IEc

Baseline Shoreline Use Estimates for the *Cosco Busan* Oil Spill Damage Assessment

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prepared for:

Cosco Busan Natural Resource Damage Assessment

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INTRODUCTION

On November 7, 2007, the *Cosco Busan* struck the Bay Bridge in San Francisco Bay, spilling approximately 58,000 gallons of intermediate fuel oil. The spill impacted a wide range of shoreline recreation sites throughout the Bay Area, including beaches, parks, piers, walking trails, and other locations. Many of these recreation sites were temporarily closed to the public or had posted health advisories during the post-spill time period.

In November 2008, approximately one year after the spill and after all closures and health advisories had been lifted, Industrial Economics, Incorporated (IEc) collected data on shoreline recreation at select locations throughout the Bay area. The goal of the data collection effort was to gather data that could be used to develop estimates of baseline visitor use throughout the spill impact period, from November 2007 to June 2008. Baseline visitor use is the amount of shoreline recreation that would have been present if the spill had not occurred. The baseline visitor use estimates served as inputs in a separate analysis that assessed shoreline use losses due to the spill.

The data collection effort focused on a wide range of activities pursued by visitors at coastal locations, including swimming, surfing, walking, exercising, biking, sightseeing, sunbathing, picnicking, and kite-boarding. Fishing and boating were excluded from the shoreline use data collection effort, as these two activities were addressed in separate analyses.

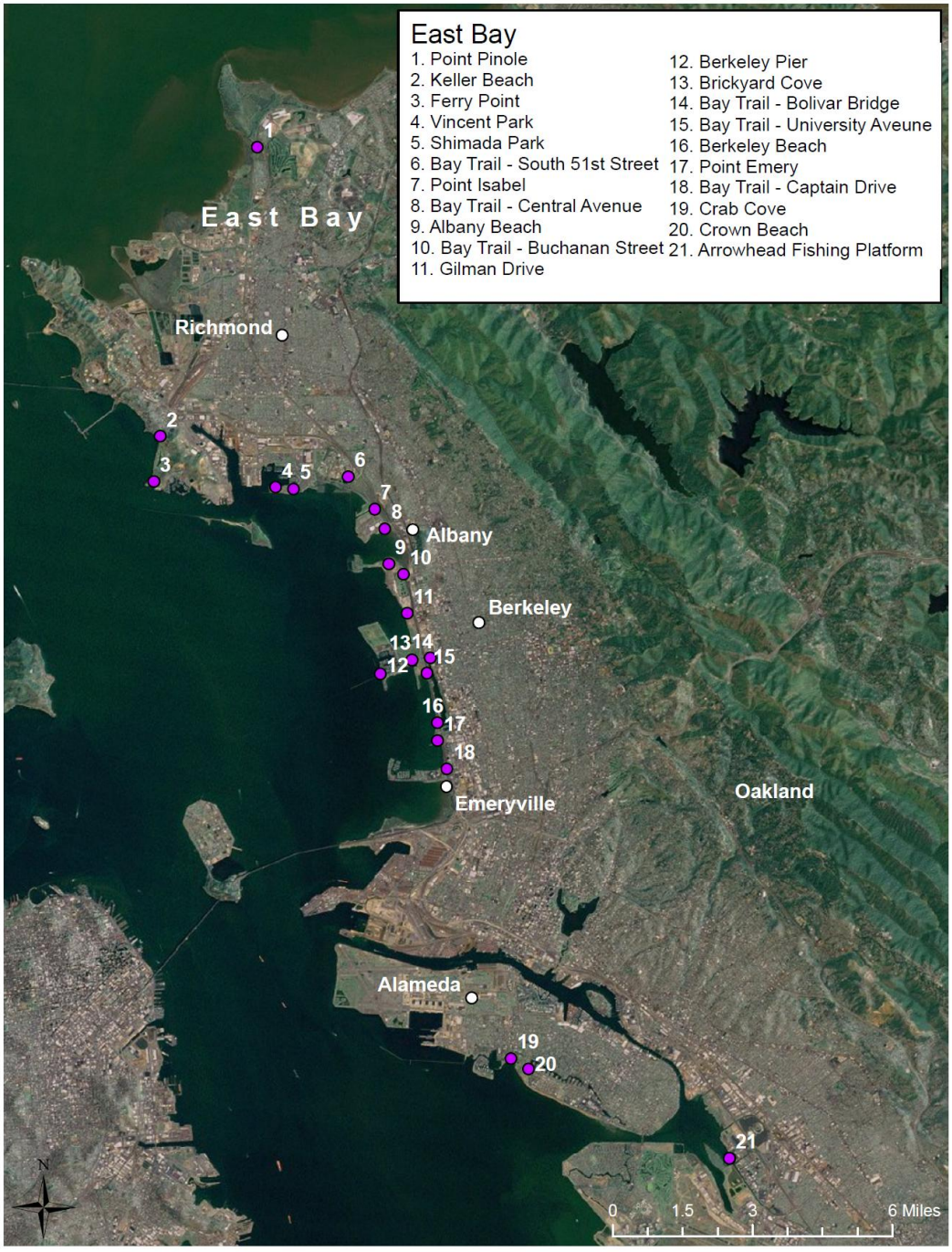
The shoreline sites selected for data collection are described in Exhibit 1. The sites are distributed throughout the San Francisco Bay area, including East Bay sites from Point Pinole in the north to Arrowhead Fishing Platform in the south, and Pacific Ocean sites from Stinson Beach in the north to Pacifica Pier in the south (Exhibit 2). Sites were selected based on the anticipated magnitude of recreational use losses. Specific selection criteria included expected number of visitors, presence of closures or advisories, and proximity to shoreline areas that were oiled during the spill.

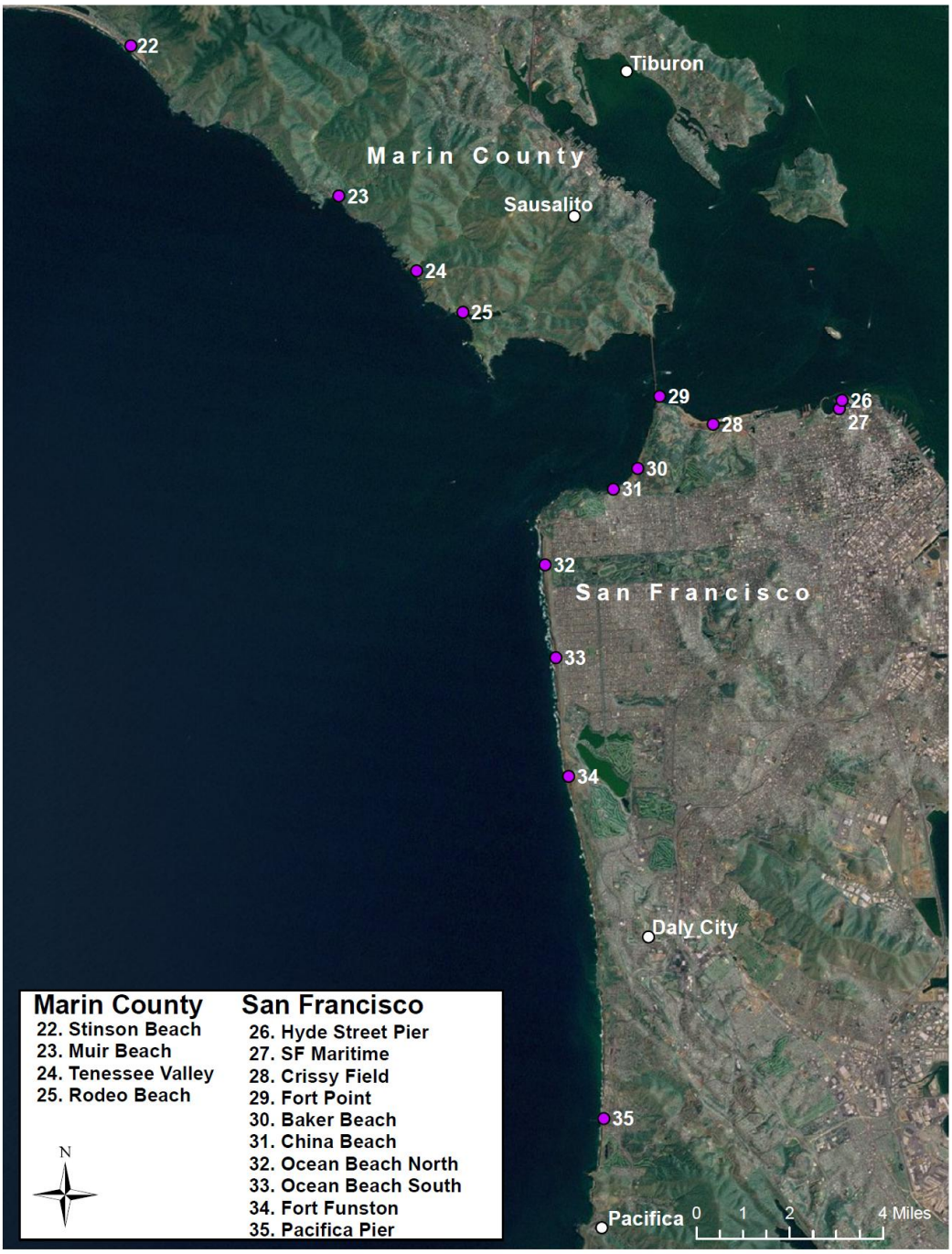
The remainder of this report describes in detail the development of baseline visitation estimates for shoreline use. After describing the general methodology and outlining the steps involved in the calculations, each of the steps is described in detail and final estimates of baseline use are presented. The report does not discuss the impacts of the spill on baseline visitation, nor does it develop estimates of economic losses associated with these impacts.

EXHIBIT 1: SHORELINE USE DATA COLLECTION SITES

COUNTY	SITE	DESCRIPTION
Marin	Stinson Beach	Beach
	Muir Beach	Beach
	Tennessee Valley	Bike path and beach
	Rodeo Beach	Beach
San Francisco	Hyde Street Pier	Pier
	San Francisco Maritime	Pier, beach, and bike path
	Crissy Field	Pier, beach, and bike/walking paths
	Fort Point	Bike/walking path
	Baker Beach	Beach
	China Beach	Beach
	Ocean Beach North	Beach and promenade
	Ocean Beach South	Beach and overlook/bluff
	Fort Funston	Beach and walking paths
San Mateo	Pacifica Pier	Pier
Contra Costa	Point Pinole	Pier and walking paths
	Keller Beach	Beach and picnic area
	Ferry Point	Pier
	Vincent Park	Pier and picnic area
	Shimada Friendship Park	Picnic area
	Point Isabel	Walking paths
Alameda	Albany Beach	Beach, walking paths
	Berkeley Pier	Pier
	Gilman Drive	Sightseeing area
	Brickyard Cove	Walking paths
	Berkeley Beach	Beach and sightseeing area
	Point Emery	Sightseeing area
	Bay Trail	Bike path
	Crown Beach	Beach and bike path
	Crab Cove	Beach and bike path
	Arrowhead Fishing Platform	Fishing platform at MLK Jr. park

EXHIBIT 2: DATA COLLECTION LOCATIONS




22
Tiburon
Marin County
23
Sausalito
24
25
29
26
27
28
30
31
32
San Francisco
33
34
Daly City
35
Pacifica
0 1 2 4 Miles
N
Marin County
22. Stinson Beach
23. Muir Beach
24. Tenessee Valley
25. Rodeo Beach
San Francisco
26. Hyde Street Pier
27. SF Maritime
28. Crissy Field
29. Fort Point
30. Baker Beach
31. China Beach
32. Ocean Beach North
33. Ocean Beach South
34. Fort Funston
35. Pacifica Pier

OVERVIEW OF METHODOLOGY

At each site, field personnel were stationed at entrances on four days in November 2008 to obtain counts of completed trips.[1] In addition, an automated vehicle or pedestrian counter was associated with each site to provide a "visitation index" for every day in November 2008. This daily visitation index was expected to be proportional to visitation at the site. The relationship between the visitation index (i.e., the automated vehicle or pedestrian counts) and the direct visitor estimates on the four sampled days was then used to estimate baseline visitation, after incorporating adjustments for differences in weather between November 2008 and the spill impact period.

The four steps used to calculate baseline visitation estimates are described below:

Step 1: Obtaining a Daily Visitation Index: Automated vehicle and pedestrian counters were deployed at site entrances to establish a daily index of visitation for each site throughout November 2008. At sites with multiple entrances, counters were deployed in locations that were expected to provide a daily count that would be highly correlated with visitation.

Step 2: Predicting the Daily Visitation Index for the Spill Impact Period: Site-specific regression models were used to predict the visitation index for every day of the spill impact period (November 2007 to June 2008). These models used observed variation in visitation index levels throughout November 2008 to estimate the parameters of the relationship between the visitation index, weather, and type of day (i.e., weekday or weekend/holiday). This relationship was then used, in combination with weather data from the spill impact period, to predict visitation index levels under baseline conditions.

Step 3: Relating the Visitation Index to Actual Visitation: Field personnel were deployed at site entrances on four days (two weekdays and two weekend days) in November 2008 to count completed trips to each site. For each site and each type of day (weekdays and weekend days) the total trip estimate was divided by the number of vehicles or pedestrians recorded on the automated counters to provide a trip/index ratio. This ratio represents the number of visitors that recreate at a site every time the automated counter records a visit. Ratios vary by site for a variety of reasons, but are most commonly due to parking conditions or because more than one person often travels to a site in a single vehicle.

Step 4: Calculating Baseline Visits: The results of Steps 2 and 3 are used to estimate baseline visitation during the spill impact period. That is, for each site

[1] On-site visitor counts were not obtained at five of the sites: Stinson Beach, Muir Beach, Hyde Street Pier, Fort Point, and Fort Funston. For these sites, information from other nearby sites was combined with on-site vehicle/pedestrian counts to estimate visitation (see later discussion).

and for every day of the spill impact period, baseline visitation is estimated by multiplying the trip/index ratio by the predicted visitation index.

Two key components of the methodology are (1) counting visitors at site entrances and (2) the use of ratio estimation. Counting visitors at site entrances/exits ensures that only completed trips are counted. While it is possible to count visitors on site while recreational activities are on-going (e.g., counting individuals on a beach), converting these on-site visitor counts to trip estimates requires data on trip durations, which typically must be obtained through visitor interviews.

Ratio estimation allows for efficient data collection by taking advantage of the relationship between the variable of interest (trips) and an auxiliary variable (vehicle/pedestrian counts), where data on the auxiliary variable is substantially less expensive to obtain.[2] In the current application, automated vehicle/pedestrian counters are placed at the study sites for an extended period of time. Then, visitor use is directly estimated on a small number of days for comparison to the automated counts. The ratio of direct visitor use estimates to automated counts indicates how many people use the site for each vehicle or pedestrian recorded by the automated counter.

The overall approach can be illustrated through a simple example, focusing on visitation at a hypothetical beach during a two-week period in November 2008. Suppose an automated vehicle counter placed at the entrance to the beach parking lot provides daily vehicle counts from November 10 to 23, 2008 (Exhibit 3). These vehicle counts serve as an index of visitation for the site. During four days of this two-week period (a Thursday, Friday, Saturday, and Sunday), field personnel are placed at the site from dawn to dusk and observe 250, 550, 1,450, and 950 individuals completing trips to the site, respectively. The corresponding vehicle counts for these four days are 150, 350, 700, and 500. The weekday trip/index ratio would then be calculated as $1.6 = (250 + 550) \div (150 + 350)$ and the weekend trip/index ratio would be calculated as $2.0 = (1{,}450 + 950) \div (700 + 500)$. Visitation on the remaining days in the two-week period would be estimated by multiplying the weekday vehicle counts by 1.6 and the weekend vehicle counts by 2.0 (see Exhibit 3).

The estimation approach that was actually implemented was somewhat more complex than the approach presented in this example, as the index values for the spill impact period were unknown (the vehicle and pedestrian counters were not in place during this period). As a result, as we describe in Step 2, regression techniques were used to *predict* these index values before applying the appropriate trip/index ratio.

