Attendance at Torrey Pines State Park

This report details a study of visitor volume to Torrey Pines State Beach and State Natural Reserve and provides a method for estimating yearly visitor count. In the past, a multiplier of reflector counts was used to estimate attendance. This multiplier was derived from a long-ago study, before State Route 56 opened and park traffic increased. Here a more comprehensive and up-to-date study of the relationship between car counts and Beach/Reserve visitor count was conducted.

Study Design

Visitors come to the park via car, bus, bike, and foot, and the park has multiple entrances, making car counts alone insufficient for measuring the number of visitors. Tallies by on-site volunteers were deemed the best method. We designed a study to most accurately estimate attendance within the resources of the park staff and volunteers.

Sixteen days were sampled for counting between February 2015 and August 2015 (excluding May). Days were stratified by month, with two each in February and April and three each in March, June, July, and August. Within a month, days were selected with probability proportional to kiosk count or lodge desk count of the corresponding day in the previous year (corresponding by day of the week). By giving higher probability to busier days, each visitor has a roughly equal chance of being counted. Choosing higher volume days also allows us to estimate the percent of visitors using each entrance more accurately.

On a sampled day, teams of volunteers were assigned a shift at one of the entrances. Originally 5 entrances were targeted, but this dropped to 3 because of very low counts at the Extension and Flintkote accesses. The estimates in this report may underestimate total visitor count because of dropping these entrances, but in the time slots we did observe them, Flintkote and the Extension accounted for less than 1% of park entrants. Volunteers counted in back-to-back two hour time slots beginning as early as 7:30am and ending as late as 6:30pm. The South Beach entrance has been labelled "A", North Beach "B", and Golf Course/S-gate as "C". The entrances were chosen such that all entrances were paired with each other several times. Time slots were chosen so that each entrance was observed at each time of day several times.
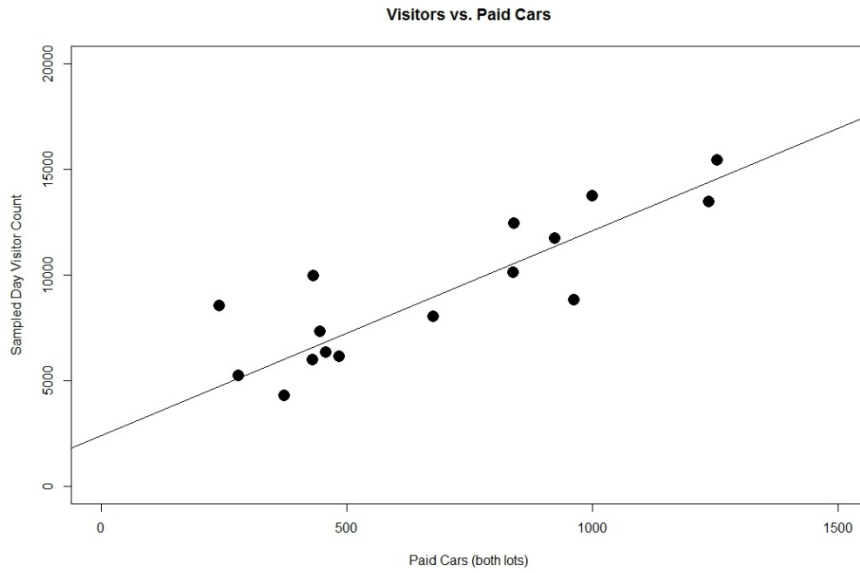
Visitor Count Estimation

Once the data were collected, we first estimated the proportion of visitors entering via each of the three entrances. An initial estimate was formed by comparing each entrance with South Beach at their overlapping times. From there, the Expectation-Maximization algorithm was used to find the maximum likelihood estimates of the proportions. While factors such as day of the week, season of the year, or time of day may affect the fraction of visitors using each entrance, it was not within the scope of this study to include those factors in our model. The table below gives the estimated percentage of visitors using each entrance.

A - South Beach	55.0%
B – North Beach	38.9%
C – Golf Course/ S-Gate	6.1%

With the estimated proportions in hand, we imputed counts for the missing time slots and entrances on the sampled days. Then, an adjustment was made for the half-hour overlap of one pair of shifts.

