

## **Appendix D**

# **VMT Estimates for Days of Air Quality Monitoring – 2003 to 2011 (LSC, 2013)**

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## TRANSPORTATION PLANNING AND TRAFFIC ENGINEERING CONSULTANTS

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### MEMORANDUM

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To: Jen Daugherty, Associate Planner, Town of Mammoth Lakes  
From: Gordon Shaw, PE, AICP, LSC Transportation Consultants, Inc.  
Date: April 25, 2013  
RE: VMT Estimates for Days of Air Quality Monitoring – 2003 to 2011

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Per your request, LSC Transportation Consultants, Inc. has conducted an analysis to estimate Vehicle-Miles of Travel (VMT) in the Mammoth Lakes area on days that air quality filter samples were collected between 2003 and 2011. The goal of this work is to provide the Town and the Great Basin Unified Air Pollution Control District with data needed to evaluate observed air quality against vehicle travel in the area.

LSC has developed a detailed, state-of-the-practice computerized model of traffic activity in the Mammoth Lakes area (most recently updated in 2011). This model, based on the TransCAD software, provides estimates of traffic volumes on every roadway in the area, based on a detailed calibration of existing land uses with existing observed traffic counts. In addition to providing a means of forecasting traffic volumes based on future changes in land uses, this model provides an estimate of total VMT for existing conditions.

The model is calibrated to reflect a single design period, specifically the average winter Saturday. The VMT associated with this design period is estimated to be 114,192. As the model only provides a VMT estimate for a single day, it is not possible to use regression analysis to develop a forecasting methodology of VMT dependent on other observable factors. Instead, the model structure and information on overall mobility patterns in Mammoth Lakes was used to develop an estimation methodology.

Table A presents available data for the various days on which air quality samples were collected. This includes the following:

- Daily traffic count data collected by Caltrans along SR 203 (Main Street) at three locations (just west of US 395, just west of Old Mammoth Road, and just east of Minaret Road).
- Daily skier figures.
- Daily sewage flows.

All three of these data sets have a correlation with total VMT. The single best indicator of VMT

is the total traffic volume observed at the three count locations, as it is a direct measure of vehicle travel.

Differences in total VMT throughout the entire street network, however, is not simply a direct function of traffic volumes observed on SR 203, as a relatively high proportion of traffic on the state highway is generated by visitors when compared with other roadways serving residential neighborhoods. Estimating VMT on various days is improved by considering a “base” VMT generated by residents (which is relatively constant, at least over the busy winter ski season when the air quality samples were collected) and a more variable VMT component generated by visitors.

The TransCAD model provides estimates of the overall proportion of VMT generated by residents versus visitors. Specifically, the vehicle trip generation of the various residential and lodging categories can be used to estimate that 53 percent of VMT is associated with visitors and 47 percent with residents.

In considering how resident VMT varies on the various air sample days, two factors were addressed:

- As the model design day is for an average winter Saturday, it does not reflect work trips of residents that work typical Monday to Friday work weeks. An air sample day that is a typical workday would therefore have additional resident-generated VMT associated with work trips (all other factors being equal) that is not reflected in the model estimate. US Census economic data (as presented in the American Factfinder website) was reviewed to establish that 10.5 percent of Mammoth Lakes jobs are in classifications that have typical work weeks (such as office jobs), while the large majority are employed in classifications such as retail and dining that have peak employment on the design day. Furthermore, the traffic model indicates that approximately 20 percent of resident-generated travel is associated with work trips. This indicates that, all else being equal, a day during the typical work week would generate 2 percent more resident VMT than the average winter Saturday design day.
- As the model estimate is based on 2010 data, it reflects the population of Mammoth Lakes in 2010. Earlier sample days should reflect that population has grown over time, and thus the resident-generated VMT can be assumed to have grown. A review of US Census data (collected near the end of the ski season) indicates a 2000 Mammoth Lakes population of 7,093 and a 2010 population of 8,234, corresponding to a 1.4 percent annual average growth in population.

