

A Proposed Methodology for Adjustments to SANDAG Model-Produced VMT/Capita and VMT/Employee Due to VMT Generated Outside the San Diego Region

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BACKGROUND

This paper was originally completed in March 2021 and was revised due to changes in the methodology for determining VMT/employee in the SANDAG regional travel demand model.

In the San Diego region, VMT calculations for land development projects are typically conducted by comparing a project's VMT/capita or VMT/employee to community, city, or regional averages using data provided by the SANDAG regional travel demand model. State guidelines recommend that these calculations take into account VMT occurring outside the region. Although the SANDAG model does not currently include any adjustments for VMT occurring outside the region, the process of comparing project VMT data to the appropriate averages may indirectly account for the effects of external VMT so that additional adjustments may not be necessary. However, for analysis of some projects within the San Diego region, it may be advisable to adjust the results of the model to account for external VMT. This paper provides information to assist analysts in determining when adjustments may be needed as well as a proposed methodology to make the adjustments.

VMT/Capita and VMT/Employee data are used for a variety of applications in transportation planning and traffic engineering. The methodology described in this paper is intended for use in CEQA transportation analyses. It is not intended for use in calculating VMT-based fees.

DETERMINING THE NEED FOR ADJUSTMENTS

VMT analysis for most projects analyzed in the San Diego region would not require an adjustment to account for external VMT. The explanation provided below describes why external VMT is typically not a consideration in VMT analysis and identifies potential exceptions.

The SANDAG region is considered to be somewhat unique among the various regions in California in that there are natural or man-made barriers to travel between the SANDAG region and all of its neighboring regions. This assertion is based on judgment since it

would be difficult to demonstrate the unique characteristics of different regions using available data. The various neighboring regions and the barriers to travel can be described as follows:

- ◆ Orange County: Orange County and the urbanized portion of the San Diego region are separated by Camp Pendleton. The presence of this Marine Corps base separates the City of San Clemente in Orange County and the City of Oceanside in San Diego County by 18 miles.
- ◆ Riverside County: Riverside County and the urbanized portion of the San Diego region are separated by a mostly rural area which separates the City of Temecula in Riverside County from the Community of Fallbrook in San Diego County by 12 miles. The City of Escondido is more distant at 24 miles. There are some rural areas of San Diego County that are closer to Temecula than Fallbrook or Escondido.
- ◆ Imperial County: Imperial County and the nearest communities in the San Diego region are separated by a mostly rural area. The City of Brawley in Imperial County is separated from the Community of Julian in San Diego County by 73 miles. The City of El Centro in Imperial County is separated from the Community of Alpine in San Diego County by 85 miles. There are some rural areas of San Diego County that are closer to Brawley or El Centro than Julian or Alpine.
- ◆ Tijuana and Tecate, Baja California, Mexico: Both these Cities in Mexico are relatively close to destinations in the San Diego region, but the delay in crossing the international border is a barrier to travel.

Relative to external VMT, these barriers are considered to have the following effect on travel:

- ◆ Due to the distances involved between most trips to the adjacent counties and due to the travel time penalties associated with crossing the international border, there are considered to be relatively few trips that occur between neighboring regions and the San Diego region that can be defined as short trips. Most of the trips crossing the regional boundaries are relatively long trips (in terms of travel time). These trips are likely to be made with a particular destination in mind and are less likely to be oriented out of convenience to the closest possible destination within the San Diego region. This means that any location within the San Diego County region is likely to experience about the same number of trips from other regions as any other location within the San Diego region.

In order to understand what this means in terms of VMT analysis, it is necessary to consider the details of the methodology for VMT analysis.

The SANDAG regional travel model does not include an estimate of VMT made outside the San Diego region. The model estimates the amount of traffic that enters and leaves

the region but does not provide any information on the length of trips or VMT that occurs outside the region.

Typical VMT analysis for land development projects is conducted by comparing project's VMT/capita or VMT/employee to community, city, or regional averages using data provided by the SANDAG regional travel demand model. A typical target is for projects to achieve a VMT/capita or VMT/employee 15% below the community, city, or regional average. In this comparison, neither the project VMT value nor the community, city, or regional averages include VMT external to the region. Since neither the project VMT value nor the average VMT value used for comparison includes external VMT, the comparison typically remains valid as the lack of accounting for external VMT is part of both the project VMT value and the average VMT value used for comparison. However, it is reasonable to conclude that there are exceptions for which external VMT may be a factor in VMT analysis.

