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MTI MINETA TRANSPORTATION INSTITUTE

A Guide to Navigating Existing and Emerging Sources of Local VMT and Travel Data

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16. Abstract

As the crisis of climate change looms, transportation policy in California continues to emphasize sustainability in land-use and transportation decisions. This report evaluates the implementation of two sustainability-focused policies (Senate Bill 375 and 743) by local governments and the current-state-of-the-practices by metropolitan planning organizations (MPOs) in assisting them in California. The research focuses on local governments' access and use of vehicle miles traveled (VMT) and transportation data for achieving VMT and greenhouse gas (GHG) reduction by land-use planning. The research also examines the role of MPOs in providing needed transportation data, training, and technical support to its local members to help them quantify VMT impacts of land-use plans and projects. Through surveys and interviews of 539 city and county governments and 18 MPOs in California, the research team analyzes current practices. Findings include that local governments utilize automobile data more frequently than alternative modes, and do not heavily rely on MPOs for obtaining transportation data. Local governments recognized the need for more transportation data and were particularly interested in publicly available sources. The MPOs reported that VMT/annual average daily traffic data and origin-destination matrix were most frequently requested. More sophisticated data such as travel-time matrix and mode-share scheme were considered useful by the MPOs, while requests were very low. Based on the results of the conducted surveys, interviews, and our analyses, we developed a transportation data guide for local governments that could help them access data for achieving VMT/GHG emission reduction via land-use planning. The guide has two parts, one for general plan update and any land-use plans along with SB 375 and the other for VMT analysis for project-level California Environmental Quality Act reviews. The guide includes several different approaches that can be chosen and tried by local governments depending on their resource level and geographic, social, and physical characteristics. These findings can facilitate the access and use of transportation data to aid in sustainable land-use planning for the betterment of local communities and the planet.

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Executive Summary

In California, the state government mandates direct the California Air Resources Board to establish greenhouse gas emissions targets for each region, require metropolitan planning organizations (MPOs) to develop the regional sustainable land-use vision (Senator Bill (SB) 375), and replace level of service (LOS) with vehicle miles traveled (VMT) as the basis for mitigating transportation impacts (SB 743). Given these circumstances, it is critical for MPOs to have up-to-date land-use data from local governments to coordinate and implement regional transportation planning. Local governments have a greater need for local VMT and transportation data than ever before to make sure their land-use decisions align with regional planning efforts.

This report evaluates the implementation of SB 375 and SB 743 by municipal governments and the current-state-of-the-practices by MPOs in assisting them in California. We particularly focus on local governments' access to and use of VMT and transportation data for achieving VMT and greenhouse gas (GHG) emission reduction by land-use planning. We also examine the role of MPOs in providing needed transportation data, training, and technical support to its local members to help them quantify VMT impacts of land-use plans and projects. This report discusses our findings.

We found, from the first phase of the study using surveys, that many local governments integrated VMT/GHG reduction strategies in their land-use plans and adopted and implemented project-level VMT analysis but were a little bit skeptical about the effectiveness of the implementations. In these activities, local governments tend to utilize automobile data more frequently than alternative modes, and do not heavily rely on MPOs for obtaining transportation data. Overall, local governments recognized the need for more transportation data for the implementation of SB 375 and SB 743, and they were particularly interested in publicly available sources of data on automobile and active transportation. However, half of the respondents experienced that the data they needed were unavailable. Even when staff identified the data they needed, purchasing costs and/or additionally required resources for utilizing the data (e.g., staff time, software, etc.) had made them give up on data use. We found that local governments that adopted/utilized new data/tools for SB 375 and SB 743 implementation showed a higher degree of confidence in their implementation and had more positive experiences with VMT/GHG reduction efforts compared to those without new data use.

The MPOs we surveyed had a general understanding of their local members' compliance with the mandates but did not necessarily know how they actually acquired transportation data needed for VMT analysis. The MPOs positively assessed their data provision upon request and reported that VMT/annual average daily traffic (AADT) data and origin-destination (O/D) matrix were the most frequently requested and most helpful datasets for VMT/GHG emission reduction. The socio-economic characteristics, travel-time matrix, and mode-share scheme were also considered useful by the MPOs, while actual requests and use by localities were very low. In addition to data sharing, the MPOs also provided technical support, training, and software licenses such as geographic information system and sketch planning tools.

In the second phase of the study using semi-structured interviews, we found that there is a learning curve with understanding regional travel models, which are a typical go-to source of VMT data. Many local government planners are not modelers by training and these models are not easy to understand as they are resource-intensive and require very technical expertise. Planning staff experienced difficulty in extracting meaningful VMT data at a small geography from regional travel models and found this process of obtaining VMT estimates expensive. We found that VMT is still a novel measure, not well received, especially in rural areas, compared to LOS, and that local governments still use LOS for operational purposes outside the California Environmental Quality Act (CEQA).

Big data use through vendors such as StreetLight or Replica was found as a dominant trend either requested by a hire consulting firm or started and explored at the MPO level. Some MPOs that used big data found a huge potential when they would be used at the local level. Some concerns exist over big data due to their black-box-like nature, discrepancy with observed traffic counts, etc. We also identified an ongoing effort to integrate a land-use model into transportation modeling at five MPOs. Some best practices of MPOs that developed their websites, platforms, and other assistance programs that effectively facilitated collaboration and data exchange between MPOs and local agencies were summarized.

From the survey and interview findings, we draw three recommendations that could be considered to address some of the challenges identified earlier: more funding support for SB 385 and 743; centralized leadership in cumulating evidence, creating a transportation data repository, and piloting VMT banking, exchange, and monitoring; and timely coordination across state departments to reduce confusion at the local level due to discrepancies, contradictions, or overlaps between some mandates. In the long run, given slow or no population growth forecasted in California, new methods or measurements will be needed to effectively reduce VMT.

Built upon what we investigated above, we developed a transportation data guide for local governments that could help them access data for achieving VMT/GHG emission reduction via land-use planning. The guide has two parts, one for a general plan update and any land-use plans along with SB 375 and the other for VMT analysis for project-level CEQA reviews. The guide includes several different approaches that can be chosen and tried by local governments depending on their resource level and geographic, social, and physical characteristics. Data introduced in the first part of the guide are network datasets, static volume data, traffic flow data, land-use scenario simulation tools, and the integration of land-use and transportation models. The second part introduces best practices of SB 743 tools at different levels of scale. While this guide briefly overviews the data and tools, the details of each can be found in Appendix D.

1. Introduction

In planning theory, there has been a consensus on the clear relationship between land use and transportation. Urban areas are the focal points of economic, social, and recreational activities and have been shaped and regulated by land-use plans and zoning implemented by local governments. Transportation infrastructure and investments play a critical role in connecting these activity locations; however, transportation planning is developed and implemented at a regional scale beyond municipal boundaries. This separation of actions has made coordination efforts difficult (Cevero, 2003) and created procedural coordination issues when decisions take into account spillover effects, cross-jurisdictional issues, or the timing of land-use change, transit investment, and infrastructure investment (Margerum et al., 2012). In many regions, metropolitan planning organizations (MPOs) have substantial regional powers but lack the authority to fully address land-development projects and general plans. Due to this governance mismatch between land use and transportation, coordination and collaboration across different levels and entities of government have been further emphasized within sustainable, smart growth plans and policies.

In the State of California, this coordination became more critical as the reduction of greenhouse gas (GHG) emissions by land use and transportation is required by the state government. The state adopted Senate Bill (SB) 375 that went into effect on January 1, 2009, requires MPOs to adopt a sustainable communities strategy (SCS) in their regional transportation plan (RTP). SB 375 targets aim to achieve a reduction of GHG emissions from automobiles and light trucks in a region (Mawhorter et al., 2020). The California Air Resources Board (CARB) is given the authority to set regional targets for GHG emissions, especially from motor vehicle trips. MPOs develop SCS and conduct Regional Housing Need Allocations (RHNA) by coordinating land-use and transportation planning across different levels of government within their region. Additionally, SB 743, which went into effect on July 1, 2020, mandates any government agencies to replace the level of service (LOS) with vehicle miles traveled (VMT) as the primary measure of and basis for mitigating transportation impacts under the California Environmental Quality Act (CEQA). VMT has been viewed as a more appropriate metric than LOS to promote sustainability goals and prioritize investments in multi-modal transportation networks and infill developments in urban areas (OPR, 2018; Volker et al., 2019a; and Volker et al., 2019b).

This is the background of SB 375 and SB 743, which further emphasizes collaborative planning efforts that allow participating entities to retain their autonomy but agree to work towards a commonly identified regional land-use vision towards GHG emission reductions. The effectiveness of the coordination on VMT reduction has been confirmed by several studies. A study in Davis, California found that local land-use decisions, such as attracting big-box retail near housing, have resulted in a reduction in vehicle trips (Lovejoy et al., 2013). A review study confirmed that local-level actions are likely to affect VMT even though the effect sizes of individual studies reviewed vary by local contexts or interactions with other policies (Salon et al., 2012). While there were not any significant findings on reducing CEQA litigation by switching from LOS to VMT, the burden of environmental reviews should be streamlined and assist in urban infill development. Volker et al. (2019a) have found that most regions can benefit by transitioning from LOS to VMT by streamlining the overall environmental review process and argued that the shift is needed to support urban infill development at affordable rates. A recent study about SB 743 implementation confirmed that there is a consensus that the shift from LOS to VMT streamlined development in urban areas (Volker et al. 2023).

Given these circumstances, it is critical for MPOs to have up-to-date land-use data from local governments to coordinate and implement regional smart growth. Several studies discussed the limitations of SB 375 (Sciara, 2020) and found that the only way MPOs can achieve the goals of SB 375 is to collect and use up-to-date land-use information and nudge local governments to be aligned with the regional land-use vision. On the other hand, it is imperative for local governments to have a clear understanding of the impacts of their land-use decisions on VMT, which requires access to VMT and travel data within and around their jurisdictions for the decisions. However, several studies commonly identified that there is a gap in the field manifested as a lack of appropriate data that quantify VMT in smaller geographies (Lovejoy et al., 2013; Salon et al., 2012; Salon, 2014). It is evident that there has been a growing demand for localized VMT and travel data in this policy context and that several attempts have been made to expand the sources of travel data for VMT estimation, particularly on local roads. However, which specific sources of VMT data are utilized by local governments and how such data help local governments' land-use decisions for sustainability goals remain unanswered. In order to fill this research gap, we explore the current state of the practice at local governments in California on the utilization of VMT and transportation data for VMT and GHG emission reduction. By conducting surveys and interviews targeting municipal governments and MPOs in the state, we attempt to answer the following questions: (1) which travel datasets do local governments in California commonly access?; (2) what are the challenges in accessing VMT data from various sources; and (3) what are the data needs and technical support for effectively implementing SB 375 and SB 743 at different levels of government? This report will provide a summary of the status of implementing the mandates around GHG emission reduction, particularly focusing on VMT and travel data access and utilization.

We propose helpful directions for local governments to access localized travel and VMT data from various sources in our Transportation Data Guide. This guide explores and introduces various levels and details of accurate VMT and travel data, and estimation tools appropriate to the local government's size, context, and capacity. This would help local governments make sure their land-use decisions would not hinder or counteract regional planning efforts to meet VMT and GHG emission reduction goals. Suggestions are also made to MPOs and the state to further assist local governments' implementation of SB 375 and SB 743 with best practices.

The methods section provides some details of the three phases of the project including surveys, interviews, and the data guide's development. The results section provides a summary of findings from the local government survey, MPO survey, and semi-structured interviews with staff from local governments and MPOs with our recommendations for improvement in the following chapter. The final chapter is a transportation data guide for local governments that could be a resource directing them to publicly available sources of transportation data and best practices of SB 743 implementation. Appendixes include more detailed information on survey data analysis and the data/tools we reviewed.

2. Methods

2.1 Study Area

Our study population consists of all 539 city and county governments and 18 MPOs in the State of California. According to the U.S. Census, as of 2022, there are 58 counties and 482 incorporated cities and towns in the state.[1] The Governor's Office of Planning and Research (OPR) publishes the Directory of Planning Agencies annually which contains contact information for California's planning agencies in cities/towns and counties. We used the directory published in 2021 to create a compiled list of key personnel contact information in a planning or community development department of local governments in California and then updated the list as needed. The contact information of staff who work on travel-demand modeling at 18 MPOs was additionally obtained from CARB.

2.2 Surveys

A survey that went to local governments (local survey) is designed to ask about a planning staff's experiences on the implementation of SB 375 and SB 743, and use of VMT and transportation data for the implementation. More specifically, the local survey has four parts asking: (1) the jurisdiction's overall efforts on GHG reduction; (2) their transportation data use and need specifically for general plan updates in association with SB 375; (3) their response to SB 743; and (4) their VMT data access and needs, and challenges regarding SB 743 implementation. We inventory sources and types of transportation data local governments used for general plan updates and SB 743 implementation.

Another survey was designed for MPOs (MPO survey) and it aims to understand MPOs' view on their member jurisdictions' participation and interest level in regional GHG reduction efforts, and their capacity to support such activities. The focus was how MPOs have provided relevant transportation/VMT data and resources for SB 375 and SB 743 implementations. The MPO survey questions include how often MPOs hold collaborative meetings with members for GHG reduction, data and tool requests from members, data and support/resource capacity within MPOs, any barriers to or challenges with sharing regional travel model input and output with member agencies, and any best practices they knew among member jurisdictions regarding VMT reduction efforts via land-use planning. Both surveys were approved by the Institutional Review Board (IRB) at the authors' institution (IRB Protocol Number: IRB-22-140).

The local survey is targeted at planning staff in a city/county government who have knowledge of their jurisdiction's land-use and transportation planning in general. The MPO survey is targeted at planning staff in MPOs who work on travel modeling and/or assist local governments in providing the transportation data they need.

[1] San Francisco City and County are treated as a city in the analysis.

Based on the list of potential participants, we sent personalized invitation emails with an online survey link that leads them to the informed consent form on the first page of the link. The first email was sent on September 7, 2022, and we sent weekly reminder/encouragement emails to individuals who had not responded by the time until October 5, 2022 (up to a total of five times). Some emails were bounced back due to resignation or retirement; so, we updated the list with alternative staff, and once someone participated from the institution, they were not included in the next round of the email blast. In addition, recruitment via phone calls was conducted from late November to early December to increase the response rate and we also reached out to the California Association of Councils of Governments and League of California Cities for additional help to spread the word. Additionally, we promised small incentives in order to encourage them to participate in the survey. The incentives were provided to the respondents who were randomly selected based on voluntarily provided contact information.

2.3 Interviews

The responses obtained from the surveys helped us identify some (not comprehensive) sources of VMT and travel data local governments have used and also helped us understand some challenges local governments and MPOs have, respectively, regarding SB 375 and SB 743 implementation. A few agencies provided responses that would need to be further examined, such as their use of big data (cell-phone-based transportation data provided by private vendors such as StreetLight or Replica) or specific tools developed for VMT impact screening, estimation, or calculation. In addition, a notable response pattern warrants a more in-depth inquiry on why a handful of agencies reported that they have not experienced significant VMT reduction yet, even though they have VMT reduction policies and thresholds formally adopted. In addition, the survey results helped us identify a few best practices where formal adoption of VMT thresholds was set and new data/collaborations have been introduced to do VMT analysis for CEQA purposes. These survey respondents, which is a subset of all the survey participants, were included in the initial interviewee pool. Further online research and data collection and analysis on SB 375 and SB 743 helped us identify a few more potential best practices that were not part of our survey participants. They were added to our initial pool for interview recruitment.

Given MPOs being an anticipated major source of transportation data that local agencies access, separate interview questions were developed based on their current initiatives and programs, specific case studies, and their unique context. Overall, the survey results and additional online research we conducted informed the development of tailored interview questions for each potential interviewee. The interview questions were also consulted by CARB and approved by IRB.

Common interview questions include a follow-up question on a specific data/tool mentioned in the survey, how they find it useful to use the tool/dataset in updating the housing element or any general plan update they recently had, any potential limitations, concerns, or technical challenges they have had with the tool/dataset, their interaction with MPO and overall experience in accessing MPO's data for VMT reduction efforts, any experience with sketch planning tools, any ongoing work regarding VMT reduction and estimation, and suggestions for improvement to CARB.

Given CARB's interest in hearing from various agencies that are in different contexts (not only the big four regions but also small, rural regions), we made an extra effort to recruit from various parts of the state (Central Valley, Central Coast, and the Northern part of California). The potential interviewees are again targeted toward planning staff in a city/county government or an MPO who has knowledge of their jurisdiction's SB 375 and SB 743 efforts in general.

The interview was conducted online via Zoom for about an hour with each interviewee.

2.4 Development of the Transportation Data Guide

The surveys and interviews allowed us to identify not only the current transportation data/tools utilized by local governments but also the void of transportation data/tools and the best practices in terms of transportation data utilization. Based on this understanding, we designed the Transportation Data Guide that catalogues transportation data sources that could support local governments' SB 375 and SB 743 implementation. The guide compiles the data/tools that have used, that are publicly available but have been underutilized, and that are exemplary cases. The guide was designed in a way that organizes the data/tools by the data-utilization scenario that represents local governments' circumstances and characteristics (e.g., location (rural, suburban, or urban), size (small, medium, or large), and so on). This will help local governments select a customized list of the data/tools that fit their capacity and circumstance. Therefore, the guide is expected to support local governments to be aware of, adopt, and utilize available, reliable transportation data for their SB 375 and SB 743 implementation. As a result, the guide will contribute to reducing local governments' burden of their own data creation and assist in the development of travel-demand management strategies and any plan development to further reduce VMT and GHG emissions.

3. Results

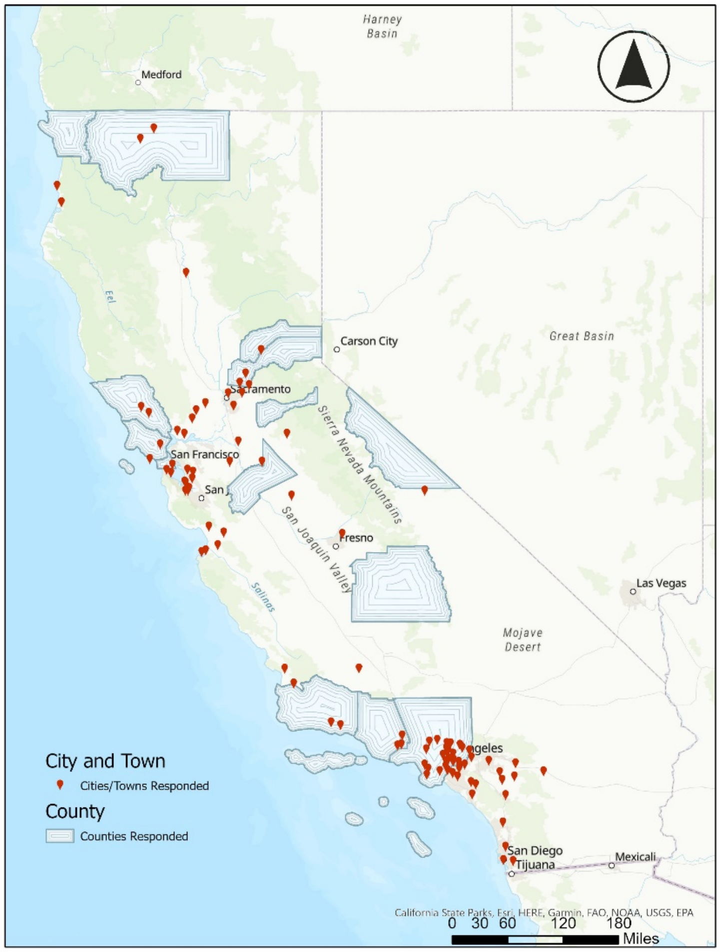
3.1 Survey Findings

3.1.1 Survey Findings Reported by Local Governments

The purpose of the local government survey is to understand (1) the current practices of local governments regarding the implementation of SB 375 and SB 743 and (2) how local governments adopt and utilize transportation data for their implementation. By cross-validating these two components, we intended to explore how the data facilitate local governments' land-use decisions in terms of VMT/GHG reduction. Ultimately, we want to investigate the roles of transportation data in the integration of land-use and transportation planning in practice. The survey returned rich data from the respondent local governments that can answer those questions. This chapter summarizes the findings of the local government survey and includes all the respondent municipalities and counties.

A total of 110 municipalities were recruited and participated in the survey, including 96 cities and 14 counties. A list of all the survey respondents can be found in Appendix A. The overall response rate among local governments is 20.4 percent with a little higher response rate from counties (24.1%) compared to cities/towns (19.9%). The respondent municipalities represent the population size relatively well. It would be reasonable to state that the geographical distribution of the municipalities is consistent with the distribution of the population (Figure 1).

Figure 1. Geographic Distribution of the Cities, Towns, and Counties that Responded to the Survey



While the regional distribution of the municipalities is well balanced except for Northern California, the high participation rates of larger municipalities were identified (Table 1). Although there is a small number of municipalities with a population greater than 250,000, their response rates are higher than the rate of municipalities with a population smaller than 250,000.

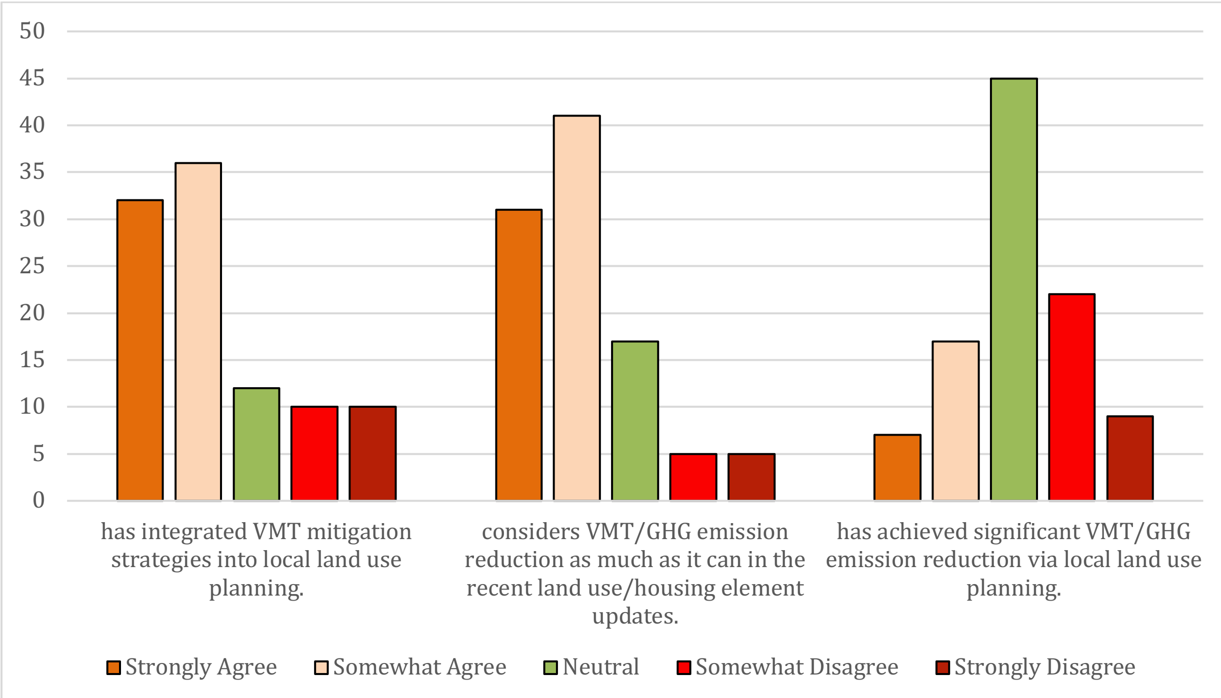
Table 1. Survey Response Rate

Category	Classification	Local						MPO		Grand Total	
		City/Town		County		Total					
		Count	%	Count	%	Count	%	Count	%	Count	%
Region	Big 4	74 (331)	22.4	6 (22)	27.3	80 (353)	22.7	3 (4)	75.0	83 (357)	23.2
	Northern	0 (9)	0.0	0 (2)	0.0	0 (11)	0.0	1 (3)	33.3	1 (14)	7.1
	Central Valley	6 (62)	9.7	2 (8)	25.0	8 (70)	11.4	6 (8)	75.0	14 (78)	17.9
	Central Coast	9 (33)	27.3	1 (5)	20.0	10 (38)	26.3	2 (3)	66.6	12 (41)	29.3
	Non-MPO	7 (47)	14.9	5 (21)	23.8	12 (68)	17.6			12 (68)	17.6
	Total	96 (482)	19.9	14 (58)	24.1	110 (540)	20.4	11 (18)	61.1	121 (558)	21.7
Population	<=50,000	53 (304)	17.4	4 (15)	26.7	57 (319)	17.9				
	50,001–250,000	34 (163)	20.9	1 (17)	5.9	35 (180)	19.4				
	250,001–500,000	6 (9)	66.7	5 (10)	50.0	11 (19)	57.9				
	>500,000	3 (6)	50.0	4 (16)	25.0	7 (22)	31.8				
	Total	96 (482)	19.9	14 (58)	24.1	110 (540)	20.4				

3.1.1.1 Local Government Practices of VMT/GHG Reduction

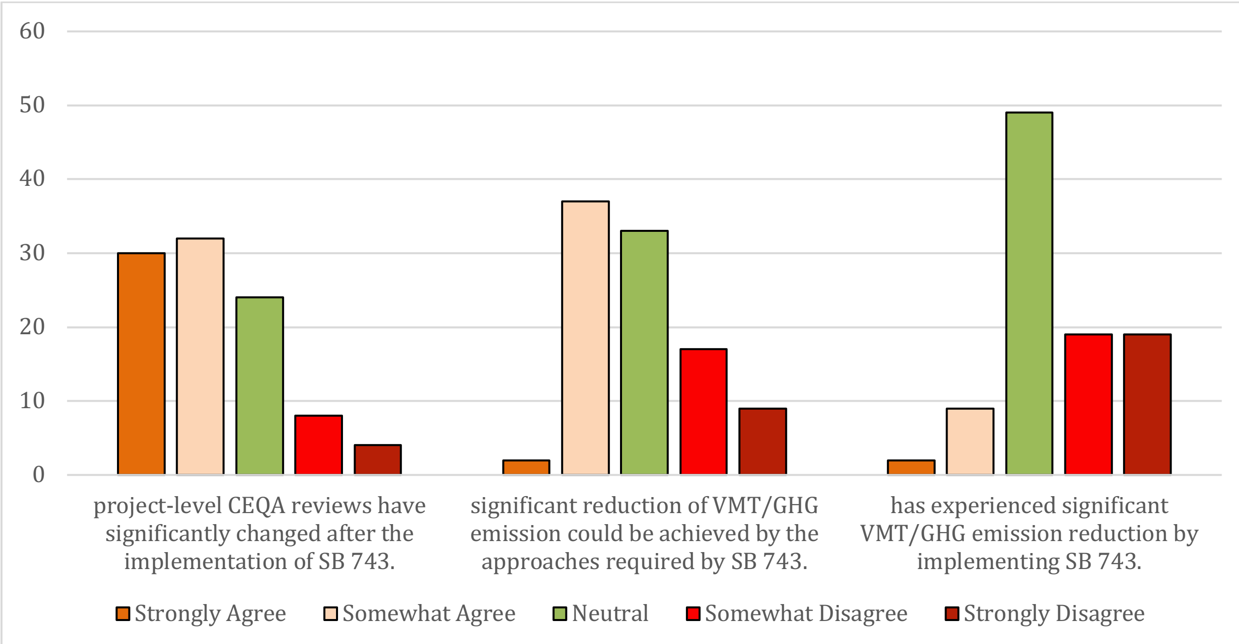
Overall, the sample that responded to the local government survey self-reported that they had coordinated their general plans and housing-element updates with the regional SCS. While many respondents strongly or somewhat agreed with their consideration of and actual plans' integration of VMT/GHG reduction strategies, only a relatively small number of respondents agreed with the efficacy of the coordination (Figure 2). This may suggest that local governments in a given time have done what they could have for VMT/GHG reduction, while there could be a certain level of uncertainty (or skepticism) about a significant VMT/GHG reduction achievement by the implementation of SB 375. CARB's 2022 SB 150 Progress Report (2022) reported that "many local agencies have not successfully advanced infill and climate-friendly development as needed, even with many regions identifying priority areas in the SCSs to do that. Too often growth is still being planned for land outside existing communities or built there first, especially in rural areas." It is possible that what actually gets permitted and constructed is different from what is in the general plans and housing-element updates.

Figure 2. Local VMT/GHG Reduction Practices by Land-Use Planning



A similar pattern was also found in the answers to the implementation of SB 743 (Figure 3). While many respondents already adopted and implemented project-level VMT analysis in response to SB 743 with the hope that it would reduce VMT/GHG emissions, many took a neutral stance about its effectiveness. This could be partly due to the relatively short time since SB 743 implementation at the time of the survey (a little over two years since July 2020). This warrants a more in-depth discussion about the efficacy of the two mandates and an investigation of what worked and what did not work.

Figure 3. Local VMT/GHG Reduction Practices According to SB 743



When updating their general plans, local governments seem to prefer land-use-oriented VMT/GHG mitigation strategies over strategies that combine transportation and land use (Table 2). According to the weighted score that synthesizes the responses, highly preferable strategies include land-use-oriented strategies such as mixed-use development, infill development, an increase in housing options and affordable housing, and an increase in density in residential areas. The only combined strategy ranked in the top five is the creation of walkable/bikeable neighborhoods. This probably suggests local planners' conservative approach or a tendency to be more inclined to tackle what they can without consulting or relying on other parties' decisions, such as the MPO. As agencies that have the authority to make their own land-use decisions, local governments may be much more familiar with land-use strategies than transportation-related alternatives and/or feel more comfortable exercising their right.

Table 2. Local Governments' Preference on VMT/GHG Reduction Strategies (SB 375)

Classification	VMT/GHG mitigation strategy	Weighted Score	Rank
Land Use	Promoting infill development	135	2
	Promoting mixed-use development	141	1
	Increasing residential density	117	5
	Increasing housing options/affordable housing	131	3
	Increasing job/housing balance	80	8
	Increasing employment density	64	9
Land Use and Transportation Combined	Promoting developments along transit corridors	97	6
	Promoting transit-oriented development (TOD)	82	7
	Creating walkable/bikeable neighborhoods	121	4
	Introducing parking-pricing/parking reform	-30	11
	Facilitating/encouraging micro-mobility options	22	10

Note: Weighted Score = (Strongly agree × 2) + (Somewhat agree × 1) + (Neutral × 0) + (Somewhat disagree × -1) + (Strongly disagree × -2).

It is worth mentioning that we converted the survey data into the weighted score employing the weighted total equation shown above. The equation is a widely accepted method. It can capture the details of the responses to a five-point Likert scale answer which expresses the tendency of increase/decrease. By assigning a higher weighting value to the answer expressing stronger agreement, this method can convert qualitative data into quantitative data without losing the details of the tendency. This method was applied to the analysis and interpretation of all the applicable five-point Likert scale data in this report.

For the project-level CEQA review, local governments prefer conventional car-traffic-mitigation approaches such as improving and promoting public transit and active transportation. Telecommuting, which earned its popularity since the COVID-19 pandemic, dominantly takes the first rank (Table 3).

Table 3. Local governments' Preference on VMT/GHG Mitigation Strategies (SB 743)

Mode	VMT/GHG Mitigation Strategy	Weighted Score	Rank
Car	Roadway Reduction (e.g., Road Diet)	152	8
	Parking Pricing	180	5
	Parking Reduction	158	7
	Rideshare (Van/Carpooling)	200	4
Public Transit	Increase Transit Access/Services	242	2
Active Transportation	Active Transportation Strategies	233	3
Emerging	Car-sharing (Uber, Lyft)	152	8
	Micro-mobility	170	6
	Telecommuting	299	1

Note: Weighted Score = (Extremely Effective × 4) + (Very Effective × 3) + (Moderately Effective × 2) + (Slightly Effective × 1) + (Not Effective × 0).

As expected, the implementation status of SB 375 and SB 743 varies by city. We conducted the gamma and Kendall's tau-b tests that analyze the association between the size of municipality and the performance of the implementations. The Gamma test and Kendall's tau-b tests are fundamentally the same, and the only difference is that the Kendall's tau-b test is less sensitive to imbalanced datasets than the gamma test.[2] The positive Gamma and Kendall's tau-b values (the rows with an asterisk) at a statistically significant level (at the α level of 0.05) indicate that more large cities have implemented SB 375 and SB 743 than small cities (Table 4). However, this variation by size is not found in the responses to the achievement of significant VMT/GHG reductions. This implies that local governments' uncertainty about the impacts of SB 375 and SB 743 on VMT/GHG emission reduction is a widespread phenomenon regardless of the size of cities or that SB 743 is relatively new to all.

[2] An imbalanced dataset means that the numbers of samples in each class are significantly different from each other (e.g., five responses to "strongly disagree" and 100 responses to "neutral"). The similar p-values generated from both tests indicate that the dataset is relatively well-balanced.

Table 4. The Variations of SB 375 and SB 743 Implementation Performance

Association of City/Town Size with	Gamma		Kendall's tau-b	
	Value	Sig.	Value	Sig.
Has integrated VMT mitigation strategies into local land-use planning.	0.362	0.008*	0.234	0.008*
Considers VMT/GHG emission reduction as much as it can in the recent land-use/housing-element updates.	-0.015	0.916	-0.010	0.916
Has achieved significant VMT/GHG emission reduction via local land-use planning.	0.180	0.219	0.116	0.219
Project-level CEQA reviews have significantly changed after the implementation of SB 743.	0.312	0.028*	0.208	0.028*
Significant reduction of VMT/GHG emissions could be achieved by the approaches required by SB 743.	0.190	0.204	0.123	0.204
Has experienced significant VMT/GHG emission reduction by implementing SB 743.	0.189	0.223	0.121	0.223

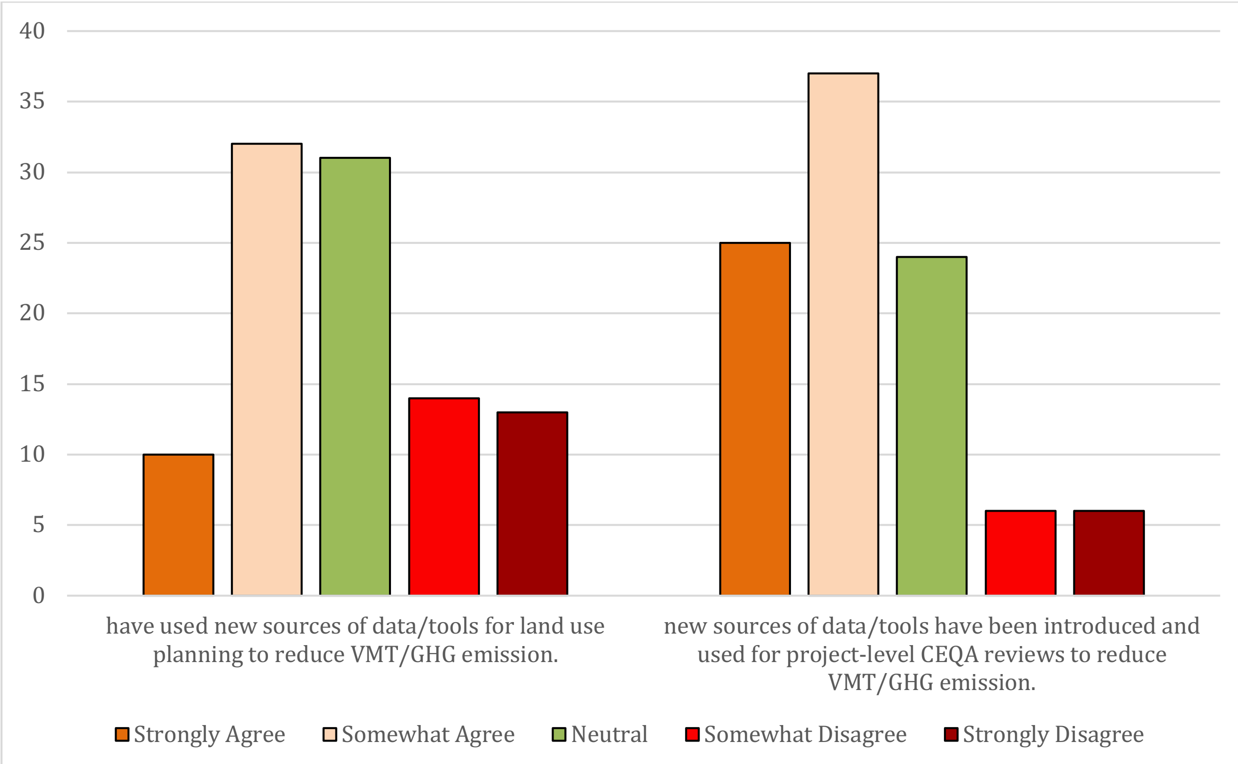
Note: Counties' responses were excluded from this analysis.
The cities and towns were classified into four categories by their population size (smaller than or equal to 50,000, between 50,001 and 100,000, between 100,001 and 250,000, and larger than 250,000).

3.1.1.2 Transportation Data Adoption/Utilization

Current Transportation Data Adoption/Utilization

Overall, we found that about two-thirds of respondent cities and counties have used new data and/or tools for the implementation of SB 375 and SB 743 (Figure 4). From the comparison of the two charts in Figure 4, we can see that new data and tool use were more frequent for project-level CEQA reviews than for land-use planning. This might be due to the fact that the OPR provided a relatively detailed technical advisory (2018) for project-level reviews. Since then, several consulting firms proactively responded to the technical advisory and created databases and tools for project-level VMT analysis, while not much guidance has been provided for plan-level analysis.

Figure 4. the Respondent Local Governments' Perspective of New Data Adoption/Utilization for SB 375 and SB 743



Based on the list of the specific datasets utilized, however, we found that the types of data adopted/utilized by local governments were very limited in terms of the level of detail and their relevance to smart growth goals. The datasets under the basic-level category primarily represent transportation network data that capture the physical location of transportation infrastructure. The intermediate-level datasets include both static traffic volume and traffic flow data. The static volume data refer to the data that represent a static snapshot of the traffic volume on roadway segments or transit ridership at stations/stops. The traffic flow data capture the movements of cars and passengers from trip origins to destinations. The advanced-level data include emerging new transportation data such as big data that can present real-time traffic volume.

About 53.2 percent of local governments responded that they have adopted/utilized at least one basic-level dataset that contains the physical location and geometry of the infrastructure and network for different modes (Table 5). Not surprisingly, intermediate-level data (static count, traffic volume and flow, or performance measures) use was lower and the advanced level (real-time data with some qualitative (service-level-related) information) was even much lower than that of the basic level. Only 10 percent of local governments adopted/utilized at least one advanced-level dataset.

Table 5. Transportation Data Utilized by Local Governments

Level		Mode		Data	
Type	%	Type	%	Type	%
Basic	53.2%	Auto	57.3%	Roadway network	69.1%
				Truck routes	45.5%
		Transit	60.9%	Transit route network	60.9%
				Transit station/stop location	60.9%
		Active	45.5%	Bicycle network	62.7%
				Bicycle-parking facilities	22.7%
				Sidewalks and other pedestrian facilities	50.9%
Inter-mediate	44.4%	Auto	53.6%	Roadway LOS	61.8%
				Automobile traffic volume	68.2%
				Automobile traffic counts	64.5%
				O/D Matrix	20.0%
		Transit	35.9%	Transit ridership by route	38.2%
				Transit ridership by station/stop	33.6%
		Active	24.5%	Bicycle/pedestrian counts	24.5%
Advanced	10.0%	Auto	12.7%	Real-time automobile traffic volume data	12.7%
		Transit	7.3%	GTFS	7.3%

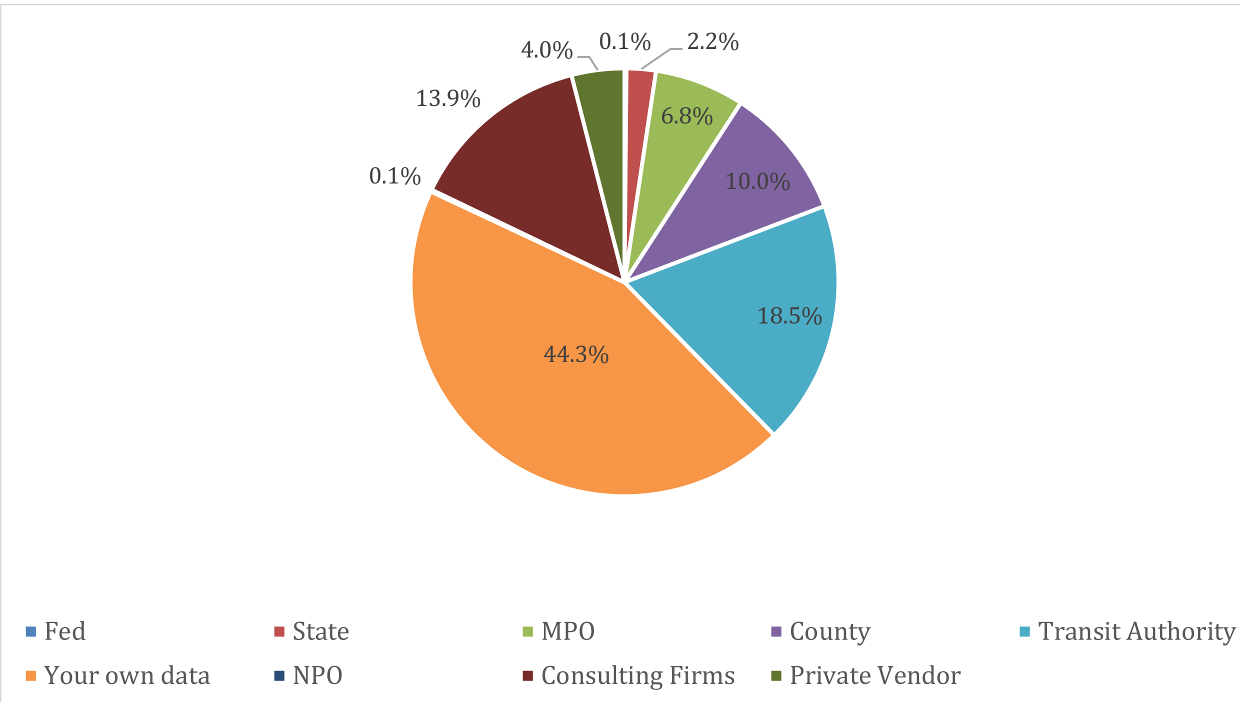
Along the same line, local governments tend to utilize automobile data more frequently than alternative modes. Four out of the top five most popular datasets are automobile data including roadway network, roadway level of service, automobile traffic volume, and automobile traffic counts. While automobile data were widely utilized both at the basic (57%) and intermediate (54%) levels, public transit and active transportation data utilization rates dropped significantly with the level of complexity. This suggests that the most accessible and also needed transportation data by local governments are automobile traffic data, which makes sense given the frequency of LOS (in the past) and VMT analyses (with SB 743). For further promotion of smart growth and VMT/GHG reduction goals, providing more publicly accessible data on various modes with fine granularity (in time and space) seems to be critical.

