decisions, in ways often better suited to addressing localized impacts of projects than impacts at a community-wide or

regional scale. In fact, localized CEQA review and mitigation can sometimes be counter-productive to region-scale strategies, such as those contemplated for regional plans under SB 375. LOS analysis and mitigation embedded in CEQA provisions has constituted a prime example of this problem.

SB 743 represents a significant change in how CEQA addresses traffic impacts, by introducing a metric aimed at encouraging more efficient development patterns, viewed at a wider-than-local scale. By focusing on VMT impacts, OPR's proposed SB 743 implementation metrics directly connect local project analysis to assessment of wider-than-local impacts. By taking this approach, SB 743 addresses the long-standing complaints, noted above, about CEQA's over-emphasis on localized impacts, even as SB 743 also redirects the performance focus of transportation analysis and mitigation. This attribute of SB 743 makes the law salutary not just for traffic analysis but for CEQA more broadly.

However, this very aspect of SB 743 – the need to consider local impacts within a wider-than-local context – also presents new practical challenges for practitioners accustomed to measuring auto LOS at the localized intersection-level scale. As one consultant noted, “We’re in a more creative environment now... a more abstract realm. VMT is not an environmental measure, but it’s a surrogate. With 743, we’re shifting from looking just at the project level to the context, even regional context. That is a big leap, and we still need to figure out how to make it work.”

While connecting project-level to plan-level analysis and mitigation under SB 743 is a promising opportunity, this connection will not occur automatically, and rather will depend on local and regional planners developing effective techniques and policies. Our case studies of San Francisco and Pasadena, presented in Chapter 5, describe the innovative approaches taken by these cities to address this challenge. The report now turns to discussing the basic motivation for their efforts – the problems encountered with traditional LOS standards, which led to the passage of SB 743 as an alternative.

Level-of-service standards

Most California localities have been using level of service (LOS) standards to measure potential transportation impacts of development projects and long range plans (calculated from OPR, *2016 Annual Planning Survey Results*). Nearly three-quarters of California cities have had LOS policies embedded in their General Plans (ibid). The LOS metric has been explicitly included in CEQA guidance “since at least the late 1990’s, when the sample environmental checklist in the CEQA Guidelines asked whether a project would exceed LOS standards” (OPR, 2013, p. 3).

While LOS has been the most prevalent metric for transportation analysis under CEQA for many years, it has come under criticism for working against development of multimodal transportation networks, infill development, and even optimization of the roadway network for motor vehicles (OPR, 2013). This section considers why this practice has come to be criticized.

The concept of Level of Service (LOS) has been used by traffic and transportation engineers for over 50 years to describe operating conditions for automobile travel on existing or planned roadway facilities (Milam, n.d.). LOS standards were readily adopted by cities across the nation following development and publication of LOS measurement techniques by the national Highway Research Board and Bureau of Public

Roads (later the Federal Highway Administration) in the 1960s (Roess and Prassas, 2014). The techniques continued to evolve, becoming ever more complicated over time (ibid).

According to two experts long engaged in refining the standards,

When first introduced in 1965, [LOS] was a simple concept describing operational quality in simple terms...As our ability to measure, quantify, and predict a wide range of operating parameters has improved we have tried to cram more and more information into this very simple six-letter descriptor. The simple has become quite complex, to the point where even professionals have difficulty discerning what exactly a given level of service designation means in a specific case...Software spits out answers that are certainly precise – often to several decimal places. Precision, however, is not equivalent to accuracy (ibid, pps. 49, 73).

LOS is defined in the Highway Capacity Manual (HCM) (Transportation Research Board, 2000, 2010) in qualitative terms, as a measure of operational conditions within a traffic stream, to consider service measures such as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. In practice, however, LOS is most commonly determined using a quantitative measure of average delay per vehicle at intersections, usually for the weekday AM and PM peak hours (ibid).¹⁰ Delay is generally defined as the difference between the actual travel time a vehicle experiences and the time it would experience if no other vehicles or traffic control devices were present at the intersection.

The HCM prescribes a methodology for estimating peak period delay that calls for use of a peak hour factor which extracts a peak 15-minute traffic volume from the peak hourly volume; this factor represents the 99th percentile traffic volume on a typical weekday. Typical transportation operations analyses are conducted using the HCM methodology, which divides LOS into six categories, ranging from LOS A to LOS F, like a report card, with LOS A representing free-flow travel, and LOS F representing over-capacity, forced flow conditions. LOS is widely accepted professionally because it is relatively straightforward to access the necessary data and produce the measurements (Henderson, 2011). Data are usually collected at peak commute hours using counting devices and then run through computers to generate estimates of delay.

Problems with LOS

LOS standards have been criticized on a number of grounds, as planners have become aware that the standards inhibit development of compact, mixed-use neighborhoods with multimodal access (OPR, 2013). LOS is criticized, at the most basic level, for focusing on the movement of vehicles, not people – or i.e. focusing on mobility rather than accessibility. Traditional LOS treats delay to a single automobile as equivalent to delay to a full bus.

LOS mitigations can work against “smart growth” goals such as for developing mixed-use, multimodal neighborhoods, increasing walking and cycling safety, and reducing VMT and air pollution. For LOS purposes, pedestrians and bikers are considered impediments to car movement. Sometimes, required LOS mitigations have sought to reduce the timeframe in which pedestrians are allowed to cross a street, or to force them to climb stairs and cross a walkway to avoid hampering traffic flows (Karlin-Resnick, 2016).

¹⁰ A second, less common method of estimating LOS is vehicle/capacity LOS, which measures the throughput of vehicles per hour and per lane on a particular roadway segment (Henderson, 2011).

Similarly, LOS standards have hampered infill, because the developments held accountable for poor LOS scores are those which push congestion over a significance threshold, meaning the “last one in must pay.” Infill development projects that downgrade an intersection’s LOS to an unacceptable score can be required to provide costly mitigation measures, although preceding projects in the area were not similarly penalized.

Meanwhile, LOS tends to reinforce the very problem it was intended to solve. Mitigations to reduce auto delay create a self-fulfilling prophecy, if widening of roads and intersections makes walking, biking or taking transit more difficult, and driving easier, and if roadway widening induces more traffic. The problem is compounded by pegging LOS standards to peak-period delay, and evaluating delay only at the localized, intersection scale. High-traffic areas, especially at peak periods, signal economic vitality, yet under LOS they receive failing grades. The cumulative impact of LOS standards is to encourage dispersal, through an artificially enhanced demand for mobility (higher speeds) (Whitelegg, 1993, cited in Henderson, 2011). LOS standards ensure that more space is dedicated to roadways, and more activities are dispersed to greenfield areas where localized traffic congestion is minimal. Meanwhile, walking and cycling are made more dangerous, and transit more impractical.

Frustrated with LOS standards, some residents and planners in urban cities in California began pressuring policymakers to address their concerns, before passage of SB 743. For example, San Francisco planners and bicycle advocates grew frustrated when proposals for new crosswalks and bike lanes were discouraged by city traffic engineers because they would contribute to auto delay (Henderson, 2011), and similarly, when proposals to introduce exclusive bus lanes were resisted because they might divert traffic, causing a decline in LOS on side streets. In this manner, LOS standards had created a “psychological impact” exerting a “chilling effect on thinking about...how urban streets can be used, and it dampen[ed] enthusiasm among decision-makers” (Henderson, 2011, p. 1139).

Such concerns led Darrel Steinberg, the state legislator who had introduced SB 375, to introduce SB 743 in the state legislature in 2013. It was adopted the same year. The next section describes its main provisions.

Provisions of SB 743

SB 743 called for eliminating traffic delay as an environmental impact to be analyzed and mitigated under CEQA, and for an alternative metric to be developed for traffic impact analysis to “promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses” (Public Resources Code §21099(b)(1)). The Governor’s Office of Planning and Research (OPR) was tasked under the law with identifying the new metric, and proposing amendments to the state’s CEQA Guidelines (Title 14 of the California Code of Regulations sections and following) that would include the new metric as an alternative to level of service for evaluating transportation impacts. Once the state’s Natural Resources Agency officially adopted OPR’s proposed guideline changes, then delay to automobiles could no longer be considered a significant impact under CEQA.

As required by SB 743, OPR circulated a first draft of the proposed changes to the guidelines in 2014. After holding public workshops and receiving comments, OPR released a second draft in 2016. Meanwhile, OPR also released several draft iterations of its accompanying technical advisory. In December 2018, the state’s Natural Resources Agency formally adopted the proposed guidelines changes, indicating that measuring

vehicle miles traveled generated by development projects is the most appropriate method for evaluating transportation impacts under CEQA. OPR released another update to its technical advisory during the same month. The documents are available at: <http://www.opr.ca.gov/ceqa/updates/sb-743/>.

The provisions described here reflect OPR's technical advisory released in December, 2018, as they pertain to residential and certain mixed use (residential plus locally serving retail) projects, the focus of this report. The advisory also includes provisions for office and transportation projects, but they are not our focus. OPR's advisory recommends methodologies for calculating VMT, and suggests criteria to indicate when a project may be determined to have a significant, or less than significant, impact on the environment for transportation purposes (i.e. impact on VMT). Here we describe major provisions pertinent to our research.

Methods for estimating VMT

For SB 743 purposes, impacts are to be analyzed for VMT from passenger vehicles, in other words, from cars and light trucks. For residential projects (the main focus of this report), OPR's guidance recommends tour-based analysis as the most complete characterization of a project's effect on VMT, and trip-based analysis as a good proxy. A home-based tour assessment includes trips starting from the home residence, and also trips from each subsequent destination until the traveler returns home again. For residential projects, the sum of all tours starting and ending at the residence comprises household VMT.

In regard to tools and techniques for measuring VMT, OPR's guidance notes that "travel demand models, sketch models, spreadsheet models, research, and data can all be used to calculate and estimate VMT" (OPR *Technical Advisory*, p. 30). Lead agencies should choose models sensitive to features of the project that affect VMT, and should ensure that data and methods match when using models and tools for multiple purposes, in particular, to ensure "apples-to-apples" comparisons between estimates of significance thresholds, project VMT estimates, and mitigation VMT estimates.

Lead agencies are encouraged to "use travel demand models or survey data to estimate existing trip lengths and input those into sketch models such as CalEEMod to achieve more accurate results" (ibid, p.30). Agencies should "input localized trip lengths into a sketch model to tailor the analysis to the project location. However, in doing so, agencies should be careful to avoid double counting if the sketch model includes other inputs or toggles that are proxies for trip length (e.g. distance to city center)" (ibid, p.31)

Retail projects should be assessed based on the change in total VMT attributable to the project. Lead agencies should adopt this approach because retail projects typically re-route travel from other retail destinations. The analysis should evaluate whether a project is likely to divert existing trips, and the effect of those diversions on total VMT. Such an analysis should address the full area over which the project affects travel behavior, even if the effect on travel behavior crosses political boundaries.

Recommended thresholds of significance

SB 743 directed OPR to propose metrics to measure transportation impacts. While noting that lead agencies retain discretion to determine thresholds, OPR's advisory recommends thresholds that normally may be considered to indicate significant effects.

OPR recommends a screening threshold for small projects – those expected to generate fewer than 110 vehicle trips per day – which may generally be assumed to cause a less than significant transportation impact. For residential and office projects, lead agencies may also use map-based screening to identify areas where per household VMT (for residential projects) and per employee VMT (for office projects) will typically show below-threshold VMT for these land uses.

Other recommended significance thresholds relate to transit access and housing affordability. Lead agencies generally should presume that residential, retail, and office projects, as well as projects which mix these uses, which are proposed within ½ mile of an existing major transit stop or an existing stop along a high quality transit corridor, will have a less than significant impact on VMT.¹¹ This presumption would not apply, however, if project- or location-specific information indicates that the project will generate significant levels of VMT.¹² Furthermore, a project in an infill location consisting of a high percentage of affordable housing units may be presumed to have less than significant impacts.

For residential projects, the recommended threshold of significance in estimating VMT impacts is a project that would generate VMT exceeding 15 percent below existing residential VMT per capita, measured at the city or regional level. As a basis for justifying its recommended thresholds, OPR’s technical advisory points to analysis by CARB conducted for its recently updated *Scoping Plan*, indicating that for project analysis, reduction in total VMT per capita of 14.3%, and in light-duty VMT per capita of 16.8%, compared to existing conditions, would be consistent with achieving the state’s climate goals (OPR, 2018, p. 11)

When proposed development is measured against a threshold referencing city VMT per capita, rather than regional VMT per capita, the development should not cumulatively exceed the population or number of units specified in the regional SCS for that city, and should be consistent with the SCS. However, precise methods for determining this consistency are not specified. Presumably the provision indicates that a city’s development should be consistent with that specified in the region’s RHNA plan, which is required to be consistent with the region’s SCS and RTP. However, OPR’s technical advisory also notes that, “At present, consistency with RTP/SCSs does not necessarily lead to a less-than-significant VMT impact” (OPR, 2018, p.11) because of the gap identified by CARB between the level of GHG reduction necessary from MPO plans to help achieve the state’s climate goals, and the level of MPO reduction targets set in 2018 (see “Recent developments in California climate policymaking to reduce VMT” in Chapter 2).

For retail projects, the recommended threshold is a project that produces a net increase in total VMT. Because new retail typically redistributes shopping trips rather than creating new trips, estimating the difference in total VMT in the area affected, with and without the project, is the best way to analyze impacts. By improving retail destination proximity, local-serving retail development tends to shorten trips

¹¹ From Public Resources Code § 21064.3 (“‘Major transit stop’ means a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods”). From Public Resources Code § 21155 (“For purposes of this section, a high-quality transit corridor means a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours”).

¹² For example, the presumption might not be appropriate if the project: a) has a Floor Area Ratio (FAR) of less than 0.75; or b) includes more parking for use by residents, customers, or employees of the project than required by the jurisdiction (only for jurisdictions specifying a parking minimum); or c) is inconsistent with the applicable Sustainable Communities Strategy (as determined by the lead agency, with input from the Metropolitan Planning Organization).

and reduce VMT. Lead agencies generally, therefore, may presume such development creates a less than significant transportation impact. Regional-serving retail development, on the other hand, can lead to substitution of longer trips for shorter ones. Where such development decreases VMT, lead agencies may consider it to have a less than significant impact. Development including stores larger than 50,000 square feet might be considered regional-serving, and so should be analyzed to determine whether the project might increase or decrease VMT.

For mixed use projects, lead agencies can evaluate each component of the project independently, and apply the significance threshold for each project type included (e.g. residential and retail). In the analysis of each use, a project may take credit for internal capture (trips within the project itself).

Provisions regarding plan-level thresholds

For CEQA review of land use plans, as with projects, agencies should analyze VMT outcomes over the full area that the plan may substantively affect travel patterns, including beyond the boundary of the plan or jurisdiction geography. General Plans, area plans, or community plans may be deemed to have significant effects if proposed new residential, office, or retail uses would in aggregate exceed the respective recommended thresholds for each use.¹³

Some additional provisions

- Auto-mobility (often expressed as “level of service”) may continue to be used as a measure for planning purposes, just not for purposes of CEQA review.
- Under SB 743, a project’s aesthetic and parking impacts will no longer be considered significant impacts on the environment if:
 - The project is a residential, mixed-use residential, or employment center project, and
 - The project is located on an infill site within a transit priority area.
- In an amendment to the Government Code regarding Congestion Management Plans, a city or county may designate an “infill opportunity zone” by resolution, if it is consistent with the General Plan and any applicable Specific Plan, and is a transit priority area within the adopted SCS or Alternative Planning Strategy (APS) conducted under SB 375. This zone becomes exempt from LOS standards in the Congestion Management Plan.

¹³ SB 743 creates a new exemption from CEQA for certain projects that are consistent with a Specific Plan (New Public Resources Code Section 21155.4.) A Specific Plan is a local plan that contains specific policies and development regulations for a defined area such as a downtown core or along a transit corridor. The exemption applies if a project meets all of the following criteria: a) it is a residential, employment center, or mixed use project; b) it is located within a transit priority area; c) the project is consistent with a Specific Plan for which an environmental impact report was certified; and d) it is consistent with an adopted Sustainable Communities Strategy or Alternative Planning Strategy. “Transit priority area” means “an area within one-half mile of an existing or planned major transit stop. “Consistent with an adopted sustainable communities strategy or alternative planning strategy” means that a project is consistent with “with the general use designation, density, building intensity, and applicable policies specified for the project area in either a sustainable communities strategy or an alternative planning strategy for which the State Air Resources Board... has accepted a metropolitan planning organization’s determination that the sustainable communities strategy or the alternative planning strategy would, if implemented, achieve the greenhouse gas emissions reduction targets.”

Mitigation

OPR's advisory recommends the following mitigation measures, among others, to reduce VMT:

- Improve or increase access to transit.
- Increase access to common goods and services, such as groceries, schools, and daycare.
- Incorporate affordable housing into the project.
- Incorporate neighborhood electric vehicle network.
- Orient the project toward transit, bicycle and pedestrian facilities.
- Improve pedestrian or bicycle networks, or transit service.
- Provide traffic calming.
- Provide bicycle parking.
- Limit or eliminate parking supply.
- Unbundle parking costs.
- Provide parking or roadway pricing or cash-out programs.
- Implement or provide access to a commute reduction program.
- Provide car-sharing, bike sharing, and ride-sharing programs.
- Provide transit passes.

Examples of project alternatives that may reduce vehicle miles traveled include, but are not limited to:

- Locate the project in an area of the region that already exhibits low vehicle miles traveled.
- Locate the project near transit.
- Increase project density.
- Increase the mix of uses within the project, or within the project's surroundings.
- Increase connectivity and/or intersection density on the project site.
- Deploy management (e.g. pricing, vehicle occupancy requirements) on roadways or roadway lanes.

Conclusion

CEQA is not a planning law, and CEQA review is not planning. Rather, CEQA is an informational instrument to help support achievement of a community's planning goals, while accounting for environmental impacts. Due to fiscal constraints, communities have increasingly relied upon CEQA review as a means for undertaking site assessment and mitigation for impacts of new growth, because the costs of CEQA review are borne by project applicants. In the case of LOS standards, CEQA has been a vehicle by which communities have systematically exacted funds for roadway widening projects, and other enhancements for automobile use, from project developers.

SB 743 was enacted to re-direct the powerful CEQA mechanism to support a different goal for transportation, more aligned with the state's environmental and compact growth policies. It is one of only a few major policies and programs adopted in California to explicitly support implementation of SB 375 (another being the Affordable Housing and Sustainable Communities program, which since 2014 has been allocated 20% of the state's GHG cap-and-trade auction funds, on an ongoing basis, for competitive grants to localities for affordable housing projects linked to transit and active transport enhancements).

Will SB 743 have a strong influence on local transportation and land use planning, and help achieve SB 375 goals in accord with local policy preferences? The next chapter addresses these questions, based on findings from qualitative research conducted for this study.

Chapter 4. CHALLENGES AND OPPORTUNITIES OF SB 743 IMPLEMENTATION: FINDINGS FROM OUR QUALITATIVE RESEARCH

This chapter presents findings from qualitative research on challenge and opportunities that SB 743 presents for cities, in relation to land use projects. The findings are based mainly on forty-three interviews conducted in 2016 (mainly) and 2017 with: local planners from 25 California cities; six transportation and/or CEQA consultants working with private firms, mainly in northern California; planners from four MPOs; and planners from two county congestion management agencies.¹⁴

This chapter first describes general perceptions from our interviewees about SB 743, and then it explores different facets of implementation in more detail, including technical, legal, policy, and political aspects. The following chapter provides in-depth case studies of programs in two of the cities we investigated, namely San Francisco and Pasadena; their programs are also noted in this chapter. The case studies should be of interest to planners even in communities very different than San Francisco and Pasadena, because they provide models for how to address salient issues.

San Francisco and Pasadena provide models for other cities because they have integrated project-level CEQA review with systematic city-wide approaches to facilities funding. In spite of this similarity, the city strategies are also distinct in significant ways that should be of interest to planners. San Francisco uses a map-based screening approach to radically streamline VMT analysis, and has placed its multimodal and VMT mitigation programs – intended to reduce VMT in line with SB 743 objectives – on an “off-CEQA” legal basis. Planners interested in developing up-front systematic approaches for financing multi-modal improvements to support VMT reduction through impact fees and TDM ordinances should pay special attention to San Francisco’s approach. Meanwhile, Pasadena upgraded its modeling capacity to facilitate coordination of project-level with plan-level CEQA review for VMT and also multimodal performance standards including non-CEQA LOS standards. City planners interested in conducting project-level VMT impacts analysis using a demand model, and integrating LOS with VMT, should pay special attention to Pasadena’s approach. See Chapter 5 for more details.

¹⁴ We targeted our requests for interviews with city planners on the following basis. We conducted interviews in policy innovator cities that we were aware of having explored and, in some cases, adopted new approaches to transportation impacts analysis and mitigation, addressing the goals of SB 743; these cities included, in addition to San Francisco and Pasadena, also Oakland, San Jose, Los Angeles, Santa Monica, and Sacramento. We also reached out to large “high growth” cities, measured in terms of their projected share of regional housing growth in adopted RHNA plans. Planners responded to our request from six San Francisco Bay area cities, nine Los Angeles area cities, four Sacramento area cities, two San Diego area cities, and four Central Valley cities. More than half of these respondent cities have high average per capita VMT compared to the regional average. Our interviews were conducted with planners from the following cities: Anaheim, Bakersfield, Chula Vista, Concord, Elk Grove, Fresno, Glendale, Irvine, Los Angeles, Modesto, Mountain View, Oakland, Oxnard, Pasadena, Roseville, Riverside, Sacramento, San Diego, San Francisco, San Jose, Santa Clarita, Santa Monica, Stockton, Sunnyvale, and West Sacramento.

General perceptions of SB 743 and the shift from LOS to VMT

Most city planners we interviewed were still in a “wait and see” mode about SB 743 implementation, indicating that they intended to wait for OPR to finalize its guidelines, and for the Natural Resources Agency to adopt them through formal rulemaking, before proceeding with implementation. For this reason, our conversations were necessarily often speculative about opportunities and concerns raised by the new law.

Almost all planners we spoke with indicated that they accept or welcome SB 743 in terms of its basic intent, because they understand concerns about LOS as a CEQA metric that led to the law’s adoption, in particular the inappropriateness of considering traffic delay as an environmental impact. At the same time, many planners were unsure about how to undertake VMT analysis and especially mitigation, and how and whether their city will retain LOS requirements and integrate them with VMT requirements.

SB 743’s mandate coincides with the experience in many cities we investigated, where planners and residents are grappling with how to improve multimodal network performance in the face of rising traffic congestion. Not surprisingly, planners from built-out coastal cities with good transit access, seeking to accommodate infill development, were the most likely to indicate they have found LOS analysis and mitigation requirements burdensome. These planners complained about the need to complete more and costlier EIRs because LOS requirements trip the CEQA trigger for many infill projects, and because LOS can provide a ready tool for opponents to try to stop projects. Many of these planners welcomed the elimination of CEQA-based LOS as the removal of an impediment to infill and multimodal transport.

The passage of SB 743 coincides with planning transitions already underway for many cities, expressed in General Plans and associated programs and policies, to provide stronger support for infill development and multi-modal mobility. Some cities, such as Santa Monica and West Sacramento, had already adopted General Plans and associated facilities impact fees and TDM ordinances aimed at fostering multimodal transportation, and they were now asking how to fit VMT impact analysis into the equation, at both the plan and project level. Planners in other cities noted that SB 743 provides a useful – even convenient – opportunity to revisit existing impact fee programs in order to shift existing funding commitments away from roadway enhancement to instead support transit, bike, and pedestrian enhancements.

Conversely, planners from cities with lower-density development and less market interest in infill, whether located in outlying suburban areas or in the Central Valley, expressed less enthusiasm overall for the shift from LOS to VMT analysis and mitigation under SB 743. Some of these planners contended that SB 743 is more appropriate for the needs of “infill cities” than their own communities. Where new development is expected to occur in low-density, outlying areas and/or areas not well served by transit, the sort of mitigation contemplated in OPR’s advisory can sometimes seem infeasible, we heard. For office projects, some planners worried that mitigations under SB 743 could make their city less competitive to prospective employers and project developers. For retail projects, they worried that losing CEQA-based LOS requirements would mean they could not exact mitigations for roadway improvements and signalization. For residential development, they noted that market factors can make infill difficult in some locales, especially as a substitute for traditional single-family development. Some planners noted that master-planned communities are easier to design with “smart growth” concepts, but “pocket” development and large single-family residential projects will be harder to mitigate for VMT impacts.

In spite of encountering more general enthusiasm about SB 743 from planners in coastal, urban cities compared to planners from suburban and Central Valley cities, we also found no simple, dichotomous distinction in perceptions and planned approaches to SB 743 implementation across these types of communities. Planners in many types of cities were questioning how to integrate VMT analysis into their cities' planning procedures, and whether to retain traditional LOS in some form.

Planners in cities intent on fostering infill sometimes expressed regret, or difficulty, in relinquishing use of LOS, which they found useful for certain purposes. For example, even cities that do not desire roadway widening often seek less extensive modifications, such as signalization improvements, based on LOS impacts. In addition, cities use LOS to assess other factors including safety and access for emergency vehicles at intersections. An early draft of OPR's advisory disputed the contention that LOS standards help improve safety, however, citing research that indicates that emergency vehicle access and travel time can be hampered in sprawl-type areas.

