San Diego Association of Governments
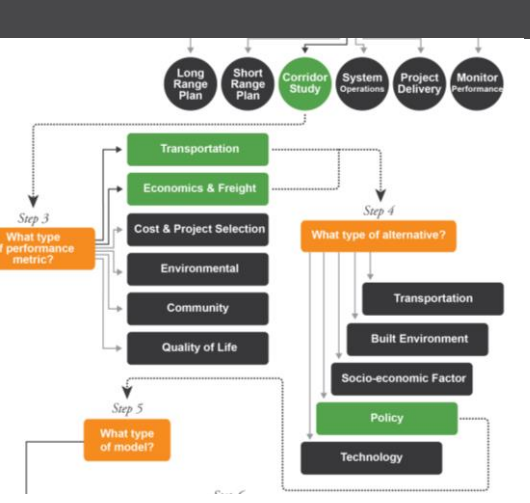
SPECIAL DESTINATION CALIBRATION

Report │ **December 26, 2018**

San Diego Association of Governments
SPECIAL DESTINATION CALIBRATION

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1.0 INTRODUCTION

This report describes the work performed to calibrate and validate special generators in the SANDAG activity-based model. Special generators refers to beaches, hospitals, major shopping centers, parks, casinos, and other key recreation sites.

The work included collection and analysis of special generator data collected in fall 2017 for San Diego County. Data collection included intercept surveys at beaches, pedestrian and traffic counts, and purchase of Location-based Services (LBS) data from Streetlight to better understand travel patterns to/from key locations. The data was used to calibrate the San Diego travel demand model representation of travel to and from special generators.

This report is organized as follows. First, it describes the data used to calibrate and validate special destination models. Next, it summarizes the data collected and the results of model calibration for each type of special generator – beaches, hospitals, major retail, and parks\casinos\other recreation sites. Next the report describes the traffic validation, and concludes with a summary section containing final remarks.

A separate report describes the development of an airport ground access model for the Cross-Border Express (CBX) facility[1].

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[1] Cross-Border Express Airport Model Development Report, prepared by RSG for San Diego Association of Governments, February 5, 2018.

2.0 DATA

This chapter describes the observed datasets utilized in calibration and validation of special generators in the SANDAG activity-based model. There are five types of data described in this chapter, as follows:

- *Beach entrance and exit counts:* Persons visiting a subset of beaches in San Diego County were counted with cameras. This data was used to estimate the number of persons attending specific beaches, and estimate an average beach visit duration which was used to expand other data.

- *Beach head counts:* Head counts were collected at most beaches intermittently during the day, and expanded to total visitors based on an average duration estimated from the entrance and exit counts.

- *Beach intercept survey:* An intercept survey was implemented to a subset of beahc visitors at key locations.

- *Location-based services (LBS) data*: GPS-enabled smartphone app data was purchased and analyzed.

- *Traffic count data:* Traffic counts were collected at a subset of hospitals, shopping centers, and parks.

This chapter describes each dataset, including how the data was collected and expanded. Key summaries from the data that are used in the calibration of the travel demand models are presented in the subsequent chapters.

2.1 BEACH COUNTS

The RSG team conducted both manual and camera-assisted visitor counts at beach sites in San Diego County in April 2017. Twenty-two cameras were used to observe visitors at four different beaches (Mission Beach, Windansea, La Jolla Cove, and Fletcher Cove) on April 25. Limited access beaches were selected as potential camera count locations because they are more cost-effective to count with cameras than manually[2]. Cameras were set up by 7 AM at each location and collecting data until 7 PM, just after sunrise and just before sunset each day. Footage was reviewed by survey staff to count total visitors by direction (inbound vs. outbound) by 15-minute interval. Table 1 lists the total entering and exiting visitors for the entire period by location. The weather on April 25 was passing clouds with a high temperature of 68 degrees. Camera data was used to estimate average duration of visits[3]. The total number of arrivals and average duration for each site is shown below. The weighted average duration based on the

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[2] Two locations on Mission Beach were included in the camera count locations so that visitor stay duration could be inferred from Mission Beach data in addition to the other beaches, due to its popularity.

[3] Average visitor duration can be calculated by counting the number of visitors present in each 15-minute period (sum of arrivals minus sum of departures for all previous periods), multiplying by the duration of each period (15 minutes) and dividing the result by total arrivals.

camera counts for La Jolla Cove, Mission Beach, and Windansea (Fletcher Cove was discarded since it was so low compared to the other sites) is 77 minutes.

- Fletcher Cove: 404 arrivals, average duration 16 minutes
- La Jolla Cove: 1933 arrivals, average duration 90 minutes
- Mission Beach: 670 arrivals, average duration 55 minutes
- Windansea: 294 arrivals, average duration 43 minutes

Attendance counts were also collected from the City of Encinitas, which deploys automated camera counters at eight beaches. In addition to the camera counts, the RSG team and SANDAG staff conducted manual counts at 22 beaches. The beaches were counted during the period starting Monday April 24th and ending Thursday April 27th. Manual counts were conducted by segmenting each beach into lengths of approximately ¼ mile, and counting the number of persons on each segment four times per day, starting at around 8 AM and ending by 7 PM (each count period was approximately 4 hours long). The weather during this period was passing clouds with highs of between 67 and 68 degrees. Counts were segmented into number of attendees in the water or on the beach.

Since the manual counts were 'head-counts' rather than total number of attendees, they must be converted into an attendance count based on an average duration of stay. First, total counted persons in each time period was multiplied by the duration of the time period to calculate total person-hours in each segment. All segments were added together to calculate total person-hours per beach. This was divided by average duration (77 minutes or 1.28 hours) to calculate total average daily attendees per beach.

Table 2 shows total daily attendance at each beach using the above methodology. In total, there were 29,347 persons per day attending San Diego County beaches during the reference week of April 24th 2017.

TABLE 1: BEACH CAMERA COUNTS

SITE ID	DATE	DAY	BEACH	LOCATION	DIRECTION	TOTAL
17-4115-007	4/25/2017	Tuesday	Mission Beach	Ventura Pl & Ocean Front Walk	In	602
17-4115-007	4/25/2017	Tuesday	Mission Beach	Ventura Pl & Ocean Front Walk	Out	528
17-4115-011	4/25/2017	Tuesday	Windansea	Neptune Pl & Palomar Ave	In	89
17-4115-011	4/25/2017	Tuesday	Windansea	Neptune Pl & Palomar Ave	Out	105

17-4115-013	4/25/2017	Tuesday	La Jolla Cove	Internal Dwy & La Jolla Cove South	NB (Out)	68
17-4115-013	4/25/2017	Tuesday	La Jolla Cove	Internal Dwy & La Jolla Cove South	SB (In)	203
17-4115-013	4/25/2017	Tuesday	La Jolla Cove	Internal Dwy & La Jolla Cove South	EB (In)	1006
17-4115-013	4/25/2017	Tuesday	La Jolla Cove	Internal Dwy & La Jolla Cove South	WB (Out)	745
17-4115-017	4/25/2017	Tuesday	Fletcher Cove	Fletcher Cove Beach & Internal Dwy	In	404
17-4115-017	4/25/2017	Tuesday	Fletcher Cove	Fletcher Cove Beach & Internal Dwy	Out	410
17-4115-107	4/25/2017	Tuesday	Mission Beach	San Fernando Pl & Ocean Front walk	In	68
17-4115-107	4/25/2017	Tuesday	Mission Beach	San Fernando Pl & Ocean Front walk	Out	97
17-4115-111	4/25/2017	Tuesday	Windansea	Neptune Pl & Gravilla St	In	58
17-4115-111	4/25/2017	Tuesday	Windansea	Neptune Pl & Gravilla St	Out	59
17-4115-113	4/25/2017	Tuesday	La Jolla Cove	Internal Dwy & La Jolla Cove North	In	724
17-4115-113	4/25/2017	Tuesday	La Jolla Cove	Internal Dwy & La Jolla Cove North	Out	531
17-4115-211	4/25/2017	Tuesday	Windansea	Neptune Pl & Windansea Middle	In	44
17-4115-211	4/25/2017	Tuesday	Windansea	Neptune Pl & Windansea Middle	Out	32
17-4115-311	4/25/2017	Tuesday	Windansea	Neptune Pl & Nautilus St	In	103

17-4115-312	4/25/2017	Tuesday	Windansea	Neptune Pl & Nautilus St	Out	81
17-4115-411	4/25/2017	Tuesday	Windansea	Neptune Pl & Gravilla St	In	55
17-4115-411	4/25/2017	Tuesday	Windansea	Neptune Pl & Gravilla St	Out	55

TABLE 2: TOTAL DAILY ATTENDANCE BY BEACH

SITEID	BEACH	SOURCE	TOTAL EXPANDED PERSON-HOURS	TOTAL ATTENDANCE
17-4114-001	Imperial Beach	Manual Count (NDS)	562	438
17-4114-002	Silver Strand State Beach	Manual Count (NDS)	427	332
17-4114-003a	Coronado Beach	Manual Count (NDS)	1,095	853
17-4114-003b	Coronado Dog Beach	Manual Count (NDS)	145	113
17-4114-004	Ocean Beach	Manual Count (NDS)	749	584
17-4114-005	Ocean Beach Dog Park	Manual Count (NDS)	903	704
17-4114-006	South Mission	Manual Count (NDS)	765	596
17-4114-007	Mission Beach	Manual Count (NDS)	2,029	1,581
17-4114-008	South Pacific Beach	Manual Count (NDS)	2,293	1,787
17-4114-009	North Pacific Beach	Manual Count (NDS)	2,183	1,701
17-4114-010	Tourmaline Beach	Manual Count (NDS)	1,271	990
17-4114-012	Marine St Beach	Manual Count (NDS)	102	79
17-4114-014	La Jolla Shores Beach	Manual Count (NDS)	1,164	907
17-4114-015	Scripps Beach	Manual Count (NDS)	469	365

17-4114-016	Del Mar Beach	Manual Count (NDS)	786	612
17-4114-018	Cardiff State Beach	Manual Count (NDS)	623	485
17-4114-020	Carlsbad State Beach	Manual Count (NDS)	3,035	2,365
17-4114-021	Oceanside Pier	Manual Count (NDS)	2,464	1,920
17-4115-011	Windansea	Camera Count (NDS)		515
17-4115-013	La Jolla Cove	Camera Count (NDS)		1,933
17-4115-017	Fletcher Cove Beach	Camera Count (NDS)		404
NA	Carlsbad State Beach	Manual Count (SANDAG)	531	414
NA	Del Mar Beach	Manual Count (SANDAG)	2,376	1,851
NA	Oceanside City - Buccaneer	Manual Count (SANDAG)	1,064	829
NA	South Ponto Beach	Manual Count (SANDAG)	1,143	891
NA	Beacons Beach	Camera Count (Encinitas 3-yr Avg)		813
NA	D Street Beach	Camera Count (Encinitas 3-yr Avg)		883
NA	Grandview Beach	Camera Count (Encinitas 3-yr Avg)		867
NA	Moonlight Beach	Camera Count (Encinitas 3-yr Avg)		1,266
NA	Ponto Beach	Camera Count (Encinitas 3-yr Avg)		232
NA	Stairway Beach (state)	Camera Count (Encinitas 3-yr Avg)		596
NA	Stonesteps	Camera Count (Encinitas 3-yr Avg)		453
NA	Swamis	Camera Count (Encinitas 3-yr Avg)		989
	Total			29,347

2.2 BEACH INTERCEPT SURVEY

Intercept surveys were conducted by field staff to obtain detailed information regarding trip origin, mode to beach, residence status, purpose of visit, duration of stay, and other useful information for modeling. The surveys were conducted by two field staff at a subset of the above

beaches, in two-hour shifts, during the week of April 11 and April 25, 2017. The surveys were conducted using tablet PCs with a live connection to an RSG server that hosts the survey instrument. Field staff intercepted persons on the beach, and collected information from willing respondents. Field staff only collected data from one person from each travel party, in the case of multiple person groups. Table 3 shows the number of samples for each site by the shift that the samples were collected in, as well as the date collected. A total of 337 surveys were collected.

TABLE 3: BEACH SURVEY SAMPLES BY BEACH AND SHIFT

Beach	Survey Date	8 AM to 10 AM	10 AM to 12 PM	1:30 PM to 3: 30 PM	5:30 PM to 7:30 PM	TOTAL
La Jolla Beach	4/11/2017		19	14	14	47
La Jolla Cove	4/13/2017		16	16		32
Moonlight Beach	4/13/2017		12	17		29
Ocean Beach	4/10/2017		27	32		59
Oceanside Beach	4/13/2017	14		18	14	46
Pacific Beach	4/12/2017		15	24	21	60
Imperial beach	4/26/2017		18	14		32
Coronado	4/25/2017		6	14		20
Coronado Dog	4/25/2017		12			12
Total		14	125	149	49	337

The beach survey data was expanded using a methodology which takes into account the probability that a given sample was surveyed based on the total number of persons observed on the beach during the time period that the sample was collected. The sample probability was

calculated for each survey record by dividing the total number of counted attendees (headcount) by the total number of samples, by beach and time period. A sample weight was calculated by taking the inverse of the sample probability. The expansion factor for each record was calculated by multiplying the sample weight by the ratio of the headcount to the total daily visitors for the beach.

Sample probability = Total sampled persons/ Total counted persons

Sample weight = 1/sample probability

Expansion factor = sample weight * total daily visitors/total counted persons

In order to expand the data to the total daily visitors across all beaches including non-surveyed beaches, the beaches shown in Table 2 were divided into five distinct groups based on location from south to north, and the expansion factors described above were scaled up to match total visitors by each of the five zones. Table 4 shows total expanded surveys by zone; note that there is some difference to total visitors due to rounding error.

Final expansion factor = expansion factor * total daily visitors at all beaches in zone/ total expanded surveys at all beaches in zone

TABLE 4: EXPANDED SURVEYS BY BEACH ZONE

BEACH ZONE	FREQ.	PERCENT
South County	659	2%
Coronado	923	3%
City of San Diego	7,471	27%
La Jolla\Del Mar	6,116	23%
North County	12,005	44%
Total	**27,174**	**100%**

Table 5 shows expanded survey respondents by beach zone and residence status. Overall, approximately 24% of respondents are non-residents, with the highest share of non-residents (39%) observed at Coronado Beach and the lowest share of non-residents (16%) observed at North County beaches. Other tables below group full-time and part-time residents together since the models treat part-time residents as residents and non-residents as overnight visitors.