Figure 5 shows the source of transportation data used by local governments. Given "their own data" being the largest source, we found that the respondent local governments tend to self-support their transportation data needs. Cataloging a comprehensive list of existing transportation data out there and increasing awareness of them could contribute to reducing local governments' burden on the search for new data or redundantly collecting data and facilitating effective collaboration among public agencies. One surprising finding is the limited role of MPOs as data providers. Due to the importance of land-use and transportation coordination, which have been emphasized for smart growth, a close relationship between agencies that have authority over land-use decisions (municipal governments) and regional transportation (MPOs) is critical. However, we found that less than seven percent of transportation data used by local governments were collected from MPOs (Figure 5).

Meanwhile, regional transit authorities' strong presence in data provision is identified. This probably indicates local governments' lack of knowledge on the list and depth of transportation data generated, managed, and monitored by MPOs. It is probably intuitive for local governments to have their respective transit authorities as the go-to source of any transit data. However, MPOs' transportation databases, which are widely ranged, complex, and multiple-layered, have not been perceived that way, as less accessible or comprehensible to many local planning staff.

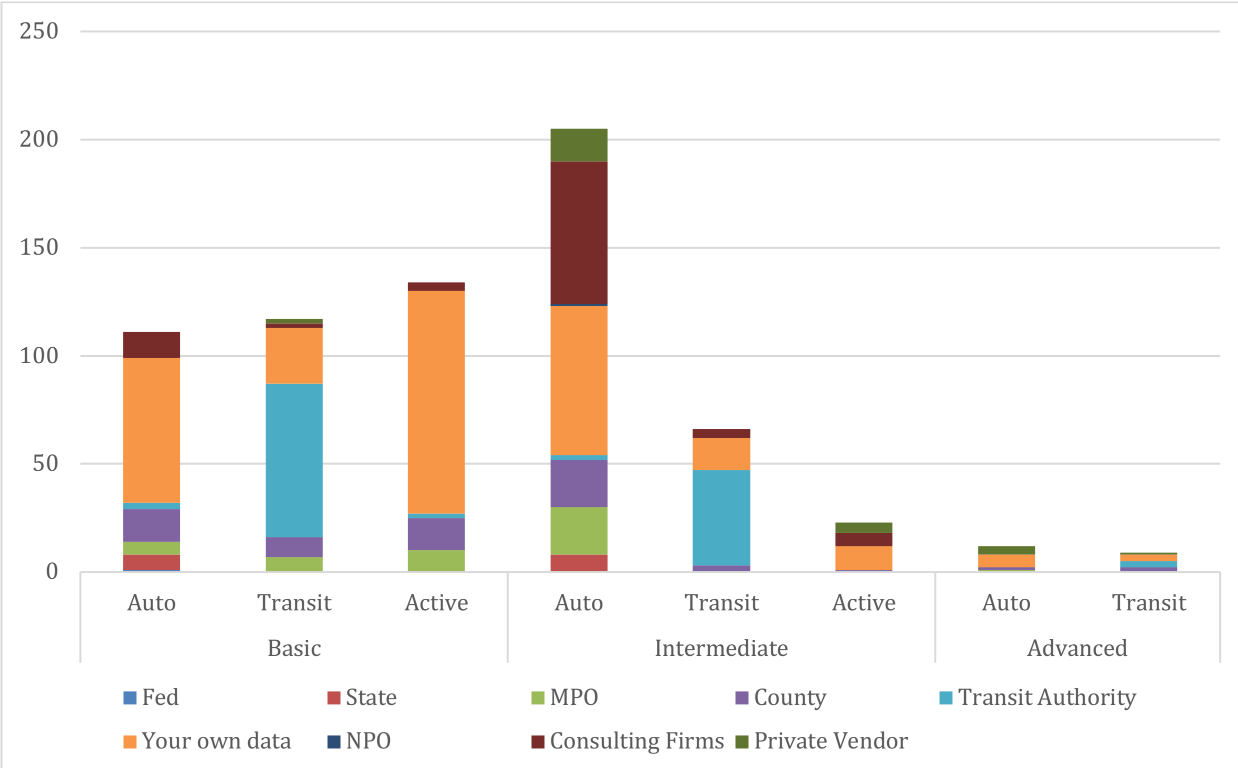
Thus, improving the awareness of and access to MPOs' databases (that can be shared with local governments) and promoting data exchange and sharing between MPOs and local governments can be a way to resolve the data issues that local governments experience.

Figure 5. The Source of Transportation Data



When breaking down the sources of the data by level and by mode, it becomes clear that local governments' data collection effort is heavily skewed to active-transportation and basic-level data (Figure 6). Local governments' own data collection of walking and bicycling counts was expected as some local transportation funding requires these data to be collected, and active transportation mostly occurs at a smaller scale than other modes. However, the fact that local governments' focus on the basic-level data probably implies that their resources are scarce and that they might have ended up collecting the most immediately needed and standardized data rather than exploring experimental or highly technical data that may be more beneficial in the long run. The data include emerging data sources like big data.

Figure 6. The Source of Transportation Data by Mode and by Level



Demands for More Transportation Data

Overall, local governments recognize the need for more transportation data for the implementation of SB 375 and SB 743. Many respondents tend to express a strong demand for more data rather than being content with the current data (Table 6). They are especially interested in publicly available data. The idea of purchasing data was not popular, which might be attributable to the challenges that local governments experience, such as limited resources for various activities they do. A majority also present their interest in creating a data-informed decision-making framework rather than depending mostly on their local knowledge.

Table 6. The Perspective on Data Adoption/Utilization

Please choose a scale for each statement that best describes your perspective about VMT data utilization for general plan updates and project-level CEQA reviews.	Weighted Score
We do not need VMT data due to our local knowledge which is good enough to understand local transportation issues and impacts.	-57
We are okay with the current datasets we use.	18
We need more VMT data to make better decisions for VMT/GHG emission reduction goals.	51
We are interested in and willing to use more VMT data if the data are publicly available.	93
We are willing to purchase VMT data to use.	-27

Note: Weighted Score = (Strongly agree × 2) + (Somewhat agree × 1) + (Neutral × 0) + (Somewhat disagree × -1) + (Strongly disagree × -2).

We also found that local governments were very interested in advanced-level data. To the question, "What dataset did you consider using, but did not use?", the frequencies of the basic and intermediate levels were similar (Table 7). Thirty-three respondents expressed their interest in seven datasets at each level, which means approximately 4.7 responses per dataset. A total of 22 respondents (11 per dataset) expressed their interest in the advanced level, such as real-time traffic volume and General Transit Feed Specification (GTFS). This suggests local governments' willingness to improve their practices by introducing the most fine-grained transportation data that would help them better understand travel behaviors and the transportation impacts of land use.

Table 7. Transportation Data Demanded by Local Governments

Level		Mode		Data	
Type	Count	Type	Count	Type	Count
Basic	33	Auto	9	Roadway network	2
				Truck routes	7
		Transit	5	Transit route network	3
				Transit station/stop location	2
		Active	19	Bicycle network	5
				Bicycle-parking facilities	10
				Sidewalks and other pedestrian facilities	4
Inter-mediate	33	Auto	14	Roadway LOS	3
				Automobile traffic volume (AADT, VMT)	3
				Automobile traffic counts	4
				O/D Matrix	4
		Transit	9	Transit ridership by route	4
				Transit ridership by station/stop	5
		Active	10	Bicycle/pedestrian counts	10
Advanced	22	Auto	14	Real-time automobile traffic volume data	14
		Transit	8	GTFS (General Transit Feed Specification)	8

We found a relatively high demand for automobile and active transportation modes. Paradoxically, this probably indicates well-fed public transit data (with their fixed schedules and availability of boarding/alighting data at stops), as well as a lack of control for transit service provisions.

Interestingly, there is no divide between large cities and small cities in terms of their need for more transportation data (Table 8). Due to SB 743, VMT data and challenges associated with them seem to be a widespread issue across California.

Table 8. The Variations of Data Adoption/Utilization

Association of City/Town Size with	Gamma		Kendall's tau-b	
	Value	Sig.	Value	Sig.
Have used new sources of data/tools for land-use planning to reduce VMT/GHG emission.	0.227	0.101	0.152	0.101
New sources of data/tools have been introduced and used for project-level CEQA reviews to reduce VMT/GHG emission.	0.224	0.129	0.146	0.129
We are okay with the current datasets we use.	0.116	0.447	0.078	0.447
We need more VMT data to make better decisions for VMT/GHG emission reduction goals.	-0.074	0.634	-0.049	0.634

Note: Counties' responses were excluded from this analysis.

The cities and towns were classified into four categories by their population size (smaller than or equal to 50,000, between 50,001 and 100,000, between 100,001 and 250,000, and larger than 250,000).

Barriers to New Data Adoption/Utilization

Overall, we identified local governments' data knowledge gap as the most pressing barrier to new data use. About 49% of the respondents indicated that the datasets they needed were unavailable (Figure 7). This could mean local planners do not exactly know where to find such data (even though they exist) or if the data exist in a form that they can readily access or understand. This suggests how important a comprehensive transportation data guide could be to point them to the right sources/contacts and reduce the knowledge gap.

Even when staff identified the data they needed, purchasing costs and/or the additionally required resources for utilizing the data (e.g., staff, software, etc.) have made them give up on the data acquisition. Since geographic information system (GIS) technology and data have been widely adopted by the transportation sector, large volumes of transportation data became readily available in GIS formats. In this trend, junior planners are expected to have a certain level of GIS capability, and some might need additional training and professional development opportunities to be able to use new tools and data. Similarly, local governments specifically identified resource constraints (financially and staffing-wise) as the biggest obstacle to the adoption of data (Table 9).

Table 9. The Challenges to Data Adoption

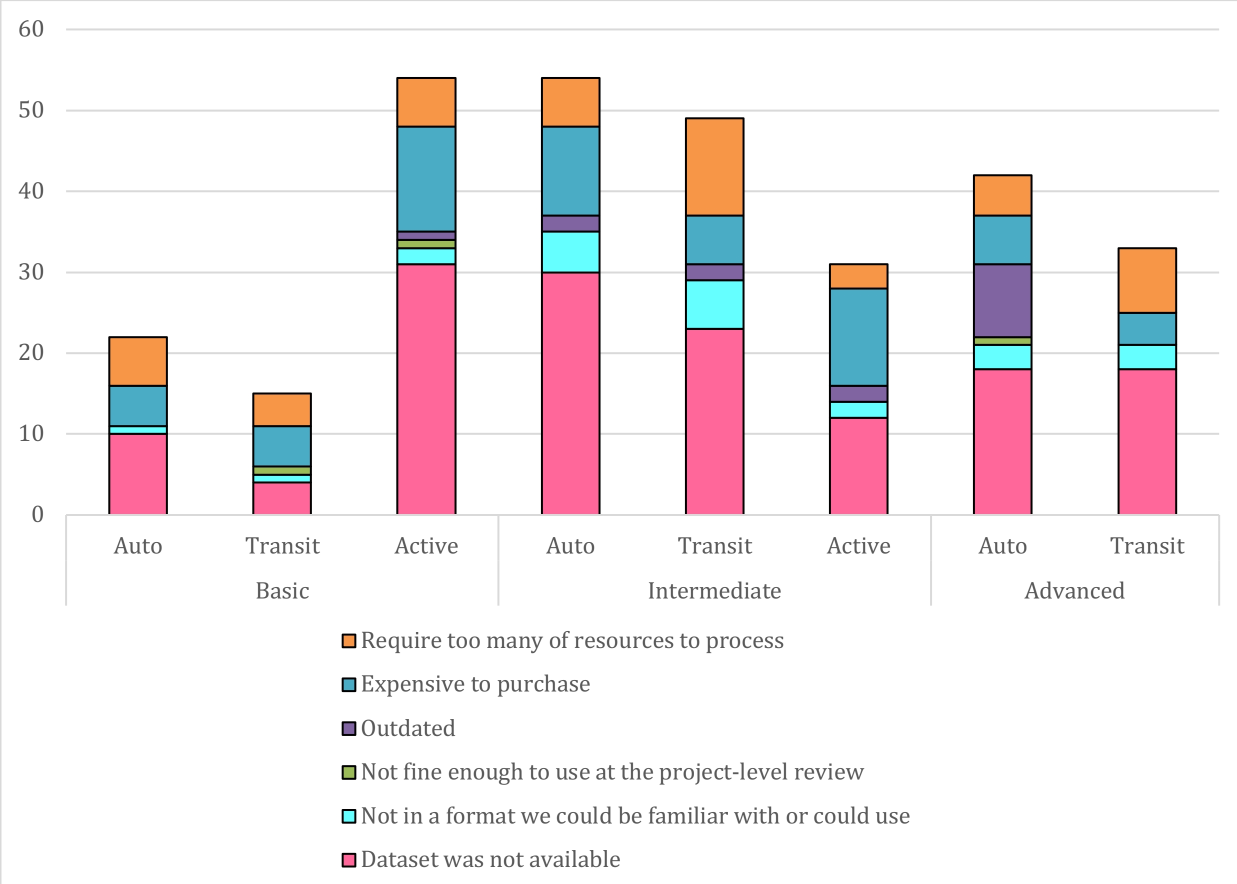
Please choose a scale for each reason that best describes your perspective about data needs and challenges.	Weighted Score
Lack of hardware/software	64
Lack of staff in general	108
Lack of required skillsets of existing staff.	95
Costs to purchase tools/data.	105
Lack of information about available data/tools.	77

Note: Weighted Score = (Strongly agree × 2) + (Somewhat agree × 1) + (Neutral × 0) + (Somewhat disagree × -1) + (Strongly disagree × -2).

Those barriers are consistently found regardless of mode and data level. The response, "dataset was not available", is the primary reason, followed by "expensive to purchase" and "requires too much of resources to process" in all the categories (Figure 8). This supports our goal to develop a transportation data guide for local governments to promote existing and publicly available data sources.

Again, transit authorities seem to serve local governments well with basic-level data. At the basic level, active transportation data (e.g., sidewalks and bike infrastructures) seem to be difficult to obtain compared to other modes. This reflects the reality that active transportation is considered local transportation and is somewhat neglected by regional and state agencies.

Figure 7. The Reasons for Not Adopting Transportation Data by Category



Impacts of New Data Adoption on VMT/GHG Emission Reduction

We found that local governments that adopted/utilized more data for SB 375 and SB 743 implementation showed a better performance in their implementation and had more positive experiences with VMT/GHG reduction compared to those without new data (Table 10).

As described above, how local governments feel about the achievement of VMT/GHG reduction was not varied by city size. However, we noted that the more data cities utilized, the more they experienced the achievement of VMT/GHG reduction. This suggests that the adoption and utilization of new data provide local governments with confidence in what they are doing and achieving intended outcomes.

Table 10. The Association Between New Data Adoption/Utilization and VMT/GHG Reduction

Used new sources of data/tools	In Association with	Gamma		Kendall's tau-b	
		Value	Sig.	Value	Sig.
For general plan updates	Integration of VMT mitigation strategies into land-use planning.	0.445	≈0.000	0.333	≈0.000
	The consideration of VMT/GHG emission reduction in the recent land-use/housing-element updates.	0.524	≈0.000	0.388	≈0.000
	The inclusion of VMT/GHG reduction in other plans than the general plan.	0.457	≈0.000	0.342	≈0.000
	The achievement of significant VMT/GHG emission reduction via land-use planning.	0.708	≈0.000	0.534	≈0.000
For project-level CEQA reviews	Project-level CEQA reviews have significantly changed after the implementation of SB 743.	0.665	≈0.000	0.526	≈0.000
	Significant reduction of VMT/GHG emissions could be achieved by the approaches required by SB 743.	0.310	0.013	0.226	0.013
	Has experienced significant VMT/GHG emission reduction by implementing SB 743.	0.286	0.035	0.200	0.035

Local governments' confidence in VMT/GHG reduction is positively associated with data adoption/utilization. On the other hand, the localities that think local knowledge is good enough tend to be less persuaded by the intent of SB 743 (negative Gamma and Kendall's tau-b values in Table 11). We also found that local governments' higher satisfaction with their current data ("We are okay with the current datasets we use") is associated with higher confidence and more positive experience with VMT/GHG reduction via general plan updates. This positive association, however, does not apply to the project-level CEQA review. This probably implies some local governments are still struggling with the project-level implementation of SB 743, which is understandable as it is a relatively new practice compared to the general plans.

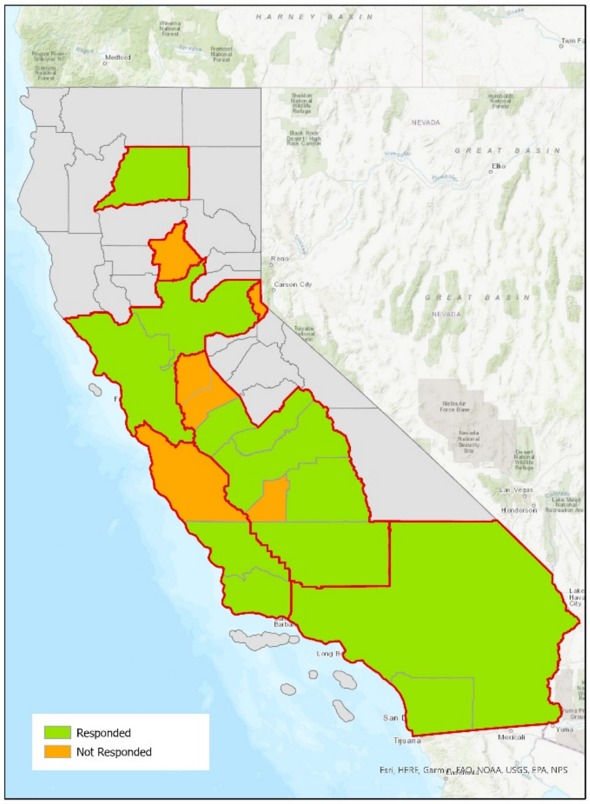
Table 11. The Association between the Perspective on Data Adoption/Utilization and VMT/GHG Reduction

Policy	In Association with	We do not need VMT data due to our local knowledge which is good enough to understand local transportation issues and impacts.		We need more VMT data to make better decisions for VMT/GHG emission reduction goals.		We are okay with the current datasets we use.	
		Gamma	Sig.	Gamma	Sig.	Gamma	Sig.
		Kendall's tau-b		Kendall's tau-b		Kendall's tau-b	
General plan updates	Integration of VMT mitigation strategies into land-use planning.	-0.072	0.582	0.008	0.95	0.141	0.296
		-0.054		0.006		0.105	
	The consideration of VMT/GHG emission reduction in the recent land-use/housing-element updates.	0.167	0.18	-0.121	0.347	0.228	0.085
		0.121		-0.086		0.167	
	The inclusion of VMT/GHG reduction in other plans than the general plan.	0.094	0.459	-0.056	0.686	0.308	0.016
		0.069		-0.041		0.228	
	The achievement of significant VMT/GHG emission reduction via land-use planning.	0.009	0.947	-0.031	0.817	0.274	0.028
		0.007		-0.022		0.204	
Project-level CEQA reviews	Project-level CEQA reviews have significantly changed after the implementation of SB 743.	-0.237	0.047	-0.064	0.623	0.144	0.266
		-0.178		-0.047		0.108	
	Significant reduction of VMT/GHG emissions could be achieved by the approaches required by SB 743.	-0.432	≈0.000	0.027	0.841	0.066	0.616
		-0.322		0.019		0.049	
	Has experienced significant VMT/GHG emission reduction by implementing SB 743.	-0.253	0.046	0.063	0.633	0.092	0.469
		-0.183		0.044		0.065	

3.1.2 MPO Survey Findings Reported by MPOs

The purpose of the MPO survey is to understand the current practices of MPOs in regard to the collaboration with their local governments in the provision of transportation data and support for VMT/GHG reduction via land-use planning. Eleven MPOs participated in the MPO survey but one MPO answered 26% of the survey questions; so, only 10 respondents were included in the analysis of MPO survey findings (Figure 9).

Figure 8. MPO Survey Participants



3.1.2.1 Perspective on Local VMT/GHG-Reduction Practices

The data from the MPO survey indicate that the MPOs have a pretty good understanding of their local agencies' practices on VMT/GHG reduction and that they present a positive assessment of the current practices. Interestingly, the MPOs and local governments answered to have a common understanding of the popular strategies of VMT/GHG mitigations (infill development, mixed-use development, an increase in housing options including affordable housing, and the creation of walkable/bikeable neighborhoods). Moreover, both parties have the same awareness that parking reform and micro-mobility options are the least preferred/selected strategies.

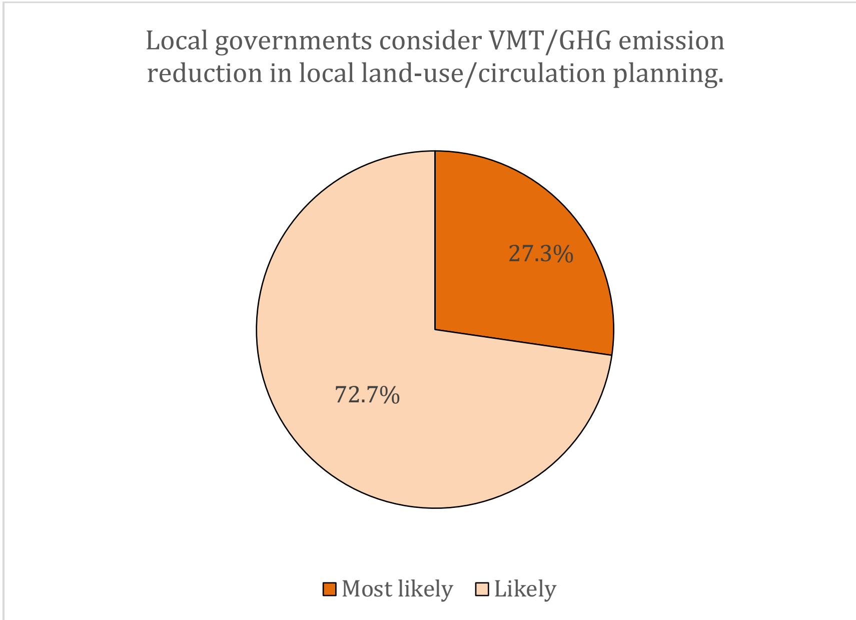
Table 12. MPOs' View on Local Governments' Preference on VMT/GHG Mitigation Strategies (SB 375).

Classification	VMT/GHG mitigation strategy	Weighted Score	Rank	Rank According to Local Survey
Land Use	Promoting infill development	13	1	2
	Promoting mixed-use development	13	1	1
	Increasing residential density	11	5	5
	Increasing housing options/affordable housing	12	4	3
	Increasing job/housing balance	10	7	8
	Increasing employment density	7	9	9
Land Use and Transportation Combined	Promoting developments along transit corridors	8	8	6
	Promoting transit-oriented development (TOD)	11	5	7
	Creating walkable/bikeable neighborhoods	13	1	4
	Introducing parking-pricing/parking reform	2	11	11
	Facilitating/encouraging micro-mobility options	7	9	10

Note: Weighted Score = (Strongly agree × 2) + (Somewhat agree × 1) + (Neutral × 0) + (Somewhat disagree × -1) + (Strongly disagree × -2).

Furthermore, the MPOs have a positive view of local governments' efforts in complying with the mandates. None of the MPOs answered negatively about the statement that "local governments consider VMT/GHG emission reduction in local land-use/circulation planning" (Figure 10). This assessment seems to be coming from their everyday practices and communications rather than regular, designated meetings for this purpose. To the question, "how often does your organization hold collaborative meetings with local governments within your jurisdiction to address greenhouse gas (GHG) emissions mitigation?", only 3 out of 11 MPOs (27.3%) answered that they have regular meetings including two responses for monthly meetings and one response for quarterly meetings. This indicates that collaborating with local governments seem more ad hoc than structured.

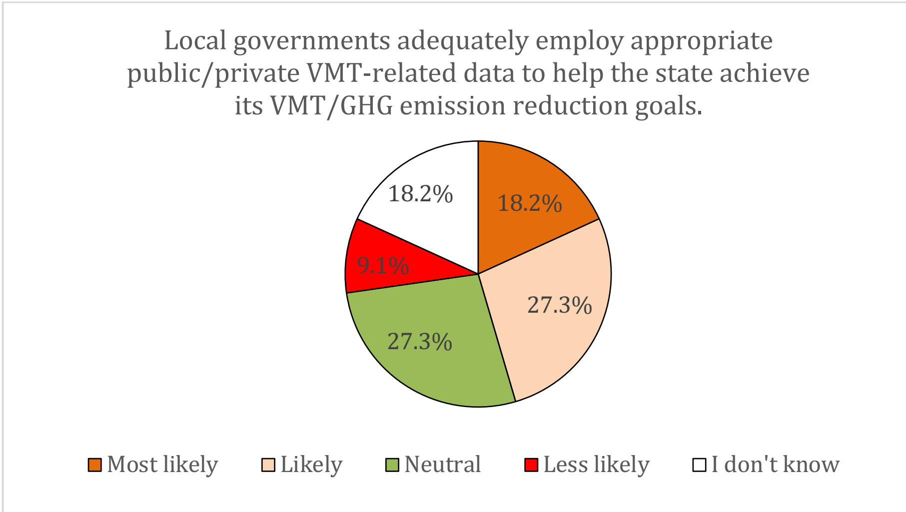
Figure 9. MPOs' Perspective on Local Governments' VMT/GHG Reduction Practices



3.1.2.2 Perspective on Local Governments' Data Utilization

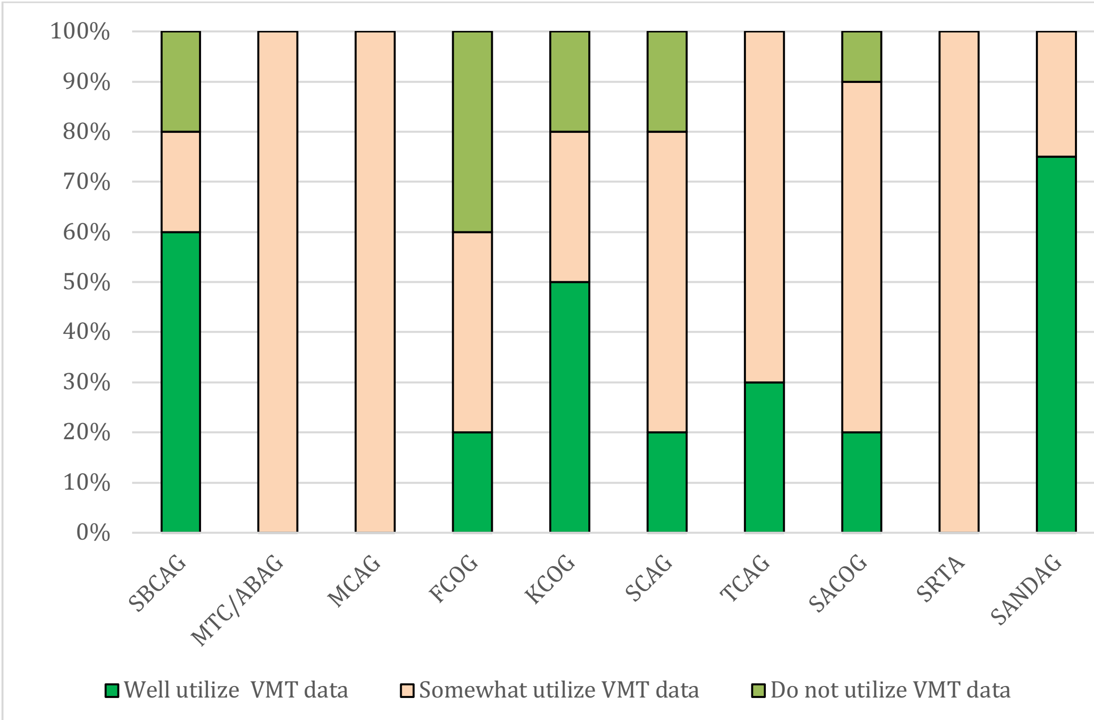
Overall, MPOs' perspective on local governments' data adoption/utilization is not as positive as the previous findings reported by local governments. Only a little more than half MPOs responded "most likely" or "likely" about their members' VMT data utilization and 18.2 percent of the MPOs answered "I don't know" about their localities' VMT data use for the implementation (Figure 11). This probably indicates the lack of collaboration and interactions between those MPOs and their members, particularly about data sharing/exchange. It is evident that MPOs have a general understanding of what local governments have in their plans for VMT reduction goals but do not necessarily know the nuts and bolts of how they actually acquire transportation data needed for VMT analysis and respond to SB 375 and SB 743 implementations.

Figure 10. MPOs' Perspective on Local Governments' Data Utilization



When individual MPOs were reviewed, we found SANDAG and SBCAG presented strong, positive statements about their local governments' data utilization, while SCAG, Fresno COG, and SACOG were on the other side (Figure 12). This variation seems to not be due to the size of the MPO as the big four MPOs and the rest are not so different in terms of the percentage of local members utilizing VMT data well (28% vs. 26%). Instead, the variation seems to be related to the collaborative meetings. MPOs holding regular collaboration meetings with their local governments answered with a much higher data utilization of VMT data (48%) among their local governments than the MPOs without regular meetings (19%). This again confirms the importance of consistent, regular collaboration between MPOs and local governments for VMT/GHG-reduction goals.

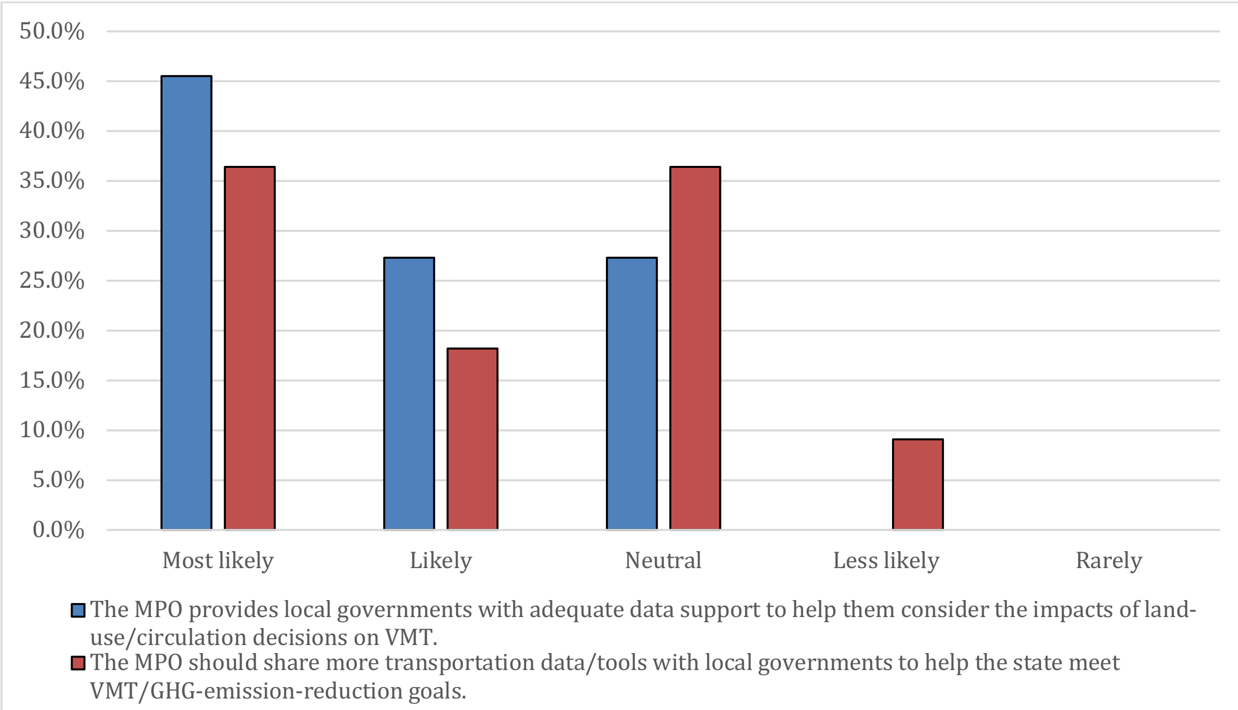
Figure 11. Each MPO's Perspective on Local Governments' Data Utilization



3.1.2.3 Perspective on Data Support/Provision for Local Governments

Overall, MPOs believe that they adequately supported local governments in terms of the provision of data when asked. About 73 percent of the MPOs chose either "most likely" or "likely" that they provided local governments with adequate data support. At the same time, 55 percent of MPOs agreed that there is room for improvement with data support/provision (Figure 13). Apparently, this is somewhat different from what we learned from the local survey as we found a relatively limited role of MPOs as a source of transportation data. Given MPOs' activities, such as regional travel-demand modeling and development of RTP/SCS, more data requests could have been made by local agencies and more data could be shared in a format that local staff can understand and use. It is understandable that MPOs' databases do not have that fine granularity local governments need as MPOs have to spatially aggregate data, simplify land-use descriptions, and sample locations for data collection, etc. It would be necessary to conduct further research that examines the reasons for this unmet demand for transportation data at the local governments.

Figure 12. MPOs' Perspective on Data Support/Provision for Local Governments



As expected, MPOs received more frequent requests for basic-level transportation data than intermediate-level data (Table 13). Overall, the MPOs reported that they provided all modes of transportation data to their local agencies. MPOs' primary responsibility, which is the regional transportation-planning entity, might have influenced the misconception that MPOs mainly focus on and manage automobile data. The misconception might have led local governments to heavily depend on transit authorities for public transit data and to put their own data collection efforts for active transportation data, as the local government survey indicated. There is potential for MPOs to become one centralized transportation data source for local governments' VMT/GHG reduction. There could be some statewide requirements to ensure that all MPOs across the state make the same minimum-level of data available to their locals and to ensure that the data are accurate/maintained. This can help local governments save time and effort in some, but not all, data collection. This can be started by building a strong collaborative relationship between local governments and MPOs.

Table 13. MPOs' Perspective on Transportation Datasets Provided by MPOs

Level		Mode		Data	
Type	%	Type	%	Type	%
Basic	70.0	Auto	72.7	Roadway network	90.9
				Truck routes	54.5
		Transit	90.9	Transit route network	90.9
				Transit station/stop location	90.9
		Active	54.5	Bicycle network	81.8
				Bicycle-parking facilities	45.5
				Sidewalks and other pedestrian facilities	36.4
Inter-mediate	57.2	Auto	68.2	Roadway LOS	54.5
				Base VMT/AADT	81.8
				Forecasted VMT/AADT	72.7
				O/D Matrix	63.6
		Transit	45.5	Transit ridership by route	54.5
				Transit ridership by station/stop	36.4
		Active	36.4	Bicycle/pedestrian counts	36.4
		Others	57.6	Socio-economic characteristics	90.9
				Travel-time matrix	36.4
				Mode-share scheme	45.5

At the intermediate level, VMT/AADT data in addition to socio-economic characteristic data are frequently requested, while the matrix-format data (including O/D, travel time, and mode share) are less frequently asked for. This is consistent with the local survey finding, implying that local governments prefer conventional data in an easy format. Or, local government staff might not necessarily have a clear understanding of travel-demand models and their middle and final products of the models.

In order to link land-use decisions to VMT reduction, it is evident to investigate VMT/AADT data that represent static traffic volume on transportation networks. However, the static data have limitations in explaining travel behaviors (e.g., where the traffic comes from and goes to), while the O/D matrix data explain the flow. Presenting an overview of various transportation data with their format and appropriate use could be a valuable training resource for local government staff.

This finding is reinforced by the most frequently requested datasets by local governments and the datasets that help local governments achieve VMT/GHG emission reduction (Table 14). According to the respondent MPOs, the VMT/AADT datasets and the O/D matrix dataset are the most frequently requested by local governments and are considered as the most helpful datasets for VMT/GHG emission reduction. In addition, the intermediate, "others" datasets (socio-economic characteristics, travel-time matrix, and mode-share scheme) are highly recommended by MPOs to be useful, while their actual requests and use by localities were very low. While the

MPOs think that public-transit and active-transportation datasets are also important for local governments, local governments seem to collect the datasets from sources other than MPOs.

Table 14. MPOs' Perspective on Datasets Requested by and Helpful for Local Governments

Level	Mode	Data	Most Frequently Requested Data Weighted Score	Helpful Data for Local Government Weighted Score
Basic	Auto	Roadway network	12	21
		Truck routes	0	14
	Transit	Transit route network	2	23
		Transit station/stop location	9	22
	Active	Bicycle network	0	23
		Bicycle-parking facilities	0	17
		Sidewalks and other pedestrian facilities	0	21
Inter-mediate	Auto	Roadway LOS	8	21
		Base VMT/AADT	41	31
		Forecasted VMT/AADT	31	31
		O/D Matrix	17	26
	Transit	Transit ridership by route	3	24
		Transit ridership by station/stop	0	19
	Active	Bicycle/pedestrian counts	4	22
	Others	Socio-economic characteristics	7	25
		Travel-time matrix	0	22
		Mode-share scheme	1	25

Note: Most Frequently Requested Data Weighted Score = (The most frequent × 5) + (The second most frequent × 4) + (The third most frequent × 3) + (The fourth most frequent × 2) + (The fifth most frequent × 1). Helpful Data for Local Government Weighted Score = (Extremely helpful × 4) + (Very helpful × 3) + (Moderately helpful × 2) + (Slightly helpful × 1) + (Not helpful × 0).

In addition to data sharing, MPOs provided local governments with technical support and software licenses such as GIS and sketch planning tools. The types of support MPOs primarily focused on were training and technical support rather than licensing (Table 15). Although MPOs recognize that both licensing and technical supports are helpful for local governments, we found some reservations or reluctance on license contracts. This may be due to high costs or a lack of interest in local governments.

The sketch planning tool is one of the most advanced technologies that allow local planners to simulate the impacts of land-use alternatives on VMT/GHG reduction. The MPOs reported frequent requests for sketch planning tool training/technical support by local governments and they agreed that sketch planning tool training/technical support would be the most beneficial for

GHG emission reduction goals. This implies that sketch planning tools have the potential to be adopted by local governments for VMT impact analysis. Thus, it is necessary to explore ways to expand the use of sketch planning tools by local governments and how MPOs can best assist in incorporating that into their regional models and plans.

Table 15. MPOs' Supports Requested by and Helpful For Local Government

Support	Type	Support Provided by MPOs	Most Frequently Requested Support (Weighted Score)	Helpful Support for Local Governments (Weighted Score)
GIS Software	License	2	18	17
	Training/technical support	6	21	21
Sketch Tool	License	2	20	23
	Training/technical support	4	53	24

Note: Most Frequently Requested Support Weighted Score = (The most frequent × 5) + (The second most frequent × 4) + (The third most frequent × 3) + (The fourth most frequent × 2) + (The fifth most frequent × 1). Helpful Data for Local Government Weighted Score = (Extremely helpful × 4) + (Very helpful × 3) + (Moderately helpful × 2) + (Slightly helpful × 1) + (Not helpful × 0).

Consistent with the local survey finding, the MPOs also identified the resource constraints of local governments as the dominant barriers to new data adoption/utilization.

Table 16. MPOs' Perspective on Local Governments' Challenges to Data Adoption

	Weighted Score
The lack of hardware/software.	8
Lack of staff in general.	11
Lack of required skillsets of existing staff.	4
Costs to purchase tools/data.	9
Lack of information about available data/tools.	7

Note: Weighted Score = (Strongly agree × 2) + (Somewhat agree × 1) + (Neutral × 0) + (Somewhat disagree × -1) + (Strongly disagree × -2).

3.2 Interview Findings

3.2.1 Interview Participants

A total of 17 interviewees from 15 different agencies with one private consultant participated in our semi-structured interviews. The government agencies that the participants are affiliated with at the time of the interview include two cities, four counties, one council of governments (COG) (not MPO), and eight MPOs. The list of the governments and their geographic locations are in

Figure 14 and Table 17. A private consultant we interviewed has served many different jurisdictions at various scales in California regarding SB 743 implementation since its conception in 2013.