Just as important to some of our interviewees as any perceived practical, functional advantages of LOS are its political benefits. Many planners we interviewed said their cities will continue to want to use LOS metrics to provide constituents with information they are accustomed to receiving about proposed projects. In many communities, "traffic is sort of a moniker for change," as one transportation consultant explained. Because it seems measurable in theory, he noted, traffic provides residents concerned about community change and urban qualities with a leverage point for challenging projects.

However, the same consultant noted that benefits of LOS can be somewhat illusory as a metric for managing the pace of urban change. He pointed to widespread frustration about the "black box" of LOS practice, which reports analytical results at a fine degree of preciseness, but based on assumptions that may be questionable. However, with LOS solidly ingrained in our planning process over decades, this consultant believes it will take a long time for planners to relinquish it.

Meanwhile, planners from outlying suburban and Central Valley cities told us they also sometimes experience LOS as problematic, for example in their downtown areas where they seek to introduce mixed use infill. Importantly, most of the cities we investigated had developed work-arounds to LOS requirements that enable them to accommodate more congestion depending on location, for example by imposing less stringent standards (LOS E or F, for example) in downtown areas and along densifying corridors. Single-family neighborhoods are often the most protected with stringent LOS standards, we heard.

The transportation consultants we interviewed, who work with many cities across the state, confirmed these observations. As one put it, "The most support for 743 is in the urbanized areas where the transportation networks are largely complete. They don't have a lot of new roadway expansion or greenfield development. If you're in a more suburban or rural area and you're still growing and need to expand the network, then you face more of a disconnect because your constituents are mostly interested in how long trips take and how much traffic they will face. Not that traffic is not an issue in urban areas, but you do have a different set of community values."

On the other hand, another consultant noted that, "I think there's plenty of willingness to change, because I think all cities are trying to balance LOS and VMT considerations. I don't think that any cities want to stay

with exactly what they've been doing and not change. But at the same time they fear that the change might be too great and too fast.”

Many planners and consultants we interviewed indicated that SB 743 is likely to prompt discussions about how to integrate project-level analysis and mitigation with city plans and policies for transportation. In the short run, many cities may simply seek to implement project-level analysis and mitigation, utilizing OPR's guidance for the purpose. This may not be technically challenging, as VMT estimation is much easier than LOS analysis, according to the transportation consultants we interviewed; in any case, cities already estimate VMT for multiple purposes in environmental documents, such as for GHG emissions analysis.

Over the longer run, SB 743 could cause many, if not most cities to undertake more thorough-going re-evaluation of their transportation policies, according to some transportation consultants that we interviewed. For cities amenable to infill and multi-modal strategies, SB 743 may provide a welcome opportunity to revisit existing plans and policies, so as to systematically integrate VMT impact analysis and mitigation into a broader approach to managing growth. However, even those communities that would prefer to retain LOS as their primary basis for transportation analysis and mitigation may need to revisit their transportation plans and policies, we heard. With traffic delay now removed as an environmental impact under CEQA, a city's use of LOS as a measure of delay and standard for developer exactions must be pegged to a non-CEQA policy basis. So even communities that seek to maintain the LOS status quo must ensure that their General Plans and associated fee policies provide a secure non-CEQA legal basis for doing so. These communities will also need to consider how to address conflicts that may arise in practice between LOS and VMT objectives during project approval review. (We discuss these issues in greater detail in a later section of this chapter.)

The overall message that we gleaned from our interviews is that SB 743 will serve to prompt discussion and revision of transportation plans and policies in communities across the state, but the process for adoption of new metrics and methods, and for connecting them to related community plans and policies, could be slow in some cases, especially in cities with fewer resources and/or contentious growth politics. Many planners indicated they would remain in the “wait and see” mode over the short run because they feared legal vulnerability if they got too far “out in front” of their peers in adopting new VMT thresholds and requirements. They also expressed some concerns about the costs of updating plans and policies and upgrading technical modeling capacity that might be needed to pursue the sort of extensive overhaul of transportation programs achieved by San Francisco and Pasadena.

The process that unfolds across the state may resemble the history of adoption of LOS techniques, and their integration into planning practice. As noted earlier, LOS standards were readily adopted by cities across the nation during the 1960s, but continued to evolve over time, even as cities embedded LOS into their local policies, such as impact fee ordinances. Going forward, community-wide policies connected to VMT mitigation, rather than LOS mitigation, are also likely to require some time to develop. Cities like San Francisco and Pasadena provide models for other communities to follow, but each community will need to consider how best to align VMT analysis and mitigation with its own conditions, priorities, and plans.

Technical aspects of VMT analysis under SB 743

Most planners we interviewed were somewhat unsure about how they would analyze and mitigate for VMT at the project level for CEQA purposes. In its advisories, OPR has asserted that VMT estimation is likely to be easier than LOS, because most cities are already calculating VMT for purposes including air quality, GHG, and energy analysis under CEQA. Transportation consultants tended to confirm this assessment; one noted, for example, that VMT analysis requires about 20% of the cost of LOS analysis that they currently conduct. However, some city planners indicated that even though VMT is a component in other analyses, they have not yet applied VMT analysis, and especially not mitigation measures, to project-level review, and they will need to consider carefully how to approach that work.

Tools for VMT analysis: the sketch tool option

One key question lead agencies will face is what sort of tool or technique to use for VMT analysis. On one end of the spectrum, in terms of cost of use, are “sketch tools” (some of which are run on spreadsheets). These tools apply elasticities derived from research on the effect of built-environment characteristics upon VMT. (Elasticities measure the percent change in the dependent variable of interest associated with a one percent change in the independent, explanatory variable of interest.)

We tested two sketch tools for this report, because of their widespread application in California (see Chapter 7). The first, called CalEEMod, was created by the California Air Pollution Control Officers Association (CAPCOA) to estimate air pollution and climate impacts of development projects. This tool is required for use by applicants to the state’s Affordable Housing and Sustainable Communities Grant program, and OPR also used it for a case study example of VMT estimation, provided in its January 2016 draft technical advisory. We also tested MXD, developed by consultant group Fehr & Peers for the US Environmental Protection Agency, for two reasons. First, independent research has confirmed the accuracy of MXD for estimating trip generation at mixed use projects, against seven other sketch tools tested, while also pointing to difficulties in generating required input data without access to use of a regional travel demand model (Shavizadeh et al., 2012). The second reason is because Fehr & Peers has very extensive working relationships with California cities, conducting transportation analysis both at the plan and project levels for every city we interviewed as well as many more. Thus, this firm’s tools, including proprietary advanced versions of the MXD model, may become commonplace for sketch tool purposes in conducting VMT analysis under SB 743, simply because of these historical relationships.

In our interviews, we identified two cities, namely Los Angeles and San Jose, where planners were developing sketch tools for project-level VMT analysis. Their work can help in addressing a common concern we heard from interviewees — the need for tested methods and standardized practice for estimating effects on VMT of mitigation measures at the project level.

Los Angeles received \$500,000 in grant funding from the state’s Strategic Growth Council for the purpose of developing a sketch tool. The city was working with Fehr & Peers to develop a modified version of MXD which can identify and measure the impact of mitigation measures appropriate for specific projects. San Jose also worked with Fehr & Peers to develop a new sketch tool for SB 743 analysis. In February 2018 the city adopted a new set of policies to comply with SB 743, and made the sketch tool available on its web site.

The tool resembles CalEEMod only with more mitigation measures, organized by type, and with updated methodologies for determining the elasticities used internally for calculating individual impacts of mitigation measures. As with CalEEMod, users must enter project-specific information on applicable mitigation measures, and the tool then displays estimated VMT per capita for the project, compared to the city's threshold, which is set at 85% of city-wide average per capita VMT. VMT measured for the area within a half-mile radius of the parcel in question is "used as the starting point" for calculated reductions.

Trade-offs between using sketch tools and travel demand models for VMT analysis

On the other end of the spectrum from sketch tools, in terms of cost and complexity of use, are regional travel demand models and their local sub-sets. Our interviews suggested that lead agencies face a major choice in whether and when to employ a sketch tool for VMT analysis, or instead, a travel demand model. However, our findings indicated that the answer is not a simple either/or.

Travel demand models have been employed for decades by state, regional, and local agencies to forecast travel behavior. The most common type in use has been the "4-step model" which simulates trip generation, distribution, mode choice, and route assignment using aggregate data by travel zone. Recently, the largest MPOs and a few cities in California have been transitioning to using disaggregate so-called "activity-based" and "tour-based" models that are better able to capture fine-grained aspects of travel such as trip chains, coordinated travel among household members, and the availability of time windows in activity scheduling (Waddell, 2011).¹⁵ These advanced models provide improved sensitivity for testing smart growth and demand management strategies. Some MPOs have also worked to improve their land use modeling capacity through disaggregated models, which, when integrated with activity-based transportation models, allow for more sensitive analysis of activities such as bike and walk trips (ibid). These land use models predict behavior at a fine-grained level, such as by using market and regulatory information stored at a parcel level, for simulating economic behavior of developers and homeowners.

The cities we investigated utilize sub-models of their MPO's regional model (or more accurately, the consulting firms that the cities hire do so) for many transportation analysis purposes, especially at the plan level. Some interviewees suggested that certain recommendations in OPR's technical guidance may compel cities to seek to rely on their local subset of the regional model, as much as possible, for SB 743 purposes. In particular, OPR recommends that lead agencies use comparable models and methodologies for calculating thresholds of significance, estimating project VMT, and estimating impacts of VMT-reducing mitigation measures. Since OPR's recommended thresholds of significance for residential and office projects include a reference to regional (MPO-scale) per capita VMT levels, we heard that most local lead agencies will be likely to refer to MPO-produced estimates of regional per capita VMT, and then, if they adopt a significance threshold pegged to the regional level, they may feel that for the sake of consistency

¹⁵ In activity-based models, some steps in a typical four-step model may be allocated to several distinct sub-models such as for estimating location choice, auto ownership, free parking eligibility, daily activity patterns, and tours and trips. The models use population synthesizers to support more sophisticated agent-based travel behavior simulation, such as coordinated travel and activity scheduling. They attempt to simulate behavior of individual households and persons in an environment described by input land development patterns and transportation projects and policies, simulating full day activity and travel schedules for persons.

they should also employ a subset of the model for local project review (for consistency in determining thresholds, estimating project VMT, and estimating mitigation impacts).

For certain types of projects, travel demand models provide distinct advantage compared to sketch tools for estimating project-level VMT, according to interviewees. Travel demand models, unlike most sketch models, account for “displaced trips” and redistributed travel. Most sketch tools assess a new project using a trip-based approach, as if trips are being inserted into the urban landscape without altering the context of travel choices (Millard-Ball, 2015). Such a tool can examine only trips added by a project, and cannot examine substitution or alteration of existing tripmaking. This assumption would generally be quite erroneous for project types which principally reroute existing trips rather than generating new trips. Unlike addition of housing and office uses, adding locally serving retail, for example, can provide a substitute for further-away retail options, rather than generating only new trips. That potential outcome means that rather than creating new VMT, a new locally-serving store could actually reduce it. That expectation is the basis for OPR’s recommendation to consider all locally-serving retail as having less-than-significant VMT impacts.

The difference in VMT estimation results using sketch tools versus a regional travel demand model can be substantial. Fehr & Peers estimated per capita VMT at the Stockton and T project in Sacramento, the same project that OPR employed for a case study example, provided in its 2016 draft guidance, for VMT estimation of a mixed use project. While OPR used CalEEMod, Fehr & Peers used the MPO’s (SACOG’s) 4-step SACMET travel demand model. OPR got a value of 12.8 daily VMT per capita for the project (OPR, 2016, p. 52), while Fehr & Peers got a value of 5.6 using SACMET (Brown and Milam, 2016, slide # 65). Our own estimate for the same project, using MXD, came out at 16.1 daily VMT per capita for the project.

It would be misleading, however, to imply that if different tools produce different results, this is necessarily a problem; thresholds should be assessed using methods compatible with the tools, and would differ as well. Different tools could deliver different estimates of project VMT and yet offer the same assessment of significance.

To counter-balance the advantages of demand models just described, there are also advantages that can be gained from using sketch tools. One obvious issue is cost. One city we investigated, namely Pasadena, relied on its demand model not just for plan-level analysis but also project-level analysis for SB 743 compliance (see Chapter 5). To make this possible, the city calibrated its local model to a finer level of detail than the regional MPO’s model. However, the approach was costly to develop, and other less wealthy jurisdictions may not be able to update their models as easily, due to resource constraints. Upgrading a city model to the level needed for fine-grained VMT analysis could cost as much as one million dollars, according to a consultant we interviewed.

Furthermore, there are reasons other than cost why use of a travel demand model may not be advisable in every instance. In a comment letter to OPR, the California chapter of the Institute of Transportation Engineers noted that, “For most land development projects, use of a regional travel model is inappropriate for the estimation of VMT because ...VMT comparisons with and without the project would tend to be lost in the rounding procedures used to provide aggregate model results” (ITE, November 21, 2014, p.14) In other words, especially for small projects, a travel demand model may not be the most accurate way to

evaluate impacts. Consultants indicated to us that the question depends in part on which demand model you consider. If a demand model is developed to a fine-grained level, it may be able to accurately represent some smaller projects.

Another advantage of sketch tools that we heard about is their potential for evaluating TDM strategies. As one consultant explained, MPO models do not assess potential impacts of local TDM strategies. Local lead agencies will want to assess TDM mitigation options in implementing SB 743, and many sketch models are able to do so.

Tool combinations

Some transportation consultants we spoke with believe that combinations of tools will be needed for SB 743 implementation, due to unequal resources and conditions in different locales, and different imperatives for analyzing different project types. One consultant told us, for example, that, “To the big question about what a lead agency needs to do, there's not a single right or wrong answer. We've seen many cities compromise what would give you the most accurate answer for what can be done the fastest or at low cost. And it depends on the project. If it's controversial enough, they'll say, we'll take the extra time and cost to do the analysis at the highest level. So that's another layer you have to add.”

Various planners indicated that a “layered” process might be useful. Smaller projects can be exempted from VMT analysis, while very large regional VMT attractors like office parks and big shopping malls are evaluated more intensively using a travel demand model. A city subset of the regional travel demand model could be used for developing a “heat map” of high and low VMT areas across town, at the same time that a sketch tool is used for project-level analysis after the heat map has been employed for initial screening. San Jose’s recently adopted policies employ this approach.

In sum, for any assessment or application, it is important to consider whether a sketch model or a travel demand model might be the more appropriate tool. OPR’s technical advisory provides guidance for many assessment types. There is room for middle ground between making a simple either/or choice between employing a sketch tool or a demand model, and different tools may be used in complementary fashion, such as in San Jose’s approach.

The question of which tools a city will employ, and how, is also likely to depend upon the city’s work with private consulting firms. Almost no city we interviewed conducted its own travel analysis in-house; instead they “contracted out” the work to consulting firms. Many city planners we interviewed were unfamiliar with the workings of the demand models that their consultants employ. The widespread practice of contracting out work could allow VMT modeling practices to develop into something of a “black box,” like LOS methods have done. In this vein, one consultant underscored the value of not focusing only on a “technical fix” for VMT analysis and mitigation under SB 743, in a manner that might replicate the transparency shortcomings of automobile LOS. If that happens, he mused, LOS could end up being replaced with another “black box” assumption-laden exercise, with focus mainly directed to technical measures and procedures rather than potentially more productive debate and attention on the feasibility of adopting land use policy measures.

To address these concerns, state and regional agencies might direct support toward continuing research on tool validity, and toward disseminating information on validated tools, as well as other best practices, to help ensure effective implementation of SB 743.

Screening techniques as a technical solution

To simplify and streamline SB 743 analysis, some cities are using screening techniques not only to identify projects that can be “normally” assumed to fall below the VMT thresholds of significance, but as a basis for radically simplifying review requirements. Two cities we investigated – San Francisco and Oakland – have adopted new CEQA methods for VMT analysis that rely on this approach. For this reason, this approach should be considered as a technique for plan and project analysis under SB 743, although OPR emphasizes that map-based screening does not obviate the need to consider other project-level impacts.

OPR recommends the use of screening maps of low-VMT zones and of areas within ½ mile of high quality transit, to identify residential and office projects that “may not require a detailed VMT analysis.” San Francisco and Oakland have adopted new CEQA thresholds to comply with SB 743 that use the screening map approach to streamline VMT analysis in low-density, high transit access zones (see Chapter 5). Essentially, projects with certain characteristics that fall in geographic locations determined to fall below OPR’s recommended thresholds are exempted from further detailed VMT analysis.

In its technical guidance, OPR provides caveats to the blanket presumption of less-than-significant effects for projects located near high quality transit if project-specific or location-specific information indicates that the project will generate significant levels of VMT. For example, the presumption might not be appropriate if the project: a) has a Floor Area Ratio (FAR) of less than 0.75; b) includes more parking for use by residents, customers, or employees of the project than required by the jurisdiction (only for jurisdictions specifying a parking minimum); or c) is inconsistent with the applicable Sustainable Communities Strategy. Therefore, cities may want to apply at least these caveats in determining whether projects can avoid more extensive environmental review based on screening maps.

Our own data analysis indicates that substantial amounts of land located near good transit access in the San Francisco Bay and Los Angeles regions is also characterized by development that produces above-regional-threshold VMT per capita rates (see Chapter 6). This finding underscores that a presumption of less-than-significant impact based on proximity to transit alone in some cases may not hold.

Comparing technical approaches by city type

Our investigation of tool choice in policy innovator cities suggests that one size will not fit all in adopting effective strategies and methods. We detected a possible emerging pattern in which tool choice reflects community resources, development patterns, and also politics.

Based on the findings from our admittedly small sample of cities that had adopted or were developing SB 743 policies, we could conclude that cities in general are likely to use travel demand models for purposes of initial screening. After doing so, if local land use patterns are determined to measure up favorably vis-à-vis recommended VMT thresholds, then cities may seek to employ screening maps to radically simplify review requirements, as in the case of San Francisco and Oakland. San Francisco’s model-based analysis is applied

at the plan level, forming a basis for the city’s new broad policy to exempt projects from detailed VMT analysis. By contrast, “high-VMT” cities with more – and more variegated (spotty) – territory falling both above and below OPR’s recommended thresholds may find it harder to apply a map-based screening technique in a similar manner for broad-brush streamlining purposes.

Among the policy innovator cities we investigated, planners in Pasadena, San Jose, Los Angeles, and Santa Monica expressed the most interest in developing and applying analytical tools at the project level, not just at the plan level, for reasons that were sometimes political as well as technical-rational. In the case of Pasadena, the effort to develop and apply project-level metrics reflects the city’s desire to combine “sustainable transportation” metrics for VMT with multimodal level of service (including auto LOS). This approach allows the city to address concerns of local residents about traffic delay, while also linking project and plan-level analyses to promote sustainable transport using the city’s travel demand model. This finding confirms the observation that resident concerns about traffic congestion can prompt the institutionalization of more careful project-level review, including use of auto LOS. We heard similar concerns from planners in other cities where the General Plan and associated programs, including transportation impact fees, support multi-modal transport as a means to reduce driving, but planners also seek to address resident concerns about congestion and delay, and to tailor mitigation requirements and strategies to particular projects.

Meanwhile, Los Angeles and San Jose share the characteristics of being large cities in terms of territory, and in containing multiple and varied land use types. For these reasons, planners from these two cities told us, the prospect of using a screening map approach for VMT impact estimation, in the relatively straightforward fashion adopted by San Francisco and Oakland, seemed more problematic. Planners in these two cities have sought to develop more context-specific approaches using a sketch tool in combination with map-based and other screening criteria. They have sought to develop sketch tools usable in varying circumstances, and with better capacity for estimating TDM mitigation impacts than available in other existing tools.

Some planners we spoke with were also thinking about logical qualitative criteria, in addition to map-based VMT and transit access screening, to help distinguish when and where streamlined versus stringent project-level review should be applied. For example, planners described how certain land uses in certain contexts might signal how extensive project-level analysis should be. Adding residential development to outlying, residential parts of town, for example, might be expected to create significant VMT impacts, therefore warranting more intensive review, whereas adding locally-serving retail to the same areas would not. In this fashion, planners highlighted the possibility of identifying land use mix not just for a given development project itself, but also in relation to how the project alters the mix in its surrounding area.

Legal concerns

Legal defensibility forms a strong concern among cities in considering how to implement SB 743. Given that CEQA is a “self-executing” statute subject to possible litigation by project opponents in the courts, planners consider technical estimation methods in relation to legal defensibility. Legal defensibility under CEQA, in turn, hinges upon the issue of substantial evidence – whether and how lead agencies substantiate their standards for determining significant environmental impacts and methods for measuring and mitigating

those impacts. Lead agencies often defer to state guidance as a benchmark for acceptable practice, even though they are able to deviate from that guidance. This helps explain why most planners we interviewed indicated they were awaiting full adoption of SB 743 guidelines before proceeding to develop implementation methods.

Many transportation consultants we interviewed indicated they believe that SB 743 may indeed be litigated (similar to many other elements of CEQA), especially in relation to issues concerning establishment of defensible thresholds of significance and evaluation of effectiveness of mitigation measures. Although one of the strongest attributes of SB 743, in our estimation, is its intent to reorient CEQA analysis from a myopic localized focus, this very attribute of SB 743 could also help account for why it may be litigated, because methods for conducting project analysis and mitigation with an eye to wider-scale impacts are not fully standardized.

Legal concerns related to estimation of impacts and mitigation methods

Some city planners we interviewed expressed trepidation about legal defensibility of estimation methods, particularly regarding mitigation requirements, with some noting that procedures for measuring impacts of mitigation are untested and even “unquantifiable.” They worried about legal defensibility in relation to mitigation in part because they could anticipate possible objections from developers who are called on to pay the price. Planners could face both legal and political consequences for mitigation strategies that lack a sound evidence basis for estimating effectiveness.

Some planners indicated that they hope regional and sub-regional agencies, including the MPOs and also county-level transportation planning agencies, will provide ongoing forums for collaborative, joint development and testing of defensible analytical techniques. At the same time, such forums can also be venues for developing innovative mitigation strategies. For example, some planners told us they are considering whether and how to develop “offset” mitigation programs that allow high-VMT projects in one part of town – or one part of the region – to contribute to supporting low-VMT infill projects or multimodal transport in other parts of town. Similarly we heard ideas about jobs-housing balance strategies that could work not just to reduce VMT in local contexts – such as by introducing more housing downtown – but perhaps even more powerfully at a wider scale, for example if mitigation offsets include support for affordable housing in built-up, expensive communities, thereby reducing commute times for service workers. MPOs provide a venue for considering whether and how such strategies could be aggregated and supported at the regional or sub-regional levels, for example through countywide or metropolitan impact fee programs. These exciting discussions reveal that SB 743 is already inducing planning innovation, in spite (and because) of concerns about how to move forward in untested waters.

Legal concerns about aligning plan- and project-level thresholds of significance

In regard to significance thresholds, we identified a concern related to alignment of project-level and plan-level standards. In its technical advisory, OPR identifies two avenues for determining a threshold, one which operates at the project level, and another at the level of local “land use” plans, to cover “general plans, area plans, and community plans.” Our interviews suggested that practitioners may grapple with how to connect the two standards, in practice.

As has been noted, OPR’s recommended analytical threshold for determining whether a residential project’s VMT impacts are significant is if the project is expected to generate household VMT per capita higher than 85% of the city-wide or regional average (whichever is higher). This standard treats every project like “broccoli,” according to one transportation consultant we interviewed, meaning that every project needs to meet the same efficiency standard. However, OPR’s guidance for determining the significance threshold of General Plans is to be measured for a city as a whole – across multiple projects, some of which could be super-efficient broccoli, while other are fattening potato chips.

At the same time, projects are to be considered in terms of whether they are “consistent” with the regional SCS, according to OPR’s advisory. How to interpret this consistency provision is somewhat unclear, however, as commonly accepted and tested methods for determining this consistency have not been established. At the same time, OPR’s advisory notes that, “At present, consistency with RTP/SCSs does not necessarily lead to a less-than-significant VMT impact” (OPR, 2018, p.11), because of a gap between the level of GHG reduction that the California air Resources Board considers necessary from RTP/SCSs under SB 375, and the GHG reduction targets that were officially adopted in 2018 (see Chapter 2). For these reasons, project sponsors, analysts, and opponents face possibly confusing guidance about how to determine significant impacts at the project versus the plan level, and the implications of determining consistency.

Different standards for plan-level and project-level thresholds may also affect cities’ efforts to “tier” project level environmental review from plan-level review, for example from a General Plan to a Specific Plan or to the project level. As previously noted, many planning experts, including some we interviewed, contend that CEQA review is intended to be an information disclosure tool that supports community goals and associated performance standards outlined in the General Plan and in specific area plans. These plans may form an important basis upon which CEQA thresholds and mitigation requirements are substantiated. For example, when project analysis deems CEQA impacts to be significant, a community may determine they are also “unavoidable” and elect to issue a “Statement of Overriding Considerations” allowing the project to continue. The project’s environmental review must substantiate the reasoning for such a decision, and the community’s identified goals and standards can support the claim of overriding priorities. As an example of how this works in practice, many of the cities we investigated had already established more lenient LOS standards in downtown areas than in other parts of the city. By establishing these provisions in the General Plan and related documents, the communities provided the basis for exempting new projects from more stringent LOS mitigation requirements.