TABLE 5: EXPANDED SURVEY RESPONDENTS BY BEACH ZONE AND RESIDENCE STATUS

BEACH ZONE	TOTAL RESPONSES	PERCENT

	Yes, year-round	Yes, part-time	No	Total	Yes, year-round	Yes, part-time	No	Total
South County	498	23	138	659	76%	3%	21%	100%
Coronado	563	-	360	923	61%	0%	39%	100%
City	5,146	109	2,215	7,471	69%	1%	30%	100%
La Jolla\Del Mar	2,959	1,270	1,887	6,116	48%	21%	31%	100%
North County	10,121	-	1,884	12,005	84%	0%	16%	100%
Total	**19,288**	**1,402**	**6,484**	**27,174**	**71%**	**5%**	**24%**	**100%**

2.3 LOCATION-BASED SERVICES (LBS) DATA

RSG purchased Location-based Services (LBS) data from Streetlight for special travel destinations in San Diego County, including beaches, major shopping centers, hospitals, parks, and casinos. LBS data is derived from GPS-enabled Smartphone apps that track spatial information (locations and times) when the app is running. Streetlight processes the data to generate trips and makes the data available through a convenient web application. Streetlight also attempts to identify home location and work location based on where the phone typically 'sleeps' at night and where the typically is during the day. It is not possible to identify the traveler name, exact origin\destination\home\work address, route trajectory, or other details from the data. To preserve anonymity, the data is only available for user-defined or preset geographic areas and it is aggregated by time-of-day and day-of-week. Streetlight checks user-defined geographies to ensure that they are sufficiently-large to preserve anonymity. The smallest preset geography available is the Census block group. Trips between geographic areas by time of day and day of week are summarized in relative terms (the "streetlight index").

RSG created polygons for each special generator location, in order to isolate movements to/from the special generator and census block groups. Data for spring (March, April) and fall (September and October) of 2016 were selected for summary and comparison to model results. We tagged each special destination zone and block group with the closest Series 13 TAZ, merged the off-peak (midday) distance skim with the Streetlight data. Two LBS data summaries were used for this analysis; the origin-destination trip summary and a home-work summary used to estimate the percent of visitors (home address not in San Diego County).

2.4 TRAFFIC COUNTS

National Data Service (NDS) collected traffic counts at a subset of the locations shown above. The sites were selected based on type of site, the size of the site, and the practicality of

isolating traffic to the site. Counts were collected using a combination of tube counters and cameras, during the week of October 23, 2017. In nearly all cases, the traffic counts isolate movement to/from the land use. Traffic counts are shown in Table 28.

3.0 BEACHES

This chapter describes the comparison of model trips to beach locations with multiple observed datasets. As described in Chapter 2.0, three different observed datasets were utilized to calibrate and validate the model for beach travel: beach counts, the beach intercept survey, and location-based service data (Streetlight). The remainder of the chapter describes the ABM's performance against these three datasets.

3.1 BEACH COUNTS

Table 6 and **Error! Reference source not found.** compare beach counts and the model for daily attendance at each beach in San Diego County. The estimated attendance in the model was calculated as half of total trips to/from a beach site. Also, only the trips with other discretionary purpose (social and recreational) were used in the analysis. The calibration process increased the size term parameter on acres of active beach space in the discretionary tour destination choice model.

In total, the model is underestimating beach attendance by 32%. Some beach sites compare well and are within +/-15% of the observed survey data. Among the rest, beach sites are generally underestimated with couple beaches are overestimated as well: Coronado and Fletcher Cove. The overestimation of Coronado Beach could be due to the inclusion of the Hotel Del Mar, located adjacent to the beach, in the same MGRA. The estimated attendance probably includes some travel related to the hotel as well therefore giving an impression of overestimation. The other beach site, Fletcher Cove, shares its corresponding MGRA with some households and employment (e.g. restaurants), thus could be causing extra trips that are not going to the beach.

Every beach site was reviewed carefully for their land-use data in the model. Table 7 presents a selected land-use attributes that are relevant in generating travel to beach sites. Two beach sites, Del Mar Dog and La Jolla Cove, are not represented in the model as their corresponding beach area is 0 in the MGRA land-use file. It is evident from the land-use attributes that many beach sites are not separately identified in the model and generally share MGRA with residential space, restaurants and sometimes other parks and open space. A future revision to MGRA boundaries clearly identifying beach sites would make it easier to adjust the model to represent beach travel more accurately.

TABLE 6: TOTAL DAILY ATTENDANCE BY BEACH

ZONE	BEACH NAME	SURVEY	ABM	DIFF	% DIFF
5	Cardiff State Beach	485	429	(56)	-11%
5	Carlsbad State Beach	2,365	888	(1,477)	-62%

ZONE	BEACH NAME	SURVEY	ABM	DIFF	% DIFF
5	Carlsbad State Beach South	414	444	30	7%
2	Coronado Beach	853	2,087	1,233	145%
4	Del Mar Beach	1,851	173	(1,679)	-91%
4	Del Mar Beach North	612	372	(240)	-39%
4	Del Mar Dog Beach	NA	107	NA	NA
4	Fletcher Cove Beach	404	558	154	38%
1	Imperial Beach	438	446	8	2%
4	La Jolla Cove	1,933	1,262	(671)	-35%
4	La Jolla Shores Beach	907	989	82	9%
3	Mission Beach	1,581	1,591	10	1%
5	Moonlight Beach	1,266	275	(991)	-78%
3	North Pacific Beach	1,701	512	(1,189)	-70%
3	Ocean Beach	584	180	(404)	-69%
3	Ocean Beach Dog Beach	704	597	(107)	-15%
5	Oceanside Beach – All	2,464	1,406	(1,058)	-43%
3	Pacific Beach	1,787	1,689	(98)	-5%
3	Tourmaline Beach	990	533	(457)	-46%
4	Scripps Beach	365	136	(229)	-63%
3	South Mission	596	392	(203)	-34%
	Total	**22,299**	**15,066**	**(7,233)**	**-32%**

FIGURE 1: TOTAL DAILY ATTENDANCE BY BEACH
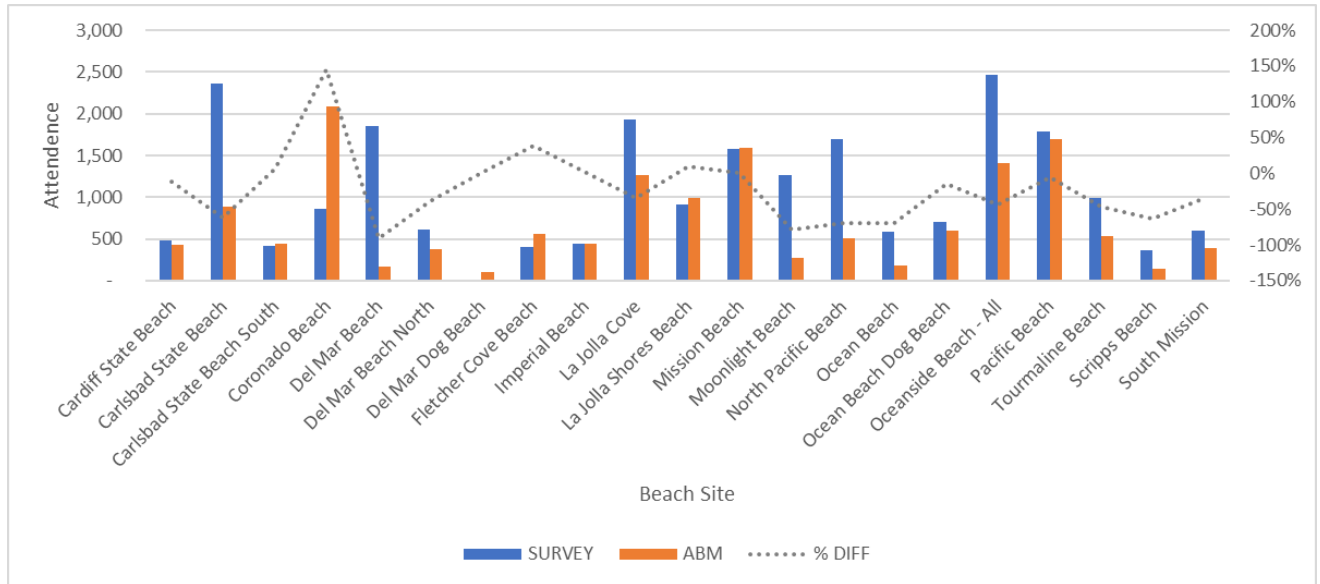
TABLE 7: MGRA LAND-USE INPUTS BY BEACH SITE

ZONE	BEACH NAME	BEACH AREA (ACRES)	PARK (ACRES)	OEPN SPACE (ACRES)	EMP	POP
5	Cardiff State Beach	16.66	-	0.84	-	-
5	Carlsbad State Beach	23.54	-	-	-	-
5	Carlsbad State Beach South	20.64	-	-	-	-
2	Coronado Beach	72.78	-	-	14	-
4	Del Mar Beach	2.85	3.32	-	-	-
4	Del Mar Beach North	7.25	-	-	22	336
4	Del Mar Dog Beach	-	-	6.31	-	-
4	Fletcher Cove Beach	15.35	-	-	178	567
1	Imperial Beach	9.39	0.96	-	112	88
4	La Jolla Cove	-	-	1.65	1,122	38
4	La Jolla Shores Beach	10.02	8.05	-	-	-

ZONE	BEACH NAME	BEACH AREA (ACRES)	PARK (ACRES)	OEPN SPACE (ACRES)	EMP	POP
3	Mission Beach	2.18	4.78	-	814	110
5	Moonlight Beach	1.27	9.76	-	15	97
3	North Pacific Beach	9.35	-	-	1	89
3	Ocean Beach	8.04	-	-	-	13
3	Ocean Beach Dog Beach	23.82	-	-	9	156
5	Oceanside Beach – All	36.92	0.51	-	112	728
3	Pacific Beach	17.74	-	8.87	483	514
3	Tourmaline Beach	17.52	-	0.65	13	433
4	Scripps Beach	5.54	-	-	-	-
3	South Mission	22.68	-	-	34	641

Fields in the MGRA land-use input file: EMP=emp_total; POP=pop, BEACH AREA=beachactive, PARK=parkactive, OPEN SPACE=openspaceparkreserve

To compare beach attendance at an aggregate level, the beaches were divided into five distinct groups (zones) based on location from south to north. The zone corresponding to a beach site is shown in Table 6. Table 8 and Figure 2 compare observed and estimated attendance by beach zone. Beaches in the City and South County are estimated close to the observed. Coronado beaches are over estimated and the other two groups, La Jolla\ Del Mar and North County are underestimated. We recommend reviewing and revising the MGRA data for beaches in these districts to improve the fit to observed attendance.

TABLE 8: ATTENDANCE BY BEACH ZONE

ZONE ID	ZONE NAME	SURVEY	ABM	SURVEY	ABM
1	South County	438	446	2%	3%
2	Coronado	853	2,087	4%	14%
3	City	7,942	5,494	36%	36%
4	La Jolla/ Del Mar	6,073	3,596	27%	24%

5	North County	6,993	3,443	31%	23%
	Total	**22,299**	**15,066**	**100%**	**100%**

FIGURE 2: DISTRIBUTION OF ATTENDANCE BY BEACH ZONE
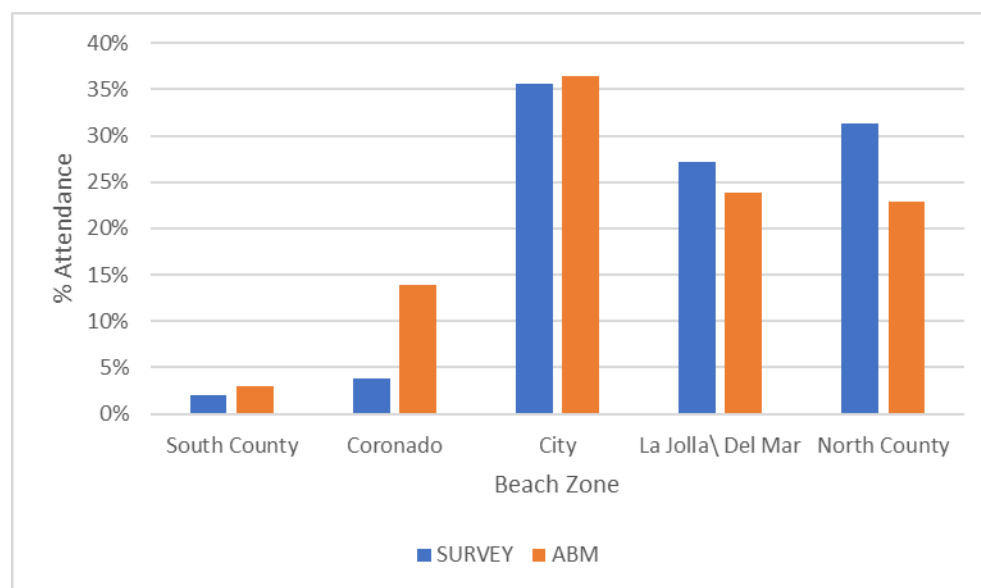
3.2 BEACH SURVEY

Attendance by Party Size

Table 9 compares share of residents and non-residents visiting the San Diego beaches within each party size category. In general, the survey indicates that irrespective of the party size, visitors to the beaches are more residents than non-residents. The model shows the same pattern for party sizes of 2 or less, however, for higher party sizes (>2), contrast to the survey, it indicates more non-residents than residents.

TABLE 9: SHARE OF RESIDENT AND NON-RESIDENT

PARTY SIZE	SURVEY			ABM		
	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
1	92%	8%	100%	86%	14%	100%
2	70%	30%	100%	70%	30%	100%
3	80%	20%	100%	26%	74%	100%

4	69%	31%	100%	13%	87%	100%
5	71%	29%	100%	9%	91%	100%
6	27%	73%	100%	6%	94%	100%
7+	61%	39%	100%	0%	100%	100%
Total	**76%**	**24%**	**100%**	**61%**	**39%**	**100%**

Table 10 compares share of beach trips by party size. The shares are compared by resident status as well. According to the model, most (85%) residents visiting the beaches travel alone, whereas the survey observed only 33% for the same. This results in lower average value of residents per trip in the model (1.26) compared to the survey (2.70). The non-resident travel compares better, however, with a noticeable difference for groups of 7 or more people. The model estimates 18% non-resident travel with party size of 7 or more persons, a significantly higher share compared to the observed (3%). The higher estimate for larger party sizes result in only a slightly higher average value (3.84) of persons per trip compared to the survey (3.60). Overall, average party size in the model (2.27) is comparable with the survey (2.70).