Figure 13. Location of Interview Participants

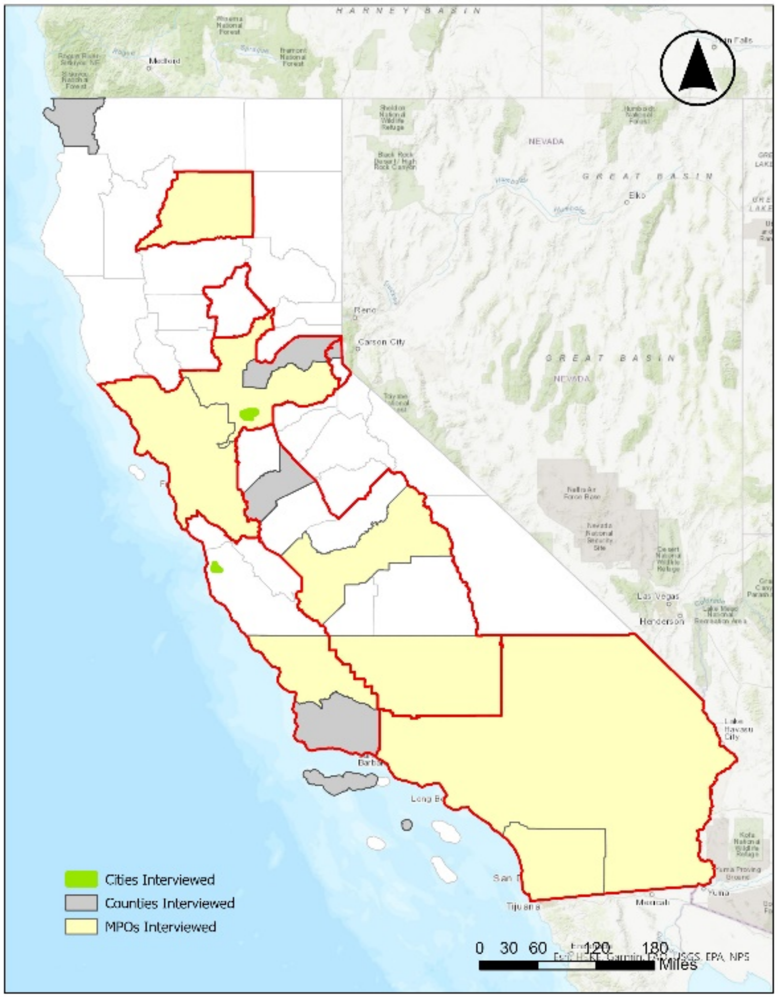


Table 17. Interviewee Information

Government Level	Region	Name of the Affiliated Government
City	Big 4	City of Elk Grove
City	Central Coast	City of Monterey
County	Central Coast	Santa Barbara County
County	Central Valley	Stanislaus County
County	Big 4	Placer County
County	Non-MPO Rural	Del Norte County
COG	Southern	San Gabriel Valley COG
MPO	Big 4	SANDAG
MPO	Big 4	SCAG
MPO	Northern	SRTA
MPO	Central Valley	Kern COG
MPO	Central Valley	Fresno COG
MPO	Central Coast	SLOCOG
MPO	Big 4	MTC/ABAG
MPO	Big 4	SACOG

3.2.2 Interview Findings

The interview questions were developed to unpack some of the survey findings and particularly understand the sources of different experiences and perspectives between MPOs and local governments regarding data access and use for VMT/GHG-reduction practices. We aim to draw some ideas to reduce the gap between levels of government and identify the critical elements of the transportation data guide (which is discussed in the next chapter) that could enhance local governments' access to data.

3.2.2.1 Barriers to the Go-To Source of Transportation Data: Regional Travel-Demand Models

With California being the first state to require a transition from LOS to VMT, there is a learning curve with understanding and obtaining VMT among local government staff. Which tools/models to use to estimate the VMT of a development project is not specifically recommended by OPR's technical advisory (Volker et al., 2023); so, in most cases, VMT data for a project most likely come from regional travel models. While regional travel models are a typical go-to source of VMT data, they are difficult to grasp and extract specific data from, which becomes a real barrier to VMT data access. From MPOs' regional models, each local government, depending on their capacity and resources, has approached how to compute and calculate the VMT impacts of a project slightly differently.

When any data from the regional models are shared by MPOs, the caveats section of a data sharing agreement becomes very critical as the models are developed based on a lot of assumptions under a certain scenario. In addition, MPOs run the model for the entire region and can provide the subset of the model outputs for each jurisdiction, but the models are designed to be used for the macro-level planning activities. The outputs "as is" do not necessarily work for a specific subarea application unless the models have subregional models in them. Several MPO staff interviews reported that this mismatch of spatial scales of interest made them very careful in sharing such data.

They [a local agency] will have to sign the data sharing agreement, clearly read the disclaimers. When provided, we clearly explain that relevancy of baseline levels, the calendar year it is applicable for, etc. We want to avoid any misunderstanding with the usage of these data. We run our original model based on a particular scenario, the local jurisdiction might use it for a different purpose. So, there is a lot of communication involved to make sure they understand the context before they use it. When it gets to a smaller focus, like analyzing VMT at the TAZ levels, it gets a little tricky. Our TAZ has four different [-levels of hierarchy] system, our modelers prefer not to go all the way down to that level, [as] the margins of error can be higher. (MPO)

Local governments reported that they could then use the regional model outputs to develop micro models with the help of consultants. However, we heard that building a local-tier model is difficult for a small agency, starting with figuring out how to use the software that the MPO uses. If a local government luckily has the resources to develop a local-tier model either in house or by a consulting firm, they start from there to develop baseline VMT data and adopt thresholds. Then, the agencies can create VMT tools, such as VMT screening maps and VMT analysis tools for a project. The VMT screening maps created based on travel surveys or travel-demand models are very common and popular practices implemented for residential and office projects. The advantage of having the screening maps is that developers can quickly identify which areas are currently below or above the VMT thresholds. By choosing a location that is lower than the thresholds, developers can avoid VMT analysis except for a few certain conditions.

An interviewee from a local government provided the detailed processes of developing a local-tier model with finer granularity.

…they [consultants] will start consolidating TAZs out at the other end of the region, and then adding TAZ details in our area. They go through and they break up the TAZs, they start aggregating the data, we will prepare our own sort of benchmark of existing and build out conditions, we have got a different set of land-use descriptions that we use that are more refined [than the MPO's] …. I have got a big general plan amendment that is going to essentially codify it or lock it down as the official travel model for the city. And then I have got Public Works using it for I think three or four projects. I have got two annexation projects using it. I have got a new zoo that is using it. So, everybody is starting to build up their projects around the city's travel model as the basis.

Jurisdictions not within an MPO boundary can use California state-wide travel-forecasting model output. It provides VMT per capita and VMT per employee estimates by Traffic Analysis Zone (TAZ) and a few non-MPO rural counties used such data for baseline VMT assessment (according to a consultant interviewee who worked with those counties).

The real barrier is that many local government planners are not modelers by training and these models are not easy to understand simply by attending a few workshops and reviewing documents of the models. These models are resource-intensive and require very technical expertise. The model run requires many iterations, and it would take several days and months to get the needed output (Lee et al., 2017). Transitions from the traditional four-step models to activity-based models (ABMs) are taking place these days in many MPOs, and this makes the situation even worse. As travel-demand models become more complex, local governments that rely on regional models expressed that it is hard to extract meaningful VMT data in a small geography and compare it against the local's own thresholds.

An interviewed consultant's observation is that with SB 743 it is now easier to develop a land use with a screened-out project as it will not need a traffic impact analysis. However, it could be more difficult if a project needs a VMT impact analysis, as VMT is not a well-understood concept by practitioners compared to what LOS used to be.

Our research also suggests that VMT is still a novel measure and that VMT is not well received by the public, decision makers, city councils, etc., especially in rural areas. Even though the discussion on the shift of the metrics started back in 2013, the mandate of SB 743 became effective on July 1, 2020; so, it has only been a little less than three years at the time of the interviews. Many jurisdictions have come up with a policy and have a database of VMT by TAZ in place mostly from a hired consulting firm using regional travel models, while some rural and small jurisdictions have not been compliant with the mandate yet.

We are just so very early, and we have maybe only received three projects where they have to do VMT analysis. So, it's still very new to us. (Central Valley)

We think it might take a few more years to see the full depth of its implementation and efficacy of the mandates, particularly around significant VMT reduction by mitigation measures.

3.2.2.2 Rare Use of Plan-Level VMT Quantification (Sketch) Tools

A piece that is missing so far is that the current practices place too much emphasis on project-level VMT analysis. The implementation of MPOs' SCS heavily depends on both land-use planning and project approvals made by cities and counties. In that sense, true, meaningful implementation of SB 375 could be accomplished by local governments' use of some VMT quantification tools (sketch planning tools) when they are adopting general plan updates, specific plans, climate-action plans, etc. Since using regional travel models or local-tier models for land-use scenario evaluations on VMT is a heavy lift, as aforementioned, less resource-intensive methods have been developed and they are called sketch tools (Lee et al., 2017).

The City of Woodland is an early adopter case that was selected as a best practice by the SB 743 Implementation Assistance Project (a coordinated project by the Urban Sustainability Accelerator, a joint program of the Toulan School of Urban Studies and Planning and the Institute for

Sustainable Solutions at Portland State University).[3] The city conducted an Environmental Impact Report (EIR) for their 2035 General Plan update with two land-use alternatives that differ by timing and location of growth (eastern vs. southern districts to accommodate new growth). OPR's technical advisory (2018) suggests considering the plan to have a significant impact on the environment if the proposed new residential, office, or retail land uses would in aggregate exceed the respective thresholds. The hired consulting firm used UrbanFootprint (UF)'s Transportation Module to estimate the VMT impacts of the two alternatives and compare them to regional travel-model estimates.[4] At the time of the EIR, UF only provided VMT generated from households; so, the report was limited to the residential portion of the analysis.

The important caveat is that whatever sketch tool is used to estimate the land-use plan's VMT, the methodology should be the same as that used to set the threshold ("apples-to-apples" comparison by OPR TA). For example, a city set the thresholds based on its MPO's regional travel model. Therefore, a sketch tool of choice by the city should be based on its available input (the MPO model's VMT generation rates) and output VMT metrics (VMT estimates by trip purpose). Moreover, depending on the tool, users could provide local-specific parameters such as trip lengths as the input of the sketch model, while some tools do not allow users to set custom parameters or only offer a limited number of options as input.

There are many sketch tools out there, but none of the tools are perfect or without limitations. The interviewed consultant shared his view on one of the sketch tools, CalEEMod developed for the California Air Pollution Officers Association (CAPCOA) in collaboration with the California Air Districts. It is simple enough to use but is too simple to be accurate or reflect the reality of complex urban settings.

> *…with the CalEEMod. Yes, I have used CalEEMod… it is possible that would have changed, but when I was familiar with it, it had used two trip lengths for every county. One rural and one urban, and so it is just a very rough tool…what they [air quality professionals] were trying to do was very different from what we [transportation planners/engineers] are trying to do in VMT and so it just did not work because any transportation engineer or planner would look at that and say this is ridiculous, [for example, for] LA County you are going to use two different trip lengths for the whole county.*

The City of Elk Grove's general plan update in 2021 is another example of conducting VMT analysis at the city level with their local-tier travel-demand model called EG SIM 17 or 19.

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[3] https://www.sb743.org/casestudies (accessed on January 19, 2023).

[4] https://static1.squarespace.com/static/5b96d09a3c3a53da0e1ba210/t/5e223be52326435803bcdd1d/1579301865032/Woodland+General+Plan+Case+Study+1.15.2020.pdf (accessed on March 25, 2023).

So, the general plan sets the threshold. So, we say let us spit out of the model what is the total VMT for the community? And then what is the VMT average by land-use designation, and then we apply the 15% reductions to those, those become our thresholds.

And then what we do with the housing-element update, we run the model with those with the land-use changes, and we compare the model results back to the thresholds that are in the general plan. What we found with the housing element in [20]21 is the totality of the sites did not exceed our community-wide number. Our citywide-total VMT limit, that was fine. But we had individual sites that would exceed the threshold of the VMT per capita for the land use. So, we have individual sites that will have mitigation obligations when those projects come in, but the totality of the sites we are fine so it becomes a site-specific basis. (City of Elk Grove)

We found two case studies that performed VMT analysis at the plan level (both cases were general plan updates), and we expect that this will be a trend from now on, either using one of the sketch models that are out there that allow "apples-to-apples" comparison to their thresholds or using regional or local travel models if they can.

3.2.2.3 Lack of Staffing and Resources

When discussing the implementations of SB 375 and SB 743 by local governments we encountered, we found the overall sentiment that the lack of resources, staffing, and funding has inhibited their efforts to implement the mandates and mitigate VMT. For example, the extra work that local governments would need to do is to collect/develop baseline VMT data for their jurisdiction, set the thresholds of significance, create VMT screening maps, and develop a project-level VMT analysis tool. In addition, theoretically, they are supposed to enforce and monitor VMT mitigation implementations. These are not replacing the work they used to do with LOS, as they are still doing LOS analysis for non-CEQA purposes. For plan-level analysis, staff would need to learn how to use a sketch planning tool to compare VMT impacts of alternatives being considered in land-use plans. If they could not do these in house, they have to hire a consultant to implement them.

Struggles of small, rural cities/counties were also further discussed in the interviews consistent with the survey findings. It is obvious that it is hard to get data in small, rural municipalities as there are not a lot of large projects that prompt CEQA reviews and data collection. They do not have that many new projects or any comparable projects in the neighborhood to collect such data or compare such data with. Even with projects, local governments do not have a budget to collect data. A COG interviewee shared that they provided resources and expertise and applied for grants for small cities as they struggle with a lack of staffing. Another interviewee in Central Coast expressed a concern that these data-intensive metrics and data-driven implementation trends made local governments rely too much on private consulting firms.

I do not think it is a policy thing, especially smaller cities and counties, it is just this hamster wheel of state requirements and people are just struggling to find those and wrap their head, sink their teeth into it, …

Take SB 743, for example, there is no way we could have implemented [it] without a third-party consultant. So that instantly puts us in a difficult position because we need to hire somebody to help us implement something. And it just seems like that will continue to be the trend moving forward especially as we get shift to even more data-driven metrics like VMT and GHG. The metrics are getting clearer, but the support on the agency side is not…I do not know any agencies actively ramping up their data analysis aside from the big players, so the divide between private and public seems to be widening in my opinion. (Central Coast)

Local governments are aware of the importance of building transportation databases for achieving goals of sustainable and smart growth. However, in most cases, comprehensive collection, digitization, and management of transportation data are almost impossible due to lack of staffing and funding.

We have the traffic counts by our regional transportation agency, that gets updated every year and then the MPO's travel model for the region. That is really all we have. We could go out and do our own traffic counts, but we do not do that very often. We just do not have the staff availability to do that. We generally know where people are biking. We have the ability to ask for transit boarding data, but we do not really use that very much either…I think the biggest challenge is funding us and staff time. Honestly, because the staff wearing so many hats, we do not really have anyone that is fully dedicated to keeping a good database for us... I feel like we should have someone more dedicated to doing that… it is kind of very piecemeal right now. (City)

The above interviewee also addressed why data requests to other agencies have not been as frequent as they could have been. Local governments do not really use that much data due to a lack of staff time.

The transportation and planning staff are only three people, we divide our tasks between transportation planning, traffic engineering, and roadway safety. Half our time is on transportation-planning efforts... I do not see many projects that fare well with SB 743 impact analysis, because we are comparing it to the unincorporated county average… Eventually, it falls flat with the public, the rural areas will have a higher per capita VMT, it is unavoidable. (County)

The doubt about the efficacy of SB 375 and SB 743 found from the survey is unpacked by this interview in a rural county. There have not been many projects that needed VMT analysis; the mandates and shift have not been well received by the public; they expect to have a higher VMT level anyway compared to other urban areas, assuming mitigation measures would not work here; and the skepticism is prevalent among the interviewees from jurisdictions with rural areas. It is possible that these local governments expect to approve the projects anyway after doing the analysis by following this in CEQA: "disclose to the public why a project was approved if that project has significant environmental impacts that cannot be mitigated to a less than significant level." This means that CEQA does not always require mitigation.

3.2.2.4 Disadvantages in Rural, Small Jurisdictions to Reduce VMT/GHG

We found that the transition from using LOS to VMT as required by SB 743 has been difficult for some regions that are rural or lack the amenities for infill development to reduce trip lengths. It is challenging to balance the statewide environmental goals and maintain affordability in some regions. A study by Laurian et al. (2016) indicated that there are low levels of implementation of sustainability practices in smaller and mid-sized U.S. cities and counties because the practices are not included in the early stages of the planning process. This resonates with our responses when surveying rural cities and counties; there is a gap in the inclusion of mitigation efforts when compared to urban and larger government agencies. We heard from rural participants that they do not have the density of amenities and housing to effectively reduce GHG emissions through VMT mitigation. Economic and social constraints can be leveraged to assist in determining what type of VMT mitigation approach would work and if alternative policies can be most effective and suited for long-term adoption in rural regions. Unique challenges in different regions were collected through the interviews.

> *…[our city] does not have very many options. So, we are also looking at putting a lot of these housing units in the outskirts, which would be very bad for VMT. Unfortunately, we do not have the land to do it in core. (City)*

> *We have a lot of agriculture. That is our main industry here. And we have most of our general plan policies that are in place to protect agriculture, so it is not developed. And none of these state laws about GHG and VMT do not really come through that lens. They come through the lens of like an urban setting. (Central Valley)*

> *One special consideration should be considered for the region with lots of rural, because their needs are slightly different... not slightly but completely different sometimes from their urban areas. (SRTA)*

> *Public transportation and biking [as VMT mitigation measures] do not work to address daily needs. (County)*

Findings of our survey align with a prior study reporting that rural and suburban regions would face difficulty with mitigating baseline VMT levels because of the necessity of vehicle trips. Due to these disadvantages and pushback in rural areas, it was frequently discussed if applying SB 743 throughout the state would make sense. The rationale was it would make rural development more difficult and costly due to additional costs for VMT mitigations.

SB 743 was targeted for certain parts of the state, but OPR applied it statewide and unfortunately, rural areas are not compatible with it. (County)

One size does not fit all…. You need some economic development. And the VMT restriction that SB 743 is putting on these little communities is hampering them from ever being able to see the investment necessary to be able to grow, to have the amenities so reduce their overall VMT. So, by telling them they cannot have the VMT, you are basically cursing them to always have more VMT than the statewide average. (Central Valley)

I think part of the frustration we have is that we have really good air quality attentive to the rest of the state. We have great air quality the majority of the year and the only time it's really affected is fires. So, we're trying to reduce GHG and VMT and all of that. But when you look at how many vehicle [trip]s we could possibly generate based on the land that is available, that is not owned by the government. We cannot exceed 20% of the land and the county. So, our countywide, we're going to be significantly less on GHG than anywhere else. (County)

It will likely cost more for development and housing; it might get rejected due to budget. (Central Coast)

We truly struggle with housing… We are struggling with the regulations such as the solar and the fire sprinkler systems that have been added in the last few years that have increased costs. And now on each house that was roll we have added the additional cost of the sidewalk improvement… [but] we do not have the incomes in our community to support the cost of housing…Are we getting the benefit for the cost? And is it reasonable what we are doing? (County)

With doubt about the efficacy of replacing LOS with VMT, we found that local governments still use LOS for operational purposes outside CEQA, such as in their own transportation analysis, general plan updates, and traffic-signal operations. The study by Volker et al. (2019b) indicated that respondents regarded VMT as the ideal metric to consider the impacts of land use and new development but not for all situations.

In our general plan, we still have local LOS criteria, … and our general plan we still use LOS to assess neighborhood compatibility. Because we still have certain things we want to achieve in our local network. We do not want traffic to be totally stopped at an intersection, but it would not be an impact under CEQA. (City)

3.2.2.5 Big Data Use as Dominant Trend

Our survey results and interviews indicate that there is a need for more data and the level of granularity varies for cities, counties, and MPOs. Layered upon this is the cost of data acquisition and the frequency of updated information for local governments to adequately make planning and land-use decisions that result in VMT reductions.

Travel-demand modeling requires traffic count data to validate and calibrate the model. However, traffic counts are hard to come by as they are expensive to collect. Urban areas tend to have yearly counts for major intersections and segments, while small and/or rural communities do not have as frequent traffic counts on their roads. For travel-model validation and calibration purposes, several MPOs have used third-party big data such as StreetLight. The advantages of big data are that they can offer information on general trip distribution and destinations/origins beyond a jurisdictional boundary. CEQA requires EIR to reflect a "good faith effort at full disclosure" and asks lead agencies to include external trips associated with a project. This prompts the need for big data because traditional travel surveys, traffic count data, or traffic impact analysis do not necessarily have those external trips.

In the case of Placer County, its western part has great coverage with the SACOG screening map, but the eastern part of Placer County does not have useful details of trips or VMT. This prompted their hired consultant to suggest using big data to supplement travel patterns in the eastern part, which is less dense and to which annual/seasonal visitors are more attracted. They viewed that StreetLight data supplemented the needed information to obtain baseline VMT data and establish thresholds. They found the big data option was a more cost-effective one compared to developing a travel model for the eastern part. With big data, they can refresh as needed, while they anticipated so many challenges that come with building their own travel model, specifically for the eastern part. There is not enough granularity in the existing regional model for the eastern part because the county is shared with another MPO, Tahoe Regional Planning Agency (TRPA). For this reason, the SACOG screening map does not include that area. Fortunately, this big-data option aligned with their budget, as StreetLight data would be only extracted as needed for future projects.

The City of Citrus Heights is another example that uses StreetLight data to develop a block-group-level baseline VMT database. In their report, they compared the outcomes from big data against the SACOG region average and against California Household Travel Survey estimates and found that they were slightly different but in a reasonable margin given the nature of each dataset.[5]

Overall, local governments and MPOs have had a chance to be presented with big data and a few of them used big data on a few studies in the past through directly contracting them or via a consultant's contract. Except one interviewee, several interviewees we talked to mentioned that big data could be an alternative data source unless there is better data on VMT, turn movements, external trips, etc.

We identified two major vendors used in California so far in our research, StreetLight and Replica. Fresno COG, SACOG, and Santa Barbara County are the ones that used or started to explore contracting with Replica for modeling efforts and/or VMT analysis. Santa Barbara County has a blend of urban and rural regions that make it difficult to identify ways to mitigate VMT sources.

[5] http://www.citrusheights.net/DocumentCenter/View/16288/SB-743-Implementation-Guidelines-Adopted-42221?bidId= (accessed on May 1, 2023).

The use of big data, specifically Replica, has helped them understand demographics and more efficiently understand work and residential trip patterns. The interviewee said that this option was much more affordable than StreetLight at that time, and was made possible by Santa Barbara CAG, as their staff assisted with coordinating modeling and training for the platform. Our interviewee said that SBCAG is in negotiation with Replica to make the platform available to any local agency. We noticed anecdotally that Replica often offered lower costs than StreetLight, particularly for small regions.

SCAG also has a plan to provide access to StreetLight to their local agencies, starting from the summer of 2023. Their first contract started in 2021 that costs about $700k for a 1.5-year-long contract. It was first explored due to the increased interest from their partners and even the in-house modeling team. The interviewee shared the use of big data within the SCAG; data needs that were met by StreetLight were O/D analysis, zone-activity analysis, top route zones, trips for the preset geography (user-selected OD), ADT, and turning-movement counts. A couple of interviewees, including SCAG, discussed the limitations and concerns with location-based services (LBS), such as not knowing how the vendor manipulated and validated their data as they are inferential data coming out of a "black box". Sometimes, absolute numbers from the tool do not really match up that well with the previously collected/observed numbers that SCAG has. When they find a discrepancy between actual traffic counts that are observed versus what StreetLight generates, then they have more weight on observed traffic counts and use big-data-based tools as references. According to them, LBS-based big data is not the best solution, but it is one of the alternatives that they can utilize.

However, they expect that the utility of it would be different with local jurisdictions. If you go down to a smaller-than-regional level, their accuracies are higher compared to the regional level analysis. Along the same line, SACOG assessed in their SB 743 implementation report the potential of LBS. They state that the most beneficial part of LBS is to get VMT data for land-use types that are not available from regional travel models (SACOG 2020 report).[6]

This potential benefit to local governments has motivated SCAG to secure another contract with StreetLight. This time, it will be a three-year contract not only for SCAG staff but also regional partners including the County Transportation Commissions (CTCs), local governments and their hired consultants, and universities (as long as the usage of the tool aligns with the objectives of the Regional Early Action Plan (REAP) 2.0, which is to promote infill housing development and VMT reduction with housing policy). The interviewee said if local governments find it useful, they would use their data budget or even secure some other extra funding through local partnerships to continue this type of service.

[6] https://www.sacog.org/sites/main/files/file-attachments/sacog_sb_743_implementation_tools_final_report_june_2020.pdf?1595895391 (accessed on May 10, 2023).

This type of regional or multi-regional collaboration happened when many MPOs have been transitioning to ABM and purchasing additional data for new model validation and calibration. Gathering various pools of funding and budget to bring in big data access at a more affordable cost can be a feasible method for small MPOs, as smaller jurisdictions cannot afford to do so by themselves.

> *If we build a five-county regional ABM with Santa Barbara CAG and ABAG, they are two years away from their RTP. It will be more affordable if we all do ABM together. Santa Barbara CAG contracts out all their modeling and just started doing land-use modeling. The collaboration with these three MPOs is an advantage, it is only possible because we realized we are stronger together and learn from each other to find solutions and processes. (SLOCOG)*

So far, only a few were able to try and secure a contract with big data vendors, and not all had the resources to do so on their own.

> *Economies of scale helps. Currently MPOs must individually go after this big data. The bigger agencies have the resources, but it is very difficult and expensive for smaller agencies. (MPO)*

> *50k is budget for our modeling team a year, 50k is a budget for Replica or StreetLight for our region. (MPO)*

3.2.2.6 Attempt to Integrate Land-Use Model into Transportation-Modeling Effort

Above, we mentioned that the true implementation of SB 375 could be realized by the local's use of VMT quantification tools for their land-use plans and project-level CEQA reviews. Then, the land-use scenarios the local governments considered and selected could feed into the MPOs' regional travel models to take into account the interactions between land use and transportation. If there is a continuous feedback loop between land-use and transportation systems' supply and demand characteristics, and the systems' service and performance indicators, it would be an ideal and comprehensive model that integrates land-use, transportation, and environmental-impact modeling efforts.

We found that a couple of MPOs are currently working on developing an integrated land-use and travel model, along with a land-use monitoring framework tool. The MPOs include Shasta Regional Transportation Agency (SRTA), the Association of Monterey Bay Area Governments (AMBAG), the Butte County Association of Governments (BCAG), the San Luis Obispo Council of Governments (SLOCOG), and the Tahoe Regional Planning Agency (TRPA). According to one interviewee, they are working on developing an online land-use data collection framework like "MassBuilds".[7] Currently, they get this land-use information from locals by collecting building permits and what has been built since the previous cycle, with pipeline projects. Then, at the quarterly meetings with regional planning directors and monthly meetings with

[7] https://www.massbuilds.com/map (accessed on May 22, 2023).

housing planners, they gather updated information and collect project-approval information from cities and counties. They hope that this new online mapping land-use tool will streamline the data-gathering process and feed into the CommunityViz. CommunityViz is an ArcGIS extension and allows planners to do geospatial modeling of the effects of any potential plan or land-use change, including transportation and environmental impacts. The user interface of web-based platforms allows members to visually engage with parcels on the basemaps and eliminate the financial burden for software licenses, and it usually does not require the expertise and extensive training that is needed for GIS, CUBE, etc.

Then, they use CommunityViz to map every parcel in their region and aggregate parcels to reduce the number of geographies and processing time. Based on what they know about development projects and what is going to change in the future, as heard from locals, they run land-use scenario models. In the end, the land-use scenario model outputs will feed into the regional travel model.

> *We are working on developing land-use model, and for that land-use model we are going to create a framework to receive data* via *framework, something like MassBuilds. This is the initial step to collect data for that land-use model that we want to have in CommunityViz. Using this platform, we are able to receive all information about future development that we want…*

> *In doing so [land-use scenarios], they treat different areas in the region differently, because of how each are*a *prioritize projects in the pipeline; for example, if there is only 50% build out, they then do not need to evaluate every parcel in the model. [Then] run the land-use scenario model and export the output of CommunityViz and input that into the socio-economic portion of the regional travel-demand model.*

From the MPO survey, we learned that the MPOs provided some software licenses with technical support. However, one interviewee who was familiar with UrbanFootprint shared that it is not worth using UrbanFootprint for land-use plans in small cities as it requires in-house horsepower and many datasets as input. He suggested it might work for bigger cities and counties to quickly compare alternative land-use scenarios. Given the local governments' constraints and burden on the implementation of existing mandates in the state, it is difficult to expect them to pick up a new tool. An interviewee from an MPO echoed that from their experience of providing licenses (ESRI products), the actual use was not that much, less popular than they thought, and they ended up terminating the license-provision contract.

> *…that program has a whole suite of ESRI products; it has ended now. We had provided to 139 local jurisdictions with licenses, about 80%. After three years we tracked that not many members were using the access, this ended March 2022.*

> *It was determined that it was best for ESRI to conduct all the administrative tasks for local members that wanted to continue having access to the suite. It was done in a collaborative way, with about 50% participation from local governments. (MPO)*

This all indicates that asking local governments to take on the land-use modeling part and develop their own land-use scenarios using sketch models could be very burdensome and impractical given their resource constraints (staff and time).

Maybe a better way to do this is doing it at the regional level, led by MPOs, as the SRTA and four other MPOs have done. MPOs' role in collecting up-to-date land-use data and future development projections or scenarios from local agencies would need to be strengthened and the next step would be to update those scenarios quickly into their regional travel models.

3.2.2.7 Data-Exchange Platforms for Better Collaboration between MPOs and Local Agencies

The study by Laurian et al. (2016) found that the level of interaction that municipalities have with other levels of government to assist in the adoption of sustainability practices that are tailored for respective local regions is important. From the surveys, we found consistent findings with the study; local governments needed more transportation data but found many data unavailable, not necessarily knowing where to find such data, while MPOs provided data upon request but there is room for improvement in increasing access to various data that might help local land-use planning for GHG reduction. Helping local governments find the data they need and adopt new sources of information would increase local governments' confidence in their implementation and impacts on the intended goals.

In our research, we found that some MPOs are proactively supporting local governments with collective and collaborative efforts to access regional data and improve the granularity of information. We summarized some of the best practices that we identified among the interviewed MPOs, particularly around their recently launched platforms or framework that is being explored to enhance data exchange with local agencies. More detailed information can be found from the provided links or by directly contacting them.

SCAG

There are two approaches from SCAG that stand out, the Local Data Exchange (LDX) and the Local Information Services Team (LIST). The Regional Data Platform (RDP) from SCAG has many tools, data, and resources for local jurisdictions to support VMT and GHG-emission reductions. Amongst them is the LDX, which is a primary step to collect the most recent land-use and growth information from local jurisdictions. Local jurisdictions can access and review the datasets to make more informed land-use and planning decisions to help mitigate VMT and GHG emissions. This process creates a collaborative effort among SCAG members to improve land-use decisions on a local and regional scale.

The LIST provides specific supportive services to more than 150 local jurisdictions within SCAG, the team is comprised of approximately 15 staff members from respective departments. Their support includes demos and best uses of certain tools with Toolbox Tuesdays and one-on-one support to address questions with the RDP or accessing/using datasets.

More is coming and they are elaborated in this quote from an interview with SCAG staff.

> *New tools are being funded by the State for the Regional Action Plan (REAP) 2.0. There are three tools that we are thinking of including, one tool is the* Big Data Platform *with StreetLight data; it will be available to all local jurisdictions and academia researchers to better inform housing development. The intention is to make sure housing is better developed, to consider equity and infill development. This platform will help with that. Second tool is* Disadvantaged Community Active Transportation Tool*, more focused on active transportation and safety. It helps local jurisdictions with planning for safety and encourage more people to bike and walk in their neighborhood. We have the tool, but we are working on it internally to incorporate it on the RDP when it is ready to run. It is somewhat directly related to offsetting VMT. Third tool is* Regional Performance Monitoring Dashboard. *This will allow the public to track indicators and evaluate how we are doing with VMT levels, GHG emissions, jobs, etc. These are not available yet, but the Big Data Platform will be available first. The RDP is a centralized location/hub for all tools, data, and technical assistance that SCAG offers. Being that we have so many tools available and more coming out. The concern that we have is a good job providing information and technical assistance through LIST to provide guidance for tools and resources that are available. We need to have more momentum from local jurisdictions to use these tools. (SCAG)*

MTC/ABAG

MTC developed a tool in the last plan cycle called Bay Area Spatial Information System (BASIS). It is a web-based platform providing an inventoried database of trends associated with land use and development, made accessible with their Data Discovery Tool. BASIS is only accessible by local agencies of MTC with an ID/password, for which there was close to 100% participation from members. Agencies contribute by updating their land-use, zoning, residential permitting, and related datasets to develop a more robust regional understanding of future growth patterns. A feedback and review process helps validate information provided by local jurisdictions.

Bay Area Spatial Information System (BASIS): https://basis.bayareametro.gov/

The region also has a shared public transportation tap card network called Clipper 2.0; it serves 28 transit agencies and gathers ridership data for transfers between bus and rail. This could be an important data source for travel behaviors in the region as all transfers and origins and destinations could be analyzed from this.

Fact Sheet on Clipper 2.0: https://mtc.ca.gov/sites/default/files/RM3_Clipper_fact_sheet.pdf

SANDAG

To prepare for SB 743 and support their 18 member agencies to shift their metric from LOS to VMT, SANDAG created their Open Data Portal. The webpage contains SB 375 and SB 743 maps of the region and GIS datasets of various categories related to land use and transportation. SANDAG has a tradition of regular collaborative meetings with local members; currently, they are held quarterly. This collaborative effort has encouraged an extensive variety of datasets that are instantly available on the Open Data Portal. It is a unique region that has to also consider freight and tourism traffic with the Mexico–U.S. border in addition to VMT and GHG emissions sourced from residential and work trips.

Open Data Portal: https://sdgis-sandag.opendata.arcgis.com/

Data Surfer is a data warehouse for the San Diego region. You can get accurate census data, estimate and forecast information on population and economy, etc., and create reports based on your specific needs.

Data Surfer: https://datasurfer.sandag.org/

SRTA (and SLOCOG)

SRTA is currently using excel spreadsheet platform as a database where local agencies can input data on current development, future developments, estimated wealth, etc. They are working on developing a land-use model to create a framework that will be like MassBuilds. SRTA has developed an online mapping tool; so, people with GIS skills at local jurisdictions can use it to provide input next time.

MassBuilds: https://www.massbuilds.com/map

Then, they will run a land-use model using CommunityViz, then provide its output to their regional travel model. CommunityViz is an ArcGIS extension and allows planners to do geospatial modeling of the effects of any potential plan or land-use change, including transportation and environmental impacts.

CommunityViz: https://communityviz.com/

SACOG

Their VMT screening map was developed based on a tour-based model at the HEX geography level (hexagon), where blue and green hexagon areas are screened out for transportation impact analysis as they are below 85% thresholds of significance. It uses the Esri web-based platform to create two publicly accessible VMT screening maps that use a base map of the SACOG region.

The HEX geography is utilized to create a visual representation of per capita VMT of households and per job, which are compared to thresholds, 15% reduction of regional averages. These screening maps provide an open platform for COG members and the public to clearly determine if a project is meeting the requirements for SB 743. The platform is easily navigable and creates a clear visual representation with the use of colored gradient scales and VMT per capita details when a specific hexagon is selected.

SB 743 regional VMT project screening maps: https://sb743-sacog.opendata.arcgis.com/

The travel model user conferences website provided conference content archived over time to provide an overview and new information of their regional travel-demand modeling efforts to the attendees that include local government staff and private consultants in the region.

Travel model user conferences: https://www.sacog.org/travel-model-users-conference

Fresno COG

The SB 743 Regional Guidelines and Tools page on the Fresno COG site has an array of resources and tools that can completely inform and support member agencies on the VMT mitigation process. The training videos and tools are all publicly accessible and utilize web-based platforms, and do not require specialized software or training that might be difficult to cultivate in rural locations. This approach is well suited for the unique blend of urban and rural demands of the local governments in the Fresno COG region to be prepared to meet SB 743 requirements.

SB 743 Regional Guidelines and Tools: https://www.fresnocog.org/project/sb743-regional-guidelines-development/

4. Recommendations

4.1 More Funding Support

Some ideas for improvements in how SB 375 and SB 743 are implemented are drawn from both the surveys and interviews. Overall, the sentiment is that they would like to see more funding support from the state as the direction became more data-intense and data-driven. Particularly about funding, a lot of MPOs and local governments called for more funding, with reducing administration requirements in grants. Due to resource constraints, there is no staffing for extra reporting tasks and administration itself is perceived as very burdensome. An MPO staff shared that raising levels of VMT reduction would be very unrealistic as many cities are not even meeting the 15% reduction goals. Another MPO staff mentioned that they had a hard time developing scenarios and communicating with local jurisdictions when CARB previously had increased the GHG-emission-reduction targets from 16% to 19%. There is a struggle to help cities meet the previous and new mandates without additional funding on the MPO side. Furthermore, if big data use is a trend now, then wider support for that at the economy of scale would be an idea to reduce the cost and make it accessible to all regions in California.

However, we found that MPOs have not historically been a huge help to local jurisdictions when it comes to being a data resource. If MPOs were given more funding to build up their VMT data analysis capabilities including big data purchase, there should be assurances that the data would be useful to and shared with local governments. Access to data would mean they are easily accessible to local governments and easy to use by them. As mentioned in a previous chapter, there should be some statewide requirements to ensure that all MPOs across the state make the same minimum-level of data available to their local members and to ensure that the data are accurate/maintained.

On the local government side, without more staff time and budget, expecting them to reach out to other agencies, attend training, collect data, and build databases on transportation and VMT is impossible. In addition, not all jurisdictions have at least one planning staff with subject area expertise (such as travel modeling, affordable housing, CEQA, etc.) as staff wear many hats in small jurisdictions. Assuming staff are lay people about changes in legislation, new interfaces, data, tools, terminologies, and skillsets might help design training materials and resources more accessible to any planning staff.

> *I just attended a training and I feel like if I go and try to search for stuff, I am not going to be able to find them…I feel like we would need more consistent training opportunities. And like someone reaching out and telling us what datasets are available to us, because I do not really know. I do not feel like I have a good relationship with the MPO. They reach out to us when they want to provide a training, but the trainings are not consistent. Like they're not as far as I know, they do not happen every year, or maybe they do, and I just do not know about them. Then, I would just really like to understand all the assumptions that they make, because those are all done behind the scenes, so I have no idea. They showed us their GIS interface, but I*

think that is it. They just assume that we understand everything already. I wish that they talk to us more like we were lay people, like we do not know anything, because that would be really useful. (Local)

It would be nice to have more guidance, because we have a consultant to prepare a VMT tool in our VMT policy and our VMT reduction measure, but even they did not know much. (Local)

Even though there are a lot of sketch tools out there that helped project-level VMT analysis, some planning staff shared reservations and uncertainty about how VMT is measured in the tools and needed some confirmation on what can be done for the next 10 years. That uncertainty also comes from the transition of their MPO's four-step model to ABM. Due to the "apples-to-apples" comparison by OPR TA, once ABM is completed by the MPO, locals' current VMT analysis tools developed based on four-step models would need to be updated with the outputs from ABM. These are expensive activities that usually involve private consulting firms that require funding.

4.2 Centralized Leadership

The OPR technical advisory refers to the CAPCOA (2010) Handbook,[8] which was also mentioned by several interviewees as the main source for mitigation measures and has been updated in 2022.[9] It provides guidance for VMT-mitigation measures that would most likely work in urban areas; so, it has been consistently criticized by planners in suburban and rural areas (Volker et al., 2023). What is critical is to find a cost-effective solution that produces a sizeable VMT reduction and where its efficacy is easy to monitor over time. Most of the interview participants shared the sentiment that those solutions do not exist yet and that all have been trying to avoid situations to mitigate VMT impacts from a project.

*…we have not done any of them [VMT mitigation cases]. Because the developers just want to avoid that. So, we don't really know how to implement that... and we would also need to monitor it. So, we do not have the staff time to do that, either. So, we are like muddling through? Because we do not know how it is all going to work out in the end… I think a develo*per se*es that as an extra cost, because someone will have to manage the program and they just do not want to have to do that. Because that is basically for the life of the project.…the developer [would] need to build bicycle or pedestrian infrastructure, but we do not know how much we can ask for. Can we ask for a sidewalk here or can we ask for a full bike path? And how much for how long? It is just really complicated. (City)*

With the urgency to meet the goals of SB 743, there is still a general lack of certainty as to which approaches and models are most effective and can create the highest and best use for VMT

[8] CAPCOA (2010) *Quantifying Greenhouse Gas Mitigation Measures*, p. 55, available at http://www.aqmd.gov/docs/default-source/ceqa/handbook/capcoa-quantifying-greenhouse-gas-mitigation-measures.pdf (accessed on June 1, 2023).

[9] https://www.fehrandpeers.com/greenhouse-gas-and-vmt-mitigation-measures/ (accessed on June 10, 2023).

reduction, while still considering the unique needs of each region. While the report from Elkind et al. (2018) mentions that a VMT-mitigation bank or exchange will assist in offsetting the VMT of new developments, the authors also weigh the complexities of such models and how to ensure validity, effectiveness, and equity among agencies within a larger region.

We found that there is a great level of interest in exploring VMT banks and exchanges and several studies and pilot programs are on the way.

We have all these great infrastructure improvements to reduce VMT, but we have no money to pay for it. Is there a way to do a regionwide bank, exchange, in-lieu fee program? Call it what you want to fund some of this. [There are] Lots of issues there and that will be part of the stuff that we go forward if we get grant funding. (MPO)

In terms of other mitigation measures, I think the entire state needs more data. For mitigation right now, we need to think about on-site or off-site, regional, etc. I think everyone is exploring a mitigation bank or mitigation exchange, or fees. We are one of the leading agencies that are looking into a VMT bank or exchange, but we are still working on that. (MPO)

Ongoing research and tracking will be needed to evaluate what approaches and methods are best suited to assist local governments in land-use planning decisions to effectively reduce VMT and GHG emissions. A recommendation is made for a state entity monitor VMT mitigation bank/exchange pilot projects to evaluate their potential to reduce VMT. As we are not 100% sure yet that these new ideas will reduce VMT, it is critical to examine any evidence to support that claim. This approach could assist city and county agencies to readily align with a regional land-use vision.

It is more of the OPR. I think they need to have some guidelines on VMT mitigation, and they need to have some legislation to back it up. Right now, it is too much of an open book and everyone is waiting for a lawsuit to figure it out. I think that is not proactive planning. I think they should proactively determine what they consider mitigation for VMT and how they can do something on a more holistic basis. (MPO)

It is an open question right now, looking at a bank or an exchange. [I have] been on several studies on Caltrans planning grants, one just ended with a Transportation Authority. They just have developed the framework for a mitigation bank or exchange. They are going to pilot it as a next step, but all this is going to go to their board next month. (MPO)

With the cumulating of data sources of VMT and evidence of a VMT-mitigation effort, a central data repository could be created in a state department or at every MPO regarding VMT/GHG emission reduction goals.

