WESTERN DISTRICT

INSTITUTE OF TRANSPORTATION ENGINEERS

November 21, 2014

Christopher Calfee, Senior Counsel
Governor's Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814

Re: Updating Transportation Impacts Analysis in the CEQA Guidelines
Preliminary Discussion Draft of Updates to the CEQA Guidelines Implementing SB 743

Dear Mr. Calfee:

Thank you for the opportunity to provide comments and suggestions regarding your efforts to amend CEQA (California Environmental Quality Act) Guidelines, as required by Senate Bill 743 (SB 743). This letter specifically responds to the report titled "Updating Transportation Impacts Analysis in the CEQA Guidelines" written by the Office of Planning and Research (OPR) dated August 6, 2014 (hereafter called the "Draft Guidelines").

We represent over 2,000 California members of the Institute of Transportation Engineers (ITE), an international society of transportation engineers and planners. These members conduct transportation analysis for environmental documents under CEQA, and in some cases the National Environmental Policy Act (NEPA), and we understand the purpose of these analyses to identify potential environmental impacts.

Our purpose in writing this letter is to provide recommendations for revisions to the Draft SB 743 Guidelines in order to achieve a more successful implementation of SB 743. Included are a summary of key comments followed by a list of all of our comments on the Draft Guidelines.

SUMMARY OF KEY COMMENTS

We believe that the following key issues should be resolved prior to the issuance of final guidelines for the implementation of SB 743:

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- For land development projects that are inappropriate for VMT analysis using a regional transportation model (either because they are too small or outside the geographic area of a model), a different or refined methodology should be developed to determine the significance of VMT impacts. The VMT models and methodologies that are currently available do not achieve the level of accuracy that would be desirable in order to determine project trip length and VMT for the wide variety of project types and project locations that would be analyzed under CEQA.

- For small land development projects and small transportation projects, a methodology should be developed to analyze the significance of VMT impacts and mitigate those impacts (if appropriate) without going through the long and expensive process of preparing an Environmental Impact Report. Although lead agencies (not OPR) will be responsible for the determination of significance thresholds, the agency writing the guidelines (i.e. OPR) has a responsibility to provide guidelines that can be reasonably and efficiently implemented.

- For lead agencies who are currently using CEQA roadway capacity/LOS analysis as the methodology for requiring land development projects to provide roadway improvements, an alternative methodology should be developed. Ideally, OPR would facilitate this discussion. At a minimum, OPR should limit the implementation of SB 743 to transit priority areas until others have provided a methodology for lead agencies to obtain roadway improvements as a condition of the implementation of land development projects.

ADDITIONAL COMMENTS

Our additional comments are as follows:

1. General Comment: The overall level of detail provided in the Draft Guidelines is appropriate. While additional detail needs to be added in order to conduct actual studies, the wide variety of projects subjected to CEQA as well as the variety of settings in which they are located requires that statewide guidelines leave room for discretion at the local level. While this leaves local agencies with some effort required in order to implement SB 743, that situation is preferred to a situation where detailed guidelines are issued at the state level that are inappropriate for some local agencies.

2. General Comment: It is recommended that OPR provide one or more case studies to show how a CEQA transportation analysis would be conducted under these proposed guidelines. At a minimum, the case studies included in the attached memo should be analyzed. In addition, it will be important to provide examples of a land development project that initially has a VMT impact, then subsequently provides mitigation measures to reduce the project's VMT and mitigate the impact to less than significant. The simple example in Appendix D does not determine the project's level of significance or propose mitigation measures for VMT impacts. ITE has analyzed 11 case studies based on actual completed CEQA projects and the results of our analysis are included as Attachment A to this memo.

3. Page 13, Vehicle Miles Traveled and Land Use Projects - Section 15064.3 (b) (1): While a case can be made for the use of regional averages for VMT significance determination, it would be better if each region were allowed the discretion to use sub-regional VMT averages, where appropriate. Average VMT varies greatly within some regions. In order to provide a few examples, please consider the City of San Francisco and the City of Livermore in the San Francisco Bay Area; the City of Santa Barbara and North Santa Barbara County in the Santa Barbara County Association of Governments (SBCAG) region; and the City Los Angeles and the Antelope Valley/North Los Angeles County within the Southern California Association of Governments (SCAG) region. This will not solve all the potential problems with the use of averages for VMT, but it will help.

4. Page 13, Vehicle Miles Traveled and Land Use Projects - Section 15064.3 (b) (1): The statement that "Land use plans that are either consistent with a sustainable communities strategy, or that achieve at least an equivalent reduction in vehicle miles traveled as projected to result from implementation of a sustainable communities strategy, generally may be considered to have a less than significant impact" is interesting and should be expanded further. If a region can implement a Sustainable Communities Strategy (SCS) and then exempt projects that are consistent with this strategy from a CEQA VMT analysis, that would be an incentive to create and implement SCS strategies that would further the intent of the SB 743 legislation. We would support this concept and would also recommend including roadway projects (i.e. a roadway project that is within an SCS strategy would be exempt from induced travel analysis).

5. Page 13, Vehicle Miles Traveled and Land Use Projects - Section 15064.3 (b) (1): The terms "existing major transit stop" and "high quality transit corridor" should be defined or a reference should be included to let readers know where this term is defined. The required frequency of both buses and trains required to meet this category should also be defined.

6. Page 13, Vehicle Miles Traveled and Land Use Projects - Section 15064.3 (b) (1): The use of VMT per capita could lead to anomalous/illogical results. The following example is hypothetical, but is based on actual vehicle trip generation data from the Statewide Travel Survey conducted by Caltrans (Institute for Metropolitan Studies, San Jose State University. "Effects of Density on Transit Usage and Residential Trip Generation." San Jose: Department of Urban and Regional Planning, Final Report, October 1994):

   Land Development Projects A and B are adjacent to each other, and each consist of 100 proposed new dwelling units. The lead agency has established a threshold of significance of 35 VMT/capita. Project A will have an average household size of 2 adults, and each unit will generate 7.49 private vehicle trips per day. Assuming the 10 mile average trip length in Appendix D, it will generate 74.9 VMT per household, or 37.5 VMT/capita each day.

   Project B will have an average of 4.2 people per household and, because there are more occupants to each household, will generate 13.92 private vehicle trips per household per day, or 139.2 VMT per dwelling unit. This is equivalent 33.1 VMT/capita (that is, 139.2 VMT divided by 4.2 people/unit). Thus, Project A generates a total of 7,490 daily VMT (100 units X 7.49 trips/day X 10 miles per trip), while Project B generates a total of 13,920 VMT (100 units X 13.92 trips/day X 10 miles per trip). However, because Project B is below the 35 VMT/capita threshold for the lead agency's threshold significance, it is not considered a significant CEQA impact. Project A, with 37.5 VMT/capita/day, is above the threshold, and the project is therefore has a significant impact. In short, the project with the greater overall GHG emissions (greater VMT) is environmentally insignificant, while the project with the lesser GHG impact *is* significant.

   On an overall basis, it is not clear whether either or both of these projects should have a significant VMT impact. However, because of the way averages work, one falls below and one falls above the average for reasons that do not necessarily relate to the desirable characteristics of the project from a smart growth point of view.

7. Page 14, Induced Travel and Roadway Projects - Section 15064.3 (b) (2): For some large roadway projects, analysis of induced demand may be appropriate. However, reasonable limits should be placed on the amount of analysis and research a small roadway project would need to conduct in order to satisfy the requirement to analyze induced demand. ITE's recommendations and opinions regarding induced travel can be best summarized in the research paper included in Attachment B (Effects of Increased Highway Capacity: Results of Household Travel Behavior Survey, Richard G. Dowling and Steven B. Colman, Transportation Research Record 1493, Transportation Research Board, 1995). This research concluded that projects that decrease travel time by more than five minutes for a large number of trips would probably warrant an upward adjustment of travel demand. It is recommended that this standard be incorporated into the Draft Guidelines and that projects that create a travel time savings of five minutes or less would be relieved of the need to analyze induced demand.

8. Page 14, Local Safety – Section 15064.3 (b) (3): The examples of objective factors that may be relevant should be revised to be less specific in order to encourage evaluations of safety on a case-by-case basis. We would recommend the deletion of (b) and (c) and the revision of (d) to read as follows: "Encourage excessive motor vehicle speeding"

9. Page 15, Applicability: Given the complexities of the implementation of SB 743, its provisions should be implemented in transit priority areas first. After a few years of experience in transit priority areas, the outcomes of the implementation process should be analyzed and a decision should be made regarding broader implementation to additional geographic areas. Evidence of the complications of SB 743 implementation are included in the comments in this letter as well as the 100 or so comment letters that were submitted in response to OPR's Preliminary Evaluation released in December of 2013.

10. Page 15, Applicability: If OPR is unwilling to incorporate the recommendation above regarding the implementation of SB 743, an extension is needed for applicability statewide to beyond January 1, 2016. Given that incorporation of the SB 743 into CEQA is a six-month process and incorporation by local agencies is a four-month process, it is unrealistic to expect that the SB 743 would be implemented in transit priority areas before August of 2015 at the earliest. A minimum of two years' worth of time should be allowed between incorporation by local agencies in transit priority areas and implementation statewide.

11. Page 15, Applicability: Guidance should be given regarding projects that are partially within a transit priority area. The recommended guidance is that projects partially within a transit priority area would be left to the local agency to determine whether the rules for within transit priority areas or outside transit priority areas would apply. An alternative would be to state that areas partially within transit priority areas would follow the rules for transit priority areas.

12. Page 20, Amendments to Appendix G: It is recommended that item XVI. a) be deleted. Referencing conflicts with plans raises unnecessary complications and it is preferable to focus on the real-world impacts of the project. In addition, it is recommended that guidance be provided elsewhere (such as within new Section 15.064.3) that local agencies have police powers through ordinances and general plans, even though these police powers are not a part of CEQA.

13. Page 20, Amendments to Appendix G: It is recommended that item XVI. b) be revised to delete "regional average" and replace it with "appropriate comparable average". This change is needed to provide the same level of flexibility in Appendix G that is included in Section 15064.3.

14. General Comment: Based on our preliminary investigations using the Draft Guidelines to determine significance of impacts and mitigation strategies, we have found project VMT and VMT averages to be very difficult to determine for land development projects. Following are examples of the questions we have come across:

    - If VMT is determined using a transportation model, it is relatively easy to determine the total VMT generated with the project and without the project. However, it is difficult to determine the average VMT for the land use type. Using standard trip generation rates and the average regional trip length for the project type would lead to an "apples to oranges" comparison of VMT determined using a transportation model and VMT using manual techniques or a VMT model such as CalEEMod.

    - If VMT is determined using a transportation model, questions arise regarding VMT generated by the project versus VMT generated by the land uses that are the origins and destinations of trips generated by the subject project. ITE members do not agree on whether the subject project should be responsible for the entire VMT that results from entering and leaving the project site or whether the responsibility for VMT generation should be shared with developments that represent the other end of trips generated by the subject project.

- If VMT is determined using a transportation model, questions have been raised regarding projects that are near the border of the model's geographic area or have a significant number of trips that have origins or destinations outside the model's geographic area. The transportation model cannot track VMT for internal-external trips since either the origin or destination of these trips would be an external location at an unknown distance from the project site.

- If VMT is determined without using a transportation model, it is relatively easy to determine the average VMT for the land use type. This could be done using a VMT model such as CalEEMod or by determining trip generation using manual techniques and multiplying the number of trips generated by the average regional trip length for the land use type. However, determining the project VMT is difficult because it is difficult or impossible to accurately estimate the average trip length for the project site without using a transportation model.

15. Further research is needed into the use of VMT as a mitigation measure to address the questions raised above as well to provide additional accuracy in estimating VMT for a wide variety of applications. We would recommend that OPR or another state agency provide funding for this research.

This letter was prepared by the California SB 743 Task Force, a task force appointed by the Western District of the Institute of Transportation Engineers. The Western District oversees the thirteen Western states, including California. Within California, the Institute of Transportation Engineers is represented by seven sections throughout the state. The Officers representing the seven California ITE Sections have supported the task force in preparing this letter and their names and contact information are shown below.

Future correspondence should be directed to Erik Ruehr, Chair of the California SB 743 Task Force, who can represent the California ITE Section Presidents for correspondence purposes. Contact information is shown below:

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Thank you again for the opportunity to be involved in this discussion. We look forward to working with you in the months ahead.

Respectfully yours,

Institute of Transportation Engineers
California SB 743 Task Force

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ATTACHMENT A

MEMO ON SB 743 CASE STUDIES

MEMORANDUM

TO: ITE Members

FROM: Erik Ruehr, Chair, California SB 743 Task Force
Institute of Transportation Engineers, Western District

DATE: November 21, 2014

RE: Analysis of SB 743 Case Studies

Senate Bill 743 (SB 743) is intended to make changes in the way that CEQA transportation analyses are conducted in California. The Governor's Office of Planning and Research (OPR) is currently undergoing a process to prepare guidelines for the implementation of SB 743.

CEQA transportation analyses are conducted for a wide variety of projects. SB 743 gives OPR the authority to implement its provisions either statewide or in a smaller geographic area. The minimum implementation area is specified to be within transit priority areas, a relatively small portion of the state where above average transit service is provided. Because of the wide variety of types of CEQA projects and the wide variety of settings, a group of volunteers working with the ITE California SB 743 Task Force, has analyzed a number of case studies to test the implications of the implementation of SB 743. This memo provides a summary of the analysis of SB 743 case studies.

The remainder of this memo provides a summary of the case studies, analysis of the results of the case studies, acknowledgments, conclusions, and the case studies themselves (included as an attachment).

SUMMARY OF CASE STUDIES

Exhibit 1 on the following page shows the category or type of project, the project name, and the project location for each case study. The case studies were selected to represent a wide variety of projects in a variety of settings throughout California. Each project was subjected to a completed CEQA analysis and is documented in OPR's State Clearing House. All of the environmental

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EXHIBIT 1

SUMMARY OF ITE SB 743 CASE STUDIES

Category	Project	Location
General Plan - Transit-Served Metropolitan Area	SACOG RTP EIR	Sacramento Area
General Plan – Mid Sized Suburban (Not Transit Served)	Yolo County General Plan	Yolo County
General Plan – Small Rural (Not Transit Served)	Plumas County General Plan	Plumas County
Specific Plan Inside Transit Priority Area	Palomar Specific Plan	Chula Vista San Diego County
Specific Plan Outside Transit Priority Area	Mission Village Specific Plan	Los Angeles County
Roadway Project in Congested Congested Urban Area	I-880 Improvements at 23rd Ave/29th Ave	Oakland Alameda County
	West Mission Bay Drive Bridge	City of San Diego San Diego County
Roadway Project in Suburban or Rural Area	Golden State Boulevard Corridor Study	Fresno County
Transit Project	AC Transit Bus Rapid Transit	Oakland Alameda County
Land Development Inside Transit Priority Area	Hazard Center Redvelopment	City of San Diego San Diego County
Land Development Outside Transit Priority Area	Escondido Walmart	Escondido San Diego County

analysis and transportation analysis needed to conduct the case studies was obtained from information available to the public on the lead agency's database. Since websites can change at any time, there is no guarantee that the analysis will continue to be available in the future.