No adjustments were made to improve these comparisons. Significant modifications would need to be made to the joint tour destination choice and individual tour mode choice models to increase the party size of visitors to MGRAs with beaches.

TABLE 10: BEACH VISITORS BY PARTY SIZE AND RESIDENCE STATUS

	SURVEY			ABM		
PARTY SIZE	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
1	33%	9%	27%	85%	21%	60%
2	18%	24%	19%	8%	6%	7%
3	15%	12%	15%	4%	19%	10%
4	16%	22%	17%	2%	18%	8%
5	16%	21%	17%	1%	12%	5%
6	1%	9%	3%	0%	5%	2%
7+	2%	3%	2%	0%	18%	7%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

| Average | 2.70 | 3.60 | 2.70 | 1.26 | 3.84 | 2.27 |

Note: Trips are person trips

Activity Duration

The survey also asked beach visitors for their guesstimate of stay (duration) at the beach. However, model outputs do not report an activity duration directly, rather each trip record is attached with information on arrival time (stop period) at trip destination. The stop period is reported in 40 bins of 30 minutes. A beach activity duration was calculated using stop period of trip to beach and stop period and travel time of the following trip (from beach), as shown below.

Activity duration (mins) = $30*$(stop period)$_{\text{from beach}}$ − $30*$(stop period)$_{\text{to beach}}$ − (travel time)$_{\text{from beach}}$

Table 11**Error! Reference source not found.** and Table 12 compare model outputs with beach survey respondents by duration of visit and residence status. Note that Table 11 shows lower number of beach activities in the model (14,952) than the model attendance (15,066) reported in Table 6. This is because some beach trips are excluded from this analysis due to a reporting inconsistency discovered in the model - some trips are reported with a lower stop period than the previous trip.

TABLE 11: BEACH ACTIVITY DURATION - COUNT

	SURVEY			ABM		
DURATION	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
< 1 hr	125	165	290	6,585	2,803	9,388
1 - 2 hrs	4,636	948	5,584	1,455	175	1,630
2 - 3 hrs	6,242	1,603	7,845	651	385	1,036
3 - 4 hrs	4,083	860	4,943	312	394	706
4 - 5 hrs	2,749	934	3,682	121	355	476
5 - 6 hrs	1,509	563	2,072	82	201	283
6 - 7 hrs	634	651	1,285	36	123	159
7 - 8 hrs	56	463	519	21	257	278
8+ hrs	656	298	953	60	936	996
Total	**20,690**	**6,484**	**27,174**	**9,323**	**5,629**	**14,952**
Average	3.1	3.8		0.8	2.4	

The survey data observed that non-residents tend to spend longer at the beach than residents. The average duration of visit is approximately 4 hours for non-residents and 3 hours for residents. Very few respondents report visiting for less than one hour. Note that the average duration of surveyed visitors is much longer than the duration calculated from observed camera count data. We suspect this is response bias due to the survey technique which targeted persons on the beach for in-person interviews. Respondents were probably more likely to participate if they were at the beach for longer than one hour, as visitors with limited time probably did not want to participate in the interview.

The model predicts 63% beach visitors staying for less than an hour, compared to only 1% in the survey data. Like the survey, the model predicts longer stay for non-residents than resident, though with a shorter average duration (2.4 hours) as 50% spend less than an hour. Surprisingly, 17% non-residents stay at the beach for 8 or more hours. Residents' stay at the beach is even shorter (0.8 hours), primarily due to a large portion (71%) of them spending less than an hour on the beach. Note that beach activity duration for model estimates was calculated from trip arrival time which is available only in 30 minutes period, thus could be introducing duration error up to an hour (arrival time of two trips - to and from beach). In addition, as mentioned earlier, we suspect that survey duration is biased towards longer stay.

TABLE 12: BEACH ACTIVITY DURATION - SHARE

	SURVEY			ABM		
DURATION	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
< 1 hr	1%	3%	1%	71%	50%	63%
1 - 2 hrs	22%	15%	21%	16%	3%	11%
2 - 3 hrs	30%	25%	29%	7%	7%	7%
3 - 4 hrs	20%	13%	18%	3%	7%	5%
4 - 5 hrs	13%	14%	14%	1%	6%	3%
5 - 6 hrs	7%	9%	8%	1%	4%	2%
6 - 7 hrs	3%	10%	5%	0%	2%	1%
7 - 8 hrs	0%	7%	2%	0%	5%	2%
8+ hrs	3%	5%	4%	1%	17%	7%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Average	3.1	3.8		0.8	2.4	

Trip Length

The RSG team geocoded the survey data for the origin of each trip to the beach to the Series 13 MGRA system and calculated the distance of each trip to the beach based on the trip origin and beach MGRA using the auto distance skim. A similar distribution was created from the model outputs as well.

Figure 3 compares average trip length frequency distribution for all travelers to the San Diego beaches. The survey distribution is lumpy due to gaps in the data and exhibits an average trip length of 13.6 miles. The model trips are comparatively shorter in lengths with an average trip length of only 6.60 miles. Note that model predicts a high percentage of trips traveling less than 2 miles as many trips originate from land-uses close to the beach destination. Only a few of such trips are observed in the survey. In general, compared to the survey, the model is estimating a higher share of trips that are shorter than 9 miles and fewer trips longer than 35 miles in lengths.

FIGURE 3: BEACH TRIP LENGTH FREQUENCY DISTRIBUTION
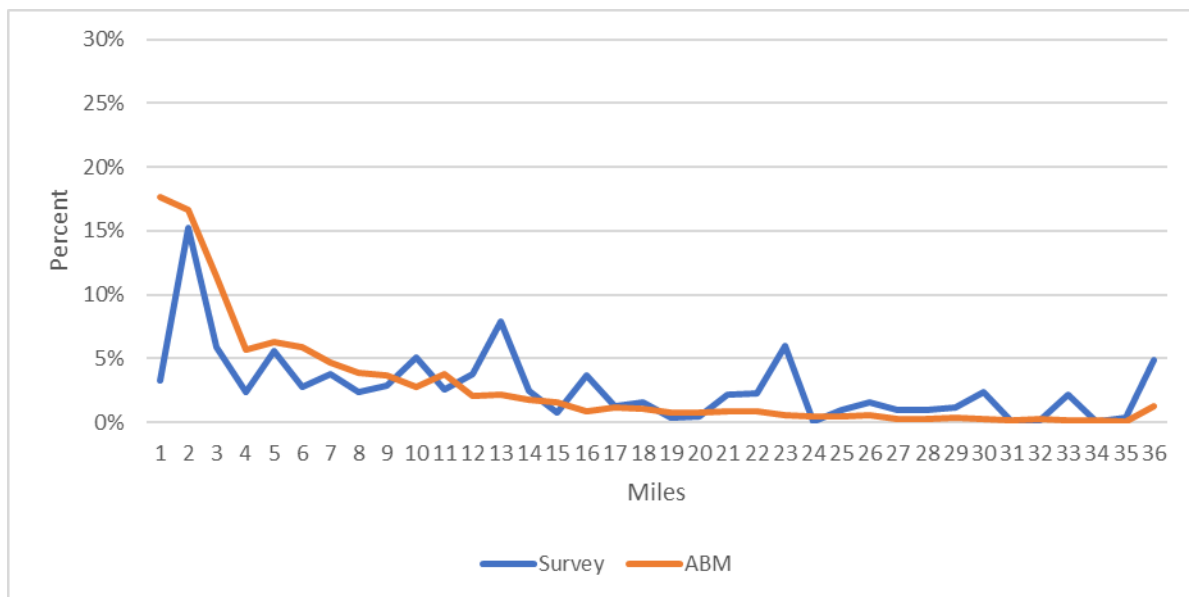
Origin Purpose

Table 13 shows the origin purpose of trips to the beach as reported in the intercept survey. 84% of all resident trips originate in the respondent's home or a friend's home, while 80% of all visitor trips originate in either a home, hotel, or vacation rental. 88% of residents and 73% of non-residents report planning to return to the origin location after leaving the beach, indicating that the majority of beach tours are relatively simple with only one out-of-home location. 33% of the visitors who report planning to visit a different location plan to visit a restaurant after leaving the beach.

TABLE 13: ORIGIN PURPOSE - SURVEY

ORIGIN PURPOSE	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
Home	16,036	752	16,788	78%	12%	62%
Hotel	298	3,388	3,686	1%	52%	14%
Vacation rental (AirBnB, VRBO, etc)	106	904	1,010	1%	14%	4%
Work	372	19	391	2%	0%	1%
School	1,668	16	1,684	8%	0%	6%
Shopping	0	52	52	0%	1%	0%
Sight-seeing	142	0	142	1%	0%	1%
A different beach	0	69	69	0%	1%	0%
A restaurant or bar	706	153	859	3%	2%	3%
Family or friend's home	1,319	932	2,251	6%	14%	8%
Other	42	199	242	0%	3%	1%
Total	**20,690**	**6,484**	**27,174**	**100%**	**100%**	**100%**

To compare with model outputs, as shown in Table 14 and Table 15, origin purposes in the survey data were combined into six categories that are common with purpose definitions in the model. The survey observed 79% trips originating at home (home, hotel or vacation rental) with 23% of such trips made by non-residents. The model produces only 45% trips with home as origin with 42% of these trips belonging to non-residents. 37% trips started at a location of discretionary purpose, compared to only 13% reported in the survey. The model produces 9% beach activities originating from a maintenance activity, whereas the survey saw only a handful of such travel. The beach trips starting from work place are also higher in share compared to the survey. The survey observed only 5% such trips made by non-residents, whereas the model estimates 28%. Note that the calibration did not make any adjustments to improve comparisons by origin purpose.

TABLE 14: ORIGIN PURPOSE - TRIP COUNT

SURVEY	ABM

	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
Home	16,440	5,044	21,484	3,813	2,733	6,546
Work	372	19	391	413	160	573
University	-	-	-	67	-	67
School	1,668	16	1,684	791	-	791
Maintenance	-	52	52	1,054	203	1,257
Discretionary	2,209	1,355	3,565	3,315	2,152	5,467
TOTAL	20,690	6,484	27,174	9,453	5,248	14,701

Note: airport and int-ext (aggregate) models do not report origin purpose, thus excluded from the analysis.

TABLE 15: ORIGIN PURPOSE - TRIP SHARE

	SURVEY			ABM		
	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
Home	77%	23%	79%	58%	42%	45%
Work	95%	5%	1%	72%	28%	4%
University	0%	0%	0%	100%	0%	0%
School	99%	1%	6%	100%	0%	5%
Maintenance	0%	100%	0%	84%	16%	9%
Discretionary	62%	38%	13%	61%	39%	37%
TOTAL	76%	24%	100%	64%	36%	100%

Mode to Beach

Table 16 shows survey respondents by mode to the beach as reported in the survey. 76% of residents either drove alone or drove with others. 10% of residents walked, and 8% used a Transportation Networking Company (TNC). 66% of non-residents drove alone or with others,

while 21% walked and 6% used a TNC. The bike, taxi, and transit shares for both residents and visitors is very low.

TABLE 16: SURVEY RESPONDENTS BY MODE TO BEACH

MODE TO BEACH	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
Drove alone	4,992	373	5,365	24%	6%	20%
Drove with others	10,631	3,863	14,494	51%	60%	53%
Dropped off (private vehicle)	614	145	759	3%	2%	3%
Biked	485	44	530	2%	1%	2%
Walked	2,142	1,374	3,516	10%	21%	13%
Taxi	0	17	17	0%	0%	0%
Uber, Lyft, etc.	1,572	396	1,968	8%	6%	7%
Transit (bus, trolley	23	0	23	0%	0%	0%
Other (motorcycle, skateboard, etc)	231	271	502	1%	4%	2%
Total	**20,690**	**6,484**	**27,174**	**100%**	**100%**	**100%**

For comparison purpose, mode to beach reported in the survey were recoded to be consistent with the model definitions. Table 17 and Table 18**Error! Reference source not found.** compare model and survey trips to the beaches in seven standard trip mode categories. Note that walk shares in the survey increased slightly due to recoding the 'Other' category based on the information provided in the survey. The model (24%) is estimating more drive alone trips than the survey (20%), consistent with the comparison by party size (Table 9 and Table 10). More residents are driving alone (37% vs 24% in the survey), and more non-residents are using taxi (15% vs very few in the survey), possibly due to larger party size. Only 31% travelers are choosing shared-ride 3+ as trip mode to beaches, compared to 53% observed in the survey. Calibration did not make any adjustments to improve these comparisons.

TABLE 17: TRIP MODE - COUNT

	SURVEY			ABM		
	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL

Drive Alone	4,992	373	5,365	3,482	131	3,613
Shared 2	2,115	753	2,868	2,353	358	2,711
Shared 3+	10,701	3,769	14,470	2,037	2,630	4,667
Walk	2,373	1,538	3,911	979	1,464	2,443
Bike	485	44	530	510	-	510
Transit	23	-	23	112	17	129
School bus	-	7	7	-	-	-
Taxi	-	-	-	-	802	802
TOTAL	**20,690**	**6,484**	**27,174**	**9,473**	**5,402**	**14,875**

TABLE 18: TRIP MODE - SHARE

	SURVEY			ABM		
	RESIDENT	NON-RESIDENT	TOTAL	RESIDENT	NON-RESIDENT	TOTAL
Drive Alone	24%	6%	20%	37%	2%	24%
Shared 2	10%	12%	11%	25%	7%	18%
Shared 3+	52%	58%	53%	22%	49%	31%
Walk	11%	24%	14%	10%	27%	16%
Bike	2%	1%	2%	5%	0%	3%
Transit	0%	0%	0%	1%	0%	1%
School bus	0%	0%	0%	0%	0%	0%
Taxi	-	-	-	0%	15%	5%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

3.3 LOCATION-BASED SERVICES DATA

Table 19 shows Streetlight data for beaches in San Diego County. The Streetlight OD Traffic Index for all origins and destinations at the beach is shown along with the average trip length for all trips to/from the beach, and the average trip length from home to the beach. As can be seen in the table, the average home to beach trip length (11.4 miles) is much longer than the OD trip length (5.6 miles). Comparing the average trip lengths in Streetlight to the intercept survey, we observe that the intercept survey respondents report much longer observed trip lengths (13.6 miles average for residents and 9.5 miles average for visitors). The survey trip lengths are closer to the home to beach trip lengths in the Streetlight data, which suggests that the Streetlight data may be more successful in recording short non-home-based trips to/from the beach that intercept survey respondents did not report. This finding also suggests that the mix of trips by origin purpose shown in Table 13 may over-state the percentage of trips to/from home and hotel locations. The trip length may also be correlated with duration at the beach; travel for short beach visits would probably originate closer to the beach than longer stays. This is consistent with the analysis comparing survey data to duration of visits based on the camera count data, which indicates that the survey is biased towards longer durations. Figure 6 shows the trip length frequency distribution for beach visitors according to the Streetlight data. The distribution is much steeper and smoother than the one created from the intercept survey (Figure 3).