4.3 Timely Coordination across State Departments

It is obvious that planning staff at local governments and MPOs have all been bombarded and are just trying to keep up with recent changes in the laws around housing, transportation, and climate change. The common theme that arose from the interviews was a time lag between different mandates and when the updated data/model/implementation kicks in. For example, there are different cycles of different things such as RHNA (by California Department of Housing and Community Development (HCD)), RTP and SCS (by Caltrans and MPO), population projection (Department of Finance), and various rules and activities by the Air Pollution Control District and Water Resources Control Board, that all in some way affect land-use plans and projects by local governments.

> *There's a huge issue right now with all of the cities in California are updating their housing elements. And the current [regional travel] model, it does not reflect all the new housing units, but we need to plan for the next eight years. So, I do not know how useful the [current] travel model will be after this year, because it will not have the future housing that is needed, like assumed into the model…. if we change our zoning, that should change I think the assumptions in the regional model. I do not know how soon they are going to do that, or I do not know what kind of coordination is going to happen. (City)*

Moreover, some local governments found some overlaps across different mandates regulated and/or certified by different state departments or state agencies. A local government interviewee shared the situation with the state's Water Resources Control Board; they issued a cease-and-desist order due to the over-drafting of the local water source. That means the local government cannot have any new water meters (new housing) until the order is lifted. That limits the ability to construct new or infill housing significantly and the locality runs into a dilemma.

An MPO staff shared his experience of contradiction or discrepancies across the state departments, in this case, between the Department of Finance and the Department of Housing and Community Development.

> *I am concerned about AB 1335; we need to work closer with Department of Finance and their growth projections. The RTP process is long and targets from 2017 carried forward to today, yet Department of Finance has changed growth projections a couple years back, reducing projections from 315,000 to currently 285,000; essentially projecting growth of 5,000 people by Department of Finance in 10 years. However, RHNA process from HCD has targets of 11,000 new homes by 2029, these are contradictory targets for us. (MPO)*

> *The state needs to be more consistent on laws between its departments. Caltrans and OPR have worked together on SB 743, but more coordination needs to happen. In the end local agencies and rural areas get hurt with overlap and contradiction of requirements. (MPO)*

The difficulties with the discrepancies in growth projection numbers hamper the synergy that is expected from all of the orchestrated effort around smart growth. Another difficulty that came up during the interview is that the SCS is not allowed to take account of all the state changes, including the mandates for electric cars (EVs) and hybrids. CARB only allows MPOs to take into account the money that has been spent on VMT and GHG reductions. This challenge is more likely to arise in areas without light rails or efficient transit options. Moreover, in the near future, all MPOs might need to prepare for a no-growth model, or population decline and how to still meet VMT/GHG reduction goals with efficiency metrics (per capita, per employee).

The rural setting in Central Valley has been able to address GHG emissions by meeting standards established by the San Joaquin Valley Air Pollution Control District. The thresholds established focus on metrics to improve the health and quality of life for Valley residents through "efficient, effective, and entrepreneurial air quality management strategies." The interviewee argued that reducing air contaminants sourced from agricultural and industrial infrastructure was better suited for their rural region where it is difficult to specifically reduce VMT in their current setting with low density and lack of sufficient infrastructure for alternative modes. Another interviewee from Centra Valley also cited Rule 9410 as being beneficial in establishing and implementing job-based trip reductions for new developments to reduce VMT and GHG emissions in their region. However, in their opinion, this makes it difficult for them to further reduce VMT as there is so much overlap between different mandates.

> *We get very specific comment letters from like San Joaquin Valley Air Pollution Control District on their metrics for air contaminants or say health risk assessments. I think they have very established standards that we can judge our projects against. And they do not necessarily have that for GHG or VMT. So, it would be nice to get a specific comment letter from them about those items as well, so that we could rely more on the states and their evaluation of projects. (Central Valley)*

In sum, all of these discrepancies, contradictions, different cycles of things, and overlaps create confusion and burden at the local level. More collaboration, cross-checking, and adjustments would be needed to reduce those hiccups and alleviate doubts about VMT/GHG-emission-reduction efforts.

5. Transportation Data Guide

The surveys and interviews bring attention to the void of transportation data. In other words, there are transportation data that are needed but not fully accessible and utilized by local governments for various reasons. Identifying the sources of the data and increasing the accessibility to the data can help local governments make sustainable land-use decisions in a way that reduces VMT/GHG. Based on the void of transportation data identified from the surveys and interviews, we developed the guides for transportation data adoption/utilization for local governments and MPOs' land-use and transportation coordination. Due to the distinct processes, elements, and scales of SB 375 and SB 743, this research suggests two guides for each planning practice: one for general plan and RHNA updates along with SB 375 and the other for VMT estimation for the development review according to CEQA and SB 743. The guides include multiple scenarios that can be adopted by local governments depending on their geographical, social, and physical characteristics. Each scenario suggests the list of adoptable/utilizable data. According to the findings from the survey, we identified and listed publicly available data. While this guide briefly overviews the data, the details of the data can be found in Appendix D.

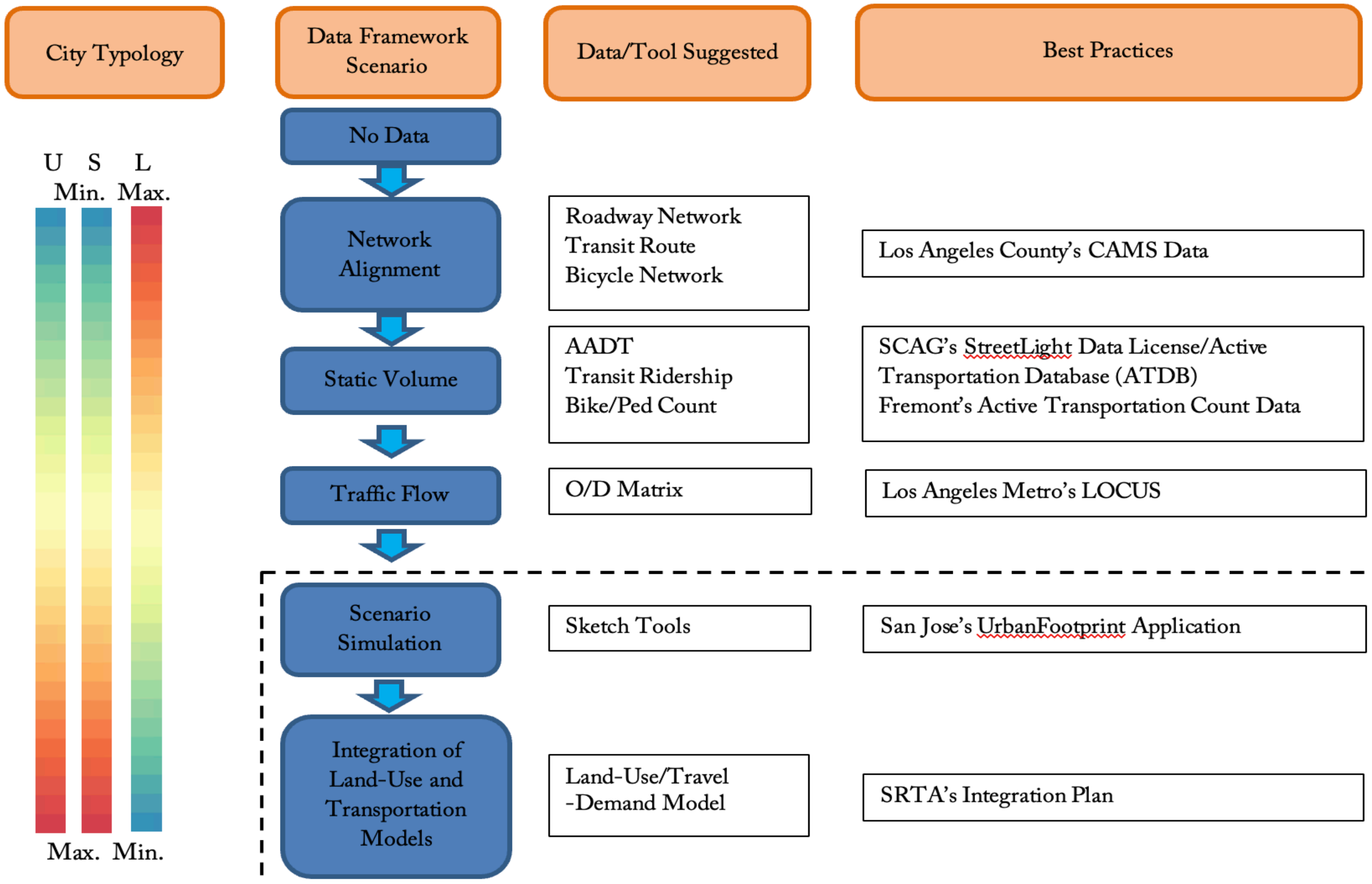
5.1 Data Utilization Guide for Land-Use Plans

This guide proposes data adoption/utilization scenarios depending on the typology that represents the variations of local governments in terms of size, location, levels of development, and so on (Figure 15). This guide was designed in a way that reflects the findings from the surveys and interviews. As identified in the surveys and interviews, the levels and demands of transportation data adoption/utilization vary by local governments. For example, small, rural towns may be able to apply sustainable land-use decisions to their general plan update without sophisticated and expensive big data, while large metropolitan cities may demand extended transportation data for VMT/GHG reduction. In the same vein, the built-out cities may also have different levels of data demands compared to those not built out. Thus, it is reasonable to flexibly address the demand for and utilization of data by the characteristics of cities. The city typology section in the figure illustrates this equity and variation issue by the capacity of the cities. The Data Framework section reflects the level of transportation data adopted and demanded by local governments. After carefully analyzing the three data levels (basic, intermediate, and advanced), we reconfigured the levels into six data framework categories. This allows sophisticating the range of data adoption from "No Data" (no adoption) to "Integration of Land-Use and Transportation Models" (a visionary plan that incorporates local land-use and travel-demand models). The Data/Tool Suggested section lists the minimum datasets corresponding to the data framework. According to the framework, we rearranged the datasets that were included in the surveys. The Best Practice section reflects what we found from the interviews. The best practice cases identified in the interviews were integrated into the data framework.

We developed five data adoption/utilization scenarios, which include "Network Alignment", "Static Volume", "Traffic Flow", "Scenario Simulation", and "Integration of Land-Use and

Transportation Models”. In general, the order of the scenarios indicates applicable scenarios from small, rural towns to large, urbanized cities. In other words, the “Network Alignment” scenario is designed to support small, rural cities/towns that maintain consistent social and physical conditions. The “Integration of Land-Use and Transportation Models” scenario at the other end of the spectrum is perhaps more appropriate for metropolitan cities that need sophisticated land-use strategies in order to reflect complex social and physical changes to VMT/GHG reduction.

Figure 14. Transportation Data Utilization Framework by City Typology



Note: U = Urbanization level; S = Size of the city; L = Local knowledge dependency level; Min. = Minimum; and Max. = Maximum.

These scenarios were designed to help local governments adopt a strategy that works for them depending on cities' interests, demands, and situations. After thinking of where they are and what they want, local governments may want to choose a scenario that fits them. It is also noteworthy that local governments can create their own customized strategy by combining multiple scenarios or adding to and subtracting a part of the suggested data from one scenario. For example, when a city identifies itself as somewhere between the "Network Alignment" and "Static Volume" scenarios, the city can customize the data adopted/utilized by mixing and matching the data suggested in two scenarios.

5.1.1 Network Alignment

Network Alignment refers to the scenario where local governments adopt/utilize transportation-network data for their land-use decisions. The network data do not include traffic-volume data. Instead, they simply capture and represent the physical location of transportation infrastructure.

Although this scenario represents a primitive approach in terms of reflecting VMT/GHG reduction concerns to land-use/housing decisions, it may work for small, rural cities/towns. In the state of California, there are many small, rural cities. Approximately 212 (44 %) of 482 cities/towns in the state have a population smaller than 25,000. They tend to be geographically small and located in rural or suburban areas. Since the cities/towns do not experience much population increase and development pressure, there is a relatively high consistency in the social and physical structure of the cities/towns. The areas to which land-use changes and strategies may apply are limited, and they tend to not be very proactive in terms of updating their general plans. It is also often observed that local planners in the cities/towns have a good understanding of local areas and a high level of local knowledge. In the cities/towns, it would be beneficial to overlay transportation network data with the cities/towns' land-use maps. This will help them visualize physical relationships between major transportation corridors (links) and their core facilities and anchor points.

It is critical to secure transportation network data by transportation mode. Since the primary transportation mode in many small, rural cities/towns is the automobile, roadway network data will be essential for this scenario. Although there are various sources that provide roadway network data, the following can be reliable sources.

- The U.S. Census TIGER road file (https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html, accessed June 18, 2023): The U.S. Census provides linear road features, called the "All Roads" shapefile. The shapefile is delineated by county boundary and annually updated. The shapefile contains all linear street features classified by the MAF/TIGER Feature Class Code (MTFCC). The code represents the hierarchical types of all street features (e.g., primary roads, secondary roads, local neighborhood roads, rural roads, city streets, vehicular trails, ramps, service drives, walkways, stairways, alleys, and private roads). The shapefile also contains multiple overlapping road segments where a segment is associated with more than one road feature.

For example, if a road segment is associated with US Route 36 and State Highway 7, and 28th Street, the shapefile will contain three spatially coincident segments, each with a different name.

- OpenStreetMap road file (https://www.openstreetmap.org/, accessed June 18, 2023): OpenStreetMap (OSM) is a free, open geographic database updated and maintained by a community of volunteers via open collaboration. Contributors collect data from surveys, traces from aerial imagery, and also import from other freely licensed geodata sources. OSM allows users to define a geographical boundary and download linear road features in a GIS format (shapefile). Like the TIGER file, OSM road files contain road classification data (e.g., freeway, trunk, primary, secondary, tertiary, residential, pedestrian, and so on). The OSM road files also contain the speed limit data of each roadway segment, although the data are not comprehensive.

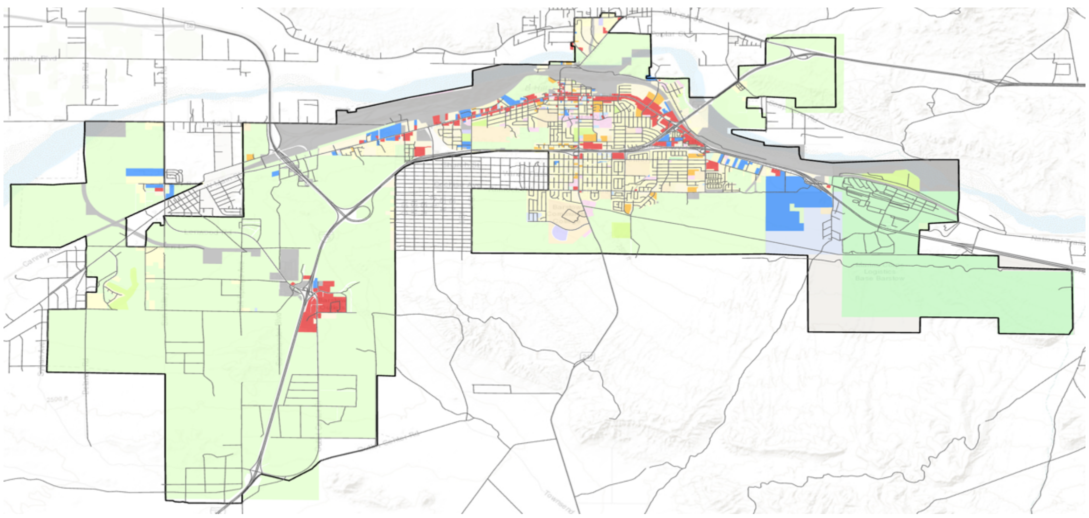
In the case that highways and truck routes passing by or through significantly influence the cities/towns' traffic, it would be beneficial to separately overlay highways with the land-use layer. While it is possible to separate highways from the roadway feature files mentioned above, Caltrans also offers a highway shapefile (https://gisdata-caltrans.opendata.arcgis.com/datasets/77f2d7ba94e040a78bfbe36feb6279da_0/about, accessed June 18, 2023). Each record represents a segment of the California state highway where the county, route, post mile prefix, and post-mile suffix are unchanging, and there are no gaps or overlaps in the post miles. Each segment is coded with the district, county, route, post mile prefix (if any), begin post mile, end post mile, and post-mile suffix (if any).

Additionally, transit and bicycle route data can be also utilized when the cities/towns want to incorporate them into their land-use decisions. As the survey indicates, many local governments seem to acquire transit-route data from local transit agencies. This is a good practice, which allows them to collect the most up-to-date local transit route data. Since it is a general practice for MPOs to collect transit route data, the MPO to which each city and town belongs can be a reasonable source of the data. In the case that local governments want to simplify this data collection procedure, the National Transit Map data by the Bureau of Transportation Statistics can be a reliable source for transit-route and -stop data (Appendix D.1). The data capture a set of nationwide geographic databases of transportation facilities, networks, and associated infrastructure. The data are easy to download.

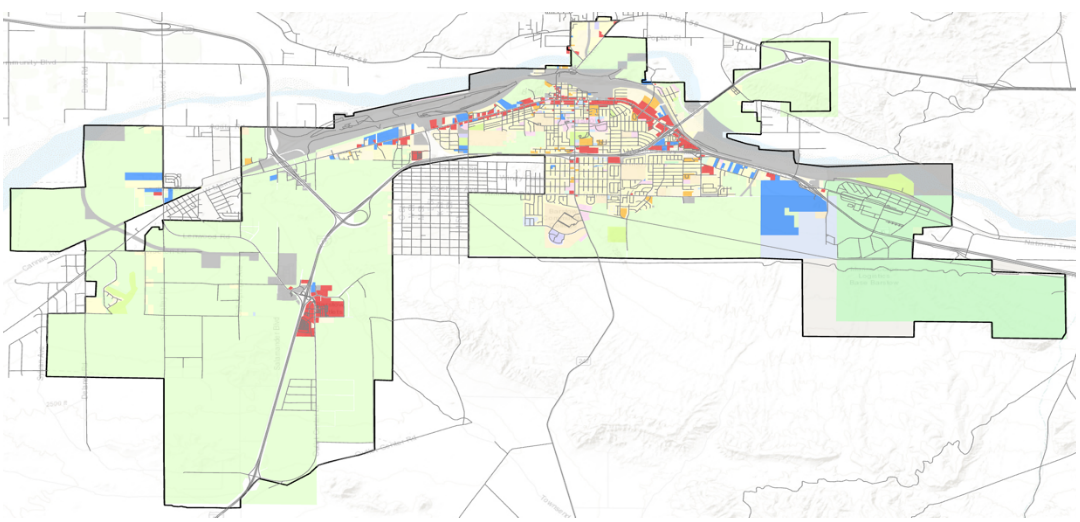
Like transit route data, bicycle route data are locally oriented data. Commonly, it is expected for local governments to develop and maintain bicycle route data in their jurisdictions. If not, MPOs or local bicycle coalitions would be expectable sources of bicycle route data. The California Bicycle Coalition (CalBike) compiles bicycle route data in the State of California and makes them available for download (Appendix D.2). The figure below illustrates how the transportation data can visualize spatial relationships with a city's land use using a small, rural city, the City of Barstow (Figure 16).

While multiple sources for decent roadway network data are available, we found Los Angeles County's impressive effort in developing and managing its roadway network data, called the Countywide Address Management Program (CAMS) (Appendix D.3). Developing a centralized repository of an authoritative physical address database, CAMS offers an accurate road segment file also called "street centerline" that includes the start and end geography of the approximate road feature. Since the data consist of address ranges that associate with each roadway segment, the data support address matching (also known as geocoding), which refers to the process of converting street addresses into geographic points on a map.

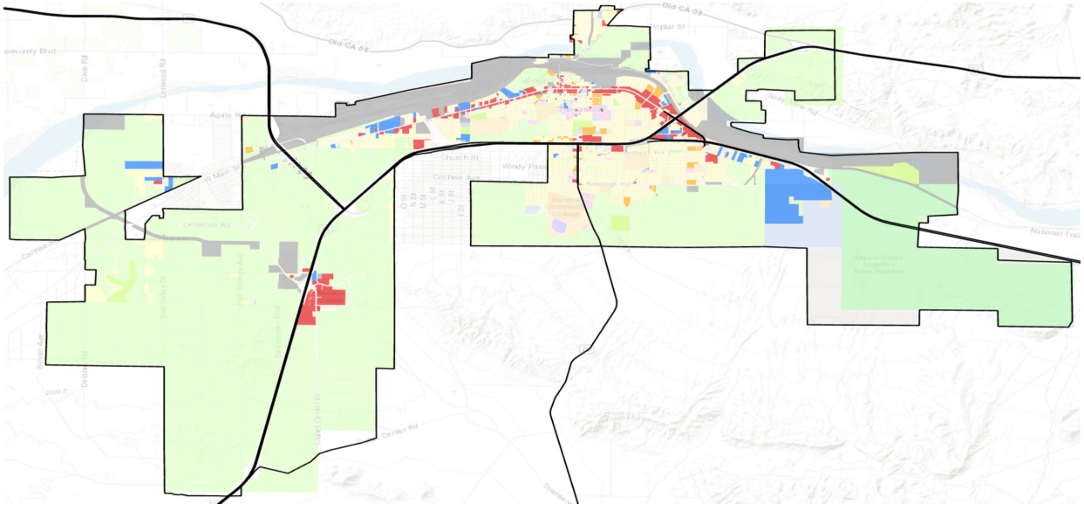
Figure 15. The Network Alignment Scenario Example



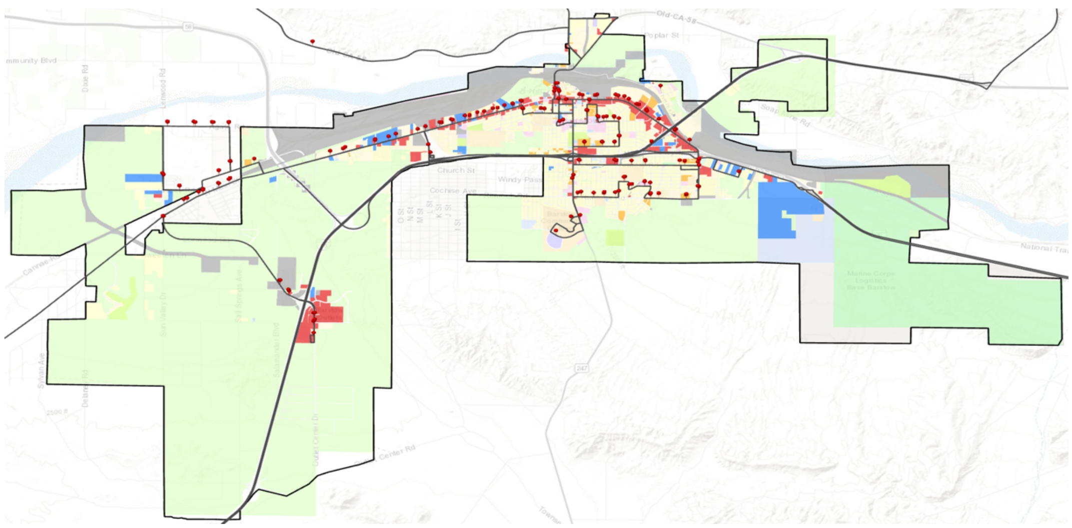
U.S. Census TIGER Road Data



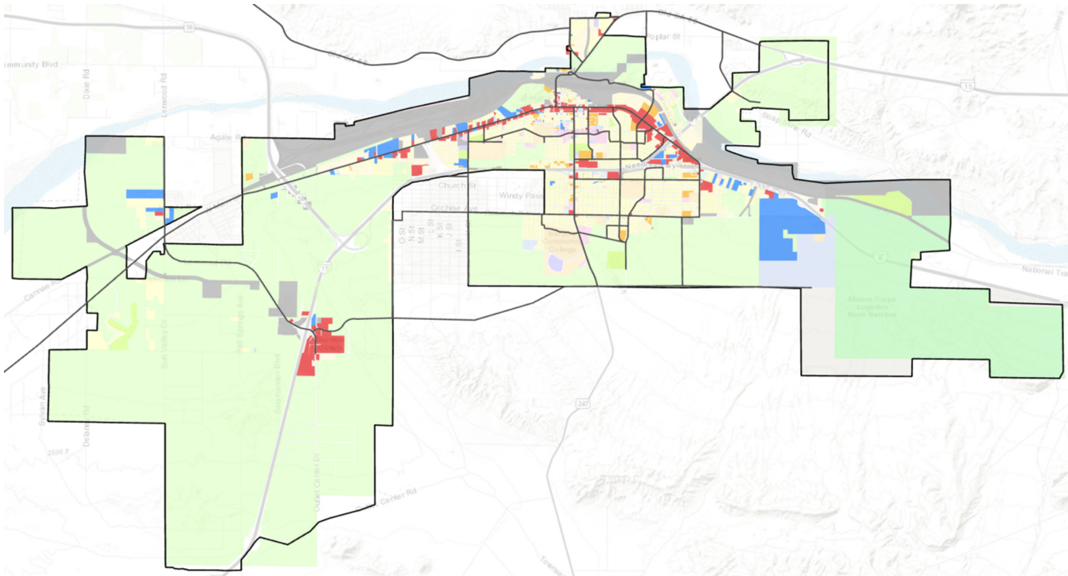
OSM Road Data



Caltrans State Highway Data



National Transit Map Route and Stop Data



Local MPO (SCAG) Bikeway Data

5.1.2 Static Volume

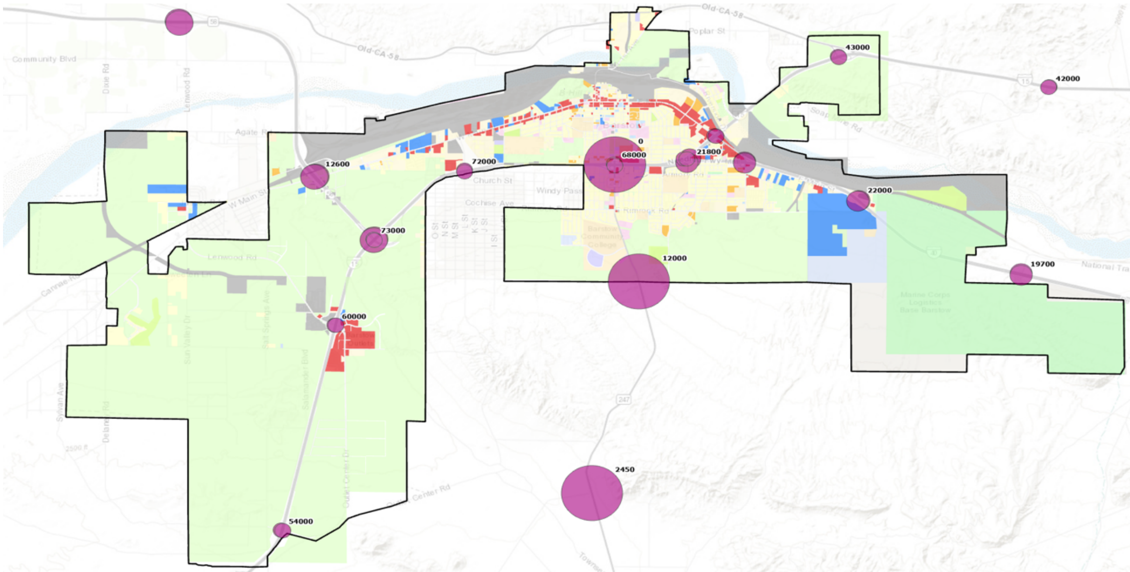
The "Static Volume" scenario refers to the case that local governments adopt/utilize traffic volume data for their land-use and housing-allocation decisions. This scenario was named "static" since the traffic volume data represent a static snapshot of the traffic volume on roadway segments. For example, the data often mean a standardized traffic volume such as VMT and AADT on roadway segments, transit ridership such as the number of access and egress at transit stops, and bicycle or pedestrian counts at intersections.

There is a wide range of traffic volume data available. Highway traffic-volume data will be valuable for small- to medium-size rural and suburban cities that major highways pass through. According to the interviews, these cities are concerned with a large volume of traffic that passes by their jurisdictions (also known as external–external (EE) trips), particularly for SB 743 implementation. Although EE trips are not generated by the cities, they significantly influence their traffic flow and VMT/GHG-reduction strategies.

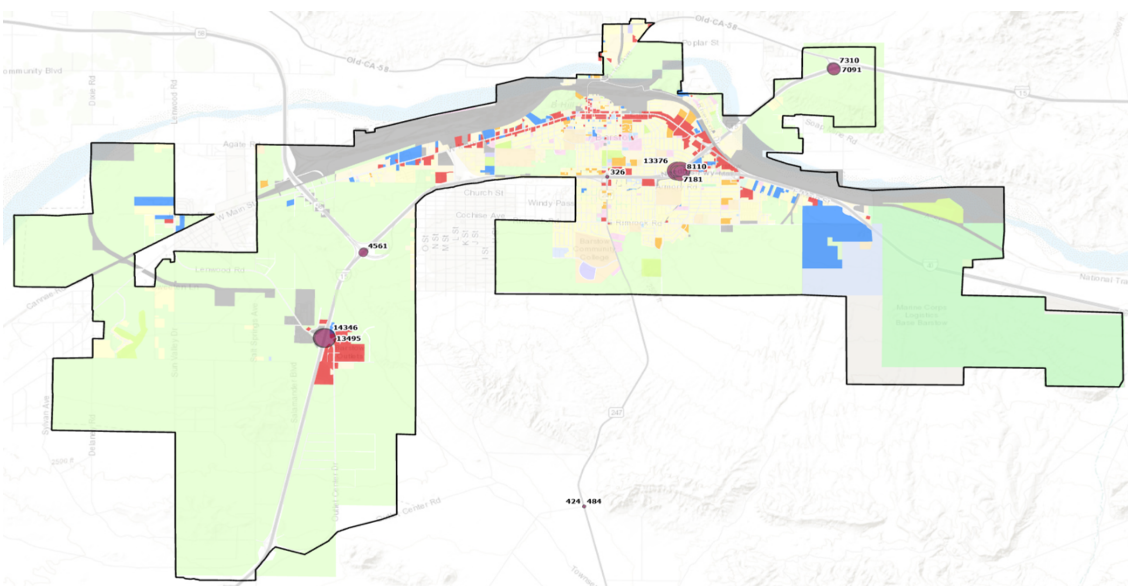
Caltrans' highway AADT data can provide the cities with insight into EE trips (https://gisdata-caltrans.opendata.arcgis.com/datasets/d8833219913c44358f2a9a71bda57f76_0/about, accessed June 18, 2023). The data contain traffic volumes (counts) on the California state highway network. Similarly, Caltrans provides truck AADT data (https://gisdata-caltrans.opendata.arcgis.com/datasets/c079bdd6a2c54aec84b6b2f7d6570f6d_0/about, accessed June 18, 2023). This is the total truck traffic volume divided by 365 days. The data will support the cities to have a better understanding of traffic flow on highways and trucks, especially the highway and truck volume data at major gateways of the cities help cities analyze their EE trips.

Taking the City of Barstow as an example, Figure 17 illustrates how the highway traffic volume data can show the impacts of the traffic passing through the city.

Figure 16. Highway Traffic Volume



Caltrans Highway AADT data



Caltrans Truck AADT data

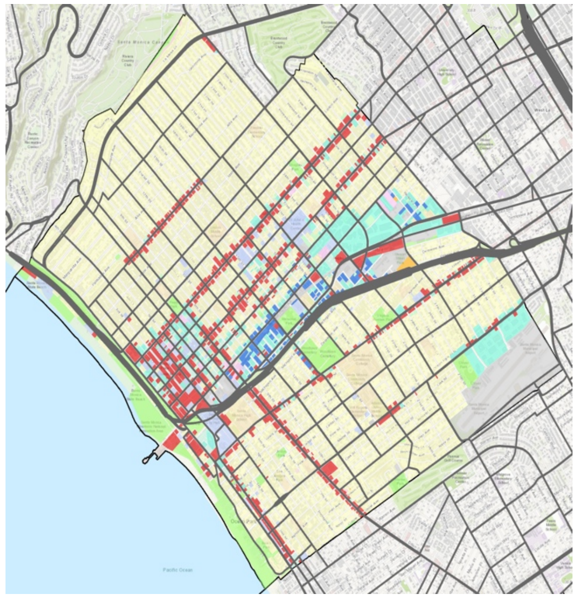
It is clear that the traffic volume on highways is not sufficient for larger and more urbanized cities. Taking into consideration the fact that the cities have more sophisticated roadway networks, complex travel patterns in the cities, and more dynamic traffic flows with surrounding areas, the cities may need to adopt/utilize more extended traffic-volume data. Local MPOs are always the primary source of automobile traffic volume. MPOs create their travel-demand models (TDMs) for RTP, and the TDMs consist of traffic volumes of major roads in their jurisdictions. It is common for the TDMs to consist of traffic volume by time of day (e.g., morning peak hours, mid-day afternoon peak hours, evening, and so on). Thus, the traffic volume data can play an important role in figuring out the cities' travel patterns. However, one of the drawbacks of the TDMs is that they do not include all the roadways in the cities. Instead, they tend to contain major roads in MPOs' jurisdictions. Thus, the TDM traffic-volume data may not be detailed enough for local applications. The survey also found that it is a common practice for local governments to collect automobile traffic counts. The count data can fill the gap in the TDM data.

According to the survey, local governments often collect transit-ridership data from transit agencies based on strong collaboration. This is a good practice since transit agencies collect and maintain transit ridership data that are applicable to local planning practices. The data include the number of accesses and egresses at each stop and station. Other sources that can provide the latest transit-ridership data are very limited.

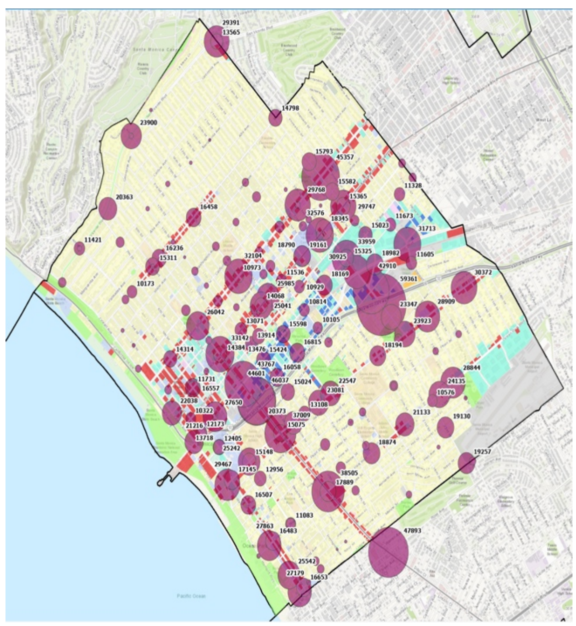
Many local governments are interested in taking consideration of active transportation including biking and walking as one of the sustainable transportation modes. It is expected that local governments collect their own active-transportation count data since active-transportation activities primarily create local traffic. Some cities such as Fremont have done a great job of collecting bicycle and pedestrian count data. Another exemplary work in regard to active-transportation count data is SCAG's Active Transportation Database (ATDB) (Appendix D.4), which collects and stores bicycle, pedestrian, wheelchair, and scooter/skateboard volume counts from infrastructure and planning projects across Southern California.

By adopting/utilizing the data, local governments can visually associate physical relationships between their land-use and transportation conditions. The figure below illustrates the example of the "Static Volume" scenario using the City of Santa Monica as a study case (Figure 18). As the figure illustrates, the data transfer the overall picture of transportation conditions in the city. When the City of Santa Monica wants to apply a land-use strategy (and/or housing allocation) to a specific area in the city, for example, the data allow the city to explore the current transportation status of the area. By doing so, the city can link the strategy and transportation conditions of the area.

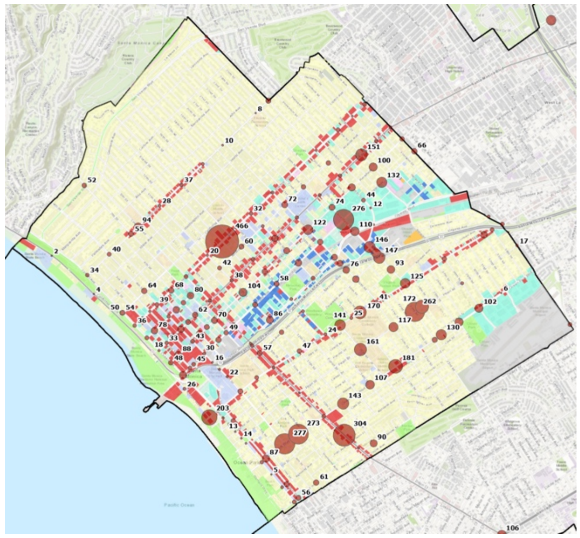
Figure 17. Example of Traffic Volume Data



SCAG's TDM VMT data



Santa Monica's traffic count data



SCAG's ATDB pedestrian count data

Although various traffic volume data are available, local governments' concerns about the data were identified in the interviews. They include that MPOs' TDM data may not be detailed and fine enough to analyze local travel patterns and phenomena and that data collection (both automobile and active transportation) requires significant costs. We found that SCAG's StreetLight data license purchase can be a perfect resolution for the concerns (Appendix D.5). StreetLight Data is an on-demand mobility-analytics platform that provides traffic-volume data based on big data from mobile devices. The data includes not only automobile traffic volume data but also transit-ridership and active-transportation volume data. SCAG purchased the license for the data and provided it to all the local governments in its jurisdiction. This approach will contribute to satisfying locals' demands on transportation volume data.

5.1.3 Traffic Flow

The "Traffic Flow" scenario refers to the collection of data that can support the analysis and visualization of the movements of cars and passengers. When making land-use and housing-allocation decisions, local governments need to consider the flow of traffic from trip origins to destinations. Unlike the static traffic-volume data that represent how many cars and transit riders are on specific sites (e.g., the number of cars on a roadway segment or the number of transit riders at a bus stop), the traffic-flow data measure and present how many cars and transit riders move from the trip origin (from where) to the trip destination (to where).

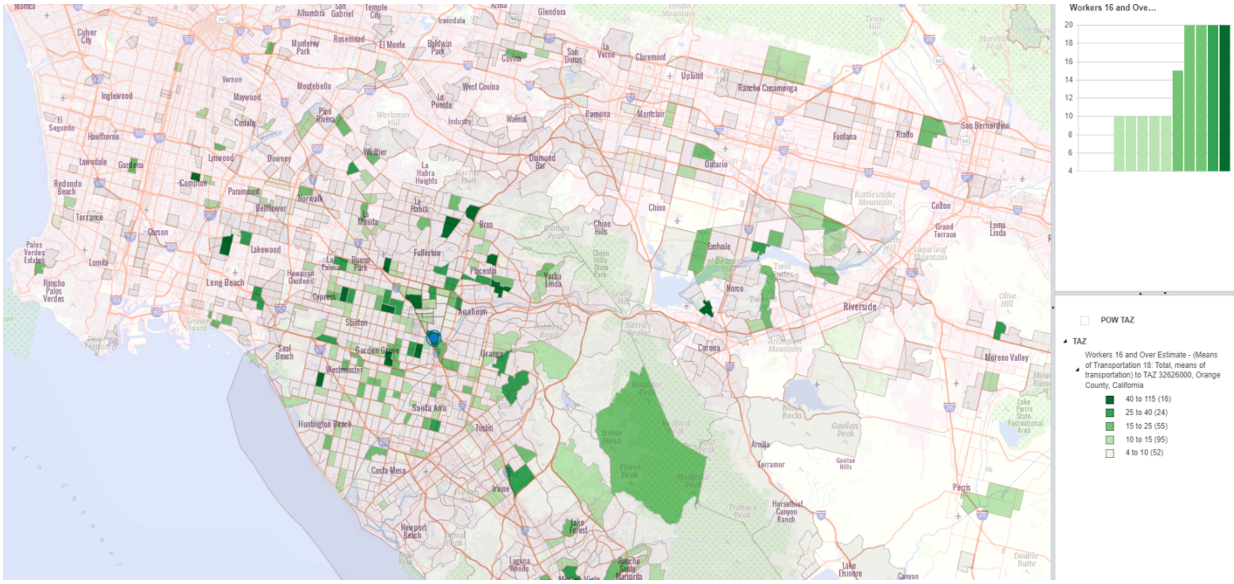
This scenario may be primarily applicable to medium-to-large cities that are located in urbanized areas. The cities tend to have multiple activity centers that make their residents' travel patterns complicated. Consequentially, land-use and housing-allocation decisions become complex and need to consider the dynamics of land-use changes in multiple geographical areas and their impacts on VMT/GHG reduction. Hence, planners' local knowledge becomes less reliable. Thus, understanding the traffic volume that moves from one point in the city to another can be invaluable information.

The primary traffic flow dataset is an O/D matrix, which refers to a table (in the format of a matrix) that stores the description of movement in a certain area and is used to assess the demand for transportation. Each cell in an O/D Matrix is an intersection of a trip from an origin to a destination, and the higher the number of these trips, the more this route is in demand. An O/D matrix can be acquired from MPOs since the matrix is an element of MPOs' TDM. MPOs' O/D matrix typically captures traffic flow between TAZs. Since the TDMs generate multiple O/D matrixes by travel mode and trip purpose (e.g., commuting trip, shopping trip, social trip, and so on), the matrixes can support picturing comprehensive travel patterns in a city in detail. However, the drawback of the O/D matrixes is the difficulty of format conversion. The matrixes are created and stored in a unique format selected by the TDM software that each MPO chooses. This makes it hard to convert the matrixes into a format which local governments are familiar with (e.g., an Excel table or GIS file). Therefore, MPOs and local governments need to collaborate to develop methods to facilitate format conversion and promote matrix sharing in the future.