The remainder of the report describes each of the four steps of the methodology in greater detail, with intermediate results presented after each step.

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[2] Ratio estimation is described in detail in Cochran (1977) and Lohr (1999). The current approach departs slightly from traditional ratio estimation in that the days chosen for on-site counts were not randomly selected.

EXHIBIT 3: ILLUSTRATION OF ESTIMATION METHODOLOGY

DATE	VISITATION INDEX (VEHICLE COUNTS)	TRIP COUNTS	TRIP/INDEX RATIO	PREDICTED TRIPS[a]
11/10/08 (Monday)	200	--	1.6	320
11/11/08 (Tuesday)	150	--	1.6	240
11/12/08 (Wednesday)	300	--	1.6	480
11/13/08 (Thursday)	150	250	1.6	240
11/14/08 (Friday)	350	550	1.6	560
11/15/08 (Saturday)	700	1,450	2.0	1,400
11/16/08 (Sunday)	500	950	2.0	1,000
11/17/08 (Monday)	200	--	1.6	320
11/18/08 (Tuesday)	400	--	1.6	640
11/19/08 (Wednesday)	200	--	1.6	320
11/20/08 (Thursday)	350	--	1.6	560
11/21/08 (Friday)	250	--	1.6	400
11/22/08 (Saturday)	450	--	2.0	900
11/23/08 (Sunday)	650	--	2.0	1,300

Note:
[a] - Although trip predictions are presented for all days in the two-week period, direct trip counts are clearly preferred, when they are available (i.e., 11/13/08 to 11/16/08). Direct trip counts are not available for the spill impact period.

OBTAINING A DAILY VISITATION INDEX

The first step in estimating baseline visitation involves establishing an index of visitation at each site for all days in November 2008. These visitation indices were established using data from existing National Park Service (NPS) vehicle counters and from new vehicle/pedestrian counters deployed for the current effort.

The daily visitation index used for each site is presented in Exhibit 4, and the locations of all automated counters are depicted in Attachment A. In selecting a daily visitation index for each site, the primary criterion was that the index be strongly correlated with visitation at the site. Thus, whenever possible, vehicle or pedestrian counts at a site's main entrance served as the site's visitation index. At some locations, the collection of appropriate automated count data was difficult or infeasible. For example, the parking lot at China Beach does not have a well-established entry or exit lane. At these locations, data from vehicle or pedestrian counters deployed at nearby sites with similar visitor activities were used to develop visitation indices.

Daily Visitation Index for Automated Counters with Time Stamp Data Recorders

Fifteen automated counters with time stamp data recorders were installed to gather data for the site-specific visitation indices throughout November 2008. Eleven of these automated counters were vehicle counters, while four were infrared pedestrian counters.

Both the pedestrian and the vehicle counters provided daily totals for the 7:00 a.m. to 5:30 p.m. time period (hereafter "daytime counts"), which corresponds exactly to the time period covered by the on-site trip counts by field personnel.

Ten of the vehicle counters were magnetic field counters and one (at Rodeo Beach) was an existing inductive loop counter that had been installed and used by NPS to count vehicles prior to the current effort. The magnetic field counters were self-contained devices placed in waterproof containers and deployed a few feet from the edge of the pavement at each site. When a vehicle passed within a specified distance of the counter, the counter would detect changes in the background magnetic field, and the vehicle would be tallied. The effective range of the counter was adjusted and tested at each location.

The four pedestrian counters were attached to railings alongside trails or piers, with an infrared scope pointing perpendicular to the primary direction of foot/bicycle traffic. When a pedestrian passed by the counter, it would detect the infrared signature associated with a warm, moving object, and a person would be counted.

Daily Visitation Index for Automated Counters without Time Stamp Data Recorders

Ten existing inductive loop vehicle counters without time stamp data recorders were also used to gather data for the site-specific visitation indices. These counters had been installed and used by NPS to count vehicles prior to the current effort, and they simply maintained cumulative counts of total vehicles at each location. In order to develop a count for a specific time period at a given location, the counter needed to be read by field personnel at the beginning and end of the time period, with the difference between the two readings providing the desired tally. As a result, 24-hour counts were developed for these counters by having field personnel read the counters at the same time every evening throughout November 2008.

As on-site trip counts were completed only during daytime hours (from 7:00 a.m. to 5:30 p.m.), these 24-hour counts must be converted to daytime counts to establish appropriate visitation indices. Daytime counts were obtained on four days (two weekdays and two weekend days) at six counter locations (Crissy Field East, Crissy Field West, Baker Beach, Ocean Beach Balboa, Ocean Beach Fulton, and Ocean Beach Sloat) by reading the counters at 7:00 a.m. and 5:30 p.m. The ratios of daytime counts to 24-hour counts observed at these six locations were then used to convert all 24-hour counts to daytime counts. For sites where daytime counts were not obtained, ratios from similar sites were used to convert 24-hour counts to daytime counts. Specifically, the Baker Beach ratio was applied to Muir Beach, Tennessee Valley, and Fort Funston.

The visitation index values for each site are presented in Attachment B for all days in November 2008.

Sites with Monthly Visitation Index

Daily visitation indices were not established for three of the sites: Stinson Beach, Hyde Street Pier, and Fort Point. At these locations, a monthly visitation index was developed using data from pre-existing NPS vehicle/pedestrian counters.

EXHIBIT 4: SOURCE OF VISITATION INDEX FOR EACH SITE

SITE	SOURCE OF VISITATION INDEX
Marin	
Stinson Beach	Vehicle counter at entrance to parking lot[a]
Muir Beach	Vehicle counter at entrance to parking lot
Tennessee Valley	Vehicle counter on Tennessee Valley Road approximately one mile northeast of parking lot entrance
Rodeo Beach	Vehicle counter at entrance to parking lot[b]
San Francisco	
Hyde Street Pier	Pedestrian counter at entrance to pier[a]
San Francisco Maritime	Vehicle counter at entrance to Crissy Field East parking lot[c]
Crissy Field	Vehicle counters at entrances to Crissy Field East and West parking lots (sum of two counter tallies)
Fort Point	Vehicle counter at entrance to parking lot[a]
Baker Beach	Vehicle counter at entrance to parking lot
China Beach	Vehicle counter at entrance to Baker Beach parking lot[c]
Ocean Beach North	Vehicle counters at entrances to Ocean Beach parking lots at Balboa Steet and Fulton Street (sum of two counter tallies)
Ocean Beach South	Vehicle counter at entrance to Ocean Beach parking lot at Sloat Boulevard
Fort Funston	Vehicle counter at entrance to parking lot
San Mateo	
Pacifica Pier	Pedestrian counter at entrance to pier[b]
Contra Costa	
Point Pinole	Vehicle counter at parking lot entrance[b]
Keller Beach	Vehicle counter at entrance to Ferry Point parking lot[b,c]
Ferry Point	Vehicle counter at parking lot entrance[b]
Vincent Park	Vehicle counter at parking lot entrance[b]
Shimada Friendship Park	Vehicle counter at entrance to Vincent Park parking lot[b,c]
Point Isabel	Vehicle counters at parking lot entrances (sum of two counter tallies) [b]
Alameda	
Albany Beach	Vehicle counter at parking lot entrance[b]
Berkeley Pier	Pedestrian counter at entrance to pier[b]
Gilman Drive	Vehicle counter at entrance to Point Emery parking lot[b,c]
Brickyard Cove	Vehicle counter at entrance to Point Emery parking lot[b,c]
Berkeley Beach	Vehicle counter at entrance to Point Emery parking lot[b,c]
Point Emery	Vehicle counter at entrance to Point Emery parking lot[b]
Bay Trail	Pedestrian counter at Bolivar Bridge[b]
Crown Beach	Vehicle counter at entrance to parking lot[b]
Crab Cove	Vehicle counter at entrance to parking lot[b]
Arrowhead Fishing Platform	Vehicle counter at entrance to main parking lot[b]

Notes:
[a] – A monthly (rather than daily) visitation index was established for this site.
[b] – Daytime counts were obtained directly from time stamp data recorders at this site.
[c] – The collection of automated count data was difficult or infeasible at this site. As a result, the visitation index is derived from a nearby site that is expected to have similar visitor activities (see discussion in text).

PREDICTING THE DAILY VISITATION INDEX FOR THE SPILL IMPACT PERIOD

The second step in estimating baseline visitation is to predict the baseline visitation indices for every day of the spill impact period, November 2007 to June 2008. That is, site-specific daily visitation indices for November 2008 calculated in Step 1 must be adjusted for differences in temperature, precipitation, and type of day (i.e., weekend/holiday vs. weekday) to obtain predicted baseline daily visitation indices for the entire spill impact period. These predicted visitation indices will be linked to actual visitation using the trip/index ratios calculated in Step 3.

Site-Specific Regression models

The daily visitation index data from November 2008 were used to estimate the parameters of a series of site-specific**,** semilog regression models.[3] The dependent variable in each of the models is the natural logarithm of the vehicle or pedestrian count for the location on day *t*, which we denote $\ln c_t$. The independent variables are daily high temperature (*TEMP*), total daily precipitation (*PPT*), and a binary variable for weekdays (i.e., non-weekends/holidays), *WEEKDAY*.

The regression model for each location is specified as:

$$\ln c_t = \beta_0 + \beta_1 TEMP_t + \beta_2 PPT_t + \beta_3 WEEKDAY_t + \varepsilon_t$$

Separate models are estimated for each location because the mix of visitor activities pursued differs across sites, and the impact of weather and type of day on visitation is therefore likely to vary across locations.

The estimated parameters from each regression model are combined with daily weather data from the spill impact period to predict vehicle or pedestrian counts on each day of the spill impact period.[4] In determining these predicted counts, the binary weekday variable is adjusted as appropriate for every day of the spill impact period, depending on the dates of the weekends and holidays.

Weather data were obtained from Weather Underground (http://www.wunderground.com), a service that compiles information from weather stations around the world. We matched each site to one of three weather stations (San Francisco -- KCASANFR63, Berkeley -- KCABERKE7, or Pacifica -- KCAPACIF4) based on geographic location and proximity to the ocean. Crissy Field was matched to the San Francisco station; all other Marin County, San Francisco, and San Mateo County

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[3] The semilog form ensures that predicted counts will be positive, which is consistent with site data. We also estimated the regression models in linear form, with results similar to those obtained using semilog models.

[4] With the semi-log specification, taking the exponential of the predicted logged count results in the median of the conditional count distribution. In order to recover the mean, we multiply the exponential of the predicted logged count by $\exp\left(\hat{\sigma}^2/2\right)$:

$$\hat{c}_t = \exp\left(\hat{\beta}_0 + \hat{\beta}_1 temperature_t + \hat{\beta}_2 precipitation_t + \hat{\beta}_3 weekday_t\right) * \exp\left(\frac{\hat{\sigma}^2}{2}\right)$$

sites were matched to the Pacifica station; and all Contra Costa and Alameda sites were matched to the Berkeley station. The daily temperature and precipitation data from the matched station were used to represent weather conditions at the location.

Estimation Results

The estimated coefficients for each of the regression models are presented in Attachment C. The coefficients are generally highly significant, with 17 of the 21 models explaining over 60 percent of the variation in the logged vehicle/pedestrian counts, and half of the models (11 of the 21) explaining over 80 percent of the variation in the logged vehicle/pedestrian counts. All of the temperature coefficients are positive, all of the precipitation coefficients are negative, and all of the weekday coefficients are negative, as expected. With a semilog model, the coefficients are interpreted as the percentage change in counts due to a one-unit increase in the independent variable. Thus, the estimated temperature coefficient of 0.03 for Muir Beach indicates that a one-degree increase in temperature is associated with a three percent increase in predicted counts.

Predicted Daily Visitation Index

The predicted visitation index for each location and month (summed across all days) is presented in Attachment D for the entire spill impact period. For comparison, Attachment D also presents the actual visitation index for November 2008.

Note that while the models are estimated using data from November, predictions are obtained for the entire November to June time period. We have greater confidence in the predictions for November than for other months, as (1) weather conditions from December to June may lie outside the range of the data used to estimate the model and (2) factors unrelated to weather and type of day may cause visitation in other months to differ, on average, from November visitation (e.g., school vacations, seasonal differences in outdoor activities, or special events).

Predicted Visitation at NPS Sites with Monthly Visitation Index

At NPS sites with monthly (rather than daily) visitation indices (Stinson Beach, Hyde Street Pier, and Fort Point), the predicted monthly visitation for the spill impact period was determined by averaging the value of the index over a six-year period: the five years immediately preceding the spill and one year following the spill.

RELATING THE VISITATION INDEX TO ACTUAL VISITATION

The third step in estimating baseline visitation is to estimate the ratio of completed trips to the daily visitation index (hereafter the "trip/index ratio"). Recall that this ratio is required to convert our predicted visitation index to an estimate of trips. Separate estimates are produced for each site and for each type of day (weekdays and weekend days). The calculation of site-specific daily visitation indices was described above under Step 1. This section describes the methodology used to estimate completed trips to each site for a sample of days in November 2008, and it presents the final trip/index ratios.

Methodology for Estimating Trips

Trained field personnel were deployed at site entrances on four days (two weekdays and two weekend days) in November 2008 to count completed trips to each site. The count locations for each site are provided in Attachment A. Counts were conducted from November 7 to 10 (Friday to Monday) at East Bay sites and from November 13 to 16 (Thursday to Sunday) at all other locations. The counts were conducted from 7:00 a.m. to 5:30 p.m. on each day, covering nearly all of the daylight hours.

Visitor counts were maintained on a tally sheet where the field personnel recorded all adults and children leaving the site. Anglers and park personnel were tallied separately from other visitors so that they could be removed from the counts. Anglers were identified based on the equipment that they carried (rather than interviews), and park personnel were identified based on their uniforms/vehicles. The duration of any breaks taken by field personnel were recorded directly on the tally sheet.

Trip estimation methodologies differed somewhat across sites due to differences in the number of entrances, visitation levels, and other site-specific factors. We describe the primary approach and two common variations below. The sampling approach for each site is summarized in Exhibit 5, with additional details provided in Attachment E.

Many of the targeted sites had a single entrance, so that daily trip estimates were developed by summing the tallies at that entrance and adjusting for any missed time periods (e.g., breaks). Missed time periods were addressed by dividing the total count for each day by the proportion of the day during which counts were conducted. For example, if field personnel took occasional breaks that totaled 5% of the monitored time period, then the total count for the day would be divided by 0.95 to obtain the trip estimate for that day.

At sites with multiple entrances (e.g., entrances to Crown Beach from Shoreline Drive), interviewers rotated systematically among these entrances throughout the day (e.g., moving to a different entrance every hour), with the starting location randomly selected on the first day. At these sites, the trip estimate was obtained by adjusting the counts for any breaks (as described above), summing the adjusted counts, and multiplying by the number of entrances.[5]

At several smaller sites (e.g., Vincent Park and Shimada Friendship Park) trip counts were conducted in tandem with a nearby site: a single person rotated systematically between the two sites (e.g., moving to a different location every two hours), with the starting location randomly selected on the first day and alternating every day thereafter. At these sites, the daily trip estimate was obtained by adjusting the counts for any breaks (as described above), summing the adjusted counts, then dividing by the proportion of the day during which counts were conducted at the site. For example, if counts were

[5] This approach treats the counts obtained during each time period as a random sample from the set of entrances, and the count is assumed to represent completed visits at all of the entrances during that particular time period.

conducted every other hour at a given site, the adjusted counts would be summed and divided by 0.5 to estimate the daily count.[6]

The unique nature of several sites necessitated more tailored estimation approaches:

- **San Francisco Maritime Bike Path:** At San Francisco Maritime National Historic Park, a short section of bike path passes along the shore next to the beach, then continues past the park, entering Crissy Field after several miles. The path is commonly used by bikers to tour the shoreline area between San Francisco Maritime and the Golden Gate Bridge. In order to avoid double-counting bikers visiting San Francisco Maritime *and* Crissy Field, bikers were omitted from the counts at this location. Walking/jogging visits on the path were estimated by (1) counting walkers/joggers passing by a single location in one direction (alternating directions every hour) (2) doubling the single-direction counts to estimate the number of walkers/joggers passing by the location in either direction, (3) interviewing a sample of walkers/joggers passing by this location to determine the number of times each visitor passed by that point during his or her trip (number of "crossings"), and (4) dividing the count by the average number of crossings.