Table 19 also shows the Streetlight reported percent of non-residents (non-Metro area residents) who visit each beach. The weighted average percent of non-residents according to Streetlight data (15%) is lower than the survey share of non-residents (25%). This also might explain some of the differences between the Streetlight data summary and the intercept survey data. Finally, the table shows the share of trips that are internal-external (trips with one end outside of San Diego County). The share of internal-external (IE) trips at all beaches is low, with the exception of Oceanside beach. The average percent of trips that are IE is 2%.

Table 20 shows the same summaries from the model outputs. The model (1%) produces fewer internal-external trips to the beaches than the observed data (2%). This could be due to the model summaries not including trips from the external-internal model. This sub-model reports trips at an aggregate level (TAZ) and therefore makes it hard to identify travel specific to the beaches. Inclusion of these trips would have added more error to the summaries.

TABLE 19: STREETLIGHT BEACH DATA[4]

BEACH	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT
Cardiff State Beach	11	3.7	10.7	27%	0%
Carlsbad State Beach	31	4.1	NA	26%	0%

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[4] Some beaches omitted due to low Streetlight OD index; totals for these beaches included in summaries.

Carlsbad State Beach South	15	6.9	9.9	26%	0%
Coronado Beach	541	5.7	14.3	17%	1%
Del Mar Beach	34	5.6	10.7	7%	0%
Del Mar Beach North	69	4.3	11.6	31%	0%
Del Mar Dog Beach	95	8.1	11.5	NA	3%
Fletcher Cove	305	6.6	11.5	5%	1%
Imperial Beach	155	5.2	9.4	4%	0%
La Jolla Cove	163	6.4	15	NA	1%
La Jolla Shores	66	5.7	14.3	5%	0%
Mission Beach	125	4.1	12.4	6%	0%
Moonlight Beach	190	5.0	9.6	3%	1%
North Pacific Beach	138	2.9	8.7	8%	1%
Ocean Beach	209	5.5	10.2	5%	0%
Ocean Beach Dog Beach	85	7.6	10.6	6%	0%
Oceanside Beach - All	1,948	5.7	12	17%	5%
Pacific Beach	177	3.2	10.2	31%	0%
Pacific Tourmaline Beach	10	6.6	7.9	19%	0%
Scripps Beach	67	7.2	14.4	19%	0%
South Mission Beach	372	6.3	12.5	31%	1%
Total	**4,843**	**5.6**	**11.4**	**15%**	**2%**

TABLE 20: BEACH DATA - ABM

BEACH	OD TRIPS	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT

Cardiff State Beach	750	6.9	7.5	0%	0%
Carlsbad State Beach	1,663	6.2	6.8	15%	0%
Carlsbad State Beach South	799	7.7	9.2	8%	0%
Coronado Beach	4,173	8.8	9.9	13%	0%
Del Mar Beach	211	8.1	7.8	12%	0%
Del Mar Beach North	742	7.5	8.7	68%	2%
Del Mar Dog Beach	40	8.1	4.1	85%	0%
Fletcher Cove Beach	1,003	7.1	6.9	13%	3%
Imperial Beach	1,221	5.4	3.6	52%	0%
La Jolla Cove	2,359	5.3	6.9	75%	0%
La Jolla Shores Beach	1,810	7.2	7.3	64%	0%
Mission Beach	3,138	5.6	9.2	59%	0%
Moonlight Beach	454	5.6	6.0	0%	1%
North Pacific Beach	988	5.6	4.6	53%	0%
Ocean Beach	357	4.9	5.3	11%	0%
Ocean Beach Dog Beach	1,326	6.3	7.8	22%	0%
Oceanside Beach - All	2,828	6.0	6.6	17%	3%
Pacific Beach	3,013	6.4	7.1	62%	0%
Tourmaline Beach	1,065	5.1	5.8	11%	1%
Scripps Beach	271	6.4	5.9	11%	0%
South Mission	791	8.9	9.0	23%	2%
Total	**29,002**	**6.6**	**7.6**	**36%**	**1%**

Average OD trip length, Figure 4 and Figure 5, across all beach sites in the model is 6.6 miles, slightly longer than the observed data (5.6 miles). The average home trip length (7.6 miles) is shorter than the observed (11.4 miles). Home trip lengths are consistently underestimated

across all beach sites. The shorter home trip lengths are due to the model sending more non-residents, thus fewer residents (64%) to the beaches than the observed data (85%). Apparently, not enough residents living away from the beaches are visiting them. This also points to a possible bias in the Streetlight data. It is suspected that the Streetlight data is biased towards longer trips as the data disregards walk trips shorter than a particular threshold, thus causing observed home trip lengths to be longer than expected. Walk trips of visitors living close to the beaches are probably not accounted for in the Streetlight data. This seems to be an issue more for residents than non-residents.

FIGURE 4: OD TRIP LENGTHS BY BEACH SITE
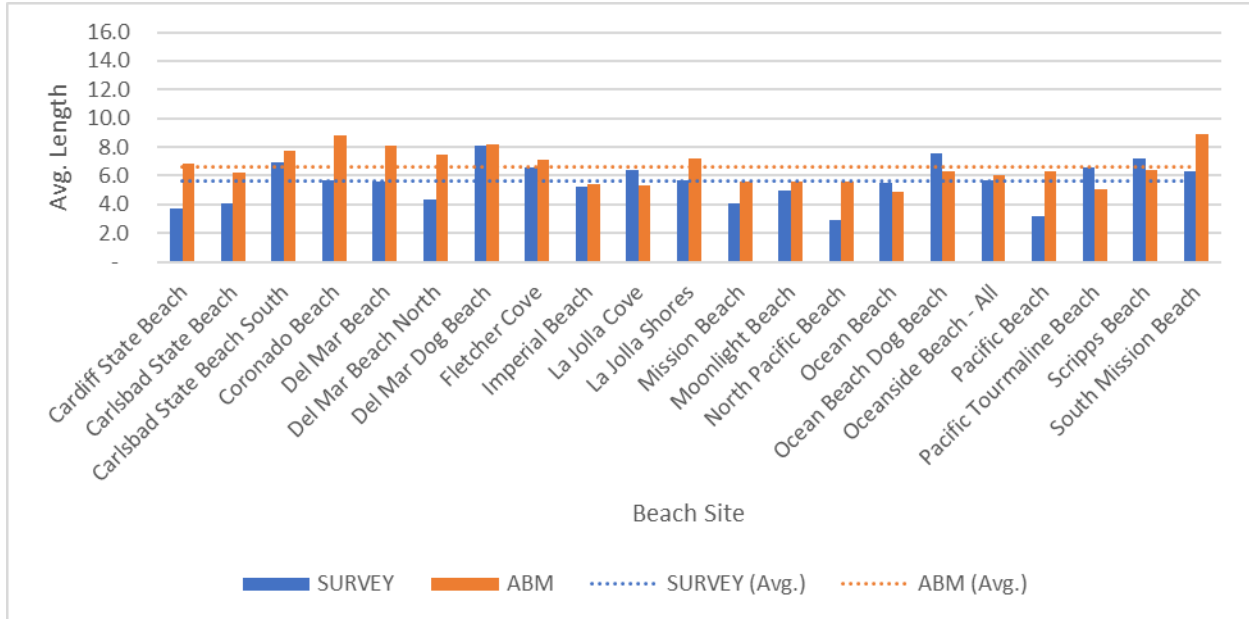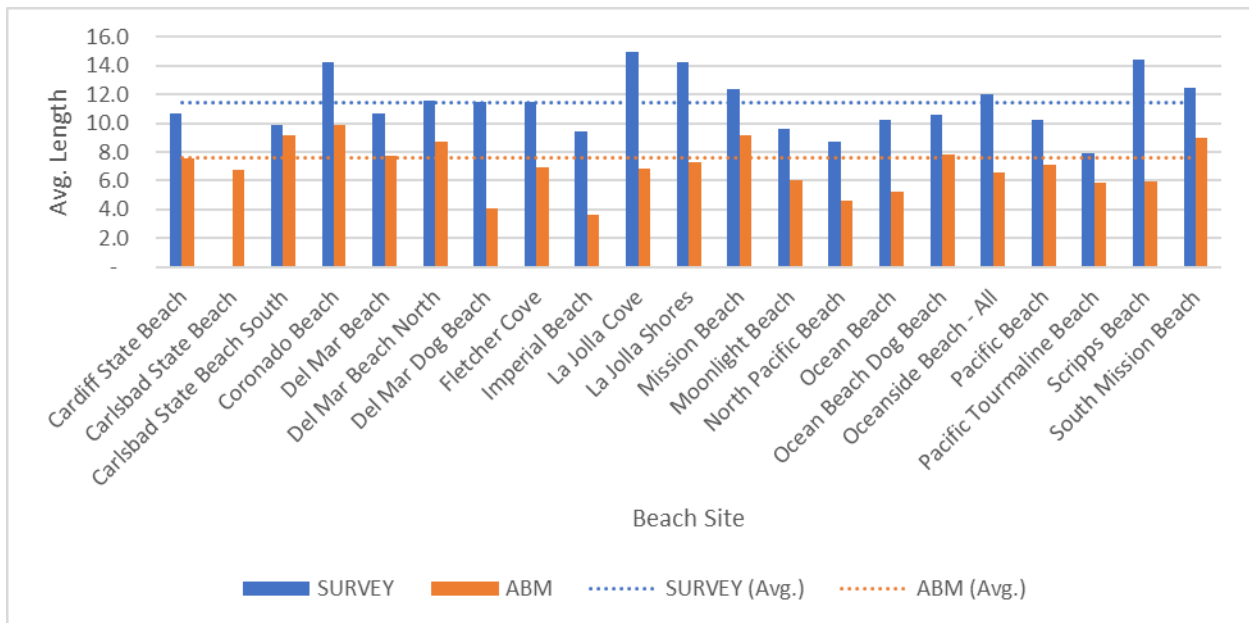

FIGURE 5: HOME TRIP LENGTHS BY BEACH SITE

Table 21 shows the sum of the Streetlight OD Traffic Index across the five beach zones shown in Table 4 and compares the percent of the index in each zone to the percent of estimated daily average beach visitors to each zone from Table 5. The percentages compare favorably except for Coronado Beach. This may be a function of the Streetlight data picking up trips to/from Coronado Hotel, which might inflate the Coronado beach share, or may be a problem with the expansion of the beach counts to total visitors, perhaps due to an incorrect duration estimate applied to Coronado beach visitors.

TABLE 21: VISITORS BY BEACH ZONE

BEACH ZONE	SURVEY	ABM	ABM	SURVEY	ABM
South County	155	1,221	3%	2%	4%
Coronado	541	4,173	11%	4%	14%
City	1,116	10,678	23%	36%	37%
La Jolla\Del Mar	799	6,436	17%	27%	22%
North County	2,195	6,494	46%	31%	22%
Total	**4,806**	**29,002**	**100%**	**100%**	**100%**

Figure 6 compares beach visitor trip length frequency distribution from the ABM with the Streetlight data. The ABM generates fewer shorter trips (less than 2 miles) than the observed data. This concurs with the observation from Figure 4, where average OD trip length in the model is slightly overestimated.

FIGURE 6: STREETLIGHT BEACH VISITOR TRIP LENGTH FREQUENCY DISTRIBUTION
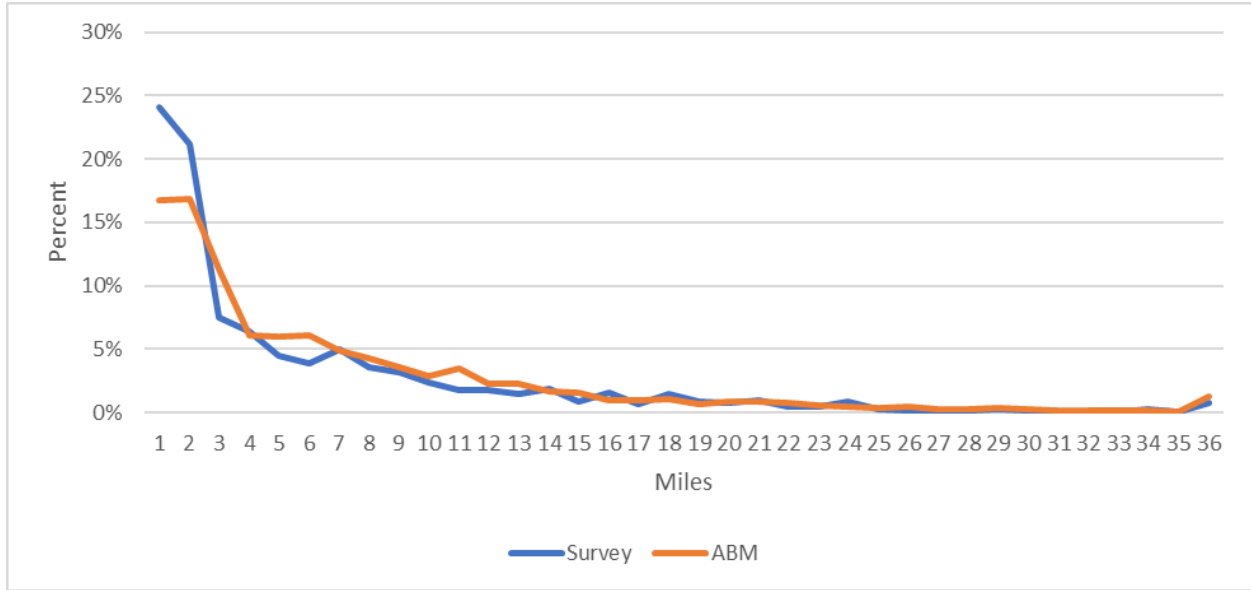
4.0 HOSPITALS

Table 22 shows Streetlight data for hospitals. According to the Streetlight index, hospitals in San Diego County generate approximately 17 times more trips than beaches. Based on the total number of visitors to beaches (29k, as shown in Table 2) this translates to 493k total hospital attractions, including workers, patients, visitors, etc. The average trip length for all trips to and from hospitals is 10.8 miles, according to Streetlight data. The average home to hospital distance is 10.5 miles. This is a bit odd since one might expect that non-home based trips to/from hospitals would be shorter than the distance from home. As one might expect, the average distance to/from the VA hospital is longer than other hospitals (15.6 miles).

