CITY OF SAN LUIS OBISPO

MULTIMODAL TRANSPORTATION IMPACT STUDY GUIDELINES

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2nd Edition

City of San Luis Obispo 2035 Circulation Element

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WARNING TO PRACTITIONERS

Please contact the City Transportation Division before initiating preparation of a transportation impact study to confirm that you are using the latest edition of these guidelines

I. INTRODUCTION

The City of San Luis Obispo's General Plan 2035 Circulation Element establishes key transportation policies to accommodate growth and balance travel modes. Compared to older versions of the Circulation Element, the 2035 Circulation Element places greater emphasis on bicycles, pedestrians and transit in order to achieve a system of complete streets and a multimodal community. Transportation Impact Studies (TIS) are a critical component of the development review process, including but not limited to studies required under the California Environmental Quality Act (CEQA). In addition to the City's general plan policies, Senate Bill 743 established changes to how transportation impacts are measured for CEQA purposes, shifting from auto Level of Service (LOS) and other congestion-related metrics, to analysis of vehicle miles travelled (VMT) as the primary metric for evaluating transportation impacts. These guidelines prescribe the methodologies for conducting Transportation Impact Analyses under both CEQA criteria consistent with SB743 and separate operational policy analysis, which is not subject to CEQA.

These guidelines are periodically updated to reflect changes in City policies, the regulatory environment, industry best practices for the evaluation of transportation impacts.

Process

Due to potential conflicts of interest private development applicants are not permitted to conduct or commission their own official Transportation Impact Studies. However, private development applicants are welcome to conduct or commission peer review and comment on City-initiated studies before the documentation is finalized.

When a development application or infrastructure project is submitted, the City of San Luis Obispo's Transportation Department will determine whether or not a transportation study is required based on CEQA guidelines and City policy. If a transportation impact study is required, the study should be initiated with the following steps.

1. City notifies applicant of transportation study requirement as part of comments on application.
2. Applicant submits a request to the City to initiate the study and City staff drafts a scope of work.
3. City staff advertises the scope of work among the City's certified on-call traffic consultants which are selected bi-annually thru a competitive RFQ/RFP process.
4. City staff selects a traffic consultant based on their proposal, schedule, and cost estimate.
5. City staff submits the scope, consultant proposal, and draft reimbursement agreement to the applicant for review and approval.
6. The applicant signs the reimbursement agreement, deposits the funds with the City, and work on the study begins.

A 30% City administrative fee is applied to the consultant's total cost estimate, with any remaining funds at the end of the contract refunded to applicant. If out of scope work is needed during the course of the study, an amendment to the consultant's proposal and applicant's

reimbursement agreement is required. The Transportation Manager at their sole discretion may apply a time & materials administrative fee in lieu of the 30% in special circumstances.

When Transportation Impact Studies Are Required

The decision to require a Transportation impact study will be made by the City's Transportation Manager. Traffic impact studies, either as part of environmental impact reports or as part of local policy analysis, must be prepared by a registered Traffic Engineer (TE), Certified Professional Traffic Operations Engineer (PTOE), or Certified Transportation Planner (PTP or AICP CTP). Traffic impact studies may be prepared by a registered Civil Engineer (PE) that has demonstrated appropriate expertise to the satisfaction of the Transportation Manager. Transportation impact studies are required whenever there is the potential for inconsistency with local transportation policy or a potential impact under CEQA. The following are examples of when a Transportation Impact Study maybe required.

- Any project that has the potential to increase regional VMT beyond adopted thresholds.
- Any project that would generate 100 or more peak hour automobile trips or 150 or more peak hour person trips.
- Any project that increases density where the prior use(s) generated less than 100 peak hour automobile trips or 150 peak hour person trips and the existing + proposed use exceeds this peak hour trip threshold.
- Any project that proposes frontage improvements, new or modified access points, or adds trips to an intersection in a manner that could increase or exacerbate the propensity for traffic collisions based on adopted standards and best practices.
- Any project that has the potential to degrade bicycle, pedestrian, transit or auto level of service standards below City adopted minimums.
- Any project that would generate transit demand beyond current service capacities.
- Any project that is inconsistent with adopted Transportation Plan, policy, or standard.
- When the original impact study is more than two years old.

Transportation Impact Study Scoping

Depending on the scale and extent of the proposed project, the scope of a transportation impact study could range from a focused study, such as a simple intersection control type selection analysis for a proposed intersection, to a large-scale study, such as a complete analysis of all transportation facilities within a defined study area. The impact study scope will be drafted by the City and collaboratively reviewed and refined by traffic consultant, applicant teams, and other affected public agencies. Advanced analysis such as travel demand model updates, project specific trip generation rate development, and micro simulation may be required for certain studies.

Extents of Study

The TIS study area should include transportation facilities that could reasonably be foreseen to be impacted by physical changes or trips generated by the project. This is generally determined by conducting an initial trip generation and distribution assessment to gauge the volume and extent of traffic a project would generate. A general rule of thumb for scoping study intersections and roadway segments is to include any facilities where a proposed project would

add 10 or more peak hour auto, bike or pedestrian trips per lane. City staff will prepare an initial scope of work on a project-by-project basis and identify the preliminary extents of the study, in consultation with other affected public agencies, for the purposes of advertising and awarding the traffic impact study contract.

Once the authorization to proceed has been given the first order of work for the consultant team is to conduct a refined trip generation estimate, select zone analysis using the City's Travel Demand Model (SLO TDM), and recommend to City staff any modifications to the scope based on a preliminary assessment of the volume and distribution of project traffic.

Any modifications will be formalized through a development services amendment with the project applicant.

Analysis Scenarios

Analysis scenarios shall be determined on a case-by-case basis depending on the unique characteristics of each project. Each scenario will include an evaluation of multimodal intersection and roadway segment LOS, induced traffic and safety analysis. VMT analysis will be conducted for the analysis scenario consistent with current CEQA Guidelines and technical direction published by the California Governor's Office of Planning and Research. If the project as the potential to impact neighborhood traffic thresholds or modal priorities as established in the City's general plan an analysis of those will also be required:

1. Existing Conditions – The most recent available traffic conditions and existing transportation network.
2. Existing + Project Conditions – Existing Conditions plus project-generated trips and changes to the transportation network.
3. Cumulative Conditions – Future year traffic conditions reflecting land use and transportation improvements anticipated to be complete with build out of the City's General Plan.
4. Cumulative + Project Conditions – Cumulative Conditions plus project-generated traffic and changes to the transportation network.

Near term analysis maybe scoped for individual projects as deemed necessary when significant near term development or infrastructure improvements are planned within the vicinity of the project.

Analysis Periods

The determination of time periods for operational analysis will depend on the travel modes being evaluated and the time periods that are most applicable to the uses proposed in the project. For most uses, the analysis may include daily, peak period, and/or peak hour conditions. Final determination shall be made in consultation with City staff. For recreational or other uses that do not coincide with typical weekday peak hours, consideration will be given to analyzing weekday afternoon, weekday late evening, or weekend time periods. Based on the land use of the proposed project and upon consultation with City, the study shall analyze traffic operations during the peak hour of the following time periods:

- Weekday morning peak (7:00 – 9:00 AM)

- Weekday evening peak (4:00 – 6:00 PM)

For some projects, the City may substitute or require additional peak hour analysis for the following time periods:

- Weekday afternoon peak (2:00 – 4:00 PM)
- Friday evening peak (5:00 – 7:00 PM)
- Weekend midday peak (11:00 AM – 1:00 PM)
- Weekend evening peak (4:00 – 7:30 PM)

The determination of study time periods should be made separately for each proposed project based upon the peaking characteristics of project-generated traffic and peaking characteristics of the adjacent street system and land uses. The time period(s) that should be analyzed are those that exhibit the maximum combined level of project-generated traffic and adjacent street traffic.

II. BASELINE CONDITIONS

The City of San Luis Obispo's Transportation Division maintains a master Synchro Network of existing AM, MID, and NOON peak hour conditions for most existing intersections within the City. This network is generally updated for geometric, signal timing and multimodal volumes every two years. This master network is the primary source of peak hour transportation data to be used for impact studies. The City also collects 48-hour segment counts on most roadways within the City. Data at specific locations not already collected by the City will need to be collected as part of individual impact studies, consultants should inventory what data is already available and scope any necessary data collection.

Existing Volumes

Average Daily Traffic (ADT) segment counts are collected in 15- or 5-minute intervals for a period of no less than 48 hours. Volumes used for segment analysis should be based on the average of the entire count period. Peak hour intersection movement counts are collected in 15-minute intervals during the required peak hours identified from the segment counts. All traffic volumes are collected during clear environmental conditions, during regular school session, with no adjacent construction activities or special events. It is the responsibility of the consultant to validate traffic counts prior to their use in the analysis. Unless otherwise approved by the Transportation Manager, traffic data used for transportation impact analyses shall be no more than two years old at the time the study is initiated.

Vehicle Volumes

Peak hour intersection vehicle movements are collected in UTDF (Universal Traffic Data Format). In order to calculate pedestrian intersection levels of service, intersections with protected/permissive phasing shall have the volume of permissive left turns by each left turn movement counted in addition to the total left turn volumes. At intersections where right turns on red (RTOR) are permitted, the volume of right turns on red by each right turn movement counted in addition to the total of right turn volumes. If any form of testing or research indicates pedestrian LOS is not sensitive to the expected volume of permissive left or right turn on red

movements, these volumes may be estimated based on professional judgment in lieu of counting.

Bicycle Volumes

Peak hour intersection bicycle volumes are collected by the approach direction to the intersection (i.e. EB, WB, NB, SB). If any form of testing or research indicates that bicycle LOS is not sensitive to the expected volume of bicycles, these volumes may be estimated based on field observations and professional judgment in lieu of counting.

Pedestrian Volumes

Segment pedestrian flow rates can either be counted or estimated based upon adjacent peak hour intersection movements. Pedestrian movements shown in the figure below need to be counted or estimated in order to calculate pedestrian level of service. If any form of testing or research shows that pedestrian LOS is not sensitive to the expected pedestrian volumes, these volumes may be estimated based on field observations and professional judgment in lieu of counting.

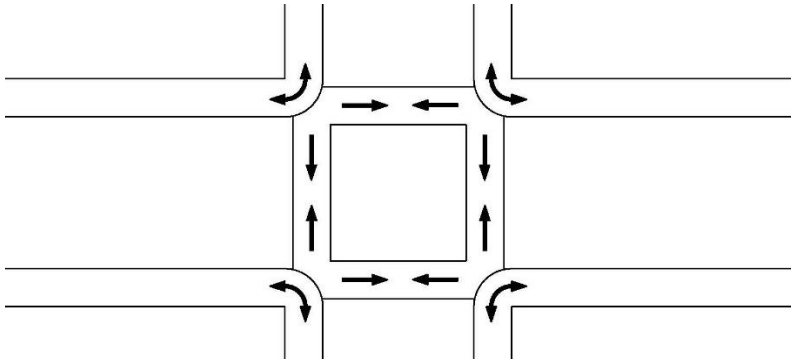


Figure 1: Peak Hour Pedestrian Volumes Should Be Collected for All Movements

Cumulative Volumes

The City of San Luis Obispo's Transportation Division maintains a Cumulative Year scenario within the SLO TDM TransCAD model, which reflects forecasted build out of the City and region (2035 for City SOI, 2040 for remaining County areas). ADT and Peak Hour multimodal volumes are to be derived from this model consistent with forecasting methods established in NCHRP 255. This model is only a tool for estimating future volumes, professional judgment shall be used in determining the appropriate estimates to be used in the technical analysis. Any assumptions or modification to model inputs or outputs should be explicitly documented in final reports.