- **Bay Trail:** Bay trail visitation was estimated by counting visitors leaving the section of the Bay Trail that stretches from Vincent Park in the north to Emeryville Beach in the south. Visitors were only counted at locations where a departure was likely to represent the end of a visit to the trail. This generally included departures at the northern and southern ends of the trail, departures at parking lots along the trail, and departures towards the residential neighborhoods to the east of the trail.

  At a subset of the Bay Trail locations (Vincent Park, Gilman Street, Brickyard Cove, Berkeley Beach, and Point Emery), field personnel were already stationed on site to count visits to adjacent coastal parks and beaches. At these locations, field personnel maintained separate tallies of Bay Trail departures. The methodology for estimating Bay Trail visits at these locations was identical to the methodology for estimating visits to the adjacent park/beach.

  Six additional Bay Trail departure locations were monitored by field personnel. At Bolivar Bridge, a major Bay Trail access point, departures were counted continuously by field personnel on all sampling days. At the remaining five locations (51st Street, Central Avenue, Buchanan Street, University Avenue, and Frontage Road at Shorebird Park), field personnel rotated through the locations on every sampling day, counting departures at each location during a single, two-hour time period. Daily departures were estimated at each location by dividing each two-hour count by an estimate of the proportion of daily visitation

[6] This approach treats the periodic counts at the site as a random sample of time periods, and the sample is assumed to represent completed visits to the site during all time periods.

represented by that two-hour period. This proportion was estimated using data from the automated pedestrian counter at Bolivar Bridge.

- **Sites without On-Site Visitor Counts:** At five NPS sites (Stinson Beach, Muir Beach, Hyde Street Pier, Fort Point, and Fort Funston), on-site visitor counts were not conducted during the November 2008 effort. Trip/index ratios at four of these sites were transferred from sites with similar activities. The trip/index ratio from Rodeo Beach was transferred to Stinson and Muir beaches, the trip/index ratio from Point Isabel was transferred to Fort Funston (both parks are popular with dog walkers). For Fort Point, counts were calculated as the average monthly one-way car counts on the Fort Point car counter for 2002-2006 and 2008, multiplied by the average number of individuals in each exiting vehicle at Crissy West Bluff parking lot. At the fifth site, Hyde Street Pier, the trip/index ratio was set to one, as the visitation index is from an NPS count of all visitors to the pier.

The final trip estimates for every site and sampling day are provided in Exhibits 6 and 7.

EXHIBIT 5: OVERVIEW OF TRIP ESTIMATION METHODOLOGY FOR EACH SITE

SITE	TRIP ESTIMATION METHODOLOGY
Marin	
Stinson Beach	No visitor counts; transfer trip/index ratio from Rodeo Beach.
Muir Beach	No visitor counts; transfer trip/index ratio from Rodeo Beach.
Tennessee Valley	Count all departures.
Rodeo Beach	Count all departures.
San Francisco	
Hyde Street Pier	No visitor counts; trips obtained directly from NPS counts.
San Francisco Maritime	Alternate hourly between counting departures from Municipal Pier and Aquatic Park beach. Methodology for walking/biking path described in text.
Crissy Field	Count all departures at East Beach parking lot, West Bluff parking lot, and east end of promenade. Alternate hourly between counting departures at Long Avenue and at trail near East Beach lot. Rotate every half hour among the four trails crossing the center of Crissy Field, counting all departures.
Fort Point	No visitor counts; use car counts from Fort Point and average number of individuals in each exiting vehicle at Crissy West Bluff parking lot.
Baker Beach	Alternate hourly between counting departures at the parking lot entrance and at the Sand Ladder Trail.
China Beach	Count all departures.
Ocean Beach North	Divide promenade into three sections, with one field staffperson covering each section. Rotate every half hour among four or five stations within the section, counting all departures. Divide area between Lincoln Way and Sloat into eight sections. Rotate every hour among the sections, counting all departures.
Ocean Beach South	Alternate hourly between counting departures at Sloat Boulevard and at Second Overlook.
Fort Funston	No visitor counts; transfer trip/index ratio from Point Isabel.

SITE	TRIP ESTIMATION METHODOLOGY
San Mateo	
Pacifica Pier	Count all departures.
Contra Costa	
Point Pinole	Count all departures.
Keller Beach	Count all departures.
Ferry Point	Count all departures.
Vincent Park	Alternate hourly between Vincent and Shimada Friendship Park, counting all departures.
Shimada Friendship Park	Alternate hourly between Vincent and Shimada Friendship Park, counting all departures.
Point Isabel	Count all departures at Rydin Road and Isabel Street parking lots.
Alameda	
Albany Beach	Count all departures.
Berkeley Pier	Count all departures.
Gilman Drive	Alternate hourly between Gilman Drive and Brickyard Cove, counting all departures.
Brickyard Cove	Alternate hourly between Gilman Drive and Brickyard Cove, counting all departures.
Berkeley Beach	Alternate hourly between Berkeley Beach and Point Emery, counting all departures.
Point Emery	Alternate hourly between Berkeley Beach and Point Emery, counting all departures.
Bay Trail	Count all departures at Bolivar Bridge. Rotate every two hours among five different access points, counting all departures. Maintain separate counts of Bay Trail departures while sampling at Vincent Park, Gilman Drive, Brickyard Cove, Berkeley Beach, and Point Emery. Estimation methodology described in text.
Crown Beach	Count all departures from main parking lot on Westline Drive. Rotate every two hours among five locations along Shoreline Drive, counting all departures.
Crab Cove	Count all departures.
Arrowhead Fishing Platform	Count all departures.

EXHIBIT 6: DAILY TRIP ESTIMATES FOR FOUR SAMPLING DAYS – MARIN, SAN FRANCISCO, AND SAN MATEO SITES

SITE	THURSDAY 11/13/08	FRIDAY 11/14/08	SATURDAY 11/15/08	SUNDAY 11/16/08
Marin				
Stinson Beach[a]	n/a	n/a	n/a	n/a
Muir Beach[a]	n/a	n/a	n/a	n/a
Tennessee Valley[b]	505	505	1,501	1,501
Rodeo Beach	811	853	2,744	2,074
San Francisco				
Hyde Street Pier	n/a	n/a	n/a	n/a
San Francisco Maritime	4,504	4,748	9,005	8,306
Crissy Field	5,955	7,305	17,294	15,641
Fort Point	n/a	n/a	n/a	n/a
Baker Beach	840	1,331	3,949	3,635
China Beach	151	314	806	717
Ocean Beach – North	4,148	8,262	18,834	18,713
Ocean Beach – South	556	1,610	2,275	3,521
Fort Funston[a]	n/a	n/a	n/a	n/a
San Mateo				
Pacifica Pier	211	300	1,280	1,196

Notes:
[a] – No trip counts were obtained for this site. The trip/index ratio was transferred from a site with similar activities.
[b] – At Tennessee Valley, trip estimates were obtained for two days (11/14/08 and 11/15/08) rather than four. The estimate obtained on 11/14/08 was used for 11/13/08, and the trip estimate obtained on 11/15/08 was used for 11/16/08.

EXHIBIT 7: DAILY TRIP ESTIMATES FOR FOUR SAMPLING DAYS – CONTRA COSTA AND ALAMEDA SITES

SITE	FRIDAY 11/7/08	SATURDAY 11/8/08	SUNDAY 11/9/08	MONDAY 11/10/08
Contra Costa				
Point Pinole	179	214	200	428
Keller Beach	59	57	39	116
Ferry Point	46	32	66	122
Vincent Park	124	104	67	239
Shimada Friendship Park	71	123	131	179
Point Isabel	1,435	1,354	1,890	3,168
Alameda				
Albany Beach	265	220	285	558
Berkeley Pier	209	181	364	761
Gilman Drive	31	28	227	57
Brickyard Cove	37	53	47	59
Berkeley Beach	103	118	65	137
Point Emery	113	117	154	146
Bay Trail	853	633	914	1,718
Crown Beach	717	637	655	1,125
Crab Cove	166	127	151	286
Arrowhead Fishing Platform	54	61	18	53

Estimated Trip/Index Ratios

For each site and each type of day the total trip estimate was divided by the total visitation index on the two count days to estimate the trip/index ratio. This provides weekday and weekend estimates of the trip/index ratio for each site (Exhibit 8).

EXHIBIT 8: SITE-SPECIFIC TRIP/INDEX RATIOS

SITE	WEEKDAY RATIO[a]	WEEKEND RATIO[a]
Marin		
Stinson Beach[b]	1.25	1.76
Muir Beach[b]	1.25	1.76
Tennessee Valley	1.01	1.44
Rodeo Beach	1.25	1.76
San Francisco		
Hyde Street Pier[c]	1.00	1.00
San Francisco Maritime	3.72	3.68
Crissy Field	3.49	4.63
Fort Point[d]	2.80	2.80
Baker Beach	1.51	2.17
China Beach	0.31	0.44
Ocean Beach – North	6.35	8.78
Ocean Beach – South	1.11	2.19
Fort Funston[e]	1.13	1.43
San Mateo		
Pacifica Pier	0.53	0.95
Contra Costa		
Point Pinole	0.62	0.87
Keller Beach	0.65	0.66
Ferry Point	0.44	0.83
Vincent Park	0.45	0.56
Shimada Friendship Park	0.37	0.61
Point Isabel	1.13	1.43
Alameda		
Albany Beach	0.77	0.74
Berkeley Pier	0.91	1.22
Gilman Drive	0.11	0.72
Brickyard Cove	0.18	0.25
Berkeley Beach	0.43	0.45
Point Emery	0.45	0.71
Bay Trail	2.72	3.59
Crown Beach	5.10	5.21
Crab Cove	1.85	3.51
Arrowhead Fishing Platform	0.64	0.34

Notes:
[a] - The trip/index ratios are not required to be greater than one, as they do not necessarily represent the number of visitors per vehicle. Rather, they represent the number of visitors at the site divided by the value of the visitation index. Although this index is expected to be correlated with visitation, it does not necessarily equal the number of vehicles that the counted visitors used to access the site. In some cases, for example, the index is transferred from a nearby site (see Exhibit 4).
[b] - Trip/index ratio transferred from Rodeo Beach.
[c] - Trip/index ratio for Hyde Street Pier set equal to one, because daily visitation estimates were obtained directly from the National Park Service.
[d] - Trip/index ratio transferred from persons-per-vehicle counts at Crissy West Bluff parking lot.
[e] - Trip/index ratio transferred from Point Isabel, another park popular with dog walkers.

CALCULATING BASELINE VISITS

The final step in the estimation process is to combine the visit/index ratio for each site with the predicted daily visitation indices to estimate daily baseline visitation. Specifically, for every day of the spill impact period, daily baseline visitation for each site is estimated by multiplying the predicted visitation index (calculated in Step 2) by the weekday or weekend visit/index ratio (calculated in Step 3).

As these daily baseline visitation estimates exclude visits outside of the daytime period covered by the on-site count effort (i.e., 7:00 a.m. to 5:30 p.m.), the estimates are adjusted upwards to account for night-time visitation. At each site, the proportion of the 24-hour automated vehicle/pedestrian counts attributable to night-time visits is estimated separately for weekdays and weekends using the automated counter data from November 2008. These night-time proportions range from a low of zero at several sites with entry gates that are closed at night (e.g., Baker Beach) to a high of 0.33 at Berkeley Pier on weekdays. The daily baseline visitation estimates are divided by one minus the night-time proportion to estimate total daily visitation.

Exhibit 9 presents baseline visitation estimates for each site and for every month of the spill impact period. Total baseline visitation across all sites ranges from a low of 756,293 in January 2008 to a high of approximately 1,094,522 in November 2007.

EXHIBIT 9: BASELINE TRIP ESTIMATES[a]

SITE	NOVEMBER 2007	DECEMBER 2007	JANUARY 2008	FEBRUARY 2008	MARCH 2008	APRIL 2008	MAY 2008	JUNE 2008
Marin								
Stinson Beach	18,328	14,888	10,043	10,228	12,639	12,304	13,529	13,296
Muir Beach	13,115	11,147	8,099	8,318	9,949	9,575	10,603	10,371
Tennessee Valley	19,536	18,273	13,019	13,377	17,084	16,173	17,825	17,410
Rodeo Beach	32,045	28,405	22,527	22,841	25,963	24,757	27,264	26,599
San Francisco								
Hyde Street Pier	27,911	21,053	14,977	17,396	21,822	15,852	26,607	29,254
San Francisco Maritime	118,754	94,136	82,955	93,509	110,491	111,809	123,302	143,825
Crissy Field	210,926	174,416	151,375	164,769	194,513	192,449	210,811	236,542
Fort Point	72,666	52,153	58,267	56,252	60,872	60,859	81,245	89,934
Baker Beach	32,447	23,796	17,722	18,944	20,868	21,021	23,731	22,874
China Beach	6,576	4,824	3,598	3,852	4,241	4,272	4,829	4,652
Ocean Beach - North	265,865	217,047	172,268	177,452	194,140	188,772	209,455	204,235
Ocean Beach - South	51,166	46,475	37,690	37,676	42,353	40,027	44,044	42,844
Fort Funston	36,748	33,755	26,908	27,218	31,445	29,867	32,727	31,910
San Mateo								
Pacifica Pier	15,462	13,724	10,161	10,152	12,062	11,384	12,625	12,294
Contra Costa								
Point Pinole	7,344	6,781	6,040	6,332	7,301	6,987	7,559	7,573
Keller Beach	1,982	1,797	1,610	1,723	1,988	1,923	2,068	2,080
Ferry Point	1,848	1,733	1,478	1,525	1,805	1,685	1,857	1,842
Vincent Park	3,862	3,254	2,948	3,152	3,672	3,601	3,967	4,208
Shimada Friendship Park	3,731	3,159	2,821	2,968	3,494	3,389	3,736	3,947
Point Isabel	54,605	48,674	42,846	45,394	53,187	51,007	55,770	56,944
Alameda								
Albany Beach	9,941	8,365	7,438	8,071	9,510	9,296	10,234	10,795
Berkeley Pier	14,917	11,626	9,094	10,265	13,553	13,230	14,555	15,751
Gilman Drive	2,785	2,539	2,119	2,074	2,525	2,293	2,574	2,594
Brickyard Cove	1,611	1,415	1,279	1,358	1,568	1,523	1,663	1,722
Berkeley Beach	3,451	3,006	2,764	2,978	3,405	3,349	3,638	3,786
Point Emery	4,328	3,815	3,423	3,607	4,184	4,041	4,422	4,569
Bay Trail	31,263	23,850	20,387	23,482	29,065	28,999	32,309	35,355
Crown Beach	25,198	19,680	17,725	20,159	23,845	23,983	26,849	29,417
Crab Cove	4,846	4,103	3,691	3,902	4,569	4,450	4,904	5,185
Arrowhead Fishing Platform	1,267	1,081	1,022	1,136	1,280	1,287	1,389	1,461
Overall Total[b]	**1,094,522**	**898,969**	**756,293**	**800,108**	**923,395**	**900,165**	**1,016,090**	**1,073,268**

Notes:

[a] - Fishing and boating are excluded from these estimates, as these two activities were addressed in separate analyses.

[b] - Totals may not sum due to rounding.

EXAMPLE CALCULATION

This section demonstrates the approach used to calculate baseline visitation using Albany Beach as an example.

Daily Visitation Index

An automated vehicle counter was deployed at the Albany Beach parking lot entrance throughout the month of November, 2008. This vehicle counter provides a daily count of vehicles entering Albany Beach between 7:00 a.m. and 5:30 p.m.