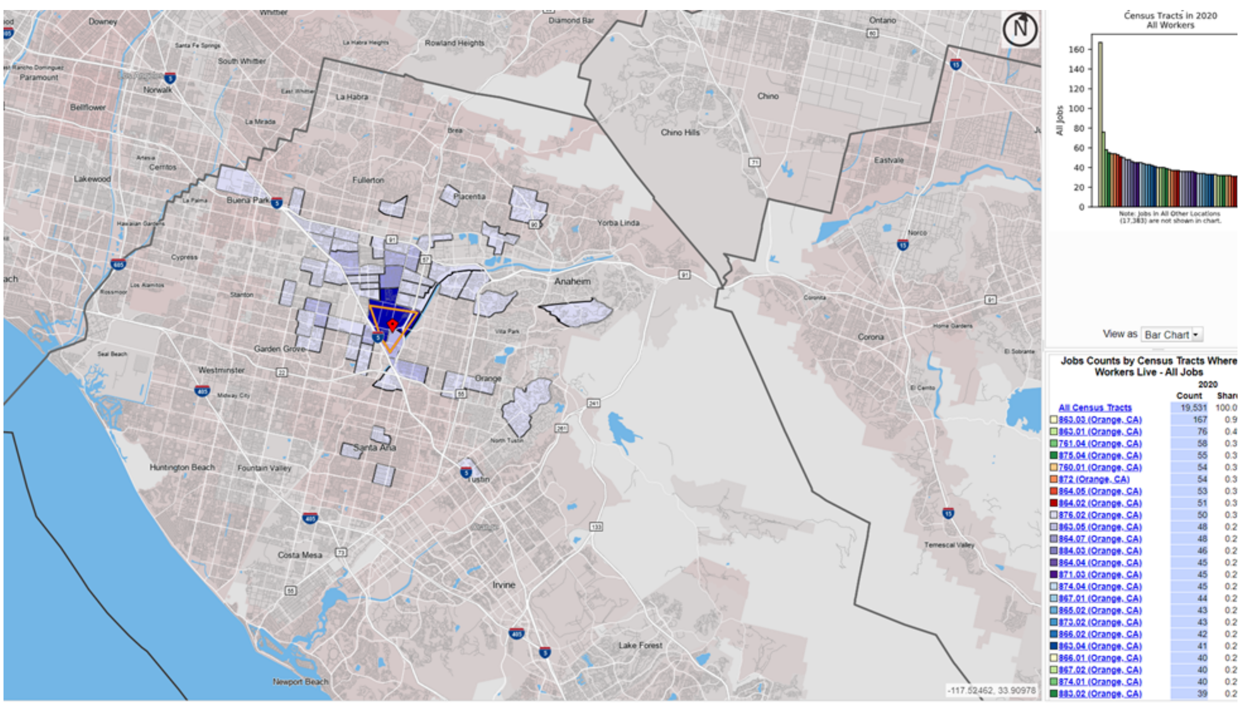
Alternatively, other resources provide traffic-flow data that can support local governments' land-use and housing-allocation decisions. First, Census for Transportation Planning Products (CTPP) data offer the O/D matrix by travel mode at the census tract and TAZ levels (Appendix D.6). The data, which were built based on U.S. Census American Community Survey (ACS) data, primarily offer the flow of people along with their socio-demographic characteristics. However, the traffic volume captured in CTPP represents only commuting trips. The other source for traffic flow is the Longitudinal Employer-Household Dynamics (LEHD) Origin–Destination Employment Statistics (LODES) (Appendix D.7). The LODES data can be used to answer questions about spatial, economic, and demographic questions related to workplaces and home-to-work flows. Like CTPP, LODES data capture only the flow of commuting trips at a census-tract level. Additionally, the LODES data classify commuting trips by industry type, workers' age, and workers' earning level.

The figure below illustrates the example of the O/D matrixes using the City of Anaheim as a study case (Figure 19). Let us say that the City of Anaheim considers the application of a land-use strategy for VMT/GHG reduction in its downtown. As the figure illustrates, the data allow the city to analyze where the workers in the downtown commute from. This includes not only local but also regional commuting patterns. The city can pick another comparable location where the strategy can be applied and analyze the commuting patterns. By comparing the patterns of two alternative locations, the city may be able to select the location that can contribute to VMT/GHG reduction. Similarly, this approach can also apply to analyzing the impacts of housing allocation on commuting traffic since the data include commuting destinations from each TAZ and census tract.

Figure 18. Example of O/D Matrixes by CTPP and LODES



CTPP O/D Matrix



LODES O/D Matrix

Note: Both images illustrate the resident locations of the commuters who come to work in the downtown Anaheim area.

As mentioned above, the O/D matrixes have clear advantages and weaknesses. We found an exemplary case that overcomes the weaknesses. The Los Angeles County Metropolitan

Transportation Authority (LA Metro) recently developed a data dashboard named LOCUS. LOCUS dashboards provide information from transportation trips based on data from smartphones and other connected devices. LOCUS provides the flow of persons (O/D matrix) by trip mode, trip purpose, and trip time at a census-block-group level. Thus, LOCUS can play an important role in local governments' land-use and housing-allocation decisions by collecting and analyzing transportation data to better understand travel patterns at a micro level. More details can be found in Appendix D.8.

5.1.4 Scenario Simulation

The "Scenario Simulation" refers to the case where local governments proactively simulate the impacts of land-use changes and housing-allocation decisions on VMT/GHG reduction, employing one of the sketch planning tools. This scenario is primarily applicable to large, urban cities such as principal cities in metropolitan areas. The complexity level of their land-use and housing-allocation decisions is very high. Local planners need to consider multiple activity centers in a relatively large geographical area. Due to this complexity, it is hard to clearly understand residents' travel patterns and behavior. Estimating the impacts of the decisions on VMT/GHG reduction is even tougher.

In this situation, it would be ideal for local governments to explore and simulate the impacts of the decisions on VMT/GHG reduction before making their final decisions. Sketch planning tools allow the building of multiple land-use and housing-allocation scenarios and the testing of their impacts on VMT/GHG reduction. MPOs' travel-demand models (TDMs) can also be used for this purpose, but these models are resource-intensive, requiring modeling expertise and sometimes many days to complete a single analysis. To fill the need for less resource-intensive methods which are more appropriate for localized plans and individual projects, several sketch planning tools have been developed and are available. The review of all the sketch planning tools is not in the scope of this research. More information about the existing sketch planning tools can be found in the following reports.

- Avin, U. (2016). *Sketch Tools for Regional Sustainability Scenario Planning*. NCHRP 08-36. Washington D.C.: American Association of State Highway and Transportation Officials (ASSHTO).

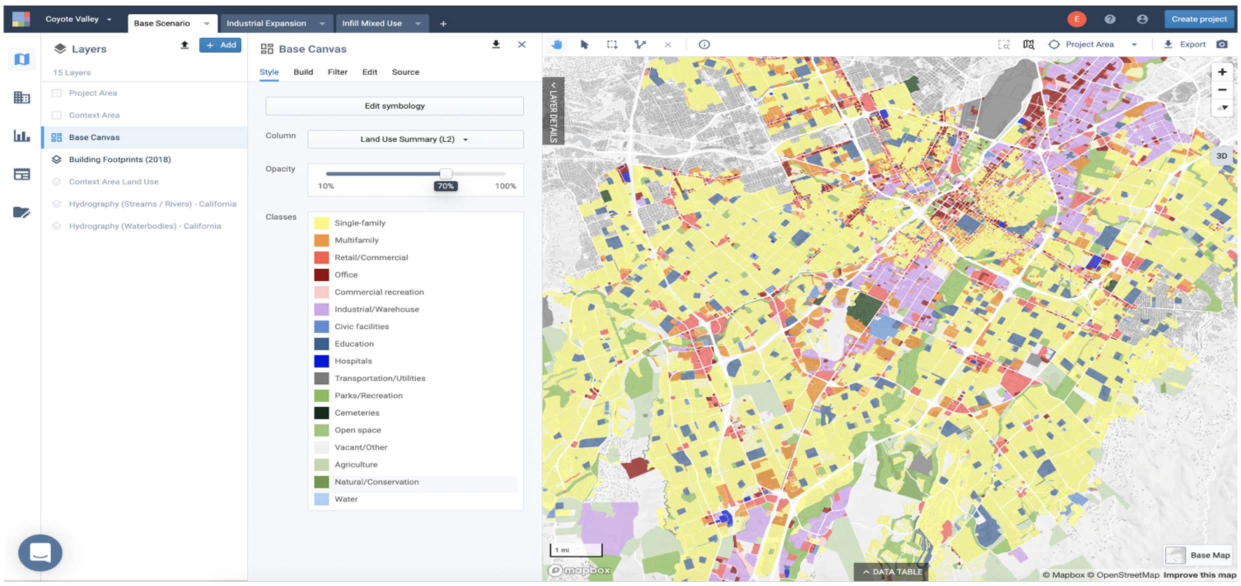
- Lee, A., Fran, K., & Handy, S. (2017). *Evaluation of Sketch-Level VMT Quantification Tools: A Strategic Growth Council Grant Programs Evaluation Support Project*. Davis, CA: University of California, Davis.

- Sacramento Area Council of Governments (SACOG). (2020). *Senate Bill 743 Implementation Tools*. Sacramento, CA: SACOG.

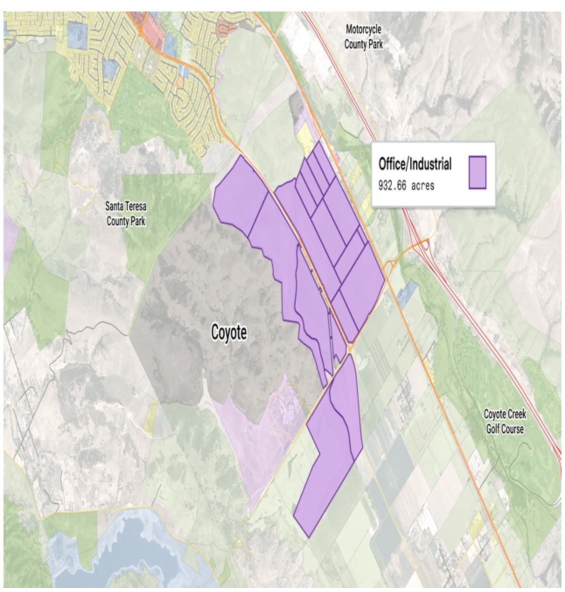
The surveys and interviews also found that multiple sketch planning tools have been used in the state and that a number of local governments consider adopting the tools. It was observed that the most popular tools in the state include CalEEMod (Appendix D.9) and UrbanFootprint (Appendix D.10) as both are free and available for public use.

The City of San Jose employed UrbanFootprint for the city's "Envision 2040 General Plan" update. Simulating two development scenarios, North Coyote Valley and the proposed Google Transit Village Plan, the city was able to measure the benefits of land conservation and infill development as a strategy to create and transform historically underutilized growth areas into walkable, mixed-use urban villages (Figure 20).

Figure 19. Example of Scenarios in Urbanfootprint



UrbanFootprint map of existing land use in San Jose



North Coyote Valley development scenario

Google Transit Village Plan

5.1.5 Integration of Land-Use and Transportation Models

The "Integration of Land-Use and Transportation Models" scenario is not a current option that local governments can select for their land-use changes and housing allocation decisions. Instead, this scenario is a future direction identified in the interviews. Although metropolitan cities such as Los Angeles, San Diego, and San Francisco are perhaps capable of making the integration, this is primarily considered as the MPOs' vision and plan. Currently, Shasta Regional Transportation Agency (SRTA), in collaboration with a consulting firm, is working on the integration of its land-use and travel-demand models. Other MPOs, including the Association of Monterey Bay Area Governments (AMBAG), the Butte County Association of Governments (BCAG), the San Luis Obispo Council of Governments (SLOCOG), and the Tahoe Regional Planning Agency (TRPA), are planning to do so as well.

This scenario envisions the development of a tool that cohesively integrates a land-use model and travel-demand model (TDM). Land-use models are sophisticated modeling approaches that capture and estimate both the spatial and scalar characteristics of land-use changes in the future. Computing and estimating many of the factors that influence land-use patterns occur across multiple spatial and temporal scales and the system components associated with land-use decisions; as a result, the models predict how future land uses will change. When a land-use model is integrated with MPOs' TDMs, the impacts of land-use changes on VMT/GHG reduction can be accurately and seamlessly measured in one platform.

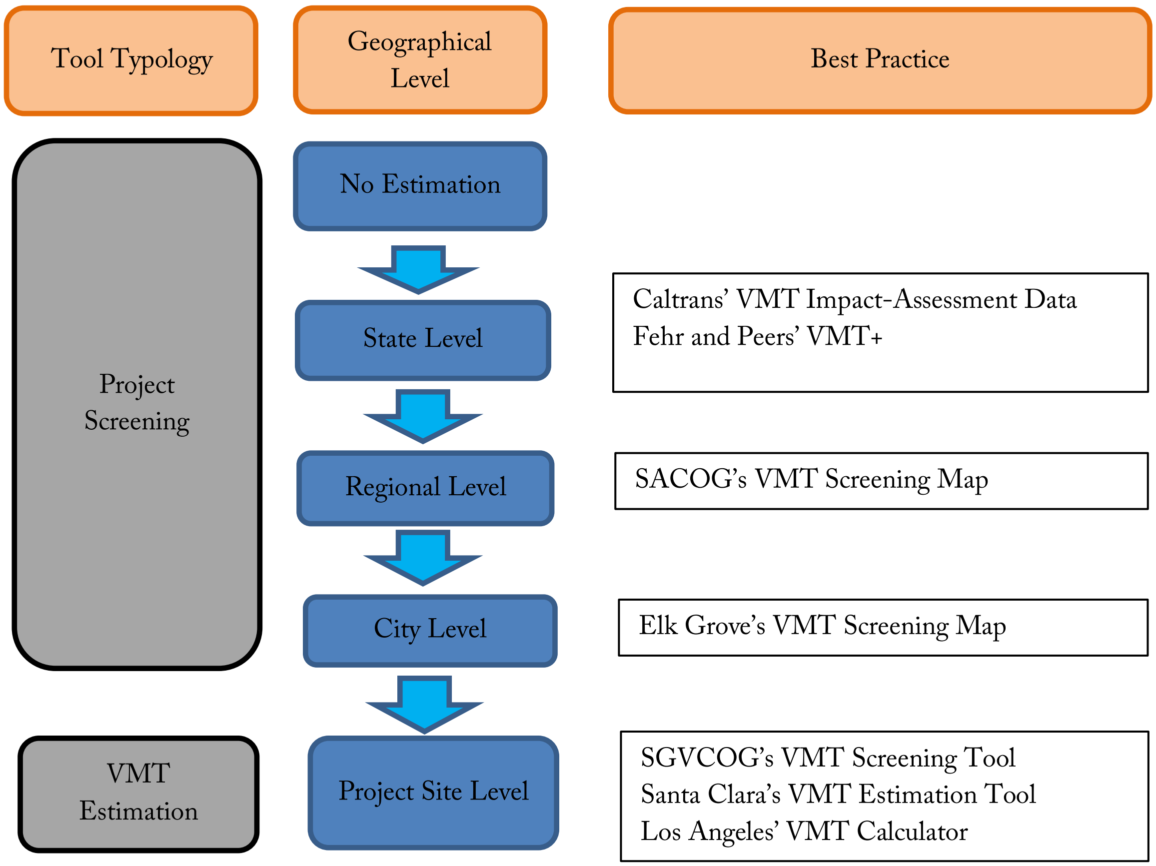
Some critics point out that the tools compensate for estimation accuracy with user-friendly approaches and less resource-intensive methods. The integration of land-use and travel-demand models can overcome the drawback of sketch planning tools. However, it is important to remember the reason why sketch tools earned their popularity. The complex, demanding TMDs were not appropriate for local governments' practices. Thus, when integrating land-use and travel-demand models, they need to design the integrated models in a way that facilitates not only MPOs' practices but also local applications.

5.2 Best Practices of SB 743 for Project-Level CEQA Reviews

We identified various efforts by state, regional, and local governments in order to effectively implement SB 743 at the local level. This guide is a summary of the efforts. The efforts primarily focus on the development of VMT calculation tools. The tools are broadly divided into two categories, VMT screening tools and VMT analysis tools (Figure 21). The VMT screening tools provide the estimated current VMT values in various geographical units. For example, the tools present the areas with lower or higher VMT generated. This approach allows cities to guide new developments to be located in the areas with lower VMT generated. The VMT screening tools have been developed by multiple agencies from the state to the local level.

The VMT analysis tools compute VMT generated by new developments. Taking the detailed information of a new development proposal, the tools associate the information with the site where the development is proposed and estimate the impacts of the development on regional VMT generation. As this guide introduces examples of the tools at multiple geographical levels, local governments will be able to select the tools that are available for them and/or use the tools as references if they are interested in developing a tool.

Figure 20. VMT Screening/Estimation Tools by Geographical Typology

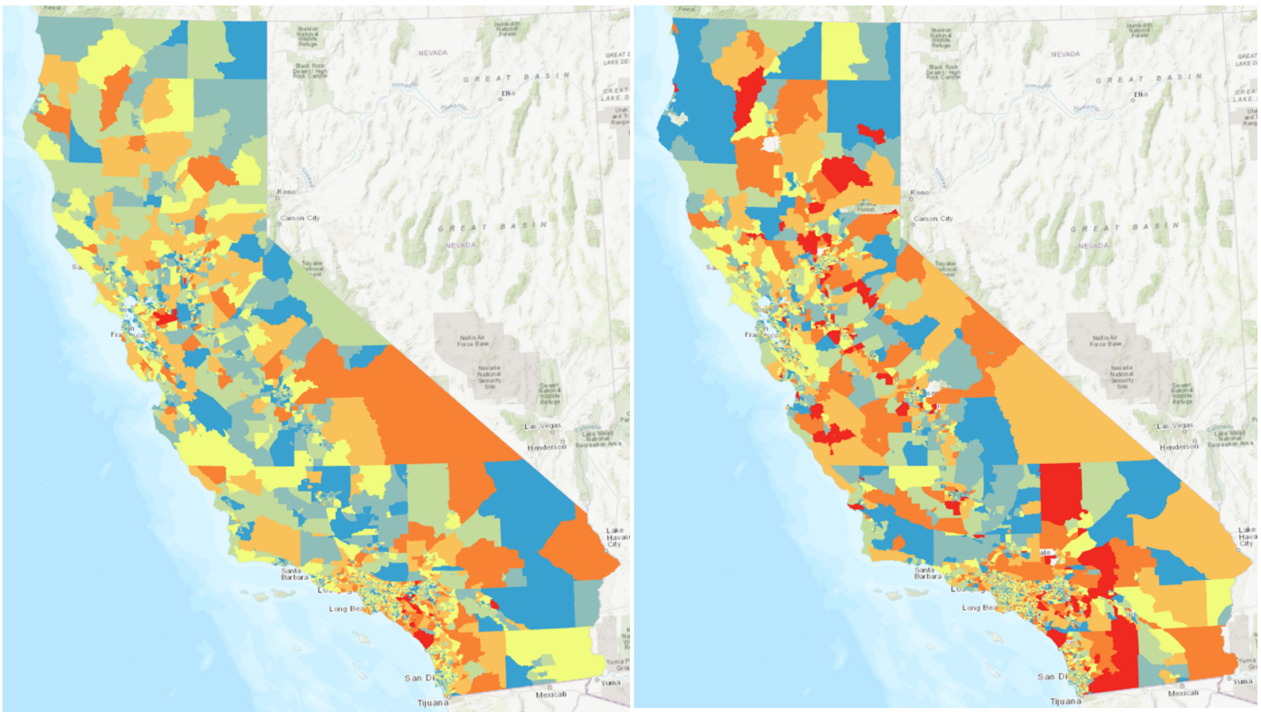


5.2.1 State Level VMT Screening Tools

Based on the California Statewide Travel-Demand Model (CSTDM), Caltrans developed SB 743 VMT impact-assessment data (http://www.norcalite.org/sb-743-resources/; https://dot.ca.gov/programs/transportation-planning/multi-modal-system-planning/statewide-modeling/sb-743-vmt-impact-assessment, accessed June 20, 2023). The CSTDM is Caltrans' official travel-demand model that provides an advanced multi-modal tour/activity-based travel-demand model that can forecast short- and long-distance travel by California residents. Caltrans uses the model to develop and evaluate transportation-related policies and programs of projects, and partner agencies utilize this model to meet the air-quality requirements set forth under AB 32, SB 375 and SB 391.

The data offer VMT/capita and VMT/employee information by traffic analysis zone (TAZ) for the entire state for the base year of 2010 and the horizon year of 2040. The data also provide VMT by trip purpose (e.g., home-based work, home-based shopping, and so on). There are 5,414 TAZs in total. The comparison of VMTs in 2010 and 2040 can help local governments guide their developments in a way that reduces their impacts on VMT generation (Figure 22). These data can play the role of general guidelines for new development assessments from the perspective of VMT generation. VMT was calculated based on the socio-demographic characteristics and built-environment conditions of each TAZ. Thus, TAZs with high VMT values are the areas where new developments will have a higher VMT burden.

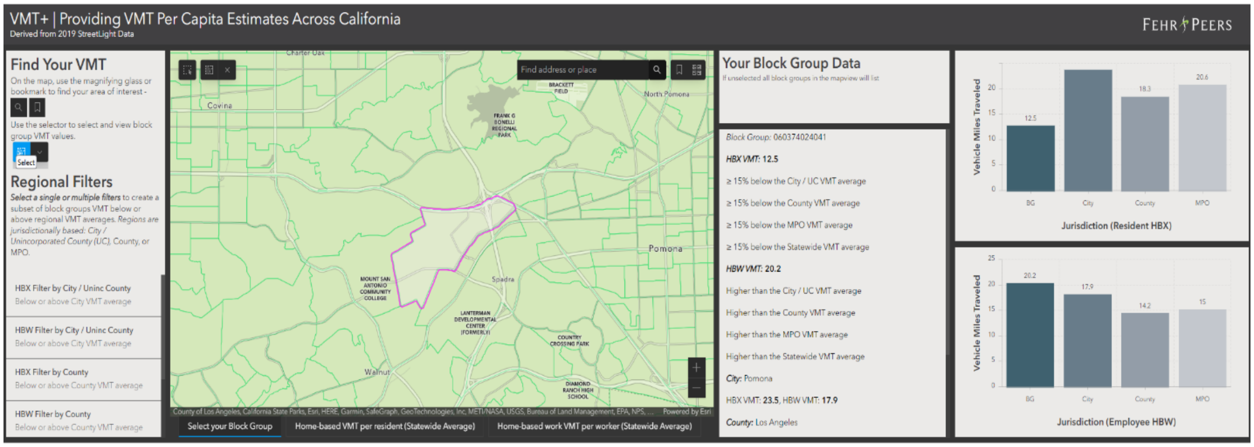
Figure 21. CSTDM's VMT Change Estimation



VMT 2010 VMT 2040

VMT+ is another state-wide VMT estimation tool (https://www.fehrandpeers.com/visualizing-vmt-per-capita/, accessed June 20, 2023). This tool offers current VMT per capita estimates by census block group, which is much finer than TAZ employed in SB 743 VMT impact-assessment data. The tool also provides the comparison of the VMT values of each census block group with the average value of the city to which the census block group belongs. This can become intuitive information for local governments since they screen new developments at a city level. For example, the block group in the figure below has lower home-based VMT and higher home-based work VMT than the average of the City of Pomona where the block group is located (Figure 23). This tool is a web-based platform, which is easy to navigate and use. When users select a census block group that they are interested in (by clicking on the map or searching with a block group ID or an address), the tool returns the VMT estimation of the block group.

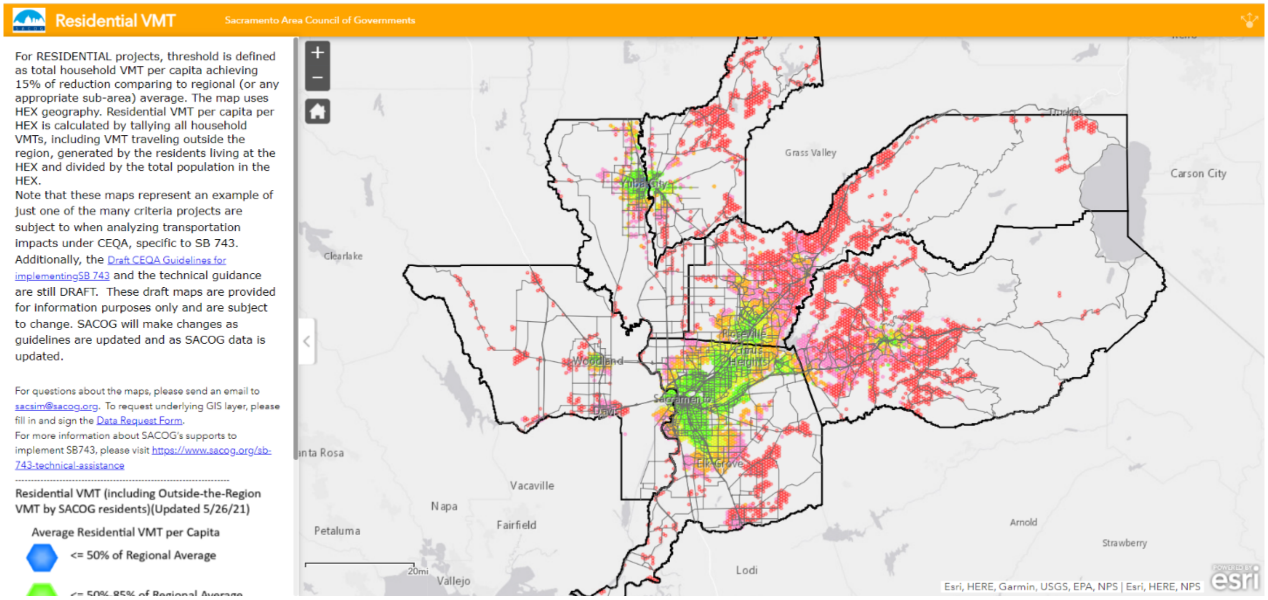
Figure 22. The Screenshot of VMT+ Interface



5.2.2 Regional Level VMT Screening Tools

Similar to the state-wide tools, regional-level VMT screening tools are available. One of them is the Sacramento Area Council of Governments' (SACOG) VMT screening map (https://sb743-sacog.opendata.arcgis.com/, accessed June 21, 2023). SACOG developed the VMT screening map for residential and office projects based on its 2016 base-year-activity/tour-based TDM. The map is designed to estimate individuals' daily travel, accounting for land use, transportation, and demographics that influence peoples' travel behaviors. The map employs a hexagon as the unit of analysis due to the consideration of privacy protection of city data at the parcel level. The map visualizes VMT per capita (all household VMTs / total population) for residential projects and VMT per job (all work VMTs / total jobs) for office projects and it compares the VMTs to thresholds which are a 15 percent reduction of regional levels. This is a web-based platform that allows users to navigate the map of SACOG's jurisdiction (Figure 24).

Figure 23. VMT Screening Map's VMT Per Capita Estimation



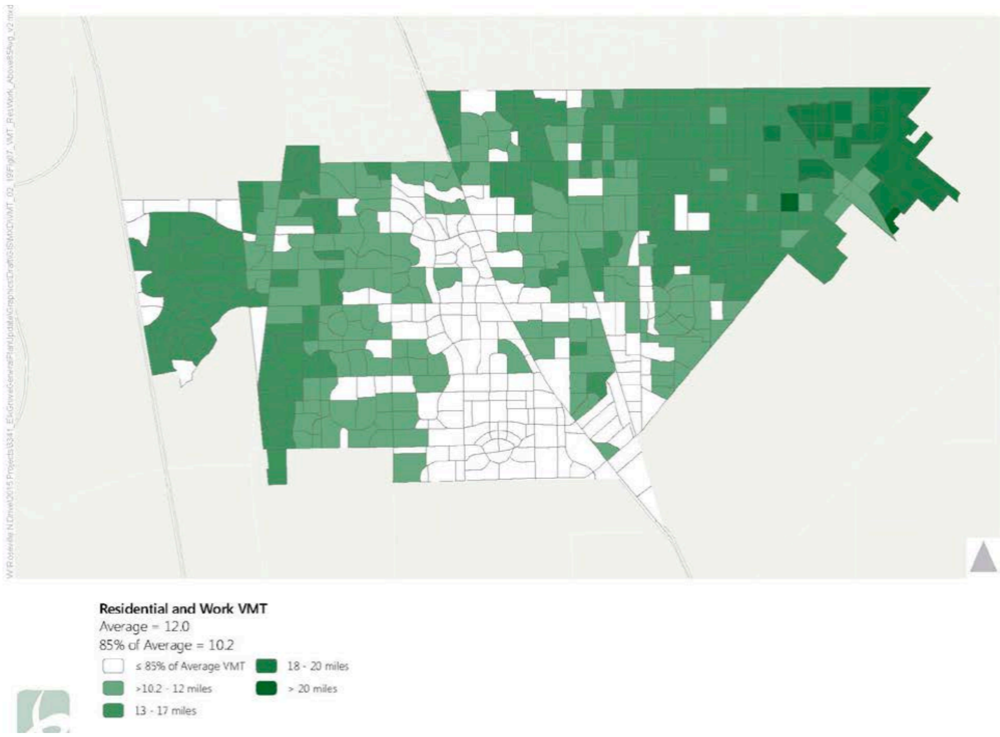
Apparently, the VMT calculation methods and the unit of analysis to which the calculation is applied vary by the agencies that developed the tools and by the geographical levels. However, how to utilize the tools from the users' perspective is consistent. Local governments need to assess new developments in a way that new developments are located in the areas that generate lower VMTs.

5.2.3 City-Level VMT Screening Tools

The City of Elk Grove developed the city's VMT screening map based on its own travel model:(https://www.elkgrovecity.org/sites/default/files/city-files/Departments/Planning/Projects/General%20Plan/GPU/Adopted_2019-02/EG_Traffic_Analysis_Guidelines_CC%20Final_Adopted_2019-02-27.pdf, accessed June 21, 2023).

The city has established specific limits on VMT allowable for each land-use project by general-plan land-use designation as well as city-wide limits and limits within each study area. The city conducts an initial assessment of each project based on the project description and proposed uses using the VMT screening map. The VMT screening map identifies areas in the city that are exempt from VMT analysis (Figure 25). These include sites that have been pre-screened through citywide VMT analysis. Pre-screened areas, shown in white in the figure, have been determined to result in a 15 percent lower VMT than the average VMT established for that land-use designation if built to the specifications of the Land-Use Plan.

Figure 24. The City of Elk Grove's VMT Screening Map



Since the map is designed for internal uses in the city, there is no platform that allows public access to the map. However, sharing this information aligning with the visions of the city's general plan with developers will contribute to increasing the predictability of the city's land-use decisions.

5.2.4 Project-Site-Level VMT Analysis Tools

In order to provide straightforward assistance to local governments in the assessment of individual development impacts on VMT generation, many regional agencies including MPOs and COGs developed regional VMT analysis tools. Unlike the VMT screening tools, the VMT analysis tools estimate the potential amount of VMTs generated by the specific development proposed for a specific location. Thus, it is common for the VMT analysis tools to request extended input data about a development proposal including the parcel that the development will implement, the types of development (e.g., residential, industrial, office, commercial, and so on), proposed parking, VMT-reduction strategies that will be employed, and more. It is also common for the tools to allow users to set up their VMT simulation options such as VMT comparison baselines and VMT-reduction thresholds. Then, the tools estimate the VMT generated by the development proposal associating the input data with the built-environment features of the surrounding context (Figure 26).

Figure 25. VMT Estimation Output Example of the Santa Clara County VMT Analysis Tool

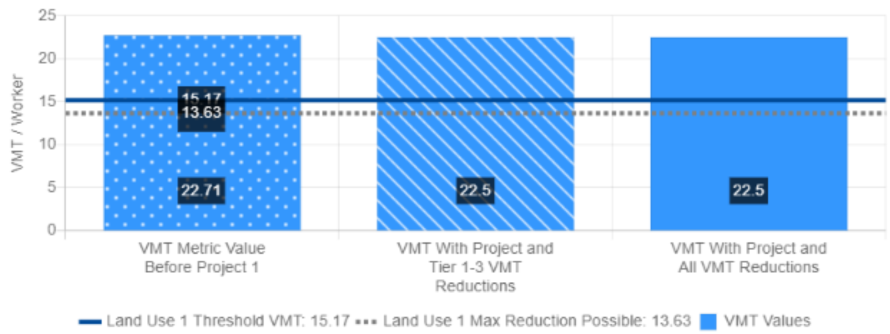
Santa Clara Countywide VMT Evaluation Tool - Version 2 - Report

Valley Transportation Authority

Office Vehicle Miles Traveled (VMT) Screening Results

Land Use Type 1:	Office
VMT Metric 1:	Home-based Work VMT per Worker
VMT Baseline Description 1:	City Average
VMT Baseline Value 1:	17.85
VMT Threshold Description 1 / Threshold Value 1:	-15% / 15.17
Land Use 1 has been Pre-Screened by the Local Jurisdiction:	N/A

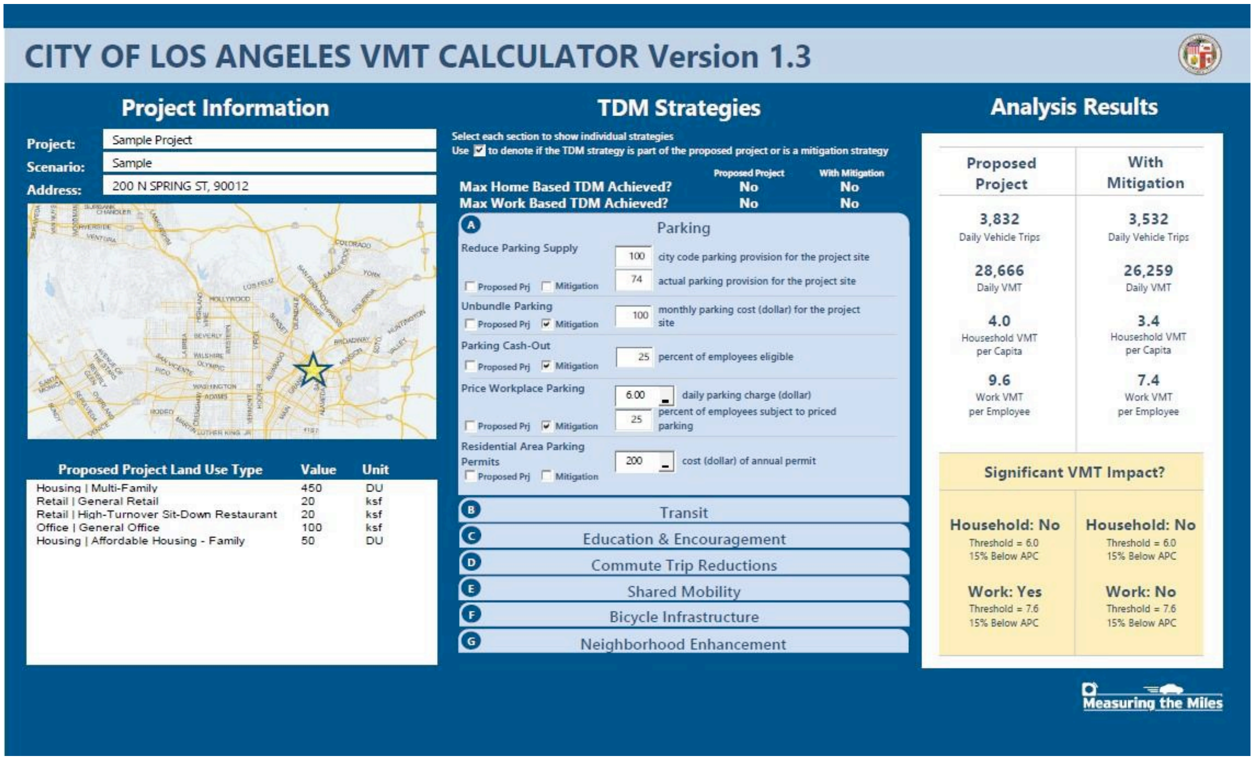
	Without Project	With Project & Tier 1-3 VMT Reductions	With Project & All VMT Reductions
Project Generated Vehicle Miles Traveled (VMT) Rate	22.71	22.5	22.5
Low VMT Screening Analysis	No (Fail)	No (Fail)	No (Fail)



Adopting this method of VMT estimation, several MPOs and COGs developed regional VMT analysis tools. They include Santa Clara County (Appendix D.11), San Gabriel Valley Council of Governments (SGVCOG) (Appendix D.12), City/County Association of Governments of San Mateo County (C/CAG), San Bernardino County Transportation Authority (SBCTA), Western Riverside Council (WRCOG), and the City of San Diego. All of the tools provide a web-based platform. Although there are multiple tools, the user interfaces of, and the outputs generated by, the tools are almost identical.

The City of Los Angeles (Appendix D.13), Alameda County, Sonoma County, and San Diego Association of Governments (SANDAG) developed and disseminated Excel workbook-based VMT-mitigation and -reduction calculators. All the calculators are very close to each other in terms of their interfaces and capacity. Like web-based tools, the calculators require the address, use, and development intensity of new development. Based on the input data, the calculators estimate daily trips and VMT with or without the VMT-mitigation strategies that will be implemented. The tools measure the significance of VMT impact by the development by comparing the estimated VMT to the VMT reduction threshold that the cities set up. While doing so, users can explore the potential of VMT-reduction strategies and calculate their effectiveness (Figure 27).

Figure 26. The City of Los Angeles' VMT Calculator



Conclusion

The research provided an opportunity to ground the truth of how VMT and GHG mitigation is being implemented at a regional and local level, and also unpacked the perspective of planning staff who work in land use and transportation, particularly on data-related issues and challenges.

The survey and interview results indicate that there are some gaps in transportation data knowledge and access between local governments and MPOs. Local governments tend to utilize automobile data more frequently than alternative modes, and do not heavily rely on MPOs for obtaining transportation data. Overall, local governments recognized the need for more transportation data for the implementation of SB 375 and SB 743, and they were particularly interested in publicly available sources of data on automobile and active transportation. The MPOs we surveyed had a general understanding of their local members' compliance with the mandates but did not necessarily know how they actually acquired transportation data needed for VMT analysis. The socio-economic characteristics, travel-time matrix, and mode-share scheme were also considered useful by the MPOs, while actual requests and use by localities were very low.

We also found that there are different obstacles that are faced by the various regions in the state. We found that there is a learning curve with understanding regional travel models, which are a typical go-to source of VMT data. Many local government planners are not modelers by training and these models are not easy to understand as they are resource-intensive and require very technical expertise. Big data use through vendors such as StreetLight or Replica was found as a dominant trend either requested by a hired consulting firm or started and explored at the MPO level. Some MPOs that used big data found a huge potential when they would be used at the local level.

The disparity in data access and challenges in doing so indicated that a universal approach is not feasible for SB 743, especially for rural regions. The respective RHNA targets and urgency to create new housing, layered upon transportation planning, has made efforts to reduce VMT and GHG more complicated. Many local governments are struggling with the capacity and availability of skilled/experienced staffing to effectively implement VMT policy and mitigation efforts; further support is needed from the state to streamline the process. Challenges with data are that the datasets they needed were not available or expensive to collect and did not provide a fine enough granularity. This reemphasizes how important the identification and introduction of reliable transportation data sources for local planners are. We found that several MPOs were working on improving data access and sharing with their member agencies through different platforms and frameworks as having a collaborative and supportive relationship is critical in achieving the goals of SB 375 and SB 743.

We found that big data are actively being explored or utilized at the MPO level and at some local level to provide the granularity that local governments need to conduct project-level VMT analysis, but they need to be made more accessible in terms of cost, licenses, training, and potential support provided by a state entity or a respective MPO.

Interviews have revealed that VMT banks and exchanges are being explored at the MPO level but have not been implemented yet because of the uncertainty of outcomes and complications of an equitable framework. A thorough monitoring of the pilot studies and their results by a state entity is warranted to examine the potential of VMT banks and exchanges. More funding from the state would be required to move forward with all the challenges and obstacles aforementioned as more research, collaboration, and staff time would be needed to compile enough cases and databases to examine the efficacy of the new data sources, sketch tools, and frameworks, such as VMT-mitigation measures. Furthermore, timely coordination across state departments could be improved to reduce confusion at the local level and eliminate any overlaps or contradictions that burden local government staff. Orchestrated efforts by state departments will provide a big picture of how the state is paving the road for VMT/GHG emission reduction goals.