ANALYSIS OF COMPLETED CASE STUDIES

The case study analyses are included as an attachment to this memo. The case studies were intentionally conducted by a group of seven individual transportation engineers and planners without strict guidance on consistency between the analyses. This was done to provide a realistic snapshot of the variations in results and styles of analysis that would result if and when the current draft of the SB 743 guidelines (dated August 6, 2014) were to be implemented.

SB 743's key provisions include the elimination of roadway capacity/level of service analysis to determine CEQA environmental impacts and the addition of vehicle miles travelled (VMT) as a CEQA performance measure. The former provision is included in the SB 743 legislation and the latter was included in the Draft SB 743 Guidelines dated August 6, 2014. The case studies focus primarily on the addition of VMT as a performance measure. This is partly because VMT analysis for individual projects is not well developed in the transportation engineering profession, while roadway capacity/level of service analysis is well known and understood. In addition, the effects of elimination of roadway capacity/level of service analysis as a CEQA performance measure relate to policy issues rather than technical calculations.

One additional comment regarding the case study analyses is that the analysis of the significance of VMT impacts and mitigation of those impacts is not well developed. This is due to the relatively short time frame between the release of the Draft SB 743 Guidelines (August 6) and the due date for comments (October 10). While it has been expected for some time that VMT would be the performance measure used to implement SB 743, the exact nature of the VMT significance thresholds was not known until the Draft Guidelines were released. Further analysis of the significance of impacts and mitigation may be desirable, both for helping to shape the final SB 743 guidelines and for use in assisting ITE members in implementing SB 743 once the final guidelines are determined.

After reviewing the results of the case studies, comments on the analysis can best be described in terms of the following general categories of projects: general plans, specific plans, land development projects, roadway projects, and transit projects

For general plan projects, the following comment applies:

- Many general plan projects, including regional transportation plans, are already conducting VMT analyses because of the need for Sustainable Communities Strategies (SCS) analysis. VMT can easily be calculated using a regional travel model. For the one case study in ITE's list that did not have a model available (Plumas County), VMT was successfully calculated in the original environmental document through sketch planning techniques. Under SB 743, the need for VMT analysis in general plan projects would be strengthened and there would be a need to conform to whatever guidelines result from the SB 743 implementation process.

For specific plan projects, the following comments apply:

- Larger specific plan projects within the geographic area of a regional transportation model have the option of using the model to estimate VMT. The Palomar Specific Plan case study provides an example of the methodology that may be applied and the level of effort required. Specific plan projects also have the option of using stand-alone models that produce a VMT estimate. A number of VMT models are listed in OPR's Draft SB 743 Guidelines and further discussion is included below under land development projects.

- Under the current Draft Guidelines, VMT for specific plan projects would need to be calculated based on an average VMT per capita, per employee, or some other appropriate measure. Averages can be misleading if not properly used and additional detail on methodology considerations will be needed at the lead agency level or within the VMT analyses of individual projects in order to provide unbiased information regarding VMT comparisons.

For land development projects, the following comments apply:

- For most land development projects, use of a regional travel model is inappropriate for the estimation of VMT because the project would represent only a very small component of the model's components. VMT comparisons with and without the project would tend to be lost in the rounding procedures used to provide aggregate model results.

- The case studies used various techniques to calculate VMT. In addition to using a regional transportation model. The techniques included the CalEEMod and Urbemis air quality models, the Fehr and Peers VMT/GHG calculator, and sample average trip lengths provided in San Diego Association of Governments (SANDAG) trip generation manual. Exhibit 2 summarizes the results. While the VMT estimates among different models are comparable at the gross level, substantial variations in the results are apparent.

Exhibit 2
Summary of VMT Results

	Estimated Daily Increase in VMT Due to Project				
Project	**Fehr and Peers VMT Calculator**	**CalEEMod (1)**	**SANDAG Trip Generation Manual**	**Urbemis**	**Regional Model**
Palomar Specific Plan	107,247	N/A	N/A	N/A	36,912
Mission Village Specific Plan	539,000	400,548	436,689	394,500	N/A
Hazard Center	12,400	17,973	10,300	N/A	N/A
Escondido Walmart	69,200	35,423	38,700	N/A	N/A

(1) CalEEMod provides VMT increases in terms of Annual VMT. Results were divided by 365 to produce comparable results to daily VMT estimates. This simplified calculation may not be applicable to all projects.

- For transportation engineers and planners beginning to conduct VMT analyses for individual projects, the CalEEMod model is considered to be a good starting point. It is free, relatively easy to use, and has a history of use in the air quality modeling field. CalEEMod can be obtained from the following website: http://www.caleemod.com/

- For determination of mitigation measures for VMT impacts, the CAPCOA (California Air Pollution Control Officers Association) report, Quantifying Greenhouse Gas Mitigation Measures, is considered to be the best starting point. It can be obtained from the following website: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

For roadway projects, the following comment applies:

- For larger projects within the geographic area of a regional transportation model, the model can be used to estimate some or all of the project's change in VMT. According to the SB 743 Draft Guidelines, roadway projects would also need to consider induced demand. Some roadway projects may be able to offset their VMT increases if they include components for transit, bicycling, and pedestrian components.

For transit projects, the following comments apply:

- Most transit projects will reduce VMT and will therefore not need a study of VMT impacts or mitigation. Transit projects will generally benefit from the implementation of SB 743, since they will be relieved of the need to analyze potential traffic impacts.

ACKNOWLEDGMENTS

Special thanks go out to the ITE members who analyzed case studies for inclusion in this memo. They are listed below:

- Victoria and Walt Huffman
- Justin Rassas, LOS Engineering
- David Wong Toi
- Mark Jugar, Rick Engineering
- Phuong Nguyen, Chen Ryan Mobility Group
- KC Yellapu, LLG Engineers

CONCLUSIONS

Following are conclusions based on this analysis:

- The case studies provided in this memo represent a first attempt at providing the analysis that would be necessary under the implementation of SB 743. They are provided both to stimulate comments on the current Draft SB 743 Guidelines and as a starting point for VMT analyses after implementation of SB 743.

- As indicated in the discussion above, the implications of VMT analysis vary substantially depending on the type of project and location.

- This memo provides some initial ideas on the tools available for VMT analysis. Further research and discussion is encouraged.

ATTACHMENT A

SB 743 CASE STUDIES

ITE SB 743 TEST SCENARIO

CATEGORY: GENERAL PLAN FOR A TRANSIT SERVED METROPOLITAN AREA

PROJECT INFORMATION

Project: The Metropolitan Transportation Plan/Sustainable Communities Strategy For 2035

SCH#: 2009122063

Lead Agency: SACOG (Sacramento Area Council of Governments)

Location: Sacramento, California

Proposed Improvements: Capital and operational improvements to the regional transportation system including road, bicycle, pedestrian, and transit projects. The plan also includes maintenance and rehabilitation activities to preserve the existing and expanded transportation system through 2035.

BASELINE DATA

Methodology:

VMT (Vehicle Miles Traveled), both in total from all sources, and household-generated; the subset of VMT which occurs on congested roadways ("congested" means that demand is near the assumed capacity for the roadway). Congested VMT are VMT occurring on roadways at or near generalized hourly capacity). SACOG defines a congested VMT (C-VMT) as VMT that occurs on roadways with volume-to-capacity (VC) ratios of 1.0 or greater.

Household-generated VMT is the measure used in the analysis of impacts for the plan.

Although the absolute amount of household-generated VMT is reported, impact analysis is based on VMT normalized to population as "per capita" rates, to account for population growth between the base year 2008 and analysis year 2035.

SACOG utilized its regional travel demand model to compare the MTP/SCS for 2035 conditions to the existing conditions for the 2008 base year. SACOG's primary model is the "Sacramento Regional Activity-Based Simulation Model" or "SACSIM." SACSIM11 was used for the analysis of this MTP/SCS.

The major sub-model is "DAYSIM," which is an advanced-practice activity-based tour sub-model for predicting household-generated travel. The analysis period of SACSIM is a "typical weekday."

For impact analysis, all impacts and thresholds are defined as differences or changes between the baseline (2008) and the MTP/SCS horizon year (2035).

Number of Geographic Levels Analyzed:

At the same time, the programmatic nature of this Draft EIR necessitates a general approach to the evaluation of existing conditions and potential impacts associated with implementation of the MTP/SCS. Quantitative analyses are provided where applicable and when information is available; in other cases, qualitative analyses are provided.

In addition to describing impacts of both the land use and transportation aspects of the project, this Draft EIR also conducts analyses at three geographic levels: Regional, Localized (Community Type), and Transit Priority Area, as appropriate to the environmental resource. Regional level analysis assesses the extent of the project's impacts on the entire SACOG region; Localized level analysis assesses the extent of the project's impact on each of five Community Types; Transit Priority Area analysis assesses the extent of the project's impact on each of three Transit Priority Areas.

Thresholds:

No specific threshold was stated for either VMT per capita or for congested VMT per capita.

Significance of Impact:

A goal of the MTP/SCS is that VMT per capita decline, even though the absolute amount of VMT may increase. A per capita decline in VMT indicates that the transportation network is operating more efficiently, and that people have more travel choices.

A goal of the MTP/SCS is to see a decline in C-VMT relative to the regional baseline. While it is important to see a decline at the regional level, it is expected that the measures that help facilitate this decline – compact development, mixed-use, and infill- will cause some localized areas to see a limited C-VMT increase per capita from the baseline in the same geography. Notwithstanding these localized increases in C-VMT, these areas will experience shorter and fewer auto trips because of the land use changes and the expanded walk, bike and transit travel options. Therefore, with respect to the localized areas with some increase in C-VMT, impacts are only significant **if the C-VMT per capita exceeds the regional baseline average.**

Mitigation:

Impact TRN-2: Cause an increase in VMT on congested roadways (C-VMT) per capita relative to the applicable baseline for the area, and cause an increase in C-VMT per capita that exceeds the baseline regional average.

The MTP/SCS land use and transportation changes result in a 2.1 percent increase in C-VMT per capita. However, C-VMT in Center and Corridor Communities is 29 percent below the baseline regional average (compare Table 16.15 to 16.16).

The MTP/SCS land use and transportation changes result in a 1.6 percent increase in C-VMT per capita. Also, C-VMT in Developing Communities is 13 percent above the baseline regional average (compare Table 16.15 to 16.18).

Therefore, the congested VMT per capita impacts related to land use and transportation changes from implementation of the proposed MTP/SCS at the Developing Communities level are potentially significant (PS) for Impact TRN – 2. Mitigation is described below.

The MTP/SCS land use and transportation changes result in a 4.9 percent increase in C-VMT per capita. However, Sacramento County TPAs are 27 percent below the baseline regional average (compare Table 16.15 to 16.21).

The MTP/SCS land use and transportation changes result in a 34 percent increase in C-VMT per capita. However, Yolo County TPAs are 30 percent below the baseline regional average (compare Table 16.15 to 16.22).

Mitigation Measure TRN –1: Implement transportation demand management and investment strategies to reduce congested vehicle miles traveled (C-VMT). In order to reduce the impact of congested vehicle miles traveled (C-VMT) in Developing Communities, several transportation demand management and investment strategies should be considered for implementation in these areas.

Significance after Mitigation:
Implementation of the transportation demand management and investment strategies included in Mitigation Measure TRN-1 would likely reduce the impact of congested vehicle miles traveled (C-VMT) in Developing Communities. However, the strategies identified are programmatic and general; they would need to be refined and matched to local conditions in any subsequent project level environmental analysis. The level of C-VMT reduction possible through these strategies would require project level environmental analysis, and therefore it is not known if these strategies will reduce the impact to a less then significant level.

Moreover, the MTP/SCS has policies and strategies to support these efforts, but SACOG cannot require implementing agencies to adopt these mitigation measures. It is ultimately the responsibility of a lead agency to determine and adopt mitigation. Therefore, this impact remains significant and unavoidable (SU).

Other Modes:

Bicycles, pedestrians and transit were also analyzed for potential significant impacts, determining if any of the following occurred:

- Cause combined bicycle, walk, and transit person trips per capita to be lower than the applicable baseline average, and cause a decline in the bicycle, walk, and transit person trips per capita that exceeds the baseline regional average.

- Cause average transit passenger boardings per vehicle service hour to be lower than the applicable average;

- Cause interference with existing or planned bicycle and pedestrian facilities.

Improvements for cyclists, pedestrians and transit travel are also fundamental aspects of the project itself.

Safety:

The proposed MTP/SCS contains a mix of road and highway investments, including new facilities that serve new development and high growth areas, expansion of existing facilities to relieve existing or future bottlenecks, realignments and bypasses to improve or redirect traffic flow, maintenance of existing infrastructure, and other operational and safety improvements such as the addition of guardrails to highways, rumble strips, intersection signalizations, restriping, etc.

Hours Required: No estimate of hours to conduct the analysis is available.

Additional Comments

Nine alternatives were identified for examination and analysis in this EIR. A total of three alternatives were carried forward for detailed analysis: the No Project Alternative (Alternative 1) and two other potentially feasible alternative MTP/SCS scenarios (Alternatives 2 and 3). All would result in Less than Significant transportation and traffic impacts. Mitigation measures identified for the proposed MTP/SCS would be applicable.

ITE SB 743 TEST SCENARIO

CATEGORY: GENERAL PLAN – MID SIZED SUBURBAN

PROJECT INFORMATION

Project: Yolo County 2030 Countywide General Plan

SCH#: 2008102034

Lead Agency: Yolo County

Location: Yolo County, California

Proposed Improvements: The Draft General Plan contains the following seven elements:

- Land Use and Community Character;
- Circulation;
- Public Facilities and Services;
- Agriculture and Economic Development;
- Conservation and Open Space;
- Health and Safety; and
- Housing.

BASELINE DATA

Methodology:

Quantitative roadway impact analysis was conducted for 2030 conditions. A modified version of SACOG's regional SACMET travel demand forecasting (TDF) model was used to forecast future traffic volumes for the Yolo County Draft General Plan.

The County sought an alternative method to estimate unincorporated Yolo County VMT. The new SACOG travel demand model, called SACSIM, was selected, which is a state of the art activity-based travel demand model. This new type of model simulates people and their activity patterns (i.e., why they travel) to estimate regional travel performance measures.

For the purposes of the VMT analysis for Yolo County, the performance measure of **VMT generated per household** for all trip purposes was used. This performance measure includes VMT associated with all of the households in a specific area and does not include the VMT associated with vehicle trips to work, shopping, and other activities that originate from households outside of the specific area. This estimate also does not include VMT from commercial vehicle trips. This approach focuses on the VMT generated by new population growth and indirectly includes VMT related to employment and other non-residential growth.

This approach was used since most new growth in the unincorporated areas of the County under the Draft General Plan would include communities with a balanced mix of residential and non-residential land uses.

Traffic operations analysis was also performed to determine increases in volumes and levels of service on roadways.

Number of Locations Analyzed:

VMT was analyzed and reported for eight areas: the four incorporated cities of Davis, West Sacramento, Winters, and Woodland, 3 SACSIM analysis unincorporated areas of Clarksburg, Dunnigan - Knight's Landing, and Esparto - Capay, and the combined unincorporated areas in the County.

