

Appendix E

Vehicle Miles Traveled (VMT) Analysis

Memorandum

Date: June 8, 2023

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Subject: City of Carlsbad Housing Element Update Transportation Modeling Considerations and Results

SD22-0437

This memorandum presents an overview of options considered for the Carlsbad Housing Element Update (HEU). There are various methods and tools available for forecasting Vehicle Miles Traveled (VMT) for a project. This memorandum explains the methods/tools considered for the City of Carlsbad HEU and the scope of work for performing the currently preferred method.

Selecting a Transportation Modeling Tool/Method

Fehr & Peers began collaborating with the City of Carlsbad on methods for forecasting VMT for the HEU in 2022. Since the HEU would require updating residential land use assumptions for the entire city, using the SANDAG model was deemed the most appropriate tool.

Background on the SANDAG Model

Using the SANDAG Model has presented significant challenges over the last two years, and these challenges have necessitated revising the approach to using the SANDAG Model to estimate VMT. The following provides a summary of the considerations/challenges using the SANDAG Model:

- The SANDAG Model goes through major version changes every time a new SANDAG Regional Plan is adopted. The most recent model version change is to the "Activity Based Model 2+" (ABM2+), which is the model that includes a scenario for the December 2021 SANDAG Regional Plan/Sustainable Community Strategy (SCS).
- The previous version of the SANDAG Model, "Activity Based Model 2" (ABM2) had limited functionality because it was an interim version that SANDAG prepared only for the Federal Regional Transportation Plan. A fundamental limitation with ABM2 is that a user is unable to make land uses changes in the model (in other words, the land use file is locked and can't be edited). Custom modeling is not available using ABM2.
- SANDAG communicated that ABM2+ would have full functionality and would have the ability to adjust and test various land use assumptions; however, adding that functionality was going to



require additional SANDAG effort and ABM2+ would not be usable for custom modeling efforts until that functionality was added. ABM2+ became the current model in December 2021; however, the full functionality of ABM2+ was not available until July 15, 2022.

- The SANDAG Service Bureau typically performs custom modeling for member agencies and private clients. Their department is short-staffed; therefore, they were not able to perform the modeling in a timely manner that they had queued for the fully functional ABM2+.
- On September 23, 2022 the SANDAG Board directed SANDAG staff to remove the “road user charge” from the 2021 Regional Plan and prepare a focused amendment to the 2021 Regional Plan. This direction requires significant revisions to the SANDAG model and resulted in SANDAG alerting all projects that were in the modeling queue that all SANDAG Service Bureau modeling would be delayed at least six more months.
- The SANDAG Service Bureau had over 12 projects in the queue for custom modeling using ABM2+, they were unable to complete any of these projects and all custom modeling work is on hold.
- An overarching challenge is that the SANDAG model is a large tool that requires specialized expertise and significant computer processing power. The model can’t be run on a standard computer, and it takes several days to completely run. Therefore, it can be cumbersome and time consuming to use.

Fall 2022 Modeling Options Considered

The SANDAG model background helps clarify why the modeling for the Carlsbad HEU has had delays and is now taking a new direction. The HEU entered into an agreement with SANDAG in April 2022 to perform the modeling and was number ten in the SANDAG Service Bureau queue. The SANDAG Service Bureau updated the schedule for performing the custom model runs several times, culminating in them canceling the contract for the Carlsbad HEU work after the SANDAG Board direction in September 2022 to remove the road user charge assumptions from the Regional Plan.

Due to this, the HEU Team again deliberated on an approach for performing the VMT analysis for the HEU. The following factors were considered:

- Schedule, especially considering the delays that have already been experienced.
- Reasonable land use assumptions.
- Use a model dataset that does not include road user charge.

In Fall 2022 the HEU Team decided to employ Fehr & Peers to perform custom model runs using ABM2+ that includes adjustments to the land use growth to reflect realistic growth assumptions in the City for a future year.

Fehr & Peers performed a detailed review of the SANDAG model assumptions including residential and employment land uses as well as policy to provide data for deciding the preferred option for performing the modeling for the HEU. **Table 1** summarizes the options considered.



