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To: Tahoe Model Working Group
From: TRPA Staff
Subject: Tahoe Travel Demand Model - Model Day

Introduction

As part of the update to the Tahoe travel demand model, the model will be calibrated and validated using observed traffic counts from 2018. In selecting traffic counts for model validation, it is important that the time period or days of the selected traffic counts align as closely as possible to the time period which the model architecture and zonal input data represent. This time period is referred to as the 'model day'. TRPA staff conducted research and performed statistical analysis of observed 2018 traffic counts to distinguish patterns in the data to help identify a set of traffic counts that could be used to validate the travel demand model and refine the time period which the model represents. This memo presents the results of that analysis and provides context for the staff recommendation.

Background

Establishing the model day requires an understanding of the model design, travel behavior and of the overall volume of travel. To avoid biasing model calibration by the events of a single day (e.g. weather, events, or an accident) models are typically calibrated to average traffic volumes over a series of days with similar travel behaviors and traffic volumes. The suite of days which are averaged and then used to calibrate the model are collectively referred to as the "model day."

The choice of a model day should reflect the pertinent transportation conditions and problems to be addressed. In most metropolitan areas the choice of model day is simple because the most common trip-pattern is work-home-school. As a result, most regions orient their modeling programs around a typical weekday (FHWA 2010; Fehr and Peers 2019). For example, the Sacramento Area Council of Government (SACOG) models a typical weekday (Tuesday, Wednesday, Thursday) in the spring or Fall (March, April, May, September or October). These days were selected because they share similar travel behavior (commute to work, school in session) and are not generally impacted by extreme weather, high levels of workers on vacation, or weekend travel behavior (SACOG 2015). Similar model days are used by Santa Cruz County Regional Transportation Commission, San Francisco County Transportation Authority, and Regional Transportation Commission of Southern Nevada (Cambridge Systematics, Inc. 2002; Fehr & Peers 2016; RTCSNV 2016).

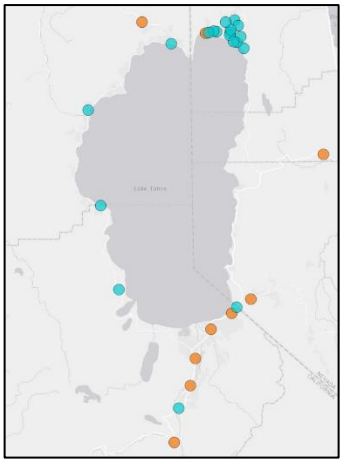
Travel patterns and volumes in Tahoe are unique; they are heavily influenced by visitors and exhibit strong seasonal fluctuations. Tahoe's transportation program emphasizes multi-modal transportation options, to reduce visitor, resident, and commuter reliance on the single occupancy vehicle. With these planning concerns in mind, the Tahoe travel demand model was designed to include both visitor and resident travel at relatively high levels. There is a short period of the time during which both residents and visitors have high levels of activity in the Region. Visitation is highest in the summer (June-

September) and resident travel is highest on workdays when school is in session. The intersection of these two time periods has been the focus of the model.