There are two primary situations in which external VMT may be an important factor in VMT analysis:

- ◆ Based on project characteristics, the project attracts a substantially higher number of external trips than the average project in the region. For example, a technology campus located near the County line or international border may draw a higher than average number of employees from outside the region and would therefore have a higher proportion of external trips.
- ◆ Based on the project's location near one or more external gateways, the project attracts a substantially higher number of external trips than the average project in the region. For example, trips generated at a residential development located near an external gateway may be oriented toward the gateway and may generate a higher level of VMT to outside the region than a typical project.

For the two situations described above, adjustments to VMT calculations could be considered.

It should be noted that adjustments to VMT calculations described in this paper apply to trips made outside San Diego County to destinations within California and Baja California, Mexico. If a project were considered to generate greater than average VMT to other locations (e.g. other U.S. states, Canada, or locations in Mexico other than Baja California), adjustments to VMT calculations could be considered, but the methodology for these adjustments are not provided in this paper and would need to be developed based on individual project characteristics.

PROPOSED METHODOLOGY FOR ADJUSTMENTS TO VMT CALCULATIONS FOR EXTERNAL VMT: RESIDENTIAL PROJECTS

The SANDAG regional travel model is an activity-based model that simulates travel for San Diego region residents and visitors. Trip-making for San Diego County residents is

tracked in terms of “tours” that represent an individual’s travel throughout a typical day. For example, a residential daily tour may involve leaving home, dropping children off at school, traveling to work, picking up children from school, and stopping at a shopping destination on the way home. VMT/capita is calculated by determining the sum of all VMT generated by all daily tours for a collection of residents in a study location and dividing by the number of residents that study location. While some of these tours may involve travel to an external gateway, the VMT that occurs beyond the model boundary is not calculated and would need to be added in cases where external VMT is considered to be higher than average.

The basic data used in the methodology to adjust for external VMT is as follows. This procedure and the data used is based on the Series 14/ABM2 version of the SANDAG model as well as other data available in March 2021. Analysts may wish to update this data in the future as new information becomes available from newer versions of the SANDAG model and other sources.

- ◆ The total daily VMT generated outside San Diego County at each external gateway may be estimated by multiplying the ADT at the gateway by the average trip length of trips crossing the gateway. Exhibit 1 shows the estimated external VMT values for 2016 conditions, corresponding to the base year for the Series 14/ABM2 version of the SANDAG model that is currently used for VMT/capita and VMT/employee values for land development projects that do not require a model run.
- ◆ The total daily internal VMT generated within San Diego County per the SANDAG Series 14/ABM2 version of the model is 83,120,208.
- ◆ The total daily external VMT generated within San Diego County is 15,876,539 per Exhibit 1.
- ◆ The total daily VMT (internal plus external) generated within San Diego County is 98,996,747.
- ◆ Exhibit 2 shows estimates of the average percentage of total trips oriented to each external and estimates of the VMT associated with each external gateway.

Analysts who wish to adjust project VMT calculations for VMT external to the region may do so using the following steps:

- ◆ Step 1: Determine External VMT Occurring at Gateway(s)

For each external gateway at which the project is expected to have a higher percentage of project trips than the average regional project, determine the percentage of project trips associated with the gateway. Subtract the average percentage of trips oriented to the gateway. Multiply the result by the project’s trip generation and the average length of external trip at the gateway to estimate the external VMT that

occurs. Repeat the process if the project is expected to have a greater than average percentage of trips at more than one gateway.

- ◆ Step 2: Determine Adjusted Total Project VMT (Including VMT Generated at External Gateway(s))

Obtain an estimate of project VMT/capita or from the SANDAG regional travel demand model. Determine the number of residents expected to be located at the site. Multiply the VMT/capita value by the number of residents or employees expected to be located at the site to obtain an estimate of unadjusted total project VMT. Add the external VMT associated with gateway(s) from Step 1 to determine to estimate total adjusted VMT.

