Mountain Area Transportation Study

Model Methodology and Assumptions| Final



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Submitted to:

sb cta
san bernardino county transportation authority

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ABBREVIATIONS

HBO	Home-Based Other
HBW	Home-Based Work
MATS	San Bernardino County Mountain Area Transportation System
NHB	Non-Home Based
SBCTA	San Bernardino County Transportation Authority
SBTAM	San Bernardino Transportation Analysis Model
SED	Socioeconomic Data
TAZ	Transportation Analysis Zone

1.0 OVERVIEW

This report presents the methodology and results of the travel model tool developed for the San Bernardino County Mountain Area Transportation Study (MATS). The purpose of the travel model spreadsheet tool is to provide the ability to forecast areas of hot spot congestion with a known number of visitors.

Visitors to the area make up a large portion of the needs assessment, as the full-time population and associated employment are relatively low. Peak winter and summer months experience a substantial increase in traffic congestion for extended periods of time as visitors and associated additional employees access the MATS communities. In addition, the traffic congestion caused by visitors has the potential to discourage would-be visitors, hindering the local economy.

Studies show that in 2012, the City of Big Bear Lake had a full-time population of 5,100 in approximately 2,200 households with a year-long employment of 3,800. In 2012, the City of Big Bear Lake served approximately 10,000 visitors on a typical day. However, during a peak season weekday for 2012, the City of Big Bear Lake had employment of approximately 5,800 while serving nearly 60,000 visitors. In 2040, visitors are expected to increase to over 76,000 (an increase of over 25 percent).

The geographic study area for MATS is shown in **Figure 1-1**, and is located solely within San Bernardino County, and is comprised of many communities. The MATS area stretches from the Los Angeles County Line on the west to the Lucerne Valley on the east. The communities within the MATS area include: Wrightwood, Crestline, Blue Jay, Lake Arrowhead, Running Springs, Green Valley Lake, Arrowbear, Big Bear City, and the City of Big Bear Lake.

The MATS area is traditionally a vacation area for all residents of Southern California (and beyond), yet the residents of the MATS area make up less than five percent (5%) of the population of San Bernardino County. **Figure 1-2** shows the population densities for San Bernardino County, as shown in the 2015 San Bernardino Countywide Transportation Plan. This difference in demand (visitors) and available service (residents) creates a unique challenge for providing adequate transportation services to meet the needs of both visitors and residents. Not to mention that the visitor needs are seasonal and resident needs are year-round.

The San Bernardino County Transportation Authority (SBCTA) maintains a regional model; however, it does not have the ability to accurately forecast peak season conditions, or weekend conditions. This report documents the development of MATS Travel Model Tool (MATS Model). The MATS Model is a focused model which takes a simplistic approach to a traditional four-step travel demand model, and includes only major facilities. The MATS Model is validated to a base year of 2015, and includes a forecast year of 2040. The MATS Model does not include a feedback loop, and takes approximately 5 minutes to complete a full model run. The MATS Model is fully developed within an excel spreadsheet with visual basic macros, and provides a user-friendly interface.

Figure 1-1: Study Area

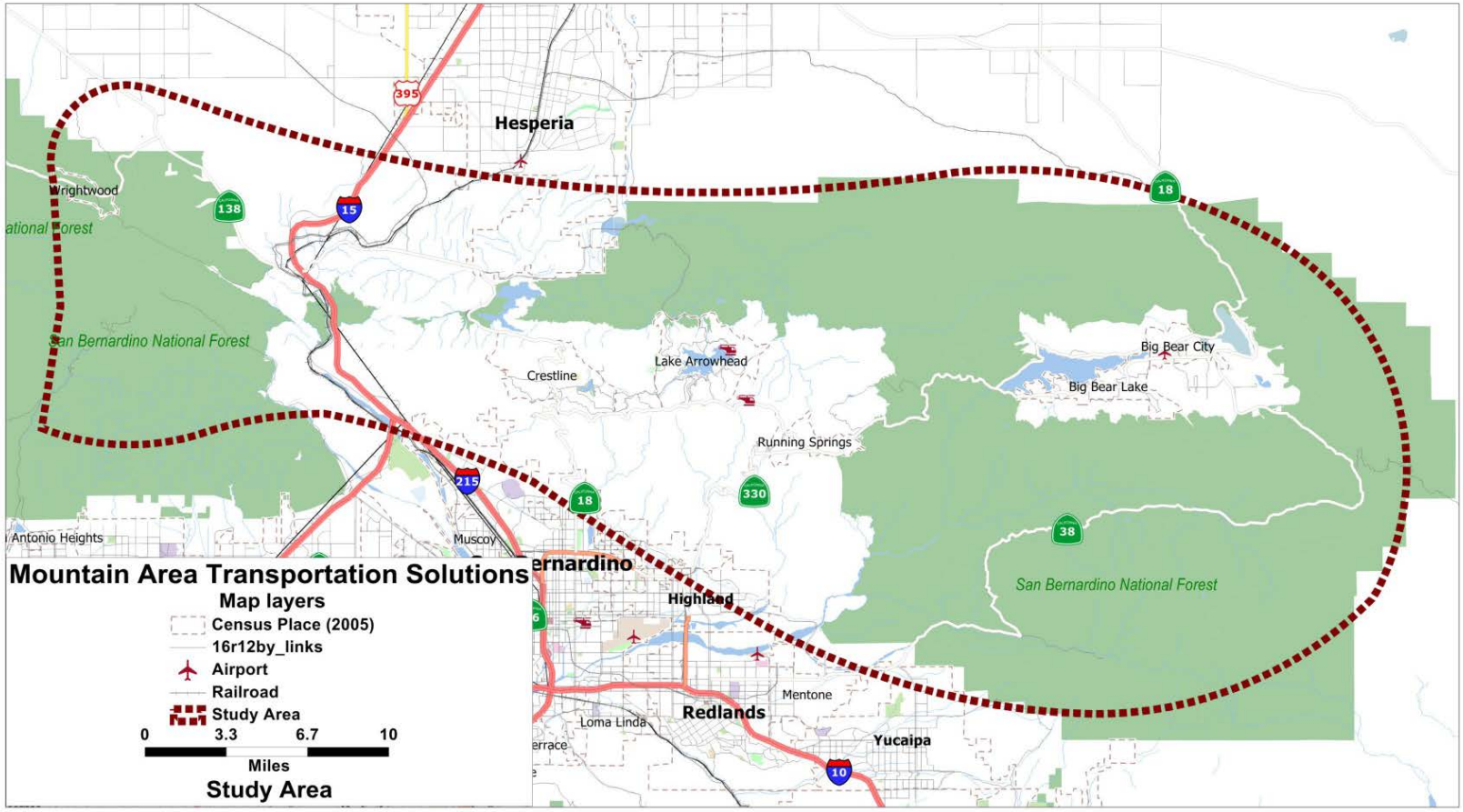
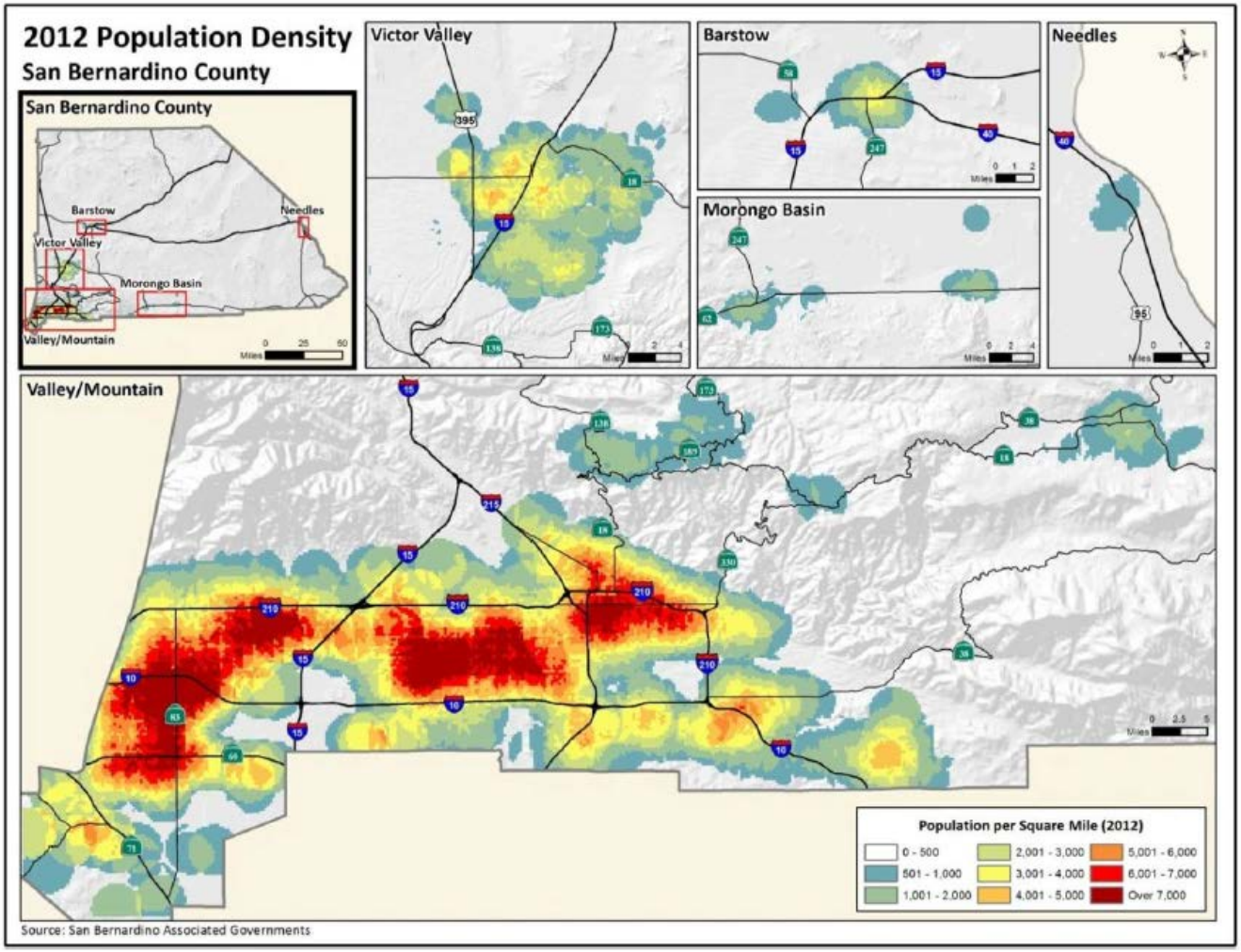


Figure 1-2: San Bernardino County Population Density



1.1 Project Objective and Tasks

The primary objective of the MATS project is to conduct a transportation needs study for the MATS area that identifies key projects that address both existing and forecast transportation deficiencies during both peak summer and winter seasons. Based on an analysis of potential improvements, an implementation plan will be developed for future improvements considering implementation timeframe, prioritization, and potential funding sources. The key tasks of the project include:

- **Assessment of Existing Conditions.** Define the existing transportation setting in terms of infrastructure and performance.
- **Development of Refined Traffic Forecasts.** Develop a modeling tool to ensure reasonable future traffic volume forecasts throughout the MATS area.
- **Identification and Costing of Transportation Projects.** Identify improvement projects to address existing and future problem locations throughout the MATS area.
- **Analysis of Transportation Projects.** Evaluate future transportation conditions under peak weekday and weekend seasonal traffic volumes.
- **Recommendations and Implementation Plan.** Generate recommended future infrastructure improvements based on the needs assessment.

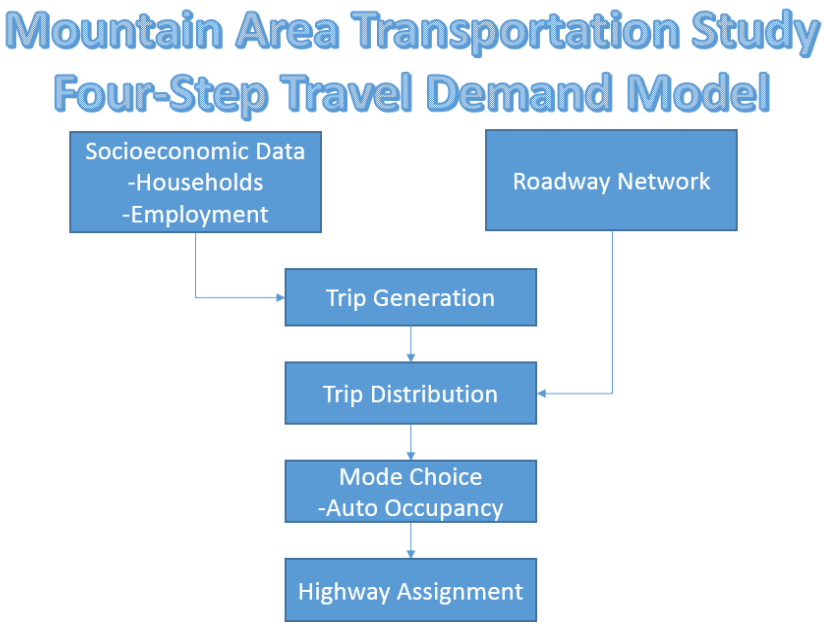
1.2 Model Process

The following list, organized in the traditional four-step modeling process, highlights the various components and sub-components of the MATS Model. Various components are also identified as to their role, type and function (e.g. inputs, process and outputs, etc.).