Thus, a community’s General Plan and associated plans and policies set a framework very pertinent to CEQA review and the determination of levels of significance. Inconsistent or indeterminate standards for integrating plan-level and project-level review may be entirely legal, given that plan and project-level standards are different matters. Nevertheless, according to our consultant interviewees, inconsistency also may provide leverage for project opponents to sue, for example, if a project sponsor can argue that her project is consistent with the city’s General Plan, but the General Plan and associated policies do not stipulate explicitly how project-level review under SB 743 connects to the plan goals.

This legal confusion prompted one transportation consultant we interviewed to ask why RTP/SCSs should not form the sole basis for determining VMT thresholds of significance and compliance under SB 743, given the law’s explicit intent to support SB 375’s goal of reducing transport-related GHGs. However, while GHG

reduction is one explicit goal of SB 743, it is not the only one. The law has other explicit goals, in particular to support infill development and use of alternative transportation modes. One transportation consultant described advantages of SB 743, in comparison to SB 375, as the following. First, localities are not required to alter their land use plans and policies to conform to regional plan goals under SB 375, while SB 743 requirements are less easy to ignore. Second, RTP/SCSs do not include modeled effects from TDM policies at the local level – the sort of mitigation that SB 743 contemplates. Third, while VMT is associated with GHG impacts, it is not precisely the same thing. For example, MPOs, cities, and project sponsors can mitigate for GHG impacts using strategies not related to land use or multi-modal transport, such as by providing charging stations for electric vehicles. To the degree that SB 743 induces localities to seek mitigations and adopt policies and funding strategies for TDM and multi-modal transport, the law will achieve more than SB 375 can do on its own.

Will SB 743 lead to better transportation planning? Connecting plan-level strategies to project review

So far we have touched upon legal and technical aspects of SB 743 implementation. This section considers how planning and policymaking fits into the equation.

Our research indicates that in the short run, the adoption of SB 743 may be unlikely to change transportation planning dramatically in the state, as many cities move toward conducting project-level analysis in line with OPR's guidance, utilizing VMT estimation techniques they already employ for other analytical purposes. The new guidelines will allow cities to approve infill projects more easily, avoiding costly EIRs that become necessary when infill projects trigger LOS impacts. However, many cities have already developed work-arounds for overly restrictive LOS requirements, for example by developing tiered requirements that apply different LOS standards in different parts of town. Many cities have also already developed programs to fund multimodal improvements, in particular through impact fees. SB 743 does not force any changes to such policies and programs, except to the degree that LOS standards and mitigations can no longer be CEQA-based.

Given these conditions, in the short run, many cities may focus mainly on implementing the state's guidance for project-level VMT analysis. The most dramatic change that may occur could be what happens to review procedures in suburban and outlying cities, where planners now familiar and comfortable with traditional LOS review will be called upon to undertake something new that could appear challenging. Many of these cities, if they have developed in a low-density fashion, are likely to need to address significant VMT effects for development. Essentially, the greater burden that fell in the past upon higher-density urban cities for LOS analysis and mitigation now shifts toward lower-density suburban cities for undertaking VMT mitigation.

Our consultant interviewees indicated that they expect many suburban cities to simply issue more Statements of Overriding Consideration, especially for large outlying development projects where the cost of an EIR is a small component of overall costs and can be borne fairly easily by project sponsors. However, ad hoc application of SB 743 provisions at the project level may soon be perceived as inadequate. For example, communities seeking to retain LOS standards may find that they conflict with project-level VMT

standards, resulting in the need for more costly project-level review, even if it ends in issuance of a Statement of Overriding Consideration. Meanwhile, for cities aiming to promote infill and multimodal transport, we heard that ad hoc VMT mitigation strategies may also be hard to defend legally. Without a TDM ordinance and multi-modal fee program in place, a city may find project sponsors resisting TDM mitigation requirements, if they can argue that a project is consistent with the General Plan.

For these reasons, over the long term, the effects of SB 743 upon planning processes may be significant, as cities seek to align SB 743 review with local plans and policies. Just as LOS practice evolved and became embedded and pervasive in California planning practice over time, so it may take time for VMT reduction strategies to disseminate and become embedded. Over the long run, SB 743 may cause many or even most localities to revisit their transportation plans and policies, to ensure that they support community goals, whether for retaining LOS standards or for linking TDM and multi-modal funding to VMT analysis and mitigation.

Making the VMT-TDM-complete streets connection: Impact fees and TDM ordinances

The question of how to integrate project-level and plan-based standards and policies is very pertinent to mitigation goals and strategies. We heard that cities may find it more difficult to exact VMT mitigation from developers if the city lacks plan-based, up-front funding and program strategies, such as multi-modal impact fees and TDM ordinances. Thus, over the long run, cities seeking to approach VMT analysis and mitigation effectively may wish to develop systematic, up-front, policy-based methods for doing so.

Most California cities impose impact fees on new development for a wide variety of purposes (Landis et al., 2001). California cities tend to impose impact fees more than cities in most other US states, tracing back to the passage of Proposition 13 in 1978 which restricted property tax revenue as a component of local government budgets. One study indicates that 80% of California cities impose impact fees for transportation (ibid). Disappointingly little systematic research has assessed the application of transportation impact fees toward distinct purposes. Our consultant interviewees indicated that many California cities use their fees for multi-modal improvements, including for transit and active modes, and not just roadway improvements. Almost all of the cities we investigated had adopted transportation impact fees, which they use not just for roadway improvements but also alternative modes. At the same time, consultants noted that most cities do not impose fee levels high enough to cover costs of maintenance and operations of many facilities, including roadways.

Impact fees can play a useful role in promoting efficient development and travel patterns. In general, economists consider impact fees to be an efficient form of financing that allocates marginal costs of public service provision to new development (Burge et al., 2013). LOS-based impact fees have been used to fund millions of dollars of roadway widening, as though free-flowing traffic were an environmental benefit rather than a cost. The state has now determined that efficient land use and travel should be the focus instead, and to the degree that SB 743 induces localities to revisit or initiate impact fees oriented to achieving those efficiencies, transport impact fees in California might start to approximate the sort of pricing mechanism that transportation economists advocate to capture full costs of driving and to discourage sprawl (ibid).

Cities may tie mitigation requirements to CEQA or to other community goals and objectives. For non-CEQA related objectives, mitigation requirements must comply with provisions of the state’s Mitigation Fee Act (AB 1600). Enacted 1987, in the wake of the famous Nollan and Dolan court decisions, the law established a firm legal footing for imposing impact fees. Under the law, localities can do so if they first conduct a “nexus study” that describes and details the need for new facilities to support future growth, the relationship between new development and use of those facilities, and then determines a “fair share” proportional method for allocating costs of the new facilities based on impacts created by the new development.

We heard that especially in connection to CEQA, mitigation requirements are often applied, in practice, on an ad hoc project-by-project basis. A 2005 survey of local jurisdictions in California, conducted by OPR for its annual “Book of Lists,” found that of 120 responding localities, 56 of them (47%), “routinely accept traffic fees as a CEQA mitigation measure” (OPR, 2005, p. 85) although it is unclear whether the fees were collected in an ad hoc way or as part of concerted strategies.

To make VMT mitigation work most effectively, cities may need to revisit their General Plans and associated transportation impact fees and ordinances. A number of our interviewees indicated that SB 743 will cause them to revisit and maybe revise their fee structures and purposes, generally in conjunction with planned updates to their General Plans. Thus, we conclude that one positive outcome of SB 743 may be that it will prompt many localities to revisit fee structures and orient them more towards efficient travel and land use.

We heard from some planners that only by employing a systematic, up-front approach to TDM and multi-modal impact fees can a city maximize the potential for VMT mitigation. San Francisco provides a model for this approach, having aligned CEQA compliance with the city-wide TDM ordinance and multi-modal transport impact fee policy. A systematic approach of this type is required for a city to focus on multimodal network capacity-building, as opposed to just ad hoc project-specific TDM amenities. As cities begin to shift their transportation priorities to multi-modal and non-auto strategies, they need to consider connections between bikeways, pedestrian pathways, and transit access, for example. Systematic multi-modal planning can address the challenges of designing efficient networks, rather than only addressing localized intersection-scale strategies, such as under traditional LOS.

Retaining LOS standards through “off-CEQA” provisions

Even though SB 743 eliminates LOS as an environmental impact to be evaluated under CEQA, that edict in no way prevents a locality from continuing to employ LOS standards citywide and at the project level. Almost all the cities we investigated intend to retain some use of LOS metrics for certain purposes, including for traditional purposes as a measure of congestion and traveler delay requiring project level mitigation, and/or as an underlying metric for estimating certain CEQA impacts such as for safety and access. Our interviews indicated that cities seeking to retain LOS standards will likely to need to consider legal and policy-related questions about how to do so. LOS would need to be extricated from city policies as they pertain to CEQA review, and solidified in policies on a non-CEQA basis as an aspect of the project approval process.

One planner we spoke with explained how his city has approached this matter. As part of a comprehensive General Plan Update, the city looked at addressing SB 743 by establishing a series of VMT metrics, based

upon OPR's advisory, but also creating a new policy with performance targets for vehicle, pedestrian, and bicycle mobility efficiency. These performance targets would replace existing LOS requirements, and be de-linked from CEQA, while still forming part of conditions of approval which the city applies during the project approval process. The policy is intended to provide for flexibility when applied at the project level, to "allow the city to more flexibly counterbalance roadway efficiency with CEQA VMT standards at the project level, if and when they should conflict," according to the planner.

The mobility targets would no longer enter into the approval process during project environmental review (at the end of the process), but instead up-front as an element of project design subject to conditions of approval. If CEQA analysis identifies a significant VMT impact, city planners would have flexibility to accept or modify the efficiency of the roadway network, or alternately, they could also use the city's policies as a basis for issuing a Statement of Overriding Considerations, allowing the project to move forward without reducing VMT to below significant levels (so long as all feasible mitigation is first imposed). In this manner, the city can retain and apply a roadway efficiency target, while also integrating VMT standards, in a manner that enables flexible application and integration.

San Jose's new VMT impact assessment policy, adopted in February, 2018, follows a somewhat similar approach, intended to integrate VMT with other city-wide goals and plans affecting transportation. In addition to revisions to the General Plan, the City Council adopted a separate VMT impact study policy. It sets the city's significance threshold at 85% of city-wide average for residential projects. Various types of residential projects receive blanket exemptions from review requirements, including affordable housing located in targeted growth areas near transit, and any housing in the same areas if they are also low-VMT areas. (The policy is available at <http://www.sanjoseca.gov/vmt>)

Non-exempt project applicants, in addition to completing VMT analysis using the city's new sketch tool, described earlier, also must complete an additional, supplemental transportation analysis that addresses other goals outlined in the General Plan, including mobility (circulation) measured with LOS. Large projects may be analyzed using the city's travel demand model instead of the sketch tool.

Provisions established in the General Plan provide a basis for issuing statements of overriding consideration, which enable the city to pursue its own growth strategies in cases when they conflict with VMT mitigation requirements. The provisions establish the types of projects that may be issued statements of overriding consideration, allowing them to be approved even with VMT impacts deemed to be significant. Eligible project types include affordable housing projects, and projects in the city's targeted growth zones that meet minimum density criteria, and that also construct or fund multi-modal improvements, with fees set per each VMT not mitigated. Payment of the fee is considered to be an overriding benefit, not mitigation for VMT impacts.

With this approach, San Jose has integrated VMT analysis into its existing suite of policies and plans, even using the General Plan as a basis for clarifying when existing city growth strategies will be used to override VMT mitigation requirements.

Conclusion

Challenges and opportunities of SB 743 implementation are significant. While short-run adoption and application of techniques for VMT analysis, in line with OPR's technical advisory, may not pose a great challenge in many or most cities, long-run exigencies for aligning community plans and policies with SB 743 analysis may require sustained effort, while also holding promise for more effective VMT reduction. Our interviews indicate that SB 743 will likely cause many or even most localities to revisit their transportation plans and policies, to ensure they support community goals. To the degree that this process results in more carefully crafted transportation plans and programs to support sustainability, SB 743 could help improve transportation planning substantially.

SB 743 will also help improve CEQA, in our estimation, by directing project review to considering wider-than-local impacts of development. In our interviews, we heard some grumbling about this aspect of the law, as one interviewee noted, for example, that SB 743 has been construed in some communities as a back-door effort by the state government to determine local land use policy, long a cherished prerogative of local governments.

The argument that SB 743 is intrusive fails to recognize, however, that traditional LOS policy in California also substantially influenced land use and transportation choices and outcomes, inhibiting infill development and multi-modal mobility strategies. SB 743 heralds and supports a major shift in focus for transportation planning and analysis, which is likely, over time, to become embedded in transportation planning and mitigation finance, just as was the case with LOS. In aligning CEQA practice with state climate and growth policy goals, SB 743 can help ensure better state-regional-local planning coordination for sustainability, with potential benefits for all communities.

However, a persistent problem in realizing this vision is lack of resources. With city budgets for planning purposes often constrained, many cities lack up-to-date General Plans, let alone associated policies for multi-modal impact fees or TDM ordinances. While SB 743 may not change the underlying dynamic, discussed earlier, of the CEQA tail wagging the planning dog, it does redirect the power of the formidable CEQA analytical and finance machine toward supporting development more conducive to the state's planning goals. The more the state government and regional agencies can do to assist localities in developing innovation plan- and policy-based strategies linked to project review for reducing VMT, the more benefits may accrue to the state from SB 743.

Chapter 5. SAN FRANCISCO AND PASADENA CASE STUDIES

This chapter presents case studies from two California cities, San Francisco and Pasadena, that were early leaders in replacing CEQA-based LOS analysis with standards for VMT instead. Given that few California cities have made this transition, the experience of San Francisco and Pasadena is important for other cities to consider, even if they face different conditions. Years of work went into the processes in these two cities, needed to address technical, political, and policy-related challenges and opportunities arising from the transition to VMT-based analysis and mitigation. Other cities can benefit from the lessons learned.

San Francisco case study

An early leader in SB 743 implementation, the City of San Francisco adopted a Transportation Sustainability Program (TSP) between 2015 and 2017, which includes the replacement of LOS with a VMT metric for CEQA traffic analysis, in line with OPR's guidelines. The city linked this CEQA change to a new Sustainable Transportation Fee and a Transportation Demand Management (TDM) Ordinance, ensuring that CEQA review will support efforts to leverage infill development to improve transit and non-motorized modes.

Other cities should consider San Francisco's up-front, policy-based approach to SB 743 implementation, if they also seek to link traffic impact analysis to investment strategies for sustainable transport. On the one hand, San Francisco's somewhat unique context helps explain the new approach. The city's dense and built-out development pattern means that transit and non-motorized modes are the most practical solution to mobility needs. San Francisco also found that it could replace LOS with VMT in a wholesale manner as the basis for traffic impact review, because most of the city's territory falls below OPR's recommended threshold of significance for significant VMT impacts. Other cities with less transit access and higher VMT will realize streamlining provisions of the law over a smaller share of their geography.

Furthermore, as both a city and county, and with its own transit agency, San Francisco's institutional capacity for collaboration among agencies helped facilitate the Transportation Sustainability Program, which is a coordinated effort among the SF Municipal Transportation Agency, the SF Planning Department, the SF County Transportation Authority (the official County Congestion Management Agency), and the city's Office of Economic and Workforce Development. Few other cities in California enjoy the same degree of institutional coherence.

Nevertheless, in spite of San Francisco's somewhat unique circumstances that propelled the TSP approach, other cities should still consider the program as a valuable model. It shows how CEQA streamlining can support policies and plans to capture value from infill development and make it more viable in turn through improved provision of sustainable transport. The points of conflict and controversy that emerged in developing the TSP provide lessons for other cities in addressing technical, legal, policy-related, and political challenges of such an approach.

Motivations for San Francisco's Transportation Sustainability Program

San Francisco has dubbed the three parts of its Transportation Sustainability Program “invest,” “align,” and “shift.” The city had been working to develop an integrated policy approach to support sustainable transport for more than a decade, and the adoption of SB 743 aided its efforts.

Since 1973, the city had put in place a “Transit First” policy, giving planning priority to modes of transportation other than the automobile. However, in spite of the Transit First policy, “for years, Muni [the city transit system] has been underfunded, in part because the city didn’t require many developers to offset the transportation impacts of their new buildings” (SF Transportation Sustainability Fee website).

When the city’s housing and commercial real estate market began to surge in the late 2000s, policymakers turned attention to ensuring that new growth alleviates impacts on transport (Seifel, 2015). With the regional SCS plan targeting 190,000 new jobs and 100,000 new households to San Francisco by 2040 (ABAG, 2013), the city anticipated the need for more concerted transport investment. Without investing in new transportation infrastructure to support non-auto modes, the city determined that more than 600,000 vehicles would be added to its streets every day by 2040. Given the city’s built-out development pattern, planners contemplated a next generation of multi-modal transportation improvements from a system management perspective, including the possibility of re-allocating rights-of-way from mixed flow traffic to pedestrian, bicycle, and transit uses.

The “invest” component of the Transportation Sustainability Program

In 2013, a Transportation Task Force convened by San Francisco’s mayor pegged ongoing funding needs to meet future demand for transportation infrastructure in the city at \$10 billion through 2030, including \$6.3 billion in new revenue (O’Rourke et al., Mayor’s Transportation Task Force, 2013). City voters stepped up to the plate in 2014, passing Proposition A, which approved a \$500 million one-time investment, and Proposition B, which increased the share of general funds for transportation based on population growth, and is projected to contribute about \$300 million for transportation over the next 15 years.

To plug remaining funding gaps, the Board of Supervisors adopted the Transportation Sustainability Fee (TSF) in November 2015, comprising the “invest” component of the TSP. The TSF is a citywide impact fee on both residential and non-residential development that replaced the existing Transit Impact Development Fee (TIDF), adopted in 1981, which applied only to non-residential development. The fee applies to commercial development, market-rate residential developments with more than 20 units, and certain large institutions, while exempting affordable housing and subsidized middle-income housing.¹⁶

Funds raised by the fee are directed as supplemental funding for a specified set of projects, including expanding the Muni fleet by more than 180 vehicles; upgrading Muni maintenance facilities; upgrading transit reliability through reengineering of transit stops and streets; new or improved BART train cars; investment in electrifying Caltrain to increase service into and out of San Francisco; and improved bike and

¹⁶ About one-quarter of projected development in San Francisco over the 30-year planning horizon will be exempt from the fee, in most cases because the development is subject to an adopted development agreement (which may also require implementation of transportation mitigation measures during the entitlement process) (Spencer, 2015).

pedestrian infrastructure. In accordance with the state’s Mitigation Fee Act, the city produced a nexus study which determines a reasonable relationship between new development and the need for expanded transportation services; a reasonable relationship between new development and the benefits to be received from the identified additional transportation services enabled by the fee; and proportional cost, or in other words, a reasonable relationship between the impact of a development project and the total cost (maximum justified fee) attributed to the project under the fee program (Spencer, 2015).

The specifics of the Transportation Sustainability Fee were controversial and debated for a number of years before adoption, in particular about the level of the fee and what sorts of development should be exempted. Although many developers supported the concept for the sake of improving certainty in the regulatory process (Jaffe, 2015), they also opposed setting the fee as high as the city’s required nexus study determined would be needed to fully cover travel impacts of development. The city commissioned an Economic Feasibility Study of the fee, which determined that it should be set lower than full mitigation would warrant, for the sake of economic feasibility of development projects (Seifel Consulting, 2015).

The fee ultimately adopted by the Board of Supervisors was set at only about one quarter of the full level identified in the Nexus Study to cover mitigation needs, an outcome viewed by some observers as a victory for developers in the debate. The program allows for the level of the fee to be revisited in the future, so that changes in market conditions, and changing priorities of city leaders regarding growth and development, can be accommodated. On top of the original transit impact fee, the new fee is projected to add about \$14 million a year, or roughly \$430 million in net new revenue over 30 years; together the fees (now consolidated) will raise nearly \$1.2 billion for transportation improvements during that period.

The “align” component of the Transportation Sustainability Program

San Francisco added the “align” component of its Transportation Sustainability Program in March, 2016, when the city’s Planning Commission adopted OPR’s guidelines as the basis for measuring transportation impacts of new development under CEQA. Automobile delay was removed as a significant impact on the environment and replaced with a vehicle miles traveled threshold for all CEQA environmental determinations, including active projects, going forward.

LOS analysis and mitigation had been the subject of complaint for many years in San Francisco. City planners complained that LOS failed to capture important environmental effects, contradicted the city’s Transit First policies, entailed costly, time-consuming, and unpredictable requirements for project sponsors, called for infeasible and ineffective mitigations, created burdens for the Planning Department to implement, and discouraged infill development due to a “last-in” bias, meaning that infill was required to bear the burden of existing cumulative traffic problems (Chang, 2012).

As roadway widening measures are often infeasible in built-out San Francisco, city planners sought ways to avoid auto-supportive LOS mitigations, for example by issuing exemptions for particular projects based on tiering provisions from area plans, or, when necessary, issuing statements of overriding consideration for negative impacts identified in EIRs. In spite of these efforts, LOS standards still hampered infill and sustainable transport goals and strategies, as they provided a way for opponents to stall development projects by imposing the need more extensive environmental review. Various controversial projects in the

city had been stalled by opponents who challenged CEQA review based on LOS impacts. For example, a 2005 lawsuit postponed implementation of the city's master bicycle plan on the grounds that it failed to consider potential impacts on automobile traffic — an injunction not lifted until 2010 (Jaffe, 2011). Environmental review for a bus-rapid transit line proposed in 2004 was only fully approved in 2013, at a cost of \$7.6 million, due in part to the same problem (Jaffe, 2014). The only project-related concern expected to entail significant and unavoidable negative impacts, which could not be offset under CEQA, was traffic delay. Meanwhile, compensating transit benefits could not be factored into the analysis.

Under CEQA, projects expected to produce significant and unavoidable negative impacts, such as a shift to LOS “F,” require the preparation of a full-blown EIR. This situation created a chilling effect in San Francisco, in that LOS analysis and mitigation could sometimes be considerably more costly in time and money than the original project itself. Research indicates that various bike enhancement projects in San Francisco never made it to the table for this reason (Henderson, 2011). As a result, the city’s bike lobby became vocal advocates for eliminating LOS as a standard for CEQA review.

For these reasons, the city had been searching for an alternative to LOS analysis and mitigation for many years. In 2003, the SFCTA Board requested policy analysis of alternatives to LOS, and in 2007, the Board of Supervisors recommended eliminating LOS and replacing it with an auto trip generation measure and mitigation fee (SF Planning Department, March 3, 2016). The conversation bogged down, however, in debates about how to apply such a standard to all development, as certain constituencies, such as affordable housing advocates, were seeking exemption, and about how and whether to assess fees commensurate with full mitigation of traffic impacts of development, given push-back from developers and their allies. The conversation threatened to become a “death spiral,” according to one San Francisco city planner (interview).

A number of recent state-level policy changes, including passage of SB 743, then served to help San Francisco find a way forward (SF Planning Department, March 3, 2016). In March 2010, the state amended Appendix G of its CEQA Guidelines to no longer identify traffic delay as a significant environmental impact. Appendix G was also amended to remove parking and aesthetics as topics for consideration. However, conflicts with an applicable congestion management program were retained as a significant impact.

These policy shifts triggered action from the city’s Board of Supervisors. They “took the wind out of the sails” of city leaders who remained concerned about relinquishing any version of traffic delay analysis during CEQA review, said one city planner we interviewed). Instead, city leaders were convinced to see traffic and parking considerations as most appropriately belonging to discussions about project approval, rather than CEQA discourse. “There was nothing other than custom keeping us using LOS. We saw we had everything in place,” said our interviewee.

Among the first steps in the transition from LOS to VMT based analysis and mitigation was a resolution adopted by the Board of Supervisors in December 2009, establishing Infill Opportunity Zones for Congestion Management Planning pursuant to State Senate Bill 1636 (Government Code Sections 65088). Under that statute, network roadway segments within an Infill Opportunity Zone are exempt from minimum LOS standards in county-mandated Congestion Management Programs. The majority of San Francisco is designated as within an Infill Opportunity Zone, and for the remaining areas, the Congestion Management

Program analyzes LOS on segments of roadways, not intersections. The city determined that existing LOS significance criteria used for CEQA review were inconsistent with this change, but then struggled to define the right set of new metrics.

Passage of SB 743 addressed that concern, simplifying the decision process, as the city chose to adopt in wholesale fashion OPR's recommended thresholds for SB 743 implementation in March, 2016. The city abandoned its earlier attempt to use VMT or another sustainability-oriented traffic metric as a basis for conducting project-level review and exacting CEQA mitigation directly from projects. Instead, the city used the OPR thresholds as a basis for simplifying and streamlining CEQA review of traffic impacts. This approach allowed for a more flexible and up-front approach to developing the Transportation Sustainability Fee (the "invest" component of the TSP), one not tied to project-by-project CEQA analysis and mitigation, and instead to systematic assessment of needs and identification of capital and maintenance projects to improve transit and alternatives modes for the city as a whole. In addition, the city's new Transportation Demand Ordinance (discussed below – the "shift" component of the TSP) could also operate separately from CEQA requirements.