Appendix A: The List of Survey Participants

Local Government Survey Participants

Monterey city	Association of Monterey Bay Area Governments
Salinas city	Association of Monterey Bay Area Governments
San Juan Bautista city	Association of Monterey Bay Area Governments
Seaside city	Association of Monterey Bay Area Governments
Watsonville city	Association of Monterey Bay Area Governments
Clovis city	Fresno Council of Governments
Mono County	Fresno Council of Governments
Tulare County	Fresno Council of Governments
Taft city	Kern Council of Governments
Merced city	Merced County Association of Governments
Stanislaus County	Merced County Association of Governments
Benicia city	Metropolitan Transportation Commission
Brisbane city	Metropolitan Transportation Commission
Burlingame city	Metropolitan Transportation Commission
Cotati city	Metropolitan Transportation Commission
Dixon city	Metropolitan Transportation Commission
East Palo Alto city	Metropolitan Transportation Commission
Fairfield city	Metropolitan Transportation Commission
Hayward city	Metropolitan Transportation Commission
Larkspur city	Metropolitan Transportation Commission
Los Altos city	Metropolitan Transportation Commission
Los Altos Hills town	Metropolitan Transportation Commission
Marin County	Metropolitan Transportation Commission
Menlo Park city	Metropolitan Transportation Commission
Mountain View city	Metropolitan Transportation Commission
Newark city	Metropolitan Transportation Commission
San Bruno city	Metropolitan Transportation Commission
San Francisco city	Metropolitan Transportation Commission
San Francisco County	Metropolitan Transportation Commission
Sebastopol city	Metropolitan Transportation Commission
Sonoma County	Metropolitan Transportation Commission
Union City	Metropolitan Transportation Commission
Vacaville city	Metropolitan Transportation Commission
Vallejo city	Metropolitan Transportation Commission
Angels city	Non-MPO
Arcata city	Non-MPO
Bishop city	Non-MPO
Del Norte County	Non-MPO
Fort Jones city	Non-MPO
Siskiyou County	Non-MPO

Tehama city	Non-MPO
Trinidad city	Non-MPO
Yreka city	Non-MPO
Amador County	Sacramento Area Council of Governments
Citrus Heights city	Sacramento Area Council of Governments
Colfax city	Sacramento Area Council of Governments
Elk Grove city	Sacramento Area Council of Governments
Folsom city	Sacramento Area Council of Governments
Loomis town	Sacramento Area Council of Governments
Nevada County	Sacramento Area Council of Governments
Placer County	Sacramento Area Council of Governments
Rancho Cordova city	Sacramento Area Council of Governments
Sacramento city	Sacramento Area Council of Governments
Chula Vista city	San Diego Association of Governments
Coronado city	San Diego Association of Governments
San Diego city	San Diego Association of Governments
San Marcos city	San Diego Association of Governments
Stockton city	San Joaquin Council of Governments
Tracy city	San Joaquin Council of Governments
Arroyo Grande city	San Luis Obispo Council of Governments
Goleta city	Santa Barbara County Association of Governments
Santa Barbara city	Santa Barbara County Association of Governments
Santa Barbara County	Santa Barbara County Association of Governments
Santa Maria city	Santa Barbara County Association of Governments
Agoura Hills city	Southern California Association of Governments
Anaheim city	Southern California Association of Governments
Beaumont city	Southern California Association of Governments
Brea city	Southern California Association of Governments
Burbank city	Southern California Association of Governments
Cerritos city	Southern California Association of Governments
Chino city	Southern California Association of Governments
Cypress city	Southern California Association of Governments
El Monte city	Southern California Association of Governments
Garden Grove city	Southern California Association of Governments
Glendora city	Southern California Association of Governments
Hemet city	Southern California Association of Governments
La Cañada Flintridge city	Southern California Association of Governments
La Habra city	Southern California Association of Governments
La Habra Heights city	Southern California Association of Governments
La Puente city	Southern California Association of Governments
Lake Forest city	Southern California Association of Governments
Long Beach city	Southern California Association of Governments
Los Angeles County	Southern California Association of Governments
Manhattan Beach city	Southern California Association of Governments
Menifee city	Southern California Association of Governments

Monrovia city	Southern California Association of Governments
Montclair city	Southern California Association of Governments
Montebello city	Southern California Association of Governments
Palm Springs city	Southern California Association of Governments
Perris city	Southern California Association of Governments
Placentia city	Southern California Association of Governments
Rancho Palos Verdes city	Southern California Association of Governments
Rancho Santa Margarita city	Southern California Association of Governments
Riverside city	Southern California Association of Governments
San Dimas city	Southern California Association of Governments
San Juan Capistrano city	Southern California Association of Governments
Santa Ana city	Southern California Association of Governments
Santa Fe Springs city	Southern California Association of Governments
Sierra Madre city	Southern California Association of Governments
Simi Valley city	Southern California Association of Governments
South El Monte city	Southern California Association of Governments
Temecula city	Southern California Association of Governments
Temple City	Southern California Association of Governments
Torrance city	Southern California Association of Governments
Ventura County	Southern California Association of Governments
West Hollywood city	Southern California Association of Governments
Westlake Village city	Southern California Association of Governments
Whittier city	Southern California Association of Governments
Yorba Linda city	Southern California Association of Governments
Riverbank city	Stanislaus Council of Governments

MPO Survey Participants

Fresno Council of Governments
Kern Council of Governments
Merced County Association of Governments
Metropolitan Transportation Commission
Sacramento Area Council of Governments
San Diego Association of Governments
San Luis Obispo Council of Governments
Santa Barbara County Association of Governments
Shasta Regional Transportation Agency
Southern California Association of Governments
Tulare County Association of Governments

Appendix B. Local Government Survey Analysis

1. Please provide the name of the jurisdiction that you are affiliated with and your title.

- Name of the jurisdiction (text entry)
- City (select)
- County (select)
- Title (text entry)

Response summary

	All	Received	%
City and Town	482	96	19.9%
County	58	14	24.1%
Total	540	110	20.4%

1. We will randomly select 10 respondents and provide them with a gift card ($25) as a token for your participation. Please provide your work email if you want to participate in the raffle for the gift card.
2. Work email: (text entry)
3. Has your jurisdiction adopted plans, programs, policies, ordinances, or other measures to help meet local, regional, or State GHG reduction goals? (check all that apply)

Response Options:

3-1. .Developed General Plan GHG reduction goals, policies, and programs
3-2. Developed a Climate Action Plan
3-3. Streamlined solar permitting (per AB 2188)
3-4. Streamlined electric vehicle charging station permitting (per AB 1236)
3-5. Streamlined hydrogen or other zero emission fuel station permitting
3-6. Adopted a carbon neutrality or net-zero goal
3-7. Adopted a green building reach code for electric vehicle charging readiness
3-8. Other

Response summary

Response	3-1	3-2	3-3	3-4	3-5	3-6	3-7
Yes	59.1%	48.2%	72.7%	62.7%	4.5%	20.0%	25.5%
No	32.7%	45.5%	17.3%	27.3%	81.8%	70.0%	60.9%
No Answer	8.2%	6.4%	10.0%	10.0%	13.6%	10.0%	13.6%

4. Does your jurisdiction track the implementation of your GHG emissions reduction targets or strategies?

Response Options:
Yes or No
If yes, Describe how (text entry)
Response summary

Response	Yes	No	No Answer	Total
	36 (33%)	64 (58%)	10 (9%)	110 (100%)

5. Does your jurisdiction currently have the capacity (i.e., staffing and resources) to apply for Greenhouse Gas Reduction Fund (cap-and-trade) or other federal, state or local grants?

Response Options:
Yes or No
If no, Describe why not (Insert text)
Response summary

Response	Yes	No	No Answer	Total
	38 (35%)	62 (56%)	10 (9%)	110 (100%)

6. Which year did your jurisdiction update the land-use element in the general plan?

Response Options:
(text entry)
Response summary

Response	After 2010	Before 2010	In Progress	No Answer	Total
	63 (57%)	29 (26%)	4 (4%)	14 (13%)	110 (100%)

7. Which year did you jurisdiction update the circulation element in the general plan?

Response Options:
(text entry)

Response summary

Response	After 2010	Before 2010	In Progress	No Answer	Total
	62 (56%)	29 (26%)	3 (3%)	16 (15%)	110 (100%)

8. Is your jurisdiction currently in the process of updating the land-use element?

Response Options:
Yes or No
Response summary

Response	Yes	No	No Answer	Total
	38 (35%)	62 (56%)	10 (9%)	110 (100%)

9. Is your jurisdiction currently in the process of updating the circulation element?

Response Options:
Yes or No
Response summary

Response	Yes	No	No Answer	Total
	36 (33%)	64 (58%)	10 (9%)	110 (100%)

10. Please choose a degree of agreement with each statement that describes your perspective. "I think the jurisdiction I am affiliated with..."
    10-1. has integrated VMT mitigation strategies into local land-use planning.
    10-2. considers VMT/GHG emission reduction as much as it can in the recent land-use/housing-element updates.
    10-3. includes VMT/GHG reduction in plans other than the general plan (i.e., active transportation plan, climate action plan, etc.).
    10-4. has achieved significant VMT/GHG emission reduction via local land-use planning.
    10-5. have used new sources of data/tools for land-use planning to reduce VMT/GHG emission.

Response Options:
5 Likert scales from “Strongly Agree” to “Strongly Disagree”
Response summary

Response	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	No Answer
10-1	32 (29%)	36 (33%)	12 (11%)	10 (9%)	10 (9%)	10 (9%)
10-2	31 (28%)	41 (37%)	17 (15%)	5 (5%)	5 (5%)	11 (10%)
10-3	37 (34%)	34 (31%)	16 (15%)	7 (6%)	6 (5%)	10 (9%)
10-4	7 (6%)	17 (15%)	45 (41%)	22 (20%)	9 (8%)	10 (9%)
10-5	10 (9%)	32 (29%)	31 (28%)	14 (13%)	13 (12%)	10 (9%)

11. Do you find the following strategies adopted and accepted in your jurisdiction according to the recent general plan updates?
    - 11-1. Promoting Transit-oriented development (TOD)
    - 11-2. Promoting infill development
    - 11-3. Promoting mixed use development
    - 11-4. Increasing residential density
    - 11-5. Promoting developments along transit corridors
    - 11-6. Increasing employment density
    - 11-7. Increasing housing options/affordable housing
    - 11-8. Increasing Job/Housing balance
    - 11-9. Creating walkable/bikeable neighborhoods
    - 11-10. Introducing Parking-Pricing/Parking Reform
    - 11-11. Facilitating/Encouraging Micro-mobility options
    - 11-12. Others (list all other strategies used to reduce VMT/GHG emission)

Response Options:
5 Likert scales from "Strongly Agree" to "Strongly Disagree"
Response summary

Response	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	No Answer
11-1	37 (34%)	26 (24%)	24 (22%)	5 (5%)	8 (7%)	10 (9%)
11-2	59 (54%)	26 (24%)	9 (8%)	3 (3%)	3 (3%)	10 (9%)
11-3	61 (55%)	27 (25%)	7 (6%)	3 (3%)	2 (2%)	10 (9%)
11-4	48 (44%)	34 (31%)	10 (9%)	5 (5%)	3 (3%)	10 (9%)
11-5	45 (41%)	21 (19%)	23 (21%)	3 (3%)	8 (7%)	10 (9%)
11-6	21 (19%)	41 (37%)	25 (23%)	6 (5%)	7 (6%)	10 (9%)
11-7	48 (44%)	40 (36%)	9 (8%)	2 (2%)	1 (1%)	10 (9%)
11-8	26 (24%)	42 (38%)	23 (21%)	5 (5%)	4 (4%)	10 (9%)
11-9	46 (42%)	39 (35%)	9 (8%)	4 (4%)	2 (2%)	10 (9%)
11-10	10 (9%)	19 (17%)	33 (30%)	23 (21%)	23 (14%)	10 (9%)
11-11	11 (10%)	25 (23%)	44 (40%)	7 (6%)	11 (10%)	12 (11%)

12. Has your jurisdiction shifted to VMT from LOS as its primary metric of transportation impact?

Response Options:

Yes or No

Response summary

Response	Yes	No	No Answer	Total
	82 (75%)	17 (15%)	11 (10%)	110 (100%)

13. Has/will your jurisdiction formally adopt* CEQA thresholds of significance for transportation based on vehicle miles traveled (VMT) metrics, pursuant to SB 743 updates to the CEQA Guidelines that took effect on July 1, 2020?

Response Options:

1) No
2) Yes, planning to formally adopt a significance threshold(s)
3) Yes, in the process of formally adopting a significance threshold(s)
4) Yes, we already formally adopted a significance threshold

Response summary

Response	1	2	3	4	No Answer	Total
	20 (18%)	47 (43%)	10 (9%)	21 (19%)	12 (11%)	110 (100%)

14. Please choose a degree of agreement with each statement that describes your perspective. "I think in the jurisdiction I am affiliated with"…"

14-1. project-level CEQA reviews have significantly changed after the implementation of SB 743.
14-2. new sources of data/tools have been introduced and used for project-level CEQA reviews to reduce VMT/GHG emission.
14-3. significant reduction of VMT/GHG emission could be achieved by the approaches required by SB 743.
14-4. has experienced significant VMT/GHG emission reduction by implementing SB 743.

Response Options:
5 Likert scales from "Strongly Agree" to "Strongly Disagree"
Response summary

Response	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	No Answer
14-1	30 (27%)	32 (29%)	24 (22%)	8 (7%)	4 (4%)	12 (11%)
14-2	25 (23%)	37 (34%)	24 (22%)	6 (5%)	6 (5%)	12 (11%)
14-3	2 (2%)	37 (34%)	33 (30%)	17 (15%)	9 (8%)	12 (11%)
14-4	2 (2%)	9 (8%)	49 (45%)	19 (17%)	19 (17%)	12 (11%)

15. How effective do you see the following strategies are to mitigate transportation impacts of development projects?
    15-1. Roadway reduction (e.g., road diet)
    15.2. Parking Pricing
    15-3. Parking Reduction
    15-4. Increase Transit Access/Services
    15-5. Rideshare (Van/Carpooling)
    15-6. Car-sharing (Uber, Lyft)
    15-7. Micro-mobility
    15-8. Active Transportation strategies
    15-9. Telecommuting
    15-10. Other (list other strategies used to reduce VMT/GHG emission)

Response Options:
5 Likert scales from "Extremely effective" to "Not effective at all"
Response summary

Response	Extremely effective	Very effective	Moderately effective	Slightly effective	Not effective at all	No Answer
15-1	5 (5%)	12 (11%)	40 (36%)	16 (15%)	23 (21%)	14 (13%)
15-2	12 (11%)	19 (17%)	29 (26%)	17 (15%)	20 (18%)	13 (12%)
15-3	5 (5%)	19 (17%)	29 (26%)	23 (21%)	22 (20%)	12 (11%)
15-4	19 (17%)	29 (26%)	33 (30%)	13 (12%)	5 (5%)	11 (10%)
15-5	7 (6%)	27 (25%)	33 (30%)	25 (23%)	7 (6%)	11 (10%)
15-6	4 (4%)	18 (16%)	29 (26%)	24 (22%)	24 (22%)	11 (10%)
15-7	8 (7%)	13 (12%)	34 (31%)	31 (28%)	13 (12%)	11 (10%)
15-8	13 (12%)	34 (31%)	32 (29%)	15 (14%)	5 (5%)	11 (10%)
15-9	40 (36%)	32 (29%)	19 (17%)	5 (5%)	3 (3%)	11 (10%)

16. Please choose the datasets that your jurisdiction uses and their source. For each item, provide the name and source of specific datasets you used.
    16-1. Roadway network (text entry for each bullet)
    16-2. Truck routes
    16-3. Transit route network
    16-4. Transit station/stop location
    16-5. Bicycle network
    16-6. Bicycle-parking facilities
    16-7. Sidewalks and other pedestrian facilities
    16-8. Roadway LOS
    16-9. Automobile traffic volume (AADT, VMT)
    16-10. Automobile traffic counts (collected using videos, tube, etc.)
    16-11. O/D Matrix
    16-12. Real-time automobile traffic volume data
    16-13. Transit ridership by route
    16-14. Transit ridership by station/stop
    16-15. GTFS (General Transit Feed Specification)
    16-16. Bicycle/pedestrian counts collected by field observations

Other (list all other transportation datasets used)
16.A. Response Options:
Yes or No
If yes, provide specific names of the datasets used for each category – text entry

Response summary

Response	Yes	No	No Answer
16-1	76 (70%)	17 (15%)	17 (15%)
16-2	50 (46%)	43 (39%)	17 (15%)
16-3	67 (61%)	26 (24%)	17 (15%)
16-4	67 (61%)	26 (24%)	17 (15%)
16-5	69 (63%)	24 (22%)	17 (15%)
16-6	25 (23%)	68 (62%)	17 (15%)
16-7	56 (51%)	37 (34%)	17 (15%)
16-8	68 (62%)	25 (23%)	17 (15%)
16-9	75 (68%)	18 (16%)	17 (15%)
16-10	71 (65%)	22 (20%)	17 (15%)
16-11	22 (20%)	71 (65%)	17 (15%)
16-12	14 (13%)	79 (72%)	17 (15%)
16-13	42 (38%)	51 (46%)	17 (15%)
16-14	37 (34%)	56 (51%)	17 (15%)
16-15	8 (62%)	85 (23%)	17 (15%)
16-16	27 (25%)	66 (60%)	17((15%)

16.B. Response Options:
Fed
State
MPO
County
Transit Authority (TA)
Your own data (YOD)
NPO
Consulting Firms (CF)
Private Vendor (PV)
Response summary

	Fed	State	MPO	County	TA	YOD	NPO	CF	PV
16-1	0	1	4	12	3	38	0	9	0
16-2	1	6	2	3	0	29	0	3	0
16-3	0	0	3	4	38	13	0	1	0
16-4	0	0	4	5	33	13	0	1	2
16-5	0	0	7	7	2	43	0	1	0
16-6	0	0	2	3	0	19	0	2	0
16-7	0	0	1	5	0	41	0	1	0
16-8	0	2	4	7	0	21	0	24	2
16-9	0	4	9	6	2	19	1	22	4
16-10	0	2	2	6	0	23	0	19	8
16-11	0	0	7	3	0	6	0	1	1
16-12	0	0	1	1	0	6	0	0	4
16-13	0	0	0	2	24	8	0	2	0
16-14	0	0	0	1	20	7	0	2	0
16-15	0	0	0	2	3	3	0	0	1
16-16	0	0	0	1	0	11	0	6	5
Total	1	15	46	68	125	300	1	94	27

17. (based on the response options with NO from Q16) What dataset did you consider and why did you not end up using it? *(Check all that apply)*

    17-1. Roadway network (text entry for each bullet)
    17-2. Truck routes
    17-3. Transit route network
    17-4. Transit station/stop location
    17-5. Bicycle network
    17-6. Bicycle-parking facilities
    17-7. Sidewalks and other pedestrian facilities
    17-8. Roadway LOS
    17-9. Automobile traffic volume (AADT, VMT)
    17-10. Automobile traffic counts (collected using videos, tube, etc.)
    17-11. O/D Matrix
    17-12. Real-time automobile traffic volume data
    17-13. Transit ridership by route
    17-14. Transit ridership by station/stop
    17-15. GTFS (General Transit Feed Specification)
    17-16. Bicycle/pedestrian counts collected by field observations
    17-17. Other (list all other transportation datasets used)

17.A. Did you consider using the data?
Response Options:
Yes or No
Response summary

Response	Yes	No	No Answer
17-1	2 (1.8%)	9 (8.2%)	99 (90.0%)
17-2	7 (6.4%)	27 (24.5%)	76 (69.1%)
17-3	3 (2.7%)	14 (12.7%)	93 (84.5%)
17-4	2 (1.8%)	16 (14.5%)	92 (83.6%)
17-5	5 (4.5%)	12 (10.9%)	93 (84.5%)
17-6	10 (9.1%)	43 (39.1%)	57 (51.8%)
17-7	4 (3.6%)	24 (21.8%)	82 (74.5%)
17-8	3 (2.7%)	14 (12.7%)	93 (84.5%)
17-9	3 (2.7%)	8 (7.3%)	99 (90.0%)
17-10	4 (3.6%)	10 (9.1%)	96 (87.3%)
17-11	4 (3.6%)	52 (47.3%)	54 (49.1%)
17-12	14 (12.7%)	48 (43.6%)	48 (43.6%)
17-13	4 (3.6%)	33 (30.0%)	73 (66.4%)
17-14	5 (4.5%)	37 (33.6%)	68 (61.8%)
17-15	8 (7.3%)	57 (51.8%)	45 (40.9%)
17-16	10 (9.1%)	41 (37.3%)	59 (53.6%)

17.B. Reasons for no use or unsatisfaction
Response Options:
A) Dataset was not available
B) Not user friendly to explore
C) Not in a format we could be familiar with or could use
D) Granularity of the data is not fine enough to use at the project level review
E) Outdated
F) Expensive to purchase
G) Requires too much of resources to process
Response summary

Response	A	B	C	D	E	F	G
17-1	0	0	0	0	0	2	3
17-2	10	0	1	0	0	3	3
17-3	2	0	0	0	0	3	2
17-4	2	0	1	1	0	2	2
17-5	3	0	0	0	0	3	1
17-6	21	0	1	0	1	6	3
17-7	7	0	1	1	0	4	2
17-8	5	0	0	0	1	2	1
17-9	3	0	2	0	0	3	0
17-10	2	0	0	0	0	2	2
17-11	20	0	3	0	1	4	3
17-12	18	0	3	1	9	6	5
17-13	9	0	3	0	1	3	6
17-14	14	0	3	0	1	3	6
17-15	18	0	3	0	0	4	8
17-16	12	0	2	0	2	12	3
Total	146	0	23	3	18	60	47

18. Please choose a scale for each statement that best describes your perspective about VMT data utilization for general plan update and project-level CEQA reviews.
    - 18-1. We do not need VMT data due to our local knowledge which is good enough to understand local transportation issues and impacts.
    - 18-2. We are okay with the current datasets we use.
    - 18-3. We need more VMT data to make better decisions for VMT/GHG emission reduction goals.
    - 18-4. We are interested in and willing to use more VMT data if the data are publicly available.
    - 18-5. We are willing to purchase VMT data to use.

Response Options

5 Likert scales from “Strongly Agree” to “Strongly Disagree”

Response summary

Response	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	No Answer
18-1	6 (5.5%)	10 (9.1%)	19 (17.3%)	31 (28.2%)	24 (21.8%)	20 (18.2%)
18-2	10 (9.1%)	28 (25.5%)	26 (23.6%)	22 (20.0%)	4 (3.6%)	20 (18.2%)
18-3	17 (15.5%)	32 (29.1%)	30 (27.3%)	7 (6.4%)	4 (3.6%)	20 (18.2%)
18-4	28 (25.5%)	42 (38.2%)	17 (15.5%)	3 (2.7%)	1 (0.9%)	19 (17.3%)
18-5	5 (4.5%)	16 (14.5%)	32 (29.1%)	21 (19.1%)	16 (14.5%)	20 (18.2%)

19. Please choose a scale for each reason that best describes your perspective about data needs and challenges. "We are interested in more VMT data, but expect some challenges to do so due to…"
    19-1. Lack of hardware/software
    19-2. Lack of staff in general
    19-3. Lack of required skillsets of existing staff.
    19-4. Costs to purchase tools/data.
    19-5. Lack of information about available data/tools.
    19-6. Other (please type any other reasons)

Response Options
5 Likert scales from "Strongly Agree" to "Strongly Disagree"
Response summary

Response	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	No Answer
19-1	20 (18.2%)	40 (36.4%)	14 (12.7%)	10 (9.1%)	3 (2.7%)	23 (20.9%)
19-2	42 (38.2%)	33 (30.0%)	6 (5.5%)	3 (2.7%)	3 (2.7%)	23 (20.9%)
19-3	35 (31.8%)	35 (31.8%)	9 (8.2%)	6 (5.5%)	2 (1.8%)	23 (20.9%)
19-4	40 (36.4%)	30 (27.3%)	12 (10.9%)	5 (4.5%)	0 (0.0%)	23 (20.9%)
19-5	20 (18.2%)	43 (39.1%)	19 (17.3%)	4 (3.6%)	1 (0.9%)	23 (20.9%)

20. In addition to the datasets presented in Q16, please list any other transportation data that you would like to have access to for updating land-use/circulation element in general plan or project-level CEQA reviews.

(Examples could include truck traffic volumes, estimated future traffic volume by modeling, traffic volume by time of day, traffic volume by trip purpose, commuting trip, real-time traffic volume, travel time between TAZs, Internal-External (IE) and External-Internal (EI) trips, transit travel time between stations/stops, transit headways, Ped/Bike collision data, local road pavement management and performance data, local public health data (asthma rate, climate data (for example, fire WUI), etc.), allowed parking and restricted parking areas, etc.)

Appendix C. MPO Survey Analysis

1. Please provide the name of MPO that you are affiliated with and your title at the MPO.
   Name of MPO: (text entry)

Title: (text entry)

Response summary

	All	Received	%
MPOs	18	11	61.1%

2. We will randomly select 10 respondents and provide them with a gift card ($25) as a token for your participation. Please provide your work email if you want to participate in the raffle for the gift card.
   Work email: (text entry)

General Plan and VMT/GHG Reduction

The purpose of this survey is to understand your organization's experiences with member jurisdictions when supporting local governments with travel data needs for general plan updates, particularly land-use and transportation/circulation element updates.

3. Please choose a scale for each statement that best describes your/the MPO's perspective.
   - 3-1. Local governments consider VMT/GHG emission reduction in local land-use/circulation planning.
   - 3-2. The MPO provides local governments with adequate data support to help them consider the impacts of land-use/circulation decisions on VMT.
   - 3-3. Local governments adequately employ appropriate public/private VMT-related data to help the state achieve its VMT/GHG emission reduction goals.
   - 3-4. The MPO provides local governments with scenario/sketch tools to estimate VMT impacts of land-use/transportation planning and development projects.
   - 3-5. The MPO should share more transportation data/tools with local governments to help the state meet VMT/GHG emission reduction goals.

Response Options:
Most likely, likely, neutral, less likely, rarely, I don't know.
Response summary

Answers	Most likely	Likely	Neutral	Less likely	Rarely	I don't know
3-1	3 (27.3%)	8 (72.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
3-2	5 (45.5%)	3 (27.3%)	3 (27.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
3-3	2 (18.2%)	3 (27.3%)	3 (27.3%)	1 (9.1%)	0 (0.0%)	2 (18.2%)
3-4	2 (18.2%)	3 (27.3%)	1 (9.1%)	2 (18.2%)	3 (27.3%)	0 (0.0%)
3-5	4 (36.4%)	2 (18.2%)	4 (36.4%)	1 (9.1%)	0 (0.0%)	0 (0.0%)

4. Please choose a scale for each reason that best describes your perspective. "I noticed that local governments experienced challenges to use more transportation data due to..."
   4-1. the lack of hardware/software.
   4-2. lack of staff in general.
   4-3. lack of required skillsets of existing staff.
   4-4. costs to purchase tools/data.
   4-5. lack of information about available data/tools.
   4-6. Other (please type any other reasons)

Response Options:
5 Likert scales from "Strongly Agree" to "Strongly Disagree"
Response summary

Answers	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	No Answer
4.1	4 (36.4%)	2 (18.2%)	2 (18.2%)	2 (18.2%)	0 (0%)	1 (9.1%)
4.2	4 (36.4%)	4 (36.4%)	1 (9.1%)	1 (9.1%)	0 (0%)	2 (18.2%)
4.3	1 (9.1%)	5 (45.5%)	1 (9.1%)	1 (9.1%)	1 (9.1%)	1 (9.1%)
4.4	3 (27.3%)	5 (45.5%)	0 (0%)	2 (18.2%)	0 (0%)	1 (9.1%)
4.5	2 (18.2%)	5 (45.5%)	1 (9.1%)	2 (18.2%)	0 (0%)	1 (9.1%)

5. How often does your organization hold collaborative meetings with local governments within your jurisdiction to address greenhouse gas (GHG) emissions mitigation?
   5-1. No collaborative meetings
   5-2. Irregular collaborative meetings
   5-3. Annual collaborative meetings
   5-4. Quarterly collaborative meetings
   5-5. Monthly collaborative meetings

Response Options:
Multiple choice (Choose one)
Response summary

	5-1	5-2	5-3	5-4	5-5	No Answer
Response	1 (9.1%)	6 (54.5%)	0 (0.0%)	1 (9.3%)	2 (18.1%)	0 (0.0%)

6. Do you find the following strategies frequently adopted and accepted in your member jurisdictions according to their recent general plan updates?
   6-1. Promoting Transit-oriented development (TOD)
   6-2. Promoting infill development
   6-3. Promoting mixed use development
   6-4. Increasing residential density
   6-5. Promoting developments along transit corridors
   6-6. Increasing employment density
   6-7. Increasing housing options/affordable housing
   6-8. Increasing Job/Housing balance
   6-9. Creating walkable/bikeable neighborhoods
   6-10. Introducing Parking-Pricing/Parking Reform
   6-11. Facilitating/Encouraging Micro-mobility options
   6-12. Others (list all other strategies used to reduce VMT/GHG emission)

Response Options:
5 Likert scales from "Strongly Agree" to "Strongly Disagree"
Response summary

Answers	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	No Answer
6.1	3 (27.3%)	6 (54.5%)	0 (0%)	1 (9.1%)	0 (0%)	1 (9.1%)
6.2	3 (27.3%)	7 (63.6%)	0 (0%)	0 (0%)	0 (0%)	1 (9.1%)
6.3	3 (27.3%)	7 (63.6%)	0 (0%)	0 (0%)	0 (0%)	1 (9.1%)
6.4	2 (18.2%)	7 (63.6%)	1 (9.1%)	0 (0%)	0 (0%)	1 (9.1%)
6.5	1 (9.1%)	7 (63.6%)	1 (9.1%)	1 (9.1%)	0 (0%)	1 (9.1%)
6.6	0 (0%)	7 (63.6%)	3 (27.3%)	0 (0%)	0 (0%)	1 (9.1%)
6.7	2 (18.2%)	8 (72.7%)	0 (0%)	0 (0%)	0 (0%)	1 (9.1%)
6.8	2 (18.2%)	6 (54.5%)	2 (18.2%)	0 (0%)	0 (0%)	1 (9.1%)
6.9	3 (27.3%)	7 (63.6%)	0 (0%)	0 (0%)	0 (0%)	1 (9.1%)
6.10	0 (0%)	5 (45.5%)	2 (18.2%)	3 (27.3%)	0 (0%)	1 (9.1%)
6.11	2 (18.2%)	4 (36.4%)	3 (27.3%)	1 (9.1%)	0 (0%)	1 (9.1%)

Data and Tool Support provided by your organization

This part of survey is designed to understand how the MPO provided assistance and support for local governments regarding their data needs for VMT estimation and reduction efforts.

7. Approximately, what percentage of local governments in your jurisdiction do you think…
    7.1. well utilize your VMT data
    7.2. somewhat utilize your VMT data
    7.3. not at all utilize your VMT data

Response Options:
Percent
Response summary

MPO	7.1	7.2	7.3
SBCAG	60%	20%	20%
SLOCOG	No Answer	No Answer	No Answer
MTC/ABAG	0%	100%	0%
MCAG	0%	100%	0%
FCOG	20%	40%	40%
KCOG	50%	30%	20%
SCAG	20%	60%	20%
TCAG	30%	70%	0%
SACOG	20%	70%	10%
SRTA	0%	100%	0%
SANDAG	75%	25%	0%

8. What VMT or VMT-related data sources do you provide to local agencies? Check all that apply.

Infrastructure

8.1 Roadway network
8.2 Truck routes
8.3 Transit route network
8.4 Transit station/stop location
8.5 Bicycle network
8.6 Bicycle-parking facilities
8.7 Sidewalks & other pedestrian facilities

Response Options:
Check all that apply
Response summary

Answers	Checked
8.1	10 (90.9%)
8.2	5 (45.5%)
8.3	10 (90.9%)
8.4	10 (90.9%)
8.5	9 (81.8%)
8.6	5 (45.5%)
8.7	4 (36.4%)

<u>Performance</u>

8.8 Roadway LOS
8.9 Socio-economic characteristics (car ownership, etc.)
8.10 O/D Matrix
8.11 Travel-time matrix
8.12 Mode-share scheme
8.13 Base VMT/AADT
8.14 Forecasted VMT/AADT
8.15 Transit ridership by route
8.16 Transit ridership by station/stop

Bicycle/pedestrian counts collected by field observation
Response Options:
Check all that apply
Response summary

Answers	Checked
8.8	6 (54.5%)
8.9	10 (90.9%)
8.1	7 (63.6%)
8.11	4 (36.4%)
8.12	5 (45.5%)
8.13	9 (81.8%)
8.14	8 (72.7%)
8.15	6 (54.5%)
8.16	4 (36.4%)
8.17	4 (36.4%)

9 Based only on the response options selected from Question 8 and added answers from 8-1, please provide <u>Top 5 most frequently requested datasets</u> by local governments.

Response Options:
Rank 1 to 5
Response summary

MPO	1ST	2ND	3RD	4TH	5TH
SBCAG	O/D Matrix	Base VMT/AADT	Forecasted VMT/AADT	Transit Station/Stop Location	VMT per resident
FCOG	Base VMT/AADT	Forecasted VMT/AADT	Roadway LOS	Roadway Network	Bicycle/Pedestrian counts collected by field observations
KCOG	Roadway Network	Base VMT/AADT	Forecasted VMT/AADT	Bicycle/Pedestrian counts collected by field observations	Transit ridership by route
SCAG	Base VMT/AADT	Forecasted VMT/AADT	Socio-Economic characteristics	Transit Route Network	Transit station/stop location
TCAG	Forecasted VMT/AADT	Base VMT/AADT	Socio-Economic characteristics	Transit Station/Stop Location	Bicycle/Pedestrian counts collected by field observations
SACOG	Roadway Network	Household generated VMT per Capita at certain zone level	Forecasted VMT/AADT	Transit Ridership by route	Mode-share scheme
SRTA	Roadway LOS	Base VMT/AADT	Forecasted VMT/AADT	O/D Matrix	Socio-Economic characteristics
SANDAG	O/D Matrix	Base VMT/AADT	Forecasted VMT/AADT	Transit Station/Stop Location	VMT per resident
SBCAG	O/D Matrix	Base VMT/AADT	Forecasted VMT/AADT	Transit Station/Stop Location	VMT per resident

10 Which of the datasets do you think will help local governments achieve VMT/GHG emission reduction?

<u>Infrastructure</u>

10-1. Roadway network
10-2 Truck routes
10-3. Transit route network

10-4. Transit station/stop location
10-5. Bicycle network
10-6. Bicycle-parking facilities
10-7. Sidewalks and other pedestrian facilities

Performance

10-8. Roadway LOS
10-9. Socio-economic characteristics (carownership, etc.)
10-10. O/D Matrix
10-11. Travel-time matrix
10.12 Mode-share scheme
10.13 Base VMT/AADT
10.14 Forecasted VMT/AADT
10.15 Transit ridership by route
10.16 Transit ridership by station/stop
10.17 Bicycle/pedestrian counts collected by field observations
10.18 Other (list all other transportation datasets used)

Response Options:
5 Likert scales from “Extremely helpful” to “Not at all helpful”
Response summary

Answer	Extremely helpful	Very helpful	Moderately helpful	Slightly helpful	Not at all helpful	No Answer
10.1	1 (9.1%)	4 (36.4%)	2 (18.2%)	1 (9.1%)	1 (9.1%)	2 (18.2%)
10.2	0 (0%)	1 (9.1%)	5 (45.5%)	1 (9.1%)	2 (18.2%)	2 (18.2%)
10.3	0 (0%)	6 (54.5%)	2 (18.2%)	1 (9.1%)	0 (0%)	2 (18.2%)
10.4	1 (9.1%)	3 (27.3%)	4 (36.4%)	1 (9.1%)	0 (0%)	2 (18.2%)
10.5	1 (9.1%)	3 (27.3%)	5 (45.5%)	0 (0%)	0 (0%)	2 (18.2%)
10.6	0 (0%)	2 (18.2%)	4 (36.4%)	3 (27.3%)	0 (0%)	2 (18.2%)
10.7	1 (9.1%)	3 (27.3%)	3 (27.3%)	2 (18.2%)	0 (0%)	2 (18.2%)
10.8	3 (27.3%)	2 (18.2%)	1 (9.1%)	1 (9.1%)	2 (18.2%)	2 (18.2%)
10.9	1 (9.1%)	5 (45.5%)	3 (27.3%)	0 (0%)	0 (0%)	2 (18.2%)
10.10	1 (9.1%)	6 (54.5%)	2 (18.2%)	0 (0%)	0 (0%)	2 (18.2%)
10.11	0 (0%)	6 (54.5%)	1 (9.1%)	2 (18.2%)	0 (0%)	2 (18.2%)
10.12	1 (9.1%)	6 (54.5%)	1 (9.1%)	1 (9.1%)	0 (0%)	2 (18.2%)
10.13	4 (36.4%)	5 (45.5%)	0 (0%)	0 (0%)	0 (0%)	2 (18.2%)
10.14	4 (36.4%)	5 (45.5%)	0 (0%)	0 (0%)	0 (0%)	2 (18.2%)
10.15	1 (9.1%)	4 (36.4%)	4 (36.4%)	0 (0%)	0 (0%)	2 (18.2%)
10.16	0 (0%)	4 (36.4%)	2 (18.2%)	3 (27.3%)	0 (0%)	2 (18.2%)
10.17	0 (0%)	5 (45.5%)	3 (27.3%)	1 (9.1%)	0 (0%)	2 (18.2%)

11. Does your organization provide the following tools and support to local governments?

11.1 GIS software license
11.2 GIS software training/technical support
11.3 Sketch planning tool License (example: Urban Footprint/CalEEMod/Envision tomorrow/ArcUrban)
11.4 Sketch planning tool Training/Technical Support
11.5 List any other tools and support you have provided to local agencies (text entry)

Response Options:
Check all that apply
Response summary

Answers	Yes	No	No Answer
11.1	2 (18.2%)	7 (63.6%)	2 (18.2%)
11.2	6 (54.5%)	3 (27.3%)	2 (18.2%)
11.3	2 (18.2%)	7 (63.6%)	2 (18.2%)
11.4	4 (36.4%)	5 (45.5%)	2 (18.2%)

12. Please rank the response options from the most frequently requested to the least frequently requested support by local governments.
    12.1. GIS software license
    12.2. GIS software training/technical support
    12.3. Sketch planning tool License (i.e.: Urban Footprint/CalEEMod/Envision tomorrow/ArcUrban)
    12.4. Sketch planning tool Training/Technical Support
    12.5. List any other tools and support you have provided to local agencies (text entry)

Response Options:
Rank 1 to 5
Response summary

Answers	1st	2nd	3rd	4th	5th
12.1	1 (9.1%)	1 (9.1%)	2 (18.1%)	0 (0.0%)	3 (27.3%)
12.2	0 (0.0%)	4 (36.4%)	0 (0.0%)	2 (18.1%)	1 (9.1%)
12.3	3 (27.3%)	0 (0.0%)	0 (0.0%)	2 (18.1%)	1 (9.1%)
12.4	1 (9.1%)	8 (9.1%)	4 (36.4%)	2 (18.1%)	0 (0.0%)
12.5	1 (9.1%)	8 (9.1%)	1 (9.1%)	2 (18.1%)	0 (0.0%)

13. Which of the tools/support do you think will help local governments achieve VMT/GHG emission reduction? (using the same list from Q11 and Q12)

    13.1. GIS software license
    13.2. GIS software training/technical support
    13.3. Sketch planning tool License (example: Urban Footprint)
    13.4. Sketch planning tool Training/Technical Support (example: Urban Footprint/CalEEMod/ Envision tomorrow)
    13.5. List any other tools and support you have provided to local agencies (text entry)

Response Options:
5 Likert scales from "Extremely helpful" to "Not at all helpful"
Response summary

Answers	Extremely helpful	Very helpful	Moderately helpful	Slightly helpful	Not at all helpful	Blank
13.1	1 (9.10%)	1 (9.10%)	3 (27.30%)	4 (36.40%)	0 (0.00%)	2 (18.20%)
13.2	2 (18.20%)	1 (9.10%)	4 (36.40%)	2 (18.20%)	0 (0.00%)	2 (18.20%)
13.3	1 (9.10%)	4 (36.40%)	3 (27.30%)	1 (9.10%)	0 (0.00%)	2 (18.20%)
13.4	1 (9.10%)	4 (36.40%)	4 (36.40%)	0 (0.00%)	0 (0.00%)	2 (18.20%)
13.5	6 (18.2%)	6 (18.2%)	2 (6.1%)	3 (9.1%)	0 (0.00%)	16 (48.5%)

14. What barriers or challenges have you encountered with accessing/using VMT data for regional planning as well as for sharing data with local governments?

- MCAG has been working on regional guidelines for VMT data and have been developing an online tool that is integrated with a regional traffic model, should be completed by end of 2022 year.
- Fresno COG challenges: Datasets have become very large and sophisticated, this has left local agencies without the expertise to use them fully.
- SCAG iterated that there is a need to determine the types of VMT in local regions.
    - Need to understand the per capita VMT for residents in the jurisdiction or the network/roadway VMT within the boundary of the jurisdiction.
    - There is a concern of the VMT data generated by regional models and if local jurisdictions can validate the modeled versus the observed, thus data should be used with caution.
    - Challenge of consistency and quality of locally assessed VMT data and sketch modeling tools.
- Tulare CAG, shared that there is limited scope and precision of Highway Performance Monitoring System (HPMS) with respect to VMT data.

- Sacramento Area Council of Govt. challenges were focused on the lack of data and tools:
    - Need timelier and “spatially granular VMT data”
    - Lack of tools/methodologies to estimate VMT/GHG impacts at project level
- Shasta Regional Transportation Agency, listed challenges around the accessibility and use of data
    - Local agencies are concerned about accuracy of data and misunderstanding by land developers.
    - Legal implications of data being available to the public.
    - Concerns over how state agencies use the data.
    - Cost of acquiring data, including big data for smaller regions.
    - Lack of comprehensive database.
- SANDAG barriers data available for local planning efforts:
    - Activity Based Model (ABM) and “best available data”
    - Need more sketch and planning options and methods to quickly analyze VMT

15. We would like to identify best practices among your member jurisdictions regarding VMT reduction efforts via land-use/circulation planning. Please provide name(s) of the local jurisdictions that have developed/used any VMT data and calculation methodologies to meet their local VMT need for land-use planning. It would be particularly helpful if you could provide a specific list of jurisdictions that you think we might want to reach out to understand their practices in more detail.