Thresholds:

Implementation of the Draft General Plan would have a significant impact on transportation and circulation if it causes any of the following outcomes:

- Result in increased vehicle miles of travel (VMT)
- Result in traffic operations below LOS C for Yolo County roadways, which is minimum acceptable threshold according to the 1983 General Plan
- Result in traffic operations below the minimum acceptable thresholds on roadways outside Yolo County's jurisdiction (i.e., Caltrans, the Yolo County CMA, and the incorporated cities of Davis, West Sacramento, Winters, and Woodland)
- Several other criteria related to other road users, transit, safety, etc.

Significance of Impact:

Build-out of the Draft General Plan could result in increased vehicle miles of travel, which would be a significant impact. The Draft General Plan includes new population and employment growth that will generate additional VMT. The Draft General Plan includes policies that are expected to reduce the growth of VMT generated per household, but will not eliminate the growth in total VMT.

For traffic operations, in most cases no mitigation measures are feasible to reduce the impacts to a less-than-significant level. Therefore the impacts would remain significant and unavoidable. However, in many cases mitigation measures are proposed to lessen the extent of the impact.

Mitigation:

Full service cities in Yolo County such as Davis and Woodland are estimated to have 44 VMT generated per household per weekday by 2035. With the new policies recommended under the Mitigation Measure, new growth in Specific Plan areas would be planned and designed to achieve a maximum of 44 VMT generated per household per weekday under the Draft General Plan. (The other two cities in Yolo County are Winters with 53 and West Sacramento with 36 VMT generated per household per weekday by 2035. So coincidentally the figure of 44 is the mode, median and approximate average VMT of the four incorporated cities.)

The Draft General Plan includes policies that focus on reducing VMT for the entire unincorporated area of the County. The proposed VMT threshold can help to reduce the VMT produced by the unincorporated area of the County but would be difficult to apply on a parcel-by-parcel basis versus an area-wide approach. Therefore, the VMT threshold is proposed to be applied to the Specific Plan areas where the majority of planned development would occur and where the proposed land uses can be refined and balanced to reduce VMT through the Specific Plan process.

The mitigation measure also proposes achievement of the VMT threshold to be measured based on the build-out of the plan area phases using a travel demand forecasting model that is sensitive to built environment variables including but not limited to the 4Ds (density, diversity, design, and destination).

For traffic operations, in many cases mitigation measures are proposed to lessen the extent of the impact, although the impacts remain significant and unavoidable.

Other Modes:

The Draft General Plan includes various policies with emphasis on non-vehicular travel, including Policy CI-3.6, which includes the concept of “complete streets” in developing roadway cross-sections to account for all users of the transportation system.

While implementation of the Draft General Plan would increase demand for public transit service to an area with limited available service, implementation of the policies and programs included in the Draft General Plan would result in a less-than-significant impact related to transit service.

Safety:

The recent accident history for Yolo County roadways was researched to identify locations with high accident rates.

Hours Required: No estimate of hours to conduct the analysis is available.

ITE SB 743 TEST SCENARIO

CATEGORY: GENERAL PLAN – SMALL RURAL

PROJECT INFORMATION

Project: 2035 Plumas County General Plan Update

SCH#: 2012012016

Lead Agency: Plumas County

Location: Plumas County

Background Information: Plumas County is located in Northern California in the northernmost portion of the Sierra Nevada mountain range. The County has a population of 20,007 residents according to the 2010 U.S. Census.

BASELINE DATA

Methodology: Plumas County does not have a regional transportation model. Traffic forecasts were prepared by manual methods based expected growth in dwelling units and analysis of trip generation and distribution for those dwelling units. Roadway capacity analysis was conducted using the 2010 Highway Capacity Manual.

Number of Locations Analyzed: The analysis included 9 roadway segments. No intersection analysis was conducted.

Thresholds: Level of service C was used as the threshold for roadway segment capacity analysis. Vehicle Miles Traveled (VMT) was also analyzed, but no thresholds were specified for VMT.

Significance of Impact: Traffic impacts were identified at 2 of the 9 roadway segments for cumulative plus project (2035) conditions, as these 2 roadway segments were expected to operated at level of service D. Traffic impacts were determined by comparing cumulative plus project conditions with existing conditions. VMT impacts were not identified because the project was forecasted to reduce VMT as compared to the existing General Plan.

Mitigation: Mitigation measures were not identified for the 2 roadway segments with traffic impacts and the impacts were considered to be significant and unavoidable.

Other Modes: Other modes (transit, bicycle, pedestrian) were reference, but not analyzed in detail. Potential conflicts between autos with bicycles and pedestrians were identified as a less than significant safety impact of the project.

ITE SB 743 TEST SCENARIO

CATEGORY: GENERAL PLAN – SMALL RURAL (CONT.)

Safety: Traffic safety was one of the primary reasons for proposing the project and safety was analyzed extensively in the transportation analysis for the environmental document.

Hours Required: No estimate of hours to conduct the analysis is available.

TEST METHODOLOGY

VMT Models Available: This project included a detailed VMT analysis determined by manual methods based on trip generation and estimated trip length. The manual calculation was possible because there were relatively few areas of development in the County. While variations in the detailed methodology could be considered, a manual calculation is considered to be the only possible way of estimating VMT.

Options to Reduce Project's VMT: Since the project was considered to generate less VMT than the existing General Plan, there was no mention of VMT impacts or options to reduce VMT. Given the rural character of the County the only viable option to reduce VMT would be to locate new developments closer to existing activity centers in order to reduce trip lengths for trips generated by new developments.

Person-Hours to Perform the VMT Analysis: It is estimated that the VMT analysis documented in the General Plan EIR required 40 hours to prepare.

ITE SB 743 CASE STUDY

CATEGORY: SPECIFIC PLAN INSIDE TRANSIT PRIORITY AREA

PROJECT INFORMATION

Project: Palomar Gateway Specific Plan Mobility Study

SCH#: 2009122063

Lead Agency: City of Chula Vista, San Diego County CA

Location: City of Chula Vista, San Diego County CA

Study Objective: Analyze existing and future mobility conditions for both motorized and non-motorized travel in the Palomar Gateway District and provide recommendations to revitalize the District through mixed-use density, Smart Growth design, and Transit Oriented Development (TOD).

BASELINE DATA

Methodology: Intersection capacity analysis was conducted using the Highway Capacity Manual for motorized travel. Traffic forecasts were prepared for Year 2020 and 2030 conditions.

Number of Locations Analyzed: The analysis included 6 intersections and 8 roadway segments.

Thresholds: Level of Service D or better was used as the threshold of acceptable operations for intersection and segment operations.

Significance of Impact: Intersection operations were mitigated in cases where the level of service threshold was not achieved and where the project worsened the condition as compared to the no project condition. It should be noted that mitigation was recommended at 1 intersection.

Mitigation: Mitigation measures were specified for 3 intersections and 3 segments despite not calculating a deficient LOS. Improvements were recommended to improve intersection operations, pedestrian access and safety. One of the segments was consistent with CE and did not promote other modes.

Other Modes: Non-motorized travel was reviewed at an equal level to ensure enhancements for pedestrians, bicyclist and transit were incorporated into the project. The recommendations were prioritized based on a defined tiered system. The non-motorized improvements indicated in Exhibit 1 were recommended for the project.

Safety: Safety for all users was a guiding principle in developing the mobility study. Safety was ranked as the highest priority in determining recommended improvements.

Hours Required: 138 hours

EXHIBIT 1
PALOMAR GATEWAY DISTRICT MOBILITY PLAN

Mobility Element	Constraints	Opportunities		
		Tier I (High Priority)	Tier II (Medium Priority)	Tier III (Low Priority)
Pedestrian	▪ At-grade trolley crossing compromises pedestrian safety and bisects community ▪ Missing sidewalk links hinders mobility ▪ Lack of ADA compliance at certain locations ▪ No buffer on Palomar Street creates a dangerous and unpleasant user experience ▪ "Mega-blocks" lack human scale and hinder walkability ▪ Abundance of driveways along Palomar Street exposes pedestrians	▪ Grade-separate trolley line per 2050 RTP (recommend trolley under Palomar Street to avoid bisecting the community and avoid visual impact)[b] ▪ Introduce new roadways that introduce human scale and encourage walkability ▪ Add countdown timers to existing traffic signals ▪ Square up the at I-5 SB ramps at Palomar Street to avoid free high-speed right-turns	▪ Close/modify driveways on Palomar Street ▪ Provide non-contiguous sidewalks on Palomar Street ▪ Provide sidewalks on missing links ▪ Provide ADA compliant curb ramps ▪ Provide high visibility crosswalks ▪ Provide adequately sized islands for pedestrian refuge on Palomar Street ▪ Provide two pedestrian curb ramps per intersection corner	▪ Provide a multi-use path in the SDGE easement. ▪ Provide a multi-use bridge over I-5 at Ada Street extension
Bicycle	▪ At-grade trolley crossing compromises bicycle safety ▪ Missing bicycle links hinders mobility ▪ Poor accessibility to future Bayshore Bikeway ▪ "Mega-blocks" lacks any human scale and does not promote bicycle activity	▪ Grade-separate trolley line per 2050 RTP recommend trolley under Palomar Street to avoid bisecting the community and avoid visual impact)[b] ▪ Class II bike lanes on Palomar Street and Industrial Boulevard to integrate with the Bayshore Bikeway ▪ Provide bicycle facilities on missing links ▪ Provide bicycle lockers at the Palomar Transit Station	▪ Use colorized or elevated bike lanes to enhance bicycle safety and create driver awareness at vehicle-bicycle conflict points[a] ▪ Developer subsidy of transit passes	▪ Provide a multi-use path in the SDGE easement. ▪ Provide a multi-use bridge over I-5 at Ada Street extension
Transit	▪ At-grade trolley crossing lowers transit capacity ▪ Increasing demand on Blue Line adds congestion and delay to buses on Palomar Street ▪ Increasing congestion on Palomar Street reduces reliability of bus service ▪ Only one driveway with limited movements serves both buses and vehicles ▪ On-board bus collection increases dwell and route travel times[a]	▪ Grade-separate trolley line per 2050 RTP (recommend trolley under Palomar Street to avoid bisecting the community and avoid visual impact) to reduce transit travel times on Palomar Street[b] ▪ Shade structures at busiest stops such as Broadway and Palomar Street	▪ Passive transit signal priority along Palomar Street[a] ▪ Allow level boarding by providing low-floor buses ▪ Provide amenities such as illuminated bus shelters, system maps and schedule, wayfinding signage and bars that passengers that can lean on while standing ▪ Display real time arrival information at Palomar Transit Center	▪ Off-board bus collection system[a] to improve headways ▪ Consider public art and unique design for bus shelters, benches and other street furniture
Light Rail	▪ At-grade trolley crossing impedes vehicular, pedestrian and bicycle mobility ▪ Increasing demand on Blue Line adds congestion and delay to Palomar Street ▪ High-floor trolley cars inhibit disabled and bicycle loading leading to increased gate closing time and excessive delays to vehicles ▪ Frequency of trolley line needs to increase to serve highest ridership trolley blue line demand ▪ Trolley vehicle lengths needs to increase to serve highest ridership trolley blue line demand	▪ Grade-separate trolley line per 2050 RTP (recommend trolley under Palomar Street to avoid bisecting the community and avoid visual impact)[b] ▪ Consider low-floor trolley cars to reduce passenger loading and unloading times (currently under construction)	▪ Grade-separate trolley line at Ada Street ▪ Increase trolley car length and reduce headways to serve Blue Line demand	▪ None
Vehicular	▪ At-grade trolley crossing at Industrial Boulevard/ Palomar Street intersection causes excessive vehicular delay and poor LOS during peak hours ▪ Loading and unloading maneuvers on high-floor trolley cars causes excessive queuing and disrupts signal progression on Palomar Street ▪ Absence of parallel routes, limited roadway network and multiple driveways affects traffic throughput	▪ Grade-separate trolley line per 2050 RTP recommend trolley under Palomar Street to avoid bisecting the community and avoid visual impact)[b] ▪ Restrict Walnut Avenue access to/from Palomar Street to allow right-in/right-out only[b] ▪ Introduce new access to Oxford Street from Industrial Boulevard to relieve traffic congestion on Palomar Street ▪ Change left-turn phasing from permitted-protected to protected[b]	▪ Realign Transit Center Place driveway to avoid intersection offset ▪ Enhance segment capacity on Palomar Street by modifying and/or closing driveway access where feasible[b] ▪ Increase curb-radii on Anita Street to allow truck turning to/from Industrial Boulevard	▪ Provide landscaping along the median on Palomar Street to add visual character

EXHIBIT 1
PALOMAR GATEWAY DISTRICT MOBILITY PLAN

Mobility Element	Constraints	Opportunities		
		Tier I (High Priority)	Tier II (Medium Priority)	Tier III (Low Priority)
ADA	▪ Disintegrated/absent sidewalks and crosswalks hinders mobility for disabled and senior users ▪ Wide curb radii on driveways create high-turning speeds of traffic compromising safety	▪ Repair all disintegrated sidewalks and provide sidewalks on missing links ▪ Retrofit all intersections within the PGD to ADA compliant crosswalks and curb-ramps ▪ Remove or relocate street furniture on sidewalks that hinder mobility ▪ Close/modify driveways on Palomar Street to reduce exposure	▪ Introduce infrastructure such as audible count-down pedestrian signals, truncated domes/ ADA pads to enhance mobility ▪ Provide dedicated ADA parking at the Transit Station	▪ None
Parking	▪ Current parking layout promotes auto use ▪ Free parking does not provide a revenue source ▪ Lack of parking efficiency with over-supply and non-shared land uses	▪ Promote mixed-use, compact development with shared parking ▪ Provide parking interior to the development and not along roadway to add visual character and promote other travel modes	▪ Use dynamic parking pricing to promote non-motorized travel and create a revenue stream ▪ Consider on-street parking as supply for development	▪ None

Footnotes:
a. Case studies presented in ***Appendix N***.
b. Subject improvements are treated as CEQA mitigations.

TEST METHODOLOGY

VMT Models Available: Fehr and Peers VMT/GHG Calculator, CalEEMod Emissions Estimator Model, and LLG/SANDAG Regional Travel Demand Model method were considered in calculating the VMT for the project.

Analysis: Utilizing Fehr and Peers VMT Calculator the following inputs were used:

Land Use

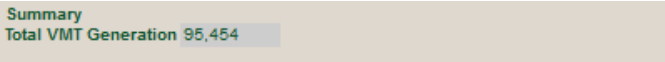
	Existing Trips*	Total Estimated Buildout Trips
Multi Family	3,200	13,600
Retail	8,000	12,000
Office	-	1000
Park	-	250
Industrial	240	-

*Trip generation rates based on *SANDAG Not So Brief Guide Vehicular Traffic Generation Rates, April 2002*

Retail Pass By
Other Retail = 15%

Inputs/Assumptions
H-W = 41.6%
H-S = 18.8%
H-O = 39.6%
* Percentages based on default values from CalEEMod for San Diego

Results: According to the Fehr and Peers VMT/GHG Calculator, the project would result in an additional **107,247 VMT.** Following are the estimated VMT estimates without and with the project, respectively.