- Trip Generation
  - Socioeconomic (SED) data (input)
  - Trip production models for Residents, Visitors, and External-Internal/Internal-External Trips
  - Regression trip attraction models based on household and employment data
  - Total person trips stratified into 3 trip purposes
    - Home-Based Work (HBW)
    - Home-Based Other (HBO)
    - Non-Home Based (NHB)
- Trip Distribution
  - Friction factors by trip purpose
  - Gravity model trip distribution by trip purpose
- Trip Assignment
  - External trips from external model (input)

A summary flow chart of the key components of the MATS Model process is presented in **Figure 1-3**.

Figure 1-3: MATS Model Structure Flow Chart



1.3 Study Periods

The MATS Model structure is prepared to present daily forecasts for peak and off-peak seasons. The days that are forecast are an average weekday, as well as a typical Friday, Saturday, and Sunday.

2.0 MATS TRANSPORTATION ANALYSIS ZONE STRUCTURE

Transportation Analysis Zones (TAZs) are geographic areas dividing a planning region into relatively similar areas of land use and land activity. In general, a TAZ should be homogenous in land use and represent similar level of future population and employment. TAZs are often defined by major roadways or physical features (e.g., rivers and lakes) and county and other political boundaries.

The TAZs within the MATS Model were developed by aggregating San Bernardino Transportation Analysis Model (SBTAM) model TAZs into homogenous TAZs that represent the MATS area with as few TAZs as possible. The MATS Model TAZs were developed to accurately reflecting existing and future development patterns, while at the same time reflecting different land use levels and type of trip generation and distribution patterns. **Figure 2-1** shows the MATS TAZ boundaries.

In the MATS Model, there are 8 external stations and 15 internal TAZs.

Each TAZ maintains SED data for 2015 and 2040. The SED for 2012 and 2040 were obtained from SBCTA, and the year 2015 data was developed as a straight-line interpolation between 2012 and 2040. **Table 2-1** summarizes the zonal information for 2015, and **Table 2-2** summarizes the zonal information for 2040.

The information shown in **Tables 2-1** and **2-2** represent both off-peak season and peak season data. The peak season data for employment assumed to be 50 percent higher for both retail and non-retail employment, to be able to handle the addition of visitors to the MATS area.

Table 2-3 represents the growth in off-peak season socioeconomic data.

Figure 2-1: Transportation Analysis Zones

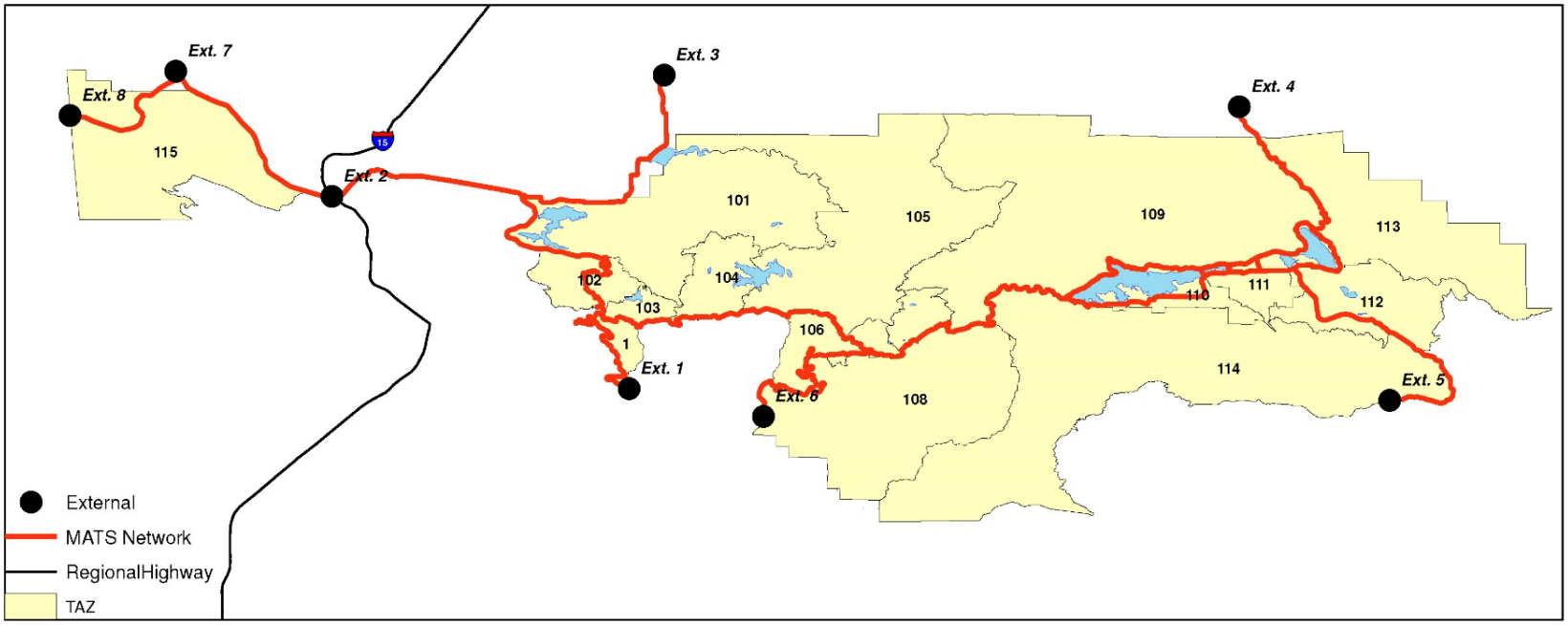


Table 2-1: 2015 Socioeconomic Data

Zone Number	Description	Population	Number of Households	Off-Peak Season Retail Employment	Off-Peak Season Non-Retail Employment	Peak Season Retail Employment	Peak Season Non-Retail Employment
1	External: SR-18 South (San Bernardino)	224	88	7	28	11	42
2	External: I-15 @ SR-138/SR-2	0	0	0	0	0	0
3	External: SR-173 (Hesperia)	0	0	0	0	0	0
4	External: SR-18 North (Lucerne Valley)	0	0	0	0	0	0
5	External: SR-38 (Redlands)	0	0	0	0	0	0
6	External: SR-330 (Highland)	0	0	0	0	0	0
7	External: SR-138 (North of SR-2)	0	0	0	0	0	0
8	External: SR-2 (West of Wrightwood)	0	0	0	0	0	0
101	Silverwood Lake	488	165	0	102	0	153
102	Crestline (West)	6,292	2,514	215	985	323	1,478
103	Crestline (East)	4,181	1,666	102	679	153	1,019
104	Lake Arrowhead	8,464	3,122	505	4,264	758	6,396
105	Lake Arrowhead (East)	4,222	1,576	95	1,175	143	1,763
106	Running Springs @ SR-330	1,973	776	43	857	65	1,286
107	Running Springs @ SR-18	2,249	872	4	331	6	497
108	Green Valley Lake	1,561	630	55	206	83	309
109	Fawnskin	1,902	808	64	389	96	584
110	Big Bear Lake	5,247	2,261	702	3,241	1,053	4,862
111	Big Bear City	5,370	2,077	124	1,089	186	1,634
112	Sugarloaf	5,918	2,413	29	214	44	321
113	Baldwin Lake	731	272	2	56	3	84
114	Ski Areas	997	368	3	138	5	207
115	Wrightwood	4,910	1,969	51	570	77	855
Total MATS Area:		**54,729**	**21,577**	**2,001**	**14,324**	**3,002**	**21,486**

Table 2-2: 2040 Socioeconomic Data

Zone Number	Description	Population	Number of Households	Off-Peak Season Retail Employment	Off-Peak Season Non-Retail Employment	Peak Season Retail Employment	Peak Season Non-Retail Employment
1	External: SR-18 South (San Bernardino)	1,100	424	4	64	6	96
2	External: I-15 @ SR-138/SR-2	0	0	0	0	0	0
3	External: SR-173 (Hesperia)	0	0	0	0	0	0
4	External: SR-18 North (Lucerne Valley)	0	0	0	0	0	0
5	External: SR-38 (Redlands)	0	0	0	0	0	0
6	External: SR-330 (Highland)	0	0	0	0	0	0
7	External: SR-138 (North of SR-2)	0	0	0	0	0	0
8	External: SR-2 (West of Wrightwood)	0	0	0	0	0	0
101	Silverwood Lake	614	203	2	125	3	188
102	Crestline (West)	6,336	2,526	202	1,027	303	1,541
103	Crestline (East)	4,200	1,674	181	627	272	941
104	Lake Arrowhead	8,632	3,182	678	4,249	1,017	6,374
105	Lake Arrowhead (East)	4,462	1,663	107	1,185	161	1,778
106	Running Springs @ SR-330	2,013	790	35	913	53	1,370
107	Running Springs @ SR-18	2,268	879	18	360	27	540
108	Green Valley Lake	2,340	919	26	389	39	584
109	Fawnskin	2,051	863	98	371	147	557
110	Big Bear Lake	6,766	2,927	871	4,388	1,307	6,582
111	Big Bear City	5,500	2,132	168	1,072	252	1,608
112	Sugarloaf	6,541	2,640	8	252	12	378
113	Baldwin Lake	1,677	613	2	80	3	120
114	Ski Areas	4,601	1,650	18	209	27	314
115	Wrightwood	5,161	2,060	122	543	183	815
Total MATS Area:		**64,262**	**25,145**	**2,540**	**15,854**	**3,810**	**23,781**

Table 2-3: Growth in Socioeconomic Data (2015 to 2040)

Zone Number	Description	Population		Number of Households		Off-Peak Season Retail Employment		Off-Peak Season Non-Retail Employment	
		Delta	Percent	Delta	Percent	Delta	Percent	Delta	Percent
1	External: SR-18 South (San Bernardino)	876	391%	336	382%	-3	-43%	36	129%
2	External: I-15 @ SR-138/SR-2	0	0%	0	0%	0	0%	0	0%
3	External: SR-173 (Hesperia)	0	0%	0	0%	0	0%	0	0%
4	External: SR-18 North (Lucerne Valley)	0	0%	0	0%	0	0%	0	0%
5	External: SR-38 (Redlands)	0	0%	0	0%	0	0%	0	0%
6	External: SR-330 (Highland)	0	0%	0	0%	0	0%	0	0%
7	External: SR-138 (North of SR-2)	0	0%	0	0%	0	0%	0	0%
8	External: SR-2 (West of Wrightwood)	0	0%	0	0%	0	0%	0	0%
101	Silverwood Lake	126	26%	38	23%	2	0%	23	23%
102	Crestline (West)	44	1%	12	0%	-13	-6%	42	4%
103	Crestline (East)	19	0%	8	0%	79	77%	-52	-8%
104	Lake Arrowhead	168	2%	60	2%	173	34%	-15	0%
105	Lake Arrowhead (East)	240	6%	87	6%	12	13%	10	1%
106	Running Springs @ SR-330	40	2%	14	2%	-8	-19%	56	7%
107	Running Springs @ SR-18	19	1%	7	1%	14	350%	29	9%
108	Green Valley Lake	779	50%	289	46%	-29	-53%	183	89%
109	Fawnskin	149	8%	55	7%	34	53%	-18	-5%
110	Big Bear Lake	1,519	29%	666	29%	169	24%	1,147	35%
111	Big Bear City	130	2%	55	3%	44	35%	-17	-2%
112	Sugarloaf	623	11%	227	9%	-21	-72%	38	18%
113	Baldwin Lake	946	129%	341	125%	0	0%	24	43%
114	Ski Areas	3,604	361%	1,282	348%	15	500%	71	51%
115	Wrightwood	251	5%	91	5%	71	139%	-27	-5%
Total MATS Area:		**9,533**	**17%**	**3,568**	**17%**	**539**	**27%**	**1,530**	**11%**

3.0 MATS HIGHWAY NETWORK

Accurate transportation modeling requires that the transportation highway network represents the same time horizon as the land-use data that is used to estimate travel demand. The attributes of links (such as speed, functional classification, and number of lanes) were updated to reflect the existing conditions in the MATS Study Area. **Figure 3-1** shows the existing MATS highway network.

Capacity assumptions for the roadway network were obtained from the City of Big Bear Lake General Plan, and are shown in **Table 3-1**. As a note, it is assumed that the winter conditions results in a 10 percent reduction in daily capacity when compared to summer months.

Table 3-1: Daily Roadway Capacities

Roadway Type	Travel Lanes	Summer Capacity	Winter Capacity
2-lane Undivided	2U	13,000	11,700
2-lane Undivided (with passing lane)	2U-P	18,000	16,200
2-lane Divided	2D	18,000	16,200
3-lane Divided	3D	21,000	18,900
4-lane Undivided	4U	25,000	22,500
4-lane Divided	4D	37,500	33,800

Table 3-2 summaries the existing highway network by function classification for the MATS Model.