The city now utilizes a screening approach to determine whether projects fall below the VMT significance threshold, with criteria established identifying types, characteristics, and/or locations of projects that would not result in significant impacts to VMT (SF Planning Department, March 3, 2016; Wietgreffe, 2017). The location-based screening criteria rely on maps produced by SFCTA using the San Francisco Chained Activity Model Process (SF-CHAMP), the city's activity-based travel demand model calibrated based on observed behavior from the California Household Travel Survey 2010-2012, Census data regarding automobile ownership rates and county-to-county worker flows, and observed vehicle counts and transit boardings. SFCTA's maps are used to determine how development-estimated VMT by land use type compares to OPR's recommended threshold of significant VMT impacts set at 15% below regional average VMT per capita or per worker. Maps illustrating areas that exhibit low levels of existing and future year VMT are used to screen out developments that may not require a detailed VMT analysis.

If a project meets the screening criteria, then VMT impacts are presumed to be less than significant and a detailed VMT analysis is not required. According to the city's analysis, "Most land use and transportation projects proposed in San Francisco over the last several years would meet the screening criteria ...and would not require a detailed VMT analysis. Therefore, the San Francisco Planning Department would be able to evaluate a project's impact on VMT without consultant assistance for most projects" (SF Planning Department, March 3, 2016).

Thus, San Francisco "solved" the decade-long discussion about how to link a new CEQA metric for traffic impacts to its new mitigation fee and TDM ordinance, by de-linking them. CEQA requirements do not form the legal basis for the city's new Transportation Sustainability Fee and Transportation Demand Ordinance, which are developed instead to comply with requirements of the state's Mitigation Fee Act.

Nevertheless, the "align" portion of the TSP – the CEQA change entailing adoption of OPR's recommended metric (VMT) and thresholds of significance – still serves to support the city's overall program approach. In particular, CEQA streamlining became a selling point for the new Transportation Sustainability Fee, as the

Economic Feasibility Study determined that the CEQA change could produce cost-savings in terms of reduced environmental review for many projects.

According to the Economic Feasibility Study of the TSF, the LOS portion of a transportation analysis for a typical land use project increases development review by five months and consultant costs by \$25,000 to \$95,000 (2014 dollars) (Seifel Consulting, 2015). Projects that would be eligible for a lesser level of environmental review as the result of the CEQA/LOS reform would achieve even greater economic benefit, potentially resulting in direct cost savings of about \$560,000 in environmental consultant and Planning Department fees and predevelopment time savings of five months.

The study determined that for five of ten prototype development projects evaluated, the CEQA/LOS reform adopted by the city would entail cost savings, in a few cases enough to offset the impact of the new TSF. For these projects, residual land values could potentially increase under the TSP by about 2% to 3% where the streamlining benefits more than offset the increase in development costs. For developments that do not currently need a transportation study (typically the case for smaller developments), no direct predevelopment cost or time savings were projected to occur, but the study concluded that even these projects could experience indirect benefits, as CEQA/LOS reform would minimize the time spent on environmental review and reduce backlogs for City staff, potentially shortening the predevelopment process for all projects. Individual projects would also be relieved of having to study cumulative transportation impacts because the TSP EIR covers those impacts.

The study notes:

The existing LOS analysis requirement creates uncertainty, as only toward the conclusion of a transportation impact analysis (well into the pre-entitlement process) does a developer fully realize if a project's traffic impact would necessitate a higher level of environmental review (such as an Environmental Impact Report). As the environmental approvals must be completed prior to project approval hearings, this situation represents a significant risk to the developer, who must invest time and money for environmental review of projects that could ultimately be rejected. Thus, time and cost savings for environmental review, as well as earlier certainty around the [Transportation Impact Study] findings, will help reduce the pre-entitlement risk taken on by project sponsors (Seifel Consulting, 2015, p. 10).

The city's CEQA change did not affect other topics currently analyzed in a Transportation Impact Study, which are still subject to CEQA review, such as site design impacts to people walking, bicycling and riding transit; freight and passenger loading; emergency vehicle access; construction; and site circulation and access. These factors will continue to be analyzed for physical environmental impacts.

Notably, San Francisco was able to weave its new CEQA approach into the TSP more easily than most other cities are likely to be able to do, because most territory in the city falls below OPR's recommended threshold for significant VMT. This situation allowed the city to use CEQA reform for regulatory streamlining and cost savings, as a means to build support for the up-front policy measures taken through the TSF and the TDM ordinance to leverage infill growth to support sustainable transport.

Considering the city's experience with developing the TSP, one San Francisco planner we interviewed noted that, "Other cities should also look at a comprehensive impact fee rather than CEQA mitigation. One reason cities are concerned about letting go of LOS is because it's a way for them to extract mitigation from developers. By doing a comprehensive nexus study and fee, we got out of CEQA mitigation as the way to do that" (interview).

The "shift" component of the Transportation Sustainability Program

The Transportation Demand Management Program – the third so-called "shift" component of the Transportation Sustainability Program – was adopted in February, 2017 to re-frame project mitigation away from roadway enhancements that support LOS, to instead favor "demand management" mitigations aimed at reducing VMT. The TDM Program, an ordinance which amended the city's Planning Code, is designed to require developers in all locations in the city to provide on-site amenities to reduce car travel and support trip-making by sustainable modes, such as by providing bicycle amenities and subsidized transit passes (TDM Ordinance on-line FAQ).

Under the program, all land use development projects must incorporate TDM amenities early in the design phase to meet a targeted number of mitigation points depending on the type of land use and the number of parking spaces the project is proposing. Property owners select from a menu of 26 TDM measures that, according to the city, have been determined through empirical research to reduce vehicle trips or shift them to sustainable modes, increase vehicle occupancy, or reduce average vehicle trip lengths. For example, providing showers and lockers as a benefit to commuters who walk or bike counts for 1 point, while providing car share membership and on-site car-share counts for 3 to 5 points, and reducing the amount of onsite parking carries up to 11 points. The more parking proposed for a project, the higher the number of points the development must achieve. The city created an online tool to help developers calculate their project's required points and forecast different ways to meeting the requirement through different TDM measures.

Under the TDM ordinance, each development project's application must now include a TDM Plan listing selected measures that allow the project to meet its mitigation requirement. The project's final TDM Plan will be recorded as a condition of approval by the city, and a proactive monitoring program will ensure compliance. The program applies to projects with 10 units or more of new residential development, 10,000 square feet or more of commercial development and relatively large (25,000 square feet or more) changes of use like expanding an auto shop or other small industrial space into office space. Residential projects that are 100 percent affordable are exempt (TDM Ordinance on-line FAQ).

Like the other two components of the Transportation Sustainability Program, the city touts the TDM Ordinance as a means to provide more certainty for developers. "A developer [will] know their TDM measure requirements upfront, prior to submitting a development review application... [the] legislation [will] also provide flexibility to the developer in crafting a TDM program that best fits the needs of their project...[with] transportation options [that] are considered an amenity to tenants...Additionally, the vehicle miles traveled reduction associated with certain TDM measures [will] be accounted for in the air quality, greenhouse gases, and transportation CEQA analyses for a project " (SF Planning Department, February 11, 2016, p. 5).

Conclusion

The three-pronged Transportation Sustainability Program has enabled San Francisco to align CEQA reform under SB 743 with its plans for transit and TDM enhancements. The city's up-front, policy-based approach took many years to develop, and some aspects may not be easy for other cities to adopt. For example, the city's wholesale approach to CEQA streamlining was possible because most of its territory falls below OPR's recommended threshold of significance. Meanwhile, the off-CEQA plan-based approach to funding multi-modal improvements and TDM (through TSF and TDM Ordinance) was facilitated by the fact that the city runs its own transit service, and collaboration among city- and county-level agencies and functions was easier than many other cities may be able to achieve if they lack the same institutional coherence as in San Francisco between transportation and land use planning functions.

In spite of San Francisco's unique attributes, other cities nationally and statewide should consider the Transportation Sustainability Program as a valuable model for fostering sustainable transportation and implementing SB 743. Other cities interested in infill development also need to ensure that their land use and transportation policies work coherently to support alternatives to driving. In California, other cities face the same challenge as San Francisco in ensuring that environmental review supports infill planning goals and means to achieve them.

The San Francisco case study contains lessons about technical, legal, policy, and political challenges of aligning CEQA reform under SB 743 with plans and funding mechanisms for sustainable transport. After years of controversy and debate about determining a new CEQA metric for traffic impacts, the city found it easier to disconnect the CEQA reform piece from the funding pieces. The CEQA VMT thresholds adopted by the city do not form the legal basis for the Transportation Sustainability Fee or TDM Ordinance, which rely instead upon nexus studies that comply with the requirements of the state's Mitigation Fee Act. Other cities can take a lesson from San Francisco's experience, as they may also choose to address up-front plan-based funding strategies for sustainable transport in a manner not directly tied to project-level CEQA compliance. At the same time, San Francisco's program shows how CEQA reform under SB 743 can effectively support plan-based funding and mitigation strategies for infill and sustainable transport.

One San Francisco planner summarized lessons learned this way:

Until you have planning reform, no one will give up anything on CEQA. LOS was a bad idea married to a bad procedure for transportation planning, because CEQA is a bad planning tool. Instead, it's an information tool meant to support planning. CEQA has been a tail wagging the dog for our traffic analysis. For example, we were doing LOS analysis on projects above 100 units, but we saw no shift in the needle for impacts below 200 units. With LOS, we are not giving up a method that helped us understand impacts.

My tag line is, with our new Transportation Sustainability Program, we're going from counting cars to doing something about it. We're still investigating trips generated, but focusing on site circulation, hazards, bike and transit conflicts, and corridor and system effects. Then with the TDM piece we're taking active steps through the approval process to reduce car trips.

I tell other cities, don't just take away LOS without providing positive alternatives. Look at your tool box. Once we looked at what we needed in order to do the TSP, we realized we had all the pieces in place. With our CMP, for example. We found savings for developers from not having to do LOS analysis. The development market was working in our favor. Those were our tools. And people are totally getting it that reducing trips means providing alternatives. People in the city are ready for the conversation about trade-offs and alternatives. It's harder for other cities because they don't have the transit to support alternatives to driving. But other cities also have to look at the tools they have in place.

Other cities can also draw lessons from the debate that ensued in San Francisco over the level and applicability of the Transportation Sustainability Fee. That debate points to political contours – both opportunities and obstacles – of building an up-front, plan-based approach to facilities funding. San Francisco achieved a policy consensus among key stakeholders over the basic principle of adopting the TSF, because it appealed both to sustainability advocates such as bicycle groups, and also to developers seeking regulatory streamlining and certainty in the project approvals process. The CEQA reform fit into the equation by addressing concerns of both groups, promising cost savings and greater certainty to developers, and the removal of a planning obstacle for sustainability advocates.

However, even with these elements of compromise in place, the debate about the appropriate level of the TSF inevitably turned political, with no truly objective method available to determine an optimal level for the fee, given different priorities among stakeholders. Instead, by divorcing the fee from CEQA compliance on a project-by-project basis, the city was able to establish a fee structure that is flexible in its level, subject to changes in the real estate market and political choices among city leaders about goals for development.

All California cities can learn from San Francisco's experience in designing a programmatic approach to transport sustainability planning. For example, if cities seek to retain LOS standards in General Plans upon full implementation of SB 743 state-wide – as many cities indicate they will do – then they, like San Francisco, will also need to consider how and whether VMT standards under CEQA conflict with LOS goals. Projects requiring mitigation for VMT impacts may suffer from "last-in" or incumbency problems in a similar fashion that projects have suffered under LOS standards, possibly inhibiting development in high-VMT areas. While sustainability advocates might consider this outcome a boon, it also implies that cities could face complications and conflicts in balancing LOS with VMT under SB 743, especially if cities approach project-level review in an ad hoc way. The San Francisco model shows how a city can deliberately weave together environmental review and VMT mitigation with systematic facilities planning for sustainable modes, thereby enabling the city to more effectively capture value from infill growth, in order to support non-auto mobility strategies that in turn make infill development more viable.

Pasadena case study

Pasadena has drawn attention as the first California city to remove driver delay as a metric in the environmental review process, substituting new performance measures aimed at promoting sustainable transportation. In 2014, the City Council approved the removal of LOS for CEQA review, replacing it with five new CEQA metrics better aligned with the city's plans for reducing car travel and promoting sustainability and accessibility. At the same time, Pasadena retained LOS as a metric for "off-CEQA" project review purposes, in response to resident concerns about congestion and traffic delay.

Thus, Pasadena has integrated LOS with a suite of sustainability-oriented metrics. Other cities can learn from this strategy to integrate the old (LOS) and the new (VMT and multi-modal performance measures). Pasadena's experience confirms some of the lessons learned in San Francisco. Both cities are built-out, and rely only on infill for new development. Both had experienced frustration in applying LOS criteria under CEQA, as outcomes often conflicted with city goals for compact growth and reducing car travel. As a result, both cities sought a new approach to traffic impact analysis that would better support long-range facilities planning and funding for multiple modes, as well as compact growth strategies.

In spite of these similarities, the conditions, experience, and outcomes in Pasadena and San Francisco were also distinct in some ways that city planners elsewhere may learn from. Because of its low VMT per capita, San Francisco could make use of the streamlining available under SB 743 to radically simplify traffic analysis under CEQA, realizing cost savings that helped build support for the city's new Transportation Sustainability Fee and Demand Management Ordinance. Although the "align" portion of San Francisco's Transportation Sustainability Program (the change in CEQA traffic review standards) supports the other two components of the program (the impact fee and TDM ordinance), it does not provide the legal basis for mitigations.

Pasadena, by contrast, has not disconnected CEQA review of traffic impacts as a legal basis for facilities funding and mitigation. On the contrary, the city's new metrics will provide a basis for exacting new mitigations oriented to sustainable transport. Nor has Pasadena made use of the streamlining available in SB 743 for below-threshold projects, as San Francisco did. Instead, Pasadena focused on developing an integrated set of transportation impact assessment metrics, some of them "on-CEQA" and others "off-CEQA," to be applied at the project level, but which also link to goals and strategies in the city's General Plan, and associated impact fees.

Cities interested in devising metrics for purposes of individual project level review, under the new SB 743 policy regime, may be especially interested in Pasadena's experience. The outcome in Pasadena reflects political compromises that were necessary for the city to transition from an LOS-based to a VMT-based approach to project review. Pasadena's program is a useful model for other cities grappling with political debate about how to preserve the character of single-family neighborhoods while also facilitating economic growth and greater residential densities in downtown transit zones.

Pasadena's decision process

Pasadena developed its new transportation metrics in response to the desire of city officials and community members to better align CEQA with the city's General Plan goals for sustainable travel and infill development. In the last General Plan updates in 1994 and 2004, the city had adopted and reinforced a limited growth strategy that protected the historic neighborhoods that ring the central district, while promoting walkable transit-oriented development along the central city corridor surrounding the Gold Line's light rail service, which opened in 2003, and in the downtown zone.

Like many older cities, Pasadena was facing development pressure to expand with limited land space. "We're...essentially down to nothing but infill development," said Fred Dock, Pasadena's director of transportation (Stephens, 2015). A "metropolis in miniature," with its dense, mixed-use downtown, distinct

thoroughfares, and stately suburban-style neighborhoods, Pasadena was perhaps “the perfect city to usher in California's next chapter in smart growth” (ibid).

Faced with increasing demand on a roadway system essentially fixed at its current size, Pasadena’s Department of Transportation, over recent years, turned to strategies for managing traffic, rather than providing new roadway capacity. Programs were developed to encourage use of non-auto modes and improve system-wide efficiency, including a transit plan, bicycle plan, pedestrian streets plan, operation of a local feeder/circulator transit system, and development of real-time management capacity for the city’s traffic signals and traveler information services (Dock et al., 2012). Travel demand management became a priority upon adoption of a Trip Reduction Ordinance requiring new buildings over 75,000 square feet to prepare and implement TDM plans.¹⁷

City transportation planners sought to employ planning metrics suited to enhancing efficient and sustainable travel patterns. They considered traditional LOS analysis to be inadequate, even detrimental, because it “increasingly resulted in outcomes...inconsistent with the city’s vision for the street system, by placing a disproportionate emphasis on reducing vehicle delay, while remaining largely silent on the impacts to pedestrians and bicyclists” (Dock et al., 2012, p. 3) Sustainability advocates in the city, such as the Downtown Pasadena Neighborhood Association and the Complete Streets Coalition, reinforced the complaints, arguing that transportation analyses were being used as a “back door” for lowering density of projects, by requiring that project sponsors widen roadways or increase parking, diverting attention from evaluation of land use and zoning changes on their merits (Downtown Pasadena Neighborhood Association 2014). LOS impacts of projects often tripped the CEQA wire, making it necessary to complete full EIRs, which presented a burden especially for small and mid-size development projects.

The city’s focus on system-wide, multi-modal efficiency and sustainability “introduce[s] new levels of complexity into the development and measurement of urban transportation strategies that goes far beyond the current Level of Service metric that we ... use to address system performance” according to the city’s transportation planners (Dock et al., 2012, p.2). The DOT sought metrics to support network and multimodal system management and travel time reliability, by shifting the scale from individual location-specific analysis to corridor or area-wide analysis, evaluating impacts on transit and non-motorized modes, and considering the "efficiency" of projects in terms of trip lengths and numbers of trips associated with changes in land use. At the same time, the city’s planners also sought to balance new metrics with more traditional measures of congestion, reflecting local resident concerns about “neighborhood preservation,” in other words livability and mobility, in the city’s lower-density, single-family neighborhoods (ibid; City of Pasadena DOT, November 3, 2014).

¹⁷ The ordinance applies to nonresidential development projects, and the nonresidential portion of mixed-use development projects, which exceed 25,000 square feet of gross floor area, as a result of new construction or an expansion of an existing use. These development projects are required to reserve and designate preferential parking spaces for carpool vehicles, provide employees with commuter-matching services and trip reduction information, and provide bicycle parking facilities and/or other non-auto enhancements. Projects exceeding 75,000 square feet of gross floor area must also gain city approval of a plan to reduce trips, such as by providing employees with discounted transit passes, or introducing parking pricing measures. Multi-family residential developments of 100 units or more, mixed-use developments with 50 or more residential units or 50,000 square feet or more of non-residential development, must also comply (from City of Pasadena, *General Plan Mobility Element*, 2015).

The city's DOT took advantage of an update of the city's General Plan, adopted in 2015, to develop new transportation metrics more suited to city planning goals. Related to mobility, the General Plan has one main guiding principle – for Pasadena to be a city where people can circulate without cars. Three main objectives were identified for the update of the Mobility Element of the plan: to enhance livability; encourage walking, biking, transit, and other alternatives to driving; and create a supportive climate for economic viability (City of Pasadena, *General Plan Mobility Element*, 2015).

In the middle of the process, SB 743 was passed in 2013. The city's former metrics for traffic analysis, focusing on driver delay and auto speeds, were now in conflict with both its planning vision and state legislation—fortifying the need to create new metrics for environmental review.

The selection of new metrics created some controversy. Proposed new metrics for bicycle, transit and pedestrian accessibility were widely accepted, but the question of how to integrate LOS with VMT measures proved to be a contentious one (Downtown Pasadena Neighborhood Association, 2014). Many community members, relying on “an intuitive sense” that any additional development causes traffic congestion, called for continuing to use LOS analysis to prevent traffic gridlock (ibid). These residents felt that VMT measures could not effectively substitute for (be “equivalent” to) LOS as a means for managing transportation problems (ibid). In addition, the residents feared a loss of control over project approval.

These debates in Pasadena point to controversies and avenues for compromise, in a city transitioning from an LOS-based to a VMT-based approach to project review. Observers noted that creating consensus in favor of the new metrics depended on convincing stakeholders that LOS is biased toward driving and driver speed, while it fails to focus on trip behavior and overall mobility (Downtown Pasadena Neighborhood Association, 2014).

After being debated and vetted through numerous city commission meetings and public workshops, on December 5, 2014, the Pasadena City Council adopted five new metrics for CEQA review of traffic impacts including VMT per capita and vehicle trips (VT) per capita, and three metrics for assessing coverage and quality of alternative mode options (for transit, biking, and walking). In addition, four non-CEQA metrics were adopted, including LOS and street segment analysis. (All the metrics are described in more detail below.) The non-CEQA metrics and associated significance standards apply to project proposals as a condition of approval, but they are not CEQA standards. While all development projects are subject to the non-CEQA standards, with discretion, the CEQA metrics and standards apply only to projects of communitywide significance above a certain size threshold (described below).

The CEQA metrics and standards are tied to the city's General Plan and associated plans for funding facilities improvements. The connection is both legal and practical. Legally, the substantial evidence basis for the standards (required under CEQA) is based on consistency of the city's General Plan with SCAG's regional SCS, referring to prescribed densities and land use types (from interview). In this way, the city has conformed to the stipulations outlined in OPR's guidance for determining significance thresholds for “land use plans,” namely, that development in the plan is consistent with the regional SCS (OPR, 2018).

The consistency determination between Pasadena's General Plan and SCAG's regional plan relies on technical modeling consistency between Pasadena's modeling procedure for estimating both current and plan-year (future) impacts, such as for VMT per capita, and SCAG's modeling procedure to estimate the

same outcomes, for its SCS. As part of the update to the city's General Plan and transportation metrics, Pasadena invested in a significant and expensive upgrade to its technical modeling capacity, using a subset of SCAG's regional travel demand model, but improving the level of disaggregation to the parcel level. "For every one Transportation Analysis Zone in SCAG's model, we have ten in Pasadena's model," explained one city planner we interviewed.

The city's upgrade of its technical modeling capacity was important not only for demonstrating the legal basis for the new CEQA standards, but also to its new procedure for transportation impact assessment and mitigation. The fine-grained level of the city's model allows for "vertical, top-to-bottom integration of plan-level and project-level analysis and mitigation," according to one Pasadena planner (interview). By ensuring that the city's traffic demand model is sensitive enough to effectively estimate travel impacts of TOD and other development projects, the model can be used to link project-level analysis to plan-based analysis.

In July, 2017, Pasadena updated existing Traffic Reduction and Transportation Improvement Fee to include transit, bike, and pedestrian improvements called for in its updated General Plan. Based on a nexus study, existing fees were nearly tripled per square foot for single-family residential developments, but raised by less than 20% for multi-family development (City of Pasadena Municipal Services Committee, 2017). The existing fees for retail and office developments were also increased, although they are much lower on a square foot basis. The new fees, which are projected to raise more than \$130 million in revenue by 2035, are assessed based on projected VMT impacts of projects, in conjunction with facilities needs as identified in the General Plan and an associated facilities needs list. Thus, the city has linked its new CEQA standards and metrics to financing for city-wide facilities needs.

Conclusion

Pasadena provides a model for how a city can integrate top-down plan-level analysis with project-level analysis and mitigation, in which CEQA standards are used to support plan-level goals. This "vertically integrated" approach took significant effort, over a period of five years, to upgrade technical capacity and advance political discussion and policy-making in the city. Like San Francisco, Pasadena's process was not unproblematic technically, legally, or politically. Commitment of substantial resources was required.

But in spite of the costs, Pasadena planners, like those in San Francisco, underscore the value of good up-front planning as the basis for rationalizing CEQA review and orienting it toward supporting the city's vision for its future. Pasadena's overhaul of transportation metrics occurred in the context of, and to support, the city's General Plan update. The city had reached the stage where traditional LOS review, on its own, was undermining planning goals. But the city went further than just adopting VMT per capita, in line with OPR's recommendations, as an alternative metric for project-level analysis. Instead, the new metrics are now embedded in a process to link project-level analysis to plan-based analytical and funding mechanisms aimed at achieving the city's overall vision for its future.

As the director of Pasadena DOT put it:

The recipe for success is to take a comprehensive approach to transportation planning, addressing the needs of every mode, and how to achieve network-level connectivity. You need a master plan, a project list, good metrics, and mitigation procedures.

Expecting instead to produce a cohesive network over time through project-level analysis and mitigation alone has a very low probability of success. A piecemeal approach is inadequate. We want a consistent forecasting tool that can capture interactivity, rather than look at each project individually without considering the context.

Within our master plan framework we can look at how projects fit in. It provides a way to align from the plan level to the project level, top to bottom. It's how we wound up choosing tools, such as the specificity in our modeling. We wanted to build a set of tools applicable at the plan and project levels – vertical integration across the process (interview).

Addendum 1: Pasadena’s metrics for CEQA traffic analysis and mitigation

Under Pasadena’s new guidelines for project-level review of traffic-related impacts of proposed development, projects of communitywide significance that propose to create more than 50 residential units or more than 50,000 square feet of commercial space are required to undergo CEQA review (and an additional non-CEQA review described below). The five new CEQA metrics to analyze impacts on multiple travel modes (shown in Table 1), are described further below. For each, the adopted threshold of significance refers to existing conditions in the city in 2013, as determined in model runs consistent with SCAG’s SCS produced that year.