Options to Reduce Project's VMT: SANDAG has designated the District as a Smart Growth Community Center. The project's VMT is reduced through smart growth land use planning. The goal is to revitalize the District through mixed-used density, Smart Growth design, and Transit Oriented Development; all of which promote mobility through active transportation and maximize the current transportation infrastructure. Active transportation encourages safe, convenient, and fun bicycling, walking and public transit to achieve a measureable shift from environmentally harmful (VMT) and sedentary travel.

ALTERNATE METHODOLOGY

VMT Model – SANDAG Regional Travel Demand Model

In June of 2013, SANDAG, in collaboration with Linscott, Law & Greenspan, Engineers, published a technical white paper detailing the methodology for calculating VMT using the SANDAG Regional Travel Demand Model. The basis for the methodology is attributed to recent legislation and technical publications identifying the need to further define VMT by jurisdictional (and project-level) responsibility. The methodology has been used in the cities of Carlsbad, Solana Beach, Chula Vista, San Marcos, Escondido, La Mesa, and in communities within the City of San Diego.

Background: The International Council for Local Environmental Initiatives (ICLEI)-Local Governments for Sustainability has developed a new national standard that establishes requirements and recommended best practices for developing local community GHG emissions inventory. The recommended method presented by ICLEI recognizes that local governments possess the authority to influence GHG emissions from passenger vehicle trips both inside and outside of a community's geographic boundaries. This method also recognizes that local governments cannot influence all passenger vehicle GHG emissions within their boundaries. As such, the recommended origin-destination method (using a travel demand-based model, such as the SANDAG traffic model which already includes mixed use, transit, and multi-modal reductions) better captures a local government's ability to affect passenger vehicle emissions than the previous method of using average trip lengths to calculate in-boundary emissions. Congruent with the methodology presented by ICLEI, the SB 375 Regional Targets Advisory Committee, in their September 2009 report to the CARB, recommended the following method for allocating VMT to a study area for the purposes of a GHG analysis:

1. Internal-Internal: all VMT should be included in the analysis
2. Internal-External or External-Internal: 50% of VMT should be included in the analysis
3. External-External: all VMT should be excluded in the analysis

The tools necessary to disaggregate VMT into the categories listed above are 1) a travel demand model with origin-destination patterns; 2) a Geographic Information System (GIS); and 3) a spread sheet. Thus, any Metropolitan Planning Organization with the listed software can perform this method for calculating VMT. The main benefit of this methodology is to define VMT by origin-destination (OD) pairs. This allows for the disaggregation of VMT into the three (3) categories identified above.

Analysis:

To develop the pre- and post-project scenarios, the SANDAG Series 12 Year 2035 Chula Vista Subarea travel demand model was utilized. The appropriate land uses and network assumptions

were coded into the baseline and post-project traffic analysis zones (TAZs). Since the project study area lies within several TAZs, an analysis of the five (5) project area TAZs was completed. This, therefore, includes land uses surrounding the project site. The entire area studied consisted of a three-mile buffer from the project site. Between the build and no build scenarios run in the analysis, only the land uses in the TAZs of which the project is contained within were changed. Below is a summary of the TAZs selected for the analysis and the changes in trips generated.

Trip Generation						
Year 2035 Palomar Gateway Project (Within 3-Mile Study Area Buffer)						
TAZ	No Build		Build		Difference	
	Person Trips	Vehicle Trips	Person Trips	Vehicle Trips	Person Trips	Vehicle Trips
4413	3,283	2,474	14,373	10,168	11,090	7,694
4430	5,158	3,483	39,413	27,730	34,255	24,247
4443	27,896	19,757	29,131	20,693	1,235	936
4451	709	489	3,986	2,747	3,277	2,258
4453	28,503	21,017	17,805	12,667	(10,698)	(8,350)
Total	65,549	47,220	104,708	74,005	39,159	**26,785**

Notes:

1. Trips represent average daily volumes.
2. Data sourced from the SANDAG post-modeling report; Series 12 Year 2035.

With the travel demand model coded correctly, a Select Zone Assignment was completed for the study area that produced an internal capture rate. This rate represents the number of trips that are local to the project study area. Once this rate is obtained, it is then used to calculate the I-to-I trips, I-to-E and E-to-I trips, and the E-to-E trips. A third category to consider is the Intra-zonal trips. These are trips that essentially never make it to the major street system, as their trips lengths are very short, but should be considered in the final VMT calculations.

Methodology Benefits: The main benefit to this methodology is accuracy. The SANDAG model has all land use and network configurations coded for the region and presents a more accurate representation of the interaction between land uses. The origin-destination component of the modeling software provides for exact trip lengths for every daily trip assigned to the regional network by balancing the interaction of productive and attractive land uses. This translates to an average trip length for every single trip generated by the project and all other area land uses, instead of multiplying each land use's total trips by an average published trip length. For GHG analysts, a clear benefit is the ability to disaggregate VMT into the three (3) categories as this provides a clear representation of the project's contribution to VMT increases (or decreases) as reflected in the I-to-I amount (100% project responsibility).

In addition to this method's ability to compare land use plans, the model can evaluate the changes in VMT due to network changes. The model is coded with functional roadway types and contains the entire network of major roads in the County. VMT can be reported as "lane miles", meaning, the deletion of a roadway or roadway capacity changes (e.g. four lanes to six lanes) can be a project-alternative of which a pre- and post-project VMT would be attainable.

The data from the model can be further refined by demographics. VMT data can be categorized using census data factors such as comparing VMT per capita, per dwelling unit, by population, jobs, etc.

The forthcoming SANDAG "San Diego Forward: The Regional Plan" will include the methodology in the Sustainable Communities Strategies component of the plan.

A copy of the technical white paper on using the SANDAG Regional Travel Demand Model method for calculating VMT can be found by visiting the following website: http://www.sandag.org/uploads/publicationid/publicationid_1795_16802.pdf

Results:

With an increase of 26,785 ADT within the study area, the Project area TAZs would result in an additional **43,664 VMT** (43,841 VMT including intra-zonal trips) to the study area street system. Further interpretations of the data can be made, such as the increase in internal-to-internal trips which although increasing VMT, produces VMT with a shorter trip length.

VMT Calculations						
Year 2035 Palomar Gateway Project (Within 3-Mile Study Area Buffer)						
Scenario	Total VMT (All Study Area Land Uses)	Total VMT (Palomar Gateway Land Uses) (I-I, I-E, E-I, & E-E)	Two Trip-Ends VMT (Palomar Gateway Land Uses) (I-I)	One Trip-End VMT (Palomar Gateway Land Uses) (I-E and E-I)	Zero Trip Ends VMT (Non-Palomar Gateway Land Uses) (E-E)	Intra-Zonal VMT (Palomar Gateway Land Uses) (Intra)
No Project	3,644,315	2,469,610	993,977	1,475,633	1,174,705	14,678
With Project	3,681,227	2,513,274	1,023,817	1,489,457	1,167,953	14,855
Change Due to Project	36,912	43,664	29,841	13,823	(6,752)	177
	1.0%	1.8%	3.0%	0.9%	(0.6%)	1.2%

Notes:

1. Palomar Gateway study area extends within a 3-mile radius of project site. Calculations represent VMT totals within the 3-mile buffer.
2. I-I = 100% project responsibility
3. E-I,I-E = 50% project responsibility
4. E-E = 0% project responsibility

Person-Hours to Perform the VMT Analysis:

SANDAG Regional Travel Demand Model Method: The total time needed to complete this process for the Palomar Gateway project was 20-25 hours of LLG time with 10-12 hours of SANDAG time. However, it should be noted that this time does not include any non-motorized transportation and transit assessment, since they are not required as part of the SB 743 guidelines. Table 1 lists all the improvements that were recommended as part of earlier CEQA assessment.

Mission Village Project

Category: Land Development (Mix of Uses) in an approved Specific Plan, Outside of Transit Priority Area

EIR State Clearing House #2005051143

Project Description:

The Mission Village project includes the construction of 4,412 residences (382 single-family homes, and 4,030 multi-family units, including attached and detached condominiums, age qualified, and apartment units); 1,555,100 square feet of commercial/mixed uses (224,100 sf retail, 634,000 sf commercial office and a 697,000 sf business park); a 9.5 acre, 900 student, elementary school; fire station; public library; bus transfer station; parks; public and private recreational facilities; approximately 18,900 linear feet of community trails; 12,400 linear feet of local trails, and 9,200 feet of pathways, as well as road improvements, on a 1,261.8 acre site located within the northeastern corner of the adopted Newhall Ranch Specific Plan in the western unincorporated Los Angeles County, south of the Santa Clara River and State Route 126 (SR-126), and west of Interstate 5 (I-5). An additional (approximate) 58,452 average daily traffic (ADT) would be added to the street network from the development site at buildout with approximately 5,065 tripends occurring in the AM peak hour and approximately 5,926 tripends occurring in the PM peak hour. Los Angeles County approved the Mission Village project in 2011.

Baseline Data

1. Methodology used to perform the analysis, including forecasting, traffic operations and impact

Trip generation for the project was calculated using trip rates from the Santa Clarita Valley Consolidated Traffic Model (SCVCTM) traffic planning computer model and the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 8th Edition*. The SCVCTM traffic planning computer model was also used to determine project trip distribution, trip assignment, study area, buildout Year 2021 with Project traffic volumes and the Horizon Year (Year 2035) with Project traffic volumes for cumulative impact assessment.

Consistent with County of Los Angeles, City of Santa Clarita, and Caltrans traffic impact analysis guidelines, the impacts of the proposed project relative to the capacity of the surrounding roadways were analyzed under four different scenarios:

(1) Existing Conditions plus Ambient Growth with and without Project
(2) 2021 Project Buildout Cumulative Conditions with and without Project
(3) Long-Range (Year 2035) Cumulative Conditions with and without Project
(4) Existing plus Project conditions

A focused traffic model called the Mission Village Traffic Model (MVTM) was used to estimate future traffic volumes for roadways within the project site. The model was developed with the capability to derive detailed peak turning movement volumes at each of the on-site intersections.

In compliance with The Los Angeles County Congestion Management Program (CMP), CMP intersections where the proposed project would add 50 or more trips during the AM or PM peak periods or mainline freeway locations where the project would add 150 or more trips, in either direction, during the AM or PM peak periods were analyzed.

To analyze impacts to roadway intersections, the intersection capacity utilization (ICU) analysis was performed. To analyze impacts to freeway segments, volume to capacity (V/C) was computed, consistent with the methodology as outlined in the Highway Capacity Manual 2000.

2. Number of LOS analysis locations (intersections, segments, etc.)

Sixty-six intersections (thirty-one on-site and thirty-five offsite) and twelve freeway segments were analyzed.

3. Thresholds

The study area roadway facilities were located in one or more of three jurisdictions (the County of Los Angeles, Caltrans District 7, and the City of Santa Clarita). As such, performance criteria from three different agencies were utilized in the traffic impact analysis.

An intersection was considered to be significantly impacted if compared to the ICU in the no-project alternative, the ICU in the with-project alternative increases the ICU by the following:

County Thresholds:	Pre-Project ICU	Project Increment
	.71 - .80 (LOS C)	greater than or equal to .04
	.81 - .90 (LOS D)	greater than or equal to .02
	.91 or more (LOS E & F)	greater than or equal to .01
City Thresholds:	With-Project ICU	Project Increment
	.81 - .90 (LOS D)	greater than or equal to .02
	.91 or more (LOS E & F)	greater than or equal to .01

A freeway mainline segment is considered to be significantly impacted if each of the following conditions are met:

(1) The segment is forecast to operate worse than LOS E or existing LOS, whichever is worse and;

(2) The With Project Scenario, when compared to the Without Project Scenario, increases the V/C by 0.02 or more

4. Significance of impact

Under Existing plus Ambient plus Project conditions, there would be a significant impact at two intersections. Under 2021 project buildout cumulative conditions, the project, in combination with cumulative traffic, would result in significant impacts at nine intersections. Under long-range (2035) cumulative conditions, the project would contribute to significant long-term cumulative impacts at twenty intersections. Under existing plus project conditions, the project would result in significant impacts at five intersections and two freeway segments.

No significant impacts would occur to Congestion Management Program (CMP) intersections or CMP freeway segments, or to the I-5 mainline. With respect to transit, the project potentially would increase demand for transit ridership beyond the capacity of existing services, thereby resulting in a potentially significant impact.

5. Mitigation, if any

A variety of mitigation measures to increase roadway capacity is proposed. At intersections, examples of such mitigation measures include re-striping lanes, adding lanes, and modifying phasing (such as adding left turn phasing or adding right-turn-overlap phasing). One impacted intersection is proposed to be replaced with a grade separated interchange. The developer will also be constructing new roadways to increase capacity. The developer will be constructing 15 new traffic signals as well as any additional signals warranted by future subdivision design. The

developer shall construct bus pull-ins at locations in coordination with the local transit provider and the Department of Public Works.

6. Bonus questions:

    a. Were impacts to other modes considered?

    Yes. The project's impacts on the local and regional transit system were evaluated. Coordination with the transit provider to identify appropriate bus stops (three are proposed for Mission Village) and payment of transit mitigation fees would reduce the potential to transit-related impacts to a less than significant level.

    b. Were safety impacts analyzed?

    No. Safety impacts were not analyzed.

    c. How many person hours were required to perform the project analysis?

    To review the FEIR and traffic study and answer the above questions for the test scenario, about 16 hours were required. It is not known how many hours were required to produce the traffic study for the FEIR.

Test Methodology

1. What existing models are available to analyze the project's VMT impacts?

An existing model that is available to analyze the project's VMT impacts is Fehr and Peers VMT/GHG Calculator. Using this model and using trip generation rates utilized in the *Mission Village* EIR, *Mission Village* is estimated to generate 539,000 (rounded) new average weekday VMT. It should be noted that the Fehr and Peers model allows for inputting percentage of trips that remain within the project and that 33% was used in the analysis consistent with data on internal capture provided in the Mission Village Final EIR.

Another existing model that is available to analyze the project's VMT impacts is the California Emissions Estimator Model (CalEEMod). Using this model *Mission Village* is estimated to generate 146,200,000 (rounded) new annual VMT.

Another available model is Urban Emissions Model (URBEMIS). Using URBEMIS, Mission Village is estimated to generate 394,500 (rounded) VMT.

Mission Village is estimated to generate 436,689 (rounded) new average weekday VMT if trip lengths published in SANDAG's *(Not So) Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region* dated April 2002 are utilized. It should be noted that the trip lengths from the SANDAG document are for the San Diego region, not Los Angeles County where *Mission Village* is located.

2. What options are available to reduce the project's VMT?

The following TDM measures could reduce the project's VMT:

- kiosks or bulletin boards in central locations in the residential areas
- a Transportation Demand Management Coordinator for the residents

- bike lockers and showering facilities for the office and commercial employees
- information newsletters to residents discussing tools for carpooling, bicycling, and alternative modes of transportation
- priority parking spaces for carpoolers for the office uses
- an incentive program to encourage transit use for the residents
- subsidized transit passes for the office and commercial employees
- alternative work schedules including telecommuting and compressed work schedules
- on-site car sharing vehicle(s) and/or bikesharing
- on-site child care
- parking pricing
- Guaranteed Ride Home

The project has been designed for pedestrian connectivity and includes facilities for walking and bicycle use. The Mission Village project will be constructing approximately 18,900 linear feet of community trails, 12,400 linear feet of local trails, and 9,200 linear feet of pathways each of which could help reduce VMT. Additionally, the project includes the installation of Class II bicycle lanes on portions of Magic Mountain Parkway and Commerce Center Drive extensions.