Figure 3-1: Existing Highway Network

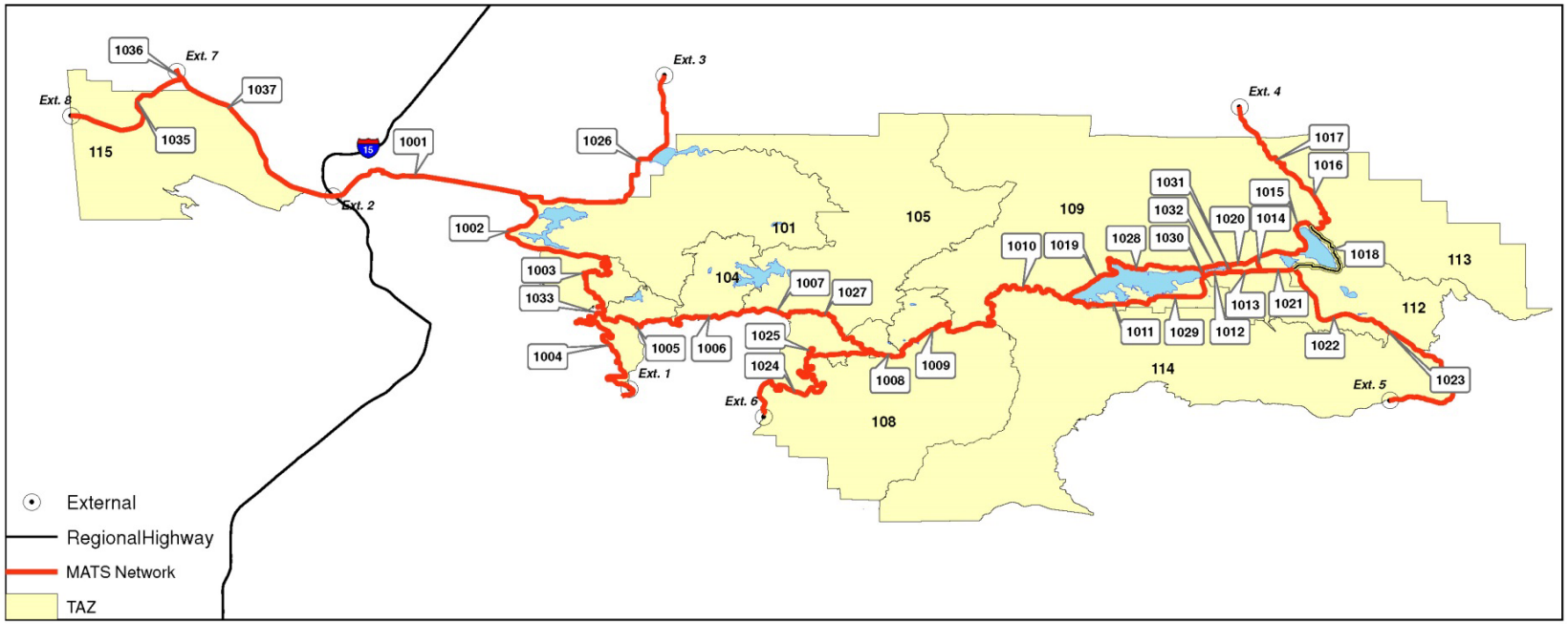


Table 3-2: Existing Highway Network Attributes

LINK ID	Location	Distance (Miles)	Facility Type	Daily Capacity (Vehicles)
1001	SR 138 Between I-15 and SR 173	11.5	2U Highway	13,000
1002	SR 138 Between SR 173 and Cleghorn Road	4.5	2U Highway	13,000
1003	SR 138 Between Cleghorn Road and Knapps Cutoff/Lake Drive	16.0	2U Highway	13,000
1033	SR 138 Between Knapps Cutoff/Lake Drive and SR 18	1.5	2U Highway	13,000
1004	SR 18 Between Old Waterman Canyon Road and SR 138	4.5	4U Highway	25,000
1005	SR 18 Between SR 138 and Lake Gregory Drive / SR 189	3.0	2U Highway	13,000
1006	SR 18 Between Lake Gregory Drive / SR 189 and SR 173	4.0	2U Highway	13,000
1007	SR 18 Between SR 173 and Live Oak Drive (Running Springs)	5.5	2U Highway	13,000
1027	SR 18 Between Live Oak Drive (Running Springs) and SR 330	2.0	2U Highway	13,000
1008	SR 18 Between SR 330 and Conifer Camp Road	1.5	2U Highway	13,000
1009	SR 18 Between Conifer Camp Road and Snow Valley Driveway	4.0	2U Highway	13,000
1010	SR 18 Between Snow Valley Driveway and SR 38	7.5	2U (with passing lane) Highway	18,000
1011	SR 18 Between SR 38 and Village Drive	4.0	2U-4U Highway	19,000
1029	SR 18 Between Village Drive and Standfield Cutoff	3.0	4D Highway	37,500
1030	Stanfield Cutoff Between SR 18 and SR 38	0.5	2U Highway	13,000
1012	SR 18 Between Standfield Cutoff and Division Drive	1.5	2U Highway	13,000
1031	Division Drive Between Big Bear Boulevard / SR 18 and North Shore Drive / SR 38	0.5	2U Highway	13,000
1013	SR 18 Between Division Drive and Greenway Drive / SR 38	1.5	2U Highway	13,000
1014	SR 18/Greenway Drive Between Big Bear Boulevard / SR 38 and North Shore Drive / SR 38	1.0	2U Highway	13,000
1015	SR 18/North Shore Drive Between Greenway Drive and Baldwin Lake Road	4.0	2U Highway	13,000
1016	SR 18/North Shore Drive Between Baldwin Lake Road and Marble Canyon Road	8.0	2U Highway	13,000
1017	SR 18/North Shore Drive Between Marble Canyon Road and SR 247	8.5	2U Highway	13,000
1018	Baldwin Lake Road Between SR 38 and SR 18	5.5	2U Arterial	13,000
1019	SR 38 Between SR 18 and Fawnskin	3.5	2U Highway	13,000
1028	SR 38 Between Fawnskin and Standfield Cutoff	4.5	2U Highway	13,000
1032	SR 38 Between Standfield Cutoff and Division Drive	1.5	2U Highway	13,000

LINK ID	Location	Distance (Miles)	Facility Type	Daily Capacity (Vehicles)
1020	SR 38 Between Division Drive and Greenway Drive	1.5	2U Highway	13,000
1021	SR 38 Between Greenway Drive and Shay Road	1.0	2U Highway	13,000
1022	SR 38 Between Shay Road and Balky Horse Canyon Road	6.0	2U Highway	13,000
1023	SR 38 Between Balky Horse Canyon Road and Santa Ana River	11.0	2U Highway	13,000
1024	SR 330 Between SR 210 and East Fork City Creek	5.0	2U Highway	13,000
1025	SR 330 Between East Fork City Creek and SR 18	10.5	2U Highway	13,000
1026	SR 173 Between SR 138 and Arrowhead Lake Road	7.0	2U Highway	13,000
1035	SR 2 Between SR 138 and West of Wrightwood	10.0	2U Highway	13,000
1036	SR 138 Between I-15 and SR 2	12.0	2U Highway	13,000
1037	SR 138 Between SR 2 and North of SR 2	1.0	2U Highway	13,000

Network skimming is included in the MATS Model and is based on the distance (miles) and time (minutes) it takes to travel between each of the zones within the MATS area. **Tables 3-3** and **3-4** are origin-destination (O-D) matrices that show the distance and time it takes to get to and from each zone within the MATS area. The rows represent the origin end of the trip, and the columns represent the destination end of the trip.

Table 3-3: Network Skimming (Distance in Miles)

TAZ	1	2	3	4	5	6	7	8	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115
1	2	32	35	70	70	50	42	44	20	14	15	22	25	25	25	33	45	45	50	55	54	56	44
2	32	2	20	70	75	45	12	14	12	25	25	30	35	35	35	45	55	52	55	60	61	61	14
3	35	20	2	80	80	60	30	32	13.5	22	30	35	45	35	35	40	55	55	60	60	65	61	32
4	70	70	80	2	30	55	80	82	60	50	45	45	40	35	35	40	20	20	20	16	10	17	82
5	70	75	80	30	2	60	85	87	70	60	58	55	58	48	45	40	30	30	30	20	25	21	87
6	50	45	60	55	60	2	55	57	40	30	25	26	25	15	16	20	35	35	35	40	40	41	57
7	42	12	30	80	85	55	2	3	22	35	35	40	45	45	45	55	65	62	65	70	71	72	3
8	42	14	32	82	87	57	3	2	24	37	37	42	47	47	47	57	67	64	67	72	73	74	2
101	20	12	13.5	60	70	40	22	24	2	8	15	20	25	25	26	30	45	45	45	50	55	51	24
102	14	25	22	50	60	30	35	37	8	2	7	12	16	16	18	22	36	35	38	45	45	46	37
103	15	25	30	45	58	25	35	37	15	7	2	8	12	12	15	18	35	30	35	40	45	41	37
104	22	30	35	45	55	26	40	42	20	12	8	2	10	12	14	18	30	30	32	38	40	39	42
105	25	35	45	40	58	25	45	47	25	16	12	10	2	10	12	16	30	30	35	36	38	37	47
106	25	35	35	35	48	15	45	47	25	16	12	12	10	2	3	6	20	20	25	38	30	39	47
107	25	35	35	35	45	16	45	47	26	18	15	14	12	3	2	5	18	18	20	25	26	26	47
108	33	45	40	40	40	20	55	57	30	22	18	18	16	6	5	2	15	15	15	20	22	21	57
109	45	55	55	20	30	35	65	67	45	36	35	30	30	20	18	15	2	7	8	10	12	11	67
110	45	52	55	20	30	35	62	64	45	35	30	30	30	20	18	15	7	2	4	8	10	9	64
111	50	55	60	20	30	35	65	67	45	38	35	32	35	25	20	15	8	4	2	10	10	11	67
112	55	60	60	16	20	40	70	72	50	45	40	38	36	38	25	20	10	8	10	2	5	3	72
113	54	61	65	10	25	40	71	73	55	45	45	40	38	30	26	22	12	10	10	5	2	6	73
114	56	61	61	17	21	41	72	74	51	46	41	39	37	39	26	21	11	9	11	3	6	2	74
115	44	14	32	82	87	57	3	2	24	37	37	42	47	47	47	57	67	64	67	72	72	74	2

Table 3-4: Network Skimming (Time)

TAZ	1	2	3	4	5	6	7	8	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115
1	5	49	55	115	115	85	60	74	35	25	24	38	50	45	45	65	120	70	80	80	90	85	74
2	49	5	25	120	130	70	16	30	20	40	40	50	65	60	60	75	95	95	95	95	100	100	30
3	55	25	5	135	135	110	36	50	20	32	45	75	90	60	60	65	85	85	110	110	120	115	50
4	115	120	135	5	40	80	131	145	95	80	85	80	75	60	60	70	40	35	35	25	16	30	145
5	115	130	135	40	5	85	141	155	100	90	85	85	95	70	65	55	45	40	40	25	30	30	155
6	85	70	110	80	85	5	81	95	60	50	40	55	55	21	25	30	65	60	60	65	65	70	95
7	60	16	36	80	85	55	5	12	31	51	51	61	76	71	71	86	106	106	106	106	111	111	12
8	60	30	50	145	155	95	12	5	45	65	65	75	90	85	85	100	120	120	120	120	125	125	5
101	35	20	20	95	100	60	31	45	5	15	28	40	55	45	45	55	80	75	80	90	95	95	45
102	25	40	32	80	90	50	51	65	15	5	15	25	35	30	35	38	70	60	70	75	80	80	65
103	24	40	45	85	85	40	51	65	28	15	5	15	30	20	25	30	70	55	60	65	75	70	65
104	38	50	75	80	85	55	61	75	40	25	15	5	25	20	25	30	60	55	55	65	75	70	75
105	50	65	90	75	95	55	76	90	55	35	30	25	5	25	26	35	60	60	65	70	75	75	90
106	45	60	60	60	70	21	71	85	45	30	20	20	25	5	7	15	40	35	45	46	55	51	85
107	45	60	60	60	65	25	71	85	45	35	25	25	26	7	5	10	35	30	36	45	48	50	85
108	65	75	65	70	55	30	86	100	55	38	30	30	35	15	10	5	30	25	30	35	38	40	100
109	120	95	85	40	45	65	106	120	80	70	70	60	60	40	35	30	5	20	20	25	28	30	120
110	70	95	85	35	40	60	106	120	75	60	55	55	60	35	30	25	20	5	12	15	20	20	120
111	80	95	110	35	40	60	106	120	80	70	60	55	65	45	36	30	20	12	5	20	22	25	120
112	80	95	110	25	25	65	106	120	90	75	65	65	70	46	45	35	25	15	20	5	12	10	120
113	90	100	120	16	30	65	111	125	95	80	75	75	75	55	48	38	28	20	22	12	5	17	125
114	85	100	115	30	30	70	111	125	95	80	70	70	75	51	50	40	30	20	25	10	17	5	125
115	74	30	50	145	155	95	12	5	45	65	65	75	90	85	85	100	120	120	120	120	120	125	5

4.0 MATS MODEL TOOL STRUCTURE

The MATS Model is a focused four-step model which includes the following modules namely trip generation, trip distribution, auto occupancy, and traffic assignment. Additional submodules were developed to assist in visitor trip assumptions and external trip processing. The following section briefly discusses the MATS Model structure.

4.1 Trip Generation

The trip generation model estimates daily person trips for a typical weekday. A production trip end is where a trip begins from the home of the trip maker and an attraction trip-end is where a trip ends.

The major inputs for the MATS trip generation model are total population, total households, and total employment. Total employment is also broken down into retail and non-retail employment. A further breakdown of retail employment into "service" employment is assumed for a greater refinement of the trip generation process. For the MATS Model, an assumption is made that a percentage of the total retail employment is considered to be service employment. The SED data for the study area were provided by SBCTA for the TAZs. **Tables 2-1** and **2-2** present the 2015 and 2040 MATS area SED.

In addition to SED inputs, the trip generation model uses several parameters and assumptions. **Table 4-1** summarizes the trip generation parameters used within the model. Several assumptions were made in determining trip generation parameters.