- ◆ Step 3: Determine Adjusted Total Project VMT/Capita (Including VMT Generated at External Gateway(s))

Divide the total adjusted VMT by the number of residents expected to be located at the site to estimate the adjusted VMT/capita or value. This value may be compared to the appropriate averages to determine whether the project has a potentially significant impact on VMT

It should be noted that this methodology is conservative in that it considers the external VMT that could be added due to the effects of selected external gateways, but it does not consider reductions in VMT that may occur due to lower than average occurrence of internal VMT or lower than average VMT at other external gateways. Therefore, the methodology is likely to overstate a project's VMT effects, but it is not possible to understate a project's VMT impacts.

PROPOSED METHODOLOGY FOR ADJUSTMENTS TO VMT CALCULATIONS FOR EXTERNAL VMT: EMPLOYMENT PROJECTS

The SANDAG regional travel model is an activity-based model that simulates travel for San Diego region residents and visitors. Trip-making for San Diego County residents is tracked in terms of "tours" that represent an individual's travel throughout a typical day. For example, a daily tour may involve leaving home, dropping children off at school, traveling to work, picking up children from school, and stopping at a shopping destination on the way home. Since individual tours in the model are only tracked for San Diego County residents, VMT/employee is calculated based on tours made by employees who are residents of San Diego County. The VMT/employee value is calculated by determining the sum of all work-related VMT generated in daily tours made by employees of that destination who are San Diego County residents and dividing by the number of employees who are San Diego County residents. This means that non-San Diego County residents are excluded from the calculation.

With respect to adjustments in VMT due to external travel, there are two important considerations in the methodology described above:

- ◆ While some of the work tours made by San Diego residents involve travel to an external gateway, the VMT that occurs beyond the boundary of the model is not calculated and would need to be added in cases where external VMT is considered to be higher than average.
- ◆ The VMT/employee calculation does not include VMT made by non-residents of San Diego County. However, land development projects in San Diego County generate VMT made by non-San Diego County residents. Neither the VMT made within San Diego County nor the VMT made outside San Diego County is included in the calculation for trips made by non-San Diego County residents. Therefore, in order to adjust project VMT/employee for non-San Diego County residents, both the VMT generated from the project site to the external gateway and the VMT that occurs beyond the external gateway should be included.

Although the exclusion of non-San Diego County residents would at first thought be an important omission, the effect of this exclusion is minimized for most projects since the VMT/employee analysis is made by comparing project VMT/employee to regional, city-wide, or community averages. Therefore, the exclusion of VMT made by non-San Diego County residents is only a factor when a project has a higher than average VMT/employee generated by non-San Diego County residents.

The basic data used in the methodology to adjust for external VMT is as follows:

- ◆ The total daily VMT generated outside San Diego County at each external gateway may be estimated by multiplying the ADT at the gateway by the average trip length of trips crossing the gateway. Exhibit 1 shows the estimated external VMT values for 2016 conditions, corresponding to the base year for the Series 14/ABM2 version of the SANDAG model that is currently used for VMT/capita and VMT/employee values for land development projects that do not require a model run.
- ◆ The total daily internal VMT generated within San Diego County per the SANDAG Series 14/ABM2 version of the model is 83,120,208.
- ◆ The total daily external VMT generated within San Diego County is 15,876,539 per Exhibit 1.
- ◆ The total daily VMT (internal plus external) generated within San Diego County is 98,996,747.
- ◆ Exhibit 2 shows estimates of the average percentage of total trips oriented to each external and estimates of the VMT associated with each external gateway.

Analysts who wish to adjust project VMT calculations for VMT external to the region may do so using the following steps:

- ◆ Step 1: Determine Trip Lengths for Project Trips Oriented Toward Gateway(s)

Determine the average trip length for trips oriented to the gateways where the project would be expected to have a greater than average number of trips. This value can be obtained from Exhibit 1. Once this value is determined, add the distance between the project site and the gateway since non-residents who work in San Diego County are not accounted for in the model's VMT methodology. The average external trip length will be the sum of the average trip length for the gateway obtained from Exhibit 1 and the distance from the project site. This calculation should be made separately for each gateway if the project generates an above average number of trips to more than one gateway.