3. How many person hours were required to perform the analysis?

Approximately 8 hours were required to calculate the project's VMT.

ITE SB 743 CASE STUDY

CATEGORY: ROADWAY PROJECT IN A CONGESTED URBAN AREA

PROJECT INFORMATION

Project: Interstate 880 Operational and Safety Improvements at 29th Avenue and 23rd Avenue Overcrossings

SCH#: 2009122063

Lead Agency: Caltrans

Location: City of Oakland, Alameda County

Proposed Improvements: Bridge replacements, reconstruction of interchanges, widening of freeway to achieve standard lane widths, lengthening of auxiliary lanes

BASELINE DATA

Methodology: Intersection capacity analysis was conducted using the Highway Capacity Manual. Queuing was analyzed using the Synchro and Traffix programs. Traffic forecasts were prepared for Year 2035 conditions.

Number of Locations Analyzed: The analysis included 28 intersections (level of service and queuing analysis) and 7 freeway merge/diverge/weaving locations.

Thresholds: Level of service D was used as the threshold for intersection operations. No specific threshold was stated for freeway operations, but none was needed because the project was expected to improve freeway operations.

Significance of Impact: Intersection operations were mitigated in cases where the level of service threshold was not achieved and where the project worsened the condition as compared to the no project condition.

Mitigation: Mitigation measures were specified for 15 intersection conditions related to overall operations and queuing. A traffic management plan was also included as a mitigation measure.

Other Modes: Enhancements for pedestrian and bicycle travel were incorporated into the project.

Safety: Traffic safety was one of the primary reasons for proposing the project and safety was analyzed extensively in the transportation analysis for the environmental document.

ITE SB 743 TEST SCENARIO

CATEGORY: ROADWAY PROJECT IN A CONGESTED URBAN AREA (CONT.)

Hours Required: No estimate of hours to conduct the analysis is available.

TEST METHODOLOGY

VMT Models Available: Since this is a roadway project, available tools such as CalEEMod and the Fehr and Peers VMT calculation tool are not applicable. The regional travel model would be able to report the VMT in the project study area for a given year of analysis, but it would not be sensitive enough to determine differences in VMT between various No Build and Build scenarios.

Options to Reduce Project's VMT: This project can be considered to be essentially VMT-neutral in the sense that it does not generate new vehicle trips or person trips. Instead, its purpose is to facilitate vehicle and person trips that would be made with or without the project. However, the project could have a slight effect on overall regional VMT by including project elements that either encourage or discourage various modes of travel. For example, the bicycle and pedestrian components that are being included in the project tend to encourage the use of these modes of travel.

Person-Hours to Perform the VMT Analysis: Less than one.

RICK
ENGINEERING COMPANY
Traffic Division

Updated June 10, 2014

SB 743 CASE STUDY – WEST MISSION BAY DRIVE BRIDGE – SAN DIEGO, CA

The following summarizes a SB 743 Case Study test scenario for a Roadway Project in a Congested Urban Area, in an effort to highlight pros and cons of various methods of measuring and reporting vehicles miles travelled (VMT) as of performance measure for CEQA transportation analyses.

The project identified for this particular case study is the West Mission Bay Drive Bridge Replacement Project within the City of San Diego. **Figure 1** shows the project area.

Figure 1
West Mission Bay Drive Bridge Project Area

The project proposes to replace the existing four lane bridge with two new parallel bridge structures each containing three lanes in each direction (six lane facility). The overall bridge replacement effort would include a construction area of approximately 131 feet in width on both sides of the existing bridge, as measured from the existing edge of the deck. The length of the bridge construction would be approximately 1,296 feet. With an existing ADT of 50,000, this existing 4-lane bridge is currently operating over capacity. The forecasted ADT for this bridge segment is 70,300 in 2015. The **Figure 3** shows the proposed six-lane bridge layout. The traffic analysis for this project was prepared under CEQA and included in the Mitigated Negative Declaration (MND) and Environmental Assessment (EA) environmental documents, with the City of San Diego as the lead agency. This bridge replacement project is identified in the City's Capital Improvement Program (CIP No. 52-643) and will build this facility to it's ultimate roadway classification (6-lane prime).

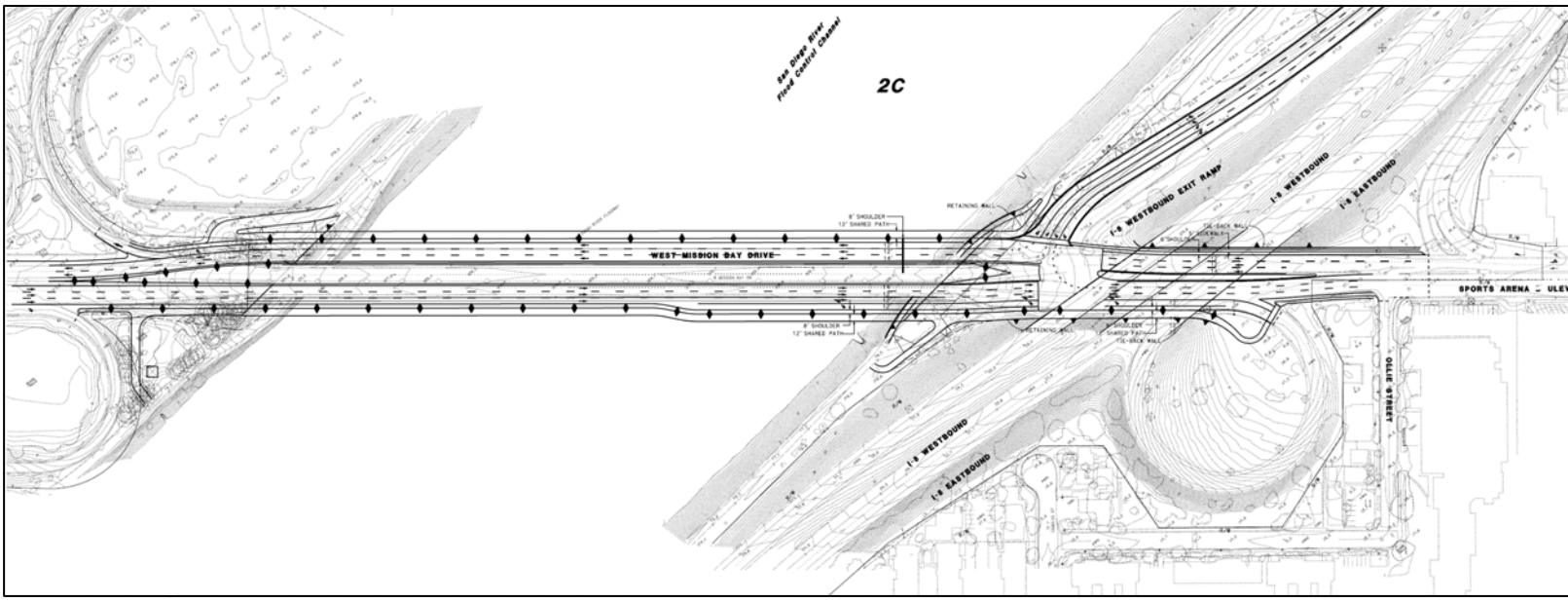


Figure 2
Proposed West Mission Bay Drive Bridge

BASELINE DATA

The following outlines the analysis methodologies and findings of the traffic analysis that was prepared for the City of San Diego (Traffic Analysis report dated December 15, 2011).

1. Methodology
   The traffic analysis was performed based on methodologies described in City of San Diego's Traffic Impact Study Manual. The roadway segment analysis was based on City's Classification/ADT/LOS table and the intersections were analyzed utilizing HCM 2000 methods and also Caltrans's ILV method at the state maintained intersections. Series 11 traffic model runs were also obtained from SANDAG for 2015 and 2035 to help estimate forecasted traffic volumes. Queues at project area intersections were also

performed utilizing results from SimTraffic software package. **Figure 3** shows a copy of the 2015 SANDAG Series 11 model run.

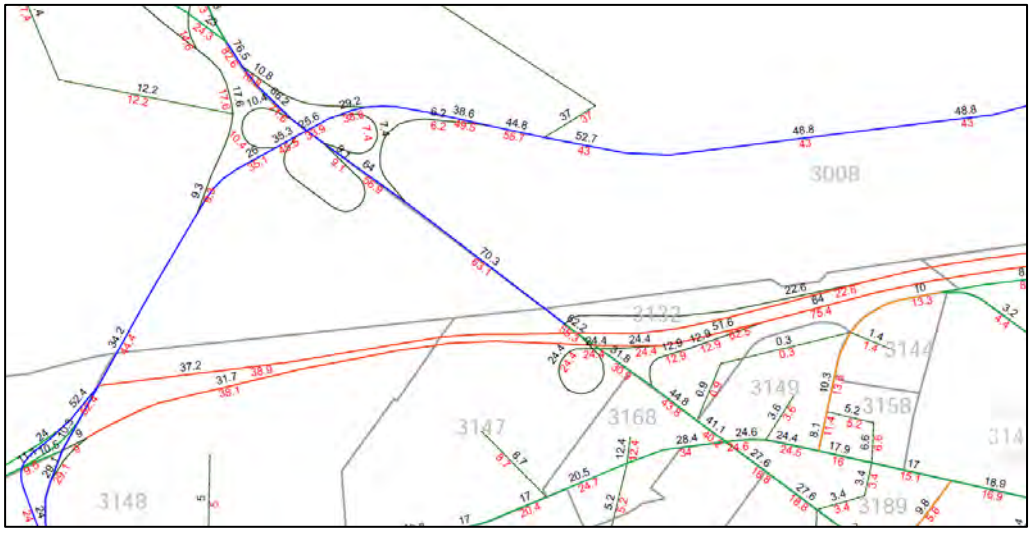


Figure 3
SANDAG Series 11 Forecast

2. LOS Analysis
   Level of Service analyses were calculated at 5 project area intersections and 4 project area roadway segments for the without project alternative (current 4-lane bridge) and with project (proposed 6-lane bridge) alternative in 2015 and 2035.

3. Thresholds
   The thresholds utilized for the traffic analysis were obtained from the City of San Diego's CEQA Significance Determination of Thresholds publication (Transportation/Circulation and Parking section of this document). **Table 1** shows a copy of the threshold table that was utilized to help determine significant impacts.

Table 1
City of San Diego CEQA Transportation Impact Threshold Table

Level of Service with Project *	Allowable Change Due To Project Impact **					
	Freeways		Roadway Segments		Intersections	Ramp Metering
	V/C	*Speed (mph)*	*V/C*	*Speed (mph)*	*Delay (sec.)*	*Delay (min.)*
E (or ramp meter delays above 15 min.)	0.010	1.0	0.02	1.0	2.0	2.0
F (or ramp meter delays above 15 min.)	0.005	0.5	0.01	0.5	1.0	1.0

Note 1: The allowable increase in delay at a ramp meter with more than 15 minutes delay and freeway LOS E is 2 minutes.

Note 2: The allowable increase in delay at a ramp meter with more than 15 minutes delay and freeway LOS F is 1 minute.

* All LOS measurements are based upon Highway Capacity Manual procedures for peak-hour conditions. However, V/C ratios for roadway segments are estimated on an ADT/24-hour traffic volume basis (using Table 2 of the City's Traffic Impact Study Manual. The acceptable LOS for freeways, roadways, and intersections is generally "D" ("C" for undeveloped locations). For metered freeway ramps, LOS does not apply. However, ramp meter delays above 15 minutes are considered excessive.

** If a proposed project's traffic causes the values shown in the table to be exceeded, the impacts are determined to be significant. The project applicant shall then identify feasible improvements (within the Traffic Impact Study) that will restore/and maintain the traffic facility at an acceptable LOS. If the LOS with the proposed project becomes unacceptable (see above * note), or if the project adds a significant amount of peak-hour trips to cause any traffic queues to exceed on- or off-ramp storage capacities, the project applicant shall be responsible for mitigating the project's direct significant and/or cumulatively considerable traffic impacts.

KEY:

Delay	=	Average control delay per vehicle measured in seconds for intersections, or minutes for ramp meters
LOS	=	Level of Service
Speed	=	Speed measured in miles per hour
V/C	=	Volume to Capacity ratio

4. Significance of Impact

Based on the above thresholds, no significant impacts were calculated at any of the project area intersections and roadway segments with the proposed project. In general, since the project proposes to add capacity (4-lane facility to 6-lane facility), intersection delays and v/c(for roadways) were calculated to improve.

5. Mitigation

Since no impacts were calculated, no mitigations were proposed. However, the analysis made lane configuration recommendations at the I-8 WB off ramp/W. Mission Bay Drive intersection (southend of the bridge) to help accommodate peak queues on the bridge. This included adding an additional southbound storage lane as well as providing signal phasing/timing adjustments at this intersection.

6. Bonus Questions

a. Were impacts to other modes considered? Yes, with the existing Class I ped/bike path on the north and south side of the San Diego River, the new 6-lane bridge provided connectivity to these existing facilities. In addition, since this facility was

classified as a Class I facility in the City's Bicycle Master Plan, a Class I facility was also proposed on both sides of the bridge.

b. Were safety impacts considered? Yes, with respect to at-grade pedestrian crossings at the I-8 WB loop on ramp from SB WB Mission Bay Drive. The crossing was located to ensure proper sight visibility. In addition, the existing narrow shared ped/bike facility (less than 5') will now be replaced with a 12' wide shared facility. **Figure 4** shows a photograph of the existing ped/bike facility on the bridge.

Figure 4
Existing West Mission Bay Drive Bridge, facing northbound

c. How many person hours were required to perform the project analysis? It was estimated that approximately 100 person hours spent to conduct the all the LOS based analysis tasks (not including queuing and ILV analyses).

TEST METHODOLOGY

The following summarizes the research and findings related to estimating vehicle miles traveled for this type of project.

1. Available Models to Analyze VMT impacts? The following sketch planning tools were evaluated in terms of VMT estimations:
   - CalEEMod Emmission Estimator Model
   - Sketch7 Estimation Tool
   - VMT/GHG Estimator Fehr & Peers
   - CAPOA GHG Mitigation Report
   - UrbanFootprint model

In reviewing these available models, typical inputs require type of land use, size of land use and other input such as home-based work trips, non-home based trips, trip lengths, etc., some of the same inputs required to estimate trip generation. In its simplest form, VMT is calculated by ADT multiplied by the link length.

Since this test scenario is not your typical land development project that generates trips (roadway improvement project that increases capacity from 4-lanes to 6 lanes), the ADT and the link length were essentially the same for both without and with the proposed project. Hence the VMT for this segment would be the same.

2. Available Options to reduce project's VMT? For this project, since the link length (bridge segment) would be the same for both with and without the project, the forecasted ADT would have to be lower than the without project conditions in order to reduce the VMT for this bridge segment. Options to reduce VMT could include implementing transit in the nearby area or adding a parallel link in the nearby area to see if these would reduce the ADT on the specific bridge segment.