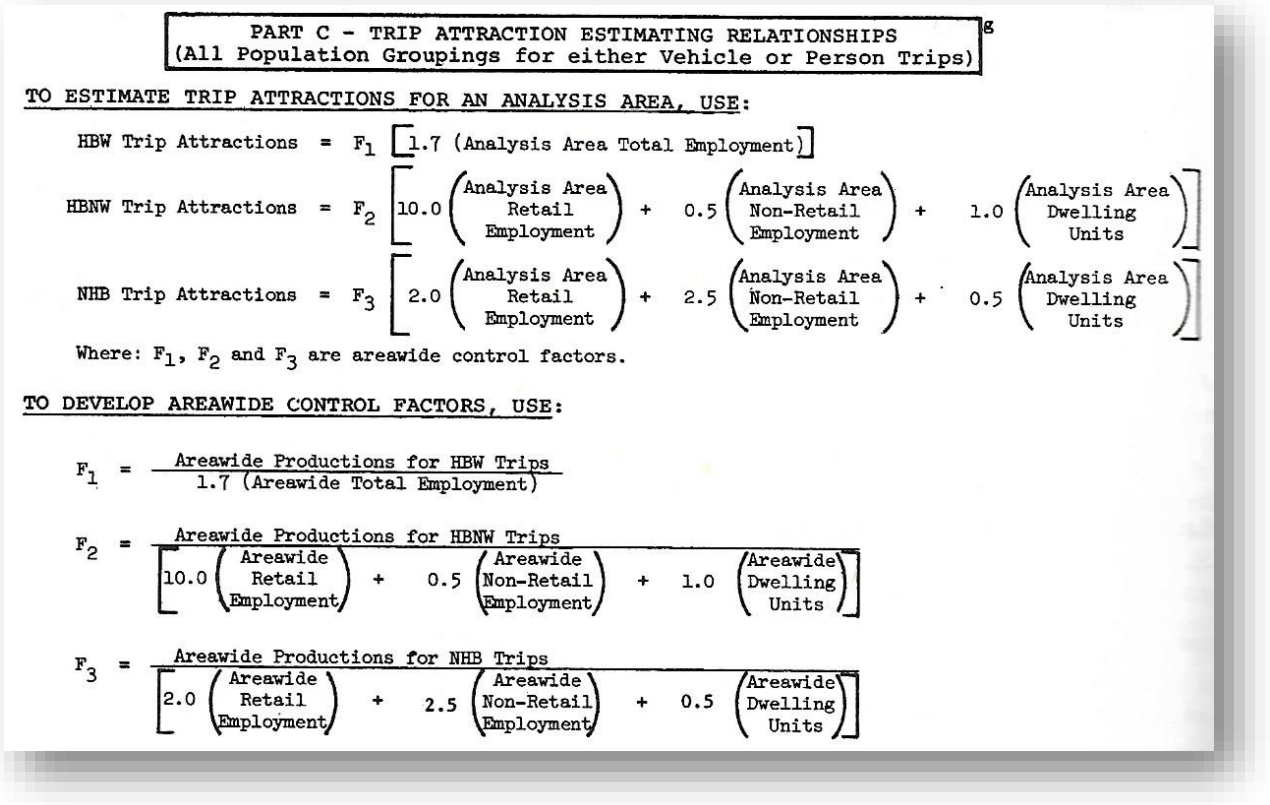
Resident internal trip production factors were obtained from the *National Cooperative Highway Research Program (NCHRP) Report 187: Quick-Response Urban Travel Estimation Techniques and Transferable Parameters User's Guide.* Values obtained from Table 3 from the NCHRP Report 187 were obtained for an urbanized area population of 50,000-100,000, and were modified to represent existing conditions.

Table 4-1: Trip Generation Parameters and Assumptions

Parameter	Value	Note
Average Daily Trips Per Household	8	
Average Daily Trips Per Hotel Room	6	Cabins are converted to hotel rooms within the Visitor Model
Resident Internal Trip Production Factors HBW – HBO – NHB	0.16 – 0.61 – 0.23	Please note that the sum of the resident trip purpose factors must add up to 1.0
Non-Resident (Visitor) Internal Trip Production Factors** HBW – HBO – NHB	0.00 – 0.00 – 1.00	Please note that the sum of the non-resident trip purpose factors must add up to 1.0. As a theory, as all non-resident trips are non-home based, there are no HBW or HBO trips assumed.

Trip attractions were calculated using Part C of Table 3 (Trip Attraction Estimating Relationships) from NCHRP Report 187. Trip attraction equations from NCHRP report 187 are shown in **Figure 4-1**.

Figure 4-1: NCHRP Report 187 Table 3 (Trip Attraction Factors)



PART C - TRIP ATTRACTION ESTIMATING RELATIONSHIPS
(All Population Groupings for either Vehicle or Person Trips)

TO ESTIMATE TRIP ATTRACTIONS FOR AN ANALYSIS AREA, USE:

$$\text{HBW Trip Attractions} = F_1 \left[1.7 \left(\text{Analysis Area Total Employment}\right)\right]$$

$$\text{HBNW Trip Attractions} = F_2 \left[10.0 \left(\begin{matrix}\text{Analysis Area}\\ \text{Retail}\\ \text{Employment}\end{matrix}\right) + 0.5 \left(\begin{matrix}\text{Analysis Area}\\ \text{Non-Retail}\\ \text{Employment}\end{matrix}\right) + 1.0 \left(\begin{matrix}\text{Analysis Area}\\ \text{Dwelling}\\ \text{Units}\end{matrix}\right)\right]$$

$$\text{NHB Trip Attractions} = F_3 \left[2.0 \left(\begin{matrix}\text{Analysis Area}\\ \text{Retail}\\ \text{Employment}\end{matrix}\right) + 2.5 \left(\begin{matrix}\text{Analysis Area}\\ \text{Non-Retail}\\ \text{Employment}\end{matrix}\right) + 0.5 \left(\begin{matrix}\text{Analysis Area}\\ \text{Dwelling}\\ \text{Units}\end{matrix}\right)\right]$$

Where: F_1, F_2 and F_3 are areawide control factors.

TO DEVELOP AREAWIDE CONTROL FACTORS, USE:

$$F_1 = \frac{\text{Areawide Productions for HBW Trips}}{1.7 \left(\text{Areawide Total Employment}\right)}$$

$$F_2 = \frac{\text{Areawide Productions for HBNW Trips}}{\left[10.0 \left(\begin{matrix}\text{Areawide}\\ \text{Retail}\\ \text{Employment}\end{matrix}\right) + 0.5 \left(\begin{matrix}\text{Areawide}\\ \text{Non-Retail}\\ \text{Employment}\end{matrix}\right) + 1.0 \left(\begin{matrix}\text{Areawide}\\ \text{Dwelling}\\ \text{Units}\end{matrix}\right)\right]}$$

$$F_3 = \frac{\text{Areawide Productions for NHB Trips}}{\left[2.0 \left(\begin{matrix}\text{Areawide}\\ \text{Retail}\\ \text{Employment}\end{matrix}\right) + 2.5 \left(\begin{matrix}\text{Areawide}\\ \text{Non-Retail}\\ \text{Employment}\end{matrix}\right) + 0.5 \left(\begin{matrix}\text{Areawide}\\ \text{Dwelling}\\ \text{Units}\end{matrix}\right)\right]}$$

In addition to using trip production factors stated in **Table 4-1**, and calculating trip attractions using equations shown in **Figure 4-1**, it was determined during validation that the application of a K-factor was necessary for accurately forecasting and producing external station trips. K-factors were applied to calculated trip productions and attractions per **Table 4-2**.

Table 4-2: Trip Production and Attraction K-Factors

Zone Description	MATS TAZ Number	Production/Attraction K-Factor
External: SR-18 South (San Bernardino)	1	2.50
External: I-15 @ SR-138/SR-2	2	1.40
External: SR-173 (Hesperia)	3	3.00
External: SR-18 North (Lucerne Valley)	4	2.50
External: SR-38 (Redlands)	5	4.50
External: SR-330 (Highland)	6	3.00
External: SR-138 (North of SR-2)	7	1.20
External: SR-2 (West of Wrightwood)	8	4.00

4.1.1 Visitor Model

A submodel to the trip generation model is the Visitor Model. For the purposes of the MATS Model, a "Visitor" is also considered to be any "Non-Resident" traveling within the MATS Area. Due to the large number of visitors to the region during peak seasons, the Visitor Model predicts the number of trips made by visitors (or non-residents) staying at area hotels and motels.

It is noted that the visitation levels to MATS area communities has an effect on infrastructure within the MATS area. Information from SBCTA shows that on a typical off-peak weekday in 2012, the City of Big Bear lake had a full-time population of 5,100 people (in approximately 2,200 households) with an employment of 3,800 while serving 10,000 visitors. Information for a peak season day showed that the City of Big Bear Lake had an employment of approximately 5,800 employees (while serving 60,000 visitors. Note that the increase in employees for peak seasons compared to off-peak seasons is approximately 150 percent (a factor of 1.5).

The Visitor Model adjusts the total number of retail and non-retail employment, which is known to change during peak seasons. **Table 4-3** summarizes the parameters and assumptions used within the Visitor Model.

Table 4-3: Visitor Model Parameters and Assumptions

Parameter	Value	Note
Peak Season (to off-peak season) retail employment factor	1.5	Calculated as a factor of peak season to off-peak season employment as obtained from SBCTA data for 2012.
Peak Season (to off-peak season) non-retail employment factor	1.5	Calculated as a factor of peak season to off-peak season employment as obtained from SBCTA data for 2012.
Assumed number of rooms to cabin	1.2	
Off-peak season hotel occupancy rate	0.4	
Peak season hotel occupancy rate	0.95	
Number of visitors per hotel room	2.0	Various sources have a range of data for visitors per room. - International travellers to the US average a party size of 1.7 travellers per room (source: https://www.ahla.com/content.aspx?id=36332) - In the City of San Francisco the average party size 2 visitors per room (source: http://www.sanfrancisco.travel/san-francisco-visitor-industry-statistics-) - Visitors per hotel room was assumed to be 2.0 for the MATS area.

An input into the Visitor Model is an inventory of the hotels/motels within each zone, along with the number of rooms or cabins. **Table 4-4** summarizes the number of hotel rooms and cabins by zone within the MATS area. A more detailed summary of hotels and cabins within the zones is included in **Appendix A**.

Table 4-4: MATS Area Hotels by Zone

		2015		2040	
	MATSZONE	Rooms/Suites	Cabins	Rooms/Suites	Cabins
Silverwood Lake	101	37	0	37	0
Crestline (West)	102	57	27	57	27
Crestline (East)	103	367	169	367	169
Lake Arrowhead	104	0	0	0	0
Lake Arrowhead (East)	105	22	0	22	0
Running Springs @ SR-330	106	0	0	0	0
Running Springs @ SR-18	107	32	4	32	4
Green Valley Lake	108	0	0	0	0
Fawnskin	109	26	0	26	0
Big Bear Lake	110	3,238	188	3,238	188
Big Bear City	111	379	0	379	0
Sugarloaf	112	0	0	0	0
Baldwin Lake	113	0	0	0	0
Ski Areas	114	0	0	0	0
Wrightwood	115	24	37	24	37
	Total:	**4,182**	**425**	**4,182**	**425**

In additional to visitors staying in hotel rooms and cabins, the day visitors attractions are assumed to go to locations called “Special Generators”. Special generators are calculated for no-staying visitors on a percentage of total visitors to the locations as shown in **Table 4-5**.

Table 4-5: Special Generators by Zone

Zone Description	MATS TAZ Number	Percent of Non-Staying Visitor Trips
Silverwood Lake	101	1.0%
Crestline (West)	102	1.0%
Crestline (East)	103	0.5%
Lake Arrowhead	104	10.0%
Lake Arrowhead (East)	105	0.0%
Running Springs @ SR-330	106	1.0%
Running Springs @ SR-18	107	5.0%
Green Valley Lake	108	0.0%
Fawnskin	109	14.0%
Big Bear Lake	110	25.0%
Big Bear City	111	20.0%
Sugarloaf	112	1.0%
Baldwin Lake	113	0.5%

Zone Description	MATS TAZ Number	Percent of Non-Staying Visitor Trips
Ski Areas	114	20.0%
Wrightwood	115	1.0%
Total		**100.0%**

4.1.2 External Trip Model

The geographic location of the MATS area includes 8 external stations. The external trip model ensures that all trips through external stations (both resident and non-resident trips) are calibrated to existing count data and closely represents known conditions. The nature of the MATS external trip model allows for different assumptions to be made for resident trips versus non-resident external trips, as non-resident trips tend to have a higher auto occupancy, and different trip purposes than residents.

Figure 4-2 shows the location of the external zones used for the External Trip model.

The External Trip Model takes existing data and uses that data to create an external to external trip matrix, as well as external to internal trips by purpose.

4.1.2.1 External to External Trip Table

The first stage in the External Trip Model begins by utilizing an external to external trip table as obtained from a select link model run completed using the current existing year SBTAM model. **Table 4-6** summarizes the external trips as obtained using the SBTAM 2008 year model. The purpose of using this data is to obtain distribution percentages between zones, and not to use the raw data. Daily count data obtained from Caltrans was used in coordination with the external trip matrix shown in **Table 4-6** to calculate a balanced external to external trip table for the MATS Model. Daily count data obtained from Caltrans is shown in **Table 4-7**.