Predicted Daily Visitation Index

Using regression techniques, the data from this vehicle counter are used to predict vehicle counts for each day of the spill impact period. For example, the regression using November 2008 data indicates that the following relationship holds between vehicle counts (*Count*), daily high temperature (*Temp*), daily total precipitation (*PPT*), and type of day (*Weekday*), where *Weekday* equals one on weekdays and zero on weekend days or holidays:

$$\ln(Count) = 5.12 + 0.02(Temp) - 2.53(PPT) - 0.59(Weekday)$$

This relationship can be used to predict counts for every day of the spill impact period. For example November 10, 2007 was a Saturday with a high temperature of 58.9 degrees and 0.17 inches of precipitation. Therefore, the predicted count for that day is:

$$360 = \exp(5.12 + 0.02x58.9 - 2.53x0.17 - 0.59x0)x1.017$$

The final adjustment of 1.017 allows us to obtain the mean rather than the median of the predicted count, which is a random variable (see Footnote 4).

Trip/Index Ratio

The trip/index ratio is calculated based on trip estimates and vehicle counts at Albany Beach from November 7 to 10, 2008 (Exhibit 10). The trip estimates for these four days were 265 (Friday), 285 (Saturday), 558 (Sunday), and 220 (Monday). The vehicle counts on these four days were 389 (Friday), 443 (Saturday), 671 (Sunday), and 255 (Monday).[7] Thus, the daily trip/index ratios were 0.68 (Friday), 0.64 (Saturday), 0.83 (Sunday), and 0.86 (Monday). The average weekday ratio is 0.77 and the average weekend ratio is 0.74.

[7] Vehicle counts are higher than trip estimates because many vehicles entering the Albany Beach parking lot do not bring visitors to the site. Persons driving to the Albany Beach parking lot can walk or bike to other locations in the area, they can sit in their cars (i.e., to read or listen to music), or they can simply turn around and leave the parking lot without stopping.

EXHIBIT 10: ALBANY BEACH TRIP/INDEX RATIO CALCULATION

	WEEKDAY		WEEKEND	
	NOVEMBER 7	NOVEMBER 10	NOVEMBER 8	NOVEMBER 9
2008 Trip Estimates	265	220	285	558
2008 Automated Counts	389	255	443	671
Trip/Index Ratio	0.68	0.86	0.64	0.83
	0.77		0.74	

Baseline Visits

The predicted daily visitation indices are multiplied by the appropriate trip/index ratio (weekend or weekday) and divided by the proportion of daytime visits to estimate baseline visits for every day of the spill impact period. For example, baseline visits for November 10, 2007 (a weekend) are calculated as:

$$283 = \frac{360 x 0.74}{0.94}$$

where 0.94 is the proportion of visitation that occurs between 7:00 a.m. and 5:30 p.m. on weekends.

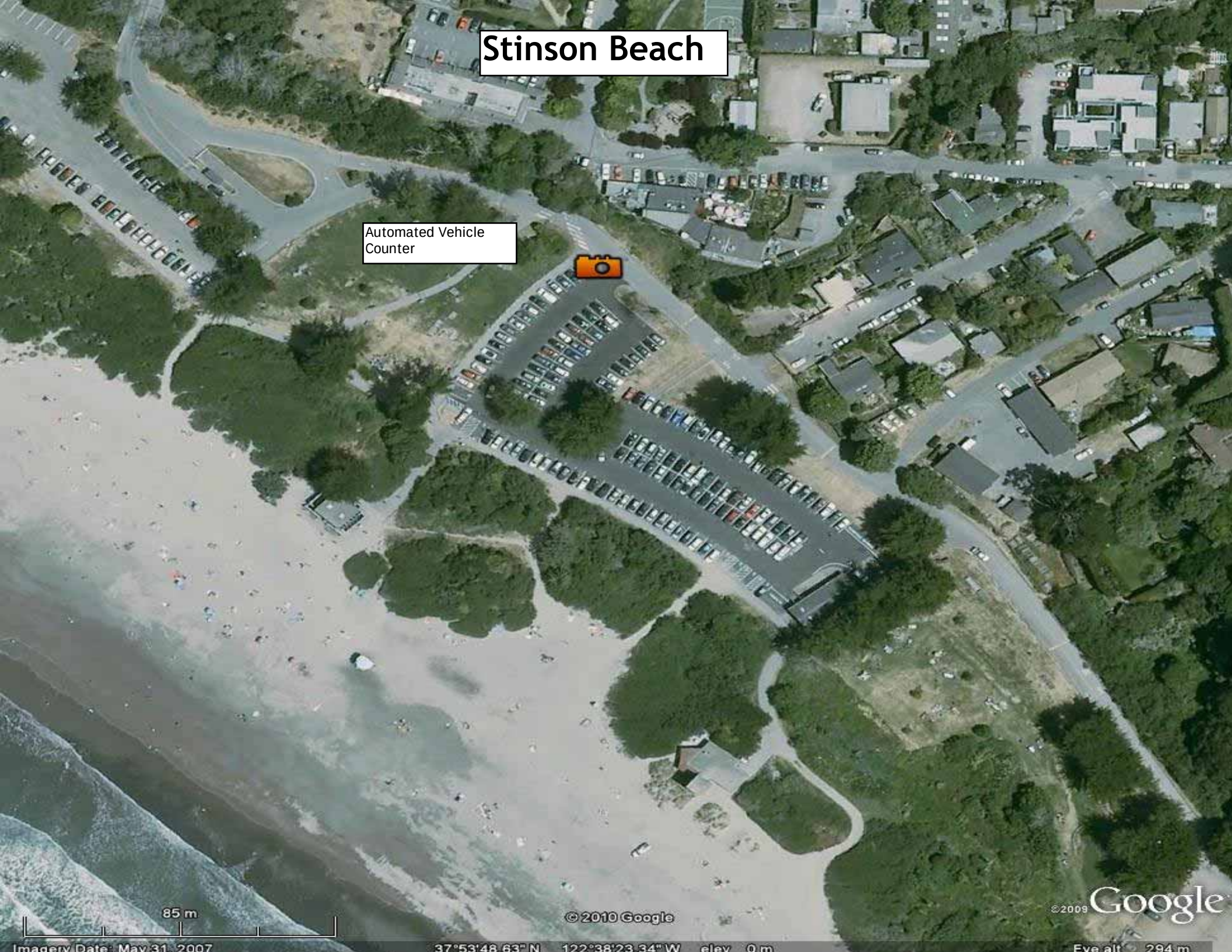
REFERENCES

Cochran, William G. 1977. *Sampling Techniques (3rd edition)*. Wiley (New York).

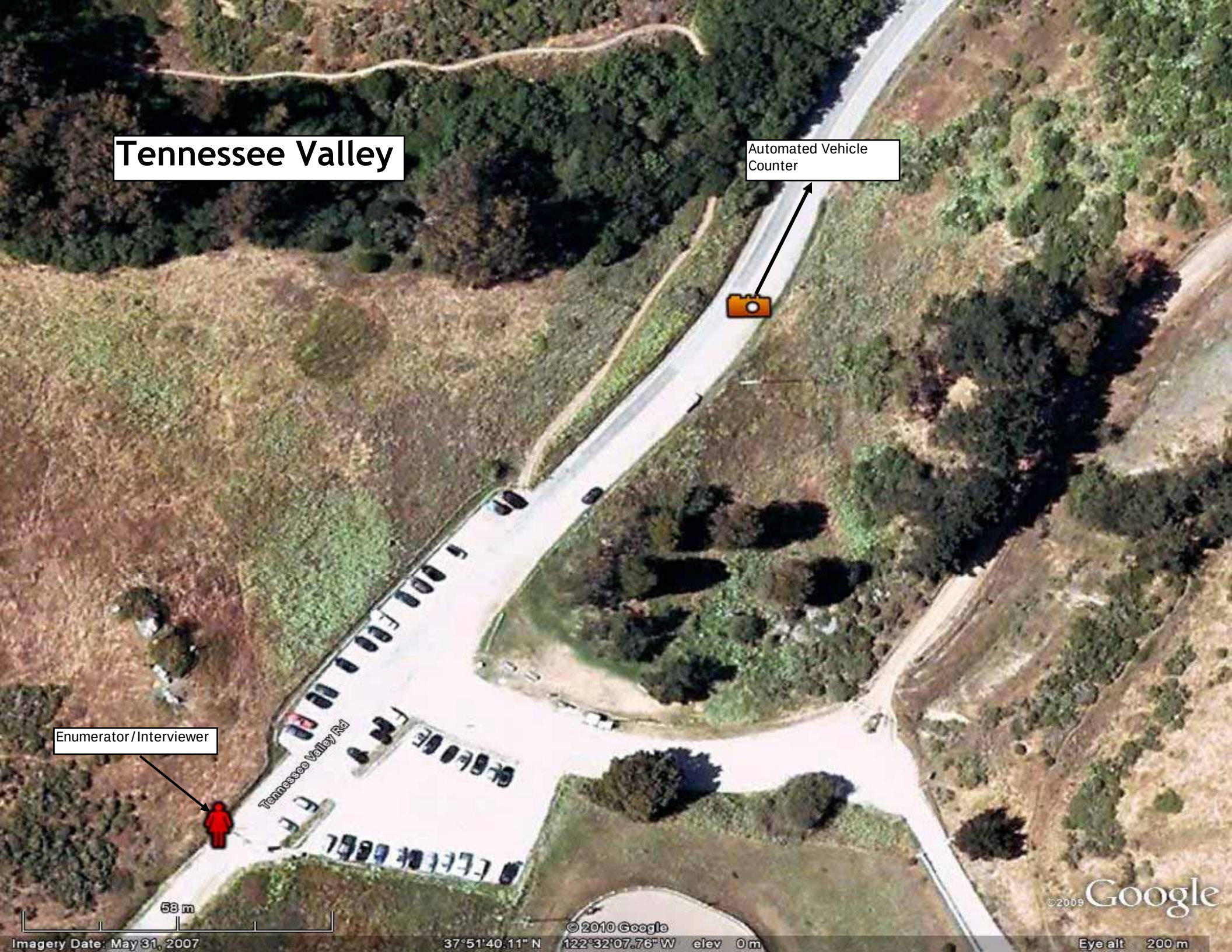
Lohr, Sharon L. 1999. *Sampling: Design and Analysis*. Duxbury (Pacific Grove, California).

Torangeau, R. and Ruser, J. 1999. *Discrepancies Between Beach Counts and Survey Results.* Report submitted to the Damage Assessment Center, National Oceanic and Atmospheric Administration. August 29.

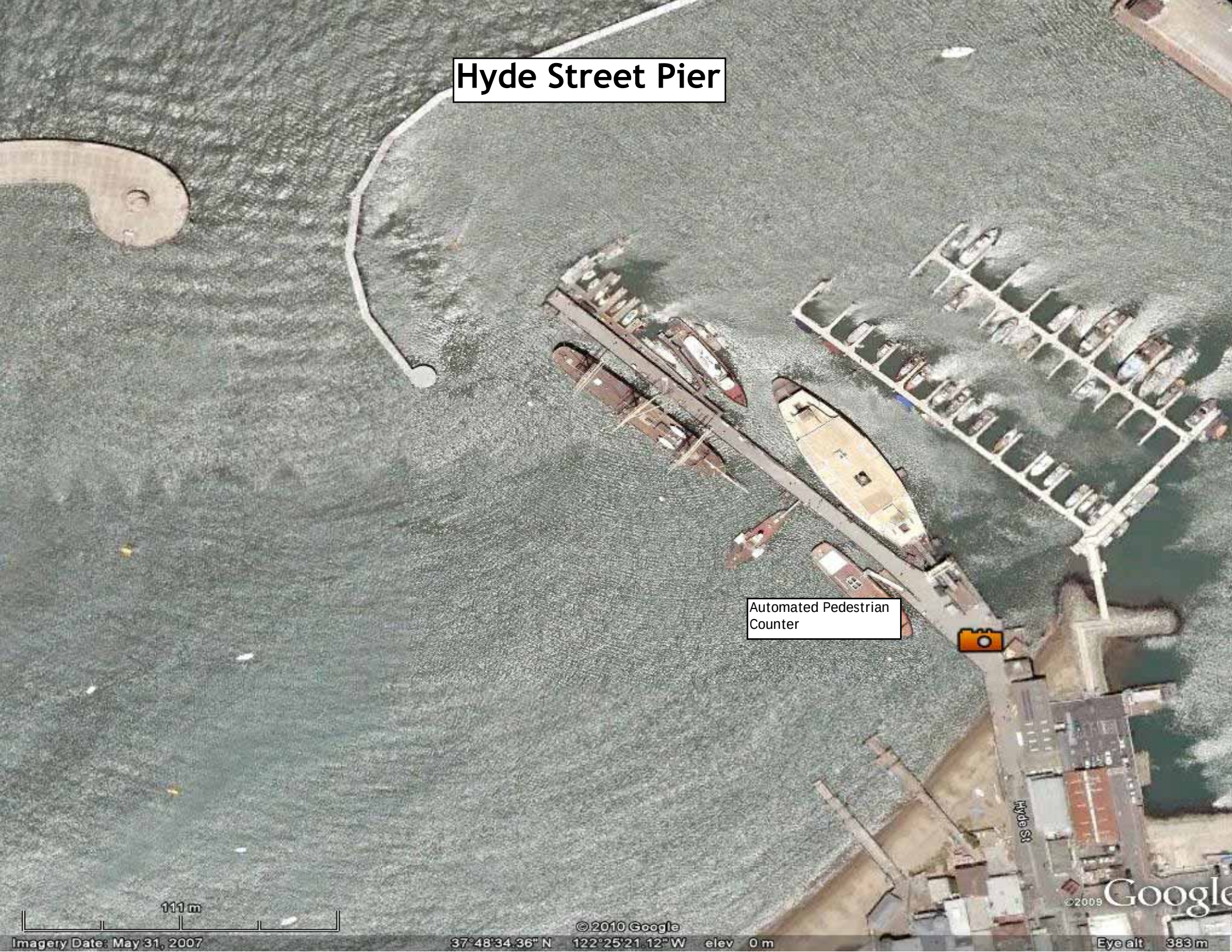
ATTACHMENT A: AUTOMATED COUNTER AND STAFF COUNTER LOCATIONS


Stinson Beach
Automated Vehicle Counter
85 m
© 2010 Google
©2009 Google
Imagery Date: May 31, 2007
37°53'48.63" N 122°38'23.34" W elev 0 m
Eye alt 294 m