Table 23 presents a summary of the model trips. Figure 7 and Figure 8 compare OD trip lengths and home trip lengths respectively in the model with the observed Streetlight data. To include only hospital related trips, the model summaries filter out trips that have one end as hospital and the end purpose as home. The model generates shorter average trip length (7.7 miles) then the observed trip length (10.8 miles) from the Streetlight data. The average home to hospital distance (10.1 miles) is very similar to the Streetlight distance (10.5 miles). Further investigation into land-use data for MGRAs corresponding to hospital sites revealed some issues in model inputs.

- Palomar medical center is not represented in the model as the corresponding MGRA does not have any employment in the input MGRA land-use file.

- The following hospitals do not have any health employment, however, other employment[5] are available: Edgemoor hospital, Kaiser hospital/ Clairemont mesa, Naval medical center, UC San Diego Hillcrest, UC San Diego Thornton Hospital, and VA Hospital. This indicates possible miscoding of health employment to other categories.

- MGRA's corresponding to Alavarado Hospital and Paradise Valley Hospital include some residential population as well, suggesting a need for more refined MGRA boundaries to isolate the hospital sites.

It is recommended to review land-use data for the hospital sites and update as necessary.

According to the Streetlight data, the average percent of non-Metro-area resident trips to hospitals is 9%. Naval Medical Center and UC San Diego Hillcrest have some of the largest non-resident trip shares. The average percent of IE trips to/from hospitals is 2%. Palomar Medical Center in Escondido attracts the highest share of IE trips (7%).

TABLE 22: HOSPITAL DATA - SURVEY

HOSPITAL	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT

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[5] emp_state_local_gov_ent, emp_state_local_gov_blue, emp_state_local_gov_white, emp_prof_bu_svcs, and and emp_prof_bus_svcs_bldg_maint

Alvarado Hospital	3,448	8.8	9.5	9%	2%
Kaiser Hospital / Clairemont Mesa	1,907	9.0	11.4	4%	1%
Naval Medical Center	8,315	11.2	11.4	16%	3%
Palomar Medical Center	3,472	10.3	12.4	4%	7%
Paradise Valley Hospital	2,215	6.7	5.4	5%	0%
Scripps Green Hospital	6,015	12.9	15.7	11%	2%
Scripps Memorial Hospital La Jolla	6,975	13.1	14.9	7%	2%
Scripps Mercy Hospital	3,691	10.0	10.8	13%	1%
Sharp Chula Vista Medical Center	3,994	7.8	7.7	5%	1%
Sharp Grossmont Hospital	10,420	8.1	8.5	4%	1%
Sharp Memorial	2,648	11.0	12.7	8%	0%
Sharp Mesa Vista Hospital	3,455	11.5	12.5	8%	1%
Tri-City Medical Center	2,998	8.6	8.4	5%	5%
UC San Diego Hillcrest	5,183	10.4	11.9	15%	1%
UC San Diego Thornton Hospital	10,459	12.3	13.8	7%	3%
VA Hospital	5,533	15.6	14.1	8%	2%
Total	**82,023**	**10.8**	**10.5**	**9%**	**2%**

Note: Some hospitals not shown due to low Streetlight index; however, values for these hospitals were included in totals.

TABLE 23: HOSPITAL DATA - ABM

HOSPITAL	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT
Alvarado Hospital	10,128	7.1	8.6	2%	0%
Kaiser Hospital / Clairemont Mesa	2,053	7.4	10.7	0%	0%

Naval Medical Center	24,906	7.5	9.8	5%	0%
Palomar Medical Center	-	-	-	-	-
Paradise Valley Hospital	12,026	6.2	6.8	1%	0%
Scripps Green Hospital	27,386	9.9	13.1	3%	0%
Scripps Memorial Hospital La Jolla	23,271	8.3	11.2	1%	0%
Scripps Mercy Hospital	21,531	6.5	9.1	3%	0%
Sharp Chula Vista Medical Center	20,692	6.1	6.6	2%	0%
Sharp Grossmont Hospital	26,874	6.7	8.5	1%	0%
Sharp Memorial	103,602	8.5	11.5	0%	0%
Sharp Mesa Vista Hospital	1,722	8.1	10.9	5%	0%
Tri-City Medical Center	13,075	6.2	7.2	2%	0%
UC San Diego Hillcrest	27,414	7.4	10.4	6%	0%
UC San Diego Thornton Hospital	2,952	7.5	10.0	6%	0%
VA Hospital	669	7.8	9.3	2%	0%
Total	**327,121**	**7.7**	**10.1**	**2%**	**0%**

Note: Some hospitals not shown due as they are not included in the table for Streetlight data; however, values for these hospitals are included in totals.

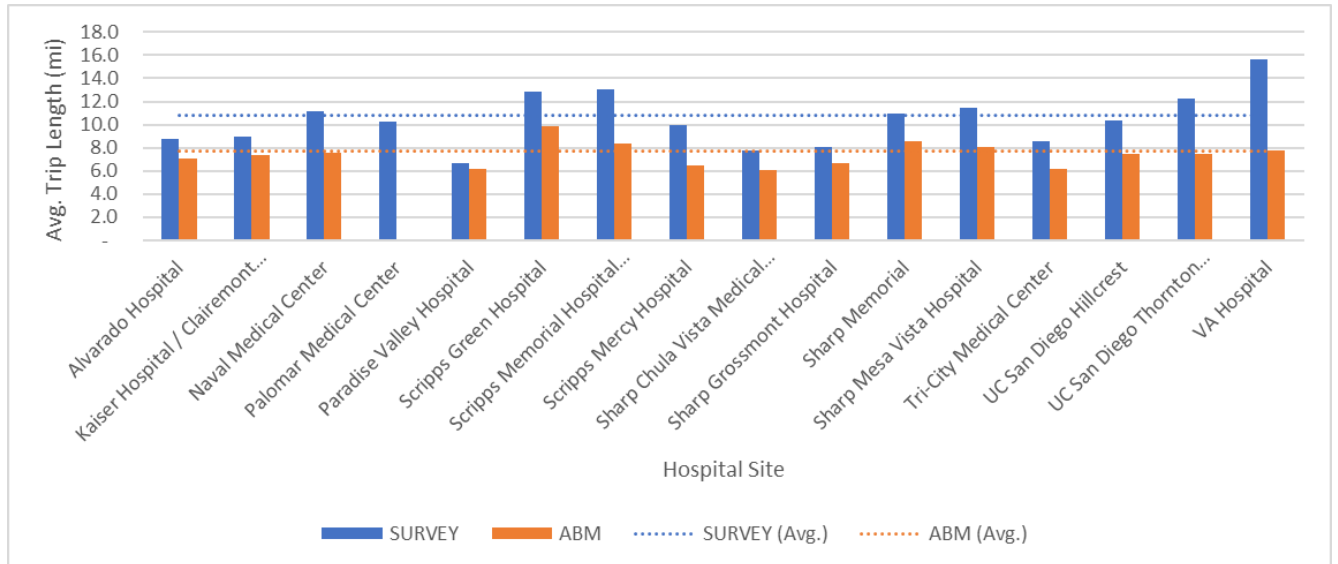**FIGURE 7: OD TRIP LENGTH DISTRIBUTION**

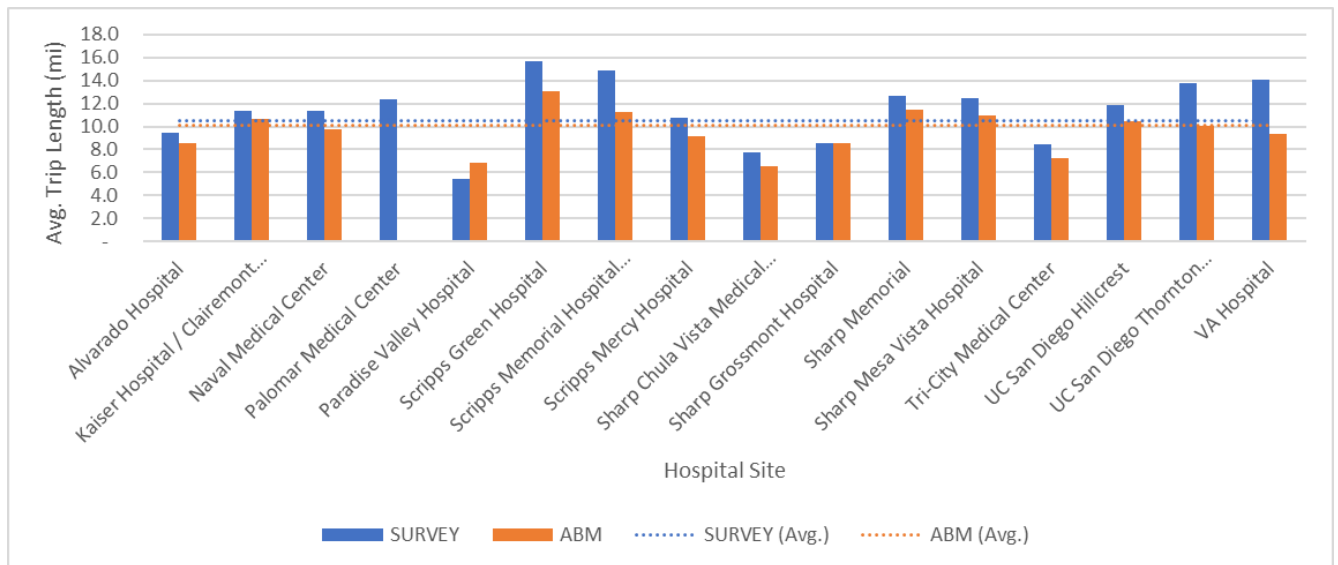**FIGURE 8: HOME TRIP LENGTH DISTRIBUTION**

Figure 9 compares trip length frequency distribution of trips to/from hospitals in the model with the Streetlight data. The model is producing more trips shorter than 7 miles, and fewer longer trips compared to the observed distribution. This results in shorter average trip lengths in the model, as observed in Figure 7. The calibration process adjusted the size term parameter on health employment in the maintenance stop location choice model.

FIGURE 9: HOSPITAL TRIP LENGTH FREQUENCY DISTRIBUTION
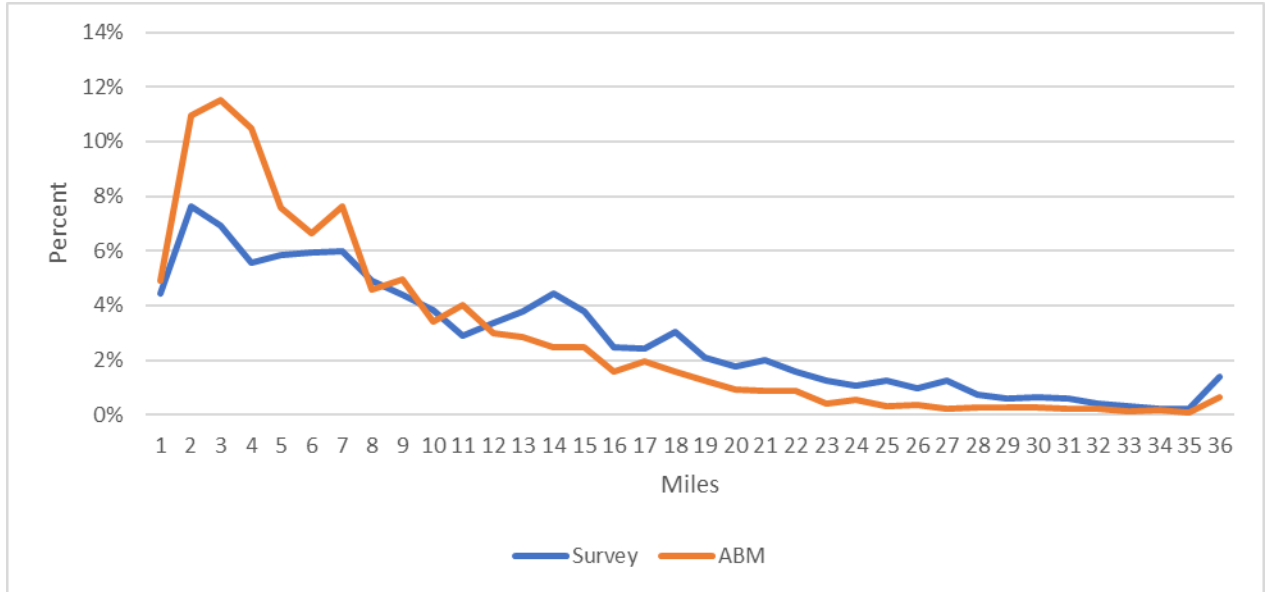
5.0 MAJOR RETAIL

Table 24 shows Streetlight data for large shopping centers. According to the Streetlight index, shopping centers in San Diego County generate approximately 1M trip attractions on an average weekday.

The average trip length for all trips to and from major shopping centers is 7 miles. The average home to shopping center distance is 10.4 miles. Outlet stores tend to have higher trip lengths, higher shares of non-resident trip attractions and a higher share of IE trips, than other shopping centers.

A similar summary of the model trips is shown in Table 25. The summary excludes trips that have one end as shopping center and the end purpose as home. Figure 10 and Figure 11 compare OD trip lengths and home trip lengths respectively in the model with the observed Streetlight data. The model generates slightly shorter average trip length (6.2 miles) then the observed trip length (7.0 miles) from the Streetlight data. The average home to hospital distance (8.1 miles) is shorter than the Streetlight distance (10.4 miles). Generally, trip lengths for each shopping center are very similar as well, except Las America outlet and Viejas outlet, where the ABM is generating significantly shorter trip lengths. The Las Americas outlet is located at the Mexico border and attracts many non-residents (mostly Mexican residents). The model generates 75% of the visitors to the shopping center as non-residents. In absence of their actual origin/destination in Mexico, the model trip lengths excluded such trips from the calculations and therefore possibly causing shorter trip lengths in the model. The results of another outlet, Viejas outlet, are also affected by higher non-resident travel. The outlet is located in the East County and as per the Streetlight data attracts 21% non-residents. The model generates only 4% non-resident trips to the outlet and again, the trip length calculations do not include non-resident travel.