Appendix D: The Summary of Data/Tools

D.1. National Transit Map

Link: https://www.bts.gov/national-transit-map/national-transit-map-data-maps-and-apps

(accessed June 18, 2023)

Overview

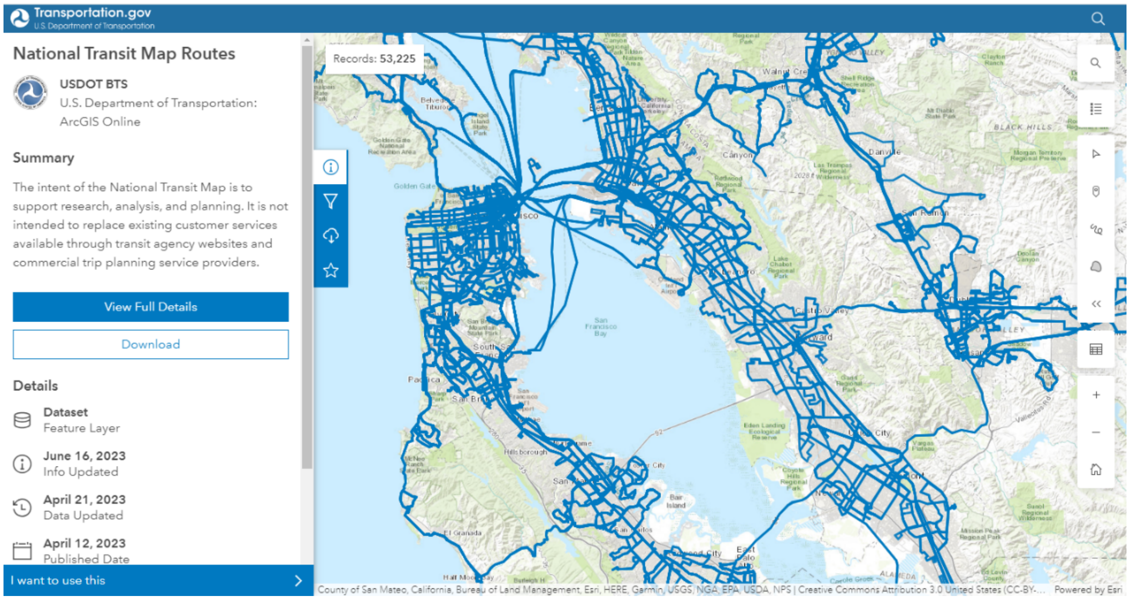
The National Transit Map (NTM) is a National Geospatial Data Asset within the National Transportation Atlas Database, a set of nationwide geographic databases of transportation facilities, networks, and associated infrastructure. NTM includes a nationwide catalog of fixed-guideway and fixed-route transit service in America that is gleaned from publicly available information. A geospatial database is included that can be used to display transit agencies' stops and routes for the purpose of supporting research, analysis, and planning.

The NTM combines voluntarily provided General Transit Feed Specification (GTFS) data for both fixed-guideway and fixed-route service. GTFS describes a transit agency's scheduled operations by collecting data on stops, routes, and scheduled service for both fixed-guideway and fixed-route services.

Data

The NTM allows downloading three transit datasets.

- Agencies: This dataset includes transit agencies that are participating in the NTM and authorize the U.S. Department of Transportation to use their publicly available General Transit Feed Specification data.
- Routes: This dataset shows a group of trips that are displayed to riders as a single service.
- Stops: This dataset shows where vehicles pick up or drop off riders. It also defines stations and station entrances.



D.2. California Bicycle Coalition (CalBike)

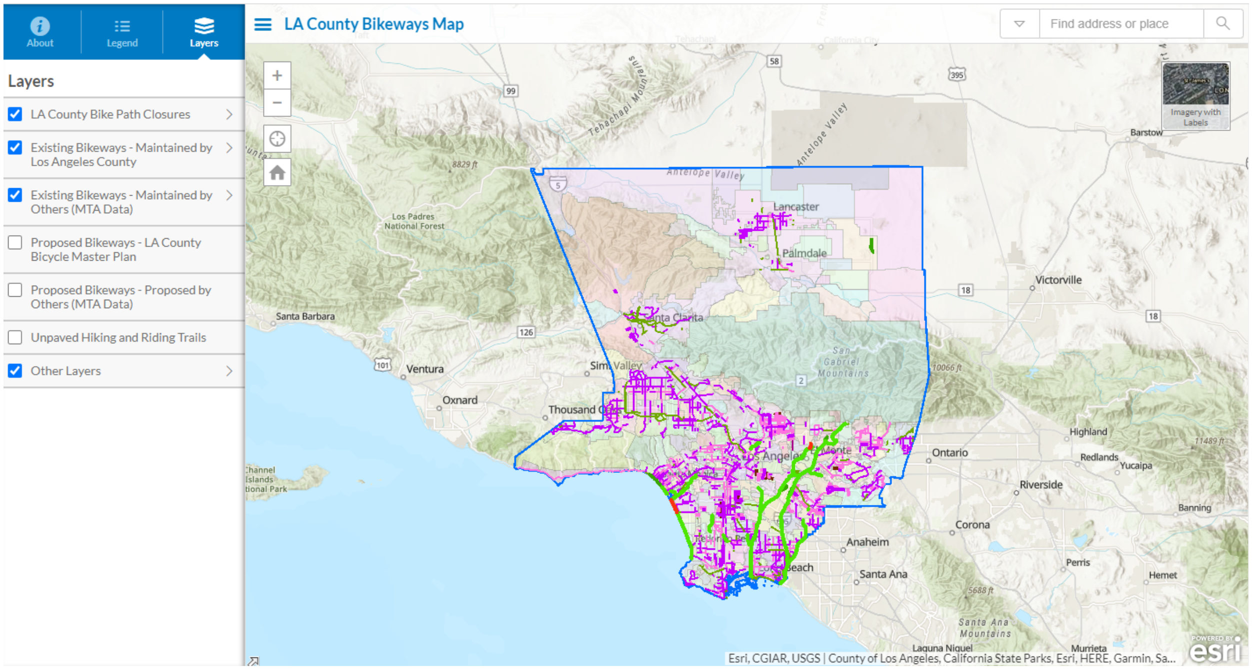
Link: https://www.calbike.org/go_for_a_ride/map_routes/ (accessed June 18, 2023)

<u>Overview</u>

California Bicycle Coalition (CalBike) is an advocacy organization that seeks to expand bicycling in the state of California. CalBike works to change policy, unite advocates, build infrastructure, reduce carbon emissions, and encourage bicycling to create safer streets for all Californians. As one of the efforts to advocate bicycling, CalBike plays a role of a central repository of bicycle route data. CalBike collects and disseminates free maps of bicycle routes on local and regional roadways and state highways, as well as some dedicated bike paths, throughout California.

<u>Data</u>

CalBike organizes the data by region in California. There are 8 regions including North Coast, North State, Sacramento area, Northern Sierras and Lake Tahoe, Greater San Francisco Bay Area, San Joaquin Valley and Southern/Eastern Sierras, Central Coast, Greater Los Angeles Area, Ventura County and Inland Empire, and South Coast. Some of the maps are in a PDF, but a large amount of data is available/downloadable in a GIS format.



D.3. The Countywide Address Management System (CAMS)

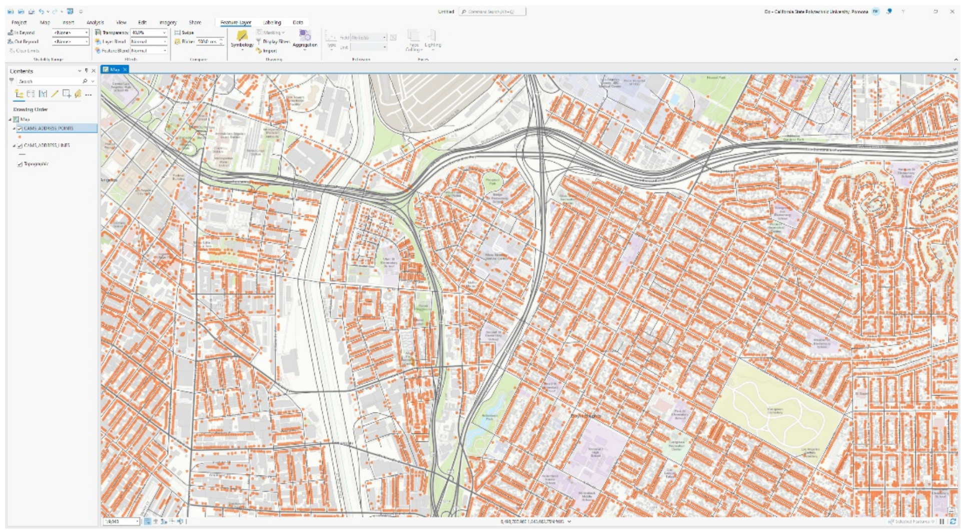
Link: https://cams-lacounty.hub.arcgis.com/ (accessed June 18, 2023)

<u>Overview</u>

Los Angeles County established the Countywide Address Management System (CAMS) as a centralized repository of authoritative physical (situs) addresses. CAMS is critical for effectively providing services used by many departments in Los Angeles County. When used in tandem with other essential county data systems, CAMS helps support the health, safety, and welfare of those who live and work in the County of Los Angeles. The Internal Services Department (ISD) Enterprise GIS Program (eGIS) manages and maintains the infrastructure behind the successful program. An address is a collection of information, presented in a mostly fixed format, used to give the location of a building, other structure, or a plot of land, generally using political boundaries and street names as references, along with other identifiers such as a house or apartment numbers and organization name. In order to manage and map addresses, CAMS developed a set of geospatial data including street centerline and address point files

Data

CAMS data include address points and road segments. The address points dataset includes the geographic coordinates of each assigned address point. Address Points represent the approximate location of a site or structure or in some cases the location of access to a site or structure. Each address point in the Site/Structure Address Points GIS data layer has attribute data associated with it that provides its street name, address number, jurisdictional place names, and other attribute information. The road segments dataset includes the start and end geography of the approximate road feature. sometimes also called "Street Centerline". The dataset represents the approximate center of a real-world roadway. The Road Segments GIS data layer utilizes arc-node topology with each road segment having attribute data associated with it that provides the segment's street name, civic address ranges and jurisdictional place names on each side of the segment, and other attribute information.



D.4. Active Transportation Database (ATDB)

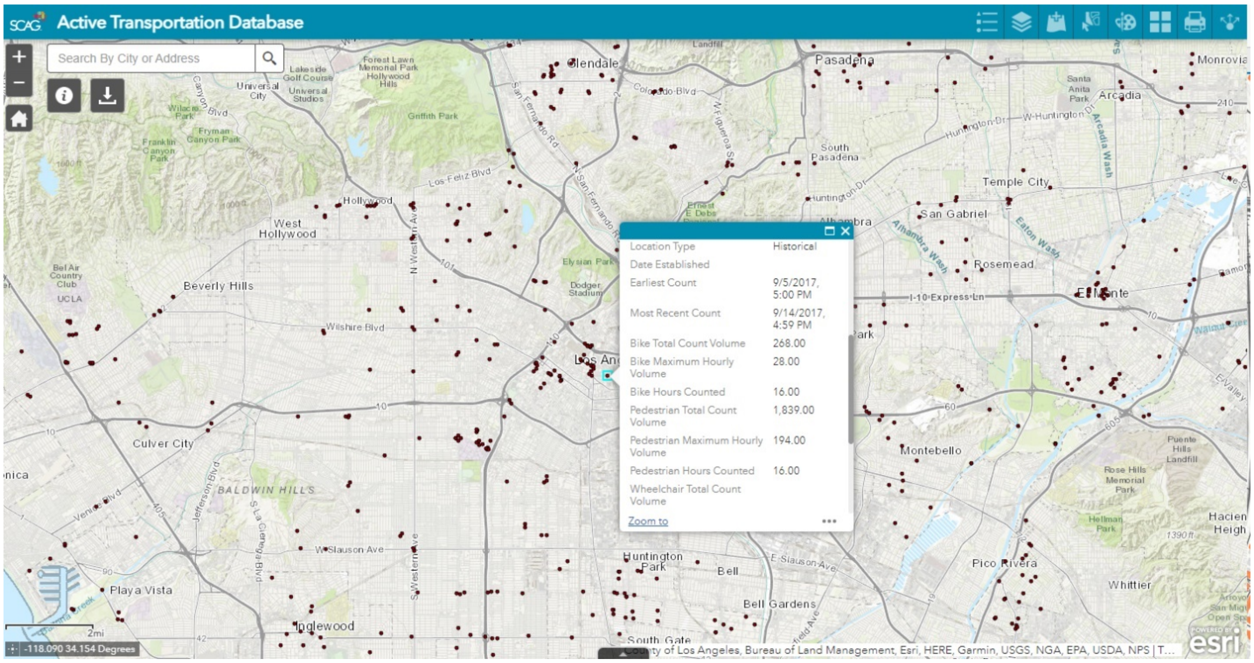
Link: https://atdb.scag.ca.gov/Pages/Home.aspx (accessed June 18, 2023)

Overview

Southern California Association of Governments (SCAG) developed the Active Transportation Database (ATDB) to collect and store bicycle, pedestrian, wheelchair, and scooter/skateboard volume counts from infrastructure and planning projects across Southern California. Building off of the Bicycle Data Clearinghouse developed by the University of California Los Angeles (UCLA), SCAG expanded its functionality and incorporate pedestrian trips. All previous counts stored in the Bicycle Data Clearinghouse have been transferred into the new database. Due to changes in the database structure, new data includes additional information that is not available for legacy counts from the previous format. SCAG intends to 1) provide a standardized methodology for pre and post-counts required by the Active Transportation Program (ATP), 2) allow for agencies that have installed automated counters to store data in order to develop seasonal correction factors for short-duration counts and other modal analysis, 3) provide an open dataset for researchers interested in analyzing trends in bicycle and pedestrian trips and mode shift, and 4) support active transportation planning by providing a “one-stop-shop" of data commonly used in active transportation planning.

<u>Data</u>

The ATDB offers longitudinal active transportation count data. Thus, users can select and download the data by defining geographical areas and time periods in which they are interested. The data include bicycle, pedestrian, and wheelchair counts.



D.5. StreetLight

Link: <u>https://www.streetlightdata.com/</u> (accessed June 22, 2023)

<u>Overview</u>

StreetLight is big data web platform that harnesses connected device and IoT data to measure vehicle, transit, bike, and foot traffic. Based on the traffic data collected, it offers self-serve software that allows analyzing traffic volumes, Origin-Destination, turning movement counts, and other transportation metrics for any road, area, or time period. Since StreetLight provides on-demand analytics that captures critical trends in transportation, letting you analyze, visualize and compare travel patterns in various geographical areas like a city or a county, it can be called as a transportation planning tool that uses cell-based data to aggregate a number of transportation analyses. StreetLight is also considered an alternative to traditional traffic counters and travel surveys that require high monetary and time costs. The tool has a database of vehicular, freight, ped/bike, and even some air travel data. StreetLight’s Metrics are primarily derived from the following list.

- Connected Vehicle Data (CVD)
- GPS data
- Commercial truck data for a range of weight classes
- Location-based services (LBS) mobility data
- Thousands of vehicular, bicycle, and pedestrian sensors
- Land use data, parcel data
- Census characteristics (e.g., demographics, vehicle ownership, housing density)
- Road network and characteristics from OpenStreetMap (OSM)

The relative share of each source has changed over time as a result of changes in availability. The share of GPS and CVD data has significantly increased, while the share of LBS mobility data has declined.

Analysis

SteetLight allows users to select and conduct a wide range of analyses including

- Modular Analysis: Understand travel patterns using geospatial filters that users define such as "Zone Activity", "Origin-Destination", and "Origin-Destination through Middle Filters"
- Exploratory Analysis: Discover what routes and geographies interact with the geospatial filters you define like "Trips to or from Pre-set Geography", "Top Routes for Zones", and "Top Routes between Origins and Destinations"
- Turning Movement Counts: Analyze the movement of vehicles in an intersection to determine traffic that moves left, right, or continues straight
- AADT: Measure Average Annual Daily Traffic anywhere in the contiguous Unites States and Canada
- Segment Analysis: Get trip information for a specific road segment from one pass-through gate to another

For the analysis, users are required to set up their analysis using basic information like name, a unit of measurement, tags, description, and location of the analysis (in the case of turning movement counts analysis, intersections). Optionally, users can set up data periods (the ranges of dates for the analysis), day parts (times of the day for the analysis), and output types.

Output Data Provided by Analysis

Apparently, the output data generated by the analysis vary. In summary, StreetLight creates the following outputs. All Outputs offer vehicle, bike/ped, or truck counts.

- Origin-Destination patterns
  - Historical Trends
  - Transit OD patterns
  - Freight
  - Ped/Bike Activity
- Turning Movement Counts
  - Zone Distribution (broken down by time in 15-minute intervals)
- Corridor Study
  - Traffic by Travel Time
  - Traffic by Trip Length
  - Traffic by Trip Speed
  - Traffic by Trip Circuity
  - Zone Distribution
- Segment Analysis
  - Zone Distribution

<u>Quick User Instructions</u>

- On the left-hand side of the screen, there are 4 icons labeled "Zones", "Analyses", "Viz3D", and "Account". To perform any analysis that was outlined in the inputs section, press the "Analyses" icon.
- Once you press the icon, you will then press the "Create New Analysis" button at the top right of the screen.

- From there, you will select which type of analysis you want to do; as outlined in the input section.

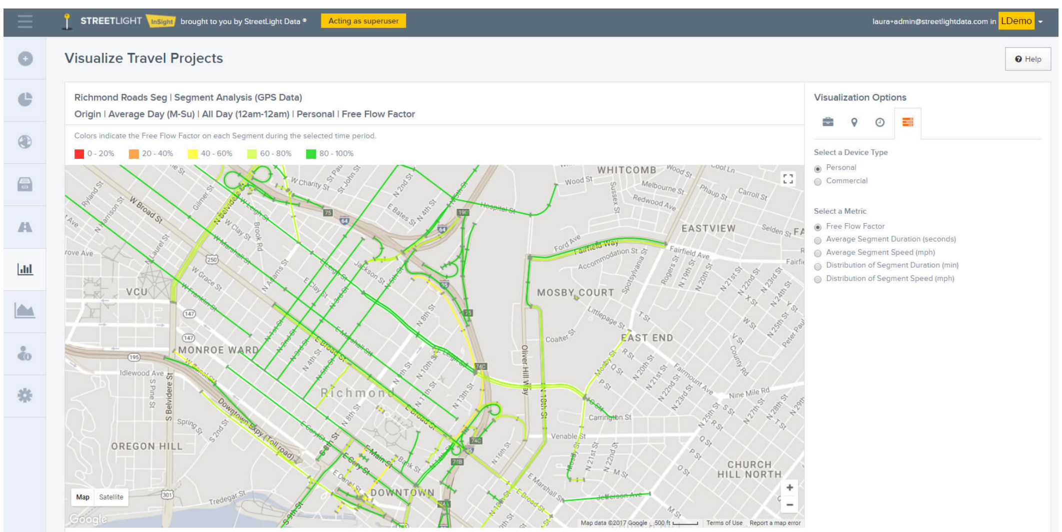
- Once you select your analysis, you will be on the Basic Info page where you will input information about your analysis.

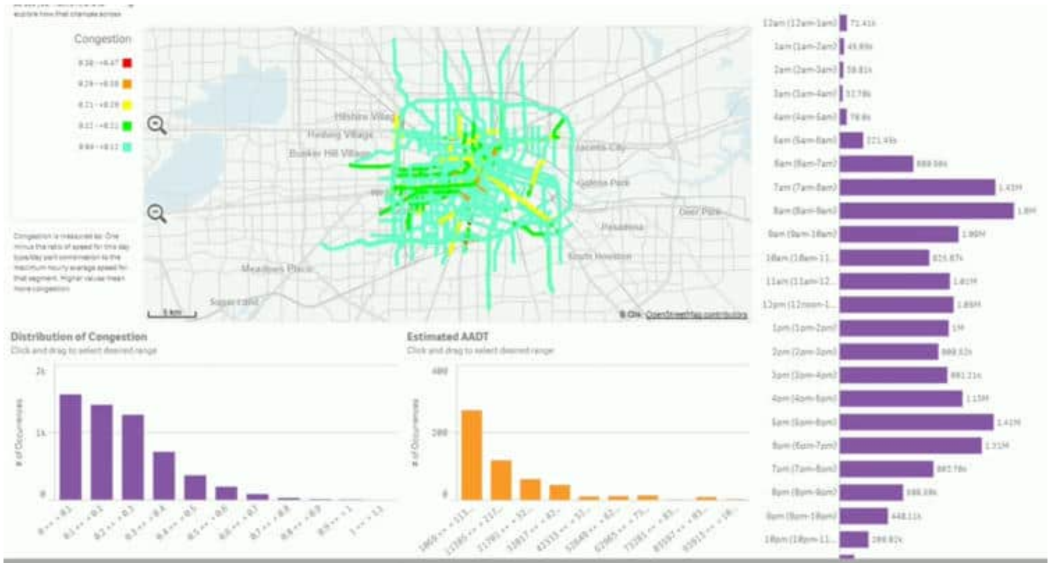
- Then, you will go to the zones page. This is where you will input the geographic information for your analysis.

- After that, you will want to go to the Options page. This is where you will input more specificities about the analysis' data as outlined in the input section

- Once you are satisfied with your inputs, press the confirm button at the bottom of the screen. A pop-up will appear showing all the inputs you have selected. If satisfied, press the confirm analysis button. If not, press the go back button and make the changes as needed.

- Once you confirm the analysis, the map will show the results of your analysis visually. To see the results graphically, press the first icon or second icon (depending on the desired analysis) at the right-hand side of the screen. Graphical results will appear on a pop-up.





D.6. Census for Transportation Planning Products (CTPP)

Link: https://ctpp.transportation.org/ (accessed June 23, 2023)

Overview

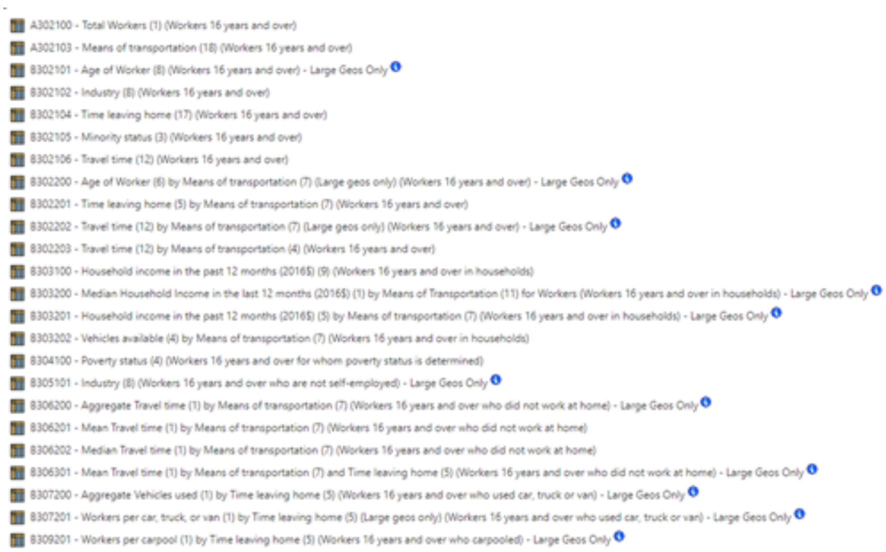
The CTPP Program is a cooperative program funded by state departments of transportation and technical support for the program is provided by the American Association of State Highway and Transportation Officials (AASHTO). The program procures tabulations of American Community Survey (ACS) 5-year (and historical Census decennial) data. The program produces a set of special tabulations from the US Census Bureau's ACS that include residence-based data, workplace-based data, and commuter flow from home to work, commonly known as journey-to-work (JTW). The ACS is an ongoing survey that provides information annually. The Census releases the data according to a population threshold in one and five-year aggregations. The CTPP tabulations provide household, personal, and commuting characteristics in addition to the geographic pattern of the home-to-work commute. The key differences between ACS data and CTPP data are the flow from home to work and workplace-based data at large and small geographies like metropolitan statistical areas and census tracts.

Inputs

You need to define the unit and locations of residence (residence-based), work (workplace-based), or both (journey-to-work) depending on the data that you want to retrieve. For the applications and analyses at a local level, it would be appropriate and useful to retrieve the data by census tract and traffic analysis zone (TAZ).

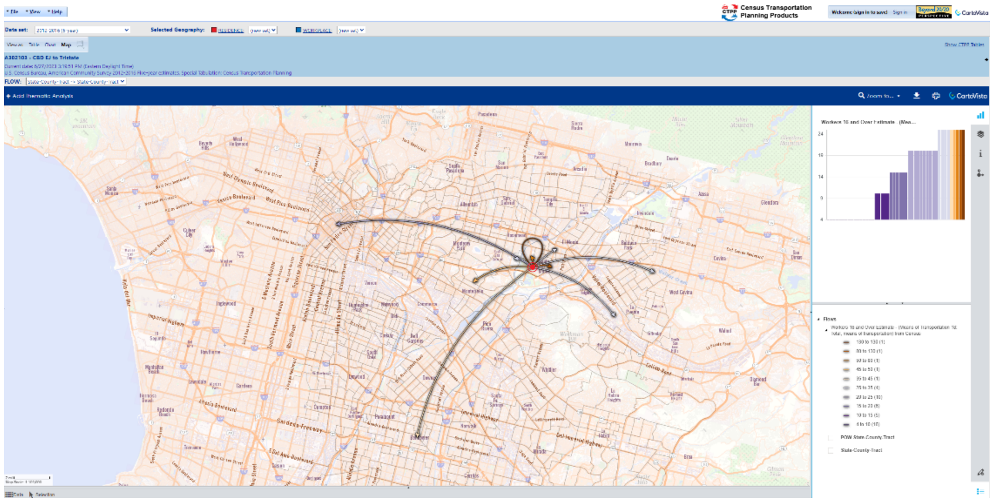
Outputs

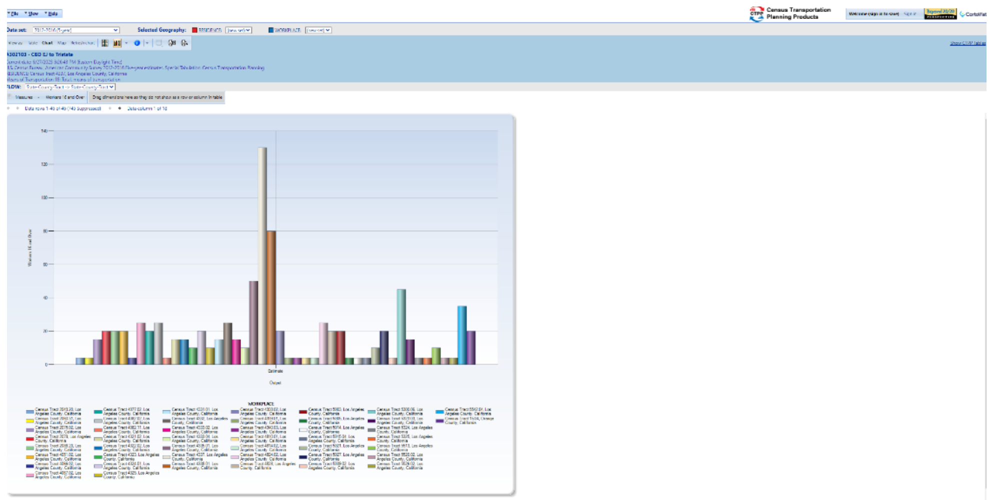
In addition to the ACS data at residences and workplaces, the program offers the commuting flow (journey-to-work) between an origin (residence) and a destination (workplace). This can play a role of an O/D matrix, especially for commuting trips. The flow is also categorized and further defined by the ACS data (see the figure).



Quick User Instructions for the Flow Analysis

- Go to the CTPP data page, http://data5.ctpp.transportation.org/ctpp1216/Browse/browsetables.aspx
- In the case that you want to retrieve the data that represent where residents go to work, click on the "RESIDENCE" icon at the top of the screen. And on the Residence page, select one or multiple geographies (e.g., census tract) for the locations of the residence in which you are interested. Click on the "WORKPLACE" icon at the top of the screen. And define and select one or multiple geographies (e.g., census tract) for the locations of the workplace in which you are interested.
- In the case that you want to retrieve the data that represent where workers come from, you want to do the previous step reversely.
- Click on the Show CTPP table button.
- Select the name of the data that you want to retrieve.
- Select one of the options for visualizing output data (e.g., map, table, or chart)
- Click on the download button if you want to download





D.7. The Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics (LODES)

Link: https://lehd.ces.census.gov/data/ (accessed June 23, 2023)

<u>Overview</u>

The Longitudinal Employer-Household Dynamics (LEHD) is a collection of datasets and tools using Census data that can be used to analyze where people work and live throughout the United States as well as other employment characteristics like veteran employment, and post-secondary employment. The LEHD offers the Origin/Destination analysis tool called LEHD Origin-Destination Employment Statistics (LODES). Like CTPP, LODES provides the commuting flow data between origins and destinations. The smallest geographical unit of analysis offered by LODES is the census tract. Although multiple geographical units of analysis are available (e.g., state, county, place, zip code, or Metropolitan/Micropolitan Area), the census tract, which is the smallest unit, could be the best option for analysis at a local level.

Unlike CTPP, LODES further delineates the commuting flow by industry type, workers' age, and workers' earning level. LODES data was generated based on the combination of unemployment insurance earnings data and quarterly census of employment and wages data from States. Thus, the limitations of the data include 1) the data do not include self-employed individuals, 2) workplace location reported by the employer may not be the physical location to which the employee commutes (e.g., telecommuters), and 3) there are known issues with employers underreporting multiple worksite locations.

Analysis

With the LODES data, users can conduct multiple analyses including the area profile analysis (the overview of the number and characteristics of the jobs in selected areas), the work area comparison analysis (the comparison of the number and characteristics of the jobs in selected areas with the jobs in the surrounding areas), the distance/direction analysis (the distance and direction that workers are traveling in the selected areas), and the inflow/outflow analysis (inflow/outflow of workers based on the selected areas such as "employed in the selected area but live outside", "live in the selected area, but employed outside", and "employed and live in the selected areas"). Of the analyses, the destination analysis presents an O/D matrix as the output. As users select one or multiple census tracts as the origin or destination for the analysis, LODES will generate the outputs of trips to workplaces or trips from residences, respectively.

Inputs for the Destination Analysis

The geographical units of analysis: The area in which you are interested. The area can be selected by searching the list (e.g., census tract IDs) or delineating it on the map.

Home/Work area: Determines whether the selection area is analyzed on where workers live ("Home") or where workers are employed ("Work").

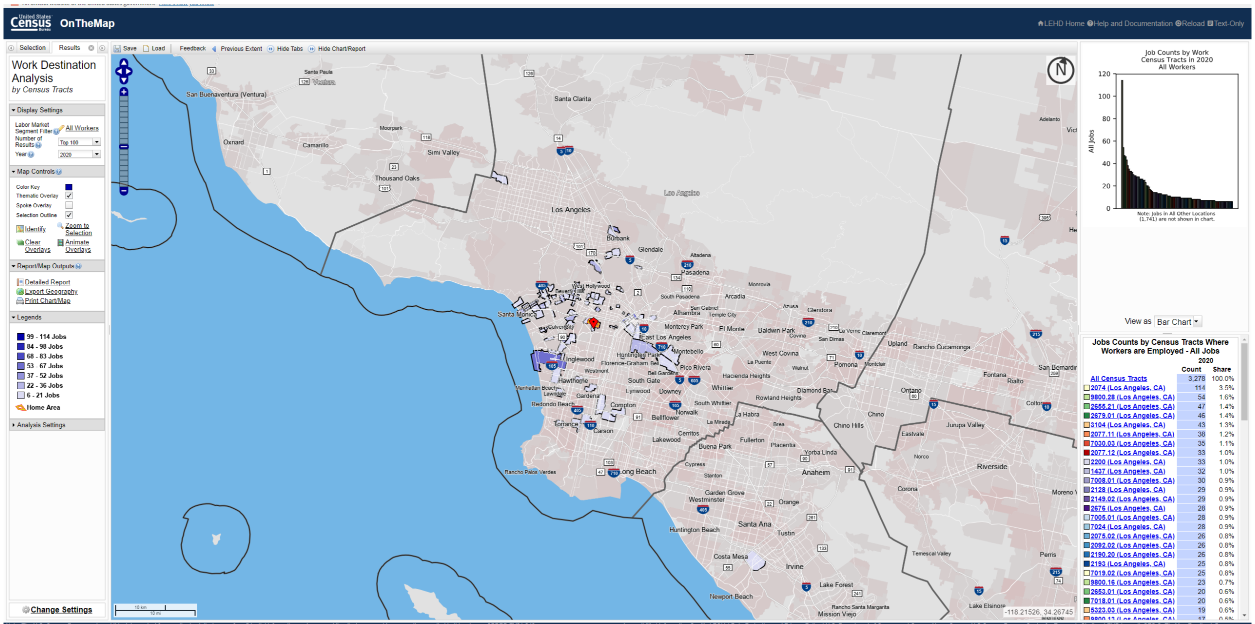
Destination type: The geographical unit of the analysis (As mentioned above, the census tract can be the best option for analysis at a local level.)

Year: Determines the year(s) of data that will be processed in the analysis.

Job Type: Determines the scope of jobs that will be processed in the analysis. Options include all jobs, primary jobs, all private jobs, and private primary jobs

Outputs

LODES generates a map for the selected origin (or destination) geography that shows where the workers travel from (or to). The output also includes the total number of commuters and their profile such as age cohort (all workers, age 29 or younger, age 30 to 54, and age 55 or older), income level ($1,250 per month or less, $1,251 to $3,333 per month, and more than $3,333 per month), and job type (goods producing, trade, Transportation, and Utilities, and all other services).



Quick User Instructions for the Destination Analysis

- Once you are at the "OnTheMap' page (https://onthemap.ces.census.gov/) , on the left-hand side you can search for your desired geography for your analysis to be based on. You can type it in directly, or you can choose the type of geography you want and then type in the name to narrow the options. You can also import a specific geography using a KML, GPS, or SHP file. Below that, you can also load a OTM file or a previous analysis that you have saved and exported.

- Once you select your geography, it will show you that geography on the map with a pop-up coming from it. On that pop-up, you can select "Perform Analysis on Selected Area" to start setting inputs for your analysis.

- Select each input as shown above in the Input for the Destination Analysis section.

- Once all inputs are completed, select the "Go" button on the bottom right-hand corner to get the output of your analysis.

- Toggle the options available for Labor Market Segment Filters on the top-left corner for the profile of commuters.

D.8. LOCUS

Link: https://10az.online.tableau.com/#/site/riits/collections/42a38832-5612-4247-9825-0d37404c6f74 (accessed June 23, 2023)

Overview

In collaboration with Measure Up! and the Regional Integration of Intelligent Transportation Systems (RIITS), the Los Angeles County Metropolitan Transportation Authority (LA Metro) lately developed a data dashboard named LOCUS. LOCUS is designed in a way that collects, shares and analyzes transportation data to better understand travel patterns and help inform transportation policies and operations throughout the Los Angeles region. LOCUS containing origin-destination trip visualizations are dashboards that provide information from transportation trips based on data from smartphones and other connected devices that are aggregated and algorithmically analyzed so that no personal information is identified or accessible.

LOCUS includes two dashboards reflecting datasets from 2017 and the second half of 2019/2020. The new 2019/2020 dataset includes additional transportation/travel behavior information, including walking, biking, public transportation, auto, goods movement and commuting. LA Metro is also sharing licenses to use the datasets with other public agencies and researchers. While multiple geographical units of analysis are available (e.g., city, unincorporated area, neighborhood), the smallest unit of LOCUS is the census block group.

Inputs

Origin: The origin of the origin-destination analysis needs to be selected. Multiple entities can be selected (e.g., census block groups)

Destination: The destination of the origin-destination analysis needs to be selected.

Trip Filters: Sorting and filtering the trips that you want to analyze. Options include travel day of the week (weekdays, Saturday, and Sunday), travel time of the Day (all, early AM (4 – 6 am), AM Peak (6 – 9:30 am), Midday (9:30 am – 2 pm), PM Peak (2 – 6:30 pm), late evening (6:30 – 12 am), and owl period (12 – 4 am)), trip purpose (all, home – regular, home – other, regular – other, other – other), trip length in miles (all, 0 – 1, 1 – 2.5, 2.5 – 5, 5 – 7.5, 7.5 – 10, 10 – 15, 15 – 20, 20 – 30, 30 – 40, 40 – 50, and 50+), trip type (all, intra-block group trips, and inter-block group trips), and equity groups (filtering trips made by travelers living in an equity-focused community (EFC) or non-EFC).

Outputs

Total trips: The total number daily of trips between your selected origin(s) and destination(s)

Total transit trips: The total number of daily transit trips between your selected origin(s) and destination(s)

Transit market share: The percentage of daily transit trips versus total number of daily trips between your selected origin(s) and destination(s) (Transit Trips/Total Trips)

Total person miles traveled: The total mileage of every daily trip between your selected origin(s) and destination(s)

Trips by equity group: The total number and percentage of daily trips made by whether it is from a EFC or non-EFC community

Trips by purpose: The total number and percentage of daily trips made by trip purpose (same trip purposes as shown above)

Trips by time of day: The total number and percentage of daily trips by each time of day (same time periods as shown above)

Trips by trip length: The total number and percentage of daily trips made by trip length (same length intervals as shown above)

Quick User Instructions

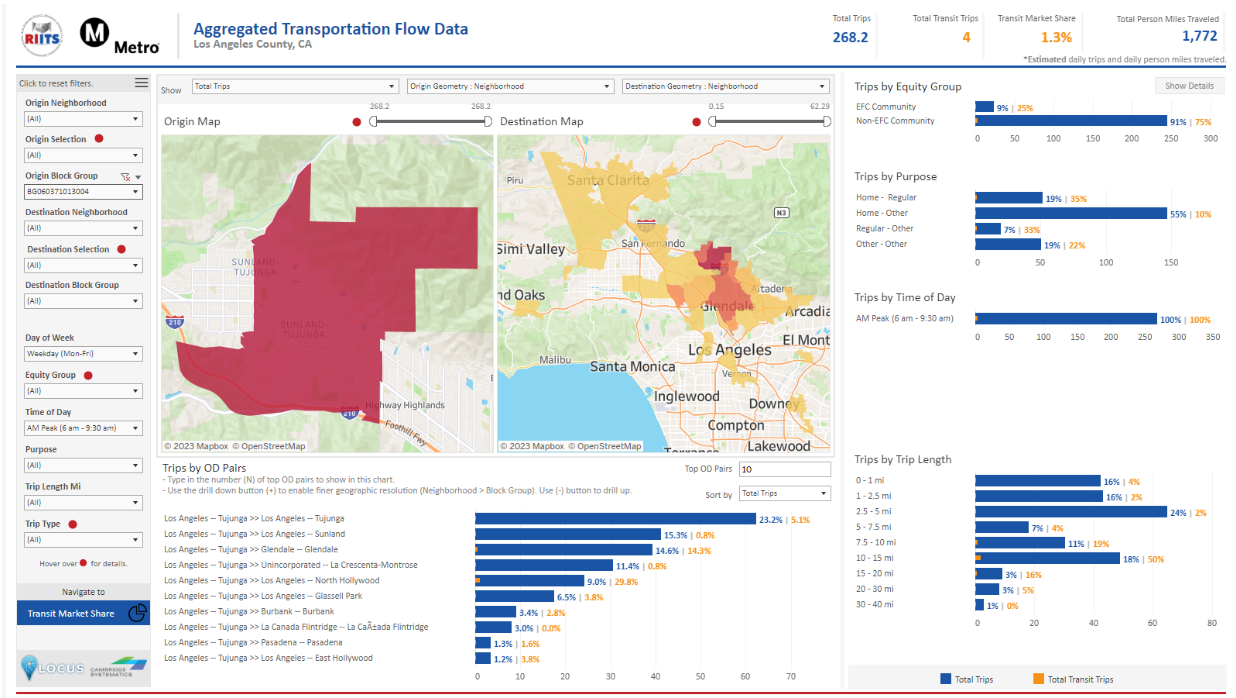
- Once on the "Aggregated Transportation Flow Data" screen, you will see two maps – an origin map and a destination map. On the left-hand side of the screen, you will see all the inputs that you can apply to the analysis. The data on the top of the screen and the righthand side of the screen are the outputs that you get from the analysis before applying any inputs or filters.

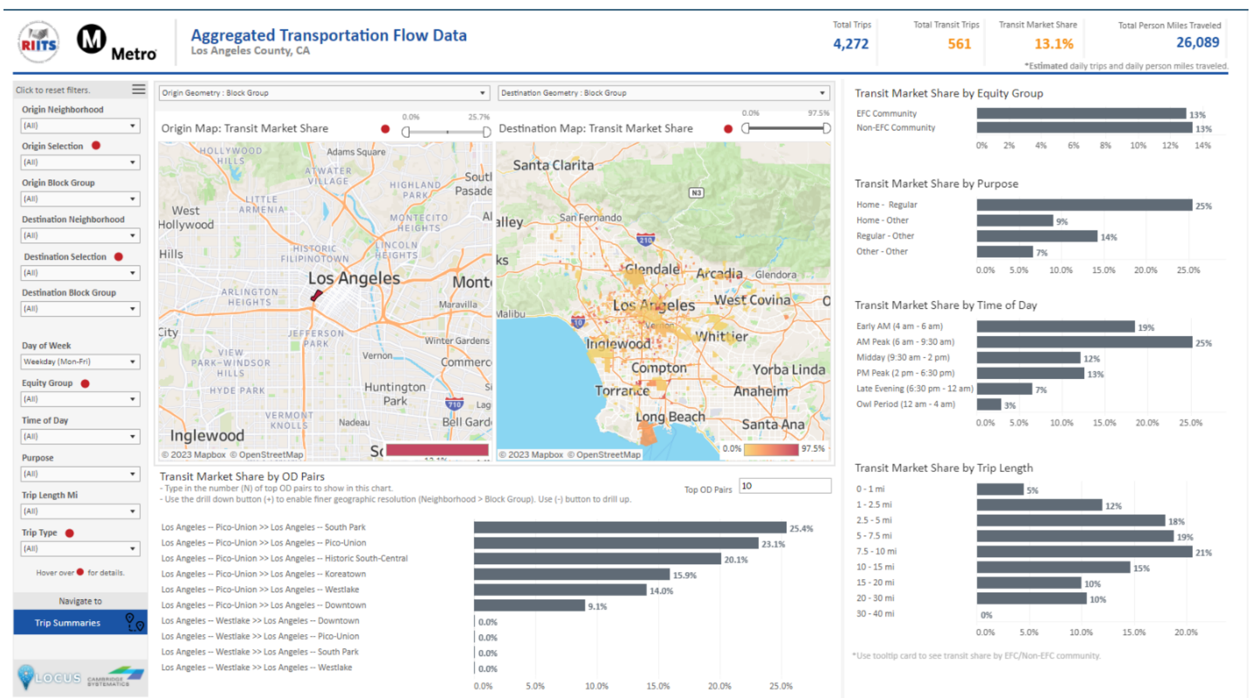
- To begin a more specific analysis, change the inputs and apply the filters as needed for your analysis. For each input, you must select "apply" at the bottom of that input's options list for it to be applied.