3. Person hours to perform analysis? N/A

FINDINGS/CONCLUSIONS

For this case study test scenario for a Roadway Project in a Congested Urban Area, there was not a clear method for estimating a VMT for this specific bridge segment utilizing the available sketch models that were listed, as these models are generally for land development type projects that generate trips. As noted earlier, the VMT for this project would essentially be the same for both with and without the project, since the link length and ADT do not change for the two scenarios. However a potential method for trying to estimate VMT for this type of project utilizing the available models could be to define a project area boundary that includes nearby major roadways to be analyzed, rather than just analyzing the specific link (bridge segment). This may produce comparable VMT results to help measure VMT's with and without the project.

For this specific infrastructure improvement project, it is anticipated that a VMT can be developed and calculated in order to determine if this project has a calculated significant impacts (assuming VMT thresholds have been defined). However, an intersection/roadway LOS analysis would still be needed to help define actual design parameters (additional turn lanes, increase storage lengths, etc.). It should be noted that for this project traffic analysis, a detailed queueing analysis was conducted to help determine storage for turn pocket lengths at the intersections as well as any additional storage that would be needed along the bridge segment. Key parameters that aided in the design of the actual facility.

ITE SB 743 TEST SCENARIO

CATEGORY: ROADWAY PROJECT IN A SUBURBAN OR RURAL AREA

PROJECT INFORMATION

Project: Golden State Corridor Economic Development Infrastructure Improvements

SCH#: 2011121032

Lead Agency: Fresno Council of Governments (Fresno COG)

Location: Fresno County

Proposed Improvements: grade separation, signalization, and intersection improvement/widening.

BASELINE DATA

Methodology: Intersection capacity analysis was conducted using the Highway Capacity Manual methodology. Computerized analysis of intersection operations was performed using the Synchro 7 traffic analysis software by Trafficware. Roadway segment capacity analysis was conducted using the Florida Department of Transportation (FDOT) ARTPLAN 2009 methodology. Queue length analysis due to the nearby railroad crossing was conducted using an equation that assumes a gate downtime of 2 minutes every hour. The project was analyzed under Existing, Existing Plus Project, Future Year 2035, and Future Year 2035 Plus Project scenarios.

Number of Locations Analyzed: The analysis included 22 intersections analyzed for delay and Level of Service (LOS), out of which 17 intersections were selected for queuing analysis. Additionally, 9 roadway segments were analyzed for roadway volume/capacity ratio and level of service.

Thresholds: Since the Golden State Boulevard traverses multiple jurisdictions within Fresno County, the intersection targeted LOS varies between LOS C and LOS D from jurisdiction to jurisdiction.

Significance of Impact: The project proposed multiple intersection improvements as a part of the project, therefore the project does not cause a significant impact.

Mitigation: Since the project proposed to improve the base year intersection LOS using various intersection improvements, the project does not cause a significant impact nor does it require additional mitigation measures.

Safety: Queuing analysis was conducted to compare the build vs. no build queue length due to the nearby railroad crossing gate under the Future Year 2035 scenarios. Queue length analysis was not conducted for the Existing scenarios.

Hours Required: No estimate of hours to conduct the analysis is available.

TEST METHODOLOGY

VMT Models Available: Since this is a corridor improvement project, most of the VMT models (such as the Fehr & Peers VMT calculation tool and the CalEEMod) are not applicable for corridor analysis, as most models were developed for land use planning and development instead of corridor and regional transit analysis. The regional travel model would be able to report the VMT in the project study area for a given year of analysis, however, the regional traffic demand model is unlikely to produce measurable result since the land use data remains the same between the base year and built conditions, and the lack of congestion under both existing and future condition along the Golden State Corridor.

Options to Reduce Project's VMT: This project can be considered to be essentially VMT-neutral in the sense that it does not generate new vehicle trips or person trips, and does not induce traffic growth due to the lack of congestion along the project corridor.

Person-Hours to Perform the VMT Analysis: Less than one.

ITE SB 743 CASE STUDY

CATEGORY: TRANSIT PROJECT

PROJECT INFORMATION

Project: AC Transit East Bay BRT Project

SCH#: 2003052070

Lead Agency: Alameda-Contra Costa Transit District

Location: Cities of Berkeley, Oakland, and San Leandro.

Proposed Improvements: The project proposes to provide dedicated BRT lanes in a portion of the BRT route by reducing the number of mix-flow lanes (thus reducing capacity) and restricting left turning movements along a portion of the route. The reduction in capacity and additional turn movement restrictions would result in shifting traffic patterns to parallel streets.

BASELINE DATA

Methodology: Intersection capacity analysis was conducted using the Highway Capacity Manual 2000 methodology. Computerized analysis of intersection operations was performed using the Synchro 7 traffic analysis software by Trafficware. The 2035 Horizon Year traffic projection was conducted using the Alameda County Travel Demand Model.

The project was analyzed under Existing, 2015 No-Build Alternative, 2015 Near-Term Traffic Impacts: Build Alternatives, 2035 Horizon Year No-Build Alternative, and 2035 Horizon Year Traffic Impacts - Build Alternatives.

Number of Locations Analyzed: The analysis included 129 intersections (Delay and Level of Service).

Thresholds: Level of Service (LOS) D was used as the threshold for intersection operations. LOS E is considered to be acceptable LOS for intersection in the Central Business District (CBD) area within the City of Oakland. Significant impact thresholds vary between cities.

Significance of Impact:

The City of Oakland has adopted a Transit-First Policy, therefore intersection operations were mitigated where the mitigation would not affect the accessibility and circulation for other modes of travel and where they would not impact existing businesses and residences.

Within the City of Berkeley and the City of San Leandro, intersection operations were mitigated to less than significant impact (if feasible) where the LOS threshold was not achieved and where the project worsened the condition as compared to the no project condition.

Thirty-three (33) intersections are projected to experience worsening traffic conditions to a level considered a significant adverse impact with the implementation of the proposed project.

Mitigation: Mitigation measures were specified for all thirty-three (33) intersections; out of which six (6) intersections remain significantly impacted after mitigation.

Other Modes:

Transit services were analyzed based on bus miles, bus hours, peak number of buses, transit speed, transit time, and transit ridership.

Pedestrian and bicycle enhancements were incorporated into the project, including documentation of existing demand and deficiencies.

Safety: Traffic safety including traffic impacts to parallel neighborhood streets were considered, traffic calming measures such as bulb-outs were also considered.

Hours Required: No estimate of hours to conduct the analysis is available.

TEST METHODOLOGY

VMT Models Available: Since this is a transit specific project, most of the VMT models (such as the Fehr & Peers VMT calculation tool and CalEEMod) are not applicable for transit corridor analysis, as most of the models were developed for land use planning and development instead of corridor and regional transit analysis. Additionally, VMT analysis can be evaluated using the travel demand model instead of other tools, since the project already utilizes the Horizon Year 2035 Alameda County Travel Demand Model. The travel demand model should be able to provide a clear VMT comparison between the build and no-build scenarios.

Options to Reduce Project's VMT: Not applicable, since the intention of the project is to provide enhanced transit services, which would increase transit usage, thus reducing the overall VMT.

Person-Hours to Perform the VMT Analysis: No estimate of hours to perform the VMT Analysis were available. Based on experience, it is estimated that it would require approximately 30 hours of staff time to conduct the VMT analysis and document the results.

ITE SB 743 CASE STUDY

CATEGORY: DEVELOPMENT PROJECT INSIDE TRANSIT PRIORITY AREA

Hazard Center Redevelopment

EIR State Clearing House #2008061058

Project Description:

The project is a redevelopment of a mixed use site. The existing site consists of a hotel, theaters, retail, and office. The redevelopment project would demolish the theaters and add residential and more retail. An additional (approximate) 1000 average daily traffic (ADT) would be added to the street network from the redeveloped site. Also, the site is less than 1/4 mile from a trolley station. The City Council (City of San Diego) approved the project in 2010.

Baseline Data

1. Methodology used to perform the analysis, including forecasting, traffic operations and impact

A SANDAG Series 10 Regional Forecasting model for Year 2030 that was modified by the City of San Diego for use in the Mission Valley Community was used to determine the project trip distribution, trip assignment, study area, and the Horizon Year (Year 2030) with Project traffic volumes for cumulative impact assessment. Trip generation was determined using City of San Diego rates published in the *City of San Diego Trip Generation Manual* dated May 2003 and applying mixed-use reductions and transit reductions since the project lies within 1500 feet of a trolley stop. The net trip generation of the proposed project was obtained by determining the difference in the trip generation of the redevelopment project and the trip generation of the existing site.

Existing conditions were determined by gathering existing turning movement counts for intersections, collecting existing ADT counts for roadway segments, and researching freeway traffic volumes from Caltrans for the project study area. Near Term w/o Project traffic volumes were determined by adding traffic from approved and pending projects to the study area. Horizon Year (Year 2030) w/o Project traffic volumes were determined by subtracting the additional traffic produced by the redevelopment project from the Series 10 City of San Diego Regional Traffic Model output.

Intersection LOS was calculated using *Highway Capacity Manual* procedures. Roadway segment LOS was determined based on roadway classification, average daily traffic, and by utilizing a lookup table from the *City of San Diego Traffic Impact Study Manual.* Freeway segment LOS was determined on a peak hour basis, by lane, and by direction.

2. Number of LOS analysis locations (intersections, segments, etc.)

Nine intersections, nine roadway segments, and two freeway segments were analyzed. No freeway ramp meters were analyzed.

3. Thresholds

The thresholds used were those specified in the City of San Diego's *Significance Determination Thresholds* dated January 2007. Specifically, for an intersection at LOS "E", a delay of more than 2 seconds was deemed significant, and for an intersection at LOS "F", a delay of more than 1 second was deemed significant. For a roadway segment at LOS "E" a volume to capacity (v/c) increase of more than 0.02 was deemed significant, and for LOS "F", a v/c increase of more than 0.01 was deemed significant. For a freeway segment at LOS "E" a volume to capacity (v/c) increase of more than 0.010 was deemed significant, and for LOS "F" a v/c increase of more than 0.005 was deemed significant.

4. Significance of impact

A significant cumulative traffic impact was found at the intersection of Friars Road and Frazee Road. This impact resulted in an increase in delay of 3.8 seconds when the Horizon Year with Project Scenario was compared to the Horizon Year without Project Scenario.

A cumulative significant traffic impact was also found at the intersections of Frazee Road/project driveway and Frazee Road/Hazard Center Drive due to queuing. Although delay calculations did not indicate a significant project impact at these intersections, the traffic study notes an existing queuing problem along this portion of Frazee Road that degrades the operations of these two traffic signals. Adding additional traffic from the redevelopment project would exacerbate the existing queuing problem.

5. Mitigation, if any

To mitigate the project's cumulative impact at the intersection of Friars Road/Frazee Road, the *Hazard Center Redevelopment* project will be required to pay a contribution of $149,492 towards Caltrans' SR-163/Friars Road Interchange Project and provide an Irrevocable Offer to Dedication (IOD) for the future construction of an additional right turn lane on Friars Road at the Friars Road/Frazee intersection.

To mitigate the project's cumulative impact to the intersections of Frazee Road/project driveway and Frazee Road/Hazard Center Drive, the project will construct an additional southbound left turn lane at the intersection of Frazee Road/Hazard Center Drive.

6. Bonus questions:
    a. Were impacts to other modes considered?

        No. Impacts to other modes were not considered.

    b. Were safety impacts analyzed?

        No. Safety impacts were not analyzed.

    c. How many person hours were required to perform the project analysis?

        To review the EIR and answer the above questions for the test scenario, about 8 hours were required. It is not known how many hours were required to produce the traffic study for the EIR.

Test Methodology

1. What existing models are available to analyze the project's VMT impacts?

An existing model that is available to analyze the project's VMT impacts is Fehr and Peers VMT/GHG Calculator. Using this model and using City of San Diego trip generation rates, *Hazard Center Redevelopment* is estimated to generate 12,400 (rounded) new average weekday VMT when compared to the existing site.

Another existing model that is available to analyze the project's VMT impacts is the California Emissions Estimator Model (CalEEMod). Using this model and using ITE trip generation rates, *Hazard Center Redevelopment* is estimated to generate 6,560,000 (rounded) new annual VMT when compared to the existing site.

Yet another way to determine the project's VMT is to use trip lengths published in SANDAG's *(Not So) Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region* dated April 2002. Using this data and City of San Diego trip generation rates, *Hazard Center Redevelopment* is estimated to generate 10,300 (rounded) new average weekday VMT when compared to the existing site. This method is the simplest way to calculate VMT; however, SANDAG's *(Not So) Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region* does not list trip lengths for every land use published in the document.

2. What options are available to reduce the project's VMT?

Per the FEIR, *Hazard Center Redevelopment* would provide the following which could reduce the project's VMT:

- kiosks or bulletin boards in central locations in the residential areas
- a Transportation Demand Management Coordinator for the residents
- bike lockers and showering facilities for the office and commercial employees
- information newsletters to residents discussing tools for carpooling, bicycling, and alternative modes of transportation
- priority parking spaces for carpoolers for the office uses
- an incentive program to encourage transit use for the residents

Other options that are available to reduce the project's VMT include providing:

- subsidized transit passes for the office and commercial employees
- alternative work schedules
- on-site car sharing vehicle(s) and/or bike sharing
- on-site child care

3. How many person hours were required to perform the analysis?

   Approximately 10 hours were required to perform the analysis.

ITE SB 743 CASE STUDY

CATEGORY: LAND DEVELOPMENT PROJECT OUTSIDE TRANSIT PPRIORITY AREA

PROJECT INFORMATION

Project: Escondido Walmart

SCH#: 2003091029

Lead Agency: City of Escondido

Location: City of Escondido, San Diego County

Proposed Improvements: Construction of a 150,000 square foot retail Walmart store

BASELINE DATA

1) Methodologies employed:
    a. Study area based on 50 peak hour trips and 200 ADT for segments
    b. City of Escondido Segment LOS lookup table
    c. Highway Capacity Manual, 2000
    d. Caltrans ILV
    e. Four analysis scenarios (E, E+C, E+C+P, Horizon+P)
    f. SANDAG Horizon Year 2030 traffic model
2) Number of LOS analysis locations:
    a. 16 intersections
    b. 24 segments
    c. 0 freeway segments
    d. 0 freeway on-ramps
3) Thresholds: City of Escondido
4) Significance of Impact
    a. Signalized Intersection Impact if:
        i. Degrades to worse than mid-level D (delay of 45.1 seconds or more),
        ii. If worse than mid-level D, then cumulative impact if 2 second increase in delay
    b. Un-signalized Intersection Impact if:
        i. Degrades to worse than mid-level D (delay of 30.1 seconds or more),
        ii. If worse than mid-level D, then cumulative impact if 2 second increase in delay
    c. Segment Impact if:
        i. Degrades to worse than mid-level D and increases v/c ratio by more than 0.02,
        ii. If worse than mid-level D, then cumulative impact v/c ratio increased by 0.02

5) Mitigation, if any
    a. Direct impacts:
        i. 1 intersection with mitigation of a traffic signal
    b. Cumulative impacts:
        i. 3 intersections (fair share to the satisfaction of City of Escondido)
        ii. 6 segments (fair share to the satisfaction of City of Escondido)
    c. Project features:
        i. Physical access improvements
        ii. Roadway signage improvements
6) Additional issues
    a. Other modes (bus, pedestrian, bicycle) were not included
    b. Safety consideration provided by recommending signal ahead symbol with flashing beacon be installed with proposed mitigation of a traffic signal
    c. Exact hours to prepare the 2004 traffic study is unknown, but is estimated at 120 hours.