Vehicle, Bicycle, and Pedestrian Volumes

Daily and Peak hour segment & intersection volumes are to be estimated based on the results of the model forecast and "Process Turns" tool embedded within the model and calibrated as necessary based on professional judgement. In addition right turn on red, permissive left turns, and permissive right turns shall be estimated based on the proportionality of those movements in the existing counts with projected traffic counts. Manual adjustments to the volumes produced by the travel demand model shall be reviewed and documented as appropriate.

Project Volumes

Vehicle Volumes

Motor vehicle trip generation is to be estimated using the most recent edition of ITE Trip Generation Manual. Upon approval from the Transportation Manager, local trip generation rates are also acceptable and preferred if those rates are developed following the method established in the current version of the ITE Trip Generation Handbook and appropriate validation is provided to support them.

Pedestrian, Bicycle, and Transit Volumes

Non automobile trips shall be calculated by first estimating person trips based on ITE vehicle trip generation and average vehicle occupancy rates. Mode split assumptions should be derived based on data from the SLO TDM, US Census or American Community Survey, and existing multimodal traffic counts within the vicinity of the proposed project.

Project Trip Distribution

Project trip distribution should be derived from the SLO TDM by conducting a select zone analysis of the TAZ in which the project is contained. In some cases, trip distribution may need to be estimated manually, such as when estimating trip distribution for pedestrian and bicycles, in these cases the assumptions and methodology must be documented in the report.

III. FORM & CONTENT OF IMPACT STUDY DOCUMENT

Per SB 743, auto LOS or other measures of traffic congestion or delay are no longer acceptable metrics for analysis of transportation impacts under CEQA. However, the City General Plan Circulation Element will continue to retain local performance thresholds based on multimodal LOS and analysis of motor vehicle traffic operations will continue to be required outside of CEQA analysis for purposes of assessing conformity with local policies and to guide transportation system and access planning. For this reason, transportation impact studies shall be divided into two components:

- Part 1: CEQA Transportation Impact Analysis
- Part 2: Multimodal Traffic Operations Report and Policy Assessment

The typical format and content required for an impact study is summarized as follows:

Introduction

I. Executive Summary
   a. Project Description and Study Scenarios
   b. Summary Table of CEQA Impacts & Mitigations
   c. Summary Table of Multimodal Operational Deficiencies & Recommended Conditions of Approval to Offset Deficiencies

II. Table of Contents

PART 1: CEQA Transportation Impact Analysis

III. Project Description
- a. Project Location, Land Uses, Phasing & Site Plan
- b. Proposed Frontage Geometrics & Access and Internal Circulation

IV. CEQA Transportation Analysis
- a. Environmental Setting
  - i. Describe Existing Study Area Circulation Network (Existing Roadways, Pedestrian, Bicycle and Transit Facilities)
  - ii. Reference applicable local, regional and state plans and regulatory policies
  - iii. Analysis Assumptions, Methodologies and CEQA Thresholds of Significance
- b. VMT Analysis
- c. CEQA Safety Analysis (per CEQA Guidelines)
- d. Assessment of Emergency Vehicle Access
- e. Assess Conflicts with Applicable Plans, Programs, Ordinances
- f. Induced Travel Analysis of Auto Capacity increasing project components

V. CEQA Conclusions and Recommendations
- a. Summary of potentially significant CEQA impacts and proposed mitigations
- b. Summary of Measures of Effectiveness before and after mitigation
- c. Cost Estimates and Fair Share Calculations for Mitigation (if applicable)

PART 2: Multimodal Traffic Operations Analysis & Policy Assessment

VI. Operations Analysis Approach
- a. Analysis Scenarios
- b. Study Facilities
- c. Assumptions, Methodologies and Local Thresholds of Significance

VII. Baseline Analysis (Existing, Near Term, Cumulative)
- a. Intersection & Roadway Geometrics
- b. Intersection & Roadway Volumes
- c. LOS Analysis
  - iv. Intersections (Auto, Bike, Ped)
  - v. Segments (Auto, Bike, Ped, Transit)
- d. Intersection Queueing

VIII. Project Analysis (Existing+Project, Near Term+Project, Cumulative+Project)
- a. Project Traffic Generation by Mode
- b. Project Trip Distribution & Assignment
- c. Intersection & Roadway Geometrics
- d. Intersection & Roadway Volumes
- e. LOS Analysis

vi. Intersections (Auto, Bike, Ped)
vii. Segments (Auto, Bike, Ped, Transit)

f. Intersection Queuing
g. Traffic Safety & Access Management Analysis (per local guidelines)
h. Neighborhood Traffic Analysis

IX. Operations Analysis Conclusions and Recommendations
a. Summary of changes in multimodal traffic operations
b. Proposed improvements/actions to offset project-related deficiencies
c. Cost Estimates and Fair Share Calculations for Mitigation (if scoped)

X. Appendices
d. Traffic Data Summary and Source
e. Worksheets Used in Analysis

IV. CEQA ANALYSIS METHODS AND SIGNIFICANCE THRESHOLDS

The following section describes analysis methods and significance thresholds for evaluation of transportation impacts under CEQA. These analyses inform Part 1 of the final Transportation Impact Study document: CEQA Transportation Impact Analysis.

Vehicle Miles Traveled

VMT analysis shall be consistent with current CEQA Guidelines, latest SB 743 Technical Advisories published by the California OPR, and per City standards as described below. All quantitative VMT analysis shall be conducted using the City of San Luis Obispo Travel Demand Model (TDM). Alternate analysis tools, such as the SLOCOG TDM or sketch planning tools, shall only be used at the approval of the Transportation Manager.

Baseline VMT

Baseline (without project) VMT shall be derived using the latest SLO TDM base year land use and transportation network inputs. Appendix B includes technical guidance for extracting VMT from the SLO TDM. Baseline VMT data shall be summarized as follows:

- All Projects
  - Total Regional (County) VMT
- Residential Development Projects (Single-Family, Multi-Family, Mobile Homes)
  - Regional (County) average Residential VMT Per Capita (home-based trip productions only)
- Employment-Based Development (Office, Industrial, Manufacturing, etc.)
  - Regional (County) average Work VMT Per Employee (home-based work attractions only)

Where proposed land use projects are inconsistent with currently adopted City and Regional long-term plans, such as the City General Plan or SLOCOG Regional Transportation Plan (RTP) and Sustainable Communities Strategy (SCS), baseline Cumulative VMT, calculated using the SLO

TDM, may also be required for evaluating Cumulative land use and transportation network impacts.

Attachment A contains detailed guidance for extracting VMT data from the SLO TDM.

VMT Impact Analysis for Land Use Projects

Per OPR guidance, land use projects that meet the following screening thresholds may be assumed to result in a less-than-significant transportation impact under CEQA, and will not require a detailed quantitative VMT assessment.

Screening Criteria for Land Use Projects Exempt from VMT Analysis

Project Type	OPR Recommended Threshold
Small Development Projects	Projects anticipated to generate < 110 daily vehicle trips (11 peak hour vehicle trips) may be assumed to cause a less-than-significant impact, unless substantial evidence indicates that a project would generate a potentially significant level of VMT or create inconsistency with the SLOCOG RTP Sustainable Communities Strategy (SCS).
Medium-Sized Residential & Employment-Based (Office, Business Park, Industrial, etc.) Development Projects	Map-based screening may be used for projects that generate < 100 peak hour vehicle trips. Baseline VMT per capita/employee heat maps are developed based on data from the SLO TDM, showing existing average Residential and Work VMT for each area of the City. (See Appendix A for VMT Screening Maps) Where proposed projects that generate < 100 peak hour trips are located within areas of the map with existing VMT at least 10% below adopted thresholds, and are generally similar to existing uses within that area (i.e. density, mix of uses, access to multimodal transportation), these projects can be assumed to cause a less-than-significant transportation impacts.
Local Serving Retail & Public Facilities	Retail development projects with ≤ 50,000 sqft. gross floor area with reasonable justification that uses will be local-serving may be assumed to cause a less-than-significant impact. Similarly, local-serving public facilities, such as Police and Fire Stations, libraries, neighborhood parks without sporting fields, etc., may be assumed to cause a less-than-significant impact.
Affordable Housing	Adding affordable housing in infill locations generally improves jobs-housing balance, in turn shortening commutes and reducing VMT. A project consisting of a high percentage of affordable housing (>50%) may be assumed to cause a less-than-significant impact on VMT if located within a low-VMT area per the City's VMT screening maps (see Appendix A) or where supporting evidence is provided that demonstrates low VMT-generating characteristics of similar affordable housing sites within the City.
Transit-Oriented Development[2]	Per CEQA Guidelines, residential, retail, office and mixed-use projects that are located within a ½ mile of an existing major transit stop or an existing stop along a high-quality transit corridor may be assumed to cause a less-than-significant impact on VMT (see Note 2 below). If project-specific or location-specific information indicates that the project would still generate significant levels of VMT, focused VMT analysis may still be required. No locations within the City of San Luis Obispo currently meet these transit service levels.

Notes:

1. A "major transit stop" is defined as a site containing an existing rail station, a ferry terminal serviced by bus or rail transit, or the intersection of two or more major bus routes with a frequency of 15 minutes or less during commute periods. A "high-quality transit corridor" refers to a corridor with fixed-route bus service with frequencies of 1 minutes or less during peak commute hours.

VMT screening maps for residential and employment-based development projects are provided in Appendix A.