- Once you have applied all your necessary inputs, you will see the outputs above the two maps, below the two maps, and along the righthand side of the screen.

- Hover over each bar graph to get a more detailed breakdown of the total trips and transit trips between your selected origin(s) and destination(s).

- Total trips are blue and transit trips are orange. Click "show details" and it breaks it down, by percentage, by trip length. Total trips and total transit trips are divided separately.





D.9. California Emissions Estimator Model (CalEEMod)

Link: https://www.caleemod.com/ (accessed June 23, 2023)

Overview

CalEEMod quantifies ozone precursors, criteria pollutants, and greenhouse gas emissions from the construction and operation of new land-use development and linear projects in California. The model integrates data from CalEnviroScreen, Cal-Adapt, and the Healthy Places Index (HPI) to identify potential climate risks and environmental burdens within the project vicinity. Measures to reduce emissions, climate risks, and environmental burdens are available for user selection and analysis. CalEEMod provides a simple and integrated platform to quantify construction and operations emissions, assess climate hazards and vulnerabilities, identify environmental burdens, and evaluate the benefits of various emission reduction, climate risk reduction, and health and equity measures.

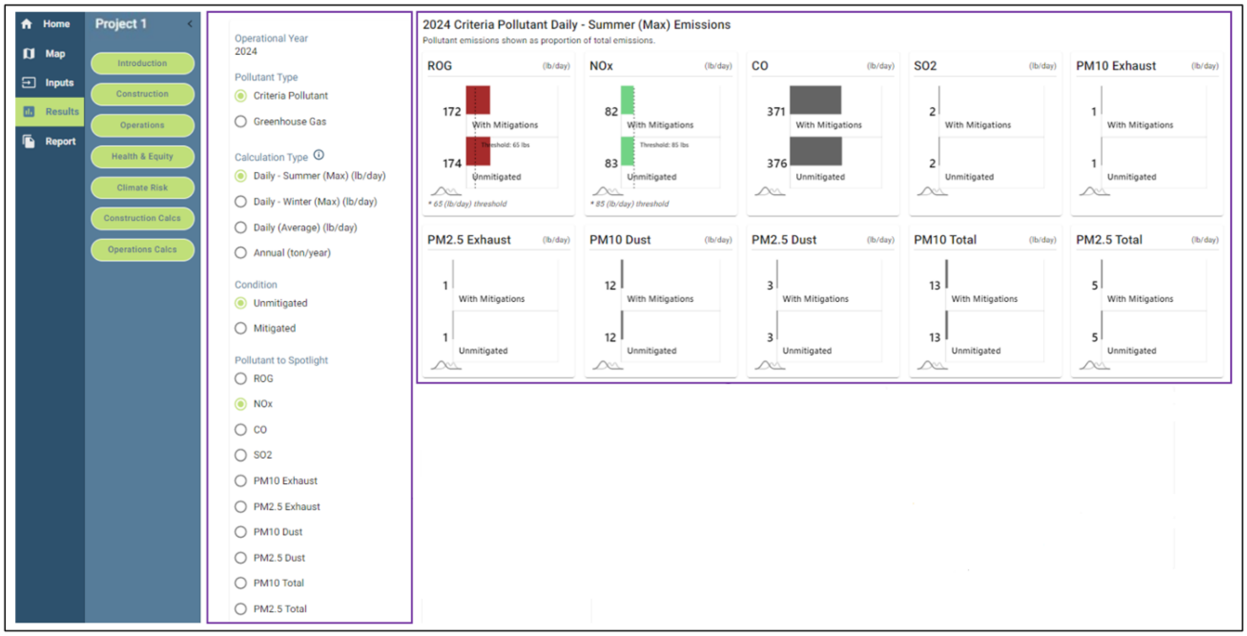
Specific to emissions, CalEEMod calculates construction and operations emissions from land-use development projects and construction emissions from linear projects. The model quantifies maximum daily, average daily, average quarterly, and annual emissions, which can be used to support the preparation of air quality and GHG analyses in California Environmental Quality Act (CEQA) documents, such as environmental impact reports (EIRs) and mitigated negative declarations (MNDs). In addition, air districts may rely on the model's emission estimates to show compliance with local agency rules. The emissions inventory modules also contain default values for estimating utility consumption (e.g., water, electricity, natural gas) that may be useful for preparing hydrology and energy analyses in other sections of a CEQA document.

Inputs

In order to measure the GHG emitted by a new development project, CalEEMod requests the details of a new project. They include the characteristics, land use, operations, vegetation, and climate risk of the project. It also asks about emissions, climate risk, and health and equity risk mitigation measures of the project, if any. Each category is further classified and defined as the figure on the right shows.

Outputs

The outputs include four dashboards that display key results for the model run and two emissions calculation screens. There are two dashboards for emissions results: construction and operations. Results for climate risk are displayed on a separate dashboard, as are results for health and equity. Especially, the two calculation screens present a series of emissions results tables by source (See the figure below).



Quick User Instructions

- Once on the CalEEMod page (https://www.caleemod.com/model), initiate a process to create a project by clicking on the "Model a Project" button on the left-hand side of the page. And click on the "New Project" button and fill out the boxes on the "Start a New Project" window.

- By clicking on the map, specify the location of the project and click the "Enter" button

- On the left-hand side of the page, click the "Input" button and fill out all the required boxes with the details of the project.

- On the left-hand side of the page, click the "Results" button. This will allow you to navigate the dashboards The dashboards are organized into multiple topics including construction, operations, health & equity, climate risk, construction calcs, and operations calcs.

- On the left-hand side of the page, click the "Report" button. This will allow you to compose reports by the level of detail including summary, quarterly, detailed, and custom reports. Then, you can download them in various formats like PDF, CSV, and Excel

D.10. UrbanFootprint

Link: https://urbanfootprint.com/ (accessed June 23, 2023)

Overview

UrbanFootprint is a tool to help the public and public officials determine the best scenarios and outcomes for their communities, using scientific research and data about real places where people live and work. UrbanFootprint lets users look at current land-use plans in their communities and visualize the potential for where new people, buildings, and urban amenities might go as population grows in the future. The software helps users experiment with the amount and location of land use and place types such as residential, commercial, and open space to create their own development scenarios. Information on household costs, public health impacts, building energy and water use, greenhouse gas emissions, land consumption, and transportation for scenarios can help identify the best land-use option. Users can make planning decisions based on possible outcomes and identify future patterns of development for their community.

As a dynamic tool, UrbanFootprint provides a way to have an organized, recordable, and consistent method to visualize land-use options and estimate future outcomes. UrbanFootprint provides a faster, more efficient way to leverage limited staff resources to identify development scenarios and their impacts, working side by side with stakeholders to quickly create, test, and discuss many alternatives much, much faster than traditional tools, and at a lower cost.

Inputs

The data input process starts with the creation of a new project by entering a project name, the organization (the organization you are doing the project with/for), project description, project area (specifying the geographical location of the project by searching the national database for preset geographies or uploading your own polygon boundary), project canvas type (how the project area is divided (by parcel or census block)), context area (the surrounding context outside your chosen project area on the map), and context canvas type (how the context area is divided by (parcel or census block).

According to the project area information entered, UrbanFootprint visualizes base layers on the map including Base Canvas (the land use of the project area), Project Area (the boundary of the project area), Context Area (the context area boundary), and Context Land-Use Area (the land use of the context area).

Then, you can apply the details of the new project by making a selection of the project area on your map and applying the profile of the project like building or place types, residential and/or employment attributes of the project.

Output

Base Canvas Summary: This is the general summary of the project area. The summary consists of population, dwelling units (by type such as single family detached, single family attached, and multifamily) and employment (by sector) that will be changed by the new project.

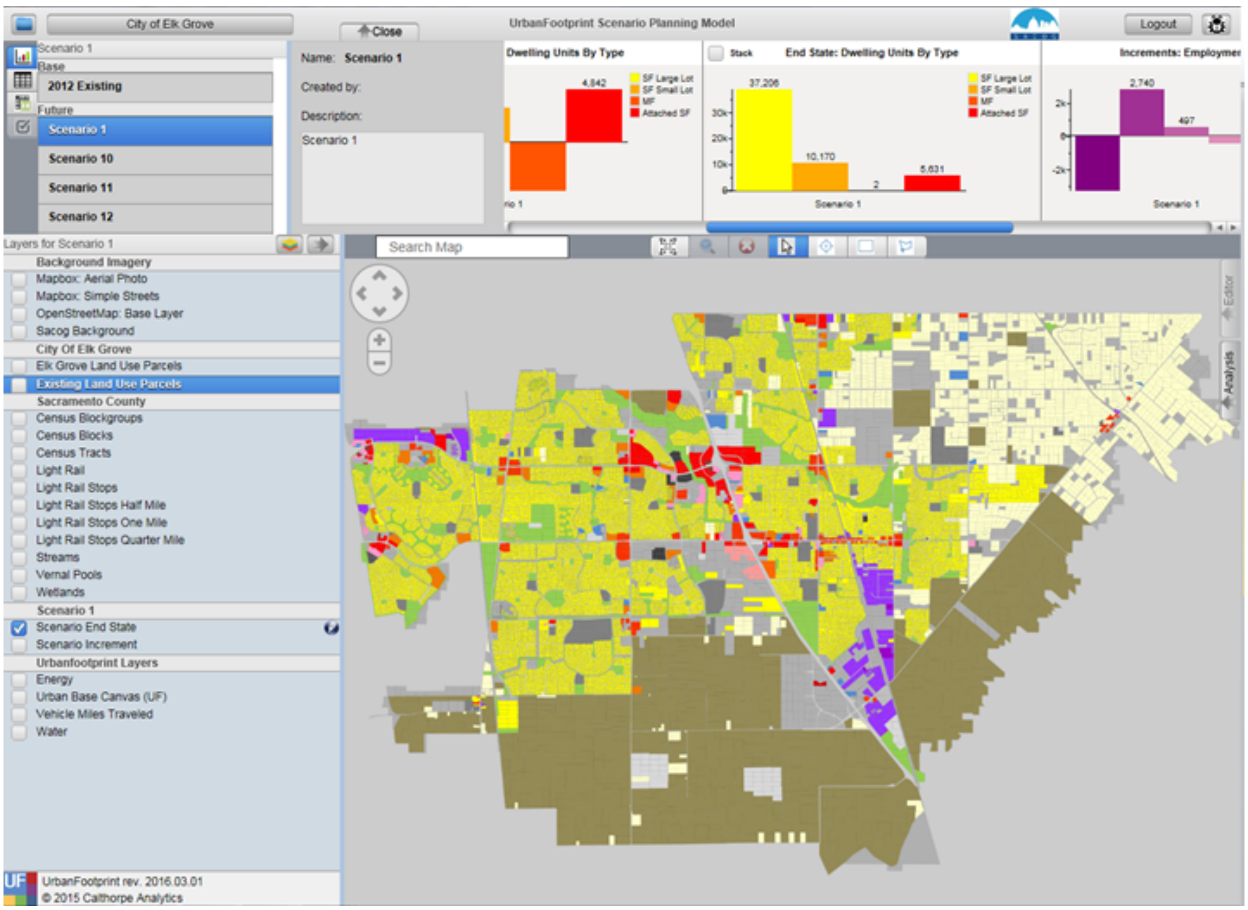
Analysis: This contains the analysis outputs about the extended changes caused by the new project. They include the elements like land consumption, energy use, water use, walk accessibility, transit accessibility, transportation, emissions, household cost, and risk and resilience.

Quick User Instructions

- When you open Urban Footprint, you will go to the top left corner of the screen to create a new project. Fill out the specifics of your project as needed.

- Once your new project is created, you will see the base layers on the left-hand side of the screen. You can add more layers by pressing the “Add” button at the top

- To the far left of the screen there will be four icons that represent “Build”, “Explore”, “Analysis”, and “Report”, respectively. Click on the corresponding icon to either get overall statistics and analysis for your project or click on the Build icon to apply different values and inputs to your project as outlined above in the Inputs sections



D.11. Regional VMT Analysis Tool

Link: https://vmttool.vta.org/ (accessed June 23, 2023)

Overview

This regional VMT analysis tool is widely adopted by multiple agencies from regional agencies to county governments. They include Santa Clara County, San Gabriel Valley Council of Governments (SGVCOG). The Tool was developed by the Santa Clara Valley Transportation

Authority (VTA) with consultant assistance, in collaboration with the 15 cities and towns of Santa Clara County, and the County of Santa Clara.

The primary purpose of the tool is to help users meet the requirements of SB 743 and CEQA. The tool is a web-based tool that helps users conduct a baseline VMT screening evaluation for small- to medium-sized residential, office, and industrial land-use projects. The tool estimates the project-generated VMT associated with the project using VMT data from a travel-demand model at that specific project location and calculates project-generated VMT after reductions from certain VMT-reducing measures have been applied. This estimation allows screening land-use projects and determining whether further VMT analysis is necessary, by identifying whether projects fall within a low-VMT area according to the applicable jurisdiction's VMT threshold and/or fall within proximity to transit.

Inputs

The input process of the tool starts with setting up a land-use project by entering the location of the project (the parcel(s)), project name, and project description. Additionally, users need to select an analysis methodology and baseline year that the tool will use to conduct the analysis. Since the methodologies vary by agency, users can select the method of the jurisdiction where the project is proposed. (e.g., C/CAG and SGVCOG use the TAZ method, while SCC allows users to choose either the TAZ method or the parcel buffer method.

Then, users need to elaborate on the details of the project. In order to conduct accurate estimation, the tool requires detailed specifications of the project. They include

- Land use type: Residential, industrial, office, or commercial
    - By the land use type of the project, the tool requires the capacity of the project
    - Residential: the number of dwelling units, residential affordability (extremely low income, very low income, or low income)
- Non-residential: the total square footage of the project
- Proposed parking: The number of parking spaces for vehicle and bicycle
- VMT metric option: Home-Based work VMT per worker/resident/per capita or total project generated VMT per service population
- The jurisdictional average for a baseline: city average, county average, regional average (e.g., bay area regional average of SGVCOG Average)
- Threshold (% Reduction from Baseline Year): 0%, -14.3%, -15%, or -25%

In addition to the details, users can specify VMT reduction strategies employed by the project.

Tier	Strategy
Project Characteristics	Increase Residential Density Increase Development Diversity Affordable Housing Increase Employment Density
Multimodal Infrastructure	Increase Bike Access Improve Connectivity Increase Transit Accessibility Traffic Calming Pedestrian Networks
Parking	Limit Parking Supply Provide Bike Facilities
TDM Strategies	School Pool Programs Bike Share Programs Car Share Programs CTR Marketing and Education Implement CTR Program Employee Parking Cash-Out Subsidized Transit Program Telecommuting and Alternative Work Schedules Free Door-to-Door Transit Fleet Price Workplace Parking Alternative Transportation Benefits Neighborhood Schools Ride-Sharing Programs Transit Service Expansion Behavioral Intervention Unbundle Parking Costs from Property Costs (On Site Parking) Voluntary Travel Behavior Change Program

Output

The tool generates a report on project details and VMT that can be exported as a PDF or Excel file. The first page will have a summary of the project area that includes parking (Motor Vehicle & Bike), land use, residential affordability, and proximity to transit.

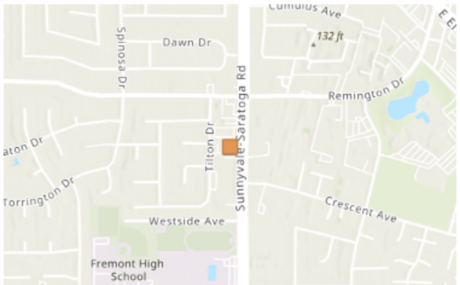
Santa Clara Countywide VMT Evaluation Tool - Version 2 - Report

Project Details

Timestamp of Analysis	June 11, 2023, 06:55:25 PM
Project Name	Example
Project Description	Example

Project Location Map

Jurisdiction:	APN	TAZ
Sunnyvale	20204013	1438



Analysis Details

Data Version	VTA Countywide Model December 2019
Analysis Methodology	TAZ
Baseline Year	2015

Project Land Use

Residential:

Single Family DU:	
Multifamily DU:	
Total DUs:	0

Non-Residential:

Office KSF:	10
Local Serving Retail KSF:	
Industrial KSF:	

Residential Affordability (percent of all units):

Extremely Low Income:	0 %
Very Low Income:	0 %
Low Income:	0 %

Parking:

Motor Vehicle Parking:	100
Bicycle Parking:	20

Proximity to Transit Screening

Inside a transit priority area?	Yes (Pass)

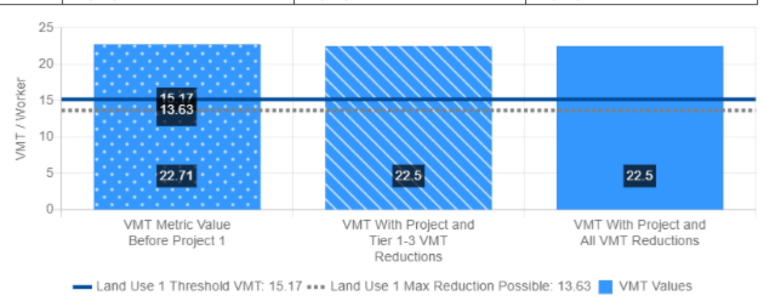
The second page will have a more in-depth analysis of the VMT. Specifically, the page summarizes the VMT reduction of the project with and without the proposed VMT mitigation strategies. It also compares the project's VMT reduction to the baseline average that users selected.

Santa Clara Countywide VMT Evaluation Tool - Version 2 - Report

Office Vehicle Miles Traveled (VMT) Screening Results

Land Use Type 1:	Office
VMT Metric 1:	Home-based Work VMT per Worker
VMT Baseline Description 1:	City Average
VMT Baseline Value 1:	17.85
VMT Threshold Description 1 / Threshold Value 1:	-15% / 15.17
Land Use 1 has been Pre-Screened by the Local Jurisdiction:	N/A

	Without Project	With Project & Tier 1-3 VMT Reductions	With Project & All VMT Reductions
Project Generated Vehicle Miles Traveled (VMT) Rate	22.71	22.5	22.5
Low VMT Screening Analysis	No (Fail)	No (Fail)	No (Fail)



The remaining pages present how the proposed VMT mitigation strategies contribute to VMT reduction. They elaborate the contribution of each strategy.

Santa Clara Countywide VMT Evaluation Tool - Version 2 - Report

Tier 1 Project Characteristics

PC01 Increase Residential Density

Existing Residential Density:	6.15
With Project Residential Density:	6.15

PC02 Increase Residential Diversity

Existing Residential Diversity Index:	0.3
With Project Residential Diversity Index:	0.33

PC03 Affordable Housing

PC04 Increase Employment Density

Existing Employment Density:	23.54
With Project Employment Density:	27.85

Tier 2 Multimodal Infrastructure

MI01 Increase Bike Access

Distance to Nearest Existing Bike Facility:	1000 ft
Distance to Nearest Existing Bike Facility With Project:	100 ft

MI03 Increase Transit Accessibility

Distance to Closest Transit Stop:	1000 ft
Distance to Closest Transit Stop With Project:	1000 ft

MI04 Traffic Calming

Traffic Calming Added Beyond Development Frontage:	

MI05 Pedestrian Networks

Pedestrian Improvements Beyond Development Frontage:	

Quick User Instructions

- On the left hand of the screen, you will be able to select your project area. Under jurisdiction, you will select the city/place that your project is in.
- Now you will select the parcel(s) that your project will be. You can do so by either typing in the APN or using the select parcel tool. To use that tool, select the "add" button and click on the desired parcel on the map.
- You can toggle on/off layers to the map to enrich the map.
- Once all inputs are selected, press "continue".
- Once on the screening input page, select the necessary inputs that apply to your project.
- After selecting the screening inputs, you can either go to the project screening by selecting "project screening only" or you can add VMT reduction factors for a VMT analysis by selecting "Continue to VMT Reduction Factors".
- Once on the VMT reduction strategies page, input the appropriate VMT reduction strategies that you will be using for your project. Once finished, select "Continue to VMT results".

D.12. Regional VMT Analysis Tool

Link:
https://sbcta.maps.arcgis.com/apps/webappviewer/index.html?id=779a71bc659041ad995cd48d9ef4052b (SBCTA) (accessed June 24, 2023)

Overview

This tool is also a web-based GIS application that enables users to determine whether or not a prospective project meets set thresholds requiring thorough VMT analysis. Unlike the tool introduced in appendix D.11, this tool merely determines whether prospective land-use projects meet screening criteria. Thus, the input data requirement and output information is much lighter than the ones by the previous tool. This tool is adopted by the San Gabriel Valley Council of Governments (SGVCOG), City/County Association of Governments of San Mateo County (C/CAG), San Bernardino County Transportation Authority (SBCTA), Western Riverside Council (WRCOG), and the City of San Diego.

Inputs

The input process of the tool starts with entering the location of the project by selecting the parcel(s) on the map that a land-use project will be applied. Additionally, users need to specify the details of the project.

- VMT metric: OD VMT per service population, PA VMT per service population (for a mixed-use (residential and commercial) project), PA VMT per Population (for a residential project), or PA VMT per worker (for a commercial project).
- Baseline year: 2016 to 20240
- Threshold: Below city baseline (0%, -14.3%, or -15%), below county baseline (0%, -14.3%, or -15%), or below county future buildout (0%)

Output

Project overview: The parcel(s) and TAZ to which hat the parcel(s) belong

VMT estimation summary: TAZ VMT (VMT per service population of TAZ), jurisdiction VMT (Jurisdiction VMT average), % Difference, and the selected VMT Metric and threshold

Screening Results: Completely Within a TPA (whether your selected parcel(s) is within a PA, Yes or No), Within a Low VMT Generating TAZ (whether your selected parcel(s) is within a low VMT generating TAZ, Yes or No), and Low VMT Generating TAZs (showing the Low VMT Generating TAZs on the map)

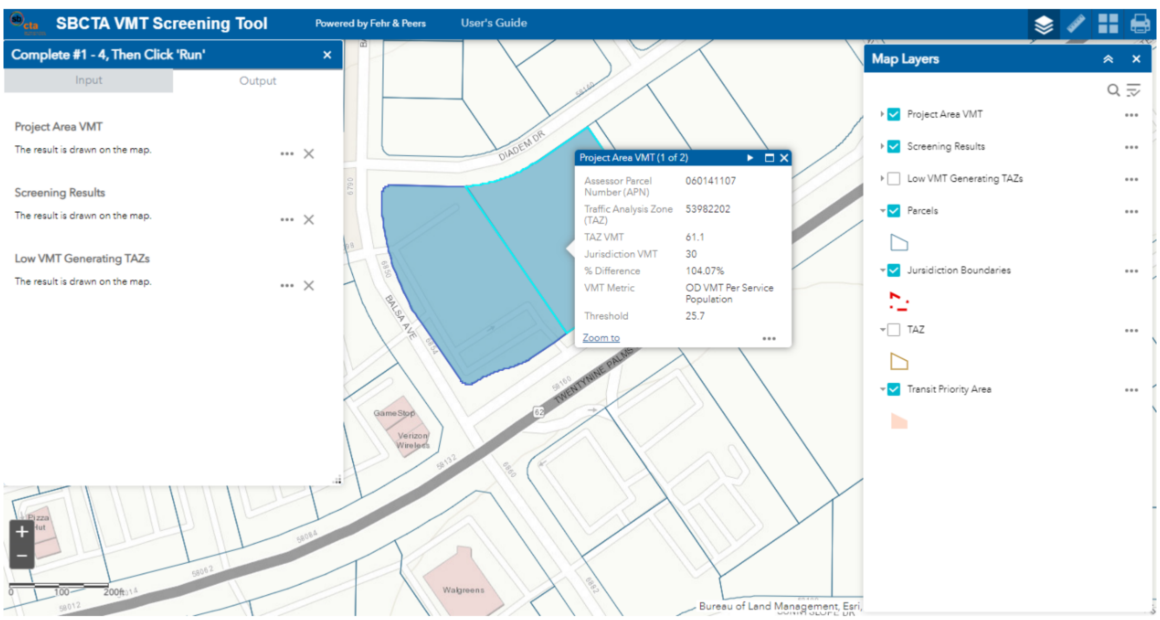
Quick User Instructions

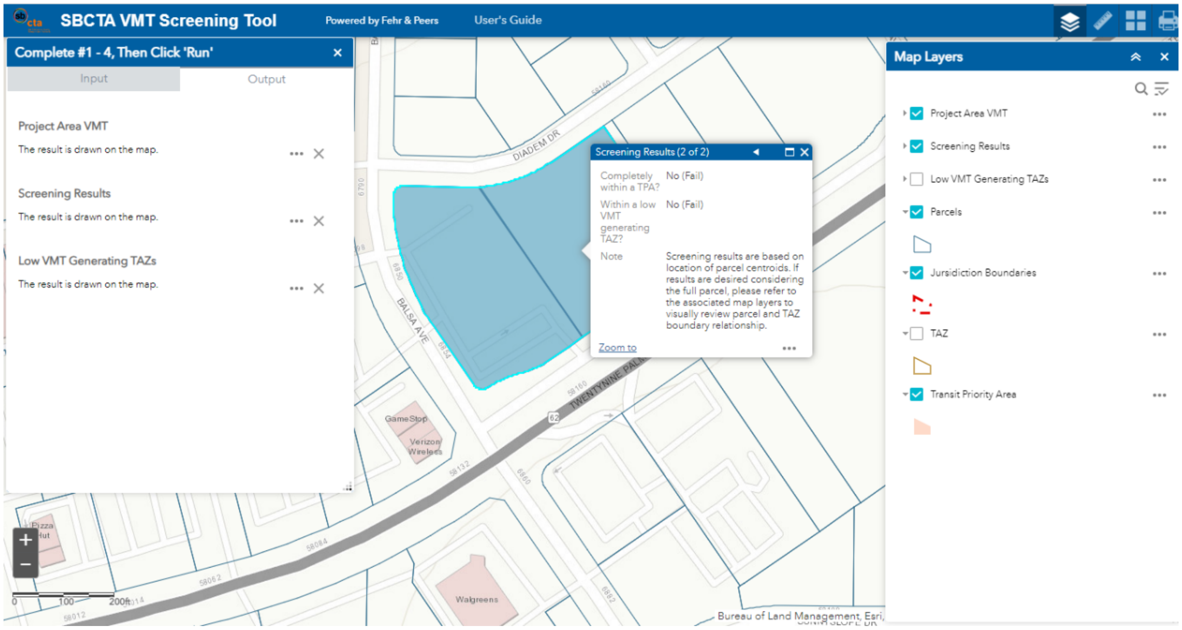
- Once on the tool, you will be on the "Inputs" tab of the pop up on the left side of the screen. On this tab, input the necessary parameters needed for you analysis. Once the parameters are selected, press "Run" at the bottom of the window.

- Once results are generated, you will see the output tab on the left-hand side window show three options: Project Area VMT, Screening Results, and Low VMT Generating TAZs. To show the results of Project Area VMT and Screening Results, press the three dots at the right of each option and select "Show Pop Up'

- Once the Pop Up is visible, this will show all the outputs and results that were discussed in the above section

- To the right of the screen, there is a Map Layers window. To toggle each option, select the checkbox to the left of each layer. To zoom to or make a layer transparent, select the three dots to the right of each layer and those options will appear.





D.13. VMT Mitigation and Reduction Calculator

Link: https://ladot.lacity.org/businesses/development-review#transportation-assessment (City of Los Angeles) (accessed June 24, 2023)

<u>Overview</u>

Although this section is written based on the VMT calculator of the City of Los Angeles, other agencies like SANDAG, Alameda County, and Sonoma County also utilize similar calculators. Los Angeles' calculator is an Excel workbook-based tool that is specifically designed and intended to be used to develop project-specific daily household VMT per capita and daily work VMT per employee metrics for residential and office land-use development projects in the City of Los Angeles. The calculator is used as a resource for evaluating and quantifying the impacts of mobility-management strategies as part of the development review and transportation analysis process at various scales. Depending on the project location and project type, tool users can select appropriate strategies of interest for mitigating transportation impacts. Each strategy requires that the user input values are used to calculate the percent reduction in VMT for the selected strategy. For many strategies, the tool offers default parameters that can be replaced with user-provided values if available. Then, the tool produces estimates of the percent reduction in VMT resulting from the implementation of mobility management strategies.

<u>Inputs</u>

The input process of the tool starts with setting up a land-use project by entering a project name, the location of the project (the address), the existing land use, and the proposed project land use. Users also need to provide a yes/no answer to the question, "Is the project replacing an existing number of residential units AND is located within one-half mile of a fixed rail or fixed-guideway transit station?"

Additionally, users need to elaborate on the VMT mitigation strategies employed by the project.

Type	Strategy	Option
Parking	Reduce parking supply	City code parking provision for the project site Actual parking provision for the project site
	Unbundle parking	Monthly parking cost (dollar) for the project site
	Parking cash-out	Percent of employees eligible
	Price Workplace Parking	Daily parking charge (dollar) Percent of employees subject to priced parking
	Residential Area Parking Permits	Cost (dollar) of annual permit
Transit	Reduce Transit Headways	Percent reduction in headways (increase in frequency) Percent existing transit mode share (as a % of total daily trips) Percent of lines within project site improved
	Implement Neighborhood Shuttle	Degree of implementation Percent of employees and residents eligible
	Transit Subsidies	Percent of employees and residents eligible Amount (dollar) of transit subsidy per passenger (daily equivalent)
Education & Encouragement	Voluntary Travel Behavior	Percent of employees and residents participating
	Promotions & Marketing	Percent of employees and residents participating
Commute Trip Reductions	Required Commute Trip Reduction Program	Percent of employees eligible
	Alternative Work Schedules and Telecommute Program	Percentage of employees participating Type of program
	Employer Sponsored Vanpool or Shuttle	Degree of implementation Employer size Percent of employees eligible
	Ride-Share Program	Percent of employees eligible
Shared Mobility	Car-share	Project setting
	Bike share	
	School carpool program	Level of implementation
Bicycle Infrastructure	Implement/Improve On-Street Bicycle Facility	
	Include Bike Parking per LAMC	
	Include Secure Bike Parking and Showers	
Neighborhood Enhancement	Traffic Calming Improvements	Percent of streets within project with traffic calming improvements

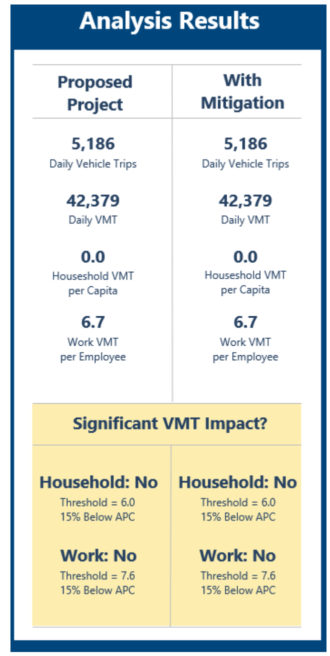
Type	Strategy	Option
		Percent of intersections within project with traffic calming improvements
	Pedestrian Network Improvements	Within project and connecting off-site Within project only

<u>Output</u>

VMT analysis for the proposed project without and with VMT mitigation strategies: Daily vehicle trips, daily VMT, household VMT per capita, and work VMT per employee

VMT screening: Significance of VMT impact (without/with mitigations) for household (yes/no) and work (yes/no)

VMT analysis for the mitigation strategies: A summary of all the mitigation strategies selected and the effectiveness of the strategies



CITY OF LOS ANGELES VMT CALCULATOR

Report 3: TDM Outputs

Date: June 28, 2023
Project Name: City Hall
Project Scenario: Test
Project Address: 200 N SPRING ST, 90012

Version 1.5

TDM Adjustments by Trip Purpose & Strategy

Place type: Urban

		Home Based Work Production		Home Based Work Attraction		Home Based Other Production		Home Based Other Attraction		Non-Home Based Other Production		Non-Home Based Other Attraction		Source
		Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	
Parking	Reduce parking supply	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	TDM Strategy Appendix, Parking sections 1 - 5
	Unbundle parking	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	Parking cash-out	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	Price workplace parking	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	Residential area parking permits	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
Transit	Reduce transit headways	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	TDM Strategy Appendix, Transit sections 1 - 3
	Implement neighborhood shuttle	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	Transit subsidies	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Education & Encouragement	Voluntary travel behavior change program	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	TDM Strategy Appendix, Education & Encouragement sections 1 - 2
	Promotions and marketing	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Commute Trip Reductions	Required commute trip reduction program	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	TDM Strategy Appendix, Commute Trip Reductions sections 1 - 4
	Alternative Work Schedules and Telecommute Program	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	Employer sponsored vanpool or shuttle	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
	Ride-share program	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Shared Mobility	Car-share	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	TDM Strategy Appendix, Shared Mobility sections 1 - 3
	Bike share	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
	School carpool program	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

TDM Adjustments by Trip Purpose & Strategy, Cont.

Place type: Urban

		Home Based Work Production		Home Based Work Attraction		Home Based Other Production		Home Based Other Attraction		Non-Home Based Other Production		Non-Home Based Other Attraction		Source
		Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	
Bicycle Infrastructure	Implement/ Improve on-street bicycle facility	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	TDM Strategy Appendix, Bicycle Infrastructure sections 1 - 3
	Include Bike parking per LAMC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
	Include secure bike parking and showers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Neighborhood Enhancement	Traffic calming improvements	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	TDM Strategy Appendix, Neighborhood Enhancement sections 1 - 2
	Pedestrian network improvements	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

Final Combined & Maximum TDM Effect

	Home Based Work Production		Home Based Work Attraction		Home Based Other Production		Home Based Other Attraction		Non-Home Based Other Production		Non-Home Based Other Attraction	
	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated	Proposed	Mitigated
COMBINED TOTAL	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
MAX. TDM EFFECT	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%

= Minimum (X%, 1-[(1-A)*(1-B)...]) where X%=		
PLACE TYPE MAX:	urban	75%
	compact infill	40%
	suburban center	20%
	suburban	15%

Note: (1-[(1-A)*(1-B)...]) reflects the dampened combined effectiveness of TDM Strategies (e.g., A, B,...). See the

Quick User Instructions

- When you open the excel sheet, the first tab named “screening” is where you will input the project information. On the left-hand side of the screen, you will input the project name, what it’s for or the scenario, and the address. The map will place a star on the address.

- The middle of the screen you will input the existing land-use information and for the project.

- Once you input that information, on the right-hand side of the screen, you will see a preliminary VMT analysis called the “Project Screening Summary”.

- On the next tab titled “Main”, you will input TDM strategies for your proposed project. In the middle of the screen there are different tabs that represent different TDM strategies as explained above. Once input, the analysis results will be on the right-hand side of the screen.

- On the next four tabs, there will be four different reports that either summarize or explain your VMT inputs and outputs further, as explained above in the outputs section. They are titled “Report 1 – Overview", “Report 2 – TDM Inputs”, “Report 3 – TDM Outputs”, “Report 4 – MXD”, respectively.

- The final tab titled “User Agreement” is the user agreement that you must abide by to use the VMT Calculator.

Abbreviations

AADT Annual Average Daily Traffic

ABM Activity-Based Models

ACS American Community Survey

AMBAG Association of Monterey Bay Area Governments

ATDB Active Transportation Database

BCAG Butte County Association of Governments

CalBike The California Bicycle Coalition

Caltrans California Department of Transportation

CAMS Countywide Address Management Program

CAPCOA California Air Pollution Officers Association

CARB California Air Resources Board

CEQA California Environmental Quality Act

COG Council of Governments

CTPP Census for Transportation Planning Products

EE External–External trips

EIR Environmental Impact Report

EV Electric Vehicle

FCOG Fresno Council of Governments

GHG Greenhouse Gas

GIS Geographic Information System

GTFS General Transit Feed Specification

HCD California Department of Housing and Community Development

KCAG Kings County Association of Governments

KCOG Kern Council of Governments

LBS Location-Based Services

LEHD Longitudinal Employer-Household Dynamics

LODES LEHD Origin-Destination Employment Statistics

LOS Level of Service

MCAG Merced County Association of Governments

MCTC Madera County Transportation Commission

MPO Metropolitan Planning Organization

MTC/ABAG Metropolitan Transportation Commission/Association of Bay Area Governments

O/D Origin-Destination

OPR Governor's Office of Planning and Research

REAP Regional Early Action Planning

RHNA Regional Housing Needs Allocation

RTP Regional Transportation Plan

SACOG Sacramento Area Council of Governments

SANDAG San Diego Association of Governments

SB Senate Bill

SBCAG Santa Barbara County Association of Governments

SCAG Southern California Association of Governments

SCS Sustainable Communities Strategy

SJCOG San Joaquin Council of Governments

SLOCOG San Luis Obispo Council of Governments

SRTA Shasta County Regional Transportation Planning Agency

StanCOG Stanislaus Council of Governments

TAZ Traffic Analysis Zone

TCAG Tulare County Association of Governments

TOD Transit-Oriented Development

TRPA Tahoe Regional Planning Agency

VMT Vehicle Miles Traveled

Bibliography

California Air Pollution Control Officers Association. (2010). *Quantifying Greenhouse Gas Mitigation Measures, A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures*. Retrieved from http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

California Air Pollution Control Officers Association. (2021). *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity*. Retrieved from https://www.caleemod.com/documents/handbook/full_handbook.pdf

California Air Resources Board. (2022). Progress Report: California's Sustainable Communities and Climate Protection Act. June 2023. Available at: https://ww2.arb.ca.gov/sites/default/files/2023-05/2022-SB150-MainReport-FINAL-ADA.pdf

Fehr and Peers. (2021). *SB 743 Implementation Guidelines for City of Citrus Heights*. Retrieved from https://www.citrusheights.net/DocumentCenter/View/16074/SB-743-Implementation-Guidelines-2-8-21

Fehr and Peers. (2023). *Find Your VMT With VMT+ A Tool to Support California Transportation Planning*. Retrieved from https://www.fehrandpeers.com/project/find-my-vmt/

Laurian, L., Walker, M., and Crawford, J. (2017). Implementing Environmental Sustainability in Local Government: The Impacts of Framing, Agency Culture, and Structure in US Cities and Counties. *International Journal of Public Administration*, 40(3), 270–283. https://doi.org/10.1080/01900692.2015.1107738

Lee, A., Fang, K., and Handy, S. (2017). *Evaluation of Sketch Level VMT Quantification Tools: A Strategic Growth Council Grant Programs Evaluation Support Project. National Center for Sustainable Transportation*. Retrieved from https://escholarship.org/uc/item/08k3q8m5

Los Angeles Department of Transportation (LADOT) and Los Angeles Department of City Planning (DCP). (2020). *City of Los Angeles VMT Calculator Documentation*. Retrieved from https://ladot.lacity.org/sites/default/files/documents/vmt_calculator_documentation-2020.05.18.pdf

Lovejoy, K., Sciara, G.-C., Salon, D., Handy, S. L., and Mokhtarian, P. (2013). Measuring the impacts of local land-use policies on vehicle miles of travel: The case of the first big-box store in Davis, California. *Journal of Transport and Land Use*, 6(1), 25–39. https://doi.org/10.5198/jtlu.v6i1.336

Office of Planning and Research. (2018). *Technical Advisory on Evaluating Transportation Impacts in CEQA*. Retrieved from http://opr.ca.gov/docs/20190122-743_Technical_ Advisory.pdf

Margerum, R.D., Brody, S., Parker, P., and McEwen, G. (2012). Regional Transportation and Land Use Decision Making in Metropolitan Regions: Findings from Four Case Studies. *Portland: Oregon Transportation Research and Education Consortium* (OTREC). Research Report OTREC-RR-11-29.

Mawhorter, S., Martin, A. and Galante, C. (2020). California's SB 375 and the pursuit of sustainable and affordable development. In Elizabeth Deakin (ed.). *Transportation, Land Use, and Environmental Planning*. Oxford: Elsevier.

Salon, D., Boarnet, M. G., Handy, S., Spears, S., and Tal, G. (2012). How do local actions affect VMT? A critical review of the empirical evidence. *Transportation Research Part D: Transport and Environment*, 17(7), 495–508. https://doi.org/10.1016/j.trd.2012.05.006

Salon, D., Boarnet, M., & Mokhtarian, P. (2014). *Quantifying the Effect of Local Government Actions on VMT*. California Air Resources Board and the California Environmental Protection Agency. Retrieved from https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/09-343.pdf

San Jose City Transportation Department. (2018). *San José VMT Evaluation Tool: User Guide*. Retrieved from https://www.sanjoseca.gov/home/showpublisheddocument/28463/636691896049230000

Santa Clara Valley Transportation Authority. (2020). *Santa Clara Countywide VMT Evaluation Tool—Version 2*. https://vmttool.vta.org/

StreetLight. (2021). *SB 743 VMT Metric Methodology and Validation White Paper*. Retrieved from https://www.fehrandpeers.com/wp-content/uploads/2023/01/SB_743_White_Paper_Final_December_2021.pdf

Volker, J. M. B., Lee, A. E., and Fitch, D. T. (2019a). Streamlining the Development Approval Process in a Post–Level of Service Los Angeles. *Journal of the American Planning Association*, 85(2), 114–132. https://doi.org/10.1080/01944363.2019.1601587

Volker, J. M. B., Kaylor, J., and Lee, A. (2019b). A New Metric in Town: A Survey of Local Planners on California's Switch from LOS to VMT. *Findings,* November. https://doi.org/10.32866/10817.

Volker, J. M., Hosseinzade, R., and Handy, S. L. (2023). *SB 743 Implementation by Local Governments for Land Use Projects*. UC Davis: National Center for Sustainable Transportation. http://dx.doi.org/10.7922/G2MP51M5 Retrieved from https://escholarship.org/uc/item/01f8m0xn

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