In order to calculate the external trip table for the future year scenario, annual growth was obtained from the current SBTAM by obtaining daily model forecasts at each of the external stations for both the 2008 and 2035 years (which are the years the current SBTAM model forecasts). **Table 4-8** summarizes the growth at external stations within the SBTAM model, which is a growth of approximately 1.9% per year.

Using data from **Table 4-6** and **Table 4-8**, a percentage split of existing count data was observed to calculate the number of trips that are external-external as well as external-internal. **Table 4-9** summarizes the percentage split for existing count data to calculate external to external and external to internal trips.

A visual basic macro within the MATS spreadsheet model is used to obtain an averaged and balanced external to external vehicle trip table. **Table 4-10** shows the external trip table for the 2015 year MATS Model with 10,000 visitors in an off-peak period. Additional external to external trip tables for different years and seasons with different visitors is shown in **Appendix B**.

Figure 4-2: External Trip Model Zones

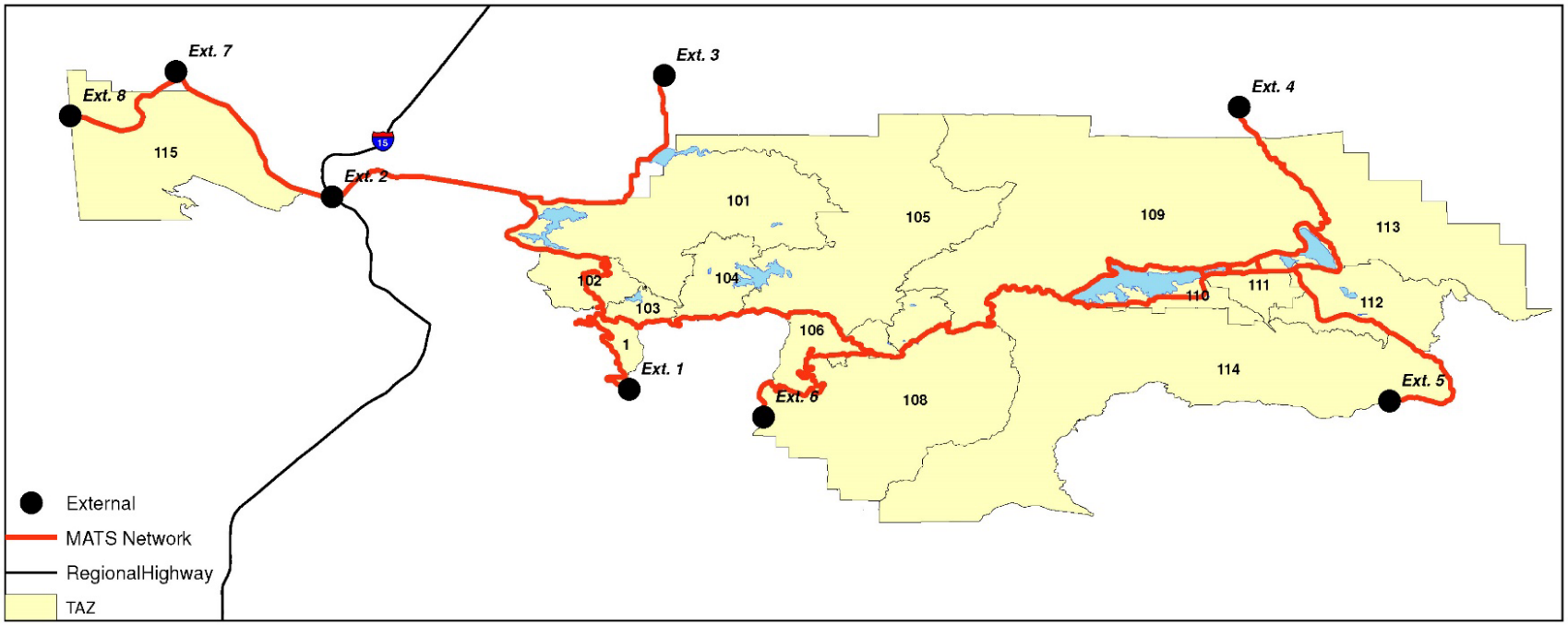


Table 4-6: External Trip Origin-Destination Matrix (2008)

MATS TAZ	1	2	3	4	5	6	7	8	TOTAL
1	0	41	0	0	0	0	28	4	***74***
2	31	0	1	0	0	27	7,553	897	***8,509***
3	0	1	0	0	0	0	0	0	***1.060***
4	0	0	0	0	23	3	1	0	***27***
5	0	0	0	22	0	0	0	0	***22***
6	0	27	0	2	0	0	20	3	***51***
7	21	7,510	0	1	0	21	0	46	***7,599***
8	2	1,222	0	0	0	2	172	0	***1,398***
TOTAL	***53***	***8,801***	***1***	***25***	***23***	***53***	***7,774***	***950***	***17,682***

Table 4-7: 2015 Daily Counts at MATS External Stations

	MATS TAZ	Peak Season 2-Direction	Off-Peak Season 2-Direction
External: SR-18 South (San Bernardino)	1	16,700	16,000
External: I-15 @ SR-138/SR-2	2	32,010	29,100
External: SR-173 (Hesperia)	3	1,550	1,150
External: SR-18 North (Lucerne Valley)	4	3,300	2,900
External: SR-38 (Redlands)	5	3,800	3,150
External: SR-330 (Highland)	6	12,000	10,000
External: SR-138 (North of SR-2)	7	20,000	19,300
External: SR-2 (West of Wrightwood)	8	1,700	1,650

Table 4-8: SBTAM Model Annual Growth (Off-Peak Season)

	MATS TAZ	2008	2035
External: SR-18 South (San Bernardino)	1	21,900	32,040
External: I-15 @ SR-138/SR-2	2	28,400	45,500
External: SR-173 (Hesperia)	3	1,600	2,420
External: SR-18 North (Lucerne Valley)	4	3,300	5,320
External: SR-38 (Redlands)	5	2,200	3,920
External: SR-330 (Highland)	6	14,900	18,580
External: SR-138 (North of SR-2)	7	19,900	33,600
External: SR-2 (West of Wrightwood)	8	4,600	5,800
	Total of All Counts:	**96,800**	**147,180**
		1.9%	**Per Year**

Table 4-9: SBTAM Model Annual Growth (Off-Peak Season)

	MATS TAZ	2008 Count	EXT-EXT Origins	EXT-EXT Destinations	EXT-EXT Trips (Origins Plus Destinations)	% of daily trips that are EXT-EXT	% of daily trips that are EXT-INT
External: SR-18 South (San Bernardino)	1	21,900	74	53	127	0.6%	99.4%
External: I-15 @ SR-138/SR-2	2	28,400	8,509	8,801	17,311	61.0%	39.0%
External: SR-173 (Hesperia)	3	1,600	1.060	1	2	0.13%	99.9%
External: SR-18 North (Lucerne Valley)	4	3,300	27	25	52	1.6%	98.4%
External: SR-38 (Redlands)	5	2,200	22	23	46	2.1%	97.9%
External: SR-330 (Highland)	6	14,900	51	53	105	0.7%	99.3%
External: SR-138 (North of SR-2)	7	19,900	7,599	7,774	15,373	38.5%	61.5%
External: SR-2 (West of Wrightwood)	8	4,600	1,398	950	2,348	31.5%	68.5%

Table 4-10: 2015 Off-Peak Season External To External Trip Table (10,000 Visitors)

MATS TAZ	1	2	3	4	5	6	7	8	*TOTAL*
1	0	22	0	0	0	0	15	2	***40***
2	23	0	1	0	0	20	5,662	672	***6,378***
3	0	1	0	0	0	0	0	0	***1***
4	0	0	0	0	13	2	0	0	***15***
5	0	0	0	13	0	0	0	0	***13***
6	0	20	0	2	0	0	15	2	***39***
7	16	5,712	0	0	0	16	0	35	***5,780***
8	1	623	0	0	0	1	88	0	***712***
TOTAL	***40***	***6,378***	***1***	***15***	***13***	***39***	***5,780***	***712***	***12,978***

4.1.2.2 External to Internal Person Trips by Purpose

In addition to external to external vehicle trips, external to internal person trips are calculated using assumptions shown in **Table 4-11**. External to internal trips are calculated for both residents and visitors separately. Resident trips are calculated as external to internal trip "Attractions" at external stations, and non-resident trips are calculated as external to internal trip "Productions" at external stations.

There was an assumption on vehicle occupancy factors for resident trips compared to non-resident trips. It is assumed that residents make trips at a lower vehicle occupancy (1.2 occupants per vehicle) than non-residents (1.8 occupants per vehicle).

Table 4-11: External Trip Model Parameters and Assumptions

Parameter	Value	Note
Resident Internal to External Vehicle Occupancy Factor	1.2	Obtained from Big Bear Modal Study
Visitor Internal to External Vehicle Occupancy Factor	1.8	Obtained from Big Bear Modal Study (which assumed a value between 1.8 and 2.0)
Off-peak season Resident/Non-Resident Factor	0.5	This assumption is that 50 percent of all off-peak season external to external trips are considered to be made by residents.
Peak season Resident/Non-Resident Factor	0.25	This assumption is that 25 percent of all peak season external to external trips are considered to be made by residents.
Resident Internal to External Trip Purpose Factors HBW – HBO – NHB	0.475 – 0.475 – 0.05	The sum of the resident trip purpose factors must add up to 1.0.
Non-resident Internal to External Trip Purpose Factors HBW – HBO – NHB	0.00 – 0.00 – 1.00	The sum of the non-resident trip purpose factors must add up to 1.0.

4.2 Trip Distribution

The trip distribution process allocates the zonal person trips generated by the trip generation model to movements between zone pairs based on the travel time/cost between the zones. The trip distribution model utilizes a traditional gravity model, as documented in both NCHRP Report 187 and NCHR Report 365. **Figure 4-3** shows the gravity model equation. Friction factor constants used in the gravity model are included in **Table 4-12**.

Trip distribution lengths for HBW, HBO, and NHB trips is shown in **Figure 4-4**. The distribution curves in **Figure 4-4** show that trips between 10 and 30 minutes tend to be the typical length of trip for travel within the MATS area.

Figure 4-3: Trip Distribution Gravity Model

$$T_{ij} = P_i \frac{A_j F_{ij} K_{ij}}{\sum_{j=1}^{n} A_j F_{ij} K_{ij}} \quad (1)$$

where

$$F_{ij} = f(tij)$$

and

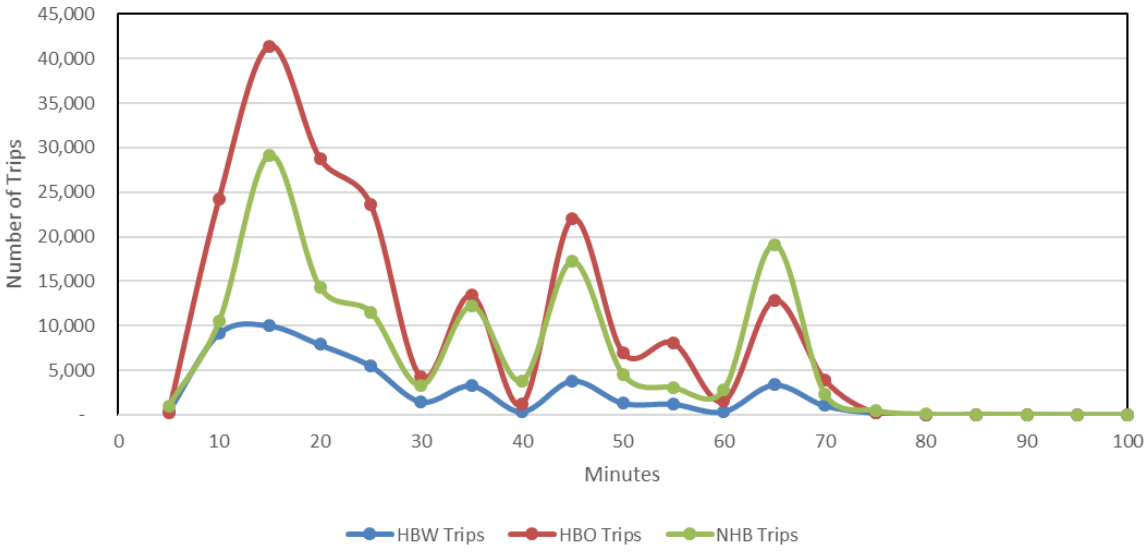
T_{ij} = trips produced in analysis area i, and attracted at analysis area j;
P_i = total trip production at i;
A_j = total trip attraction at j;
F_{ij} = friction factor for trip interchange ij;
K_{ij} = socioeconomic adjustment factor for interchange ij if necessary;
tij = travel time (or impedance) for interchange ij;
i = origin analysis area number, $i = 1, 2, 3 \ldots n$;
j = destination analysis area number, $j = 1, 2, 3 \ldots n$;
n = number of analysis areas.

Table 4-12: Trip Distribution Friction Factors

	A	b	c
HBW	28.507	-0.020	-0.123
HBO	139,173	-1.285	-0.094
NHB	219,113	-1.332	-0.100

Source: NCHRP Report 365 Table 14

Figure 4-4: Trip Distribution Lengths



4.3 Auto Occupancy Model

The MATS Model does not include a mode for transit, therefore, there is no choice to be made for vehicle other than auto. Therefore, there is no mode split as included in a traditional 4-step modelling process. In the place of the Mode Choice model, the auto occupancy model is included to convert person trips to vehicle trips prior to conversion to Origins and Destinations. An assumption was made that the auto occupancy would be different for the three different purposes of trips within the model. **Table 4-13** summarizes the auto occupancy factors for HBW, HBO, and NHB trips.