For land use projects that cannot be screened from requiring VMT analysis, Existing + Project VMT shall be estimated using the base year SLO TDM and summarized as follows:

- Residential Development Projects (Single-Family, Multi-Family, Mobile Homes)
  - Net VMT Increase/Decrease with Project
  - Project Residential VMT Per Capita (home-based trip productions only)

- Employment-Based Development (Office, Industrial, Manufacturing, etc.)
  - Net VMT Increase/Decrease with Project
  - Project Work VMT Per Employee (home-based work trip attractions only)

- Mixed-Use Development Project (include internal capture reductions)
  - Summarize Residential and Work VMT as shown above
  - Summarize Net Increase/Decrease in Retail VMT

- All Other Projects
  - Total City VMT (use City Limits, not total City Sphere of Influence)
  - Total Regional (County) VMT
  - Net VMT Increase/Decrease with Project

Project VMT impacts shall be determined based on the following thresholds of significance:

VMT Thresholds of Significance for Land Use Projects

Project Type	Evaluation Criteria	Threshold[1]
Residential	15% below baseline Regional (County) average Residential VMT per capita. Applies to single-family, multi-family and mobile homes	14.25 VMT per capita
Office / Business Park / Industrial / Warehousing / Manufacturing	15% below existing regional (County) average Work VMT per employee.	12.45 VMT per employee
Retail / Hotel / School	Net increase in total Regional (County) VMT. Small local-serving retail may be presumed to cause less-than-significant impacts. Larger, regional-serving retail will require quantitative analysis using the SLO TDM and project-specific information, such as market studies or analysis of anticipated customer travel behavior.	No set threshold, increase in total VMT would trigger impact
Mixed-Use	Evaluate each component of a mixed-use project independently, applying significance threshold for each land use type. Alternately, the City may choose to analyze VMT for only the dominant use. Analysis should take credit for internal capture between uses.	Apply Residential, Office & Retail Thresholds above

Project Type	Evaluation Criteria	Threshold[1]
Redevelopment Projects	Where a development replaces an existing VMT-generating land use, if the replacement total VMT leads to a net overall decrease in VMT, the project is assumed to have a less-than-significant impact. If net new VMT exceeds the existing land use, apply the thresholds described above.	No set threshold
Other Development Projects	City may apply adopted residential, office or retail VMT thresholds to other development projects that have predominant operating characteristics similar to those uses. Alternately, City may use more location-specific information to develop specific thresholds for other land use types. In doing so, analysis should consider the information described in the CEQA Guidelines (Section 15064.7) on the development of thresholds of significance.	No set threshold. Evaluated on case-by-case basis based on OPR guidance
Notes: 1. Quantitative thresholds will be updated as required with subsequent updates to the City Travel Demand Model and/or per revisions to CEQA Guidelines or OPR Technical Advisory on VMT analysis.		

Transportation Projects Exempt from VMT Analysis

Transportation projects that would not likely lead to a substantial or measurable increase in vehicle travel can be presumed to have a less-than-significant transportation impact. Such projects include, but are not limited to:

- Road diets (reducing or narrowing vehicular travel lanes)
- Installation of roundabouts or traffic signals
- Roadway rehabilitation and maintenance
- Safety improvements that do not substantially increase auto capacity
- Installation or reconfiguration of lanes not for through traffic (addition of left/right turn lanes, etc.)
- Addition of roadway capacity on local and collector streets, providing the project also substantially improves conditions for pedestrians, cyclists or transit
- Timing of traffic signals
- Removal of on-street parking
- Addition or enhancement of pedestrian, bicycle and transit facilities and services

Projects that fall within the abovementioned categories can be considered exempt from conducting a quantitative VMT analysis.

Transportation Projects Requiring VMT Analysis

Development- and City-initiated roadway capacity projects that involve infrastructure improvements that may result in a measurable and substantial increase in vehicle travel, such as the addition of through lanes on existing or new highways and arterial streets, should be scoped for analysis of induced traffic demand. Where roadway capacity projects may result in increases to vehicle travel, the estimated change in VMT should be quantified using the SLO TDM or other approved analysis tools. No standard significance thresholds have been adopted for induced traffic analysis; thus, potential impacts shall be evaluated on a case-by-case basis consistent with CEQA Guidelines and applicable technical guidance while ensuring that the analysis addresses:

- Direct, indirect and cumulative effects of the transportation project, including potential for induced demand (CEQA Guidelines, § 15064, subds. (d), (h))
- Near-term and long-term effects of the transportation project (CEQA Guidelines, §§ 15063, subd. (a)(1), 15126.2, subd. (a))
- The transportation project's consistency with state greenhouse gas reduction goals (Pub. Resources Code, § 21099)34
- The impact of the transportation project on the development of multimodal transportation networks (Pub. Resources Code, § 21099)
- The impact of the transportation project on the development of a diversity of land uses (Pub. Resources Code, § 21099)

For transportation projects that have already been evaluated for VMT at a programmatic level, such as within a General Plan or Specific Plan EIR, project-level analysis may tier from that programmatic analysis.

Traffic Safety & Access Management

Evaluation of the project's effect(s) on traffic safety shall include:

1. An assessment of the project's potential effect on each study intersection and segments that has been identified as a high-priority safety locations as part of the City Annual Traffic Safety Program.

2. A preliminary geometric and sight distance assessment of the project and its frontages including access points, other existing & planned future driveways, and existing and planned future intersections up and downstream of the project. Evaluate proposed site access and off-site circulation with the Access Management policies published in the Chapter 1010 of the City's Engineering Standards.

3. A queueing and functional area assessment of each study intersection.

Project impacts are considered significant if any of the following findings are made:

1. The project is projected to exacerbate an existing collision pattern at a high priority safety location as identified in recent editions of the City's Annual Traffic Safety Report based on professional engineering judgement.
2. The project substantially increases hazards due to a geometric design features, such as frontage or access improvements that include any features that are inconsistent with applicable geometric design standards or that could obstruct adequate sight distance for pedestrians, bicycles, buses, or automobiles.
3. The project's proposed access point(s) are unrestricted and within the functional area of an intersection or conflict with adjacent driveways within close proximity.
4. Project traffic extends, or exacerbates extension, of the functional area of study intersections past existing driveways or into the functional area of other intersections.
5. Project traffic extends, or exacerbates extension, of queue lengths beyond turn pocket storage length into thru travel lanes increasing the propensity for rear-end collisions.

Instances where project traffic increase queue lengths by less than one car length (25') shall be considered insignificant.

It is important to note that for the purposes of CEQA analysis, queueing concerns that do not result in a contextually significant hazards in terms of traffic safety should not be used as a proxy for justifying increases in roadway capacity. Engineering judgement shall be practices to clearly distinguish safety concerns from capacity-related queuing issues, which should not be used as the basis for transportation mitigation under CEQA.

Consistency with Adopted Policy & Plan for CEQA Analysis

The project, its frontages, and any facilities constructed by the project shall be evaluated for proposed implementation consistency with adopted plans as well as project compatibility with future transportation infrastructure contemplated in adopted plans not to be constructed by the project.

The project and its traffic generation effect on multimodal modal level of service, excluding automobiles, shall be conducted for all scenarios.

Assessment of Consistency with General Plan Policy shall include an assessment of the project's impacts on Pedestrian, Bicycle, and Transit Level of Service standards as well as Neighborhood Traffic Management standards.

Threshold of Significance:

Project impacts are considered significant if any of the following findings are made:

Applicable Plan and Policies include:

1. SLO General Plan
2. Specific Plan
3. Bicycle Transportation Plan / Active Transportation Plan
4. Short or Long Range Transit Plan

Other plans that maybe applicable include

5. SLOCOG Regional Transportation Plan
6. SLO County General Plan
7. Cal Poly Master Plan

- The project proposes to implement transportation infrastructure inconsistent with adopted plans, policies, or standards.
- The proposed project impedes or constrains future planed transportation infrastructure, including planned enhancements to pedestrian, bicycle and transit facilities and services.
- Project traffic or characteristics result in VMT increases that exceed City thresholds.
- Project traffic added to neighborhood streets exceeds or exacerbates traffic volumes level beyond adopted General Plan Thresholds.

Note that local policies that establish performance objectives based on measures of vehicle congestion or delay shall not be used for the purposes of defining CEQA impacts.

V. MULTIMODAL TRAFFIC OPERATIONS ANALYSIS METHODS & POLICY ASSESSMENT

The following section describes analysis methods and significance thresholds for evaluation of transportation deficiencies based on local policy conformance. These analyses inform Part 2 of

the final Transportation Impact Study document: Multimodal Traffic Operations Analysis & Policy Assessment. Findings of these analyses can be used to identify policy deficiencies, but measures involving vehicle congestion or delay shall not be used to define impacts or guide mitigation strategies for CEQA analysis.

Multimodal Level of Service and Capacity

All intersection and segment analysis shall be based upon the current version of the Highway Capacity Manual (HCM), unless otherwise approved by the Transportation Manager. Analysis periods should be confirmed by the Transportation Division in scoping the study. Existing and Near Term (with and without Project) analysis scenarios should assume actual traffic signal timings unless otherwise directed. Cumulative analysis may assume optimized signal timings using reasonable timing inputs consistent with traffic engineering standards and best practices. Analysis models should be geometrically correct and include peak hour factors recorded with the traffic counts.

Peak hour factors shall be applied for Existing and Near Term analysis scenarios by intersection approach only if using the same 15-minute period to calculate the factor for each approach. Otherwise, the average peak hour factor for the full intersection shall be applied to each approach. A peak hour factor of 0.92 may be assumed for Cumulative analyses where supported base on engineering judgement.

Analysis Software

The City uses a toolbox of software programs for conducting and reviewing traffic impact studies. Unless otherwise approved, the most current version of following programs are to be used:

- TransCAD: City of San Luis Obispo Travel Demand Model (TDM) for all VMT analysis, volume forecasting and trip distribution estimation.
- Synchro / SimTraffic: Primary operational and micro-simulation model for intersection analysis.
- McTrans: Multimodal LOS analysis tool for street segments
- SIDRA Intersection: Preferred analysis tool for roundabout control intersections
- VISSIM: Secondary micro-simulation model for complex analyses or multi-modal simulation.

In addition to the abovementioned software tools, roadway segment level of service and capacity can be calculated manually or using other approved spreadsheet applications. It is the responsibility of the consultant to ensure that models are properly calibrated and validated for the study area prior to use.

Automobiles

Signalized Intersections Level of service and delay at signalized intersections should be reported for the overall intersection. The maximum Volume to Capacity ratio (V/C) for the overall intersection should be reported as well as for any deficient approaches or movements. Vehicle queues should be reported for each lane or lane group with a dedicated turn pocket. Project-related deficiencies are identified where:

A. Project traffic causes minimum LOS standards to be exceeded or further degrades already exceeded LOS standards and the V/C ratio is increased by .01 or more.

B. Project causes or exacerbates 95th percentile turning movement queues exceeding available turn pocket capacity by one car length (25') or more and presents a contextually significant safety hazard.

C. Project proposes roadway geometry changes that cause minimum LOS standards to be exceeded or further degrades already exceeded LOS standards for the overall intersection or individual lane groups.

Roundabout Intersections Level of service and delay at roundabouts should be reported for the overall intersection and for each approach. Vehicle queues should be reported for each lane or lane group. Project-related deficiencies are identified where:

A. Project traffic causes minimum LOS standards to be exceeded or further degrades already exceeded LOS standards and the V/C ratio is increased by .01 or more.

B. Project causes or exacerbates 95th percentile turning movement queues to the point where turn pocket turn pocket capacities are exceeded by at least one car length (25') and presents a contextually significant safety hazard.