TABLE 24: MAJOR SHOPPING CENTER DATA - SURVEY

SHOPPING CENTER	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT
Carlsbad Premium Outlets	4,764	9.5	14.1	11%	7%
Carmel Mountain Plaza	10,637	5.8	10	4%	1%
Escondido Promenade	8,545	6.5	11.3	4%	3%
Fashion Valley	11,941	7.9	11.1	16%	1%
Fenton Marketplace	15,269	6.8	9.4	8%	1%
Grossmont Center	16,665	5.5	7.8	5%	0%

Grove Shopping Center	14,873	5.0	6.4	5%	0%
Las Americas Outlets	4,862	9.6	12.7	22%	1%
North County Square	7,079	5.6	7.7	3%	1%
Otay Ranch Town Center	6,699	7.0	8.1	7%	0%
Parkway Plaza	15,169	5.8	8.5	6%	0%
Plaza Bonita	11,114	6.2	7.4	NA	0%
Stonecrest Plaza	9,549	5.8	10.7	7%	0%
Viejas Outlet	3,976	21.3	24.1	21%	2%
Westfield Carlsbad	7,026	6.3	8.1	5%	3%
Westfield North County	11,402	9.7	13.4	5%	3%
Westfield UTC	10,970	7.8	11.3	7%	1%
Total	**170,540**	**7.0**	**10.4**	**7%**	**1%**

TABLE 25: MAJOR SHOPPING CENTER DATA - ABM

SHOPPING CENTER	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT
Carlsbad Premium Outlets	47,915	7.4	9.7	12%	0%
Carmel Mountain Plaza	56,011	5.9	7.2	4%	0%
Escondido Promenade	24,653	6.9	8.6	3%	0%
Fashion Valley	180,710	6.3	8.9	10%	0%
Fenton Marketplace	35,506	6.7	8.7	5%	0%
Grossmont Center	65,041	6.2	7.9	4%	0%
Grove Shopping Center	30,769	5.8	6.3	5%	1%

Las Americas Outlets	103,639	4.1	6.7	75%	0%
North County Square	24,142	5.8	6.5	2%	0%
Otay Ranch Town Center	52,219	5.8	5.3	19%	1%
Parkway Plaza	57,288	6.2	7.7	4%	1%
Plaza Bonita	87,131	6.9	7.5	16%	0%
Stonecrest Plaza	26,867	7.1	9.3	4%	0%
Viejas Outlet	5,881	13.3	14.8	4%	0%
Westfield Carlsbad	23,591	6.0	6.7	4%	0%
Westfield North County	54,659	8.9	10.0	4%	0%
Westfield UTC	76,769	5.4	7.5	7%	0%
Total	**952,791**	**6.2**	**8.1**	**15%**	**0%**

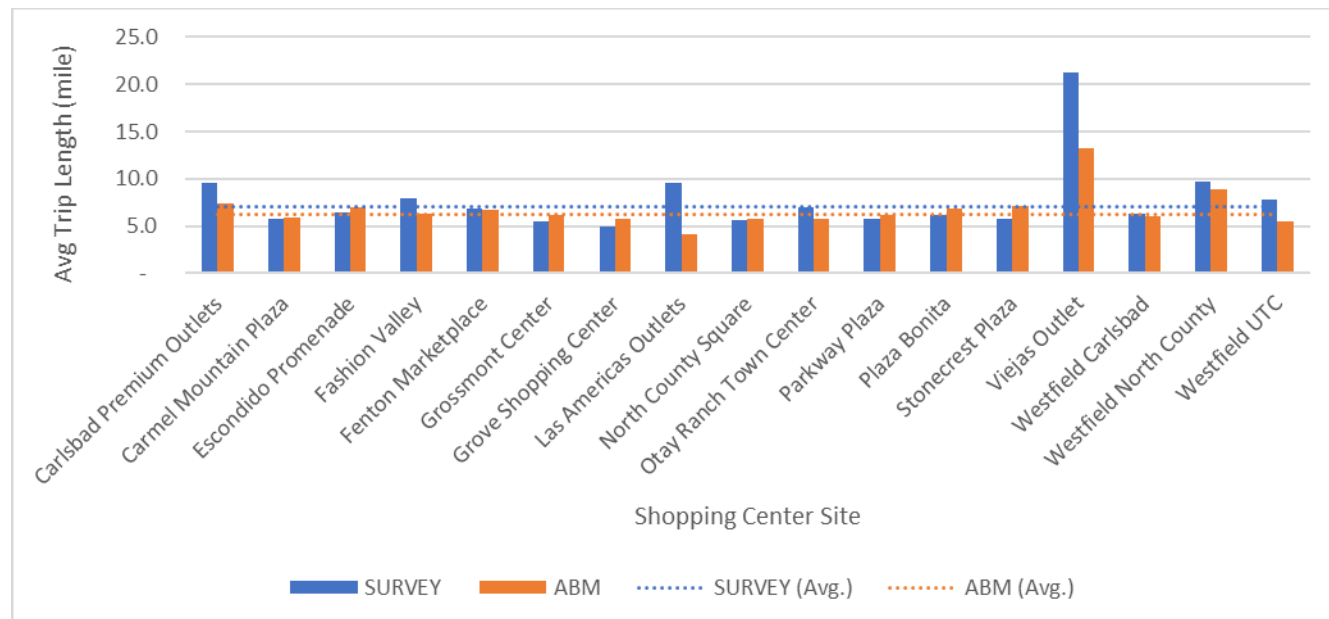**FIGURE 10: OD TRIP LEGNTH BY MAJOR SHOPPING CENTER SITE**

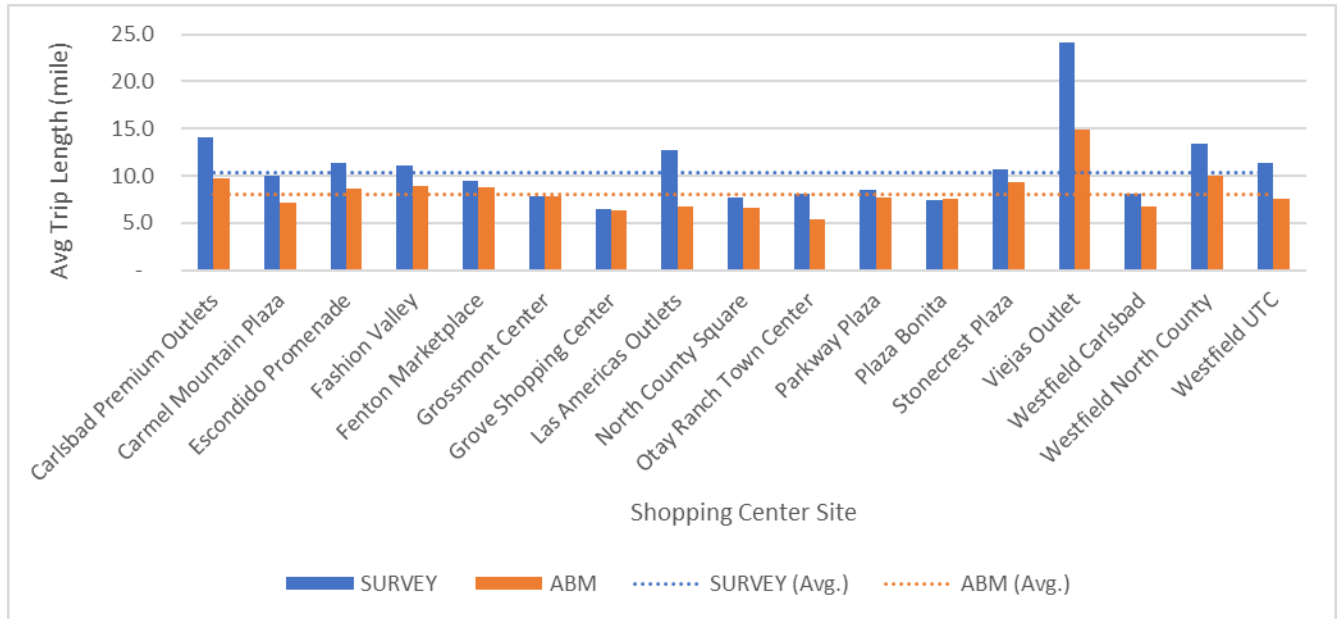**FIGURE 11: HOME TRIP LEGNTH BY MAJOR SHOPPING CENTER SITE**

Figure 12 shows trip length frequency distribution for trips to/from major shopping centers. Generally, the model distribution follows the Streetlight data, except that the model generates more trips shorter than 2 miles. A more detailed analysis of these trips could possibly inform the reason for this behavior. The calibration process adjusted the size term parameter on retail employment in the maintenance tour destination choice model and the stop location choice models.

FIGURE 12: MAJOR SHOPPING TRIP LENGTH FREQUENCY DISTRIBUTION
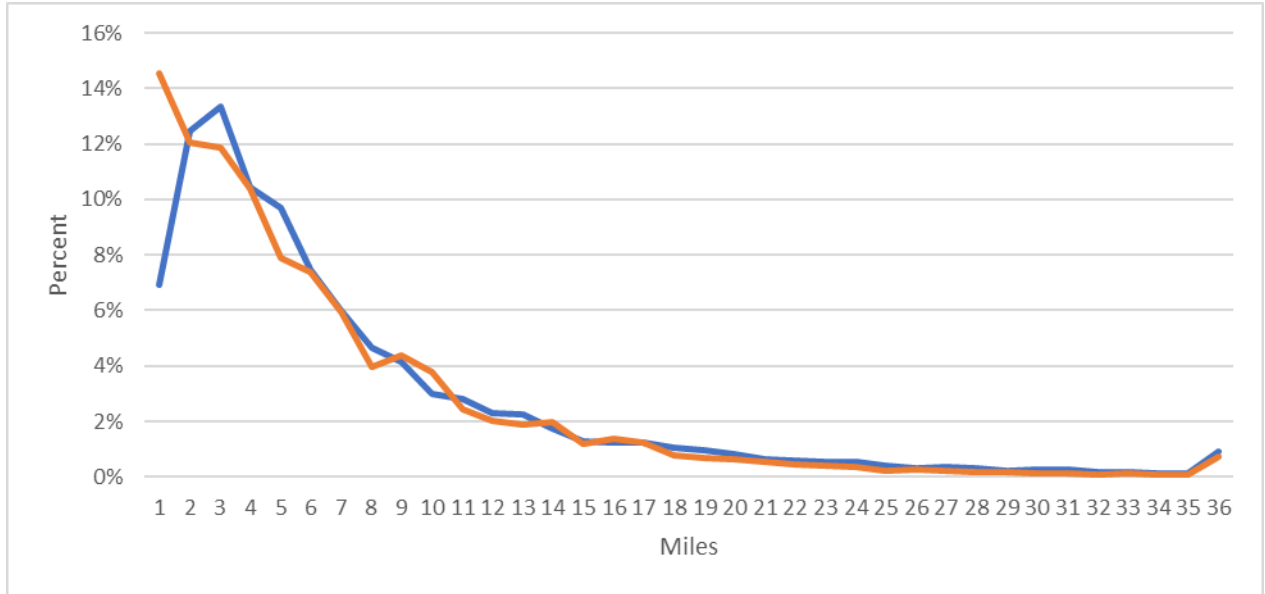
6.0 PARKS, CASINOS, AND OTHER RECREATION ATTRACTIONS

Table 26 shows Streetlight data for recreational sites in San Diego County, including parks and casinos. The average trip length for all trips to and from major recreation sites is 12 miles. The average distance to home for visitors traveling to major recreation sites is 11 miles. Casinos tend to have the longest trip lengths. The USS Midway, Hotel Del Coronado, the San Diego Zoo, the San Diego Safari Park, and SeaWorld attract high percentages of non-residents. Pala Casino and Harrah's Casino have a high share of internal\external trips compared to other sites.

Table 27 presents model data for the recreational sites and Figure 13 and Figure 14 graphically compare OD trip length and distance to home by recreation site. Average home trip length in the model (10.2 miles) is similar to the observed data (11 miles). Though, average OD trip length is shorter (7.9 miles in model vs 12 miles in the Streetlight data). Shorter trip lengths in the model are probably due to exclusion of external trips from the calculations and also due to the model producing negligible percentage of internal-external travel, whereas the Streetlight data observed 7% of such trips to the recreational sites. A few casino sites (Harrah's Casino, Jamul Casino, and Pala Casino) and Balboa Park see some of the larger differences. The model is generating significantly higher non-residents trips (53%) overall, compared to 17% as observed in the Streetlight data. More noticeably, residents visit to USS Midway Museum and Torrey Pines is very small as 96% or more visitors to these sites are non-residents. A closer look into site's land-use revealed that the MGRA corresponding to Jamul Casino is not coded with any employment in the input MGRA land-use file.

The model is calibrated by adjusting size terms in the visitor model UEC and parks size term in the accessibility UEC. The calibration process adjusted the size term parameter in the visitor tour destination choice model and the open space and parks in the tour destination choice model.

TABLE 26: STREETLIGHT RECREATION SITE DATA

RECREATION SITE	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT
Balboa Park	22,834	9.2	9.7	18%	2%
Barona Casino	5,317	19.6	18.2	10%	2%
Carlsbad Flower Fields	1,104	8.7	9.3	11%	9%
Chula Vista Wildlife Preserve	1,371	9.6	7.1	10%	1%
Harrah's Casino	2,577	19.2	7.6	9%	27%

RECREATION SITE	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT
Hotel Del Coronado	3,217	8.1	11.9	40%	2%
Jamul Casino	2,524	16.1	7.6	10%	1%
Legoland	2,436	10.4	15.0	16%	9%
Pala Casino	1,919	20.0	8.9	5%	48%
San Diego Zoo Safari Park	2,309	13.7	12.1	11%	7%
San Diego Zoo	4,161	7.6	8.9	25%	3%
SeaWorld	3,541	10.7	7.8	28%	4%
Sycuan Casino	5,844	17.2	16.7	5%	0%
Torrey Pines	1,304	9.1	10.9	15%	2%
USS Midway Museum	2,371	6.7	6.6	46%	2%
Valley View Casino	2,189	7.6	8.4	19%	2%
Total	**65,018**	**12.0**	**11.0**	**17%**	**7%**

Note: Some sites not shown due to low Streetlight index; however, values for these sites were included in totals.