Now having estimates for the whole day at all three entrances on the sixteen sampled days, we compare those to the other measures. These include the number of paid cars (through LAZ parking) from the North and South lots, electronic counters at the North kiosk, South kiosk, and S-gate, and the count of visitors to the Lodge. The number of paid cars and Lodge desk proved to be the most reliable data sources. The electronic counters suffered many problems including theft, non-function, and mis-function (repeating data from previous time periods when current days' data not recorded). Since the North lot fills after the South lot, paid cars were treated as a sum of the two lots. That is, the counts for North and South lots were added together for each sampled day and the total was used to look at the relationship with attendance. The Lodge desk data, while very good, did not improve the estimates of visitor count over the paid cars alone. A regression equation using paid car count to predict whole-park attendance was fit. Regression estimation was chosen over ratio estimation as the intercept can be interpreted as the number of visitors who attend when there are no paid cars and the slope can be interpreted as the number of park visitors per each counted paid car. Due to free parking outside the park, pass-holders, and bikers/pedestrians, it is reasonable for there to be a level of visitors before anyone pays for the lot and for us to see more park users per paid car than just the two or three people who would be in a paid car. A scatterplot of the data does show a true linear trend in the range of the observations. A change in the pattern or trend when the lots filled up was something we checked for, but was not seen. February 7th, a sampled day, appeared as an outlier in the relationship (farthest left point in the plot) and was excluded from the regression equation. This day had a special event and had a low paid car count compared to the number attending the park because shuttles were in use. The fitted regression line is

$$\text{Daily Park Attendance} = 2395 + 9.67x(\text{Daily Paid Car Count}) \qquad (1)$$

Visitors vs. Paid Cars

The correlation between visitor count and paid car count is .895 which is considered very strong. The regression on Paid Car Count explains 80% of the variability in estimated visitor count.

Regression estimation is then used to come up with daily attendance for each day based on the paid car count. The histogram illustrates how often in the year the daily attendance ranges occur. We see that a typical day has around 4000-5000 visitors while a very high day is around 15000.

Daily Estimated Visitors
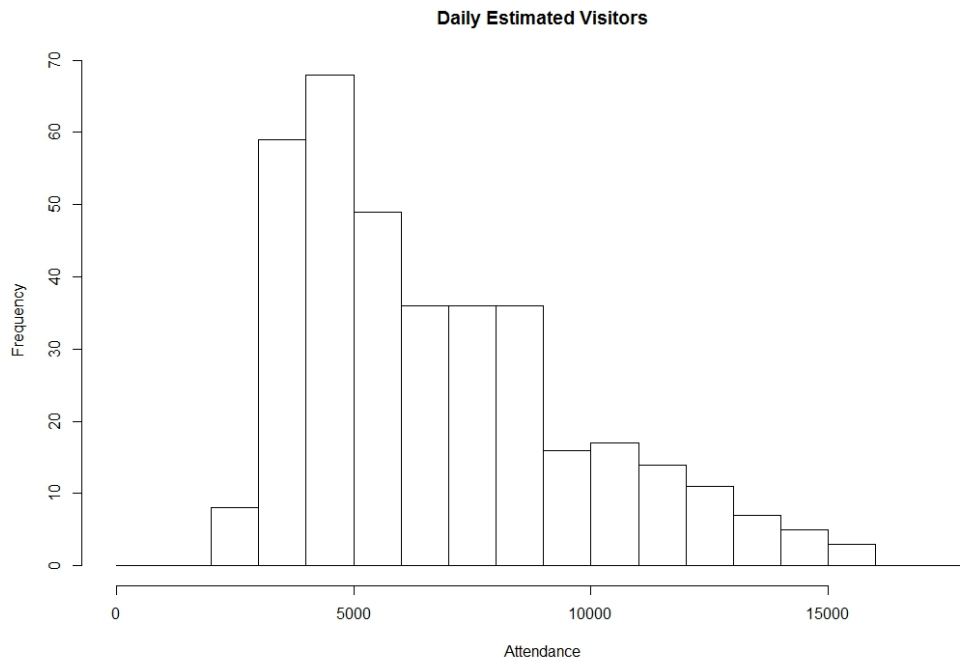
The estimates, aggregated by month are given in the table below. This gives a yearly total of 2.45 million for the period January 2015 to December 2015