C. Project causes or exacerbates 95th percentile queues by at least one vehicle length (25') at an adjacent intersection to the point where queues spill back into the roundabout functional area.
D. Project proposes roadway geometry changes that minimum LOS standards to be exceeded or further degrades already exceeded LOS standards.

Unsignalized Intersections Level of service for unsignalized intersections should be reported for minor street approaches as well as any major street turn movements. The maximum Volume to Capacity ratio (V/C) for the overall intersection should be reported as well as any deficient approaches or movements. If an unsignalized intersection exceeds minimum level of service standards a signal warrant analysis shall also be conducted. Project-related deficiencies are identified where:

A. Project traffic causes minimum LOS standards to be exceeded OR further degrades already exceeded LOS standards, and all of the following three conditions are met:
    a. V/C ratio is increased by .01 or more; and
    b. The project adds at least 10 trips to the critical approach/movement; and
    c. The intersection satisfies a traffic signal warrant analysis. It should be noted that that satisfaction of signal warrants alone does not dictate that a traffic signal would be the required solution to address operational deficiencies.
B. Project proposes roadway geometry changes that minimum LOS standards to be exceeded or further degrades already exceeded LOS standards.

Roadway Segments Level of service should be reported for scoped street segments utilizing AADT-based Level of Service thresholds as adopted in the City general plan.

A. Project traffic causes minimum LOS standards for either direction to be exceeded, or further degrades already exceeded LOS standards and the volume-to-capacity (v/c) ratio increases by at least 0.01 with the Project.

B. Project proposes roadway geometry changes that minimum LOS standards to be exceeded or further degrades already exceeded LOS standards.

Bicycles & Pedestrians

Bicycle and pedestrian level of service analysis should follow the methodologies established in the current Highway Capacity Manual (HCM), unless alternate methodologies are approved by the Transportation Manager. For the purposes of forecasting LOS calculations, pavement condition rating should be assumed at 3.0 unless there are other overriding circumstances. It is acknowledged that under certain high vehicle volume conditions, the HCM methodology for bicycle and pedestrian level of service estimation can be insensitive to improvement measures, therefore may not always be appropriate to define project-related deficiencies under these circumstances. In cases where MMLOS results are non-intuitive or inappropriate, alternative analysis techniques may be approved at the discretion of the Transportation Manager.

Intersections Bicycle & Pedestrian level of service analysis should be conducted at intersections scoped in the traffic study. Pedestrian & Bicycle level of service score and grade should be reported for each intersection approach or crosswalk. HCM intersection LOS analyses may not be sensitive to operational characteristics of Class I multiuse paths at intersections. If a parallel Class I path present, LOS shall be qualitatively assessed based on engineering judgement. Project-related deficiencies are identified where:

A. Project traffic causes minimum LOS standards to be exceeded.

B. Project proposes modifications to roadway geometry that causes minimum LOS standards to be exceeded or conflicts with engineering best practices for design of safe intersection and driveway crossings.

C. Project-related traffic or geometric modifications further degrades already exceeded LOS standards and there is contextual significance to the impact. Contextual significance may be evaluated qualitatively, and can generally be interpreted as a project-related action that results in a negative change to the bicycle/pedestrian environment that is likely to be noticeable to the average user. (i.e. a decrease in the effective buffer width between motor vehicle and bicyclists/pedestrians, addition of traffic adjacent to a bicycle/pedestrian facility that would be noticeable during a typical walk/bike trip, significant increases in crossing delays, etc.)

Segments Pedestrian level of service analysis should be conducted on public Collectors and Arterials that front or are internal to the project, or where a project adds at least 20 peak hour motor vehicle or person trips to the facility. Bicycle level of service should be conducted on

existing or planned bikeway routes, as adopted in the City's Bicycle Transportation Plan/Active Transportation Plan, that front or are internal to the project, or where a project adds at least 20 peak hour motor vehicle or person trips to the facility. At the discretion of the Transportation Manager, bicycle segment analysis may be conducted using Bicycle Level of Traffic Stress (LTS) in lieu of HCM level of service methodologies. Where LTS analysis is used, the following LTS-to-LOS equivalencies shall be assumed for identifying operational deficiencies:

- LOS A = LTS 1
- LOS B/C = LTS 2
- LOS D = LTS 3
- LOS E/F = LTS 4

As with intersections, if a separate adjacent and parallel bike or pedestrian facility is present LOS shall be assumed as follows:

- LOS A (LTS 1) where Class I paths have a width of 12 feet or more, and are separated from the adjacent motor vehicle traveled way by at least 10 feet or with a vertical element, such as a railing or landscaping.
- LOS B (LTS 2) where Class I paths have a width less than 12 feet, or are separated from the adjacent motor vehicle traveled way by less than 10 feet with no vertical elements.

Project-related deficiencies are identified where:

A. Project traffic causes minimum LOS/LTS standards to be exceeded.

B. Project proposes modifications to roadway geometry that causes minimum LOS/LTS standards to be exceeded or conflicts with engineering best practices for bicycle and pedestrian facility design, including safety at intersection and driveway crossings.

C. Project-related traffic or geometric modifications further degrades already exceeded LOS/LTS standards and there is contextual significance to the impact. Contextual significance may be evaluated qualitatively, and can generally be interpreted as a project-related action that results in a negative change to the bicycle/pedestrian environment that is likely to be noticeable to the average user. (i.e. a decrease in the effective buffer width between motor vehicle and bicyclists/pedestrians, addition of traffic adjacent to a bicycle/pedestrian facility that would be noticeable during a typical walk/bike trip, etc.)

Transit

Segments Transit level of service analysis should be conducted at segments scoped in the traffic study that have current or planned transit service. Transit frequency, load factor, and LOS score should be reported for transit routes servicing the project. A map should also be provided depicting the project and servicing transit stops with 1/8- and ¼-mile mile bands around those stops.

Project-related deficiencies are identified where:

A. Project traffic causes minimum LOS standards to be exceeded or further degrades already exceeded LOS standards and there is contextual significance to the deficiency.
B. Project proposes businesses or dwellings that are beyond 1/4 mile in existing developed areas and/or beyond 1/8 mile of employment-intensive uses or medium to high density residential uses in City expansion areas.

If approved by the Transportation Manager, a streamlined transit analysis may be performed in lieu of detailed segment HCM LOS calculations. A streamlined analysis would include a summary of existing transit load factors and evaluation of whether project-generated transit ridership would cause load factors to exceed 0.83, or add ridership to routes where existing load factors already exceed 0.83.

Neighborhood Traffic Analysis

Projects which include new local residential streets or have trips forecasted on local residential street will typically be required to evaluate the impact of neighborhood traffic conditions. Project impacts are considered significant if the maximum neighborhood ADT or speed thresholds established in Table below, of the Circulation element, are exceeded or the project adds traffic to a neighborhood already exceeding the ADT threshold.

Street Classification	Maximum ADT	Maximum Speed
Local Residential	1,500	25 mph
Residential Collector (Minor)	3,000	25 mph
Residential Collector (Major)	5,000	25 mph

A monitoring program shall be a standard condition of approval for all projects with a potentially significant impact on neighborhood traffic conditions. Because it's not feasible to estimate speed impacts, follow-up monitoring programs will be the primary method for estimating impacts on neighborhood speeds. Unless there are any documented events or conditions that could affect observed baseline speeds it shall be assumed that any increase in neighborhood speeds after the project is occupied is attributed to the project.

Modal Priorities

In addition to maintaining minimum levels of service, the City's Circulation Element establishes priorities for various modes such that construction, expansion, or improvements to one mode should not degrade the level of service of a higher priority mode. Where improvements required to offset project-related LOS deficiencies for one travel mode would result in the degradation of a higher priority mode, that shall be considered a residual deficiency and should be addressed as well.

Table 3 Modal Priorities for Level of Service

Complete Streets Areas	Priority Mode Ranking
Downtown & Upper Monterey Street	1. Pedestrians 3. Transit 2. Bicycles 4. Vehicle
Residential Corridors & Neighborhoods	1. Pedestrians 3. Vehicle 2. Bicycles 4. Transit
Commercial Corridors & Areas	1. Vehicles 3. Transit 2. Bicycles 4. Pedestrians
Regional Arterial and Highway Corridors	1. Vehicles 3. Bicycles 2. Transit 4. Pedestrians

Notes:

Exceptions to multimodal priorities may apply when in conflict with safety or regulatory requirements or conflicts with area character, topography, street design, and existing density..

VI. ADDRESSING CEQA IMPACTS AND OPERATIONAL DEFICIENCIES FOR LOCAL POLICY CONFORMANCE

Approach

Overall, CEQA mitigation measures and recommended improvements/actions to correct local policy deficiencies caused by a project, should follow the City's Circulation Element Goals & Objectives of supporting environmentally sound technological advancement, supporting a shift in modes of transportation, and establishing beautiful & livable street corridors. For example if a project creates a level of service deficiency at an intersection or roadway, measures that would reduce vehicle demand generated by the project, such as enhanced bike and pedestrian facilities or improved transit service, should be considered before measures that would increase vehicle capacity. Similarly, mitigations recommended to address VMT impacts should support existing City plans and policies to reduce dependence on single-occupant motor vehicle use, such as improving transit service consistent with the Short-Range Transit Plan or constructing bicycle facilities consistent with the City's adopted Bicycle Transportation Plan/Active Transportation Plan.

CEQA Mitigation Strategies for VMT Impacts

When significant VMT impacts are identified as part of the traffic impact analysis, mitigation measures shall be included to address those impacts. The impact study should establish the legal nexus between the project and the mitigation measures. Per current CEQA Guidelines and OPR technical guidance, potential strategies for addressing project VMT impacts include, but are not limited to:

- Implementation of a Transportation Demand Management Program (TDM).
- Improve or increase access to transit.
- Incorporate a mix of land uses to increase access to common goods and services, such as groceries, neighborhood retail, schools and childcare services.
- Locate project in lower-VMT areas of the City.
- Improve or increase access to active transportation facilities within the project vicinity, or construct planned active transportation in other areas of the City that improve cross-town mobility and safety for active transportation users.

- Provide car-sharing, bike-sharing, ride-sharing, neighborhood electric vehicle charging stations, or other on-site amenities to increase access and use of greenhouse gas reducing transportation modes.

The traffic study's description of each mitigation measure should include the following:

1. Figure schematically depicting location and nature of each mitigation measure and description of implementation feasibility (i.e. right-of-way requirements, constructability, etc.).
2. Quantitative estimate of anticipated VMT reduction and supporting summary documenting the tools and methodology used to develop this estimate. Where feasible, the same tool used to establish the City's VMT thresholds and for project-level VMT analysis (i.e. SLO TDM) shall be used to quantify VMT reductions with mitigation.
3. Comparison table of VMT with and without mitigation.
4. If scoped, provide a planning-level cost estimate of each mitigation measure, timing/phasing of measures, and equitable share calculations.