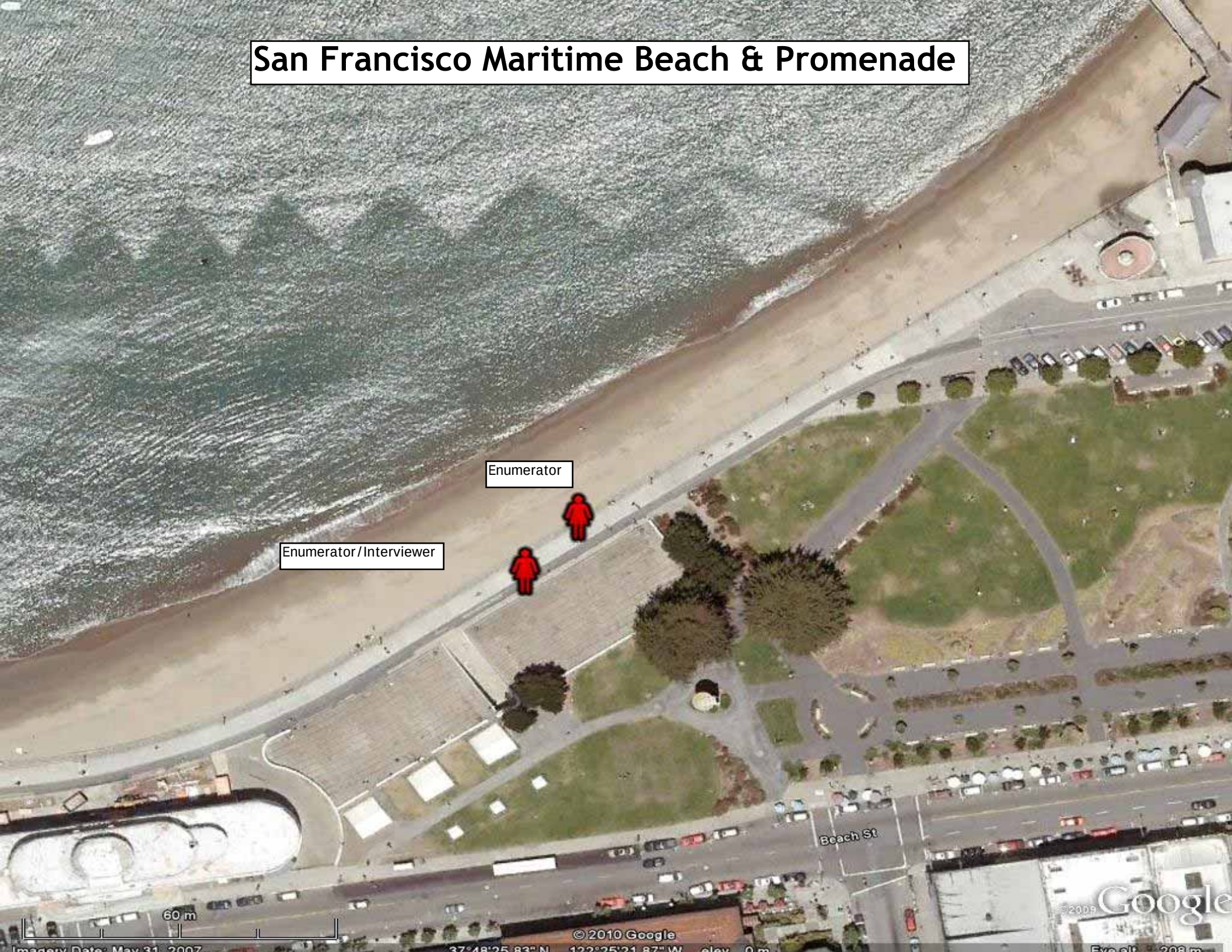
Muir Beach
Automated Vehicle Counter
75 m
© 2010 Google
©2009 Google
Imagery Date: May 31, 2007
37°51'39.11" N 122°34'32.07" W elev 0 m
Eye alt 259 m


Tennessee Valley
Automated Vehicle Counter
Enumerator / Interviewer
Tennessee Valley Rd
58 m
© 2010 Google
Imagery Date: May 31, 2007
37°51'40.11" N 122°32'07.76" W elev 0 m
Eye alt 200 m
©2009 Google

Rodeo Beach
Enumerator
Automated Vehicle Counter
178 m
© 2010 Google
©2009 Google
Imagery Date: May 31, 2007
37°49'54.91" N
122°32'06.68" W
elev 0 m
Eye alt 615 m

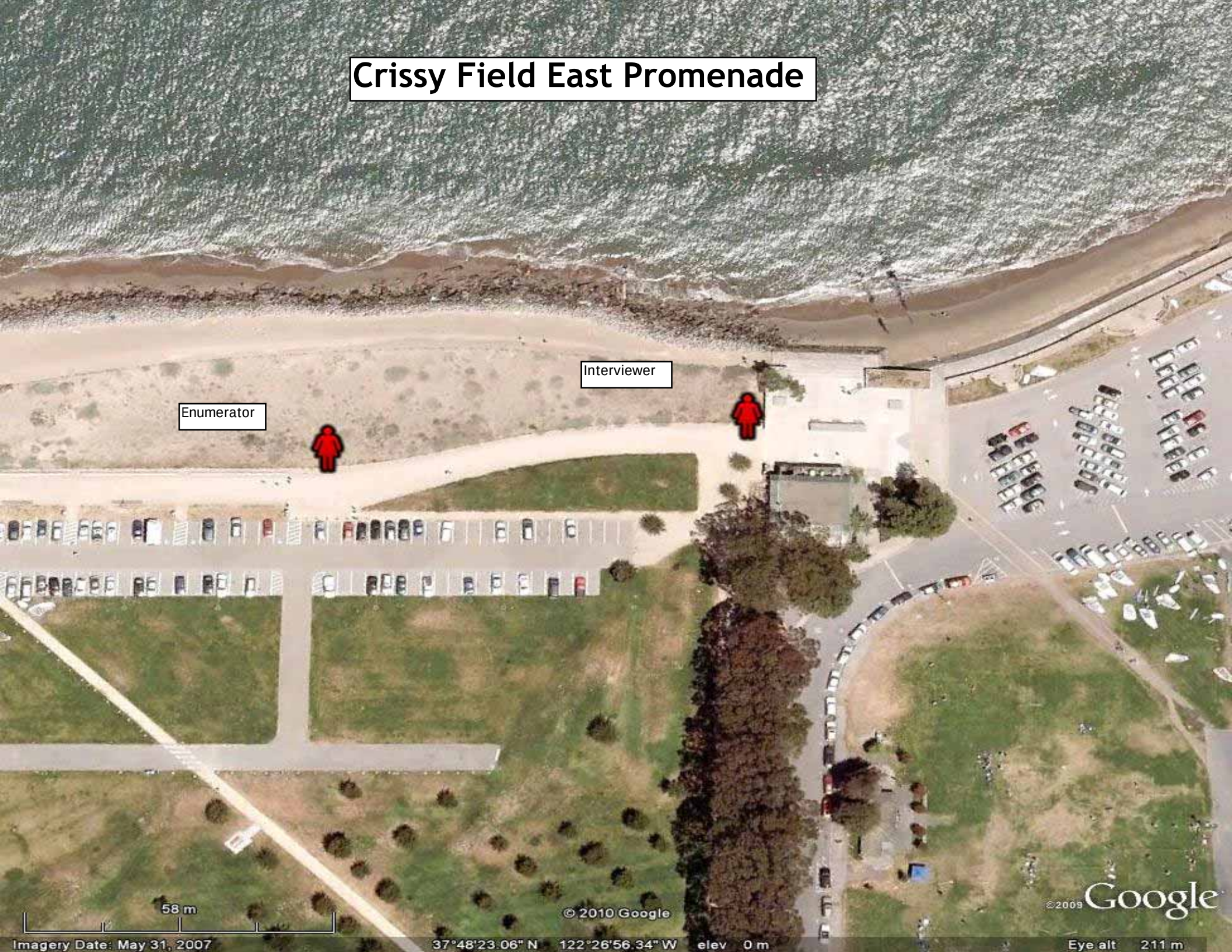

Hyde Street Pier
Automated Pedestrian Counter
Hyde St
111 m
Imagery Date: May 31, 2007
© 2010 Google
37°48'34.36" N 122°25'21.12" W elev 0 m
Eye alt 383 m
©2009 Google

San Francisco Maritime Beach & Promenade



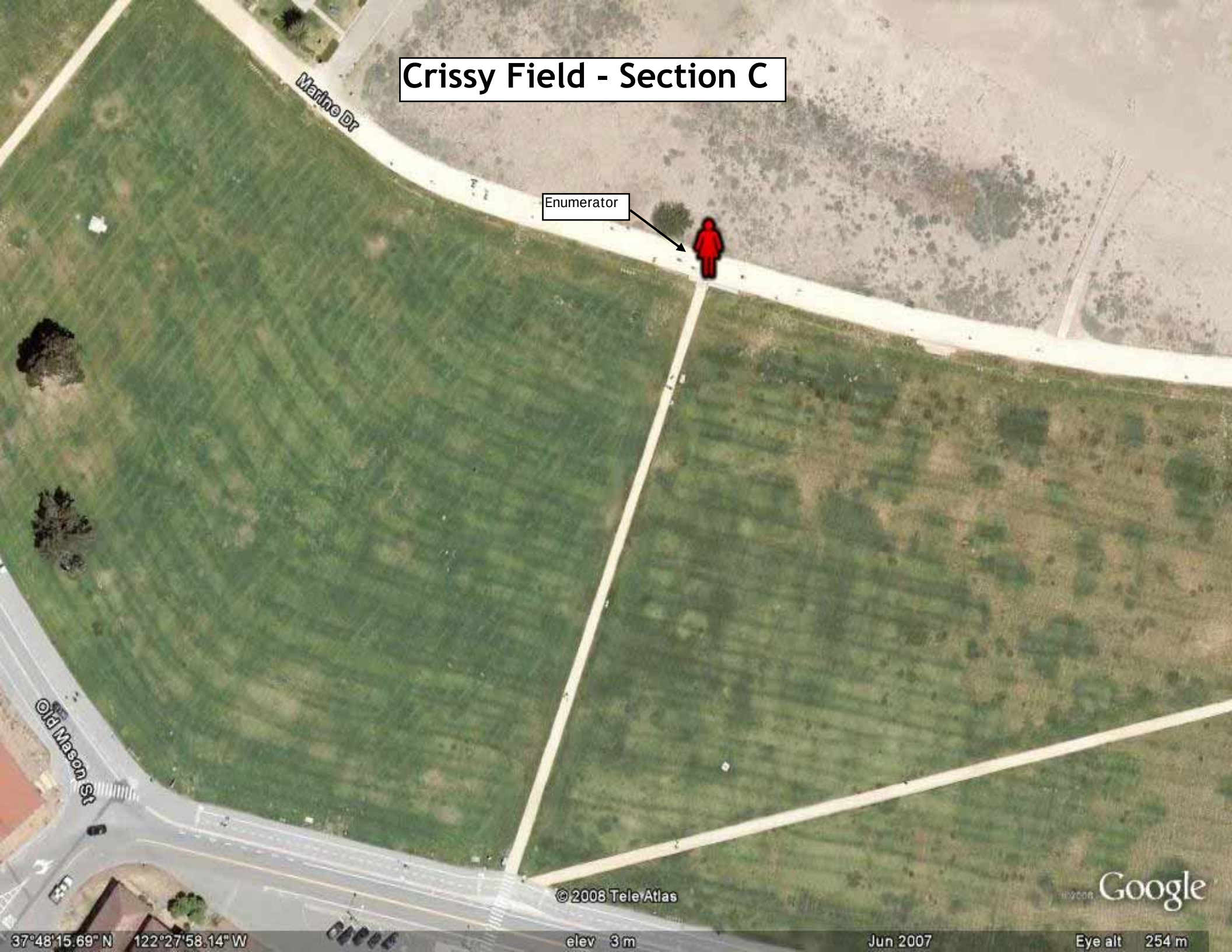
San Francisco Maritime - Municipal Pier

Crissy Field East Beach Parking Lot
Interviewer
Automated Vehicle Counter
Enumerator
47 m
© 2010 Google
Imagery Date: May 31, 2007
37°48'21.20" N 122°27'03.95" W elev 0 m
Eye alt 174 m


Crissy Field East Promenade
Interviewer
Enumerator
58 m
© 2010 Google
©2009 Google
Imagery Date: May 31, 2007
37°48'23.06" N 122°26'56.34" W elev 0 m
Eye alt 211 m

Crissy Field - Section A
Enumerator
Marine Dr
Crissy Field
Old Mason St
© 2008 Tele Atlas
Google
37°48'14.27" N 122°27'41.02" W
elev 3 m
Jun 2007
Eye alt 370 m

Crissy Field - Section B

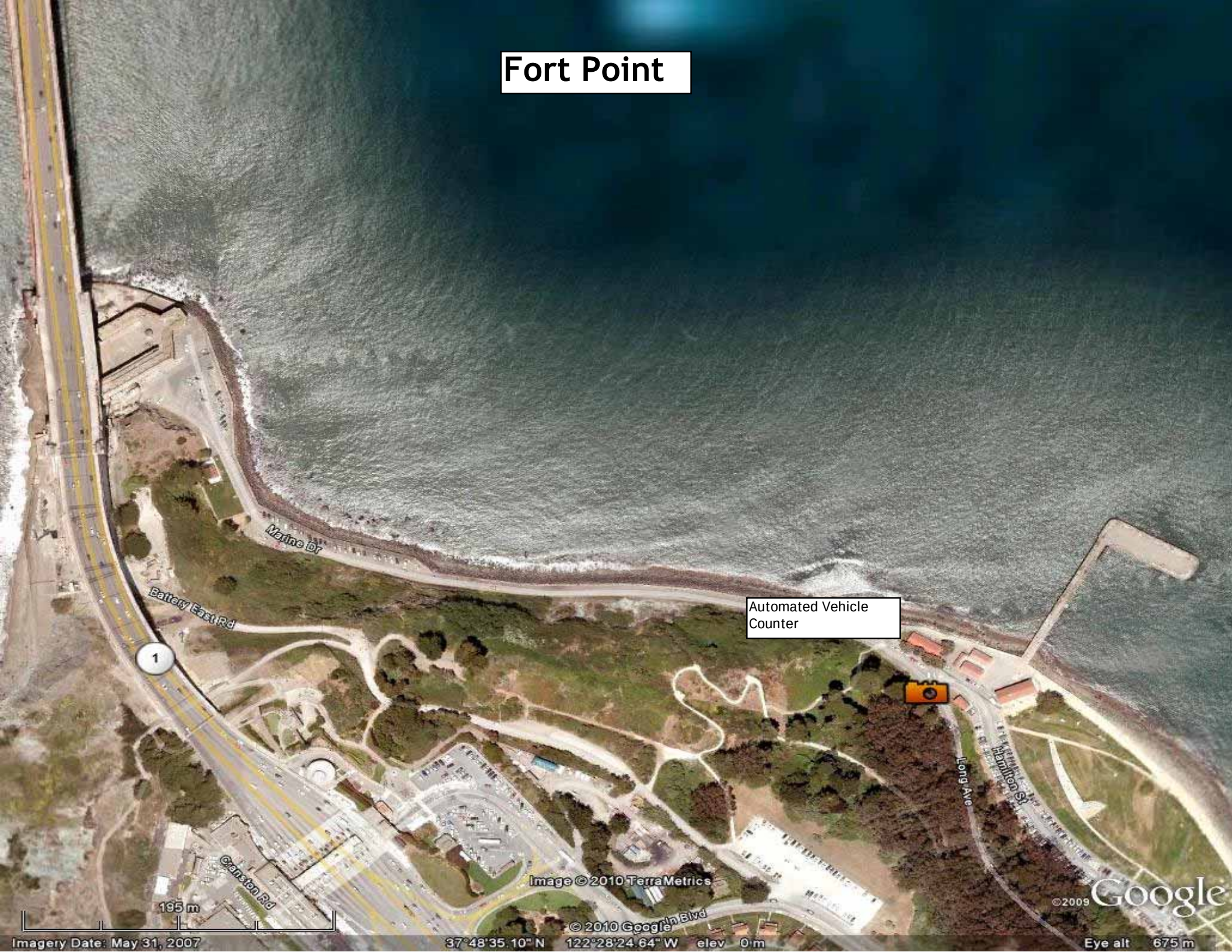

Crissy Field - Section C
Marine Dr
Enumerator
Old Mason St
© 2008 Tele Atlas
Google
37°48'15.69" N 122°27'58.14" W
elev 3 m
Jun 2007
Eye alt 254 m