TEST METHODOLOGY

1) What existing models are available to analyze the project's VMT impacts?
    a. SANDAG Series 12 Transportation Model
2) What options are available to reduce the project's VMT?
    a. Increase bus service, require employee carpooling
3) VMT Analysis was conducted for three methodologies with the following results, expressed in daily VMT increase due to the project:
    a. Fehr and Peers VMT Calculator: 69,200
    b. CalEEMod: 35,423
    c. SANDAG Trip Generation Manual: 38,700

ATTACHMENT B

TRB PAPER ON INDUCED DEMAND

Effects of Increased Highway Capacity: Results of Household Travel Behavior Survey

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Travel behavior is likely to change when road congestion and travel times are improved as a result of new highway capacity. The behavioral change is complex and may manifest itself over both the short and long run. Short-term impacts may include changes in route choice, time of day that trips are made, mode choice, trip frequency, trip chaining, and destination choice. Longer-term impacts may include changes in automobile ownership, residential location, choice of workplace location, and land development patterns. These changes occur against a background of economic, demographic, and pricing changes affecting the population as a whole. A fresh approach is taken to illuminate the question of whether highway improvements induce new travel. The research has been framed in terms of relating the time "released" by a highway improvement to how households would use this time. The question then becomes, Do travelers use the time saved to make more (or longer) trips, or do they use it for other activities? To make the responses more realistic, respondents were asked to relate hypothetical changes in congestion levels to their previous day's travel and activity patterns. The results of a stated preference/activity survey of nearly 700 urban Californians indicate that congestion-relieving projects are likely to induce a small (3 to 5 percent) but not trivial increase in trip generation. This effect could be accounted for by modifications in the traditional "four-step" travel forecasting models, which gives transportation and air quality analysts a better sense of how to assess the potential induced travel impacts of new highway capacity.

Few current transportation issues engender more controversy than the effects of new highway capacity on traffic and travel demand. The purpose of adding highway capacity is to reduce traffic congestion and improve automobile travel times and, in some cases, air quality. These changes, in turn, affect travel behavior by affecting peoples' choice of modes of travel, their choice of destination, and their choice of travel route. Less well known is how travel time changes caused by capacity increases may affect total travel demand, especially trip generation (i.e., the number of vehicle trips made per person or per household). Estimating the magnitude of this effect on trip generation is particularly uncertain. A primary purpose of this project was to examine the effects of new capacity on trip generation, because in most North American travel forecasting models, trip generation is not sensitive to transportation supply variables.

IMPORTANCE TO CLEAN AIR AND TRANSPORTATION

Federal, state and local governments spend billion dollars a year on new road improvements to reduce congestion, improve safety, and provide for economic development. There is popular and some professional opinion that new capacity in urban areas is eventually swamped by new demand so that in the end motorists are no better off than they were before the improvement was made (*1,2*). Disagreements arise about whether this effect exists and, if it does, what its magnitude is. The issue has moved to center stage because the 1990 Clean Air Act Amendments prohibit recipients of federal transportation funds from constructing projects that worsen air quality in nonattainment areas.

A road improvement may improve air quality depending on whether a trip-inducing effect occurs. New road capacity, to the extent that it reduces speed variations (stop-and-go driving) and allows vehicles to travel a steady 30 to 45 mph (48 to 72 kph), improves air quality. This claim has been challenged by others, who maintain that any air quality benefit of new road capacity in the short term will be offset in the longer term by increased travel demand that will nullify any improvement in total emissions. Of course, the trip induction effects of new highway capacity do not have to be 0 for there to be a net air quality benefit, but they must be smaller than the increase in emissions per vehicle.

STUDY PURPOSE AND RESEARCH APPROACH

The purposes of this study were to answer two fundamental questions: Do capacity increases increase trip making? If so, what is the magnitude of this increase, if it exists? The overall research objectives were accomplished through a variety of means; this paper reports on the results of a household survey of traveler behavior conducted as part of the study. Past attempts to assess the travel impacts of new highway capacity have mostly relied on before-and-after traffic volume comparisons. In some cases traffic counts have been supplemented with roadside interview or home interview surveys. A few investigators have attempted to fit regression models for predicting regional vehicle kilometers of travel (VKT) increases that result from regional increases in highway capacity. However, this approach has generally not been fruitful because a variety of extraneous factors can affect the results, including the availability of alternative modes and routes in each corridor; the condition of the local economy (growing or stagnant); zoning; and natural constraints to development. These factors not only affect the conclusions but also limit the validity of extending these results to other situations and locations. Shortcomings of the case study approach are documented in the literature (*3,4*). A brief summary of the reasons for proposing an alternative approach follows.

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Control of Exogenous Variables (Economic Conditions)

Transportation changes take place in a highly dynamic environment: household income, population, employment, fuel and parking prices, and other variables cannot be directly controlled for. A time series approach may not control for the distributional shifts in land use activities that transportation investments may induce if the area of analysis is limited. This creates a considerable problem in distinguishing between a shift along the demand curve (because of the reduced price of travel caused by added capacity), and a shift in the demand curve itself (see Figure 1). Demand curves may shift as a result of changes in income, tastes, and demographic factors. Point 1 represents an initial condition with a four-lane freeway; Point 2 is the result of a capacity increase (travel time reduction) and the associated movement along today's demand curve. Point 3 is purely the result of a demand curve shift, possibly caused by such factors as increased population or income but also possibly caused by reduced transit service, higher fares, or changes in taste. Point 4 is the final equilibrium—a combined result of capacity and demand increase.

Completeness of Data Sets

The data requirements of a case study approach include (as a minimum) annual traffic counts on the new facility and all paralleling routes along with good records of land use changes in the corridor. Local agencies often lack consistent annual count programs with counters at the correct locations to assess changes in corridor demand because of capacity changes. Even if all of the count data were available perfectly, the appropriate temporal resolution needed to assess the impacts of new capacity may be missing. Ideally, counts would be available at 15-min intervals to assess the impacts of temporal shifting in travel, and especially the "peak within the peak." Information needs to be available on all paralleling transit services; even then, one would not know what the changes in destination choices were (were people driving further because of the new capacity to reach a "better" destination?); or the shifts in land uses that took place over time.

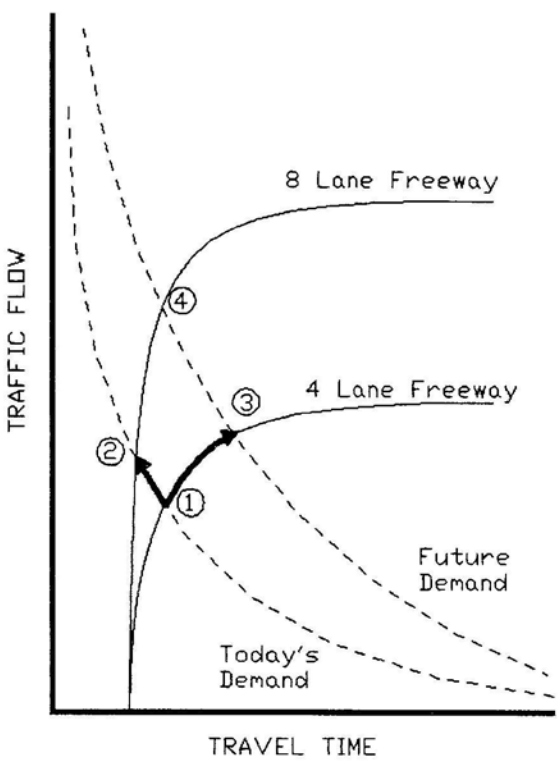

FIGURE 1 Demand versus capacity changes.

Differences in and Comparability of Data Collection Years

Traffic counts, income, and other demographic information typically are not available annually. Most agencies make projections at 5-year intervals, and generally traffic counts are made only at 2- or 3-year intervals (sometimes less often than that). This requires interpolating between demographic data, traffic count, and traffic forecast years. Increased real income and family size (lifecycle issues) typically result in higher levels of automobile ownership and a desire for more residential space. Detailed geographic information at the corridor level is usually available only from the U.S. Census, which is conducted too infrequently (every 10 years) to be useful.

Institutional Bias

Forecasts may contain an institutional bias, perhaps unconsciously. An agency may make reasonable assumptions within a "gray area" of discretion that favors the action that the constructing agency wishes to take. Biases can vary with time, place, and the individuals involved, but can all lead to forecasting errors. An agency could use optimistic or pessimistic views of the economy, of population growth, and so forth.

All of these considerations pointed toward the need for an approach that

- Considers trips in the context of the overall activity patterns of travelers,
- Considers a wider range of alternatives than would be possible to test with the case study approach, and
- Avoids the shortcomings of incomplete data sets, control of exogenous variables, and other limitations noted earlier.

RESULTS OF PREVIOUS RESEARCH

Increased highway capacity may affect travel in a number of ways. In urban areas, new capacity typically reduces congestion, resulting in shorter travel times during some or all of the day, and a less stressful driving experience. In rural areas and small cities, where congestion is minimal, new capacity may or may not change travel times. The literature (*5–8*) documents a strong relationship between reduced travel times and the following short-term effects:

- The choice of the route taken. This effect has been found to be consistently important in the literature. A major assumption underlying the conventional four-step travel forecasting process is that people seek routes that minimize travel time and cost.
- The scheduling of the trip (time of day the trip starts/ends). This effect also has been found to be consistently important in the literature; new highway capacity often has been found to cause

shifts from off-peak or "shoulder" transitional times to the "core" peak periods of travel. This effect was found in examining traffic count data before and after widening of CA-78 in San Diego, the Amsterdam M10 Orbital Motorway (*7*), and other locations.

- The choice of the travel mode used (e.g., carpool, transit, drive alone). This effect has been shown to have a much weaker impact than route and scheduling choice but is still important. The effect is probably more important in the longer term, as changes in automobile ownership and land use take place. Studies of the substantial and sudden capacity reductions caused by the 1989 Loma Prieta earthquake indicate substantial shifts to transit modes (*9*), with about a 10 to 15 percent reduction in the number of total daily person-trips (Markowitz, unpublished data). This reduction is modest compared with the large increase in travel time (often 50 to 100 percent) occasioned by many transbay travelers during the approximately 1-month period when the San Francisco–Oakland Bay Bridge was closed because of the Loma Prieta quake.
- The frequency the trip is made. The literature has been inconclusive on this topic, with some studies indicating significant impacts and others indicating little or no measurable impact. This impact was one of the primary concerns of this project.
- The linking of trips with several destinations together (sometimes known as "trip chaining" or "trip tours"). This appears to be an important impact but has proven difficult to measure and is generally outside the scope of this paper.
- A change in the choice of the destination of a trip; likewise, this impact has proven difficult to measure.

A study of disaggregate household vehicle trip generation rates as a function of proximity to freeway ramps (*10*), using distance as a proxy for accessibility to destinations in 24 urban California counties, was recently made of 6,200 randomly selected households. The study found no significant correlation between the two variables after controlling for other factors. However, this approach had limitations in that distance to the freeway could be measured only as distance to the census tract centroid because survey address records were destroyed (*11*). Furthermore, the results are complicated by the fact that the frequently found convergence of freeways near the core of central cities meant that lower-income residents were often the most proximate to one or more freeway interchanges.

Areawide models (derived by correlating VKT growth to highway system increases) seem more desirable than facility-specific studies because they eliminate the route choice effects by considering entire regions (*11,12*). They are also able to take into account long-term land use effects by extending the analysis over several decades. However, they focus on VKT instead of person-hours of travel and consequently confuse mode shift effects with true induced demand. These studies have been inconclusive about the elasticity of demand (VKT) with respect to new lane-miles of capacity; although all the reported results have been inelastic, they range from a very inelastic 0.1 to a much more elastic 0.8 (*8*).

Even the areawide studies suffer from several critical deficiencies: first, they use a single relatively simple measure of capacity increase (such as lane-kilometers or lane-miles) that is insensitive to the potentially significant different demand effects that would occur if the same investment were made in the center of the region versus the fringes. There are definitional problems in computing the denominator of the elasticity equation; the percentage increase in capacity must be estimated, meaning that a "base" capacity must be measured. Should the base capacity be measured at the corridor, county, primary metropolitan statistical area or consolidated metropolitan statistical area (CMSA) level? Economic theory, as well as experience with transportation and land use forecasting models, indicate that transportation supply cannot be treated as a homogeneous product (*13*).

Common sense suggests that new highway capacity has different impacts in an area that is already "built out" as opposed to one where much undeveloped land exists simultaneously with strong pressures for development. The costs of parcel assembly, structure demolition, and so forth, are simply too high. In most cases the structure built on a parcel of land in the United States is the only one that has ever occupied that piece of property (*14*).

Second, most areawide studies assume a constant elasticity of demand, probably because of the lack of enough data points. Intuition and economic theory suggest that elasticity is not necessarily constant but instead depends on the amount of current congestion and capacity of the system, the time frame involved (short-versus long-term), the trip purposes of road users, and possibly other factors. This issue requires further research.

Because of the problems associated with the case study before-and-after approach (facility specific or areawide), it was decided to use a survey of household travel behavior to isolate the various effects of new highway capacity and identify those effects not currently treated by conventional travel forecasting models. The travel survey and its results are described below.

TRAVEL BEHAVIOR SURVEY

A travel behavior survey was developed and administered to fill in the missing information from the case studies on the relative importance of the different effects of new highway capacity on travel behavior. Each potential effect (mode, time, destination, trip generation) would be identified and quantified for the purpose of determining its relative importance in estimating the total demand effects of new highway capacity.

Selection of Survey Approach

There are two general approaches to conducting behavioral surveys: stated preference (SP) and revealed preference (RP). Other references provide a comparison of these two methods (*15*); briefly, a stated preference survey poses various situations to the interview subject and asks How would you respond to the given situation given certain constraints? A revealed preference survey relies on measurement of actual responses to alternatives existing in the field. RP surveys can test only for the conditions that exist at the time of measurement, but an SP survey can explore behavioral changes because of a much wider range of options. RP surveys traditionally have been used to calibrate travel forecasting models. RP surveys provide information on the actual choices made by individuals in the face of two or more options. RP surveys have several limitations when applied to the problem of estimating the behavioral effects of new highway facilities. Critical shortcomings are the difficulty in avoiding bias in the selection of the survey sample and accounting for persons moving into and out of the presumed "impact" area of the new facility, and controlling for changes in background variables, such as economic and demographic changes.

The major difficulty in applying an SP survey to the research problem is that traditional SP surveys require that the respondent be offered a choice between trip or transportation system attributes that

force a realistic trade-off by the user. In a classic SP survey, the respondent is offered a higher fare/shorter travel time option, and a lower fare/longer travel time option. With increased highway capacity/reduced congestion, such a trade-off is not possible because presumably everyone would prefer a shorter travel time. To make meaningful tradeoffs between alternatives, respondents were asked to describe all of their previous day's activities and then contemplate how they would alter them if more (or less) time were available on that day to perform those activities. Perhaps more precisely, it is how people would use "released" or "freed-up" time, if congestion-relief projects made such time available.