Table 4-13: Auto Occupancy

Parameter	Value
HBW Trip Auto Occupancy	1.2
HBO Trip Auto Occupancy	1.8
NHB Trip Auto Occupancy	1.8

After person trips are converted to auto trips, the production and attraction tables are converted to origin and destination matrices prior to assignment.

4.4 Assignment

The MATS Model assignment is completed by using a fixed-route determination, and assigning trips from the Origin-Destination matrix to these trips. The trips that are assigned are average weekday trips by direction (the direction is stratified as NB/EB or SB/WB). **Table 4-14** summarizes the link number and link directions for assignment.

Table 4-14: Network Link Direction Assumptions

Link ID	Link Directions		Location
1001	1001E	1001W	SR 138 Between I-15 and SR 173
1002	1002N	1002S	SR 138 Between SR 173 and Cleghorn Road
1003	1003N	1003S	SR 138 Between Cleghorn Road and Knapps Cutoff/Lake Drive
1033	1033N	1033S	SR 138 Between Knapps Cutoff/Lake Drive and SR 18
1004	1004N	1004S	SR 18 Between Old Waterman Canyon Road and SR 138
1005	1005E	1005W	SR 18 Between SR 138 and Lake Gregory Drive / SR 189
1006	1006E	1006W	SR 18 Between Lake Gregory Drive / SR 189 and SR 173
1007	1007E	1007W	SR 18 Between SR 173 and Live Oak Drive (Running Springs)
1027	1027E	1027W	SR 18 Between Live Oak Drive (Running Springs) and SR 330
1008	1008E	1008W	SR 18 Between SR 330 and Conifer Camp Road
1009	1009E	1009W	SR 18 Between Conifer Camp Road and Snow Valley Driveway
1010	1010E	1010W	SR 18 Between Snow Valley Driveway and SR 38
1011	1011E	1011W	SR 18 Between SR 38 and Village Drive
1029	1029E	1029W	SR 18 Between Village Drive and Standfield Cutoff
1030	1030N	1030S	Stanfield Cutoff Between SR 18 and SR 38

Link ID	Link Directions		Location
1012	1012E	1012W	SR 18 Between Standfield Cutoff and Division Drive
1031	1031N	1031S	Division Drive Between Big Bear Boulevard / SR 18 and North Shore Drive / SR 38
1013	1013E	1013W	SR 18 Between Division Drive and Greenway Drive / SR 38
1014	1014N	1014S	SR 18/Greenway Drive Between Big Bear Boulevard / SR 38 and North Shore Drive / SR 38
1015	1015E	1015W	SR 18/North Shore Drive Between Greenway Drive and Baldwin Lake Road
1016	1016N	1016S	SR 18/North Shore Drive Between Baldwin Lake Road and Marble Canyon Road
1017	1017N	1017S	SR 18/North Shore Drive Between Marble Canyon Road and SR 247
1018	1018N	1018S	Baldwin Lake Road Between SR 38 and SR 18
1019	1019E	1019W	SR 38 Between SR 18 and Fawnskin
1028	1028E	1028W	SR 38 Between Fawnskin and Standfield Cutoff
1032	1032E	1032W	SR 38 Between Standfield Cutoff and Division Drive
1020	1020E	1020W	SR 38 Between Division Drive and Greenway Drive
1021	1021E	1021W	SR 38 Between Greenway Drive and Shay Road
1022	1022N	1022S	SR 38 Between Shay Road and Balky Horse Canyon Road
1023	1023N	1023S	SR 38 Between Balky Horse Canyon Road and Santa Ana River
1024	1024N	1024S	SR 330 Between SR 210 and East Fork City Creek
1025	1025N	1025S	SR 330 Between East Fork City Creek and SR 18
1026	1026N	1026S	SR 173 Between SR 138 and Arrowhead Lake Road
1035	1035W	1035E	SR 2 Between SR 138 and West of Wrightwood
1036	1036N	1036S	SR 138 Between I-15 and SR 2
1037	1037N	1037S	SR 138 Between SR 2 and North of SR 2

The main purpose of the MATS Model is to forecast average daily weekend traffic. The MATS model process primarily follows an average daily weekday model, but has a post-processing component that factors average daily weekday traffic to average weekend (Friday, Saturday, and Sunday) daily traffic. This is completed by using count data that was collected during peak periods, and using a ratio of the peak period traffic to average weekday traffic. **Table 4-15** summarizes the percentages used to estimate weekend travel in the MATS Area. **Appendix C** summarizes the full set of count data and assumptions that were used to determine these percentages.

Table 4-15: Weekend Daily Traffic Assignment Percentages

Link ID	Route	Location	Friday		Saturday		Sunday	
			EB/NB	WB/SB	EB/NB	WB/SB	EB/NB	WB/SB
1001	State Route 138	W/ State Route 173	38%	60%	50%	41%	48%	42%
1002	SR 138 Between SR 173 and Cleghorn Road	SR 138 Between SR 173 and Cleghorn Road	38%	60%	50%	41%	48%	42%
1003	State Route 138	South of SR 173	187%	131%	123%	113%	95%	105%
1033	State Route 138	N/ Rim of the World Highway (SR-18)	187%	131%	123%	113%	95%	105%
1004	State Route 18	N/ Sierra Way / Arrowhead Road	130%	86%	99%	79%	71%	89%
1005	SR 18 Between SR 138 and Lake Gregory Drive / SR 189	SR 18 Between SR 138 and Lake Gregory Drive / SR 189	158%	86%	129%	94%	91%	124%
1006	SR 18 Between Lake Gregory Drive / SR 189 and SR 173	SR 18 Between Lake Gregory Drive / SR 189 and SR 173	158%	86%	129%	94%	91%	124%
1007	Rim of the World Highway (SR-18)	W/ Ongo Camp Drive	187%	86%	160%	110%	110%	160%
1027	SR 18 Between Live Oak Drive (Running Springs) and SR 330	SR 18 Between Live Oak Drive (Running Springs) and SR 330	187%	86%	160%	110%	110%	160%
1008	State Route 18	E/ Soutar Drive	187%	86%	160%	110%	110%	160%
1009	SR 18 Between Conifer Camp Road and Snow Valley Driveway	SR 18 Between Conifer Camp Road and Snow Valley Driveway	215%	86%	190%	125%	130%	195%
1010	State Route 18	W/ State Route 38	243%	86%	221%	141%	149%	231%
1011	State Route 18	E/ State Route 38	283%	104%	264%	185%	192%	276%
1029	Big Bear Boulevard (SR-18)	E/ Moon Ridge Road	79%	76%	92%	89%	79%	79%
1030	Stanfield Cutoff Between SR 18 and SR 38	Stanfield Cutoff Between SR 18 and SR 38	98%	77%	125%	101%	96%	109%
1012	Big Bear Boulevard (SR-18)	E/ Stanfield Cutoff	85%	79%	94%	83%	84%	74%
1031	Division Drive Between Big Bear Boulevard / SR 18 and North Shore Drive / SR 38	Division Drive Between Big Bear Boulevard / SR 18 and North Shore Drive / SR 38	82%	79%	91%	83%	82%	74%
1013	Big Bear Boulevard (SR-18)	W/ Greenway Drive	74%	81%	81%	83%	77%	72%
1014	SR 18/Greenway Drive Between Big Bear Boulevard / SR 38 and North Shore Drive / SR 38	SR 18/Greenway Drive Between Big Bear Boulevard / SR 38 and North Shore Drive / SR 38	95%	107%	101%	105%	99%	89%

Link ID	Route	Location	Friday		Saturday		Sunday	
			EB/NB	WB/SB	EB/NB	WB/SB	EB/NB	WB/SB
1015	SR 18/North Shore Drive Between Greenway Drive and Baldwin Lake Road	SR 18/North Shore Drive Between Greenway Drive and Baldwin Lake Road	124%	163%	124%	148%	136%	116%
1016	State Route 18	E/ Delta Avenue	124%	163%	124%	148%	136%	116%
1017	SR 18/North Shore Drive Between Marble Canyon Road and SR 247	SR 18/North Shore Drive Between Marble Canyon Road and SR 247	124%	163%	124%	148%	136%	116%
1018	Baldwin Lake Road Between SR 38 and SR 18	Baldwin Lake Road Between SR 38 and SR 18	117%	131%	119%	128%	119%	111%
1019	State Route 38	N/ State Route 18	143%	74%	219%	147%	138%	210%
1028	State Route 38	W/ Stanfield Cutoff	143%	74%	219%	147%	138%	210%
1032	SR 38 Between Standfield Cutoff and Division Drive	SR 38 Between Standfield Cutoff and Division Drive	85%	79%	94%	83%	84%	74%
1020	State Route 38	E/ Stanfield Cutoff	85%	79%	94%	83%	84%	74%
1021	East Big Bear Boulevard	E/ Shore Drive	97%	104%	106%	107%	101%	93%
1022	SR 38 Between Shay Road and Balky Horse Canyon Road	SR 38 Between Shay Road and Balky Horse Canyon Road	123%	96%	123%	108%	100%	119%
1023	State Route 38	E/ Bryant Street	148%	89%	140%	110%	99%	144%
1024	SR 330 Between SR 210 and East Fork City Creek	SR 330 Between SR 210 and East Fork City Creek	191%	83%	155%	100%	106%	156%
1025	State Route 330	N/ Highland Avenue Ramps	191%	83%	155%	100%	106%	156%
1026	SR 173 Between SR 138 and Arrowhead Lake Road	SR 173 Between SR 138 and Arrowhead Lake Road	60%	38%	41%	50%	42%	48%
1035	SR 2 Between SR 138 and West of Wrightwood	SR 2 Between SR 138 and West of Wrightwood	38%	60%	50%	41%	48%	42%
1036	SR 138 Between I-15 and SR 2	SR 138 Between I-15 and SR 2	38%	60%	50%	41%	48%	42%
1037	SR 138 Between SR 2 and North of SR 2	SR 138 Between SR 2 and North of SR 2	38%	60%	50%	41%	48%	42%

The outputs from the assignment process includes:

- Average Weekday Daily Volume (EB or NB)
- Average Weekday Daily Volume (WB or SB)
- Average Weekday Daily Volume (total of both directions)
- Average Weekday Daily Volume/Capacity Ratio (calculated based on total volume)
- Average Friday Daily Volume (EB or NB)
- Average Friday Daily Volume (WB or SB)

- Average Friday Daily Volume (total of both directions)
- Average Friday Daily Volume/Capacity Ratio (calculated based on total volume)
- Average Saturday Daily Volume (EB or NB)
- Average Saturday Daily Volume (WB or SB)
- Average Saturday Daily Volume (total of both directions)
- Average Saturday Daily Volume/Capacity Ratio (calculated based on total volume)
- Average Sunday Daily Volume (EB or NB)
- Average Sunday Daily Volume (WB or SB)
- Average Sunday Daily Volume (total of both directions)
- Average Sunday Daily Volume/Capacity Ratio (calculated based on total volume)

The output model Volume/Capacity ratios are used to define LOS for the arterial network. **Table 4-16** shows the assumed LOS correlating with roadway segment V/C ratio.

Table 4-16: Volume/Capacity Ratio and Corresponding LOS

V/C Ratio	LOS
>1.0	F
0.91-1.0	E
0.81-0.90	D
0.71-0.80	C
0.61-0.70	B
0-0.60	A

Tables 4-17 through **4-20** summarize the validated mode outputs for the 2015 Off-Peak Season average daily traffic for weekdays and weekends. Additional scenario assignment outputs are included in **Appendix C**. All assignment result tables included in this report (**Tables 4-17** through **4-20** as well as **Appendix C**) assume summer months for roadway capacities included in the V/C ratio equation.