Strategies for Addressing Local Policy Deficiencies

When a proposed project is anticipated to create or exacerbate deficiencies related to local policy objectives, such as instances where minimum MMLOS standards are exceeded, improvements and/or actions shall be recommended to offset these deficiencies and inform development of project conditions of approval. The study should establish a legal nexus between the project and recommended strategies and include the following:

1. Figure schematically depicting location and nature of each improvement/action and description of implementation feasibility (i.e. right-of-way requirements, constructability, etc.).
2. Comparison table(s) showing deficient study locations with and without recommended improvements.
3. If scoped, provide a planning-level cost estimate of each improvement recommendation, timing/phasing of actions, and equitable share calculations.

Intersection Control Type Selection

Circulation Element policies *7.0.2 Street Network* and 9*.1.6 Streetscapes & Major Roadways* establish roundabouts as the City's preferred intersection control type where feasible. Per these policies, roundabout control should be the first and preferred improvement strategy where right-of-way issues, environmental factors, or other design constraints allow.

When roundabout control is infeasible, consideration and evaluation of multi-way stop control or signalized control should utilize the California MUTCD's Multi-Way Stop and Traffic Signal warrants. Detailed consideration should be given when determining the applicability of individual warrants.

For example, the MUTCD chapter on Peak Hour Signal Warrants states "*This warrant shall only be applied in unusual cases, such as office complexes, manufacturing plans, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time*". The peak hour warrant should only be used when the volume in a peak hour

exceeds 45% or more of the 24-hr volume and should not replace the need for a more comprehensive engineering study when confirming the need for signalization.

Transit Deficiencies

Transit operations are typically dynamic, can change over time given funding and policy circumstances, and are largely outside the control of individual private projects. Potential strategies to address project-related transit operations deficiencies include, but are not limited to:

- Fair share financial contribution towards expanding the transit fleet, which allows for future service improvements
- Construction of new transit stops, or upgrades to benches, shelters or other amenities at existing transit stops.
- Installation or fair share financial contribution towards transportation system improvements that improve transit operations, such as equipment for transit signal priority or queue jumps at congested intersections.

Bicycle and Pedestrian Deficiencies

Potential strategies to address project-related bicycle and pedestrian safety and LOS deficiencies include, but are not limited to:

- Installation of sidewalks where none currently exist
- Installation of facilities physically-separated from motor vehicle traffic, such as Class I (multi-use path) or Class IV (cycle track) bikeways.
- Addition of elements that further buffer pedestrian facilities from motor vehicle traffic, such as installation of street trees and/or landscaped parkways.
- Traffic calming or other improvements that reduce motor vehicle speeds adjacent to bicycle and pedestrian facilities.
- Major intersection crossing upgrades, such as construction of roundabouts, protected bicycle intersections, or pedestrian hybrid beacons (PHB).
- Minor intersection crossing upgrades, such as addition of lead crossing signal intervals, dedicated bicycle or pedestrian “scramble” signal phases, bike boxes, curb extensions (bulbouts), median refuge islands or rapid rectangular flashing beacons (RRFBs).
- Addition of signage and/or striping modifications that improve safety at conflict points with motor vehicles.

Equitable Share Responsibility

For level of service and capacity deficiencies, equitable share responsibility for improvements shall be calculated based upon the percent of project trips forecasted on the impacted facility for the corresponding analysis and time period. In cases where the impact is primarily attributed to a specific component of the facility, such as a left turn lane, it may be more appropriate to calculate the percent of project trips forecasted on the specific impacted component of the facility as opposed to the whole facility.

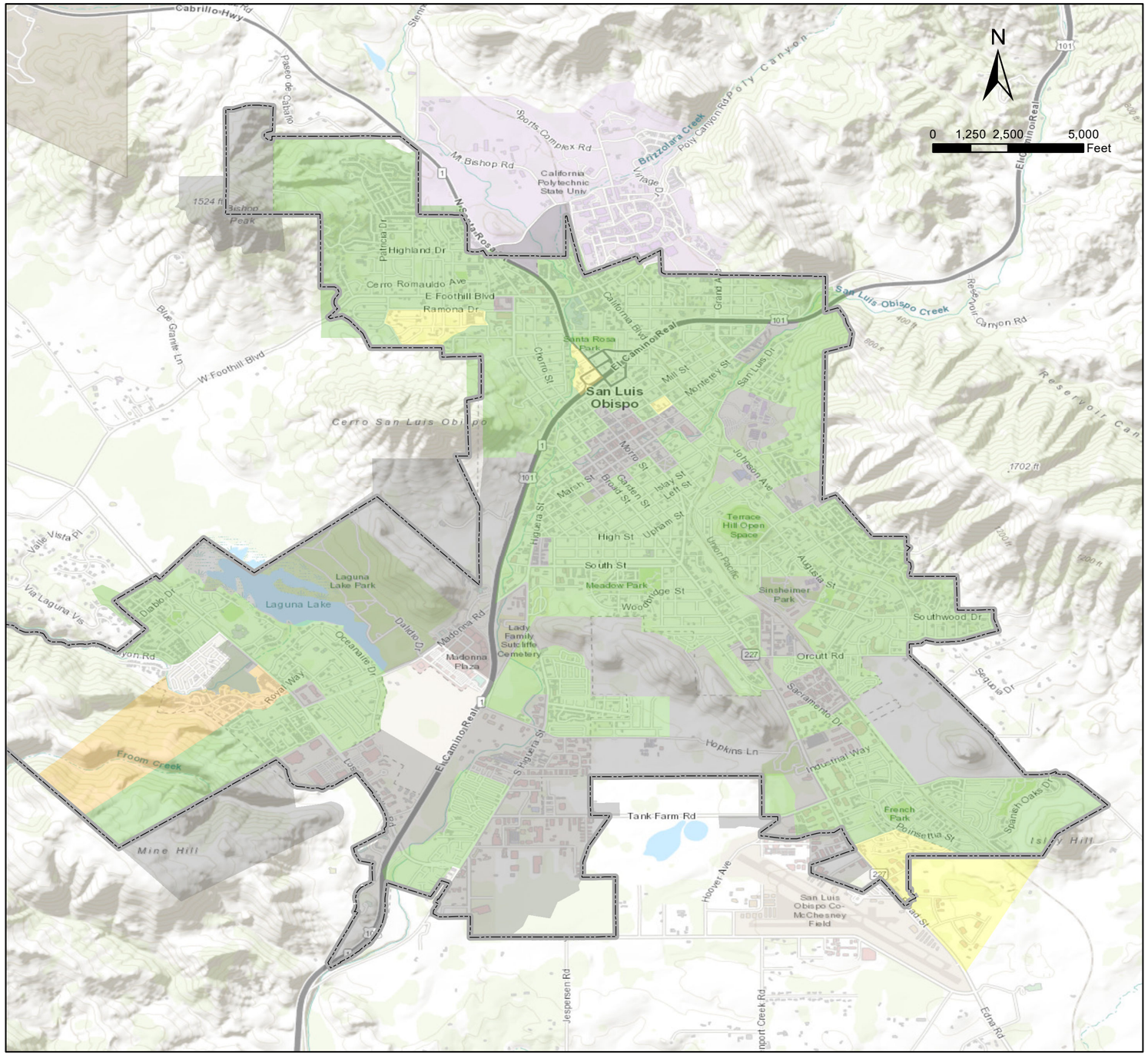
Equitable share calculations are not applicable to safety and neighborhood impacts. Also, in circumstances where the project is receiving substantial benefit from the identified mitigation

measure and that measure would not have otherwise been considered if the project was not proposed, the project should take full share responsibility. Examples of these types of circumstances include but are not limited to.

- A new access point for a project where upgraded control and/or associated striping at that intersection is an identified mitigation measure.
- A mitigation measure is identified within a generally built out area where there are no planned transportation improvements.

Appendix A:
VMT Screening Maps

City of San Luis Obispo
Residential VMT Screening Map



Residential VMT Per Capita

Regional Average = 16.76

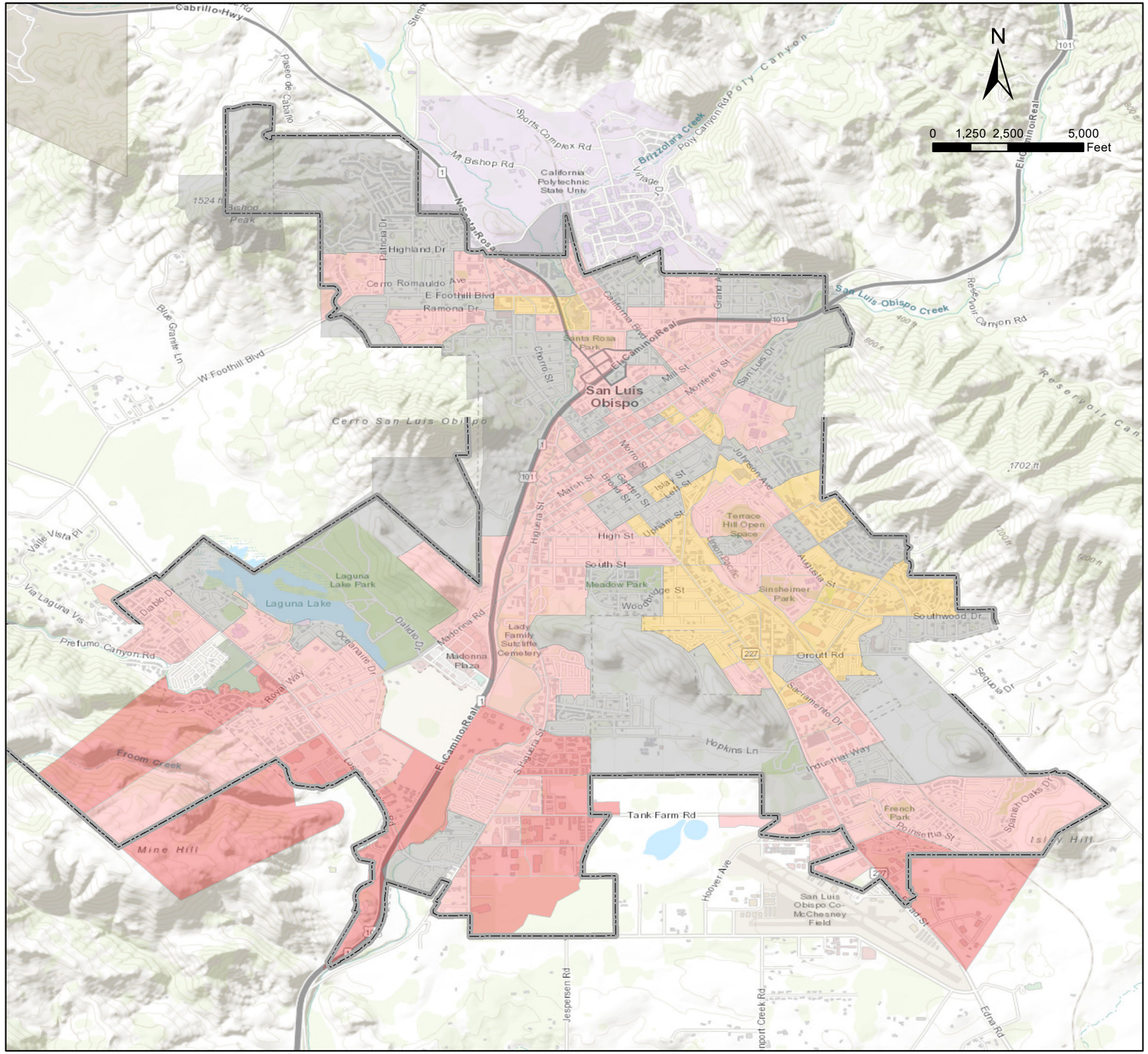
85% of Regional Average (Impact Threshold) = 14.25