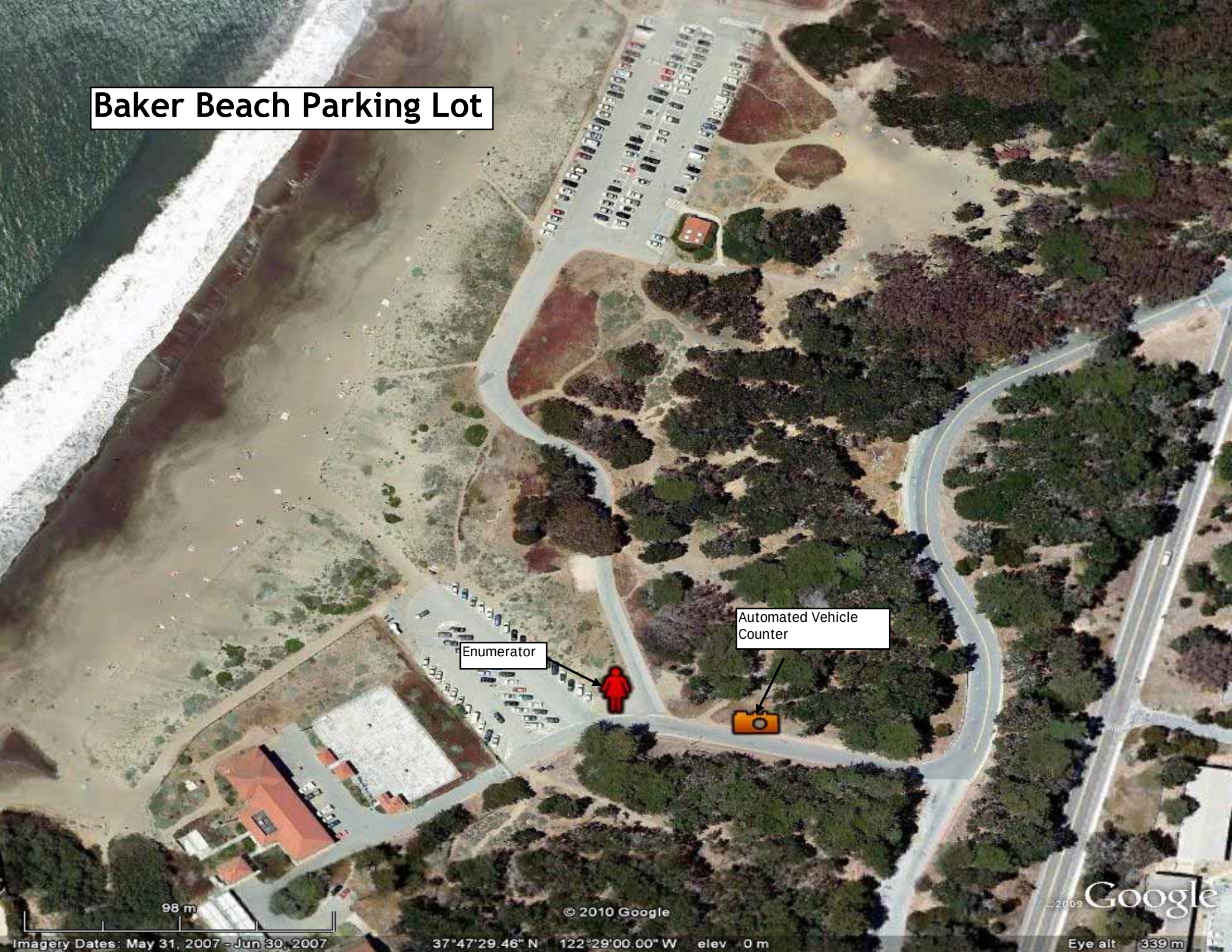
Crissy Field - Section D

Crissy Field - Trail Section A

Crissy Field - Trail Section B

Interviewer
Crissy Field West Bluff Parking Lot
Automated Vehicle Counter
Enumerator
63 m
© 2010 Google
©2009 Google
Imagery Date: May 31, 2007
37°48'25.11" N
122°28'10.66" W
elev 0 m
Eye alt 227 m

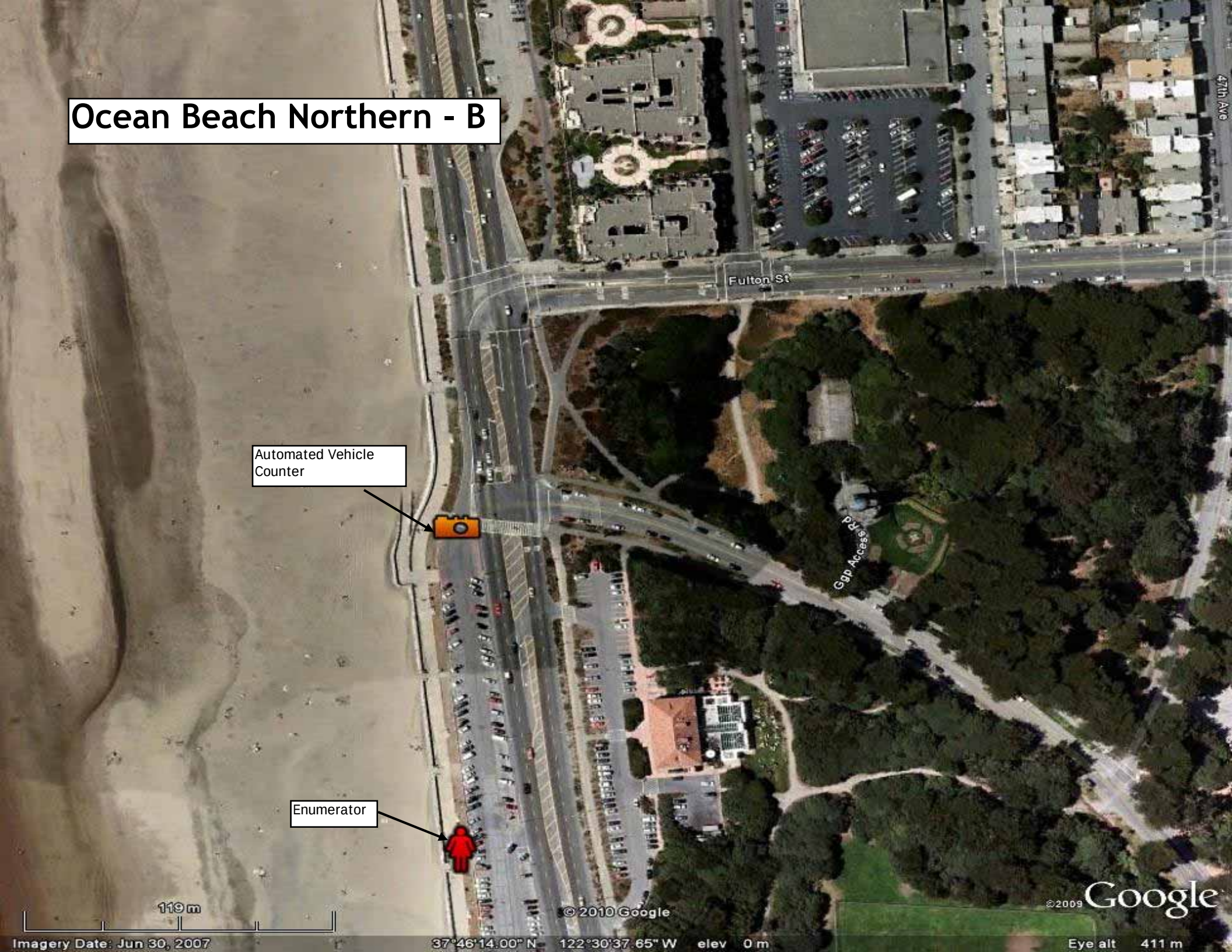

Fort Point
Automated Vehicle Counter
Marine Dr
Battery East Rd
1
Cranston Rd
Long Ave
Hamilton St
Image © 2010 TerraMetrics
© 2010 Google
©2009 Google
195 m
Imagery Date: May 31, 2007
37°48'35.10" N 122°28'24.64" W elev 0 m
Eye alt 675 m


Baker Beach Parking Lot
Enumerator
Automated Vehicle Counter
98 m
© 2010 Google
©2009 Google
Imagery Dates: May 31, 2007 - Jun 30, 2007
37°47'29.46" N 122°29'00.00" W elev 0 m
Eye alt 339 m

Baker Beach - Sand Ladder Parking Area
Enumerator
22 m
© 2010 Google
©2009 Google
Imagery Date: May 31, 2007
37°47'46.53" N
122°28'47.43" W
elev 0 m
Eye alt 77 m

China Beach
Enumerator
32 m
© 2010 Google
©2009 Google
Imagery Date: Jun 30, 2007
37°47'15.90" N 122°29'27.23" W elev 0 m
Eye alt 110 m

Ocean Beach Northern - A


Ocean Beach Northern - B
Automated Vehicle Counter
Enumerator
Fulton St
47th Ave
Ggp Access Rd
119 m
© 2010 Google
©2009 Google
Imagery Date: Jun 30, 2007
37°46'14.00" N 122°30'37.65" W elev 0 m
Eye alt 411 m

Ocean Beach Northern - C
Enumerator
South Dr
© 2008 Tele Atlas
Google
37°45'58.45" N 122°30'36.50" W
elev 5 m
Jul 2007
Eye alt 513 m

Enumerators
Ocean Beach Central Section
Martin Luther King Jr Dr
Lincoln Way
36th Ave
Noriega St
Taraval St
Sunset Blvd
Image © 2010 TerraMetrics
© 2010 Google
©2009 Google
900 m

Ocean Beach - Sloat Parking Lot
Enumerator
Enumerator
Automated Vehicle Counter
52 m
© 2010 Google
©2009 Google
Imagery Date: Jun 30, 2007
37°44'08.37" N 122°30'25.70" W elev 0 m
Eye alt 180 m

Ocean Beach - Second Overlook Parking Lot

Fort Funston
Automated Vehicle Counter
Fort Funston Rd
104 m
© 2010 Google
Google
Imagery Date: Jun 30, 2007
37°42'53.39" N 122°30'06.30" W elev 0 m
Eye alt 361 m

Pacifica Pier

Point Pinole
Automated Vehicle Counter
Enumerator/Interviewer
©2008 Tele Atlas
Google
37°59'31.08" N 122°21'20.65" W
elev 35 ft
Jun 2007
Eye alt 885 ft

Keller Beach
Enumerator
35 m
© 2010 Google
©2009 Google
Imagery Date: Oct 2, 2009
37°55'15.32" N 122°23'10.88" W elev 0 m
Eye alt 121 m

Ferry Point
Automated Vehicle Counter
Enumerator
Image © 2010 TerraMetrics
© 2010 Google
©2009 Google
116 m
Imagery Date: Oct 2, 2009
37°54'36.11" N 122°23'23.06" W elev 0 m
Eye alt 441 m

Vincent Park

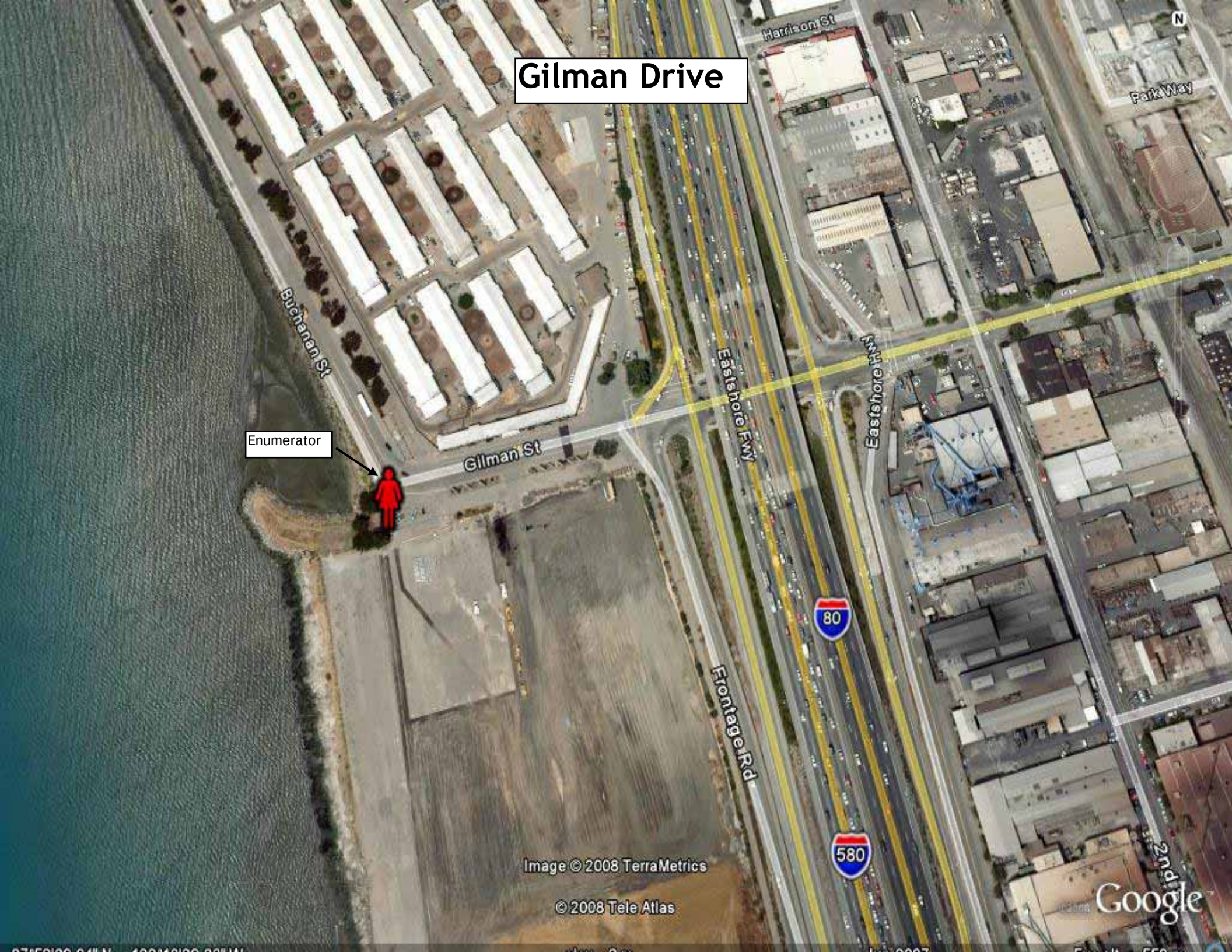
Shimada Friendship Park
Enumerator
35 m
© 2010 Google
©2009 Google
Imagery Date: Oct 2, 2009
37°54'29.72" N 122°20'40.78" W elev 0 m
Eye alt 136 m

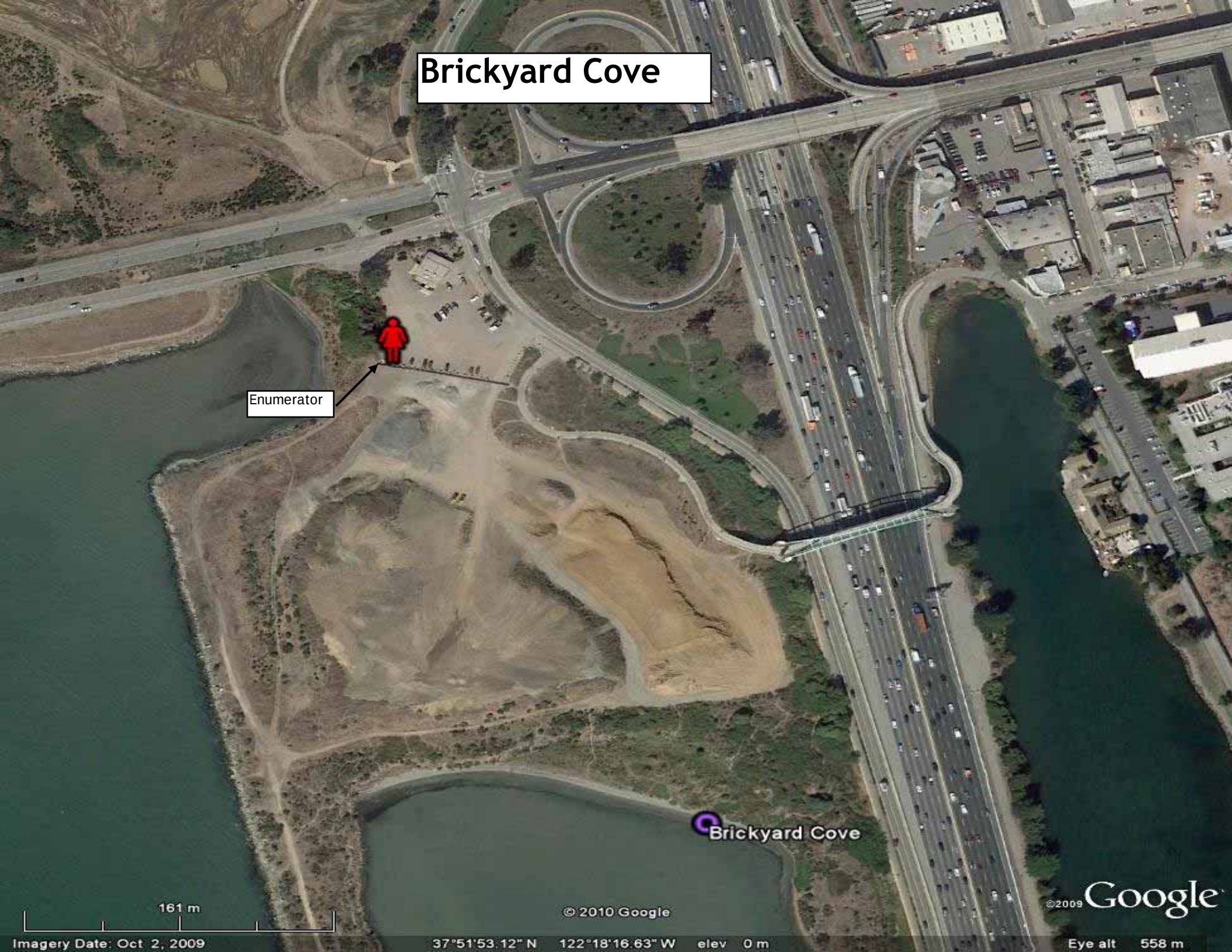
Point Isabel Parking Lot North

Point Isabel Parking Lot West
Interviewer
Enumerator
Isabel St
Automated Vehicle Counter
42 m
©2010 Google
Imagery Date: Oct 2, 2009
37°53'54.61" N 122°19'25.88" W elev 0 m
Eye alt 151 m
©2009 Google