Table 4-17: 2015 Off-Peak Season Average Weekday Daily Traffic (10,000 Visitors)

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1001E	1001W	SR 138 Between I-15 and SR 173	13,000	2,181	2,181	4,362	0.34
1002N	1002S	SR 138 Between SR 173 and Cleghorn Road	13,000	2,698	2,698	5,396	0.42
1003N	1003S	SR 138 Between Cleghorn Road and Knapps Cutoff/Lake Drive	13,000	3,600	3,600	7,200	0.55
1033N	1033S	SR 138 Between Knapps Cutoff/Lake Drive and SR 18	13,000	4,584	4,584	9,168	0.71
1004N	1004S	SR 18 Between Old Waterman Canyon Road and SR 138	25,000	8,081	8,081	16,162	0.65
1005E	1005W	SR 18 Between SR 138 and Lake Gregory Drive / SR 189	13,000	4,047	4,047	8,094	0.62
1006E	1006W	SR 18 Between Lake Gregory Drive / SR 189 and SR 173	13,000	5,868	5,868	11,736	0.90
1007E	1007W	SR 18 Between SR 173 and Live Oak Drive (Running Springs)	13,000	5,851	5,851	11,702	0.90
1027E	1027W	SR 18 Between Live Oak Drive (Running Springs) and SR 330	13,000	5,911	5,911	11,822	0.91
1008E	1008W	SR 18 Between SR 330 and Conifer Camp Road	13,000	6,844	6,844	13,688	1.05
1009E	1009W	SR 18 Between Conifer Camp Road and Snow Valley Driveway	13,000	3,386	3,386	6,772	0.52
1010E	1010W	SR 18 Between Snow Valley Driveway and SR 38	18,000	1,491	1,491	2,982	0.17
1011E	1011W	SR 18 Between SR 38 and Village Drive	19,000	1,323	1,323	2,646	0.40
1029E	1029W	SR 18 Between Village Drive and Standfield Cutoff	37,500	17,490	17,490	34,980	0.93
1030N	1030S	Stanfield Cutoff Between SR 18 and SR 38	13,000	1,320	1,320	2,640	0.20
1012E	1012W	SR 18 Between Standfield Cutoff and Division Drive	13,000	16,171	16,171	32,342	2.49
1031N	1031S	Division Drive Between Big Bear Boulevard / SR 18 and North Shore Drive / SR 38	13,000	606	606	1,212	0.09
1013E	1013W	SR 18 Between Division Drive and Greenway Drive / SR 38	13,000	11,618	11,618	23,236	1.79
1014N	1014S	SR 18/Greenway Drive Between Big Bear Boulevard / SR 38 and North Shore Drive / SR 38	13,000	1,774	1,774	3,548	0.27
1015E	1015W	SR 18/North Shore Drive Between Greenway Drive and Baldwin Lake Road	13,000	1,698	1,698	3,396	0.26
1016N	1016S	SR 18/North Shore Drive Between Baldwin Lake Road and Marble Canyon Road	13,000	1,340	1,340	2,680	0.21
1017N	1017S	SR 18/North Shore Drive Between Marble Canyon Road and SR 247	13,000	1,340	1,340	2,680	0.21

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1018N	1018S	Baldwin Lake Road Between SR 38 and SR 18	12,000	1,188	1,188	2,376	0.20
1019E	1019W	SR 38 Between SR 18 and Fawnskin	13,000	168	168	336	0.03
1028E	1028W	SR 38 Between Fawnskin and Standfield Cutoff	13,000	2,439	2,439	4,878	0.38
1032E	1032W	SR 38 Between Standfield Cutoff and Division Drive	13,000	1,120	1,120	2,240	0.17
1020E	1020W	SR 38 Between Division Drive and Greenway Drive	13,000	515	515	1,030	0.08
1021E	1021W	SR 38 Between Greenway Drive and Shay Road	13,000	10,629	10,629	21,258	1.64
1022N	1022S	SR 38 Between Shay Road and Balky Horse Canyon Road	13,000	2,459	2,459	4,918	0.38
1023N	1023S	SR 38 Between Balky Horse Canyon Road and Santa Ana River	13,000	2,459	2,459	4,918	0.38
1024N	1024S	SR 330 Between SR 210 and East Fork City Creek	13,000	5,036	5,036	10,072	0.77
1025N	1025S	SR 330 Between East Fork City Creek and SR 18	13,000	5,036	5,036	10,072	0.77
1026N	1026S	SR 173 Between SR 138 and Arrowhead Lake Road	13,000	562	562	1,124	0.09
1035W	1035E	SR 2 Between SR 138 and West of Wrightwood	13,000	4,237	4,237	8,474	0.65
1036N	1036S	SR 138 Between I-15 and SR 2	13,000	9,011	9,011	18,022	1.39
1037N	1037S	SR 138 Between SR 2 and North of SR 2	13,000	7,237	7,217	14,454	1.11

Table 4-18: 2015 Off-Peak Season Average Weekend (Friday) Daily Traffic (10,000 Visitors)

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1001E	1001W	SR 138 Between I-15 and SR 173	13,000	850	1,300	2,150	0.17
1002N	1002S	SR 138 Between SR 173 and Cleghorn Road	13,000	1,050	1,600	2,650	0.20
1003N	1003S	SR 138 Between Cleghorn Road and Knapps Cutoff/Lake Drive	13,000	6,750	4,700	11,450	0.88
1033N	1033S	SR 138 Between Knapps Cutoff/Lake Drive and SR 18	13,000	8,600	6,000	14,600	1.12
1004N	1004S	SR 18 Between Old Waterman Canyon Road and SR 138	25,000	10,700	7,100	17,800	0.71
1005E	1005W	SR 18 Between SR 138 and Lake Gregory Drive / SR 189	13,000	6,500	3,550	10,050	0.77

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1006E	1006W	SR 18 Between Lake Gregory Drive / SR 189 and SR 173	13,000	9,400	5,150	14,550	1.12
1007E	1007W	SR 18 Between SR 173 and Live Oak Drive (Running Springs)	13,000	11,000	5,100	16,100	1.24
1027E	1027W	SR 18 Between Live Oak Drive (Running Springs) and SR 330	13,000	11,100	5,150	16,250	1.25
1008E	1008W	SR 18 Between SR 330 and Conifer Camp Road	13,000	12,850	5,950	18,800	1.45
1009E	1009W	SR 18 Between Conifer Camp Road and Snow Valley Driveway	13,000	7,300	2,950	10,250	0.79
1010E	1010W	SR 18 Between Snow Valley Driveway and SR 38	18,000	3,600	1,300	4,900	0.27
1011E	1011W	SR 18 Between SR 38 and Village Drive	19,000	3,750	1,350	5,100	0.27
1029E	1029W	SR 18 Between Village Drive and Standfield Cutoff	37,500	13,800	13,350	27,150	0.72
1030N	1030S	Stanfield Cutoff Between SR 18 and SR 38	13,000	1,300	1,000	2,300	0.18
1012E	1012W	SR 18 Between Standfield Cutoff and Division Drive	13,000	13,700	12,750	26,450	2.03
1031N	1031S	Division Drive Between Big Bear Boulevard / SR 18 and North Shore Drive / SR 38	13,000	500	500	1,000	0.08
1013E	1013W	SR 18 Between Division Drive and Greenway Drive / SR 38	13,000	8,550	9,400	17,950	1.38
1014N	1014S	SR 18/Greenway Drive Between Big Bear Boulevard / SR 38 and North Shore Drive / SR 38	13,000	1,700	1,900	3,600	0.28
1015E	1015W	SR 18/North Shore Drive Between Greenway Drive and Baldwin Lake Road	13,000	2,100	2,750	4,850	0.37
1016N	1016S	SR 18/North Shore Drive Between Baldwin Lake Road and Marble Canyon Road	13,000	1,650	2,200	3,850	0.30
1017N	1017S	SR 18/North Shore Drive Between Marble Canyon Road and SR 247	13,000	1,650	2,200	3,850	0.30
1018N	1018S	Baldwin Lake Road Between SR 38 and SR 18	12,000	1,400	1,550	2,950	0.25
1019E	1019W	SR 38 Between SR 18 and Fawnskin	13,000	250	100	350	0.03
1028E	1028W	SR 38 Between Fawnskin and Standfield Cutoff	13,000	3,500	1,800	5,300	0.41
1032E	1032W	SR 38 Between Standfield Cutoff and Division Drive	13,000	950	900	1,850	0.14
1020E	1020W	SR 38 Between Division Drive and Greenway Drive	13,000	450	400	850	0.07
1021E	1021W	SR 38 Between Greenway Drive and Shay Road	13,000	10,300	11,050	21,350	1.64
1022N	1022S	SR 38 Between Shay Road and Balky Horse Canyon Road	13,000	3,050	2,400	5,450	0.42

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1023N	1023S	SR 38 Between Balky Horse Canyon Road and Santa Ana River	13,000	3,700	2,200	5,900	0.45
1024N	1024S	SR 330 Between SR 210 and East Fork City Creek	13,000	9,600	4,200	13,800	1.06
1025N	1025S	SR 330 Between East Fork City Creek and SR 18	13,000	9,600	4,200	13,800	1.06
1026N	1026S	SR 173 Between SR 138 and Arrowhead Lake Road	13,000	350	200	550	0.04
1035W	1035E	SR 2 Between SR 138 and West of Wrightwood	13,000	1,650	2,550	4,200	0.32
1036N	1036S	SR 138 Between I-15 and SR 2	13,000	3,450	5,400	8,850	0.68
1037N	1037S	SR 138 Between SR 2 and North of SR 2	13,000	2,800	4,350	7,150	0.55

Table 4-19: 2015 Off-Peak Season Average Weekend (Saturday) Daily Traffic (10,000 Visitors)

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1001E	1001W	SR 138 Between I-15 and SR 173	13,000	1,100	900	2,000	0.15
1002N	1002S	SR 138 Between SR 173 and Cleghorn Road	13,000	1,350	1,100	2,450	0.19
1003N	1003S	SR 138 Between Cleghorn Road and Knapps Cutoff/Lake Drive	13,000	4,450	4,050	8,500	0.65
1033N	1033S	SR 138 Between Knapps Cutoff/Lake Drive and SR 18	13,000	5,650	5,150	10,800	0.83
1004N	1004S	SR 18 Between Old Waterman Canyon Road and SR 138	25,000	8,100	6,500	14,600	0.58
1005E	1005W	SR 18 Between SR 138 and Lake Gregory Drive / SR 189	13,000	5,300	3,850	9,150	0.70
1006E	1006W	SR 18 Between Lake Gregory Drive / SR 189 and SR 173	13,000	7,650	5,600	13,250	1.02
1007E	1007W	SR 18 Between SR 173 and Live Oak Drive (Running Springs)	13,000	9,400	6,500	15,900	1.22
1027E	1027W	SR 18 Between Live Oak Drive (Running Springs) and SR 330	13,000	9,500	6,550	16,050	1.23
1008E	1008W	SR 18 Between SR 330 and Conifer Camp Road	13,000	11,000	7,600	18,600	1.43
1009E	1009W	SR 18 Between Conifer Camp Road and Snow Valley Driveway	13,000	6,450	4,250	10,700	0.82
1010E	1010W	SR 18 Between Snow Valley Driveway and SR 38	18,000	3,300	2,100	5,400	0.30
1011E	1011W	SR 18 Between SR 38 and Village Drive	19,000	3,500	2,450	5,950	0.31

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1029E	1029W	SR 18 Between Village Drive and Standfield Cutoff	37,500	16,150	15,500	31,650	0.84
1030N	1030S	Stanfield Cutoff Between SR 18 and SR 38	13,000	1,650	1,350	3,000	0.23
1012E	1012W	SR 18 Between Standfield Cutoff and Division Drive	13,000	15,250	13,500	28,750	2.21
1031N	1031S	Division Drive Between Big Bear Boulevard / SR 18 and North Shore Drive / SR 38	13,000	550	500	1,050	0.08
1013E	1013W	SR 18 Between Division Drive and Greenway Drive / SR 38	13,000	9,350	9,650	19,000	1.46
1014N	1014S	SR 18/Greenway Drive Between Big Bear Boulevard / SR 38 and North Shore Drive / SR 38	13,000	1,800	1,850	3,650	0.28
1015E	1015W	SR 18/North Shore Drive Between Greenway Drive and Baldwin Lake Road	13,000	2,100	2,500	4,600	0.35
1016N	1016S	SR 18/North Shore Drive Between Baldwin Lake Road and Marble Canyon Road	13,000	1,650	2,000	3,650	0.28
1017N	1017S	SR 18/North Shore Drive Between Marble Canyon Road and SR 247	13,000	1,650	2,000	3,650	0.28
1018N	1018S	Baldwin Lake Road Between SR 38 and SR 18	12,000	1,400	1,500	2,900	0.24
1019E	1019W	SR 38 Between SR 18 and Fawnskin	13,000	350	250	600	0.05
1028E	1028W	SR 38 Between Fawnskin and Standfield Cutoff	13,000	5,350	3,600	8,950	0.69
1032E	1032W	SR 38 Between Standfield Cutoff and Division Drive	13,000	1,050	950	2,000	0.15
1020E	1020W	SR 38 Between Division Drive and Greenway Drive	13,000	500	450	950	0.07
1021E	1021W	SR 38 Between Greenway Drive and Shay Road	13,000	11,250	11,350	22,600	1.74
1022N	1022S	SR 38 Between Shay Road and Balky Horse Canyon Road	13,000	3,050	2,700	5,750	0.44
1023N	1023S	SR 38 Between Balky Horse Canyon Road and Santa Ana River	13,000	3,500	2,750	6,250	0.48
1024N	1024S	SR 330 Between SR 210 and East Fork City Creek	13,000	7,800	5,000	12,800	0.98
1025N	1025S	SR 330 Between East Fork City Creek and SR 18	13,000	7,800	5,000	12,800	0.98
1026N	1026S	SR 173 Between SR 138 and Arrowhead Lake Road	13,000	250	300	550	0.04
1035W	1035E	SR 2 Between SR 138 and West of Wrightwood	13,000	2,100	1,750	3,850	0.30
1036N	1036S	SR 138 Between I-15 and SR 2	13,000	4,500	3,650	8,150	0.63
1037N	1037S	SR 138 Between SR 2 and North of SR 2	13,000	3,600	2,950	6,550	0.50

Table 4-20: 2015 Off-Peak Season Average Weekend (Sunday) Daily Traffic (10,000 Visitors)