- ◆ Step 2: Determine VMT Generated by Non-San Diego County Residents

Obtain an estimate of the number of employees at the project site who will be non-residents of San Diego County. Estimate the number of work-related daily trips made by these employees. Multiply number of daily trips by the trip length calculated in Step 1.

One potential source that could be used in estimating employee information is Longitudinal Employer-Household (LEHD) data from the U.S. census that can be found at the following link:

<https://lehd.ces.census.gov/data/>

- ◆ Step 3: Determine Adjusted Total Project VMT/Employee (Including VMT Generated by Non-Residents of San Diego County)

Estimate the number of people employed at the project site. Multiply the number of people employed by the unadjusted VMT/employee from the model. Add the external VMT from Step 2. Divide the sum by the number of people employed at the site to determine the adjusted project VMT/employee. This value may be compared to the appropriate averages to determine whether the project has a potentially significant impact on VMT.

Analysts should check with agency staff of the jurisdiction where the project is located to determine whether there are any specific requirements or methodologies related to estimating employee information. For example, one source that could be considered is employment density information provided by SANDAG.

It should be noted that this methodology is conservative in that it considers the external VMT that could be added due to the effects of selected external gateways, but it does not consider reductions in VMT that may occur due to lower than average occurrence of internal VMT or lower than average VMT at other external gateways. Therefore, the

methodology is likely overstate a project's VMT effects, but it is not possible to understate a project's VMT impacts.

ATTACHMENT – SAMPLE PROBLEMS

SAMPLE PROBLEM 1 – RESIDENTIAL PROJECT

PROJECT DESCRIPTION

This sample project includes 600 single-family residential units is assumed to be located in unincorporated San Diego County in the community of Fallbrook. It should be noted that this is a hypothetical example only since an actual project located in unincorporated San Diego would use the procedures included in the San Diego Transportation Study Guidelines to analyze external VMT. The project is located west of I-15 and north of Mission Road in Census Tract 190.01. Based on information from the SANDAG regional travel demand model at the time this sample problem was created, the year 2016 daily VMT per capita in this census tract was 35.4. It should be noted that VMT per capita values will change over time and in an actual VMT analysis, the current VMT per capita value should be used, based on guidance from the jurisdiction where the project is located. The project requires a General Plan Amendment due to a zoning change.

VMT ANALYSIS

A market survey determined that 20% of project trips will be oriented toward the external gateway at I-15 as it crosses into Riverside County. It is concluded that the external VMT associated with trips oriented toward this gateway are substantial enough that they should be included in the project's VMT analysis.

Exhibit 2 shows the estimated percentages of trips oriented to external gateways in the San Diego region as well as the estimated VMT associated with those gateways. Since the project's estimate of VMT of 20% oriented to the I-15 gateway is higher than the regional average of 1.05%, it is considered necessary to make an adjustment to the project's VMT per capita to adjust for external trips.

Step 1: Determine External VMT Occurring at Gateway

It is estimated that 20% of the project's trips will be oriented toward the I-15 gateway leading to Riverside County as opposed to the 1.05% value for the average project in the San Diego region per Exhibit 2. The external VMT can be calculated using these two values as well as the project trip generation and the average trip length at the I-15 gateway per Exhibit 2 (24.84 miles).

Per the SANDAG trip generation manual, the project daily trip generation can be calculated as follows:

Daily Trip Generation = (600 single-family units) x (10 daily trips per dwelling unit) = 6,000
The external ADT at the I-15 gateway can be determined as follows:

External ADT = (6,000 daily trips) x [(Project % Trips to External Gateway) - (Average % Trips to External Gateway)]

External ADT = (6,000) x (20.00% - 1.05%) = 1,137

The external VMT at the I-15 gateway can be determined as follows:

External VMT = (1,137 daily trips) x (24.84 miles) = 28,243

Step 2: Determine Adjusted Total Project VMT (Including VMT Occurring at External Gateway)

It is estimated that the project will have 3 residents per dwelling unit or a total of 1,800 residents. At a rate of 35.4 VMT/capita per the regional travel demand model, this indicates that the project would generate a daily adjusted VMT as follows:

Daily Unadjusted VMT = (35.4 VMT/capita) x (1,800 residents) = 63,720

Daily Adjusted VMT = 63,720 + 28,243 = 91,963

Step 3: Determine Adjusted Total VMT/Capita (Including VMT Occurring at External Gateway)

The new adjusted VMT/capita value can be determined as follows:

Daily Adjusted VMT = (91,963) / (1,800 residents) = 51.1 VMT/capita

The adjusted value of 51.1 VMT/capita may be compared to appropriate VMT averages to determine whether the project has a potentially significant VMT impact.