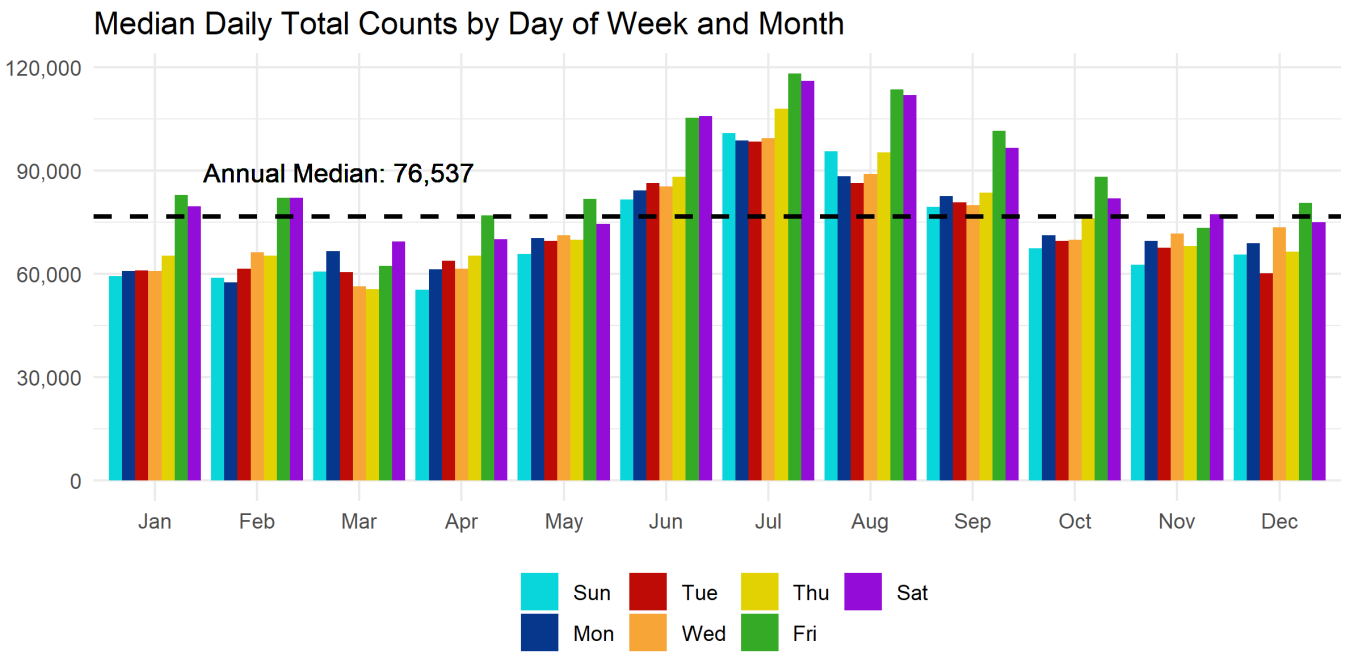
The Tahoe model was designed in several specific ways to represent this unique context. Within the model, the resident sub-model was designed to represent resident behavior on a typical workday when school is in session. Residents have distinct travel patterns depending on the day of the week or month of the year. For example, during Monday through Friday when school is in session, residents travel according to typical work and school trip patterns. On weekends and when school is not in session, resident trip patterns deviate from the norm. In Tahoe, school is in session through the second week in June and starting again the last week in August. The visitor sub-model was designed to represent visitor behavior uniformly regardless of the day of the week. For example, whether it's a Saturday or a Tuesday, visitors are typically taking similar types of trips to and from similar locations (e.g., from hotels to beaches and beaches to casinos). The model design for residents and visitors impacts how the modeled day can be formulated.

Data Analysis

To support the model day research, TRPA staff analyzed traffic count data for the nine count stations in the Tahoe Region that collected continuous, hourly data during 2018. The purpose of this analysis was to better understand fluctuations in seasonal and daily traffic volumes. Although there is available count data for over 30 locations in the region, the analysis focused on the nine stations where data was continuously collected throughout all of 2018. Data from the 30 plus stations may be used for validation but were not appropriate for this analysis. These traffic stations collected hourly count data for most days in 2018, which included ~85% of all 2018 days and hours within the 9 stations. Hourly count data for all nine count stations was summarized to daily totals and then analyzed at different scales such as day-of-week and months throughout 2018 (this is referred to as 'the dataset'). All of the count data and methodology for this analysis is published at github.com/trpa-reid/validation_traffic_counts.