Table 1. Pasadena’s transportation performance metrics for CEQA review

METRIC		DESCRIPTION	IMPACT THRESHOLD
1.	VMT Per Capita	Vehicle Miles Traveled (VMT) in the City of Pasadena per service population (population + jobs).	CEQA Threshold: An increase over existing Citywide VMT per Capita of 22.6
2.	VT Per Capita	Vehicle Trips (VT) in the City of Pasadena per service population (population + jobs).	CEQA Threshold: An increase over existing Citywide VT per Capita of 2.8
3.	Proximity and Quality of Bicycle Network	Percent of service population (population + jobs) within a quarter mile of each of bicycle facility types	CEQA Threshold: Any decrease in existing citywide 31.7% of service population (population + jobs) within a quarter mile of Level 1 or 2 Bike Facilities.
4.	Proximity and Quality of Transit Network	Percent of service population (population + jobs) located within a quarter mile of transit facility types.	CEQA Threshold: Any decrease in existing citywide 66.6% of service population (population + jobs) within a quarter mile of Level 1 or 2 Transit Facilities.
5.	Pedestrian Accessibility	The Pedestrian Accessibility Score uses the mix of destinations, and a network-based walk shed to evaluate walkability	CEQA Threshold: Any decrease in the Citywide Pedestrian Accessibility Score

Source: Yamarone, n.d, based on Pasadena DOT, *Transportation Impact Analysis: Current Practice and Guidelines*, 2015

1) Vehicle miles traveled (VMT) per capita

VMT per capita measures the project’s incremental influence on citywide VMT per capita. The measure is calculated by the change in citywide VMT with and without the project, divided by the service population using the city’s travel demand forecasting model. The calculated measure is then compared to the adopted

threshold VMT per capita to determine whether the project creates a significant impact on the environment. Unlike LOS, this VMT analysis is not an intersection analysis, but rather an assessment of the accessibility and sustainability impacts of a project on the entire network. Thus this type of analysis is better aligned with the city's General Plan and measurements of air quality and greenhouse gases.

2) Vehicle trips (VT) per capita

Unlike the previous measure, VT per capita looks at total trips and not miles. VT per capita is the project's incremental contribution to citywide VT per capita, calculated by dividing the change in citywide VT with and without project, by the service population, and comparing to the adopted threshold VT per capita. Again, Pasadena DOT uses data generated by the 2013 trip-based citywide travel demand model. Like VMT, VT is a sustainability measure closely tied with greenhouse gas production. Together VMT and VT per capita measure efficiency of projects by analyzing travel behavior associated with changes in land use (City of Pasadena, *General Plan Mobility Element EIR*, 2015).

3) Proximity and quality of bicycle network

This metric provides a measure of the percent of the city's residents and employees within a quarter mile of bicycle facilities, such as bike paths, bike boulevards, and cycle tracks.

4) Proximity and quality of transit network

To measure proximity and quality of the transit network, this metric provides a measure of the percent of residents and employees within a quarter mile of a Gold Line stop or major transit corridors. Any decrease in access for the above measure is considered a significant impact.

5) Pedestrian accessibility

The Pedestrian Accessibility Score measures the walkability of an area by providing a simple count of the number of land use types (i.e. retail, restaurant, office, open space) accessible to a resident or employee within a five minute-walk. The score can be improved by attracting mixed-use development or balancing commercial with residential development.

Together, the five metrics emphasize all modes of travel and focus the analysis on accessibility, livability, and sustainability. By removing traditional LOS, the perspective on transportation impact expands beyond the intersection and allows developers and the city to explore multiple measures to reduce impacts to the environment. While an increase in population would likely increase the number of vehicle miles and trips and trigger a significant impact, land use choices that help residents meet their daily needs within a short distance of home can reduce these impacts, and the new metrics focus attention on such opportunities (ibid).

Addendum 2: Pasadena’s metrics for non-CEQA traffic analysis

All projects regardless of size are subject to non-CEQA review during the approval process, using metrics for analysis shown in Table 2 and described below.

Table 2: Transportation metrics for non-CEQA project analysis in Pasadena

METRIC		DESCRIPTION	CAP
1.	Street Segment Analysis	The street segment analysis assesses traffic intrusion on local streets in residential neighborhoods	Increases of 10-15% above existing on streets with more than 1500 ADT would trigger conditions of approval to reduce project vehicular trips
2.	Auto Level of Service	Level of Service (LOS) as defined by the Transportation Research Board’s <i>Highway Capacity Manual (HCM)</i> .	A decrease beyond LOS D Citywide or LOS E within Transit Oriented Districts (TODs) would trigger conditions of approval to reduce project vehicular trips
3.	PEQI	Pedestrian Environmental Quality Index	Below average Conditions
4.	BEQI	Bicycle Environmental Quality Index	Below average conditions

Source: Pasadena DOT, *Transportation Impact Analysis: Current Practice and Guidelines*, 2015

1) Level of service

While LOS may not be the most effective metric to analyze environmental impacts from development, LOS still provides information on how development affects vehicle traffic in the surrounding intersections. As a supplement to the CEQA metrics adopted, Pasadena planners believe that LOS analysis can help produce better projects (interview). The city relies on LOS analysis using criteria from the Highway Capacity Manual, assigning the traditional grade of A to F depending on delay for drivers. Intersection LOS analysis is conducted for peak hour conditions, and the number of intersections analyzed will vary depending on size and location of a proposed project. For most intersections, an LOS that exceeds a grade of D (or a grade of E for intersections in transit-oriented districts) will be required to meet conditions of approval. Mitigations exacted will be consistent with the city’s planning goals to encourage more walking, biking and transit use (City of Pasadena, *General Plan Mobility Element EIR*, 2015).

2) Street segment analysis

The city’s street segment analysis measures the extent to which traffic from a new project would intrude on residential streets. The analysis uses average daily traffic (ADT) caps to determine whether relative change in daily traffic due to a new project will impact the neighborhood. If a project’s trips exceed the caps, the project sponsor must develop and implement a Complete Streets Plan, with input from affected residents, council districts, and DOT, to provide measures that encourage people to use non-auto modes. This analysis is conducted only for projects of communitywide significance (see size threshold described earlier).

3) Pedestrian Environmental Quality Index (PEQI) and Bicycle Environmental Quality Index (BEQI)

Pasadena adopted these two traveler experience metrics from San Francisco’s Healthy Development Measurement Tool. PEQI and BEQI evaluate design characteristics, volumes, and safety.

Chapter 6. TRAVEL AND LAND USE PATTERNS WITH IMPLICATIONS FOR SB 743 IMPLEMENTATION

For this research, we sought to evaluate land use and travel patterns pertinent to SB 743 implementation, focusing on how OPR’s recommendations on thresholds of significance might apply in different cities, as they execute their responsibility as CEQA lead agencies to analyze and mitigate for traffic impacts of land use projects. We sought to better understand which cities, in which regions, will be most likely to have to mitigate for VMT impacts under SB 743, because all or a large share of their land areas have VMT per capita levels above OPR’s recommended thresholds for determining significant VMT impacts, or they lack high quality transit service.

Operationalizing OPR’s recommended thresholds of significance

Our analysis operationalizes OPR’s recommended thresholds of significance for determining VMT impacts under SB 743; these thresholds are OPR’s recommended metrics for determining whether a development project’s expected VMT should be deemed “significant” — thereby triggering the need for more detailed environmental review, and mitigation of impacts, if feasible – or “less-than-significant,” in which case the project may be deemed to require less extensive environmental review and not to require mitigation. As discussed earlier, under CEQA, lead agencies maintain discretion for determining their methods to assess significance of impacts, but they also generally take into account state guidelines and technical advice.

In OPR’s technical advisory, a key recommended factor for determining significance of VMT impacts is whether a proposed project is to be located in an area with **high-quality transit access**, as defined by OPR. Residential, retail, office, and mixed-use projects are presumed to have a less-than-significant impact on VMT if they are located within a half-mile of a “major transit stop” or a stop along a “high quality transit corridor.”¹⁸

A second, key significance threshold outlined in OPR’s advisory refers to **how much VMT per capita is expected to be generated by a given development project**. For residential projects, OPR’s recommended threshold for significant VMT impacts is whether VMT produced by the project will exceed 85% of existing average city-wide VMT per capita or 85% of existing regional (MPO-wide) VMT per capita, whichever level is higher. OPR also outlines recommended significance thresholds for office projects (whether a project exceeds 85% of regional average VMT per employee) and retail projects (with local-serving retail presumed to create a less-than-significant impact, and regional-serving retail significance based on whether the project will increase or decrease VMT).

¹⁸ OPR cites existing statutes for defining high-quality transit areas, in particular, Public Resources Code § 21064.3 (“‘Major transit stop’ means a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods”), and Public Resources Code § 21155 (“For purposes of this section, a high-quality transit corridor means a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours”).

We conducted analysis at both the city level and within-city traffic analysis zone (TAZ) levels on how and whether land use patterns map onto OPR's regional threshold of significance, a measure connected to state policies for achieving climate goals. Our city-level research also investigates how many cities are likely to peg their threshold of significance for project VMT analysis at 85% of **regional** average per capita VMT, or alternately, at 85% of **city-wide** average per capita VMT (presuming they peg their significance level to whichever value is higher).

Our investigation of within-city VMT patterns takes a similar approach to OPR's recommended map-based screening of areas where VMT can be expected to be lower or higher than a city's determined significance threshold. Map-based screening is intended to provide a short cut whereby cities can screen out residential and office projects that may not require detailed environmental analysis. OPR's advisory notes that "Maps created with VMT data, for example from a travel survey or a travel demand model, can illustrate areas that are currently below threshold VMT. Because new development in such locations would likely result in a similar level of VMT, such maps can be used to screen out residential and office projects from needing to prepare a detailed VMT analysis" (OPR, 2018, p. 13). As discussed in previous chapters, some cities (including San Francisco and Oakland) are using map-based screening at the TAZ level, in conjunction with identified city-wide significance thresholds, to streamline analysis for projects in low-VMT areas.

Our methodology and data sources

Our research aimed to provide a general assessment of how OPR's recommended thresholds of significance for VMT impacts may apply to cities in the state's largest regions. To do so, we sought to use standardized statewide data. To identify areas served by high-quality transit access (HQTA), we used maps from the two largest California MPOs – the Metropolitan Transportation Commission (MTC) and the Southern California Association of Governments (SCAG) – with jurisdiction over the 9-county San Francisco Bay Area and 6-county Los Angeles metropolitan area, respectively. To assess VMT patterns across geographical areas, we used information from two primary public-use sources – the California Household Travel Survey (CHTS), and the California Statewide Travel Demand Model (CSTDM).

The CHTS is conducted by Caltrans every ten years to obtain detailed information about the socioeconomic characteristics and travel behavior of households statewide. The data are used for forecasting purposes in regional travel models, the CSTDM, and the Statewide Integrated Inter-regional Transportation Model, among other uses. The last CHTS was conducted from January, 2012, to January, 2013. Data are provided by household for all trips (trip tours) during a given day. We aggregated by household all trips for all purposes (including non-home-origin trips), calculating per capita estimates by summing the number of household members per trip, and dividing VMT per trip by that number.

The CSTDM is a multimodal, tour-based travel demand model developed by Caltrans to forecast all types of travel. It utilizes data from the CHTS on travel behavior, and incorporates information from other sources such as the US Census to estimate zonal land uses, employment, and population for model calibration. The CSTDM subdivides the state into 5,474 traffic analysis zones (TAZs), which vary considerably in size in terms of both their geographic area as well as population and employment numbers.

The CHTS has the strength of providing information on actual travel patterns as recorded by 42,431 California households who completed the survey and submitted information, including their city of residence. However, sample sizes are small for many cities in the state. We limited our analysis to those cities for which the CHTS provides data for at least 30 households. This constraint means we show results for only 224 of 395, or 57%, of cities in the five regions of the state that we studied: the Central Valley (consisting of 8 counties), and the four largest metropolitan regions, namely the San Francisco Bay, Los Angeles, Sacramento, and San Diego metropolitan areas.¹⁹ These four large metro areas and the Central Valley contain 93% of California's population (calculated from California Department of Finance, *E-1 Population Estimates*, 2016). The 224 cities we studied had populations of 7500 or more, based on data from the 2010-14 American Community Survey; their populations comprised 75% of total population, and 88% of population within cities, in the regions studied.

Meanwhile, the CSTDM provides more complete information at a finer geographic level of analysis (the TAZ level) than the CHTS, but its outputs of interest are modeled rather than taken from actual survey results. The CSTDM also is not ideal for analysis at the city scale because TAZ boundaries do not coincide with city boundaries (many TAZs cross city boundaries). We provide more detailed information about our methodology for using the CSTDM in an upcoming section.

For both the city-level analysis using the CHTS, and the TAZ-level analysis using the CSTDM, we measure total household VMT per capita, for all trip types. This conforms to OPR's recommended approach for estimating trips for residential projects using a tour-based approach to capture all household VMT.

Across-city housing growth and VMT patterns pertinent to SB 743

Our analysis begins by comparing city-level average VMT per capita to regional average VMT per capita. This sort of assessment is likely to be a first step for local lead agencies in considering how to determine thresholds of significance for evaluating proposed residential development projects within their jurisdictions. Following OPR's recommendations, they can peg their identified significance level for project-level VMT at either 85% of city-wide average VMT per capita, or 85% of regional average VMT per capita, whichever is higher.

Fully half (51%) of the cities studied would be able to adopt thresholds of significance exceeding 85% of the regional average VMT per capita, by pegging their significance level to 85% of their city-wide average rather than the regional threshold, in accord with OPR's recommendations. (The average difference in per capita VMT between the city-wide and the regional measure, for cities with above-regional-average VMT per capita, is 4% for the SACOG region, 6% for SANDAG, 12% for SCAG, and 13% for the MTC region and in the Central Valley). (Note that we calculated regional average VMT using all data available in the CHTS, including for unincorporated areas, for all households and all trips (tours). In the Central Valley, the pertinent averages are calculated at the MPO, a.k.a. county level, before aggregation.)

¹⁹ The MPOs for these four areas are: the Southern California Association of Governments (SCAG), in the 6-county Los Angeles metropolitan area; the Metropolitan Transportation Commission (MTC), in the 9-county San Francisco Bay area; the San Diego Association of Governments (SANDAG), in the single-county San Diego metropolitan area; and the Sacramento Area Council of Governments (SACOG), in the 6-county Sacramento area.

Weighting these findings by population provides a better indication of the total impact on a region if cities peg their thresholds to their city-wide VMT level, rather than to the regional threshold. We simulated the effective region-wide threshold, assuming that cities with average VMT per capita *below* the regional average set their significance threshold to 85% of the regional level (as per OPR’s recommendations), and that cities with average VMT per capita *above* the regional average set their significance threshold to 85% of their city level. Applying these assumptions, we estimated that the effective overall VMT per capita threshold would be between 3% and 10% higher than the recommended regional threshold for the five regions we studied (3% higher for the San Francisco and Los Angeles regions, 4% for the Sacramento region, 5% for the Valley, and 10% for the San Diego region). It is important to note that these findings are only suggestive, because they **do not reflect the full set of cities** in the regions studied, nor unincorporated territory. As discussed above, we include only 57% of cities in our analysis due to data limitations. Reflecting smaller average population sizes compared to low-VMT cities, the combined population of the cities with average VMT per capita above the regional average was 35% of population in all the cities we studied; however, the fraction of developable land and future development demand is likely to be higher.

We also compared cities’ average per capita VMT to OPR’s designated regional threshold (85% of regional per capita VMT). This measure is pertinent to achievement of state climate policy goals. OPR justifies its regional threshold by pointing to recent research by the California Air Resources Board indicating that a reduction of per capita VMT by 15% from current levels is in line with state climate policy goals (OPR, 2018, p.11). Furthermore, this measure is relevant to SB 375, California’s regional planning law to promote efficient development patterns. Indeed, SB 743 was adopted in part to support SB 375. Under SB 375, the state’s MPOs must develop long-range regional transportation-land use plans capable of reducing GHGs by targeted amounts (with GHG trends roughly matching VMT trends). The goal of recent MPO plans adopted in the state’s four largest regions has been to reduce GHGs per capita from light-duty vehicles by approximately 15 percent by 2035, compared to 2005 levels (similar to recent levels). As discussed in Chapter 2, the California Air Resources Board has recently called upon the MPOs to achieve even deeper GHG reduction in future plans.

For these reasons, considering how city-level VMT maps on to OPR’s regional threshold (15 percent below, or, in other words, 85 percent of, the regional average) helps in evaluating the potential impact of SB 743 on state climate goals. We found that three-quarters (78%) of the cities we studied are “high-VMT” on this measure – with average per capita VMT above the regional threshold (Table 3). This finding implies that, to the degree that new development resembles existing development in its VMT rates, regional plans under SB 375 may need to rely on a small share of cities to direct new development to low-VMT areas.

TABLE 3. Shares of cities by MPO region with average VMT per capita above or below 85% of regional VMT per capita

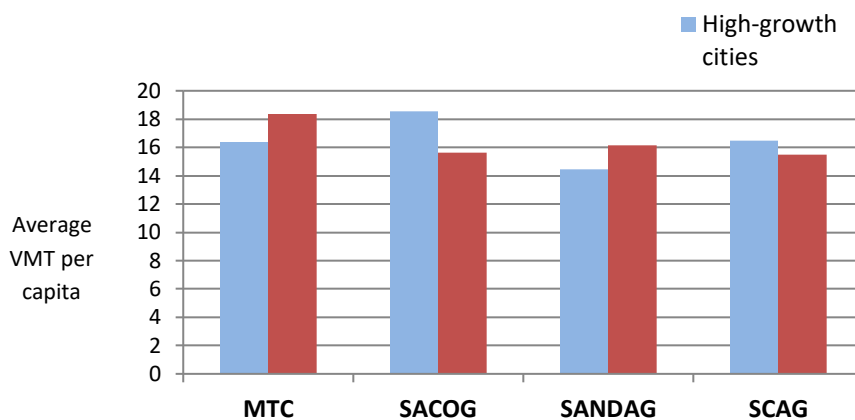
	MTC	SACOG	SANDAG	SCAG	Central Valley*	Total
Above	85%	67%	89%	74%	71%	78%
Below	15%	33%	11%	26%	29%	22%
Total	100%	100%	100%	100%	100%	100%

Source: Author calculations from CHTS

Notes: Results are for cities with at least 30 observations for households in the CHTS.

We next incorporate an additional variable, namely, projected housing unit growth rates, into the analysis, so as to distinguish high-growth from low-growth cities. To do so, we utilized data from the most recently adopted Regional Housing Needs Assessment (RHNA) plans in the four largest MPO regions to calculate projected housing growth rates for each city during the 8-year duration of the plans. RHNA plans are developed and adopted by MPOs on a regular basis, for the state-level Department of Housing and Community Development, using economic analysis on job and population growth, in coordination with California Department of Finance methods. The plans allocate projected housing need for each region among cities and unincorporated areas, based on allocation formulae developed by the MPOs in conjunction with their local government member partners. RHNA allocations thus provide a workable measure of projected housing growth because they strike a balance between projections based on analysis of market potential alone and based on local growth goals and policies. RHNA plans are also consistent with SCSs developed under SB 375, and so our study of high-growth versus low-growth communities aligns with expectations built into the regional SCS plans.

An interesting pattern is evident in comparing average VMT per capita rates in high-growth versus low-growth cities, based on their projected RHNA housing unit growth rates relative to the regional average rate for housing unit growth among cities (Figure 1). For two regions – the MTC and SANDAG regions – high-growth cities have relatively lower average VMT per capita rates than do low-growth cities. This pattern indicates that more growth in those regions may occur in low-VMT cities where VMT mitigation is easier. The opposite pattern is evident for the SCAG and SACOG regions, however.



Source: Authors' calculations from the CHTS and adopted RHNA plans

FIGURE 1. Average city-wide VMT per capita, for high-growth and low-growth cities (based on projected RHNA housing unit growth rates above or below the regional average rate), by MPO region

Table 4 breaks these results down in more detail, showing that most high-VMT cities in the MTC and SANDAG regions are also low-growth cities. This pattern also holds in the SCAG region, but high-growth cities in that region, as in the SACOG region, also have high relative VMT per capita, explaining the results seen in Figure 1. The results in Table 4 corroborate the finding that SB 743 implementation in the SCAG and SACOG regions may entail more VMT mitigation than in the other two regions, with larger shares of regional growth targeted to high-VMT cities.

TABLE 4. Average city-wide VMT per capita, and distribution, of "high-growth versus low-growth"* and "high VMT versus low VMT"* cities, by MPO region**

	MTC		SACOG		SANDAG		SCAG	
	% of cities	Avg city VMT per capita	% of cities	Avg city VMT per capita	% of cities	Avg city VMT per capita	% of cities	Avg city VMT per capita
High VMT, high growth	25%	17.5	40%	18.5	33%	14.5	24%	18.5
Low VMT, high growth	6%	11.6	0%	n/a	0%	n/a	9%	11.3
High VMT, low growth	60%	19.4	27%	17.9	56%	17.1	50%	17.0
Low VMT, low growth	9%	11.9	33%	13.8	11%	11.3	17%	10.8
Total	100%	14.2	100%	14.9	100%	12.9	100%	13.3

Source: Authors’ calculations from the CHTS and adopted RHNA plans

* Based on RHNA projected housing unit growth rates above or below the regional average rate

** Based on city-wide average VMT per capita above or below 85% of regional VMT per capita

Within-city development patterns pertinent to SB 743

We now turn to analyzing within-city development patterns pertinent to SB 743 implementation. For this purpose, we sought to investigate variations in VMT per capita across different parts of town, in connection to the policy parameters for determining significant VMT impacts, as outlined in OPR’s technical advisory.

Methodology for within-city analysis

We utilized CSTDM data for this analysis, in conjunction with the RHNA-derived data on projected housing growth rates among cities, and other information sources described below. Upon our request, Caltrans provided a TAZ-level dataset from the CSTDM with information on trip lengths and numbers of trips by trip purpose, associated VMT, and zonal characteristics including geographic area in square miles, and population and employment.

Conducting city-level analysis using the CSTDM required some data manipulation to address the problem noted earlier with TAZ boundaries, which cross city lines in many cases. We first subtracted water-only areas, using GIS data from the US Census. To address the boundary problem, we “chopped” TAZs at city borders, using GIS capability, retaining TAZs that include at least 60% of their original territory, and assigning them to the city in which at least 60% of the original TAZ is located. Our analysis of land area, population, and employment patterns includes data for these “partial TAZs” weighted by the portion of the original TAZ retained. As with the CHTS analysis, a share of cities had to be eliminated – in the case of the CSTDM because these cities were wholly included in a portion of a TAZ not comprising at least 60% of the original TAZ. The share of these small-size cities eliminated for this reason was 15% in the MTC region, 11% in the SCAG region, none in the SANDAG region, 34% in the SACOG region, and 40% in the Central Valley.

We created measures for built-environment characteristics by TAZ that are relevant in the literature on transportation-land use relationships, and which we could also employ in our “tools-testing” analysis, presented in the next chapter. We created the following measures: population-plus-employment density

per square mile, from the CSTDM data; distance to the nearest central business district (CBD), measured from each TAZ centroid to the closest boundary of a TAZ containing at least 5000 employees per square mile (the same measure used for the state’s Affordable Housing and Sustainable Communities Program); and transit access, measured (for the MTC and SCAG regions only) as whether a TAZ has at least 80% of its territory located within a high-quality transit area, based on MPO maps. We used these three variables for location setting analysis because they are among the most commonly used to depict built-environment characteristics. Research has demonstrated that density and job access (measured in our case by distance to CBD) are significantly associated with VMT (Stevens, 2017). Transit access, while shown to be less strongly associated with VMT than the other two measures, is a key factor in SB 743 implementation.

Findings for within-city analysis

Cities in the MTC and SCAG regions have more territory in higher density categories compared to cities in the other three regions (Table 5).²⁰

TABLE 5. Proportion of land by density category for cities, by region

Population-plus-employment density	MTC	SCAG	SACOG	SANDAG	Central Valley
<2500	24%	26%	16%	27%	28%
2500-5000	19%	20%	29%	22%	20%
5-10,000	30%	27%	48%	34%	44%
10-15,000	16%	17%	6%	11%	7%
15-25,000	8%	8%	1%	5%	1%
25-50,000	2%	2%	0%	1%	0%
50,000+	1%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%

Source: Authors’ calculations from the CSTDM

Adding high-quality transit access into the equation, we find that areas with high-quality transit access in the MTC and SCAG regions are considerably more dense than non-high-quality transit areas (Table 6).