SAMPLE PROBLEM 2 - EMPLOYMENT PROJECT

PROJECT DESCRIPTION

This sample project consists of a 200,000 sq. ft. agricultural processing facility that is assumed to be located in unincorporated San Diego County in the community of Rainbow. It should be noted that this is a hypothetical example only since an actual project located in unincorporated San Diego would use the procedures determined by San Diego County to analyze external VMT. The project is located west of Rice Canyon Road and south of Rainbow Valley Road in Census Tract 190.02. Based on information from the SANDAG regional travel demand model at the time this sample problem was created, the year 2016 daily VMT per employee in this census tract was 31.4. It should be noted that VMT per employee values will change over time and in an actual VMT analysis, the current VMT per employee value should be used, based on guidance from the jurisdiction where the project is located. The project requires a General Plan Amendment due to a zoning change.

VMT ANALYSIS

The total daily project trip generation is based on the Manufacturing/Assembly category from the SANDAG trip generation manual and is estimated to be 4/1,000 sq. ft. or 800 daily trips. Truck trips are estimated to be 20% of the trips and they are excluded from the VMT analysis. The remainder of the trips (640 daily trips) are assumed to be employee trips.

It has been estimated that 40% of employee trips will be oriented toward the external gateway at I-15 as it crosses into Riverside County. It is concluded that the external VMT associated with trips oriented toward this gateway are substantial enough that they should be included in the project's VMT analysis.

Exhibit 2 shows the estimated percentages of trips oriented to external gateways in the San Diego region as well as the estimated VMT associated with those gateways. Since the project's estimate of VMT of 40% oriented to the I-15 gateway is higher than the regional average of 1.05%, it is considered appropriate to make an adjustment to the project's VMT per employee to adjust for external trips.

Step 1: Determine Trip Lengths for Project Trips Oriented Toward Gateway(s)

Based on Exhibit 1, the average external trip length for the I-15 gateway to Riverside County is 24.84 miles. The distance from the project site to the gateway is estimated to be 4.16 miles. The average external trip length to be used in the VMT calculations is 29.0 miles (24.84 miles plus 4.16 miles).

Step 2: Determine VMT Generated by Non-San Diego County Residents

It is estimated that the project would have an average of 320 employees. Of these, 40% are assumed to be oriented to the I-15 gateway to Riverside County. This calculation assumes that each employee makes one round trip from home to the project site each day. Some of the employees may be truck drivers. For the purposes of this calculation, it is assumed that truck drivers who are employees would be treated the same as other employees. They would be assumed to make one round trip from home to the project site each day. The daily VMT generated by non-San Diego County residents can be calculated as follows:

$$\text{Daily VMT} = (320 \text{ employees}) \times (40\% \text{ non-residents}) \times (29.0 \text{ miles}) \times (2 \text{ one-way trips per day}) = 7,424 \text{ VMT}$$

Step 3: Determine Adjusted Total Project VMT/Employee (Including VMT Generated Non-Residents of San Diego County)

The unadjusted total daily VMT of the project site based on the SANDAG model can be calculated as follows:

$$\text{Daily Unadjusted VMT} = (31.4 \text{ VMT/employee}) \times (320 \text{ employees}) = 10,048$$

It is important to include both residents and non-residents of San Diego County in this calculation. Even though VMT related to work trips for non-San Diego County residents was included in Step 2, the VMT/employee calculation in the model includes all tours made by employees during the day. Excluding non-residents from this calculation risks undercounting VMT generated by non-residents.