Albany Beach
Enumerator/Interviewer
Automated Vehicle Counter
Albany Bulb
Albany Plateau
Albany Beach
Image © 2010 TerraMetrics
© 2010 Google
284 m
©2009 Google
Imagery Date: Oct 2, 2009
37°53'19.84" N 122°19'10.21" W elev 0 m
Eye alt 1.07 km

Berkeley Pier
Automated Pedestrian Counter
Enumerator
49 m
© 2010 Google
©2009 Google
Imagery Date: Oct 2, 2009
37°51'47.20" N 122°19'03.75" W elev 0 m
Eye alt 169 m


Gilman Drive
Harrison St
Park Way
Buchanan St
Eastshore Fwy
Eastshore Hwy
Enumerator
Gilman St
Frontage Rd
80
580
2nd
Image © 2008 TerraMetrics
© 2008 Tele Atlas
Google

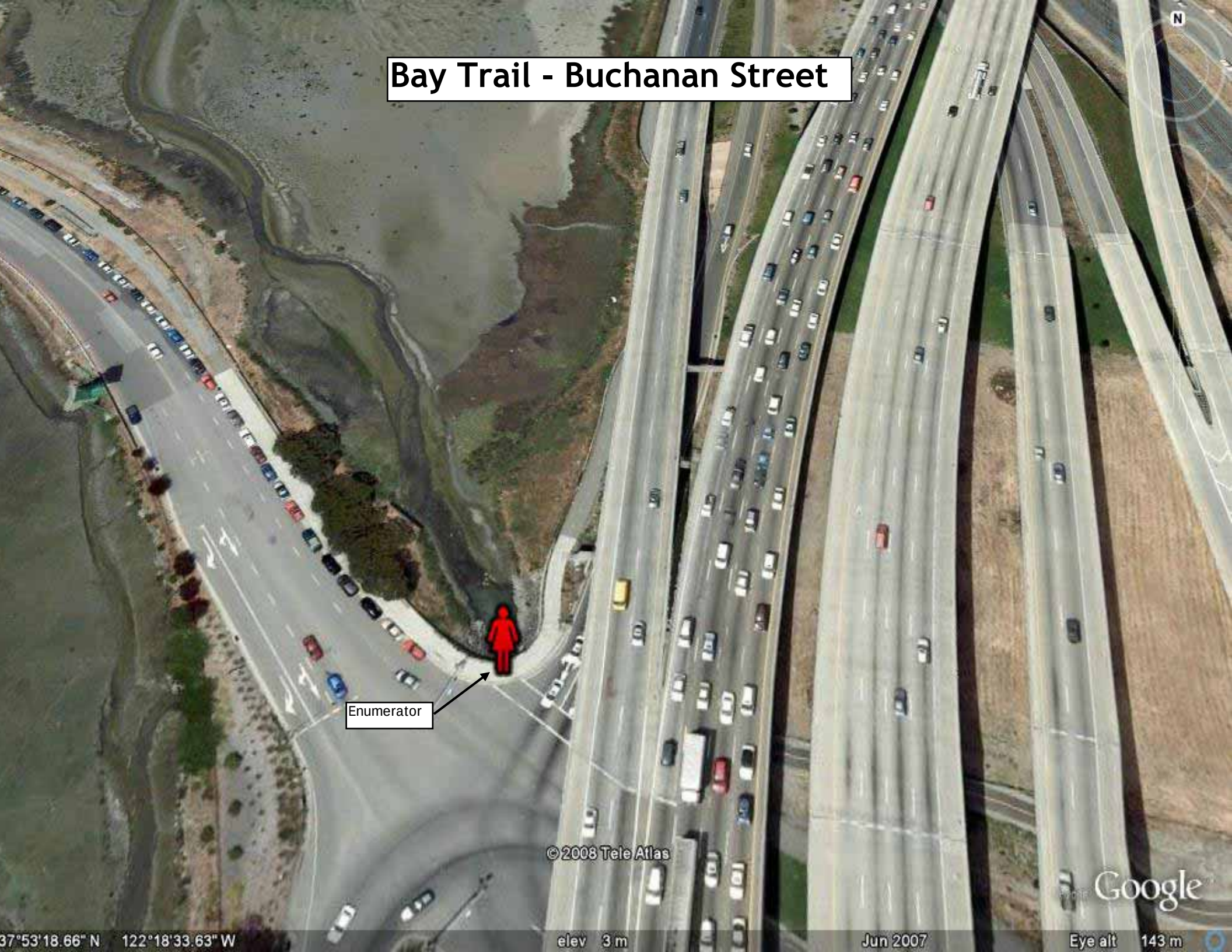

Brickyard Cove
Enumerator
Brickyard Cove
161 m
© 2010 Google
©2009 Google
Imagery Date: Oct 2, 2009
37°51'53.12" N
122°18'16.63" W
elev 0 m
Eye alt 558 m

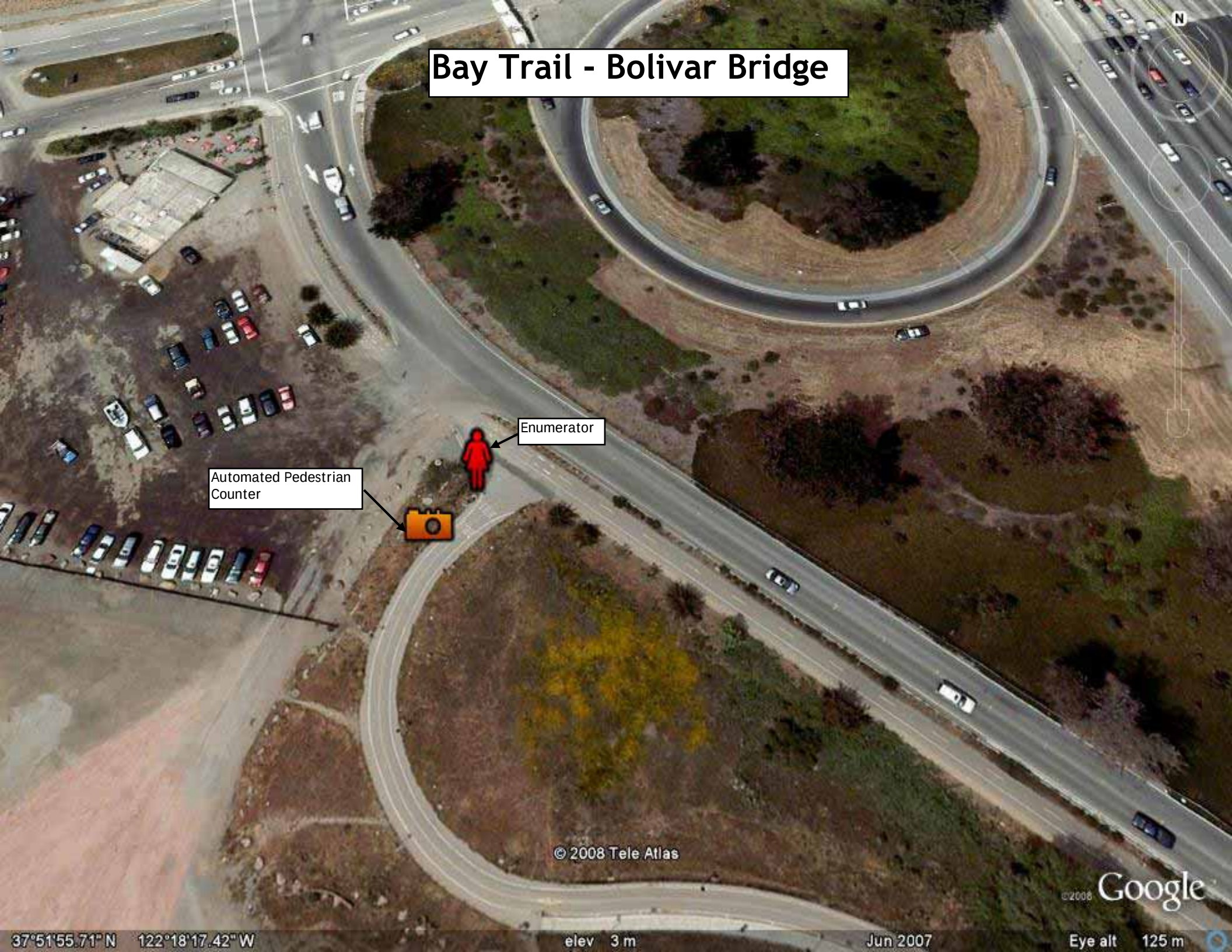
Berkeley Beach
Enumerator
44 m
© 2010 Google
©2009 Google
Imagery Date: Oct 2, 2009
37°51'04.30" N 122°18'00.45" W elev 0 m
Eye alt 151 m

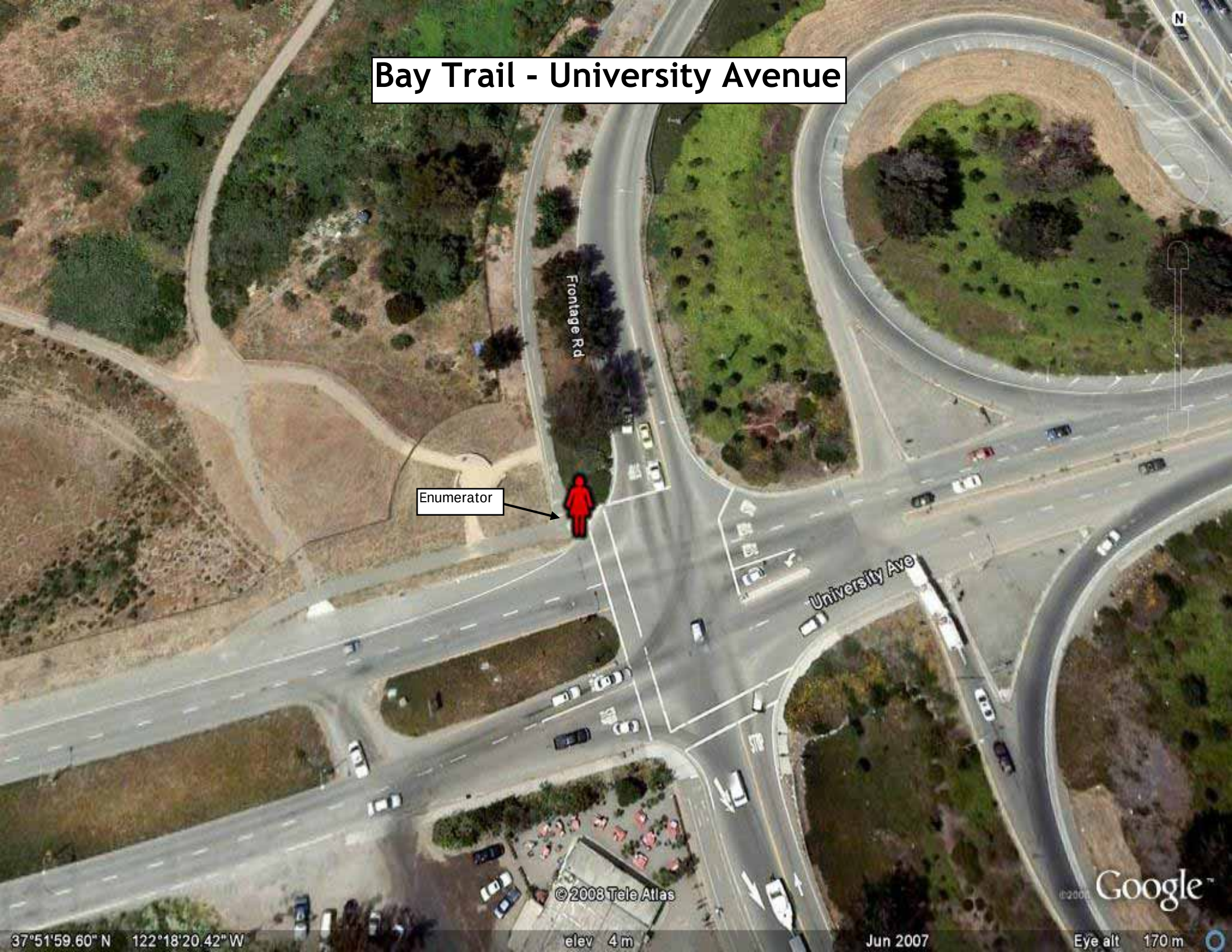
Point Emery
Enumerator
Automated Vehicle Counter
33 m
© 2010 Google
©2009 Google
Imagery Date: Oct 2, 2009
37°50'46.67" N 122°18'01.12" W elev 0 m
Eye alt 121 m

Bay Trail - South 51st Street
Enumerator
© 2008 Tele Atlas
Google
37°54'40.67" N 122°19'41.39" W
elev 2 m
Jun 2007
Eye alt 195 m

Bay Trail - Central Avenue
Enumerator
© 2008 Tele Atlas
Google
37°53'58.97" N 122°18'59.59" W
elev 2 m
Jun 2007
Eye alt 104 m