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1001E	1001W	SR 138 Between I-15 and SR 173	13,000	1,050	900	1,950	0.15
1002N	1002S	SR 138 Between SR 173 and Cleghorn Road	13,000	1,300	1,100	2,400	0.18
1003N	1003S	SR 138 Between Cleghorn Road and Knapps Cutoff/Lake Drive	13,000	3,450	3,800	7,250	0.56
1033N	1033S	SR 138 Between Knapps Cutoff/Lake Drive and SR 18	13,000	4,350	4,800	9,150	0.70
1004N	1004S	SR 18 Between Old Waterman Canyon Road and SR 138	25,000	5,900	7,300	13,200	0.53
1005E	1005W	SR 18 Between SR 138 and Lake Gregory Drive / SR 189	13,000	3,700	5,100	8,800	0.68
1006E	1006W	SR 18 Between Lake Gregory Drive / SR 189 and SR 173	13,000	5,400	7,350	12,750	0.98
1007E	1007W	SR 18 Between SR 173 and Live Oak Drive (Running Springs)	13,000	6,500	9,400	15,900	1.22
1027E	1027W	SR 18 Between Live Oak Drive (Running Springs) and SR 330	13,000	6,550	9,500	16,050	1.23
1008E	1008W	SR 18 Between SR 330 and Conifer Camp Road	13,000	7,600	11,000	18,600	1.43
1009E	1009W	SR 18 Between Conifer Camp Road and Snow Valley Driveway	13,000	4,400	6,650	11,050	0.85
1010E	1010W	SR 18 Between Snow Valley Driveway and SR 38	18,000	2,200	3,450	5,650	0.50
1011E	1011W	SR 18 Between SR 38 and Village Drive	19,000	2,550	3,650	6,200	0.40
1029E	1029W	SR 18 Between Village Drive and Standfield Cutoff	37,500	13,900	13,750	27,650	0.74
1030N	1030S	Stanfield Cutoff Between SR 18 and SR 38	13,000	1,250	1,450	2,700	0.21
1012E	1012W	SR 18 Between Standfield Cutoff and Division Drive	13,000	13,550	12,050	25,600	1.97
1031N	1031S	Division Drive Between Big Bear Boulevard / SR 18 and North Shore Drive / SR 38	13,000	500	450	950	0.07
1013E	1013W	SR 18 Between Division Drive and Greenway Drive / SR 38	13,000	8,900	8,300	17,200	1.32
1014N	1014S	SR 18/Greenway Drive Between Big Bear Boulevard / SR 38 and North Shore Drive / SR 38	13,000	1,750	1,550	3,300	0.25
1015E	1015W	SR 18/North Shore Drive Between Greenway Drive and Baldwin Lake Road	13,000	2,300	1,950	4,250	0.33
1016N	1016S	SR 18/North Shore Drive Between Baldwin Lake Road and Marble Canyon Road	13,000	1,850	1,550	3,400	0.26
1017N	1017S	SR 18/North Shore Drive Between Marble Canyon Road and SR 247	13,000	1,850	1,550	3,400	0.26

Link ID and Direction		Location	Capacity	Volume (EB or NB)	Volume (WB or SB)	Volume (Total)	V/C Ratio
1018N	1018S	Baldwin Lake Road Between SR 38 and SR 18	12,000	1,400	1,300	2,700	0.23
1019E	1019W	SR 38 Between SR 18 and Fawnskin	13,000	250	350	600	0.05
1028E	1028W	SR 38 Between Fawnskin and Standfield Cutoff	13,000	3,350	5,100	8,450	0.65
1032E	1032W	SR 38 Between Standfield Cutoff and Division Drive	13,000	950	850	1,800	0.14
1020E	1020W	SR 38 Between Division Drive and Greenway Drive	13,000	450	400	850	0.07
1021E	1021W	SR 38 Between Greenway Drive and Shay Road	13,000	10,750	9,900	20,650	1.59
1022N	1022S	SR 38 Between Shay Road and Balky Horse Canyon Road	13,000	2,500	2,950	5,450	0.42
1023N	1023S	SR 38 Between Balky Horse Canyon Road and Santa Ana River	13,000	2,500	3,600	6,100	0.47
1024N	1024S	SR 330 Between SR 210 and East Fork City Creek	13,000	5,300	7,850	13,150	1.01
1025N	1025S	SR 330 Between East Fork City Creek and SR 18	13,000	5,300	7,850	13,150	1.01
1026N	1026S	SR 173 Between SR 138 and Arrowhead Lake Road	13,000	250	250	500	0.04
1035W	1035E	SR 2 Between SR 138 and West of Wrightwood	13,000	2,050	1,750	3,800	0.29
1036N	1036S	SR 138 Between I-15 and SR 2	13,000	4,350	3,750	8,100	0.62
1037N	1037S	SR 138 Between SR 2 and North of SR 2	13,000	3,500	3,000	6,500	0.50

5.0 MATS MODEL VALIDATION

Model validation was conducted to verify that the existing year (2015) MATS Model accurately represents existing conditions. In other words, the validation was to compare the model outputs with the observed traffic volumes throughout the MATS area. The validity of the MATS Model was tested for average weekday daily traffic conditions. The average daily traffic (ADT) volumes that were used for model validation for the MATS system roadway network were obtained primarily from Caltrans traffic count inventory.

The validation tolerance threshold created for the MATS Model study is a simple pass/fail criteria. It was determined that a validated model would be one where the ratio of counts to modelled volume ranged between 0.90 and 1.10, or within 10 percent. **Table 5-1** is a summary of the model validation for external stations, and **Table 5-2** is a summary of the model validation for state routes within the MATS area. A complete summarization of roadway links with count data is included in **Appendix C**.

As shown in **Table 5-1**, all externals validate within the preferred criteria, with the exception of SR-2 west of Wrightwood. On External 8, the count to modelled volume of 0.83 reflects a location where the modelled volume is higher than the count, which shows a conservative model forecast for validation purposes.

Table 5-1: Model Validation Performance (External Stations)

	MATS TAZ	Ratio of Existing Counts to Modeled Volume
External: SR-18 South (San Bernardino)	1	0.99
External: I-15 @ SR-138/SR-2	2	
External: SR-173 (Hesperia)	3	1.02
External: SR-18 North (Lucerne Valley)	4	1.08
External: SR-38 (Redlands)	5	1.03
External: SR-330 (Highland)	6	0.99
External: SR-138 (North of SR-2)	7	1.07
External: SR-2 (West of Wrightwood)	8	0.83
	Overall	**0.91**

As shown in **Table 5-2**, State Routes 18, 330, and 173 all validate really well, and within the desired 10 percent criteria. State Routes 2, 138, and 38 all have a ratio of counts to modelled volume that are below 1.0, showing a conservative forecast of model volumes for analysis.

Table 5-2: Model Validation Performance (State Routes)

State Route	Ratio of Existing Counts to Modeled Volume
SR-2	0.83
SR-18	0.95
SR-138	0.84
SR-38	0.82
SR-330	1.00
SR-173	1.02
All	0.91

6.0 MATS MODEL USERS' GUIDE

The MATS Model is a spreadsheet tool which has been built in Excel using Visual Basic macros. This section of the report summarizes the steps required to run the model.

When you open the spreadsheet, it will take you to the only page with required user inputs. **Figure 6-1** shows you the main model setup. On this tab ("MATS_Model"), you will need to fill in all yellow cells, as well as use the "Visitors" pull-down in the red cells to define the number of visitors. When these inputs have been determined, you click on the "Run MATS Model" button on the tab and the model will complete. The model takes approximately 3 minutes to run, and will say "Traffic Assignment Done" when the process is complete. The model assumptions and parameters are also included on the "MATS_Model" tab and are shown in **Figure 6-2**.

The parameters shown in **Figure 6-2** are validated model parameters, and do NOT need to be modified prior to a model run. However, they may be modified for testing various policies. All of the assumptions and parameters shown in **Figure 6-2** are included in the text in *Sections 2.0* through *4.0* of this report.

Figure 6-1: Model Setup

Scenario	**Existing**
Year	2015
Season	Off-Peak Season (Summer)
Visitors	10000
Date	

Run MATS Model

Model Process Flow-Chart

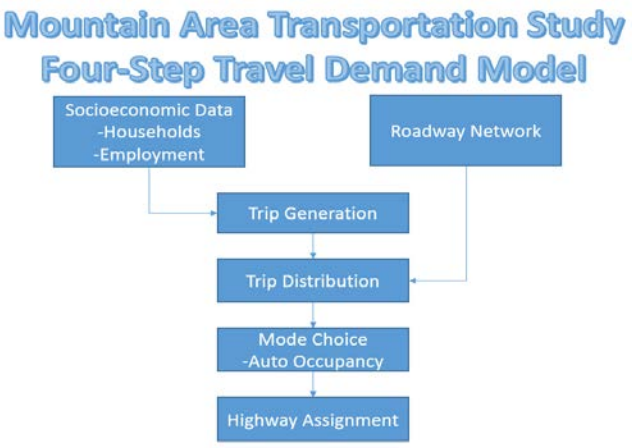


Figure 6-2: Model Assumptions and Parameters

MODEL ASSUMPTIONS AND PARAMETERS		
Visitor Model		
1.50	Peak Season Retail Employment Factor (factor of peak season to off-peak season retail employment)	
1.50	Peak Season Non-Retail Employment Factor (factor of peak season to off-peak season non-retail employment)	
1.20	Room to Cabin Factor	
0.40	Off-peak hotel occupancy rate	
2.00	Assumed Visitors per Room	
0.95	Peak season hotel occupancy rate	
External Trips Model		
1.2	Resident Internal-External Vehicle Occupancy Factor	
1.8	Visitor Internal-External Vehicle Occupancy Factor	
0.475	Resident Internal-External HBW Trip Purpose	Please note that resident trip purpose factors must add up to 1.0
0.475	Resident Internal-External HBO Trip Purpose	
0.050	Resident Internal-External NHB Trip Purpose	
0.000	Non-Resident Internal-External HBW Trip Purpose	Please note that non-resident trip purpose factors must add up to 1.0
0.000	Non-Resident Internal-External HBO Trip Purpose	
1.000	Non-Resident Internal-External NHB Trip Purpose	
Trip Generation		
8.0	Average Daily Trips Per Household	
6.0	Average Daily Trips Per Hotel Room	
0.160	Resident Internal Trip Production HBW Factor	Please note that resident trip purpose factors must add up to 1.0
0.610	Resident Internal Trip Production HBO Factor	
0.230	Resident Internal Trip Production NHB Factor	
0.000	Non-Resident Internal Trip Production HBW Factor	Please note that Non-Resident trip purpose factors must add up to 1.0
0.000	Non-Resident Internal Trip Production HBO Factor	
1.000	Non-Resident Internal Trip Production NHB Factor	
Trip Distribution		
28507	Friction factor constant a - HBW	
139173	Friction factor constant a - HBO	
219113	Friction factor constant a - NHB	
-0.02	Friction factor constant b - HBW	
-1.285	Friction factor constant b - HBO	
-1.332	Friction factor constant b - NHB	
-0.123	Friction factor constant c - HBW	
-0.094	Friction factor constant c - HBO	
-0.1	Friction factor constant c - NHB	
Mode Split		
1.2	HBW Trip Auto Occupancy	
1.8	HBO Trip Auto Occupancy	
1.8	NHB Trip Auto Occupancy	

7.0 MODEL UPDATE SCHEDULE

The MATS Model is a spreadsheet tool which has been built in Excel using Visual Basic macros. This section of the report details several model inputs that could be updated, as well as a recommended model update schedule.

7.1 Model Inputs

Several of the model inputs can be updated with additional (or more updated) information. The MATS Model is only as good as the model inputs, and there are several which could be updated as newer information is available.

7.1.1 Model Assumptions and Parameters

On the "MATS_Model" tab, there are model assumptions and parameters (shown in **Figure 6-2**) which can be updated if the model is validated.

7.1.2 Roadway Network

On the "Network" tab, the roadway network has assumptions for existing and future facility type. These assumptions are shown in **Table 3-2**. It is important to update the roadway facility type if there is ever a change in roadway capacities.

7.1.3 Network Skimming

A portion of the roadway network is included in the "NetworkSkimming" tab of the MATS Model. The information included in the network skimming is the distance (miles) and time (minutes) required to go from one zone to another zone within the model. This information can be updated if newer data is obtained.

7.1.4 Visitor Model

On the "Visitors" tab, there is information related to the location and number of hotel rooms and cabins. This information is shown in **Table 4-4** in this report. Additional information about hotel rooms and cabins would be beneficial in updating the model.

Also on the "Visitors" tab, there is a section of table that is only for special generators. **Table 4-5** summarizes the validated assumptions for the percentage of non-resident trips which are attracted to MATS area zones. The information in this table should be updated if there are additional studies or information showing the attraction zones of non-resident trips.

All other Visitor Model information is included in **Appendix A**.

7.1.5 Socioeconomic Data

Land use information for 2015 and 2040 is included in the "Zones_SED" tab. Information on this tab was obtained from SBCTA from their modeling department. If additional information is obtained, it should be updated as necessary.

7.1.6 External Trip Information

Land use information for 2015 and 2040 is included in the "Zones_SED" tab. Information on this tab was

obtained from the SBTAM model as well as existing count data sources. If the model year is modified, it may be important to update count data or the external to external select link model information obtained from the SBTAM model.

The information included in **Tables 4-6**, **4-7**, and **4-8** may be updated if newer information becomes available.

7.1.7 Peak Season Count Data

One of the more important pieces of data within the MATS Model is the weekend peak season count data. The weekend model is only as good as available count data, which is maintained on the "ADT-Directional-Summary" tab, and summarized in **Table 4-15** and **Appendix C**. This data should be updated with more data sources as better data becomes available.

7.2 Model Update Schedule

It is recommended that regular updates to the available count data for weekend peak seasons occurs as often as possible. A more thorough update of all of the model inputs is recommended to be completed on a three to five (3 to 5) year basis. The current base year of the model is 2015, and does not need to be updated until 2018 at the earliest.