TABLE 6. Average population-plus-employment density, by transit access, for TAZs in the MTC and SCAG regions

High-quality transit access	MTC	SCAG
No	6,371	5,626
Yes	22,260	17,422
Total	8,391	7,751

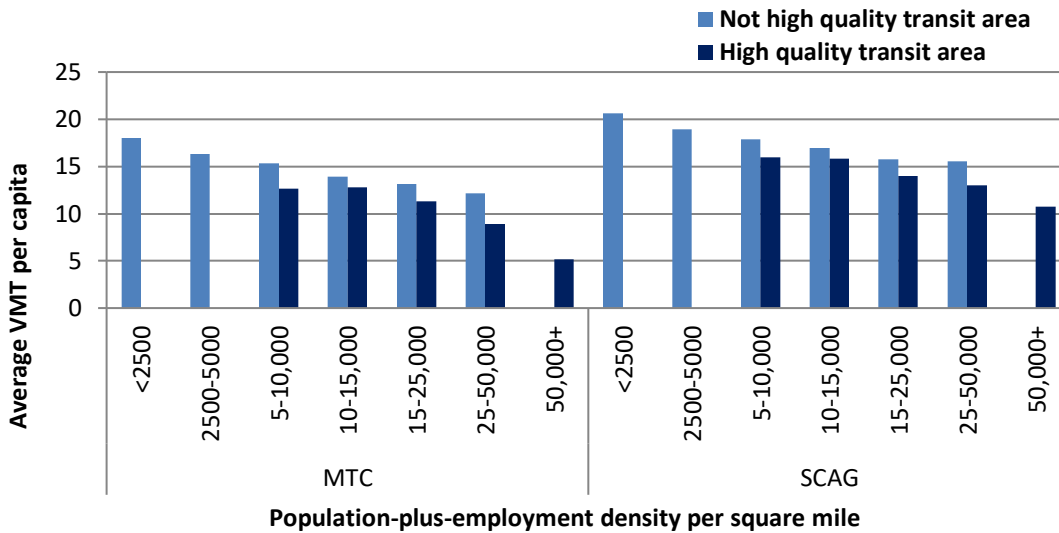
Source: Authors’ calculations from the CSTDM and high-quality transit access maps from MTC and SCAG.

For all the built-environment variables we tested, the MTC region is more compact and location-efficient than the SCAG region (results not shown). Employment in the MTC region is significantly more

²⁰ For calculations of land area by density category, land area by TAZ is summed, weighting for the portion of each TAZ included. See earlier description of methods for determining partial TAZs by city.

concentrated in the highest density category, compared to the SCAG region. Analysis of data on trip lengths points to the importance of work travel in distinguishing VMT outcomes; average trip lengths are longer for all trip purposes and for every density category in the SCAG region compared to the MTC region, but especially for home-based work trips (commutes) taken by residents of high density areas, for whom trip lengths are more than double in length in the SCAG region compared to the MTC region.

These factors help explain the pattern shown in Figure 2, in which VMT per capita is lower for both high quality transit access (HQTA) and non-HQTA territory in the MTC region compared to the SCAG region. (Results are shown for land use/transit categories with more than ten TAZs that qualify).



Source: Authors' calculations from the CSTDM and high-quality transit access maps from MTC and SCAG.

FIGURE 2. Average VMT per capita by density category (population plus employment) and transit access, for cities in the MTC and SCAG regions

We now turn to considering the implications of these built-environment factors upon SB 743 implementation. Mirroring the pattern seen earlier in Figure 1 and Table 4, we find that average densities for high-growth cities (using the same RHNA-based measure described earlier) in the MTC and SANDAG regions are higher than in low-growth cities (Table 7). The pattern is reversed for cities in the SCAG and SACOG regions, implying that SB 743 implementation may require more VMT mitigation, because more growth is slated to occur in low-density areas with higher VMT.

TABLE 7. Average population-plus-employment density per square mile, in high-growth versus low-growth cities, by MPO region

	MTC	SCAG	SACOG	SANDAG
High-growth cities	9,622	5,449	4,610	7,171
Low-growth cities	6,718	9,106	7,422	5,565

Source: Authors' calculations from the CSTDM and HQTA maps from MTC and SCAG, and adopted RHNA plans.

Conforming to this pattern, high-growth cities in the MTC region are more likely to have high-quality transit access than low-growth cities, but the pattern is reversed in the SCAG region (Table 8).

TABLE 8. Land area in high-quality versus low-quality transit areas, for high growth versus low growth cities, in MTC and SCAG regions

Projected RHNA housing unit growth rate above or below regional average rate	MTC		SCAG	
	HQTA		HQTA	
	No	Yes	No	Yes
High-growth cities	82%	18%	92%	8%
Low-growth cities	95%	5%	77%	23%
Total	88%	12%	82%	18%

Source: Authors’ calculations from the CSTDM, high-quality transit access maps from MTC and SCAG, and adopted RHNA plans

For “high-VMT” cities in the four large regions – namely, those cities where average per capita VMT is above 85% of the regional average rate – some land area (12% overall) has lower-than-regional-threshold VMT rates per capita (Table 9). This finding indicates that “high-VMT” cities tend to have only a small share of land area that falls below OPR’s recommended regional-based threshold of significance (not the city-level threshold that some cities may apply). Meanwhile, low-VMT cities have a substantial portion of land area overall (30%) with above-regional-threshold VMT per capita rates, signaling that development projects in these areas could produce significant VMT levels under SB 743 according to the region-based measure.

TABLE 9. “High-VMT” vs. “low-VMT” land area shares in “high-VMT” versus “low-VMT” cities in the four large MPO regions

High-VMT vs. low-VMT cities*	High-VMT vs. low-VMT land area in cities**	
	Above	Below
High-VMT cities	88%	12%
Low-VMT cities	30%	70%
All cities	79%	21%

Source: Authors’ calculations from the CSTDM

* Based on citywide average VMT per capita relative to 85% of regional average VMT per capita

** Land area in cities where average VMT per capita is above or below 85% of regional average VMT per capita

To look in more detail at patterns of high-VMT versus low-VMT land area by region and projected housing unit growth rates, we created “quasi-quintiles” of TAZs, broken down by average VMT per capita. They are not exact quintiles because we created a break between TAZs for which average VMT per capita is either below or above the regional threshold recommended by OPR, namely 85% of average regional VMT per capita. About two-fifths of TAZs in the cities we studied fall below that mark, and about three-fifths above.

In line with earlier findings, we see that more land area in high-growth cities in the MTC and SANDAG regions tends to be low-VMT than high-VMT, compared to cities overall in the regions (Table 10). The same pattern is also evident for the SCAG region, where high-growth cities have greater land share especially in areas with very low VMT per capita. However, the opposite pattern characterizes the SACOG region, where substantially more land area in high-growth cities is high-VMT, compared to cities in the region overall.

TABLE 10. Land area in high-growth and all cities by VMT per capita “quasi-quintile,” for the four large regions

		MTC		SCAG		SACOG		SANDAG	
Quasi-quintiles of average VMT per capita		All cities	High-growth cities	All cities	High-growth cities	All cities	High-growth cities	All cities	High-growth cities
<i>Below 85% of regional average VMT per capita</i>	Lowest quintile	8%	9%	12%	15%	22%	14%	8%	10%
	Low quintile	10%	11%	9%	8%	16%	8%	10%	11%
<i>Above 85% of regional average VMT per capita</i>	Medium quintile	22%	20%	21%	23%	25%	28%	25%	24%
	High quintile	30%	31%	23%	21%	29%	42%	29%	30%
	Highest quintile	31%	29%	35%	34%	7%	7%	29%	25%
Total land area		100%	100%	100%	100%	100%	100%	100%	100%

Source: Authors’ calculations from the CSTDM and adopted RHNA plans

Bringing transit access into the equation, a divergence between the MTC versus SCAG regions reappears (Table 11). While about one-third of land area with high-quality transit access in the MTC region is “high-VMT” (with average VMT per capita above 85% of the regional rate), more than half (58%) of high-quality transit area in the SCAG region is “high-VMT.” This finding indicates that a CEQA significance threshold based only on transit access might provide no guarantee of low VMT among residents in the area.

TABLE 11. Land area with below or above 85% regional average VMT per capita, by transit access, for cities in the MTC and SCAG regions

Land area where average VMT is above or below 85% of regional average	MTC		SCAG	
	<i>High quality transit access</i>			
	No	Yes	No	Yes
Above 85% reg average	89%	35%	83%	58%
Below 85% reg average	11%	65%	17%	42%
All land area	100%	100%	100%	100%

Source: Authors’ calculations from the CSTDM and high-quality transit access maps from MTC and SCAG

We conclude our analysis of within-city development patterns by focusing on cities with high projected housing growth *shares*, as opposed to high projected housing growth *rates*. Using the data from adopted RHNA allocation plans, we determined which cities in the MTC and SCAG regions account for the largest shares of total regional projected housing unit growth. Employing a cut-off for cities with RHNA allocations that contribute at least 1% of total expected regional housing growth within cities, we find that a small

number of cities (24 in the MTC region, and 22 in the SCAG region) account for the bulk of expected growth (79% of expected city housing growth in the MTC region, and 63% in the SCAG region).

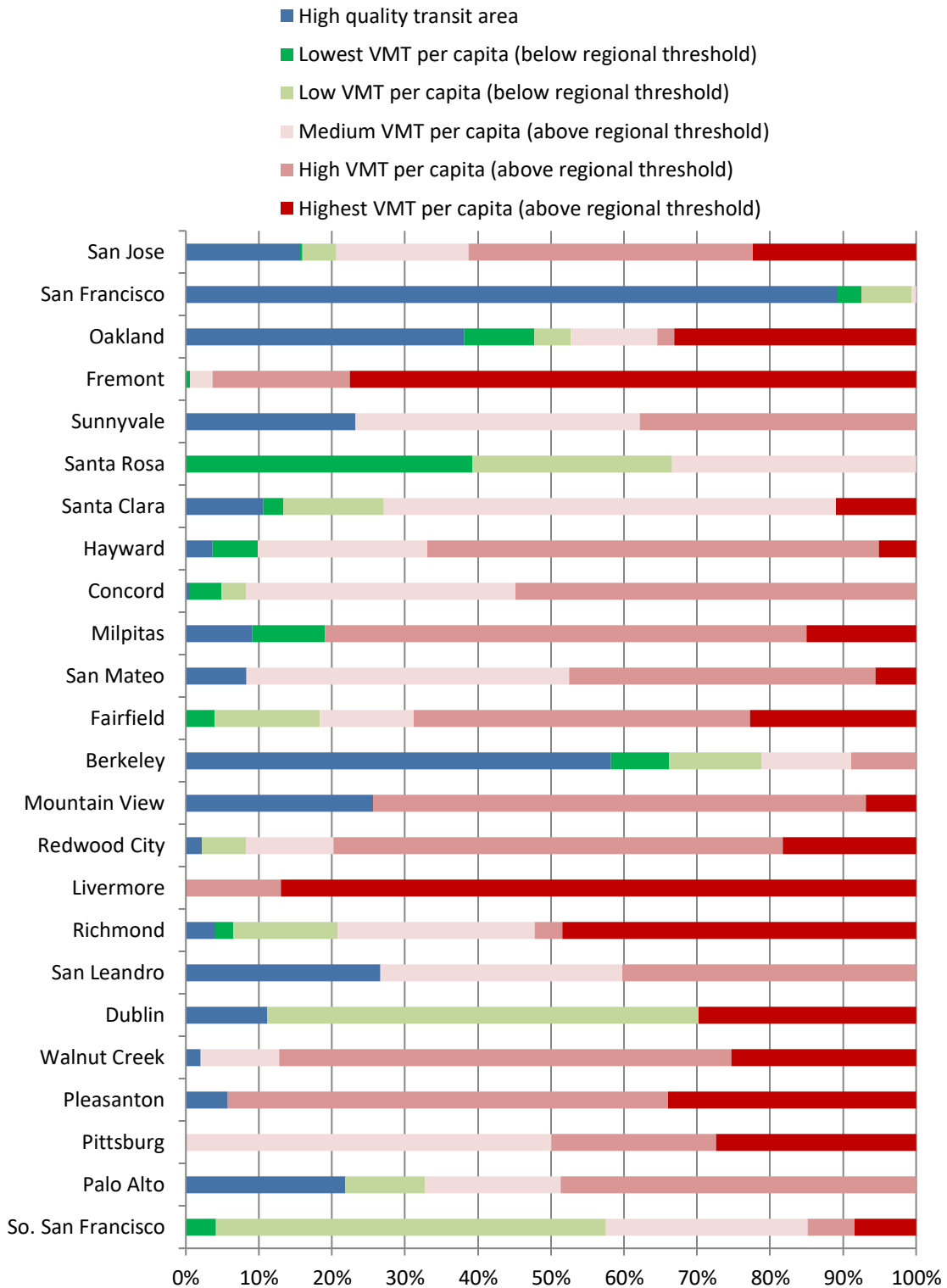
For each of these cities, we calculated the land territory within the city that falls below and above two of OPR's thresholds of significance, namely first, by identifying high-quality transit access areas, and second, by identifying territory where average per capita VMT rates fall either below or above the recommended regional threshold (namely, 85% of regional average per capita VMT). As described earlier, we divided territory into two groups below the regional threshold, and into three groups above the threshold, based on average VMT per capita by TAZ (resembling quintiles, except with the breakpoint established at the regional threshold, as described earlier).

The results, shown in Figures 3 and 4 (next page), show that within-city development patterns pertinent to SB 743 implementation vary widely among "high growth share" cities. Particularly in the SCAG region, some high growth share cities are located in outlying areas, such as the Inland Empire, where low densities and low transit service levels are more prevalent.

Conclusion

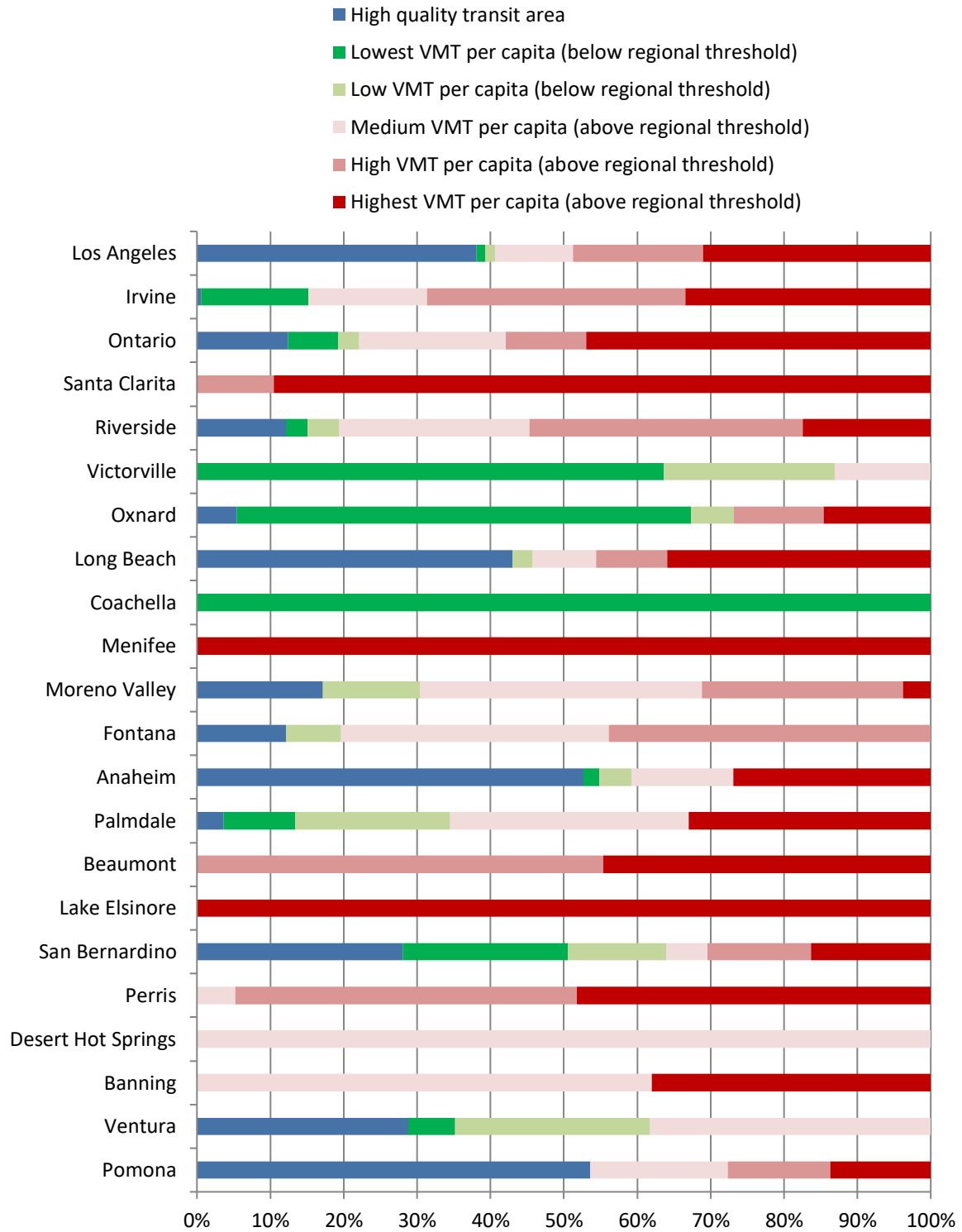
Our findings depict a regional pattern reflecting expectations for where growth is likely to occur, which is also connected to the policies embodied in SCS plans developed under SB 375. Those regions that have adopted more concentrated growth strategies, as evidenced in their RHNA plans associated with the SCS – in other words, those regions whose plans direct more housing growth toward higher-density, lower-VMT cities – will find SB 743 requires less mitigation, to the degree that the plans are realized on the ground. Our data analysis indicates that the MTC and SANDAG regions will have an easier time implementing SB 743 than the other two regions, for that reason. With more growth directed to cities with lower-VMT territory on average, the SACOG region in particular will likely find SB 743 implementation to be a greater challenge.

We find that even high-VMT cities generally have some portion of land where VMT per capita rates fall below the regional threshold. Conversely, low-VMT cities also generally have significant portions of territory – including in high-quality transit areas – where VMT per capita rates are high, on this measure. These findings suggest that all cities will need to evaluate their territories carefully to determine how to apply appropriate significance thresholds across different areas, including in transit zones, which may provide no guarantee of low-VMT development.



Source: Authors' calculations from the CSTDM and high-quality transit access map from MTC

Figure 3. Land breakdown in high growth share cities in the San Francisco Bay Area, based on transit access and average VMT per capita



Source: Authors' calculations from the CSTDM and high-quality transit access map from SCAG

Figure 4. Land breakdown in high growth share cities in the Los Angeles region, based on transit access and average VMT per capita

Chapter 7. TESTING SKETCH TOOL VMT ESTIMATES BY LOCATION SETTING AND PROJECT ATTRIBUTES

SB 743 requires that lead agencies estimate projected VMT from proposed development projects. The tools or methods commonly available for this purpose vary in their assumptions and techniques for modeling the influence of built environment factors such as proximity to transit and jobs.

This chapter investigates the question of tool use in determining VMT estimates for development projects, comparing results produced by two sketch tools in common usage, namely the California Emissions Estimator Model (CalEEMod), developed by the California Air Pollution Control Officers Association (CAPCOA), and MXD, a VMT model estimation tool developed by consultant group Fehr & Peers. We measured VMT for a stylized mixed use project that we placed in varying locations, characterized by neighborhood population-plus-employment density, distance from the nearest central business district, and presence of high-quality transit. We identify challenges of using each tool in terms of obtaining required inputs and obtaining and selecting optional inputs. We compare VMT estimation outputs produced by the tools with VMT data for the same neighborhood types calculated from the California Statewide Travel Demand Model (CSTDm). This foray into tool use allows us to examine how VMT estimates vary across location setting using the two tools, and to consider practical challenges that arose in using the tools and how differences in results correspond to idiosyncrasies of the tools.

Our method for comparing VMT estimates using two sketch tools

The sketch tools we investigated produce VMT estimates for development projects based on information supplied by the tool user on a project's physical characteristics as well as on built-environment characteristics of the neighborhood in which the project will be located. To test our two selected sketch tools, we therefore had to define the physical characteristics of a project for testing, and also measure built-environment characteristics for neighborhoods of interest in which the project would be located. The following sections describe our methodology for doing this in more detail, but here we start with a general description of our approach.

To hold project physical characteristics constant, we defined a hypothetical set of physical characteristics to test across different location settings. To define and measure neighborhood characteristics across a range reflecting the variety seen in California metropolitan areas, we used data generated by Caltrans from the CSTDm (the same dataset described in Chapter 6) to create a "location setting matrix" which categorizes neighborhoods (or more accurately, Transportation Analysis Zones or TAZs, as used in the CSTDm) according to three built-environment measures: their activity density (population-plus-employment density), distance from the nearest central business district (CBD), and half-mile access to high-quality transit. Using the CSTDm and other data, we then calculated built-environment input measures that the two sketch tools either require or allow users to input, corresponding to the neighborhood types defined by our location setting matrix. Finally, using these measures of neighborhood characteristics, we employed the two sketch tools to measure VMT for our hypothetical development project placed in different location

settings defined by our matrix. This method allowed us to compare VMT estimates produced by each tool across the location settings.

The two sketch tools we tested

For our analysis, we sought to test and compare a few sketch tools in common usage. Our first selected tool, CalEEMod, is a statewide land-use emissions sketch tool developed by the California Air Pollution Control Officers Association (CAPCOA) for purposes of CEQA analysis by local jurisdictions and environmental professionals, to use in quantifying pollutant and GHG emissions from construction and operation of land use development projects. CalEEMod, first developed in 2011, has been updated regularly since then. We employed version 2016.3.1.

We chose to test CalEEMod because it is already in common use for CEQA analysis, and it is also the sketch tool that the California Air Resources Board (CARB) requires grant applicants to the state's Affordable Housing and Sustainable Communities (AHSC) program to use in applying for project funds from the program. The AHSC program, funded by ongoing state greenhouse gas cap-and-trade revenue, provides grants and loans for transit-oriented developments and related infrastructure projects that reduce GHG emissions. Perhaps because of its use for these purposes, OPR also employed CalEEMod in its case study, included in its January 2016 draft guidance document on SB 743 implementation, demonstrating how to estimate VMT for a mixed use development project (see pages 48 to 52).²¹ We followed OPR's lead in using CalEEMod to estimate VMT from a mixed use development project, with a few differences in approach that we note below.

Reflecting its orientation toward CEQA analysis, CalEEMod's basic procedure is to produce estimates of both "unmitigated" and "mitigated" emissions from a development project, including from transportation-related emissions. In CalEEMod, a user must first input basic information on a project's characteristics and location, including its land use type and sub-type (e.g. single-family residential or strip mall retail project), and the county or air district in which it is to be located. CalEEMod then calculates unmitigated emissions for the project by applying default values for an average project of the same type (with the same physical attributes), located in a typical suburban setting, utilizing quantification methods for multiple aspects of construction and operations, developed based on various data sources and research studies described in a report produced in 2010 by the California Air Pollution Control Officers Association (CAPCOA), called *Quantifying GHG Mitigation Measures*.²²

²¹ For its case study, OPR employed an earlier version of CalEEMod, in conjunction with an off-model calculator spreadsheet developed by the California Air Resources Board (CARB) for use by applicants of the AHSC program. We do not employ the off-model AHSC spreadsheet in conjunction with CalEEMod for our analysis, because the newer version of CalEEMod that we used has revised the measures, relevant to our analysis, which had prompted CARB to call for use of the off-model calculator by AHSC program applicants for the measures in question. See the 2016-17 AHSC methodology report at <https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/quantification.htm>, specifically on page 6, where it notes that the calculation methodologies for GHG mitigation measures LUT-1, LUT-4, LUT-6, and LUT- 9 have been corrected.

²² The CAPCOA report is available at <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>. The CalEEMod user guide is available at http://www.aqmd.gov/docs/default-source/caleemod/upgrades/2016.3/01_user-39-s-guide2016-3-1.pdf?sfvrsn=2.

For calculating operational VMT associated with a project, CalEEMod utilizes default data for average (a.k.a. suburban) trip rates for different land use categories, taken from the Institute of Transportation Engineers (ITE) 9th edition of the *Trip Generation Manual*, and trip types, taken from information supplied by either air district management agencies or the 1999 Caltrans Statewide Travel Survey, and trip lengths taken from data supplied by the air districts or using a default average for the state (CAPCOA, 2010). This CalEEMod default data may be out-of-date and/or too generic for a given project site. Indeed, one of our interviewees, a transportation consultant, noted that, “The trip rates in CalEEMod are from ITE and are not calibrated to California. The trip purpose splits, which affect trip length, are from the 1999 Caltrans Statewide Travel Survey. A more current 2012 California household travel survey is now available for this data along with current trip lengths. The trip lengths in CalEEMod, according to the documentation, come from the air districts or use a default average for the state. No other information is provided about the actual source of the trip lengths and our investigation revealed that the CalEEMod trip lengths do not match the 2012 California household travel survey data or trip length estimates produced by MPO models. So, I don't have substantial evidence that the CalEEMod VMT estimates are reasonable.”

CalEEMod permits users to substitute locally obtained data for the default trip rates and trip lengths used by the tool, allowing users to adjust output to more closely match local conditions, thereby helping to address the concerns expressed by the consultant. Indeed, OPR’s technical advisory recommends using “localized trip lengths” whenever possible as substitutes for default inputs, for this reason.

Users can induce CalEEMod to produce a lower emissions estimate – a “mitigated” estimate – by indicating whether a project has characteristics associated with lower-than-average emissions. One CalEEMod mitigation category addresses “land use and site enhancements,” to calculate emissions reductions for built-environment factors associated with “location efficiency” of a project and its location, including project density, mix of land uses, distance to CBD, proximity to transit, street intersection density, share of affordable (below market rate) units, and parking characteristics. This is the mitigation category in CalEEMod pertinent for purposes of our analysis.