TABLE 27: RECREATION SITE DATA - ABM

RECREATION SITE	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT
Balboa Park	24,738	6.7	7.3	34%	0%
Barona Casino	1,993	16.4	15.6	14%	0%
Carlsbad Flower Fields	296	7.8	8.2	3%	0%
Chula Vista Wildlife Preserve	3,031	7.1	7.2	34%	0%
Harrah's Casino	219	11.7	10.9	0%	0%

RECREATION SITE	OD TRAFFIC INDEX	OD TRIP LENGTH (MI)	HOME TRIP LENGTH (MI)	% NON-RESIDENTS	% INT-EXT
Hotel Del Coronado	11,891	7.6	10.7	74%	0%
Jamul Casino	415	14.2	12.1	27%	0%
Legoland	26,984	8.9	10.9	26%	0%
Pala Casino	1,240	18.1	14.7	10%	0%
San Diego Zoo Safari Park	12,180	15.1	13.1	53%	0%
San Diego Zoo	38,160	7.1	9.4	49%	0%
SeaWorld	57,002	8.6	11.2	29%	0%
Sycuan Casino	1,469	14.6	14.2	13%	1%
Torrey Pines	19,508	9.3	10.0	96%	0%
USS Midway Museum	44,541	4.3	10.0	98%	0%
Valley View Casino	7,899	5.8	8.1	42%	0%
Total	**259,202**	**7.9**	**10.2**	**53%**	**0%**

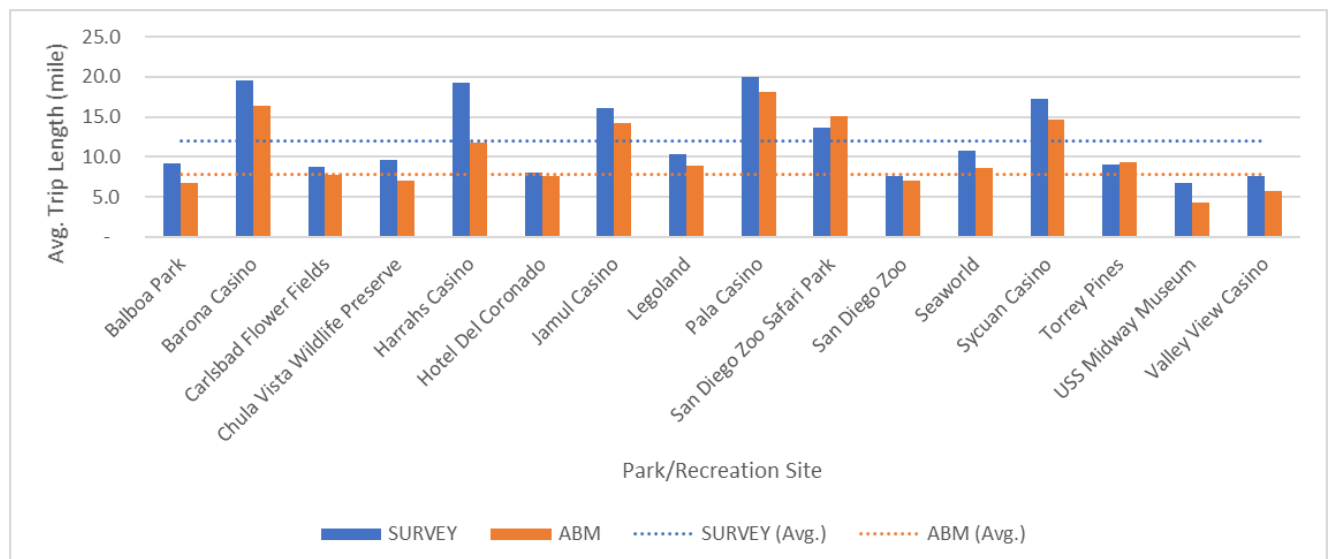**FIGURE 13: OD TRIP LENGTH BY RECREATION SITE**

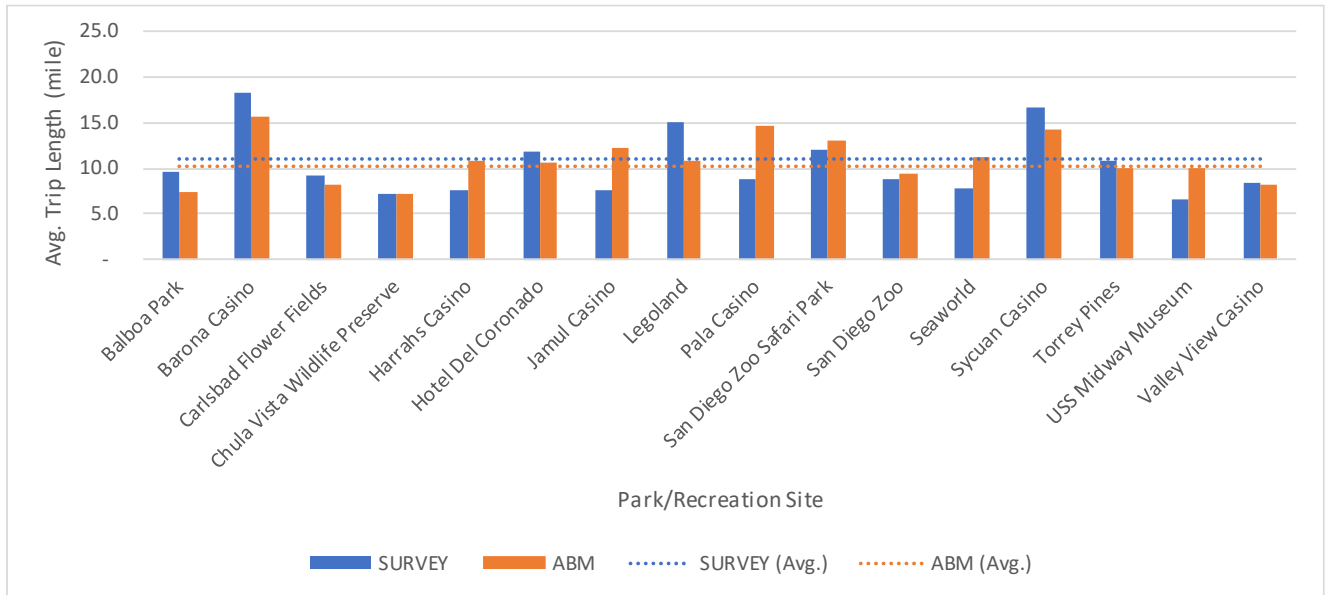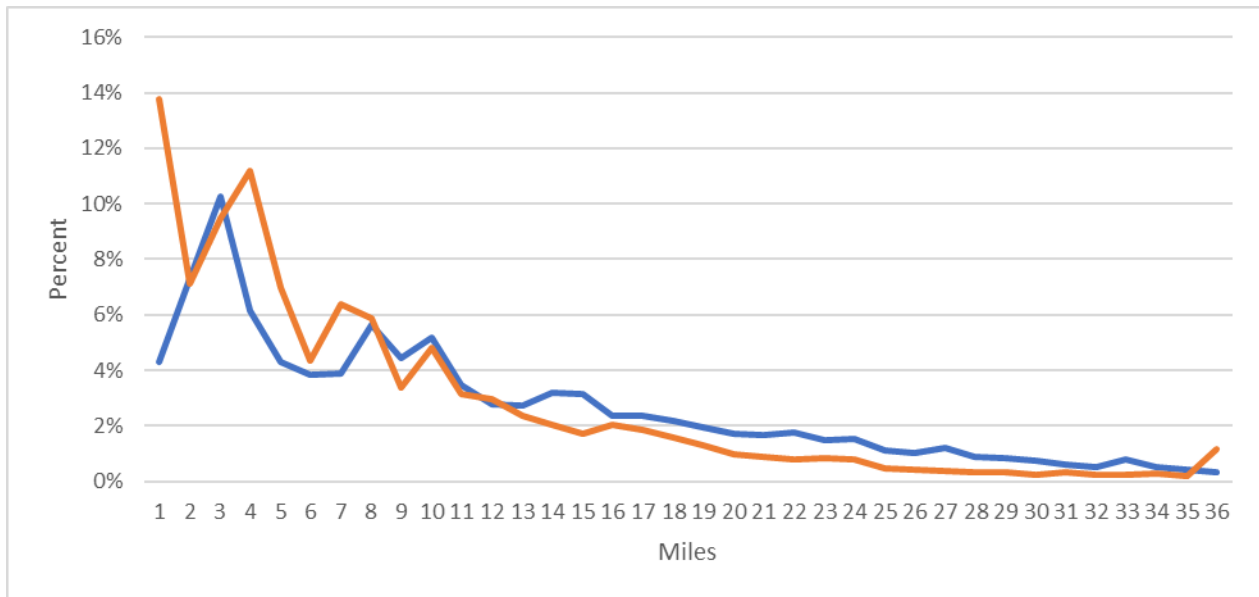**FIGURE 14: HOME TRIP LENGTH BY RECREATION SITE**

Figure 15 shows trip length frequency distribution for trips to/from recreation sites. Compared to the Streetlight data, the model generates higher percentage of trips shorter than 2 miles.

FIGURE 15: RECREATION SITE TRIP LENGTH FREQUENCY DISTRIBUTION

7.0 TRAFFIC VALIDATION

Table 28 and Table 30 summarize observed traffic counts by location and model time period. The site locations include one of the three site type: park, hospital, and shopping centers. For the same locations, vehicle flows to the sites produced by the model are summarized in Table 29 and Table 31. Further, the locations are aggregated by site type and their diurnal distributions of traffic are shown in Table 30, Table 31, Table 32, Table 33. Figure 16, Figure 17, and Figure 18 for hospitals, parks, and shopping centers respectively.

Both park sites, Torrey Pines and Mission Trails Park, compare well with traffic counts. Torrey Pines is a popular location for both residents and visitors for hiking and other recreation activities. To represent the park's unique nature and make it more attractive to visitors (non-residents), the model calibration added a size term parameter for Torrey Pines in the visitor tour destination choice model. Additionally, for all park sites, the size term on park area in the discretionary tour destination choice model is increased to match traffic counts. A comparison of total traffic to the two parks by model time period shows that the model is generating more trips in the evening periods and fewer in the other periods. This is because, in reality, parks have certain hours where access is not available (ex. after dark), but the model does not see those restrictions and generates visitors travel in those restricted hours as well, therefore causing more people visiting in the evenings then observed.

Hospital sites are over-estimated in the model. However, the diurnal distribution of the traffic is similar to the observed. Note that two hospitals, Palomar Medical Center and VA hospital, are not represented in the model (health employment in their corresponding MGRAs are 0) and are therefore excluded from the diurnal comparisons.

Shopping centers are generally overestimated as well with exception of Stonecrest Plaza which compares well and Escondido Promenade which is under-estimated. The diurnal distribution of the model traffic flow is similar to the observed traffic counts.

TABLE 28: TOTAL TRAFFIC COUNTS BY LOCATION AND MODEL TIME PERIOD

LOCATION	TYPE	EA	AM	MD	PM	EV	DAILY
Torrey Pines	Park	16	505	2,063	1,459	356	4,399
Alvarado Hospital	Hospital	174	428	1,075	578	318	2,573
Escondido Promenade	Shopping Center	278	1,817	10,363	6,509	3,514	22,481
Grossmont Center	Shopping Center	323	2,306	16,953	11,660	7,046	38,288
Mission Trails Park	Park	5	141	384	132	16	678

Otay Ranch Town Center	Shopping Center	145	1,110	7,497	7,491	4,968	21,211
Palomar Medical Center	Hospital	328	894	2,161	1,347	1,223	5,953
Paradise Valley Hospital	Hospital	92	805	2,030	866	535	4,328
Sharp Grossmont Hospital	Hospital	459	2,487	6,450	3,127	1,684	14,207
Stonecrest Plaza	Shopping Center	419	1,359	7,996	5,261	4,044	19,079
Tri-City Medical Center	Hospital	243	1,313	2,395	1,522	926	6,399
VA Hospital	Hospital	337	1,896	4,414	2,017	795	9,459
Westfield North County	Shopping Center	357	1,225	9,963	7,497	4,060	23,102
Westfield UTC	Shopping Center	879	2,476	15,409	9,027	6,070	33,861

TABLE 29: TOTAL VEHICLE TRIPS BY LOCATION AND MODEL TIME PERIOD - ABM

LOCATION	TYPE	EA	AM	MD	PM	EV	DAILY
Torrey Pines	Park	3	295	1,624	1,014	1,937	4,873
Alvarado Hospital	Hospital	188	1,399	2,850	1,964	863	7,264
Escondido Promenade	Shopping Center	228	1,773	6,699	5,664	2,699	17,063
Grossmont Center	Shopping Center	664	5,347	17,060	15,589	7,305	45,964
Mission Trails Park	Park	3	66	317	202	255	843
Otay Ranch Town Center	Shopping Center	533	3,993	12,635	9,600	5,435	32,196
Palomar Medical Center	Hospital	-	-	-	-	-	-

Paradise Valley Hospital	Hospital	185	1,816	3,375	2,221	964	8,561
Sharp Grossmont Hospital	Hospital	481	3,964	7,636	5,074	2,108	19,263
Stonecrest Plaza	Shopping Center	299	2,249	7,580	6,243	2,973	19,345
Tri-City Medical Center	Hospital	196	1,746	3,794	2,420	1,101	9,257
VA Hospital	Hospital	17	97	123	134	51	421
Westfield North County	Shopping Center	608	4,160	14,760	11,889	5,777	37,194
Westfield UTC	Shopping Center	609	5,494	19,558	15,872	8,015	49,548

TABLE 30: DISTRIBUTION OF TRAFFIC COUNTS BY LOCATION AND MODEL TIME PERIOD

LOCATION	TYPE	EA	AM	MD	PM	EV	DAILY
Torrey Pines	Park	0%	11%	47%	33%	8%	100%
Alvarado Hospital	Hospital	7%	17%	42%	22%	12%	100%
Escondido Promenade	Shopping Center	1%	8%	46%	29%	16%	100%
Grossmont Center	Shopping Center	1%	6%	44%	30%	18%	100%
Mission Trails Park	Park	1%	21%	57%	19%	2%	100%
Otay Ranch Town Center	Shopping Center	1%	5%	35%	35%	23%	100%
Palomar Medical Center	Hospital	6%	15%	36%	23%	21%	100%
Paradise Valley Hospital	Hospital	2%	19%	47%	20%	12%	100%

Sharp Grossmont Hospital	Hospital	3%	18%	45%	22%	12%	100%
Stonecrest Plaza	Shopping Center	2%	7%	42%	28%	21%	100%
Tri-City Medical Center	Hospital	4%	21%	37%	24%	14%	100%
VA Hospital	Hospital	4%	20%	47%	21%	8%	100%
Westfield North County	Shopping Center	2%	5%	43%	32%	18%	100%
Westfield UTC	Shopping Center	3%	7%	46%	27%	18%	100%

TABLE 31: DISTRIBUTION OF VEHICLE TRIPS BY LOCATION AND MODEL TIME PERIOD - ABM

LOCATION	TYPE	EA	AM	MD	PM	EV	DAILY
Torrey Pines	Park	0%	6%	33%	21%	40%	100%
Alvarado Hospital	Hospital	3%	19%	39%	27%	12%	100%
Escondido Promenade	Shopping Center	1%	10%	39%	33%	16%	100%
Grossmont Center	Shopping Center	1%	12%	37%	34%	16%	100%
Mission Trails Park	Park	0%	8%	38%	24%	30%	100%
Otay Ranch Town Center	Shopping Center	2%	12%	39%	30%	17%	100%
Palomar Medical Center	Hospital	-	-	-	-	-	-
Paradise Valley Hospital	Hospital	2%	21%	39%	26%	11%	100%
Sharp Grossmont Hospital	Hospital	2%	21%	40%	26%	11%	100%

Stonecrest Plaza	Shopping Center	2%	12%	39%	32%	15%	100%
Tri-City Medical Center	Hospital	2%	19%	41%	26%	12%	100%
VA Hospital	Hospital	4%	23%	29%	32%	12%	100%
Westfield North County	Shopping Center	2%	11%	40%	32%	16%	100%
Westfield UTC	Shopping Center	1%	11%	39%	32%	16%	100%

TABLE 32: DIURNAL DISTRIBUTION OF TRAFFIC BY SITE TYPE – TRAFFIC COUNTS

TYPE	EA	AM	MD	PM	EV	DAILY
Hospital*	968	5,033	11,950	6,093	3,463	27,507
Park	21	646	2,447	1,591	372	5,077
Shopping Center	2,401	10,293	68,181	47,445	29,702	158,022

*Note: Hospital excludes Palomar Medical Center and VA hospital due to no emp_health in the model.