The adjusted project daily VMT can be determined by adding the VMT generated by non-San Diego County residents from Step 2:

$$\text{Daily Adjusted VMT} = 10,048 + 7,424 = 17,472$$

The adjusted project VMT/employee (including the effect of trips to the external gateway) can be determined as follows:

$$\text{Daily Adjusted VMT/employee} = (17,472 \text{ VMT}) / (320 \text{ employees}) = 54.6 \text{ VMT/employee}$$

The adjusted value of 54.6 VMT/employee may be compared to appropriate VMT averages to determine whether the project has a potentially significant VMT impact.

Exhibit 1
Calculation of VMT Outside San Diego Region (1)

External Gateway		2016 ADT (2)	Average Trip Length (mi)	Daily VMT	Basis for Determination of Average Trip Length
Roadway	Location				
I-8	Imperial County	16,300	69.68	1,135,784	County of San Diego Transportation Study Guidelines (Average of IX and XI Trips)
SR 78	Imperial County	1,300	56.49	73,437	County of San Diego Transportation Study Guidelines (Average of IX and XI Trips)
SR 79	Riverside County	1,800	67.13	120,834	County of San Diego Transportation Study Guidelines (Average of IX and XI Trips)
Pehanga Pkwy (3)	Riverside County	2,000	33.40	66,800	County of San Diego Transportation Study Guidelines (Average of IX and XI Trips)
I-15	Riverside County	147,000	24.84	3,651,480	County of San Diego Transportation Study Guidelines (Average of IX and XI Trips)
I-5	Orange County	138,500	61.68	8,542,680	County of San Diego Transportation Study Guidelines (Average of IX and XI Trips)
I-5	Mexico	86,000	12.94	1,112,840	Weighted average of distance between San Ysidro and Ensenada based on population (4)
Otay Truck Route	Mexico	2,400	19.42	46,608	Weighted average of distance between Otay Mesa and Ensenada based on population (4)
SR 905	Mexico	34,000	19.42	660,280	Weighted average of distance between Otay Mesa and Ensenada based on population (4)
SR 188	Mexico	8,300	56.12	465,796	Weighted average of distance between Tecate and Ensenada based on population (4)
Total				15,876,539	

(1) For comparison purposes, the total daily VMT generated within San Diego County per the ABM2/Series 14 models is 83,120,208.

(2) Based on 2016 ADT from 2016 Traffic Volumes on California State Highways.

(3) Traffic count not available. 2016 ADT estimated based on similar roadways.

(4) 2020 Population (www.macrotrends.net)

Tijuana: 2,140,000 Ensenada: 335,000 Tecate: 74,784

Distance (mi)

I-5 to Tijuana: 3.4 I-5 to Ensenada: 73.9

SR 905 to Tijuana: 10.3 SR 905 to Ensenada: 77.7

SR 188 to Tecate: 1.1 SR 905 to Ensenada: 68.4

Exhibit 2
Trip Distribution and VMT for Average Project in the San Diego Region

Roadway	Location	ADT (1)	Percentage of Total Trips	Average Trip Length	VMT
I-8	Imperial County	16,300	0.12%	69.68	1,135,784
SR 78	Imperial County	1,300	0.01%	56.49	73,437
SR 79	Riverside County	1,800	0.01%	67.13	120,834
Pehanga Pkwy (2)	Riverside County	2,000	0.01%	33.40	66,800
I-15	Riverside County	147,000	1.05%	24.84	3,651,480
I-5	Orange County	138,500	0.99%	61.68	8,542,680
I-5	Mexico	86,000	0.62%	12.94	1,112,840
Otay Truck Route	Mexico	2,400	0.02%	19.42	46,608
SR 905	Mexico	34,000	0.24%	19.42	660,280
SR 188	Mexico	8,300	0.06%	56.12	465,796
Internal Trips (3)		13,508,584	96.86%	6.15	83,120,208
Total		13,946,184	100.00%	N/A	98,996,747

(1) Based on 2016 ADT from 2016 Traffic Volumes on California State Highways.

(2) Traffic count not available. 2016 ADT estimated based on similar roadways.

(3) Based on total 2016 total simulated internal regional trips of 16,210,301 divided by 1.2 to convert to vehicle trips.