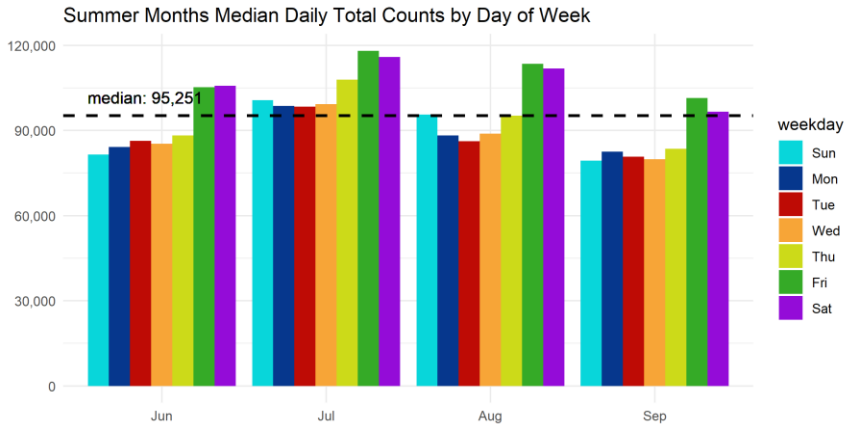


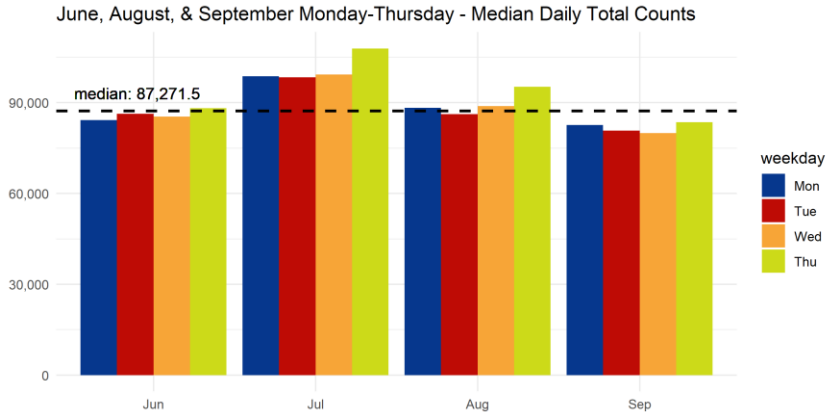
The dataset shows that traffic volumes vary throughout the year by both month and day of the week. The median daily count for 2018 was ~76,000 vehicles with a standard deviation of ~17,000 daily vehicles. The summer months (June- September) have the highest seasonal counts; all days of the week in the summer have total counts that are equal to or above the typical day (annual median). The counts for the peak summer month of July are 38 percent higher than the lowest month of year (March) and ~31-36 percent higher than the peak winter months of December, January, & February. On a weekly basis, Fridays and Saturdays exhibit the highest daily counts for all months of the year, while all other



days of the week have comparable counts depending on the month or season. For example, counts on Fridays and Saturdays are typically ~15% higher than all other days of the week throughout the year.

Due to the importance of visitation in the region, the Tahoe travel demand model has historically focused on the summer season, when visitation and traffic volumes are higher. Within that pertinent summer-time period, it is important to select days that have comparable traffic counts, so that the average of those days represents a typical and meaningful day. The dataset demonstrates that all days in July are notably higher than all other days of the summer; this indicates that July may be excluded from the model day. Moreover, traffic counts for Fridays and Saturdays for all months of the summer are higher than a typical summer day (summer median), which indicates that these days may potentially be excluded. Out of all days of the week throughout the summer, Mondays, Tuesdays, Wednesdays, and Thursdays in June, August, and September are the most similar.





In addition to comparable traffic counts the selected days need to represent consistent traveler behavior. The Tahoe Model's resident sub-model is designed around resident behavior on a weekday when school is in session, which means that

Saturdays, Sundays, and weeks when school was not in session are not suitable for model calibration or validation. As a result, the model day should potentially exclude Saturdays and Sundays. Lastly, the first week of September should also be potentially excluded because of the impact of the Labor-Day holiday which exhibits unusually high traffic counts and different travel patterns.

Options

Given these considerations, TRPA staff recommend consideration of two potential options for defining the model day. For both options, TRPA staff recommend using the first two weeks of June, the last week of August, and the 2nd and 3rd weeks of September. During these weeks, school is in session in Tahoe and visitation is relatively high.

Option 1: Mondays through Thursdays - With this option, there is a relatively small variation between traffic volumes over these days (standard deviation (SD) = 2,667 & coefficient of variation (CV) = 3%) and a large enough sample of days (20) to create a meaningful average. For comparison, the standard deviation for all days of 2018 was over 17,000 (CV = 22%) and almost 12,000 (CV=12%) for all days in August. Compared to most other potential time periods to model, the variation within this option is very small. This option represents the 66th percentile of days annually, or the 106th busiest day of the year.

Option 2: Fridays – Including only Fridays would result in a higher traffic volume day. This option represents the 88th percentile or the 38th busiest day of the year. This model day has higher variation between observed days (SD = 11,603 and CV = 11%) and a smaller sample size (5 days). As a result, this day may be less representative of an actual day compared to the first option, because it is more likely to be influenced by outlier traffic conditions (e.g., construction, accident).

In conclusion, TRPA staff recommend two potential options for the model day. Both options include relatively high levels of visitation and traffic volume. The first option represents a typical early/late summer weekday while the second represents a typical early/late summer Friday. Staff does not

Comparison of time periods - unless noted, the time period only includes days from the five recommended weeks: first two weeks of June, last week of August, and middle two weeks of September.