TABLE 33: DIURNAL DISTRIBUTION OF TRAFFIC BY SITE TYPE - ABM

TYPE	EA	AM	MD	PM	EV	DAILY
Hospital*	1,049	8,925	17,656	11,678	5,036	44,344
Park	6	360	1,941	1,216	2,192	5,716
Shopping Center	2,941	23,017	78,292	64,857	32,203	201,310

*Note: Hospital excludes Palomar Medical Center and VA hospital due to no emp_health in the model.
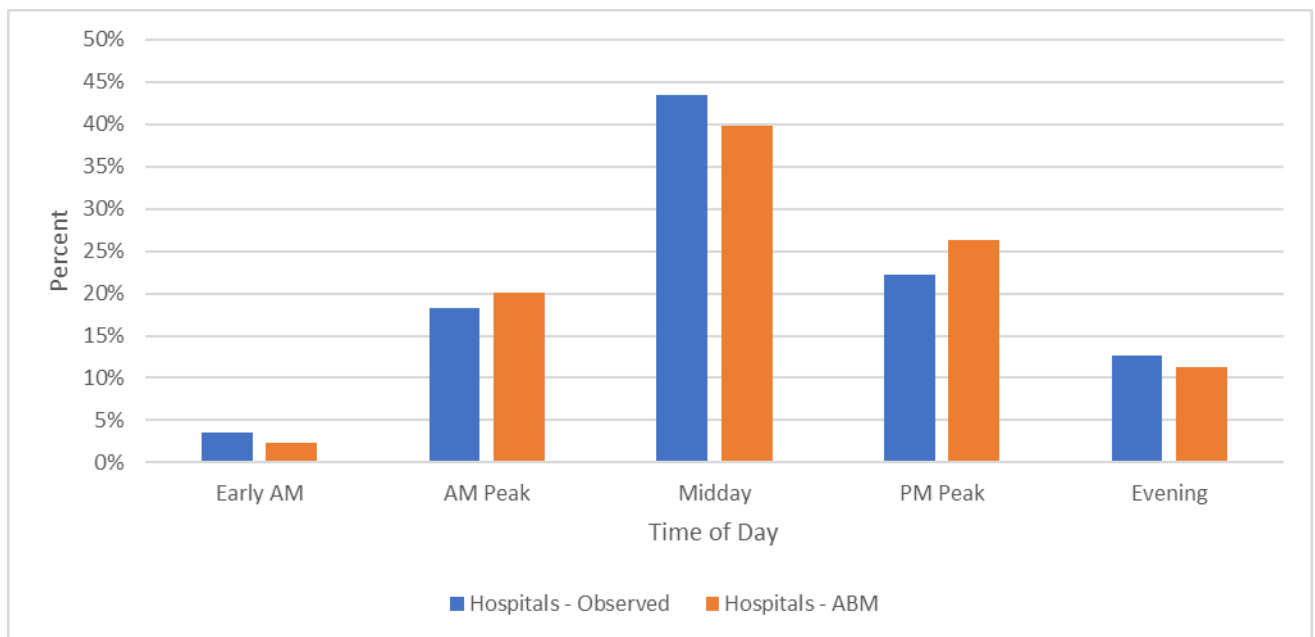
TABLE 34: DIURNAL DISTRIBUTION OF TRAFFIC BY SITE TYPE – TRAFFIC COUNTS

TYPE	EA	AM	MD	PM	EV	DAILY
Hospital*	4%	18%	43%	22%	13%	100%
Park	0%	13%	48%	31%	7%	100%

Shopping Center	2%	7%	43%	30%	19%	100%

*Note: Hospital excludes Palomar Medical Center and VA hospital due to no emp_health in the model.

TABLE 35: DIURNAL DISTRIBUTION OF TRAFFIC BY SITE TYPE - ABM

TYPE	EA	AM	MD	PM	EV	DAILY
Hospital*	2%	20%	40%	26%	11%	100%
Park	0%	6%	34%	21%	38%	100%
Shopping Center	1%	11%	39%	32%	16%	100%

*Note: Hospital excludes Palomar Medical Center and VA hospital due to no emp_health in the model.

FIGURE 16: DIURNAL DISTRIBUTION OF TRAFFIC BY TYPE OF SITE - HOSPITALS

FIGURE 17: DIURNAL DISTRIBUTION OF TRAFFIC BY TYPE OF SITE - PARKS
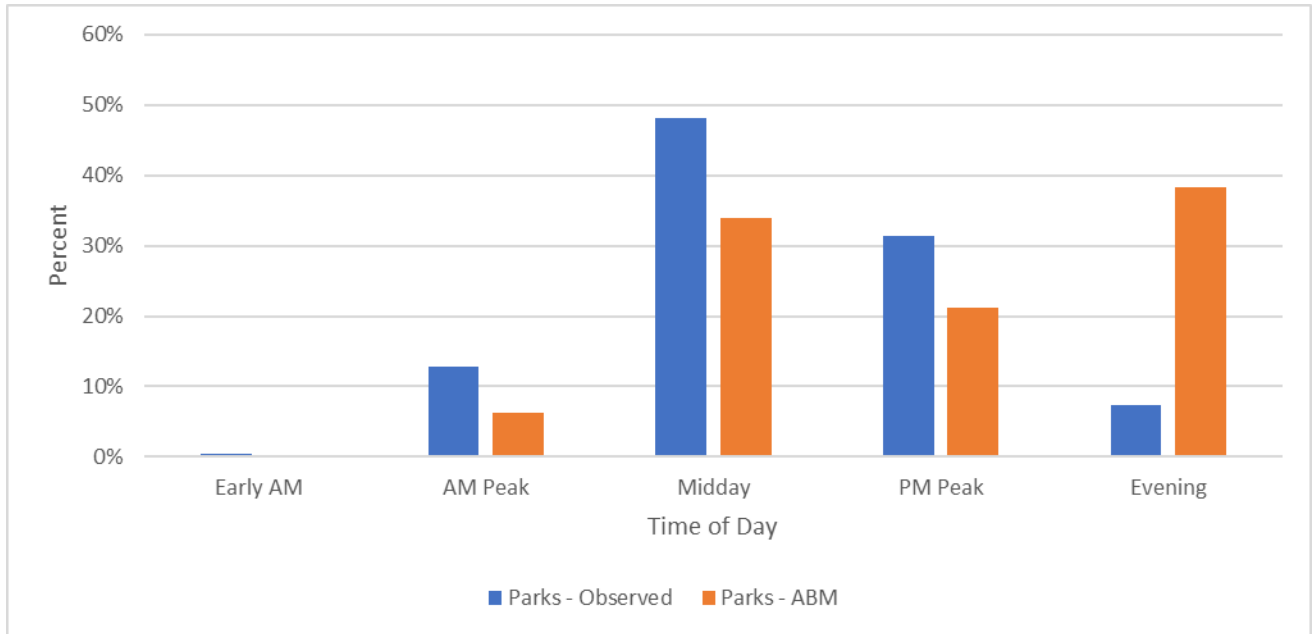
FIGURE 18: DIURNAL DISTRIBUTION OF TRAFFIC BY TYPE OF SITE – SHOPPING CENTERS
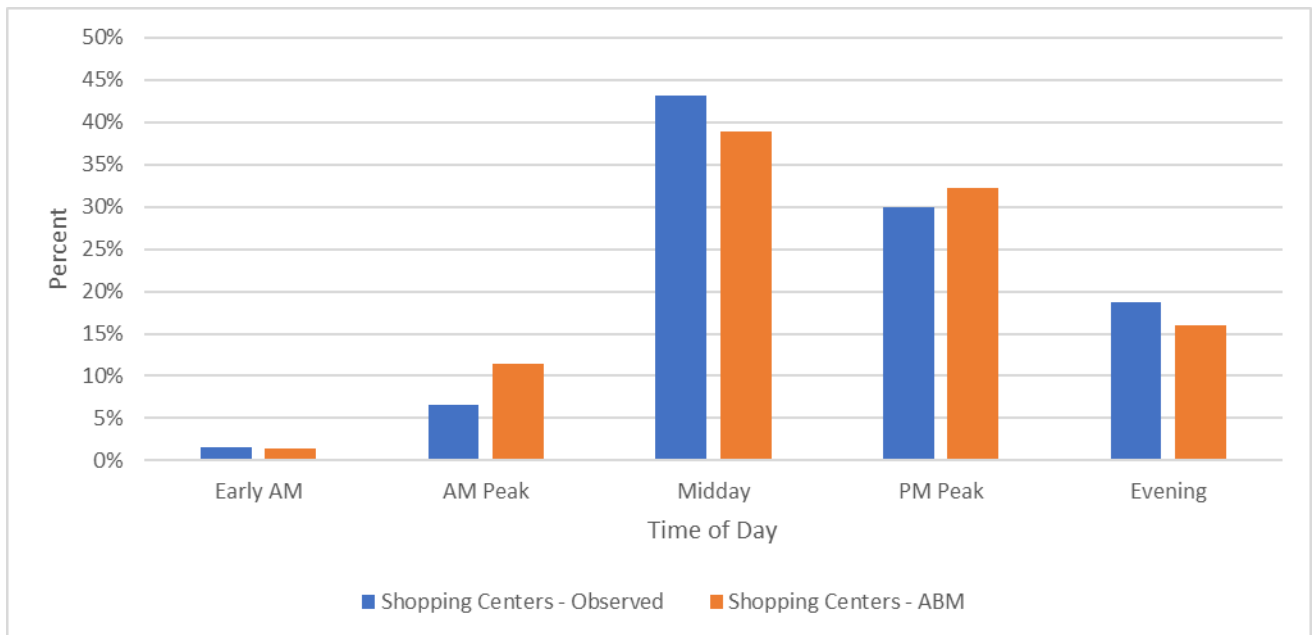
8.0 SUMMARY AND CONCLUSIONS

This work calibrated and validated the SANDAG ABM's performance of generating travel for special destinations (beaches, hospitals, shopping centers, parks, casinos, and other recreation sites) with respect to their travel behavior observed in several data sources (beach counts, beach intercept survey, streetlight data, and traffic counts). The work collected and analyzed observed data, reviewed model inputs (land-use data), and adjusted model parameters, as necessary, to improve comparisons of model outputs with the observed datasets. The following is a summary of comparisons from the final calibrated and validated model.

Beaches:

- Beach Counts:

    o Beach sites are generally underestimated with an overall underestimation of 32%.

    o Coronado beaches are overestimated, and La Jolla\ Del Mar and North County are underestimated.

    o The model does not identify many beach sites exclusively. A future revision to MGRA boundaries shall assign separate MGRA to them. Review and Revision of the MGRA data is also needed to improve the fit.

- Beach Survey:

    o More non-residents are travelling to the beaches than residents.

    o Residents are visiting the beaches in smaller party size with 85% of them visiting alone. Non-residents are visiting with more people with 21% are with 7 or more persons.

    o Residents are spending shorter time at the beaches with 48% spending only an hour or less. Surprisingly, 32% non-residents are staying for over 8 hours on the beaches. We suspect that survey duration is biased towards longer stay. Respondents were probably more likely to participate if they were at the beach for longer than one hour, as visitors with limited time probably did not want to participate in the interview.

    o Shorter trip lengths due to more trips of 2 miles or less and fewer trips longer of 35 miles or more.

    o More beach trips are originating from home, a discretionary activity, or a maintenance activity.

    o Fewer shared-ride trips to the beaches. More residents are driving alone and more visitors are choosing taxi.

- Location-based Services (Streetlight Data):

- OD trip lengths are slightly longer due to fewer trips shorter than 2 miles. Home trip lengths are shorter.

Hospitals (Streetlight Data):

- OD trip lengths are generally shorter. Home trip lengths are similar.

- Review and revision of land-use data is needed as some hospitals are not currently represented and some may have miscoded employment in the model. Also, more refined MGRA boundaries are needed to isolate hospital sites.

Shopping Center (Streetlight Data):

- OD trip lengths are similar. Home trip lengths are shorter.

- Outlets are generally underestimated, likely due to exclusion of external (non-resident) trips from calculations.

Parks, Casino, and Other Recreations (Streetlight Data):

- OD trip lengths underestimated, though home trip lengths are similar.

- Casinos see bigger differences as the model is sending fewer residents to these sites. Jamul Casino is not currently represented in the model.

- MGRA data shall be reviewed to ensure employment is coded in correct employment categories.

Traffic Validations:

- Travel to parks compare well with traffic counts. Evening travel is over-estimated due to non-representation of restrictions on visiting hours.

- Hospital sites are overestimated but diurnal distribution is similar to the observed.

- Shopping centers are generally overestimated as well but diurnal distribution is similar to the observed.

White River Junction & Burlington, VT	Arlington, VA	Chicago, IL	Evansville, IN	Portland, OR	Salt Lake City, UT	San Diego, CA