- ≤ 85% of Average VMT
- 85% - 100% of Average VMT
- 100% - 115% of Average VMT
- >115% of Average VMT
- Too Little Data - Further Analysis Needed
- CityLimit

Data Source: City of San Luis Obispo Travel Demand Model

Last Updated: 6/1/2020

City of San Luis Obispo
Work VMT Screening Map



Work VMT Per Employee

Regional Average = 14.65

85% of Regional Average (Impact Threshold) = 12.45

- ≤ 85% of Average VMT
- 85% - 100% of Average VMT
- 100% - 115% of Average VMT
- 115% - 130% of Average VMT
- >130% of Average VMT
- Too Little Data - Further Analysis Needed
- CityLimit

Data Source: City of San Luis Obispo Travel Demand Model

Last Updated: 6/1/2020

Appendix B:

SLO TDM Technical Guide - Calculating VMT (Cambridge Systematics)

CAMBRIDGE SYSTEMATICS

City of San Luis Obispo Travel Demand Model Technical Guidance

Calculating VMT

Draft Guide

prepared for

City of San Luis Obispo

prepared by

Cambridge Systematics, Inc.

February 27, 2020

www.camsys.com

draft guide

City of San Luis Obispo Travel Demand Model Technical Guidance

Calculating VMT

prepared for

City of San Luis Obispo

prepared by

Cambridge Systematics, Inc.
1801 Broadway, Suite 1100
Denver, CO 80202

date

February 27, 2020

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1.0 Introduction

This document provides a brief technical description of how to calculate VMT generated by one or more zones using SLO Model outputs and the TransCAD menu system.

Note that this guide includes a simplification to make the calculations straightforward. The VMT tool uses distance skims for the peak (AM and PM) and off-peak (MD and NT) periods. This guide makes a simplification and uses peak skims to define trip length.

This guide provides instructions on computing home-based VMT and on computing total non-residential VMT. Similar concepts can also be used to compute commute VMT by summarizing home-based work (HBW) attractions (HBW matrix column sums).

The SLO Model utilizes a land use-based model to compute trip attractions. For this reason, TAZ-level and even city-level employment is not a direct input to this model. This guide also provides guidance on calculating employment at the TAZ level based on model outputs.

2.0 VMT Required Files

Only a subset of model outputs are required to perform VMT calculations. This set of files is listed in the table below.

Files required for VMT Calculations

File Name	Notes / Description
ModeTrip\Trip_[PURP]_ [PK/OP].mtx	These files contain production/attraction vehicle trips output from mode choice.
Skim\skim_pk.mtx	This file contains the peak period drive alone shortest paths. *Note: off-peak skims are available as well, but not used in this guide.*
TripGen\SocioBV.bin	This file contains socioeconomic data totals, including total population and employment.
SLO_TAZ.dbd	This geographic file contains the TAZ definitions.

3.0 VMT Calculation Procedure

This step will produce a pair of matrix files. The first will include all home-based vehicle trips in production to attraction format. The second will include all trips in production to attraction format, including non-home-based trips.

3.1 Create Empty Matrix Files for Calculations

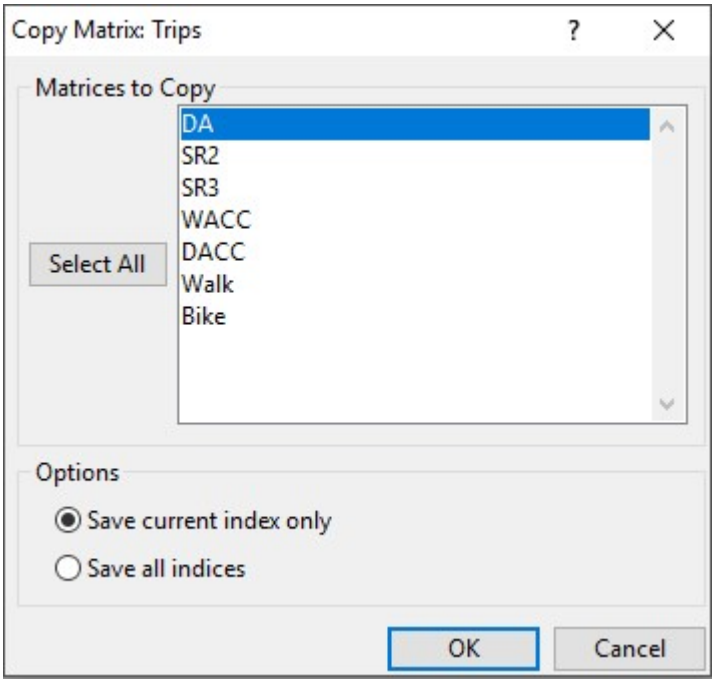
This step will create a pair of empty matrix files that can be used to perform calculations.

1. Open a trip table

a. This guide uses **Trip_HBO_pk.mtx**, but any trip table will work.

2. Choose **Matrix → Copy** from the TransCAD Menu

3. Select only the DA matrix core



4. Save the matrix in a convenient location

   a. Save the copy in a new folder named **Analysis** within the model run folder.

   b. Use the filename **HB_VMT_Analysis.mtx**.

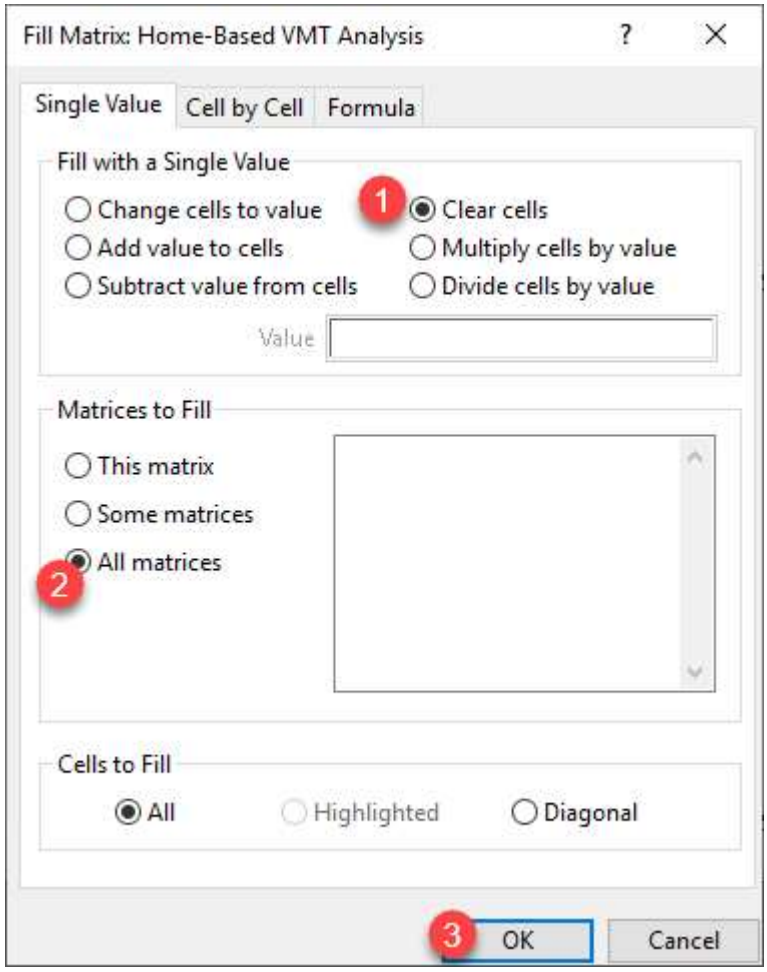
   c. Change the matrix label to **Home-Based VMT Analysis** when saving the file.

5. Close all files, then re-open the newly created matrix. This will help prevent accidental changes to the original file.

6. From Matrix > Contents, add two new cores to the matrix.

7. Rename the three matrix cores to “Trips” “Length (Skim)” and “VMT”. This can be done from **Matrix → Contents**.

8. Clear the first matrix core in the home-based trip matrix. This can be done from **Matrix → Fill**.



9. Make a copy of the home-based analysis file.

   a. Name the copy **AllTrip_VMT_Analysis.mtx**.

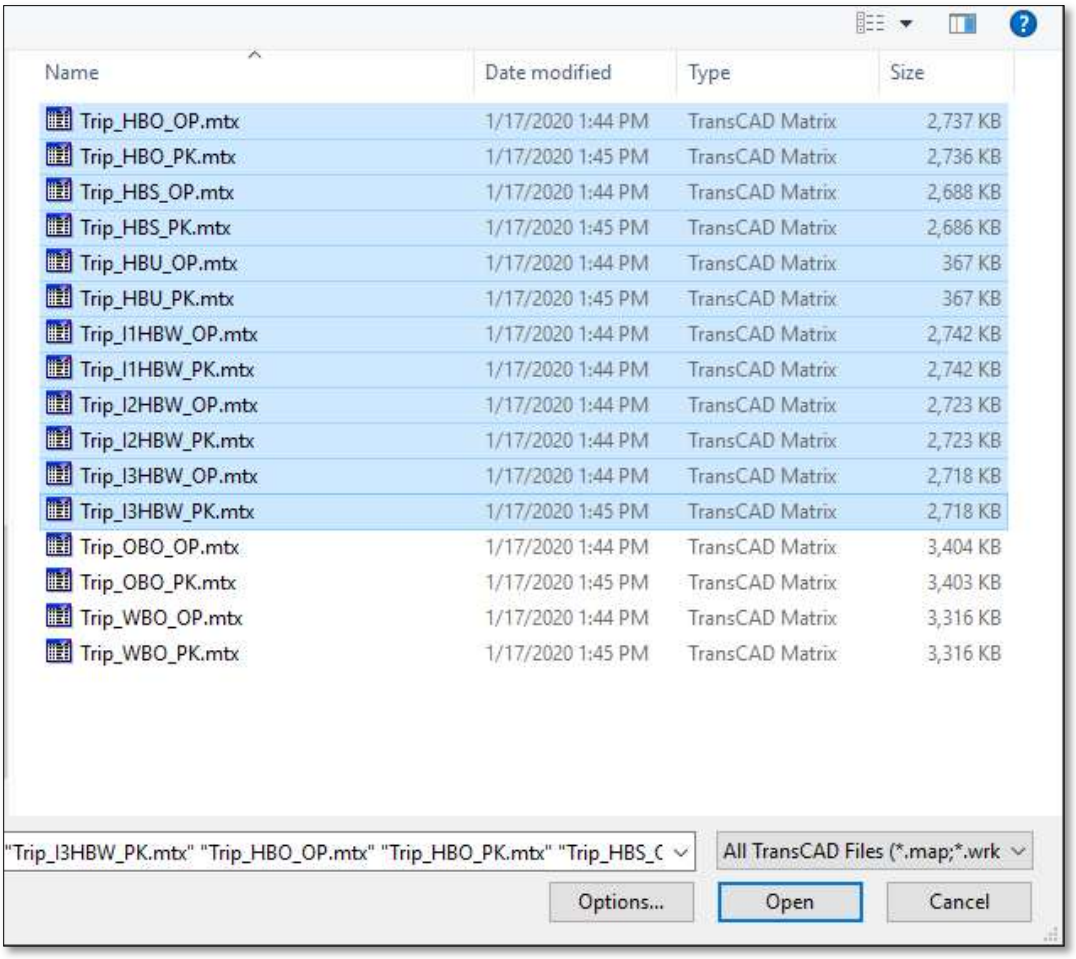
   b. Change the matrix label to **All Trip VMT Analysis**.