Table 1: SANDAG Modeling Options Considered

Option	Land Use Summary	Model Policy/Other Inputs
<p><i>Dataset 41 - DS41</i></p> <p><i>(No Build)</i></p>	<ul style="list-style-type: none"> • Post 2021 Regional Plan Project use 	<ul style="list-style-type: none"> • No build scenario does not include the road user charge. • More consistent with the city's general plan than DS 42 • Inconsistent with the adopted 2021 Regional Plan
<p><i>Dataset 42 - DS42</i></p> <p><i>(Build, Vision)</i></p>	<ul style="list-style-type: none"> • Post 2021 Regional Plan Project use • Consistent with Sustainable Community Strategy (CSC) use 	<ul style="list-style-type: none"> • Build scenario includes road user charge. • Consistent with the adopted 2021 Regional Plan

Notes:
Source: Fehr & Peers, 2023

After evaluating the options and their respective land use and policy assumptions, the HEU team opted to use the No build DS41. This option aligns most closely with the City's general plan, and it does not include the road user charge policy. By selecting this option, the team was able to use more realistic land use assumptions while also factoring in regional transportation network investments and policies. Overall, this approach provided the most reasonable conclusion regarding VMT/GHG.

Scope of Work

The project is comprised of four distinct scenarios, each serving a unique purpose. These scenarios include the Base Year 2016 No Project Condition, Future Year Alternative 1 (No Project Alternative), Future Year Proposed Project, and Future Year with Project Alternative 2.

The first scenario, Base Year 2016 No Project Condition, is identical to the SANDAG 2016 model and has not been modified in any way. The second scenario, Year 2035 Alternative 1 (No Project Alternative), incorporates the land use and network assumptions from the SANDAG 2035 model but has been adjusted to align with the City's Adopted General Plan.


The third and fourth scenarios, Year 2035 Proposed Project and Year 2035 with Project Alternative 2, respectively, both feature the project land use assumptions based on each alternative.

To develop these scenarios, Fehr & Peers collaborated with SANDAG staff to acquire off-the-shelf model files containing the necessary model inputs and outputs for the years 2016 and 2035 related to the DS41. Once Fehr & Peers obtained all the necessary files from the SANDAG model, this data was utilized to



develop the project scenarios. Subsequently, we ran three separate models including Future Year No Project Condition, Future Year Proposed Project, and Future Year with Project Alternative 2.

Finally, the outputs generated from these model runs were used to calculate two VMT metrics: total VMT and VMT per capita. The total VMT was calculated using the CAP method, which includes all internal VMT, half of internal to external VMT, and external to internal VMT based on the model data. VMT per capita estimates the total VMT generated by the project's residents, in this case, the entire city, and is calculated by dividing the residents VMT by the number of residents.

<p>Total VMT Generated (CAP)</p>	<p>All vehicle-trips are traced to the zone or zones of study. This includes internal to internal (II), 1/2 internal to external (IX), and 1/2 external to internal (XI) trips. May use final assignment origin-destination (OD) trip tables or production (P) and attraction (A) estimates multiplied by distance skims. When the model has multiple assignment periods, OD trip tables and congested skims from each period should be used.</p>	
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Total VMT and VMT per Capita were calculated for each project scenario using the origin-destination matrices (number of trips between two TAZs) and skim matrices (length of trips between two TAZs). Total VMT was calculated by multiplying the length of each segment by the ADT of each segment and summing over the area network.

VMT results are shown in **Table 2** and **Table 3**.

Table 2: Total VMT Summary

Scenario	VMT	Change from Baseline
Base Year 2016 No Project Condition	3,262,216	-
Year 2035 Alternative 1 (No Project Alternative)	3,661,216	399,000
Year 2035 Proposed Project	3,733,018	71,802 ¹
Year 2035 with Project Alternative 2	3,733,074	71,858 ¹

Source: SANDAG, Fehr & Peers 2023

¹ change from 2035 with Adopted General Plan.



Table 3: VMT per Capita Summary

Scenario	VMT/Capita
Base Year 2016 No Project Condition	24.0
Year 2035 Alternative 1 (No Project Alternative)	24.0
Year 2035 Proposed Project	23.6
Year 2035 with Project Alternative 2	23.7

Source: SANDAG, Fehr & Peers 2023

Both Year 2035 Proposed Project and Year 2035 with Project Alternative 2 lead to a higher total volume of VMT compared to the No Project Condition in 2035. Furthermore, the VMT per Capita numbers for these alternatives are higher than 85% of the city-wide VMT per Capita numbers in the base years of 2016 and 2035. The gap between the 2035 proposed project and Alternative 2 scenarios is relatively small, as the only notable difference lies in a few residential land use assumptions.