The CalEEMod user employs the “land use and site enhancements ” mitigation screen to select appropriate mitigation measures (characteristics) that are applicable to the project and its site (e.g. indicating the project’s density). Based on this information supplied by the user, CalEEMod assigns VMT reduction benefits for the designated built-environment attributes, relative to the unmitigated base case representing average (suburban) conditions. The assigned benefits are calculated from elasticities for VMT reduction associated with each built-environment factor considered singly, derived from findings of academic research (elasticities measure the percent change in the dependent variable of interest associated with a 1 percent change in the independent, explanatory variable of interest). The mitigation benefits assigned to a project are then summed in CalEEMod to produce an estimate of total project benefits, subject to an overall cap applied according to a project’s location type. CalEEMod subtracts the estimated location-related benefits from its default base-case estimate of unmitigated VMT to produce its final estimate of mitigated VMT. CalEEMod’s estimate of mitigated VMT then can serve as the VMT estimate for the project.

The second tool we tested, MXD, or the Mixed Use Trip Generation Model version 4.0, is a spreadsheet tool originally developed for the US Environmental Protection Agency by consultant group Fehr & Peers, utilizing

research conducted by Reid Ewing and co-authors.²³ We employed MXD because independent research has validated its accuracy in estimating trip rates against other sketch tools (Shavizadeh et al., 2012), and because the firm that created it, Fehr & Peers, has extensive working relationships with California cities, conducting transportation analysis both at the plan and project levels. Fehr & Peers estimation tools and methods may become commonplace for VMT analysis under SB 743, simply because of these historical relationships. Fehr & Peers has developed more advanced, proprietary versions of MXD.

The MXD method estimates the reduction in vehicle trips attributable to mixed-use development, based on results of statistical modeling of travel survey data taken from 239 multiuse sites in six metropolitan areas in the United States.²⁴ MXD first calculates a baseline number of project site trips using traditional Institute of Transportation Engineers (ITE) trip generation methods, and then reduces this baseline by estimating the percent of trips internally captured within the project, the percent of external trips made by walking, and the percent of external trips made by transit. Trip rates in the model were validated against traffic counts from the survey data obtained from mixed-use developments.

MXD calls on users to input basic information about a proposed project and its site, including land area, project type, number of intersections within the site or at its perimeter, presence of transit at or adjacent to the site, and whether the site is in a CBD or a TOD. The user can also substitute for default data on project population, and trip purpose splits if reliable data is available.

Compared to CalEEMod's extensive set of computational screens that address many aspects of a project's construction and operations, the MXD model is relatively simpler. However, its data demands for built-environment characteristics of a project site, which must be input by the user, are somewhat more difficult to obtain than for CalEEMod. In particular, MXD calls on users to input information on average trip lengths in the Traffic Analysis Zone in which a proposed project is to be located and average trip lengths for the metropolitan region as a whole, as well as information on employment within one mile of the project, and employment within a 30-minute transit trip from the project. We found the last of these data inputs to be most difficult to obtain (more details are provided below).

Defining project characteristics and settings

For our analysis, we sought to compare VMT estimation results produced by the two sketch tools across different location settings. To do so, we defined a hypothetical project with a given set of physical characteristics, and then calculated VMT for the project placed in multiple location settings representing the variety found in the Los Angeles and San Francisco Bay regions.

The physical attributes we used for our hypothetical project were taken from the example project that OPR employed for its case study, included in its January 2016 draft SB 743 technical advisory, for estimating VMT for a mixed-used project, namely the project at Stockton and T Streets in Sacramento. Stockton and T

²³ The MXD spreadsheet tool is available at <https://www.epa.gov/smartgrowth/mixed-use-trip-generation-model>. For more information on MXD, see Shavizadeh et al. (2012); Ewing et al. (2011); and Walters et al. (2013).

²⁴ The six regions from which data on mixed use developments were obtained were the Atlanta, Boston, Houston, Portland, Sacramento, and Seattle regions.

is a mixed-use project with 214 mid-rise apartment units, 24 single-family houses, and 6,000 square feet of commercial space (OPR, 2016 advisory draft, pages 48-52).

To test this project in different location settings, we sought to systematically vary data inputs for our two sketch tools, so as to capture observable characteristics associated with the spectrum of different location types in California urban areas that would be appropriate for siting a mixed use, mid-rise residential project of the sort we identified (excluding lowest-density suburban areas lacking transit access). To accomplish this goal, we created a location-type matrix at the Transportation Analysis Zone (TAZ) level, which differentiates urban locations in the Los Angeles and San Francisco Bay regions by three variables, for which we created categories: activity density, distance to central business district (CBD), and proximity to high quality transit. These three variables are among the most commonly used to measure built-environment characteristics. Research has demonstrated that density and job access (measured in our case by distance to CBD) are significantly associated with VMT (Stevens, 2017). Transit access, while less strongly associated with VMT than the other two measures, is a key factor in SB 743 implementation.

We measured the first of our three location matrix variables, namely activity density, using data from the CSTDM, as residential population plus employment per square mile in each TAZ. After examining the spread of densities in the two regions we studied, we first eliminated the lowest-density TAZs, those with less than 5,000 individuals per square mile, so as to exclude areas that would not likely be appropriate for siting a mixed-project such as Stockton and T; this step involved removing 29% of TAZs from analysis. Then, we created a four-category density variable, for which our lowest density category includes TAZs with population-plus-employment density of 5,000-10,000 people per square mile, and for which our highest density category includes TAZs with 25,000 to 50,000 individuals per square mile (see Table A1 in Appendix A for the full breakdown).

We further categorized TAZs by our second location matrix variable, namely distance to CBD. A TAZ-level CBD was defined for our purposes as any TAZ with 5,000 or more employees per square mile (using CSTDM data) – the same definition used for the state’s Affordable Housing and Sustainable Communities program. We excluded all TAZs for which distance to CBD was greater than 15 miles, and then categorized the rest into four groups: zero miles (=CBD), less than 0.5 miles, 1-5 miles, 5-10 miles, and 5-15 miles. Distance to CBD was measured using ArcGIS from the centroid of the TAZ to the nearest periphery of a CBD TAZ.

Data for measuring our third matrix variable, the availability of high quality transit within a half-mile radius (yes or no), was taken from maps of High Quality Transit Areas (HQTAs), produced by MTC and SCAG, the MPOs in the 9-county SF Bay Area and Los Angeles metro region, respectively. Using GIS capability, we determined whether at least 80% of each TAZ’s territory is contained within a high quality transit area, based on those maps; a TAZ was designated as HQTA if the answer was yes.

Location data inputs

After devising our location setting matrix in the fashion just described, we then produced measures of various built environment characteristics that are either required or optional inputs for the two tools we tested, to correspond to the different settings defined by our matrix. The purpose of utilizing these input measures was to be able to characterize distinct location settings for our analysis. To create these input

measures, we used the same CSTDM dataset that we employed for our analysis in Chapter 6, created from data obtained from Caltrans. For measures not available from the CSTDM, we employed some additional data sources, noted below. Due to limitations of our source data for one input variable required for using the MXD tool, namely a measure of employment within a 30-minute transit trip from a project location, we had to limit our analysis to portions of the state's two largest metropolitan areas, namely the Los Angeles and San Francisco Bay areas (more details are provided below).

We calculated and/or employed input values for each of the five most commonly used "D" variables for measuring built environment characteristics, namely density (in our case, for both the project itself and the surrounding area, employed in defining our location matrix), destination accessibility (measured in our case as distance to CBD), distance to transit (measured in our case as yes/no in a HQTA, based on HQTA maps obtained from the MPOs in the Los Angeles and San Francisco Bay Area regions), design (measured as intersection density), and diversity (or a.k.a. land use "mix," which both our sketch tools account for based on land use types designated by the user for the project).²⁵ For distance to CBD and intersection density, we constructed our input measures by calculating median (typical) values across TAZs in each cell defined by our location matrix. For project density, we entered a value directly as a project characteristic, based on information available in the Stockton and T project's environmental documents.²⁶ This measure is distinct from our measure of activity (population-plus-employment) density that we employed for our location setting matrix; our activity density measure pertains to the project setting rather than the project itself. For complete details on our sources and methods of construction for these input variables, see Appendix A.

Two built-environment measures required by MXD but not CalEEMod were somewhat difficult to obtain and data limitations for one of them resulted in the need for us to limit our analysis to only portions of the Los Angeles and San Francisco Bay areas. MXD requires an input for employment within one mile of the project site, which we measured as employment within a one-mile radius of each TAZ centroid, measured using GIS data from the US Census' Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) dataset. Finally, MXD needs to know total employment within a 30-minute transit trip, door to door, of the project site. To produce this measure, we calculated the average number of jobs available within a 30-minute transit trip from any point within the TAZ, using data from US EPA's Smart Location Database. Data limitations associated with this variable necessitated that we limit our analysis to 74% of TAZs in the Los Angeles area and 51% of TAZs in the San Francisco Bay Area.²⁷

In addition to developing the input measures on built environment characteristics just described, we also developed data on trip attributes by TAZ – for trip lengths, trip rates (numbers of trips by purpose), and trip type splits. The sketch tools we tested either require or allow users to input information, if known, on these

²⁵ CalEEMod calculates an entropy measure for VMT reductions associated with land use mix, based on the land use types designated by the user for a project. MXD takes land use mix into account for calculating internal trip capture.

²⁶ The Stockton and T project's Sustainable Communities Environmental Assessment (SCEA) report is available at <https://www.cityofsacramento.org/-/media/Corporate/Files/CDD/Planning/Environmental-Impact-Reports/Stockton-and-T-Street-SCEA-Initial-Study.pdf?la=en>

²⁷ The data on jobs within a 30-minute transit trip includes the time spent walking to and from transit stops, wait times, and transfers. Coverage for this data is limited to census block groups within metropolitan regions served by transit agencies who share their service data in a standardized format called GTFS. For the MTC and SCAG regions, coverage is limited to portions of the following counties: in the MTC region, for Alameda, Contra Costa, Marin, San Mateo, and San Francisco Counties; in the SCAG region, for Los Angeles and Orange Counties.

trip attributes. More specifically, MXD requires that users input data on home-based work trip (HBW) lengths, home-based other (HBO) trip lengths, and non-home based (NHB) trip lengths, both for the TAZ in which the project in question is to be located, and also for the metropolitan region as a whole, based on its MPO jurisdiction. If known, users can also substitute for MXD's default inputs for trip purpose splits by land use type; the default values, included for both trip productions and attractions by type, come from the National Cooperative Highway Research Program's Report 365, according to the technical documentation included in the MXD tool.

Meanwhile, as noted earlier, CalEEMod employs default data on trip lengths, rates, and types, taken from information supplied by regional air pollution control management agencies, ITE's 9th edition of the *Trip Generation Manual*, and/or the 1999 Caltrans Statewide Travel Survey (CAPCOA, 2010). However, users can substitute for the default data deployed in CalEEMod, and indeed, OPR's SB 743 guidance recommends that sketch tool users input locally derived data, if known, as substitutes for sketch tool defaults.

To experiment with substituting for default trip lengths in CalEEMod, we used the CSTDM data to determine median trip lengths for our location matrix cells. In the same fashion we also calculated the required inputs for trip lengths in MXD. For CalEEMod, we went further to also determine trip rates and trip purpose splits; this step was not possible to complete for MXD analysis with our Caltrans dataset, because it does not contain a full accounting of both attractions and productions by TAZ.

Before turning to presenting our results, one more input variable requires some discussion, because it figures significantly in our presentation. For CalEEMod, we used information in our location matrix to designate input values for the tool's "project setting" measure, which applies a maximum cap upon potential VMT reductions attributed to user-designated mitigation measures. More specifically, in using CalEEMod's "land use and site enhancement" mitigation screen, users must select one of four "project settings": Urban, Urban Center, Suburban Center, or Low-Density Suburb. The settings are characterized in CAPCOA's *Greenhouse Gas Quantification Report* mainly by qualitative descriptors to distinguish neighborhood types.²⁸ Our goal was to match our location matrix to the first three CalEEMod project settings, to identify appropriate areas for siting a mixed use, mid-rise residential project (excluding low-density suburban areas lacking transit access). See Table A1 in Appendix A for our designations.

Based on the project setting indicator selected by the user, CalEEMod applies a maximum cap, which varies by setting, to its calculation of total mitigated VMT; the cap is intended to ensure that the sum of

²⁸ For the CAPCOA method, "urban" is the highest density project setting, defined as a central city characterized by multi-family housing, located near office and retail. According to the description in the CAPCOA report, this setting applies to cities like Oakland and San Francisco that have an average of 48 percent lower VMT per capita than the statewide average. "Urban center" refers to a site in a central city or inner-ring suburb with high-frequency transit services, such as community redevelopment areas, reused abandoned sites, intensification of land use at established transit stations, or converting underutilized or older industrial buildings. This setting describes places like Hayward and the Fairfax area of Los Angeles that have an average 22 percent lower VMT than the statewide average. "Suburban center" refers to a site involving a cluster of multi-use development within dispersed, low-density, automobile dependent land use patterns, such as a historic downtown surrounded by suburban growth. This describes places like San Rafael and San Mateo, and reflects a range of zero to 17 percent less VMT per capita than the statewide average. Lastly, "low density suburban" refers to a site in a dispersed, low-density, single-use, automobile dependent land use pattern, usually outside of the city. We ignored this setting because we excluded the lowest-density and furthest-from-CBD TAZs in our analysis.

reductions assigned to individual mitigation measures identified by the user does not exceed a realistic level. CalEEMod’s calculation of final “mitigated VMT” for a project consists of the difference between unmitigated (default) VMT and the calculated (and capped) VMT reductions for all user-identified mitigations. The VMT reduction caps are as follows for the three project settings we utilized, for the pertinent land use and site enhancement measures employed in our tests: 65% for urban setting, 30% for urban center setting, and 10% for suburban center setting.²⁹

Differences in estimated project VMT by location setting

Our estimates of VMT varied considerably for our hypothetical development project, using our two tools across different location settings (Figures 5 and 6). The figure shows results for a few selected cells from our full location matrix, selected as especially representative of on-the-ground conditions, given their relatively high numbers of TAZs (the cells together contain 40% of all TAZs in our full matrix, for both regions depicted). (For the Los Angeles region, we added an additional cell to the graph – “suburban with good transit” – for analytical purposes; the number of TAZs for this cell in the Bay Area matrix was too small for us to use it). See Table A1 in Appendix A for a breakdown of numbers of TAZs that fall into each cell our location matrix, designation of the cells presented in Figures 5 and 6, and our selection of CalEEMod “project setting” category for each selected cell.

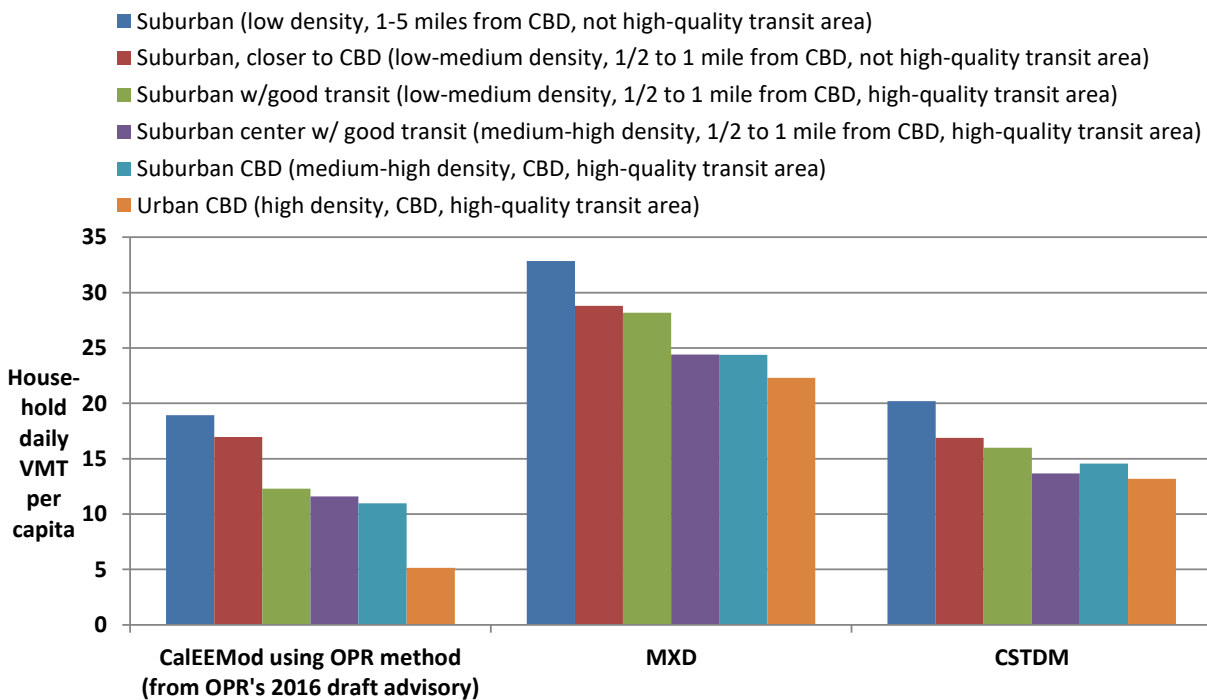


Figure 5. Estimates of per capita VMT for our hypothetical mixed use development project in different location settings, for Los Angeles and Orange Counties, using CalEEMod, MXD, and CSTDM data

²⁹ See Chart 6-2, on page 55, and related discussion about project setting caps, in CAPCOA’s report *Quantifying GHG Mitigation Measures* (2010).

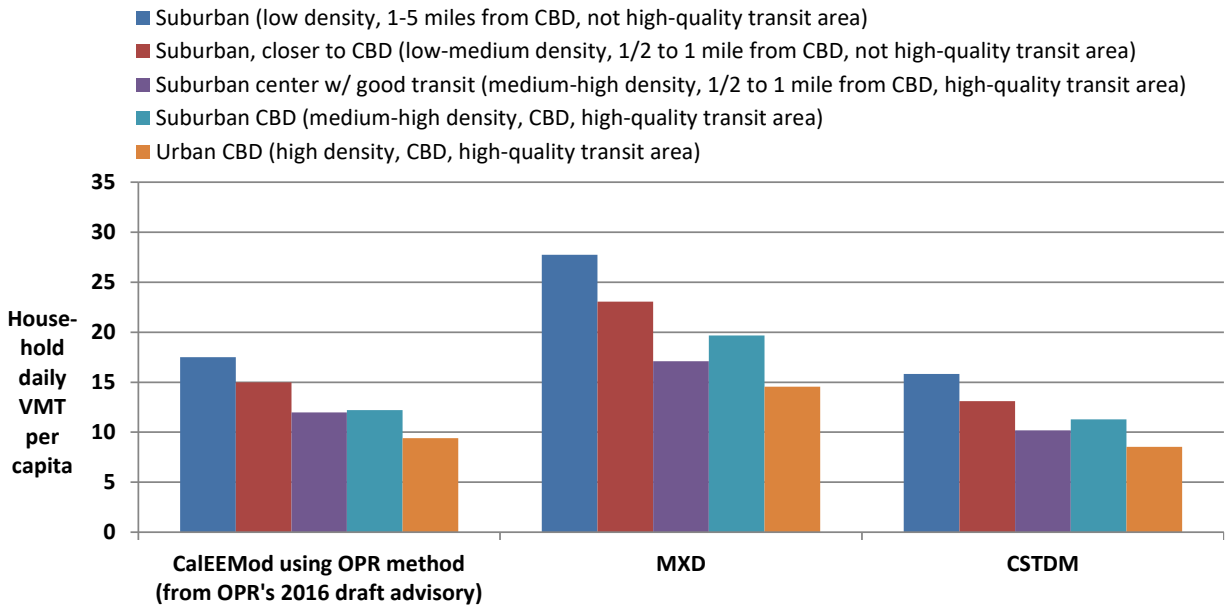


Figure 6. Estimates of per capita VMT for our hypothetical mixed use development project in different location settings, for portions of the San Francisco Bay Area,* using CalEEMod, MXD, and CSTDM data
 * For Alameda, Contra Costa, Marin, San Mateo, and San Francisco Counties

We found substantial differences in estimates of VMT per capita for our stylized project, when set in the extreme cells of our location setting matrix. Using CalEEMod, the estimated VMT per capita for the project, when set in the lowest-density, non-transit-access, furthest-from CBD location setting we tested for the Los Angeles region, was nearly four times higher than the estimated VMT per capita when the same project was set in the highest-density CBD location with good transit access. Using MXD, the spread was narrower, with the lowest-density location estimated as having VMT per capita only about 1.5 times higher than the highest-density high-transit-access location. The spread for estimates in the San Francisco Bay area was about the same using both tools, at about 1.8 times higher in the lowest-density location setting tested than the highest density location.

Comparing the tools, we found that they produced very different VMT estimates for the same stylized mixed use development project. Overall, VMT per capita estimates from MXD for the Los Angeles region ranged from between 74 percent to 333 percent higher than estimates using CalEEMod, compared across the different location settings tested. Again, the difference was smaller in the Bay Area, but still significant (ranging between 43 percent and 61 percent higher for MXD than CalEEMod, across the different settings). This finding is consistent with results from another recent study, produced by researchers from the University of California, Davis, that compares VMT estimation results produced using a number of VMT estimation sketch tools, including CalEEMod and MXD (Lee et al., 2017). Similar to our findings, the UC Davis authors found that MXD produced significantly higher VMT estimates compared to CalEEMod for three of the four mixed use projects that they tested (and also for one retail-only project), but a lower estimate for the fourth mixed use project they tested. This finding was nevertheless somewhat counter to

expectations, since MXD was created to capture internal trips in mixed use developments, which should presumably mean fewer trips.

Like the UC Davis study, we do not attempt to explain computational reasons why the results differ between the tools. Nor is it our intent to try to determine which tool is “better” for estimation purposes. However, we note that the combination of findings from both studies – ours and the UC Davis study – suggests that MXD generally produces higher estimates of VMT per capita than CalEEMod, but that differences in results produced by the two tools are also affected by project characteristics (as indicated by the finding of disparate differences in VMT estimates for different project types produced using the two tools, in the UC Davis study), and also by location attributes at least in some regions (as indicated by our finding of disparate proportional difference in results using the two tools across different location settings in the Los Angeles region, but more persistent proportional differences in results by location setting in the San Francisco Bay region).

What are implications of these findings for SB 743 implementation? The most obvious observation is that practitioners can obtain quite different results depending on the sketch tool they choose to use for analysis. This choice may affect significance findings under CEQA. For example, in our results, CalEEMod estimates are lower than the value for 85% of regional household daily VMT per capita, calculated using the same CSTDM data that we used for our analysis, for four of six location settings (for the densest location settings) that we tested in the Los Angeles area, and three of five settings (also the densest) that we tested in the San Francisco Bay region. Meanwhile, the values calculated using MXD are all higher than the CSTDM regional average value for every locating setting that we tested.

Related to this finding, we can see that values for household VMT per capita for our tested location settings, taken straight from the CSTDM data and weighted by population across the TAZs in each matrix cell, are generally higher for the Los Angeles area than the project-level results produced using CalEEMod, and lower than the results using MXD (Figures 5 and 6). CalEEMod results are lower than CSTDM values especially for the densest, most urban project location settings. CSTDM data should not be interpreted as providing direct empirical verification of VMT patterns, because the data is modeled rather than coming directly from travel survey results. As a reminder, the CSTDM is a tour-based microsimulation travel demand model, developed by Caltrans to forecast all types of travel. It utilizes travel survey data from the California Household Travel Survey to model travel behavior for all California TAZs, in conjunction with information from other sources such as the US Census that are used to estimate zonal land uses, employment, and population for model calibration. Although CSTDM data should not be interpreted as providing direct empirical verification of VMT patterns across the TAZs that we tested, the comparison with the test tool results is still noteworthy.

Validity challenges

The findings described above suggest that practitioners might select CalEEMod instead of MXD for SB 743 analysis purposes, if they want to obtain lower estimates for project-level VMT. However, in considering accuracy of CalEEMod estimates, we note that some challenges arose in employing CalEEMod that complicated VMT assessment, which made it hard to be sure about validity of our results. We scrutinized CalEEMod more than MXD in this regard, because of these challenges that arose in employing the tool. To

reiterate, our work is not intended to explain why results differ using the two tools, nor to determine which tool is the “better” choice, but rather to explore practical challenges that can arise when employing these sketch tools. A number of sketch tools are available for practitioners to choose from, including a more advanced, proprietary version of MXD; we refer readers to the UC Davis study which tested and compared six different tools (Lee et al., 2017).