January	200390
February	181806
March	237822
April	205447
May	178143
June	213189
July	267502
August	288008
September	193225
October	150533
November	167164
December	167469
2015 Total	2450697

Park versus Reserve

Torrey Pines is both a State Beach and a State Natural Reserve. The State requests attendance numbers for both entities. Some visitors use the Beach only, some use the Reserve only, and some utilize both in a single visit. To determine the fraction of visitors falling into each category, visitors were surveyed at park entrances and the lodge area for 1-3 hour time slots over five days in September and October 2015. These were weekend days at a warm time of year chosen by convenience for surveying. Should resources allow, staff might consider repeating this survey at other times of year to check for variation in Beach and Reserve utilization over seasons.   The table below gives the fraction of respondents falling into each category at each survey location.   We see that North Beach leans heavily toward Beach; South Beach is a mix; and the locations that are within the Reserve (Lodge, West Lot, and Golf Course) lean toward Reserve.

	Reserve Only	Reserve and Beach	Beach Only
North Beach	0.016	0.147	0.837
South Beach	0.294	0.308	0.398
Lodge	0.346	0.649	0.005
WestLot	0.752	0.248	0.000
Golf Course	0.878	0.122	0.000

In order to aggregate these values to get proportions for all visitors, we weight by the percents using each entrance that were derived earlier (South Beach 55.0, North Beach 38.9, Golf Course 6.1). Here we grouped Lodge and West Lot with Golf Course due to proximity. This gives overall values of 20.4% for Reserve only, 25.1% for Reserve and Beach, and 54.6% for Beach only. Thus, 45.5% of visitors use the Reserve, and 79.6% of visitors use the Beach.

To obtain estimated counts of visitors using the Reserve and Beach, take the overall visitor counts estimated previously and multiply by .455 for Reserve and by .796 for the Beach. For 2015, this would yield 1.1 million Reserve visitors and 1.95 million Beach visitors. While the State requests this breakdown on a daily basis, there is currently no way for Torrey Pines staff to track how individual visitors are making use of the region on a daily basis. The .455 and .796 multipliers can be employed on a daily basis for reporting purposes, but are not capturing daily fluctuations.

Paid versus Unpaid Visitors

In addition to separate attendance numbers for the Reserve and Beach, the State report also requires counts of paid and unpaid visitors. On sampled days, volunteers tallied visitors entering by car (classified as paid entrants) and visitors entering by foot or bike (classified as unpaid entrants). Combining numbers for all sampled shifts together, we estimate that .484 of South Beach entrants came in by car or other motor vehicle, while at North Beach, .412 of entrants arrived by car or other motor vehicle and were classified as paid entrants. At the South Gate/Golf Course, there is no vehicle entry, so all visitors using this entrance are unpaid. Combining these numbers with the proportions of visitors using each entrance, we get a fraction of .415 being paid visitors and .585 being unpaid.

Conclusion

The purpose of this study was to update methods of estimating attendance at Torrey Pines State Beach and Natural Reserve. We obtained quality counts for sixteen sampled days utilizing staff and volunteer counters at park entrances. Considering all metrics available (Lodge counts, kiosk counts, and paid cars), it was determined that a linear model using paid cars (summed at both lots) as the explanatory variable performs very well for predicting visitor count. The formula to use is Estimated Daily Park Attendance = 2395+9.67x(Daily Paid Car Count).

The electronic counters at the kiosks and golf course gate were not robust for the job of estimating visitor numbers. At times where volunteer counts were recorded along with changes in the counter at the same time period, there was considerable noise in the electronic counts. While Torrey Pines may have other reasons, such as security, to continue using the electronic counters, their maintenance may not be worth the hassle if their primary purpose was visitor counts.

This study has taken a quick look at the breakdown of Beach and Reserve utilization and provided multipliers to use with total visitor count. Multipliers for fraction paid and unpaid were also derived.

The regression model given here should produce good estimates for a few years out. Changes in parking prices, state park pass policies, or transit routes could affect it. In the next iteration of updates, park staff and consultants will want to look into whether advances in technology and personal smart device usage will have created any new publicly available metrics that can improve attendance estimates.