The survey also embodied concepts from the developing field of activity analysis (*16*). Within the survey instrument here, people were asked about all of the previous day's activities and then asked to respond to changes in travel and activity patterns given changes in travel time for trips made on the reference day. Although the 24 hr available each day is fixed for every individual, the allocation of time to each activity is not. The time and money allocated to travel is further subdivided among mandatory activities such as going to work, school, and so forth, and discretionary activities such as going to a movie. These various daily activities can be thought of as "goods" in the economic sense that people "purchase" by spending "time" and money on the activity. A 1987 survey (*17*) found that the average California adult spends 1.8 hr a day traveling, more than 10 percent of his or her waking hours.

Each survey respondent was told the following:

> We are trying to find out how traffic congestion affects what people do. I am going to describe what might happen if traffic congestion got better or worse, and ask you how you might change your activities or travel as a result. Please take some time to think carefully about what you might do.

The respondent was then read back all of the trips he or she made the previous day, and asked,

> Consider what you told me about what you did yesterday. For each trip I am going to ask you what you would have done if it had taken less time to make the trip. Consider your first trip yesterday. You started at . . . [time] and went to . . . [destination] by . . . [mode]. This trip took . . . [duration previously stated by respondent]. Now suppose that this trip took [randomized duration] less time to make. Please select one or more of these statements that best describe what you would have done.

Respondents were not asked about trips that were less than 10 min in duration, because the minimum travel time savings "offered" was 5 min, and it was thought that for trips of less than 10 min, a time savings of 50 percent or more would be unrealistic and unlikely to be achieved by any plausible capacity-increasing project and also because of the desire to offer travel time savings in increments of 5 minutes. In fact, one of the survey problems was that the total travel time change was independent of the individual's reported trips. Also the total released time during the day was not keyed to a specific hour, which some respondents indicated would condition their response of how the time would be used.

Survey Methodology

Adults over the age of 16 in the San Francisco and San Diego metropolitan areas were randomly selected; these two areas contain about 8.7 million people. Respondents were interviewed about their existing travel behavior, activity patterns, and hypothetical behavior under changes in travel time. "Number plus one" dialing was used to reach unlisted numbers. The Los Angeles area was excluded because the Northridge earthquake occurred shortly before the survey commenced and had dramatically affected travel patterns there. The survey was administered using computer-assisted telephone interviewing (CATI) because of the complex branching required in the survey. Interviews were conducted on Tuesday through Friday evenings and Saturday midday, with survey questions asked about the prior day's travel. Randomization techniques were used to ensure that the person who answered the phone was not necessarily the person interviewed.

After all trips were enumerated, the CATI program selected each trip made that was at least 10 min long. For trips between 10 and 15 min, a 5-minute reduction in travel was offered. For trips longer than 15 min, a randomized travel time savings of between 1 and 50 percent was offered; the randomized savings was a minimum of 5 min if the survey number was odd and 10 min if the survey number was even.

Survey respondents were given the following options: doing nothing differently; starting at the same time and arriving earlier; starting later and arriving at the same time; changing mode; changing trip destination; making an extra stop along the way; and "other." Only one additional "extra stop" was allowed for in the questionnaire, although in reality it is possible that some individuals might add two (or more) trips to their tour. The possibility of entirely new trips was allowed for at the end of this process by asking, Would you have left home again before the end of your day if you had [randomized time] minutes extra time? If the answer was yes, the respondents were asked where they would have gone, how much time they would have spent there, and for what purpose.

Survey Results

A total of 676 individuals over the age of 16 were interviewed in 676 households. They collectively made a total of 2,182 trips the previous day. The respondent demographics (age, income, educational achievement, and automobile ownership) were compared with those from the 1990 Census. The respondent pool was close to the state average, except that poor households (those earning under $15,000 per year) were somewhat underrepresented. About 90 percent of the respondents were willing to report their household income. Of those answering the question, 9.5 percent reported household incomes under $15,000 per year. The 1990 Census found the same group constituted 15.1 percent of the households in the San Francisco Bay Area (CMSA). Some of the difference can be accounted for by inflation between 1989 (the reference year for the census) and the year of the survey (1994).

Very-low-income groups tend to be underrepresented in most telephone surveys, but the importance of these households is mitigated by the fact that they produce a small percentage of VKT. The National Personal Transportation Survey (*18*) found that households with incomes under $10,000 generate VKT/household that is only 40 percent of the average rate for all households (using automobile driver miles as the measure). The 1990 Census found that these households represent about 15.5 percent of all households in the United States; therefore, it appears that they are responsible for somewhat over 6 percent of VKT.

The key results of the survey (Tables 1 and 2) were as follows:

TABLE 1 Responses of Travelers to Travel Time Savings for Each Trip

	Travel Time Savings due to Congestion Relief (minutes)				
Response	5	10	15	20+	All
No Change	46.5%	49.6%	35.1%	38.1%	46.5%
Arrive Earlier	34.9%	33.9%	40.5%	31.0%	34.6%
Leave Later	12.9%	12.5%	16.2%	23.8%	13.5%
Change Mode	0.4%	0.4%	2.7%	2.4%	0.6%
Change Destination	0.9%				0.5%
Make Extra Stop	2.9%	2.8%	5.4%	4.8%	3.1%
Other	1.5%	0.8%			1.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

- Over 35 percent of the trips made would be unaffected when the trip travel time increased or decreased by 15 min or less considering all trip purposes.
- Another 20 to 40 percent of trips made would change only to the extent that the respondent would arrive earlier or later at a destination and make no change to the departure time to compensate for the effect of the travel time change.
- About 10 percent to 15 percent of the trips would be rescheduled to compensate for or take advantage of the travel time change.
- A time savings of 5 min would generate extra stops for about 3 percent of the trips. This percentage increased to 5 percent when a 15-min time savings was offered. The average across all time savings offered was 3 percent.

The overall result is that 90 percent to 95 percent of the trips would be unchanged or would have schedule changes in response to travel time increases and reductions of 15 min or less. As expected, the greater the magnitude of the travel time change, the greater the traveler response. Interestingly, the results are not symmetrical: respondents tended to react slightly more strongly to increases than to decreases in travel time (see Figure 2). When faced with a travel time increase, respondents would try to adapt by changing mode, destination, and route for a higher percentage of the trips than if they were offered an equal amount of time decrease. Given the nature of the two metropolitan areas in which the survey was conducted, it is likely that more respondents had recent experience adjusting to travel time increases than decreases. Asymmetric behavior is probably not surprising: some gaming simulations have shown that even given the same actuarial odds (expected value), people are much more concerned with a possible loss of wealth than they are with a possible gain.

TABLE 2 Responses of Travelers to Travel Time Increases for Each Trip

	Travel Time Increase due to Congestion (minutes)				
Response	5	10	15	20+	All
No Change	53.5%	41.3%	38.6%	24.4%	45.7%
Arrive Later	22.1%	31.0%	38.6%	36.6%	27.8%
Leave Earlier	17.3%	17.6%	9.1%	24.4%	17.4%
Change Mode	1.2%	1.5%	4.5%	2.4%	1.6%
Change Destination	1.0%	0.4%	2.3%		0.7%
Make Extra Stop	0.2%	1.3%			0.7%
Other	4.6%	6.9%	6.8%	12.2%	6.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

The respondents indicated that only approximately 1.6 percent of their trips would be susceptible to a modal change given increased travel time for a specific trip. Of these hypothetical "mode switchers," most (38 percent and 35 percent, respectively) said they would switch to driving alone or public transit. It was implicit in the survey that the travel time by alternative modes was not changed. Greater time increases and decreases had a greater effect on traveler responses than smaller amounts of time changes. However, given that only 13 percent of survey trips were greater than 30 min in length, it was not realistic to ask the majority of the respondents about time savings of greater than 15 min.

CONCLUSIONS AND RECOMMENDATIONS

Most previous investigations of the effects of new highway capacity have been facility-specific "before-and-after" studies. At first, this approach seems appealing and logical, but on reflection, it becomes clear that it is nearly impossible to isolate the effects of new highway capacity on induced trip making. There are too many extraneous factors that can affect the results, including the availability of alternative modes and routes in each corridor; the condition of the local economy; zoning; and natural constraints to development. These factors not only affect the conclusions but also limit the validity of extending these results to other situations and locations. These factors may have been responsible for the conflicting conclusions that other researchers frequently arrived at in the past.

The results of this survey must be qualified by its relatively small size (under 700 households) and limited geographic scope. However, the following are some of the indications from this survey:

- Current travel forecasting practice probably results in an underprediction of 3 to 5 percent in the number of trips that may be induced by major new highway capacity projects. Where a project is expected to yield travel time savings of more than 5 min for a large number of trips, adjusting travel demand upward to reflect induced travel is probably warranted.
- A key impact of new highway capacity is temporal shifts in demand (trips formerly made in the off-peak moving to the peak periods). From the highway user's perspective, this is not necessarily bad because it means that he or she can make a trip in response to personal needs rather than to traffic conditions. On the other hand, it will affect the congestion, speeds, and emission estimates produced by travel models. There is a strong need to develop better models to predict peak spreading/time of day of travel.

In the longer term, new highway capacity may influence decisions about automobile ownership, residential location, employment location, and the locations of expansion areas for businesses and government. These effects are important but are beyond the scope of this paper. Several of these effects cannot be addressed with a household travel behavior survey. However, some of these impacts are already accounted for in current transportation/land use forecasting practices in California's largest metropolitan areas, using models such as DRAM/EMPAL and POLIS.

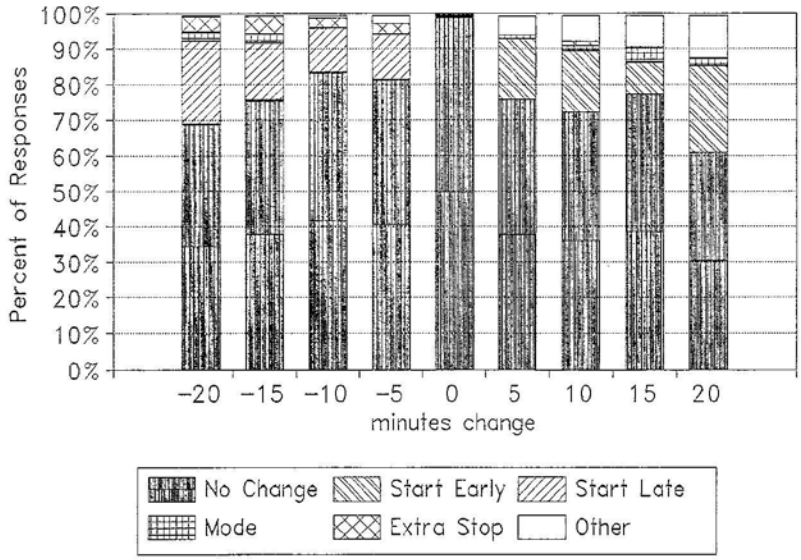

FIGURE 2 Response of travelers to hypothetical trip time changes.

Key Conclusions

Highway capacity changes influence travel behavior principally by affecting travel time and cost. The principal conclusions from the survey are as follows:

- The sample indicated definite preferences about how travelers would respond to changes in travel time. Their response preferences are in the following order:
  - Change route (find a faster route if the current one becomes congested);
  - Change schedule (find another time of day when congestion is lower);
  - Consolidate trips (reduce number of daily trips by accomplishing more activities with a given trip);
  - Change mode (switch to more convenient mode); and
  - Change destination (find another location with similar services).
- Whether a person prefers to change mode over destination (or vice versa) may depend on the trip purpose, for example, a destination change is probably preferred over a mode change for most shopping trips.
- The order of preference responses appears to be similar for travel time increases and decreases, although the magnitude is different. Whether faced with travel time increase or decrease, both changes would result in the respondent preferring a different route or rescheduling the trip, rather than changing the trip mode or destination.
- Survey respondents indicated a high degree of resistance to change in their travel behavior when offered travel time savings of between 5 and 15 min per trip. A 5-min travel time savings (on average) resulted in a 3 percent increase in daily trips made per person and a 15-min time savings resulted in a 5 percent increase in trips per person per day.

Because most trips in metropolitan areas are less than 15 min long and realistic time savings on such short trips would rarely exceed 5 min, it is unlikely that adding new lanes to an existing highway would significantly reduce travel times for the majority of trips, although this general observation may not apply to new highways or to home–work (commute) trips. Commute-related trips are longer at an average of between 20 and 30 min and are more likely to encounter peak-period congestion. The commute trip also drives many other decisions, such as vehicle holdings and household location, and those considerations have a substantial influence on generation of short trips. Thus, there could be some important secondary impacts that are not accounted for here.

Recommendations for Future Research and Survey Improvement

There were questions that could not be answered in this study. They include assessing whether the results are transferable to other areas, how congestion affects interactions between household members, and how qualitative factors (such as stress) may influence travel behavior when congestion is reduced. It seems logical to presume that a 30-min drive in stop-and-go traffic would be perceived differently from a 30-min drive in free-flowing traffic, but the survey instrument was not able to distinguish between the two. A small sample of commuters in Orange County, California (*19*), found that most, but not all, drivers perceived commuting in congested traffic as more stressful than commuting in uncongested traffic. To the extent that this is true, it suggests that the results of the travel survey conducted here could underestimate the true effects on tripmaking of reduced congestion.

It is recommended that the following steps be taken to improve the understanding of the effects of increased highway capacity on travel behavior and to improve the ability to forecast these effects at the regional level. Repeating the behavioral survey in other metropolitan, and possibly rural, areas to determine whether the survey results can be reliably extrapolated to all travelers would be desirable. A larger survey sample would also yield more information on the effect of new highway capacity on various trip types and purposes.

The wording of survey questions and presentation of alternatives are critical in most SP surveys and are among the known weak-

nesses of the method. Some respondents were confused about whether a visit to a different location meant a different location for the same purpose or a different location for a different or additional purpose. For some respondents who made fairly short trips, the total travel time savings presented was near or greater than the amount of time the respondent had reported in travel. Some respondents who realized this were confused.

This survey did not allow for the possibility that people could save a trip time reduction over a week, and "spend" it as a block. The survey approach was thought to be appropriate since, unlike money, time is not easily "banked." However, the authors recognize that the greater an individual's flexibility in allocating time, the more likely that travel time savings should be investigated using a week as the reference period (rather than 24 hr). Nonworkers or those working part time would appear to have the greatest flexibility in this regard (the increasing use of 4-day work weeks may also be important).

It would be useful to use other research approaches to corroborate the results of this survey. One is activity gaming and simulation, which allows researchers to better understand the intrahousehold allocation of travel and other activities. This study made only a rudimentary attempt to consider how one household member's travel time changes might affect the travel and activity patterns of other members of the household. Another approach would be to collect detailed information on the before-and-after effects of those living in a corridor where travel times are improved. Recently developed automatic vehicle location technology, using cellular phone technology, would allow detailed multiday travel diaries to be analyzed without the tedium and error associated with the traditional manually kept diaries.

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