A primary challenge that we faced in using CalEEMod was in determining the most appropriate method to avoid double-counting VMT reduction benefits associated with location efficiency. We also identified concerns about how to distinguish *project*-level attributes and associated benefits from *area*-level (neighborhood-scale) attributes and benefits. As we noted previously, some observers have raised concerns about default values built into CalEEMod on vehicle trip lengths, rates, and trip purpose splits not reflecting up-to-date information calibrated to California conditions (see the comments by one interviewee on this subject, presented earlier; see also Lee et al. (2017)). However, users can substitute their own values for these trip attributes for default values in CalEEMod, if they can obtain more appropriate locally-specific information. Indeed, OPR recommends doing just that, noting its guidance document that “agencies can use travel demand models or survey data to estimate existing trip lengths and input those into sketch models such as CalEEMod to achieve more accurate results. Whenever possible, agencies should input localized trip lengths into a sketch model to tailor the analysis to the project location. However, in doing so, agencies should be careful to avoid double counting if the sketch model includes other inputs or toggles that are proxies for trip length (e.g., distance to city center)” (OPR, 2018, pp. 30-31).

We found it difficult in practice to determine how best to follow OPR’s advice to avoid double-counting benefits. OPR’s concern about double-counting reflects the need to properly account for CalEEMod’s basic logic of operation, which is to assign VMT reduction benefits based on the locational and built environment attributes of a project, in comparison to default average (a.k.a. suburban) values. The problem of potential double-counting arises if users substitute their own locally-obtained values for default trip attribute values (for trip lengths, rates, and/or purpose splits) and then they also utilize CalEEMod’s mitigation screen, because VMT reduction benefits assigned by CalEEMod based on user inputs to the mitigation screen might overlap with the benefits captured in the trip attribute data. For example, if a project’s close proximity to transit and jobs – attributes captured in the mitigation screen – are also associated with shorter trip lengths in the area surrounding the project site, then the mitigation benefits assigned by CalEEMod for these project attributes could overlap with the benefits captured in the lower value for unmitigated VMT that CalEEMod calculates based on user-defined trip lengths entered as substitutes for CalEEMod’s default trip length data.

OPR deals with the double-counting issue in its case study of VMT analysis using CalEEMod for a mixed use project, provided in its 2016 draft technical advisory for SB 743 implementation, by inputting substitute data on trip lengths taken from the CSTDM for the TAZ in which the project is located, and also inputting all applicable mitigation measures with the exception of distance to CBD (the latter omission so as to avoid double-counting). This method is termed the “OPR 2016 draft method” in Figures 5 and 6.

However, it is not evident what method should be considered most appropriate for avoiding double-counting, and the CalEEMod and CAPCOA technical documentation does not clarify the matter. While OPR’s

method might be considered one valid approach, others might also be considered appropriate. For example, one early reviewer of this report (a transportation consultant) suggested that it might be advisable to avoid using “mitigation mode” in CalEEMod altogether, at least for some mitigation attributes, and to rely instead, as a means for capturing locational attributes of project settings, on substituting locally-specific data on trip attributes for CalEEMod’s default trip attribute data. However, this reviewer also underscored that in doing so, it would be important not only to substitute locally-specific data on trip lengths but also trip rates (numbers of trips) and trip purpose splits, if known.

The fundamental problem is that CalEEMod technical documentation does not provide guidance on how to best resolve these questions, and the lay user is left to guess. We show results from a series of experiments applying different methods for accounting for locational attributes in CalEEMod (Figure 7). First, we present results using only mitigation mode – inputting only applicable built-environment attributes in CalEEMod’s “land use and site enhancement” mitigation screen. As a reminder, for this purpose, we employed operational measures for the five most commonly used “D” measures of the built environment, all included in CalEEMod as possible mitigation measures, namely: density (for project density, based on the Stockton and T project’s environmental documents), destination accessibility (measured as distance to CBD), distance to transit (measured as yes/no in a HQTA), design (measured as intersection density), and diversity (or a.k.a. land use “mix,” which both sketch tools we tested account for based on land use types designated by the user for the project). See Appendix A for details.

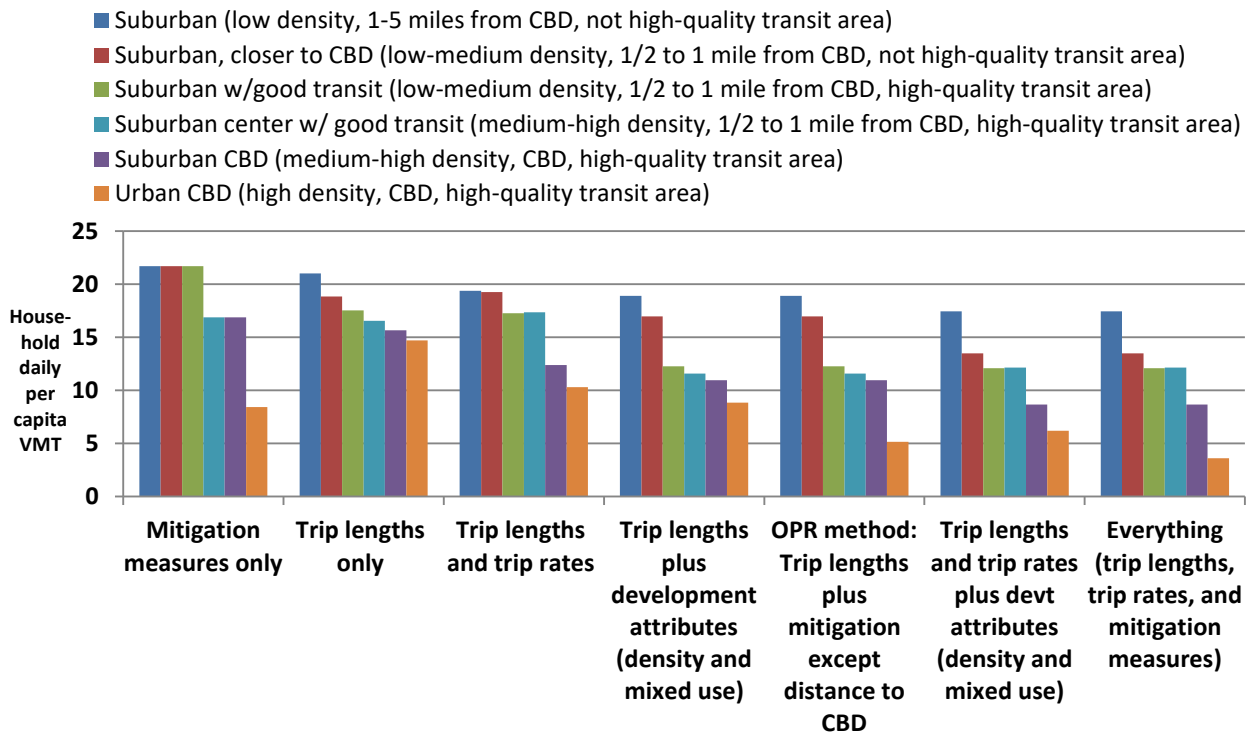


Figure 7. Estimates of per capita VMT for our hypothetical mixed use development project in different location settings, for Los Angeles and Orange Counties, using different methods for measuring locational attributes in CalEEMod

We found that these attributes of our project, when included as mitigation measures in CalEEMod’s “land use and site enhancement” mitigation screen, were estimated by CalEEMod to warrant the maximum possible VMT reduction applicable in calculating mitigated VMT, compared to default “unmitigated” values; in other words, the combination of mitigation measures identified reached the maximum possible VMT reduction cap permitted in CalEEMod. As described earlier, CalEEMod’s maximum VMT reduction caps vary by project setting, and this attribute explains the staggered pattern evident in Figure 7, in which CalEEMod estimates of project VMT for our selected location settings, for the mitigation-only test (the first test shown in the figure) reflect the designation of CalEEMod’s project setting variable. This finding was confirmed in additional analysis, not shown here, for project VMT estimation across all cells in our matrix; project VMT estimates reflected the maximum cap applied according to designated CalEEMod project setting.

In this fashion, CalEEMod’s project setting variable behaved like a blunt instrument in determining project-level VMT estimates for our hypothetical project placed in different location settings. This result is potentially concerning for two reasons. First, CalEEMod’s project setting designations are depicted using mainly qualitative descriptors in the CAPCOA technical documentation on which CalEEMod relies (see details in footnotes 29 and 30). This makes it difficult for CalEEMod users to determine project setting designations in a precise way. Second, the information source upon which CAPCOA relied for the construction of this variable and its values is out-of-date – based on analysis of data obtained in the early 1990s, and limited in the extent of its analysis to only fifteen listed cities in California.³⁰

These concerns about CalEEMod’s project setting variable provide a reason why CalEEMod users might want to heed the suggestion of our reviewer, noted above, to rely not upon CalEEMod’s “mitigation mode” but instead to designate locational attributes of a project by substituting locally-specific data for CalEEMod default trip rates, lengths, and trip purpose splits. We show results from that method in the second and third tests portrayed in Figure 7. The “trip lengths only” test shows results from substituting trip lengths taken from the CSTDM for our selected matrix cells (more specifically, median lengths that we calculated across all TAZs falling within each location setting category in our matrix), with no other input measures included. This method provides results that most closely match the straight CSTDM values on VMT per capita shown in Figures 5 and 6. The second test, for “trip lengths and trip rates,” also substitutes for CalEEMod default values the CSTDM data values we calculated for median trip rates, and also average trip purpose splits, for TAZs in each location setting category. We can see that adding these components to the mix increases the project VMT estimate in some location settings, but lowers it in others.

³⁰ Specifically, the CAPCOA report cites as “empirical evidence” for the VMT reduction caps the results from one study: Holtzclaw, John, Robert Clear, Hank Dittmar, David Goldstein, and Peter Haas (2002), “Location efficiency: Neighborhood and socio-economic characteristics determine auto ownership and use – studies in Chicago, Los Angeles, and San Francisco,” *Transportation Planning and Technology*, 25(1): 1-27. Using odometer data from 1990 to 1995 on VMT for transportation analysis zones (among other data), Holtzclaw and co-authors estimated average annual VMT as a function of density, income, household size, and public transit, as well as pedestrian and bicycle orientation (to a lesser extent). Referring to this study (although the same data are not presented in the study), the CAPCOA report lists average percent differences in VMT per capita, compared to the statewide average, for 15 California locations, broken down by location type (seven urban, four compact infill, three suburban center, and one suburban) (see pages 59-60 in the CAPCOA report). The CAPCOA report indicates that the project setting VMT caps were derived from this data by calculating the average difference from statewide VMT per capita for the listed locations by type.

In this decision process about how to avoid double-counting VMT benefits associated with location setting, the question arises *which* mitigation measures are appropriate to use, if the practitioner decides to also substitute location-specific data on trip attributes, as OPR recommends. The final four tests in Figure 7 show results of experiments addressing that question. One might decide, for example, that only building-specific attributes (e.g. project density and mix of uses) are appropriate to consider as mitigation measures, because transportation attributes of the project site (e.g. proximity to CBD and transit stations, area density and mix of uses, and intersection density) are more likely to be correlated with and proxied by trip attributes, in particular trip lengths. We show results from applying this method as the fourth test in Figure 7, for “trip lengths plus development attributes.”

A concern with this method is that the CAPCOA methodology for determining the elasticities used to assign VMT benefits for project density and mix of uses are prone to conflation by the user of project-level and area-level benefits. The CAPCOA documents indicate that users may consider these attributes for the area surrounding a project up to a one-half mile radius. Indeed, the source information for elasticities employed in CalEEMod comes from research that was focused at the area level (see Table A2). Density and mix of uses can be said to be a more important consideration pertaining to the neighborhood surrounding a proposed project than just to the project itself. A dense multi-unit mixed use project placed into a low-density, single use neighborhood will result in different, presumably smaller, VMT reduction benefits than if the same project type is placed in a high-density urban location. However, the detailed descriptions of the individual measures in the CAPCOA technical documentation refer to the project itself, and that is also how the AHSC program directs applicants to interpret the measures (and it is also how OPR interpreted the measures in its case study).

A related concern is that the elasticities used for CAPCOA quantification methodologies are based on cited research without distinguishing whether the studies controlled for multiple built environment variables simultaneously, and if so, which variables. This factor means that CAPCOA’s methods, built into CalEEMod mitigation elasticities, do not distinguish whether elasticities employed for individual built environment factors, like density, represent effects of the variable after controlling for the other built environment attributes also built into CalEEMod’s mitigation screen.

All these factors make it difficult for the lay user to know how best to account for locational attributes when using CalEEMod. The last three tests displayed in Figure 7 show other options for methods, all of which might be considered to be valid by a lay user who is unsure about how best to address these questions. The fifth test shows results using OPR’s method, while the sixth and seventh tests add in additional elements (trip rates and purpose splits in test #6, and all additional mitigation measures in the final “everything” test).

In analysis not shown here, we also tested additional project characteristics using the two tools. We found MXD to be more sensitive than CalEEMod to varying project attributes that we tested, including increasing to 100% the share of affordable units in the stylized project, doubling the project’s density, and introducing a series of parking restrictions, none of which produced any discernible difference in project-level VMT estimates using CalEEMod, because of the “blunt instrument” of the project setting caps. Again, this finding indicates that estimates produced using CalEEMod are highly influenced by this artifact of tool construction.

Conclusion

Our foray into tool-testing for VMT analysis indicates that two tools in common use that we tested provide substantially different results for project-level VMT estimates. Lay users are likely to feel unsure about which tools are preferable and why. Our tests uncovered some issues that practitioners might find challenging, in connection to each tool that we tested. MXD produced VMT estimates that were high relative not only to CalEEMod but to CSTDM estimates, which might lead practitioners to seek another tool simply to achieve a lower estimate. Use of MXD was also somewhat hampered by its data input demands; our analysis was limited to only portions of the Los Angeles and San Francisco Bay Areas, due to data limitations. Furthermore, even obtaining the data that we did employ required GIS capability.

Meanwhile, CalEEMod was easier to use in terms of data demands, but difficult to employ in practice in terms of determining how best to account for locational attributes, in particular to avoid double-counting. As our tests in Figure 7 show, results for project-level VMT estimates differed substantially depending upon which method we employed, and CalEEMod/CAPCOA technical documentation do not provide clear enough guidance for a lay user to determine which method should be preferred and why.

Ultimately, our analysis indicates that when it comes to sketch tool use, more research would be warranted to investigate reasons why different tools produce different results, and which methods and tools might be considered preferable and for what purposes. In doing so, it would be important not just to compare results produced from different tools against each other, but also against threshold values determined using consistent (comparable) data inputs.

Our tools-testing confirmed the claim that project-level VMT analysis for SB 743 purposes is not terribly difficult to conduct, especially if a practitioner has GIS capability. However, our foray into tools-testing also indicates that lay practitioners may feel unsure about which tools are preferable and for what reasons.

Chapter 8. CONCLUSION

Our research indicates that in the short run, impacts of SB 743 upon transportation planning may be less than dramatic, as cities move toward adopting new techniques to comply with the law. The transportation consultants we interviewed emphasize that technically, VMT estimation is easier than LOS analysis, as cities already estimate VMT for multiple purposes in environmental documents. However, practical approaches especially for VMT mitigation may take more time to become widely disseminated and standardized.

Over the longer term, SB 743 can be expected to more substantially affect local land use and transportation goals and policies. Our interviews indicate that SB 743 may prompt discussion and revision of transportation plans and policies across the state. The process that will unfold may resemble the history of the adoption of LOS techniques, which, while adopted rapidly, also took decades to evolve and become embedded as standard practice. To the degree that SB 743 pushes localities to revisit transportation goals, plans, and programs in order to support more efficient travel, it may promote better planning and finance of multi-modal travel networks.

However, a persistent problem in realizing this vision is lack of resources. With city budgets for planning purposes often constrained, many cities lack up-to-date General Plans, let alone associated policies for multi-modal impact fees or TDM ordinances. Resource constraints inhibit the ability of communities to develop more extensive policies and techniques under SB 743. For this reason, state and regional agencies – MPOs and congestion management agencies, in particular – should do all they can to assist localities in the process of complying with SB 743. Such assistance will allow the state to gain more benefits from achievement of intended purposes of SB 743.

Specific priorities that we heard from our interviews regarding how state and regional agencies can help localities include:

- Clarification of metrics and methodologies for determining thresholds of significance, including how localities might best integrate plan-level and project-level determination.
- Assistance in determining techniques for estimating project-level and plan-level VMT that are legally defensible in terms of accuracy and validity.
- Assistance in understanding which tools are best for which circumstances, e.g. for area-wide assessment versus for small projects.
- Assistance in determining techniques for estimating impacts on VMT of specific mitigation measures.
- Assistance in understanding how best to update General Plans, Specific Plans, Transportation Impact Analysis guidelines, transport impact fees, and Transportation Demand Management ordinances to support and be supported by VMT analysis and mitigation.
- Cataloguing experiences and procedures adopted in “policy-innovator” cities such as San Francisco and Pasadena.

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APPENDIX A. Details on our tools-testing methodology

This appendix provides additional information about the data we employed for our analysis presented in Chapter 7. First, we describe construction of some variables not covered in that chapter. Second, we present our location setting matrix, showing the breakdown of numbers of TAZs across its categories, as well as our designation of the project setting indicator for CalEEMod. Third, we provide a few additional details about data inputs to CalEEMod, including information on data sources for some of the tool's mitigation measures.

In addition to the data variable construction described in Chapter 7, we calculated the following input measures for use with our two sketch tools:

- We entered **project density** directly, not just as a variable used for devising our location setting matrix. CalEEMod's land use and site enhancement mitigation screen calls for inputting project density as dwelling units per acre; we entered 45 units per acre based on the Stockton and T project's Sustainable Communities Environmental Assessment (SCEA) report. MXD asks for project acreage, which we input as 5 acres, also based on the SCEA. MXD uses this information to calculate project density based on required input information on the project's characteristics (land use type and numbers of units).
- We calculated **median distance to CBD** for each cell of our matrix, as an input to CalEEMod's mitigation screen. MXD asks only whether a project is or is not in a CBD.
- We calculated **intersection density** as the number of intersections per square mile in each TAZ, using GIS capability in conjunction with Caltrans California Road System data. We then calculated median values of this variable across TAZs for each cell in our location matrix (and for MXD, we calculated the value per acre).³¹ While intersection density is a required user input in MXD, it is an optional (as appropriate) mitigation measure in CalEEMod.

Our location setting matrix is presented below (Table A1). After defining the matrix using three built-environment attributes (activity density, distance to CBD, and presence of high-quality transit, as described in Chapter 7), we determined how many TAZs in the CSTDM data are present for each cell, meaning they share the same values for the three characteristics utilized; Table A1 shows the numbers of TAZs that fall within each category defined by the matrix.

The table also indicates how we assigned CalEEMod project setting categories to each matrix cell. Each cell is assigned to one of three CalEEMod project settings – Urban, Urban Center, or Suburban Center. We ignored CalEEMod's fourth category, Low-Density Suburb, because, through our definitional restrictions (described above) we excluded the lowest-density and furthest-from-CBD TAZs, aiming to exclude this low-density-suburban location type.

³¹ We calculated the median value for intersections per acre across TAZs in our matrix for a 5-acre project, based on the project acreage as described in the project SCEA.

Table A1. Location setting matrix: Number of CSTDM TAZs by locational attribute category, with data available from US EPA’s Smart Location Database for calculating employment within a 30-minute transit trip

CalEEMod project setting

- Suburban Center
- Urban center
- Urban

		Density category 1: Low (5,000-10,000 individuals/sq. mi)		Density category 2: Medium (10-15k individuals/sq. mi)		Density category 3: Medium (15-25k individuals/sq. mi)		Density category 4: High (25-50,000 individuals/sq. mi)	
		High quality transit area (HQTa) (at least 80% of the TAZ)							
Distance to CBD		No	Yes	No	Yes	No	Yes	No	Yes
SCAG region (LA area)	Is CBD	21	7	48	25	31	82	3	89
	<1/2 mile	23	8	52	40	21	82	4	44
	1/2 to 1 mile	72	14	75	42	16	36	1	11
	1-5 miles	95	7	65	50	21	58	1	6
	5-15 miles	4	0	3	0	1	0	0	0
	Total	215	36	243	157	90	258	9	150
MTC region (SF Bay area)	Is CBD	4	2	10	5	8	14	5	42
	<1/2 mile	9	2	12	11	5	26	2	19
	1/2 to 1 mile	22	1	15	4	2	24	0	3
	1-5 miles	43	2	21	13	3	12	1	4
	5-15 miles	3	0	5	2	5	0	0	0
	Total	81	7	63	35	23	76	8	68

The bolded red values in Table A1, outlined with black boxes, show the location setting matrix cells for which we estimated project VMT, using our two sketch tools, with results presented in Chapter 7. The highlighted cells were used in the analysis because they had a large enough number of TAZs to reflect a common location type, and they depict a range of location settings. Together, these cells comprise 40% of all TAZs in both the SCAG and MTC regions – 40% of all usable TAZs with data available from US EPA’s Smart Location Database for our calculation of the MXD variable on employment within a 30-minute transit trip.

A few other details about our methodology bear mentioning. Each of the tools we tested produces a default measure of project population based on required user-defined inputs on project characteristics (land use type and number of units or square footage of retail space). We estimated VMT per capita using the default project population as calculated by each tool, although the values were somewhat different (681 from CalEEMod and 612 from MXD, based on default values for average household size by land use type, applied to the project’s number of units). The MXD default value is closer to the value cited in the Stockton and T project’s environmental documents, and so we tested whether substituting the cited value

for the default in CalEEMod would alter VMT estimation results; the answer was that results differed only marginally.

Finally, CalEEMod requires that users input a location setting and climate testing zone for each tested project. Based on the counties included in our analysis (see discussion in Chapter 7), we selected Los Angeles County-South Coast as the location setting for our analysis of Los Angeles area data, and the associated climate testing zone of 11, based on the California Energy Commission's Forecasting Climate Zone Map. For our analysis of San Francisco Bay Area data, we selected the Bay Area Air Quality Management District as the location setting, and the associated climate forecasting zone 5. The climate zone selected does not affect VMT estimates but is a required input for users to supply in CalEEMod.

In Table A2 below, we present details on data sources for CalEEMod mitigation measures that we used from the tool's "land use and site enhancement" mitigation screen. The information in the table is pertinent to our discussion in Chapter 7 on selecting the best method for combining mitigation measures with localized data on trip attributes, when using CalEEMod.

Table A2. CalEEMod transportation and land use mitigation measures that we operationalized and employed

The listed measures match those in CalEEMod's land use and site enhancement mitigation screen (in the order shown).

Mitigation measure	How did we operationalize/use this measure in our analysis?	CalEEMod/CAPCOA metric	CalEEMod data input	Measure applies to project site or surrounding area?			Cited source for elasticity used in measure	How does the source analysis distinguish...	
				Project	Project in context	Area		Scale of built environment factors - project or area?	Built environment and SES factors controlled for?
LUT-1 Increase Density	Entered project density as 45 dwelling units per acre for project; also used TAZ area density for our location matrix	% higher # of HUs or jobs versus typical ITE suburban development * elasticity (-0.07)	Dwelling units per acre of project	x	x		From CAPCOA report: Boarnet and Handy, 2010, <i>Draft policy brief on the impacts of residential density</i>	Results based on three studies; two measure HU density at census block group level, and the third various BE factors at metro area or zip code scale	Two of three cited studies use density as a proxy for other BE variables; the third does not measure density
LUT-3 Increase Diversity	Checked the box	CAPCOA method applies an entropy index, based on % of project area by up to 6 types * elasticity. Per CAPCOA, for urban setting, the measure should apply at project site; for suburban, at project site and/or within 1/4 mile.	Check box for "mixed use development" (CalEEMod calculates based on land use types entered as project characteristics)	x			From CAPCOA report: Ewing and Cervero, 2010, <i>Travel and the built environment: A meta-analysis</i>	Results are based on thirteen studies that use various methodologies; CAPCOA does not clarify whether studies assessed results at project or area scale	Results are based on thirteen studies that use various methodologies and control variables
LUT-9 Improve Walkability Design	Operationalized as # intersections per square mile in the TAZ, based on Caltrans California Road System data	Elasticity * % higher number of intersections versus a typical suburban area development	Enter number of intersections per square mile "of project" (per CAPCOA report)	x	x		From CAPCOA report: Ewing and Cervero, 2010, <i>Travel and the built environment: A meta-analysis</i>	Source looked at nine studies; CAPCOA does not clarify whether studies assessed results at project or area scale	Studies used various methodologies and control variables
LUT-4 Improve Destination Accessibility	Operationalized as distance from TAZ centroid to CBD defined as any TAZ with 5,000 or more jobs per square mile, as per AHSC program definition.	CAPCOA measure= Percentage lower distance to CBD versus typical ITE suburban development * elasticity (0.20). Measure applies when project distance to CBD is <12 miles.	Enter project miles from CBD, if < 12.		x		From CAPCOA report: Ewing and Cervero, 2010, <i>Travel and the built environment: A meta-analysis</i>	Results are based on ten studies that use various methodologies; does not clarify whether studies assessed results at project or area scale	Results are based on ten studies that use various methodologies and control variables
LUT-5 Increase Transit Accessibility	Operationalized as HQTAs = yes or no, based on MPO HQTAs maps. Distance to transit = 0 if HQTAs = yes, otherwise we did not implement the measure.	CAPCOA measure is based on elasticity * diff in % transit mode share for project from % for typical ITE development. Applies a reduction up to 3 miles distance of project to "transit station."	Enter distance to transit station in miles		x		Lund, Cervero, and Willson (2004). <i>Travel characteristics of transit-oriented development in California</i> .	Project-level	Based on survey results