This information was used to estimate VMT for the various sample days as follows:

1. The model design day value of total traffic counts shown in Table A (31,547) was factored by 0.47 to estimate the proportion associated with resident trips (14,827).
2. As shown in Table B, the day-of-week and annual population growth factors were applied to estimate the total traffic counts generated by residents.
3. Visitor-related total traffic counts were calculated by subtracting resident-related volumes from the total Caltrans counts (as presented in Table A).
4. Resident VMT was calculated by factoring the total resident VMT on the model design day (53,670) by the ratio of the estimated resident total traffic count on the specific air

sample day to the resident total traffic count on the model design day.

5. Similarly, visitor VMT was calculated by factoring the total resident VMT on the model design day (60,522) by the ratio of the estimated visitor total traffic count on the specific air sample day to the visitor total traffic count on the model design day. In reviewing the results, however, the estimate for 2/17/2003 stood out as an "outlier" with high traffic volumes (the highest of any of the sample days) but low skier activity (the lowest of the dataset) and low sewer flow (second lowest of the data set). This specific date was the end of the three-day Presidents Day weekend. A review of the directional traffic counts indicates that there was a high exiting (eastbound) volumes at US 395, consistent with skiers leaving at the end of the long weekend. As the skier visit data indicates that a low proportion of these visitors were not skiing, it is reasonable to assume that they left relatively early in the day and thus were not making multiple trips through the community. A reduction factor of 0.33 was applied, based upon the relative proportion of skier visits on the day in question compared with the skier visit value on the design day and assuming that visitors departing the area early have half the VMT impact per observed vehicle than is typical.
6. Adding the resident VMT and the visitor VMT results in the total estimated VMT, as shown in Table B and Figure A.

**TABLE A: Available Input Data**

Date	Daily 2-Way Traffic Volume on SR 203						Sum	Skier visits	Flow KGPD
	Just West of Old		Just East of		Just West of US				
	Mammoth Road	Minaret Road	Minaret Road	395	395	Sum			
2/17/2003	18,808	15,261	15,261	12,259	12,259	46,328	4,224	1,374	
1/13/2005	15,682	10,430	10,430	7,950	7,950	34,062	5,795	1,607	
1/19/2005	14,777	10,620	10,620	7,103	7,103	32,500	4,312	1,362	
1/22/2005	16,019	13,599	13,599	7,881	7,881	37,499	15,152	2,052	
2/9/2008	17,841	14,945	14,945	9,371	9,371	42,157	15,980	2,039	
2/27/2008	13,604	9,458	9,458	7,138	7,138	30,200	4,237	1,263	
2/21/2009	15,457	13,742	13,742	8,000	8,000	37,199	14,522	2,019	
1/2/2010	17,892	15,909	15,909	10,640	10,640	44,441	14,851	2,118	
2/13/2010	18,096	16,080	16,080	8,940	8,940	43,116	19,676	2,523	
1/12/2011	11,956	8,809	8,809	5,935	5,935	26,700	4,983	966	
Typical Winter Saturday (Model)	13,080	11,455	11,455	7,012	7,012	31,547	12,276		

**TABLE B: VMT Estimates on Air Sample Days**

Date	Resident Factors		Total Count Volume		Model VMT Estimate		
	Day of Week Factor	Year Factor	Resident	Visitor	Resident	Visitor	
			Volume Estimate	Volume Estimate	Volume Estimate	Volume Estimate	
2/17/2003	1.00	0.90	13,389	32,939	48,464	80,128	128,593
1/13/2005	1.02	0.93	14,086	19,976	50,987	72,309	123,296
1/19/2005	1.02	0.93	14,086	18,414	50,987	66,655	117,642
1/22/2005	1.00	0.93	13,800	23,699	49,952	85,786	135,737
2/9/2008	1.00	0.97	14,416	27,741	52,183	100,414	152,597
2/27/2008	1.00	0.97	14,416	15,784	52,183	57,134	109,317
2/21/2009	1.00	0.99	14,622	22,577	52,927	81,725	134,651
1/2/2010	1.00	1.00	14,827	29,614	53,670	107,195	160,866
2/13/2010	1.00	1.00	14,827	28,289	53,670	102,399	156,070
1/12/2011	1.02	1.01	15,344	11,356	55,542	41,105	96,647
Typical Winter Saturday (Model)			14,827	16,720	53,670	60,522	114,192

**Figure A: Estimated Mammoth Lakes VMT on Air Sample Days**