3.2 Sum Vehicle Trips

This step will populate the **Trips** matrices for both home-based and all trips.

1. Close all files to start with a clean workspace

2. Open the **Trip_[PURP]_ [PK/OP].mtx** files for **home-based** purposes only. This can be done by selecting all of the relevant files from the TransCAD **File → Open** dialog.



3. Open the recently created HB_VMT_Analysis.mtx file.

4. Fill the HB_VMT_Analysis matrix with the total home-based vehicle trips

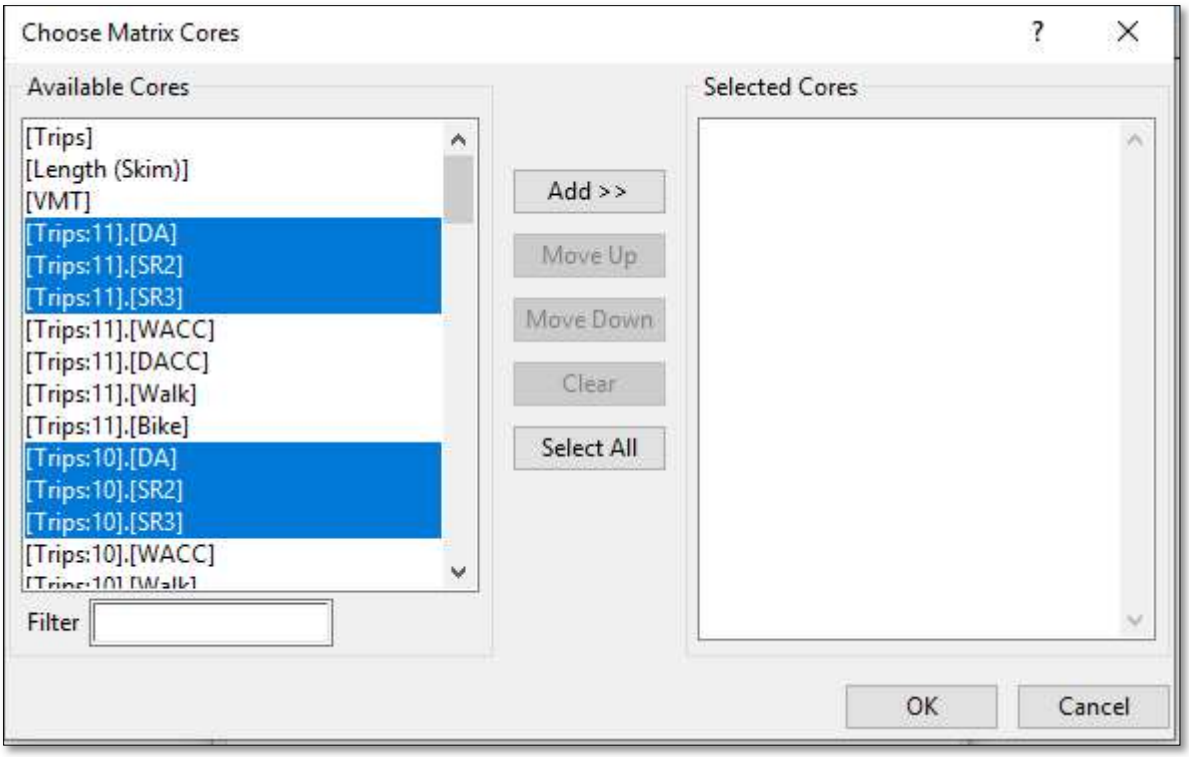
   a. Make sure that the **Trips** matrix is active and that the **HB_VMT_Analysis.mtx** window is active.

   b. Choose Matrix → Fill ( ) from the TransCAD menu or toolbar.

   c. Select the **Formula** tab.

   d. Click the **Sum Matrices** ( ) button.

   e. Select the matrices for [DA], [SR2] and [SR3] and add them to the **Selected Cores** list, then click OK.



f. Select the **Treat missing values as zeros** checkbox, then click OK to generate a formula.

g. Click OK again to populate the **Trips** matrix core with the sum of all home-based vehicle trips.

5. Close all files, then use a similar procedure to fill the **AllTrips_VMT_Analysis.mtx** file with all trips.

   a. This can be accomplished by repeating the steps above, but also including the **WBO** and **OBO** trip matrices when opening the summary matrix files.

3.3 Calculate VMT by Zone Pair

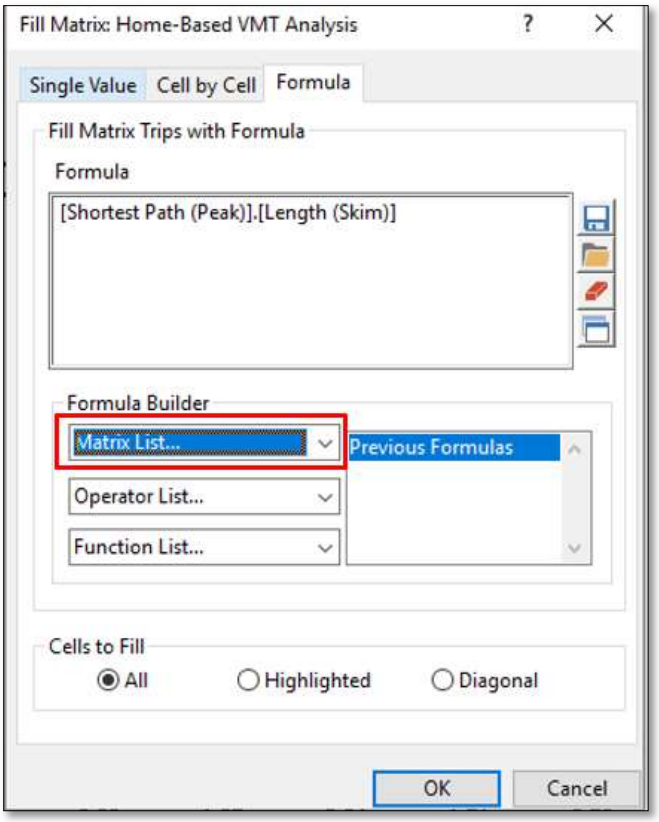
1. Close all files to start with a clean workspace

2. Open the **HB_VMT_Analysis.mtx** file and the **skim_pk.mtx** file.

3. For convenience, populate the **[Length (Skim)]** core in the **HB_VMT_Analysis.mtx** file with the corresponding matrix core in the **skim_pk.mtx** file.

   a. Select the **Length (Skim)** core in the matrix.

   b. Use **Matrix → Fill** and the **Formula** tab as shown below. The source matrix can be selected from the **Matrix List**.

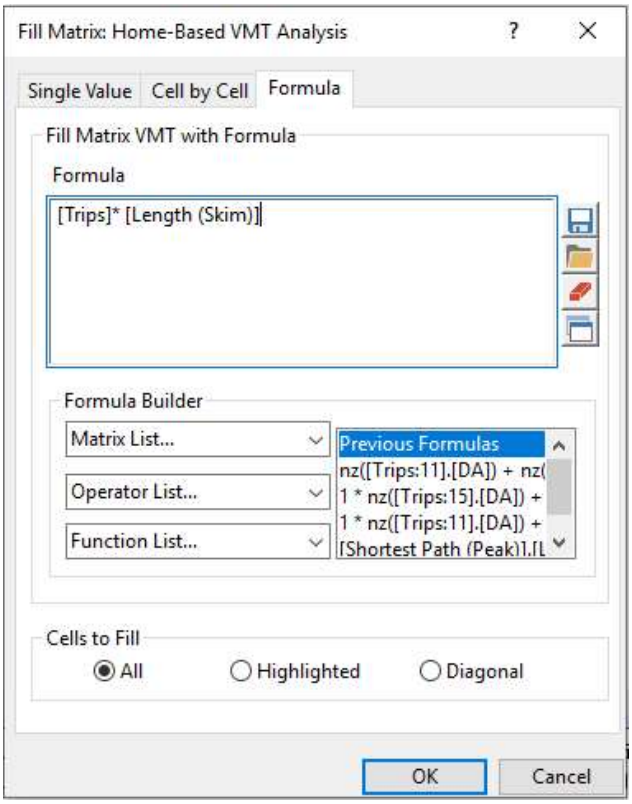


c. Close the skim matrix when done

4. Compute VMT by multiplying trips by length.

   a. Select the **VMT** core in the matrix.

   b. Use **Matrix → Fill** and the **Formula** tab as shown below.



5. Repeat the steps above using the **AllTrips_VMT_Analysis.mtx** file instead of the home-based file.

3.4 Summarize Total VMT for One or More Zones

1. Open the TAZ Layer in TransCAD (e.g., **SLO_TAZ.dbd**). It may be best to work with a copy, since this process will modify the file, and a mistake could overwrite important data.