Time Period	Number of Days	Mean	Median	Standard Deviation	Coefficient of Variation	Percentile	Day Ranked
Fridays	5	100,902	103,615	11,603	0.11	0.88	38
Saturdays & Sundays	10	97,240	97,136	10,887	0.11	0.84	49
All Days in August	28	97,312	95,444	11,637	0.12	0.84	49
All Summer Days (June-Sep)	115	95,511	95,251	11,941	0.13	0.82	55
All Summer Weekdays (June-Sep, Mon-Thurs)	63	90,674	88,652	8,992	0.10	0.77	71
Mondays-Fridays	24	86,878	83,556	9,127	0.11	0.72	87
Mondays-Thursdays	20	83,171	82,812	2,667	0.03	0.66	106
Mondays-Wednesdays	15	82,309	82,160	1,989	0.02	0.63	114
All Days in 2018	312	78,454	76,537	17,007	0.22	0.52	151

recommend including all weekdays (Monday -Friday) because traffic volumes on Friday are significantly different from the other weekdays. Although the two options are different, both are grounded in observed traffic counts as well as the travel behavior established in the model design. Moreover, both options have tradeoffs and may require factors or adjustments depending on the model application.

Conclusion

With these considerations in mind, TRPA staff have decided to refine the existing model day to represent an early/late summer weekday (option 1) and validate the model with traffic counts from Monday thru Thursday for the first two weeks of June, last week of august, and middle two weeks of September. This refinement of the Tahoe model better reflects the model design, standard industry practice and will make the model better suited for various model applications. This decision is based upon stakeholder feedback from the November 2019 Model Working Group Meeting, as well as advice from WSP. Staff received stakeholder feedback that favored both of the model day options, while WSP recommended Monday-Thursday because it better aligns with industry practice and will enable optimal validation under the existing model design.

This refinement of the model day represents a change from the historic validation methodology. For the last two major model runs (2012 & 2017), the model was validated with peak monthly average daily traffic (peak MADT), which represented the average of all days in the peak month (July or august). This approach is imperfect because it creates a 'composite' or 'amalgam' day that does not align with the model architecture. The refined approach for model validation, using only the days during the summer when school is session, is an improvement which creates a model time period that is much more consistent with the model design.

This refinement in the validation methodology will improve confidence in the model and will enable use of the model for a variety of applications:

Regional Transportation Plan / Sustainable Communities Strategy (RTP/SCS) - The RTP/SCS requires per capita GHG reductions to be achieved in 2020 and 2035. Targets are expressed as a percent change in per capita passenger vehicle greenhouse gas emissions relative to 2005. The targets established for the TRPA region – which will remain unchanged - are an 8% reduction by 2020 and 5% by 2035. These GHG targets are based upon modeled VMT and fleet mix. Due to the improvements that were made to the model in 2019, the 2005 inputs will be re-ran using the updated model. Therefore, the refinement of the model day will not impact the RTP/SCS GHG analysis.

Threshold Evaluation – The VMT threshold standard uses a 1981 benchmark. The existing methodology assumes that the ratio between today's traffic counts and 1981 traffic counts is the same as the ratio between today's VMT and 1981 VMT. The threshold standard is evaluated by calculating the ratio of current year modeled VMT (2018) and current day traffic counts (2018) in relation to 1981 traffic counts. Therefore, the days in which the model will be validated does not impact the threshold evaluation VMT methodology.

Project Analysis - Project evaluation currently proceeds under the interim guidance. TRPA and its partners continue to work towards improving the model for use in project level evaluation. When the model is ready for use in project level evaluation, its application to project level evaluation will reflect

the model day and will likely require adjustments for assessing impacts outside of the model time period.

References

Cambridge Systematics, Inc. 2002. San Francisco Travel Demand Forecasting Model Development. San Francisco County Transportation Authority.

Fehr & Peers. 2016. Santa Cruz County Travel Model Development Report. Santa CruzCounty Regional Transportation Commission, Santa Cruz, CA.

Fehr and Peers. 2019. VMT Analysis in the Lake Tahoe Basin. Fehr and Peers, Roseville, CA.

FHWA. 2010. Travel Model Validation and Reasonability Checking Manual Second Edition. Federal Highway Administration, U.S. Department of Transportation. Available from https://connect.ncdot.gov/projects/planning/TPB%20Training%20Presentations/FHWA%20Model%20Validation%20Handbook.pdf.

RTCSNV. 2016. Access 2040 – Appendix E – Travel Demand Model & Air Quality Conformity Analysis Technical Report. Regional Transportation Commission Of Southern Nevada, Las Vegas, NV. Available from http://www.rtcsnv.com/wp-content/uploads/2016/11/Appendix_E_Model_Technical_Report.pdf.

SACOG. 2015. Sacramento Activity-Based Travel Simulation Model (SACSIM15): Draft Model Reference Report. Sacramento Area Council of Governments.