2. Add fields to the TAZ dataview, setting field types to **Real (8 bytes)**:

   a. **ResVMT** to hold Residential VMT

   b. **NonResVMT** to hold non-residential VMT

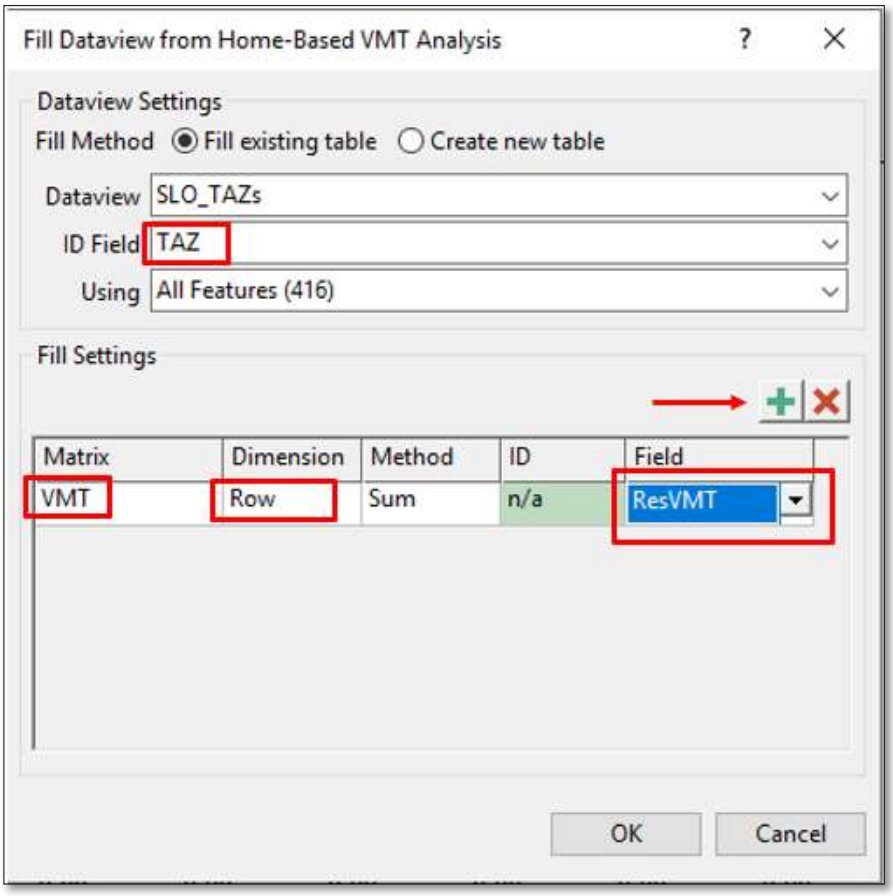
3. Populate the Residential VMT field.

   a. Open the **HB_VMT_Analysis.mtx** file.

   b. Select **Matrix → Fill Dataview** ( ) from the TransCAD menu or toolbar.

   c. Fill the **ResVMT** field with the VMT Row Sum.

   d. Close the **HB_VMT_Analysis.mtx** file.



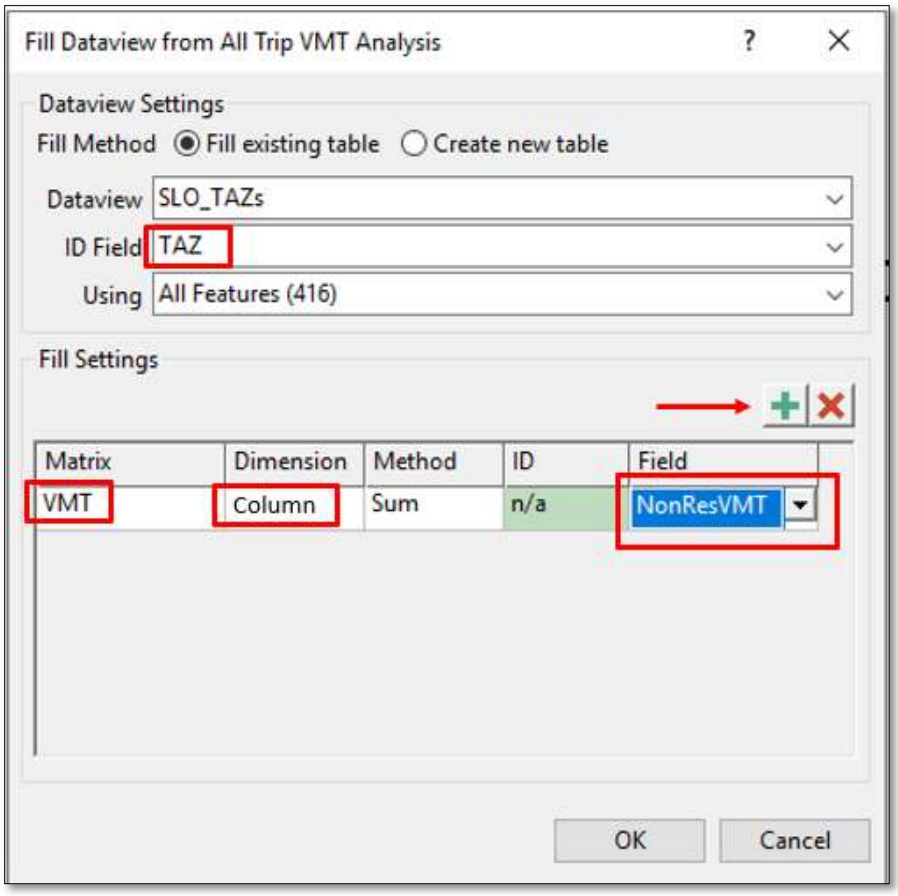
4. Populate the Non-Residential VMT field

   a. Open the **AllTrip_VMT_Analysis.mtx** file.

   b. Select **Matrix → Fill Dataview** ( ) from the TransCAD menu or toolbar.

   c. Fill the Non**ResVMT** field with the VMT Column Sum.

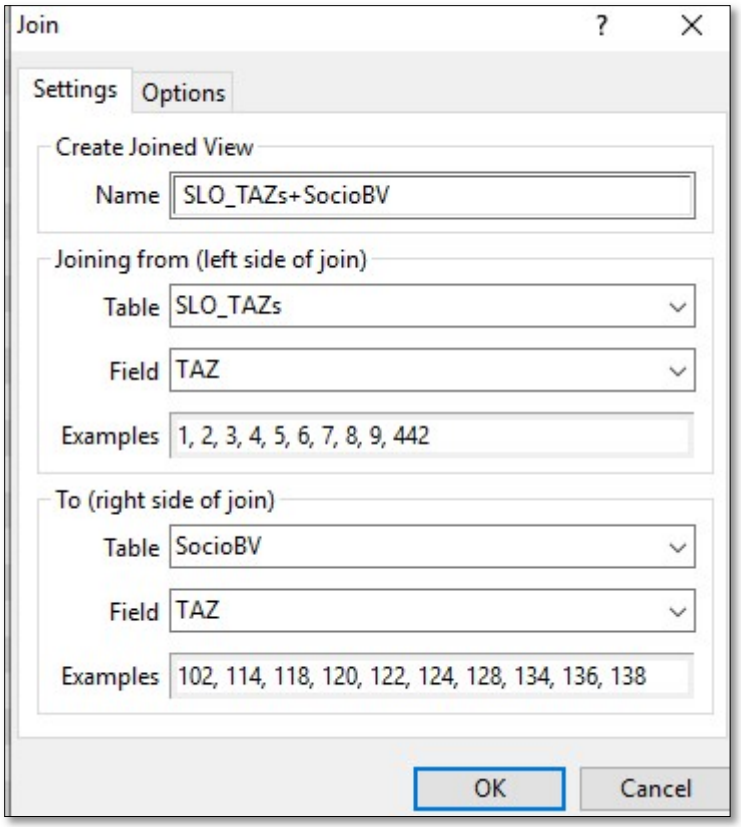
      Close the **AllTrip_VMT_Analysis.mtx** file.



5. Summarize VMT, population, and employment for a set of zones

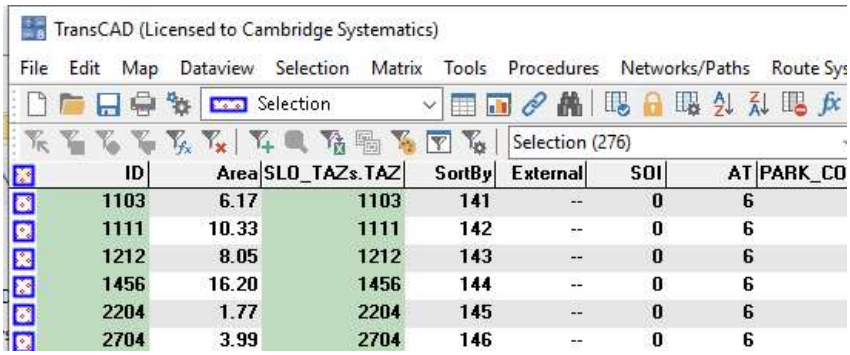
   a. Open the **SocioBV.bin** file.

   b. Join the socioeconomic data view to the TAZ layer.



c. Select zones to summarize either by pointing or using a selection query (**Selection → Select by Condition** or).

d. Activate the joined view and show only the selected records.



ID	Area	SLO_TAZs.TAZ	SortBy	External	SOI	AT	PARK_CO
1103	6.17	1103	141	--	0	6	
1111	10.33	1111	142	--	0	6	
1212	8.05	1212	143	--	0	6	
1456	16.20	1456	144	--	0	6	
2204	1.77	2204	145	--	0	6	
2704	3.99	2704	146	--	0	6	

e. Choose Dataview → Summary Statistics ( ) from the TransCAD menu or toolbar.

f. Obtain residential VMT (Res_VMT), non-residential VMT (NonRes_VMT), population (HH_POP), from the summary dataview.

6. Calculate residential VMT per capita

a. Calculate residential VMT per capita as Res_VMT / HH_POP from the summary view.

4.0 Employment Calculation

The SLO Model uses land use inputs in terms of development square footage, not based on employees, which is required to compute VMT per employee. To calculate commute VMT per employee, it is necessary to determine the number of employees at the TAZ level. This can be done using the procedure described below.

4.1 Determine Total baseline employment

The first step is to determine the total employment within either the City or SOI. This example will consider City employment. Application for the SOI is similar, but it is important to properly account for employment at CalPoly when determining employment for the SOI as a whole.

At the time of writing, total employment for the City is assumed to be 42,794.

4.2 Distributing Employment to TAZ

The model can be assumed to produce a consistent number of home-based work attractions per employee at each non-residential location. The number of employees in each TAZ can be calculated using the equations shown below.

[Conversion Factor] = [Total City Employment] / [Total City HBW Attractions]

[TAZ Employment] = [Conversion Factor] * [TAZ HBW Attractions]

The necessary information can be obtained from the following locations:

- Total City Employment: External input described in Section 4.1.
- Total City HBW Attractions: Row Sum of the file **HBW_A** column in the model output file ZonePABalanced.bin.
- TAZ HBW Attractions: Value in the **HBW_A** column for the selected TAZ in the model output file ZonePABalanced.bin.

4.3 Project Level Employment

In model application, it may be necessary to add a new land use to the model and calculate the resulting commute VMT per new employee. This requires computing employment for a specific project. Due to the nature of trip balancing, new employment cannot be determined by simply subtracting total HBW attractions in no-project model from a project model run. Instead, HBW attractions must be converted to employment at the TAZ level.

One way to approach this is to isolate a new development in a single TAZ. Alternately, TAZ-level employment with and without project can be computed and subtracted to arrive at project employment. TAZ level employment can be computed using the process described in Section 4.2. When performing this

calculation, the [Conversion Factor] should be based on the no-project model even when computing project level employment.