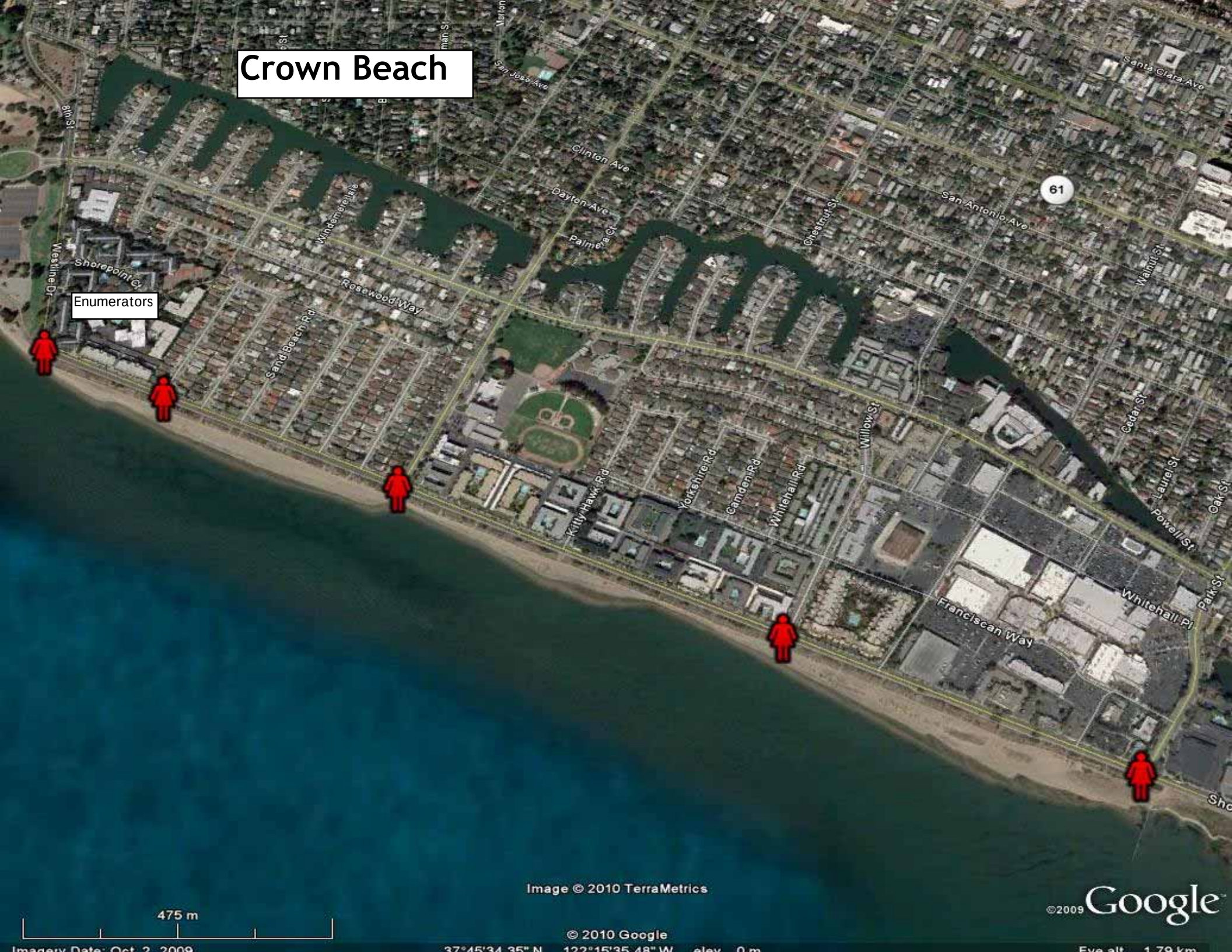

Bay Trail - Buchanan Street
Enumerator
© 2008 Tele Atlas
Google
37°53'18.66" N 122°18'33.63" W
elev 3 m
Jun 2007
Eye alt 143 m


Bay Trail - Bolivar Bridge
Enumerator
Automated Pedestrian Counter
© 2008 Tele Atlas
Google
37°51'55.71" N 122°18'17.42" W
elev 3 m
Jun 2007
Eye alt 125 m


Bay Trail - University Avenue
Frontage Rd
Enumerator
University Ave
© 2008 Tele Atlas
Google
37°51'59.60" N 122°18'20.42" W
elev 4 m
Jun 2007
Eye alt 170 m

Bay Trail - Captain Dr. at Frontage Rd.

Crown Beach Westline Drive Parking Lot


Crown Beach
Enumerators
Clinton Ave
Dayton Ave
San Antonio Ave
Santa Clara Ave
Rosewood Way
Sand Beach Rd
Shorepoint Ct
Westline Dr
Windemere Isle
Palmera Ct
Chestnut St
Walnut St
Willow St
Cedar St
Laurel St
Oak St
Powell St
Park St
Whitehall Pl
Franciscan Way
Whitehall Rd
Camden Rd
Yorkshire Rd
Kitty Hawk Rd
San Jose Ave
61
Image © 2010 TerraMetrics
475 m
© 2010 Google
©2009 Google

Crab Cove
Automated Vehicle Counter
Enumerator / Interviewer
Crab Cove
© 2010 Google
66 m
Imagery Date: Oct 2, 2009
37°46'09.45" N 122°16'38.16" W elev 0 m
Eye alt 227 m
©2009 Google

Arrowhead Fishing Platform

ATTACHMENT B

GGNRA AND PACIFICA PIER

DATE	MUIR BEACH	TENNESSEE VALLEY	RODEO BEACH	CRISSY FIELD EAST	CRISSY FIELD WEST	BAKER BEACH	OCEAN BEACH - NORTH	OCEAN BEACH - SOUTH	FORT FUNSTON	PACIFICA PIER
11/1/2008	--	--	372	566	447	315	758	531	466	232
11/2/2008	282	175	563	1,141	736	538	933	768	1,173	933
11/3/2008	174	179	389	616	326	268	501	505	662	227
11/4/2008	171	316	438	879	438	343	536	536	696	292
11/5/2008	160	346	414	850	405	324	616	903	748	351
11/6/2008	302	373	499	1,056	490	508	866	1,041	864	513
11/7/2008	237	477	554	1,191	572	597	846	1,040	926	500
11/8/2008	266	516	452	965	710	490	864	885	834	729
11/9/2008	206	499	1,021	1,854	1,006	815	1219	831	1,453	723
11/10/2008	596	821	492	941	502	406	712	700	822	417
11/11/2008	187	484	534	1,044	531	387	725	764	915	654
11/12/2008	110	372	446	845	423	301	568	745	687	232
11/13/2008	205	460	581	1,096	624	516	751	855	853	416
11/14/2008	250	549	776	1,429	644	952	1152	1,031	1,025	548
11/15/2008	843	1,064	1,523	2,460	1,273	1,814	2095	1,478	1,828	1,324
11/16/2008	742	1,026	1,204	2,247	1,133	1,675	2182	1,241	1,865	1,290
11/17/2008	135	267	498	1,181	531	638	1128	1,077	897	507
11/18/2008	182	509	385	766	435	305	555	698	635	316
11/19/2008	100	298	423	670	398	303	501	620	681	283
11/20/2008	95	350	434	826	411	335	612	665	702	390
11/21/2008	205	487	589	972	549	464	671	777	866	385
11/22/2008	437	755	790	1,518	861	690	1345	983	1,197	985
11/23/2008	471	978	988	1,720	892	855	1562	1,158	1,621	1,082
11/24/2008	178	296	451	744	439	354	760	927	764	380
11/25/2008	123	276	435	668	387	309	809	842	638	261
11/26/2008	107	201	410	462	340	267	708	764	482	206
11/27/2008	--	--	703	1,054	596	482	911	834	1,038	639
11/28/2008	389	580	729	1,076	800	550	1060	948	1,001	742
11/29/2008	568	831	1,066	1,531	938	837	1534	1,121	1,425	1,373
11/30/2008	556	915	1,282	1,783	950	1,025	1695	1,197	1,597	344
Total	**8,277**	**14,401**	**19,440**	**34,152**	**18,790**	**17,662**	**29,175**	**26,466**	**29,361**	**17,273**

Note: the values in this table are not visitation estimates. They are index values that were used in developing the visitation estimates presented in Exhibit 9.

EAST BAY

DATE	POINT PINOLE	FERRY POINT	VINCENT PARK	POINT ISABEL	ALBANY BEACH	BERKELEY PIER	POINT EMERY	BAY TRAIL	CROWN BEACH	CRAB COVE	ARROW-HEAD
11/1/2008	120	33	--	615	271	40	117	56	82	38	35
11/2/2008	364	168	--	1,745	618	524	196	381	158	59	133
11/3/2008	241	54	--	660	156	35	140	96	79	49	64
11/4/2008	339	87	--	1,054	243	149	223	249	139	76	85
11/5/2008	287	80	--	1,087	320	136	187	213	103	60	91
11/6/2008	364	88	--	1,125	399	255	241	202	158	--	86
11/7/2008	285	87	243	1,322	389	200	270	261	157	75	82
11/8/2008	248	87	210	1,466	443	301	187	222	110	43	136
11/9/2008	460	135	297	2,026	671	620	246	469	252	82	96
11/10/2008	350	89	271	1,160	255	233	249	211	113	87	99
11/11/2008	386	115	232	1,348	379	378	216	287	148	54	86
11/12/2008	291	94	200	705	330	131	203	186	133	46	45
11/13/2008	325	100	217	1,104	372	236	242	249	194	75	73
11/14/2008	326	100	196	1,295	432	308	210	299	168	56	60
11/15/2008	447	88	320	1,919	763	815	285	449	265	116	156
11/16/2008	505	131	386	2,254	836	724	326	551	277	85	169
11/17/2008	352	137	219	1,195	289	257	222	245	180	59	104
11/18/2008	368	90	211	1,056	243	139	215	211	191	81	63
11/19/2008	294	93	161	1,007	308	142	180	144	112	57	70
11/20/2008	309	62	167	958	349	182	200	171	129	60	65
11/21/2008	316	94	188	1,298	435	275	210	251	146	48	54
11/22/2008	334	125	321	2,048	614	655	237	405	187	72	83
11/23/2008	377	104	246	2,107	705	822	253	461	236	64	102
11/24/2008	281	95	158	1,100	253	162	169	152	138	64	59
11/25/2008	340	53	121	1,053	222	151	167	121	115	64	71
11/26/2008	224	56	148	769	256	70	141	82	72	27	62
11/27/2008	237	109	135	1,113	415	603	152	257	151	36	41
11/28/2008	381	86	146	1,285	445	577	185	210	118	36	51
11/29/2008	358	159	282	1,688	527	783	215	388	172	81	84
11/30/2008	478	147	308	1,957	622	787	251	522	172	81	87
Total	**9,987**	**2,946**	**5,383**	**39,512**	**12,560**	**10,688**	**6,328**	**7,995**	**4,655**	**2,076**	**2,492**

Note: the values in this table are not visitation estimates. They are index values that were used in developing the visitation estimates presented in Exhibit 9.

ATTACHMENT C

ESTIMATED REGRESSION COEFFICIENTS[a]

LOCATION	NO. OF OBSERVATIONS	R^2	ESTIMATED COEFFICIENTS[b]			
			CONSTANT	TEMP	PRECIPITATION	WEEKDAY
Muir Beach	28[a]	0.61	4.05***	0.03***	-2.30	-0.71***
Tennessee Valley	28[a]	0.48	5.25***	0.02*	-4.12*	-0.48**
Rodeo Beach	30	0.80	5.18***	0.02***	-1.15***	-0.51***
Crissy Field East	30	0.90	5.22***	0.03***	-0.64***	-0.48***
Crissy Field West	30	0.90	5.32***	0.02***	-0.44***	-0.58***
Baker Beach	30	0.87	3.72***	0.05***	-1.26***	-0.51***
Ocean Beach – North	30	0.89	5.00***	0.03***	-0.72***	-0.49***
Ocean Beach - South	30	0.73	5.53***	0.02***	-0.85***	-0.17***
Fort Funston	30	0.89	5.87***	0.02***	-1.41***	-0.48***
Pacifica Pier	30	0.80	5.10***	0.03***	-1.76***	-0.80***
Point Pinole	30	0.61	5.33***	0.01*	-2.85***	-0.11
Ferry Point	30	0.63	4.18***	0.01	-3.51***	-0.26***
Vincent Park	24[a]	0.50	4.22***	0.02***	-1.59	-0.27**
Point Isabel	30	0.80	6.59***	0.01***	-2.90***	-0.43***
Albany Beach	30	0.82	5.12***	0.02***	-2.53***	-0.59***
Berkeley Pier	30	0.93	4.74***	0.03***	-8.46***	-1.14***
Point Emery	30	0.67	4.43***	0.02***	-1.97***	-0.06
Bay Trail	30	0.80	4.24***	0.03***	-5.08***	-0.44***
Crown Beach	30	0.75	3.51***	0.03***	-2.51***	-0.24***
Crab Cove	29[a]	0.34	2.86***	0.02**	-1.55*	-0.01
Arrowhead Fishing Platform	30	0.34	3.51***	0.02*	-2.06**	-0.21*

Notes:

[a] - The following days were excluded from the model at the sites indicated:

- Tennessee Valley and Muir Beach on Nov. 1 and 27 (no staff assigned);
- Vincent Park on Nov. 1-6 (City of Richmond installed counter on Nov. 6); and,
- Crab Cove on November 6 (outlier due to cross country meet).

[b] - *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively

ATTACHMENT D

PREDICTED VISITATION INDEX FOR SPILL IMPACT PERIOD[a,b]

SITE	ACTUAL COUNTS - 2008	PREDICTED COUNTS - NOVEMBER 2007 TO JUNE 2008							
	NOVEMBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
Stinson Beach	7,773	11,477	9,299	6,422	6,665	8,130	7,941	8,788	8,615
Muir Beach	8,277	8,553	7,235	5,397	5,648	6,668	6,461	7,161	7,006
Tennessee Valley	14,401	15,114	13,979	10,298	10,800	13,505	12,951	14,146	13,880
Rodeo Beach	19,440	19,035	16,795	13,610	14,004	15,786	15,197	16,658	16,295
Hyde Street Pier	23,788	27,911	21,053	14,977	17,396	21,822	15,852	26,607	29,254
Crissy Field East	34,152	29,636	23,526	20,667	23,241	27,499	27,786	30,620	35,675
Crissy Field West	18,790	16,855	14,660	13,056	13,896	16,025	15,687	17,100	18,372
Fort Point	18,948	25,952	18,626	20,810	20,090	21,740	21,736	29,016	32,119
Baker Beach	17,662	17,416	12,817	9,756	10,652	11,663	11,735	13,497	12,893
Ocean Beach - North	29,175	28,708	23,432	18,972	19,881	21,637	21,164	23,558	22,950
Ocean Beach - South	26,466	26,565	23,866	20,290	20,916	23,131	22,416	24,267	23,804
Fort Funston	29,361	28,871	26,384	21,405	21,884	25,091	24,037	26,184	25,607
Pacifica Pier	17,273	16,781	14,773	11,340	11,616	13,566	12,984	14,319	13,992
Point Pinole	9,987	10,120	9,193	8,397	8,970	10,214	9,957	10,635	10,732
Ferry Point	2,946	2,965	2,688	2,410	2,581	2,977	2,881	3,096	3,115
Vincent Park	5,383	6,341	5,322	4,878	5,281	6,104	6,035	6,647	7,072
Point Isabel	39,512	38,921	34,454	30,679	32,830	38,210	36,947	40,228	41,209
Albany Beach	12,560	12,167	10,264	9,080	9,799	11,587	11,287	12,432	13,095
Berkeley Pier	10,688	10,122	7,834	6,195	7,057	9,246	9,060	9,994	10,830
Point Emery	6,328	6,327	5,500	5,078	5,493	6,266	6,182	6,706	6,987
Bay Trail	8,979	8,823	6,680	5,787	6,758	8,282	8,308	9,295	10,189
Crown Beach	4,655	4,561	3,561	3,209	3,652	4,318	4,344	4,864	5,330
Crab Cove	2,076	1,891	1,583	1,472	1,613	1,846	1,841	2,026	2,162
Arrowhead Fishing Platform	2,492	2,480	2,152	1,965	2,118	2,434	2,389	2,602	2,711

Notes:

[a] - The values in this table are not visitation estimates. They are index values that were used in developing the visitation estimates presented in Exhibit 9.

[b] - As described in the text, daily visitation indices were not available for three sites: Stinson Beach, Hyde Street Pier, and Fort Point. For these sites, the predicted visitation index was determined by averaging monthly counts from NPS automated counters over a six-year period: the five years immediately preceding the spill and one year following the spill.

ATTACHMENT E

SITE-SPECIFIC SURVEY APPROACHES

SITE	APPROACH
EAST BAY	
Point Pinole	On-site counts were conducted at the main parking lot to determine the number of visitors using the park. The counts were conducted from a vantage point near the shuttle stop that provided a view of all visitors leaving the park to enter the parking lot and all visitors leaving the park on the trail to the police station.
Miller/Knox – Keller Beach & Ferry Point	On-site counts were conducted at Keller Beach (beach) and Ferry Point (fishing pier) to determine the number of visitors exiting.
Vincent Park & Shimada Friendship Park	One field staff person alternated every hour between the two parks, with the initial location randomly selected on the first day of sampling and alternating every day thereafter. The last sampling period every day was 1 ½ hours long, from 4:00 to 5:30 p.m. • Vincent Park: On-site counts were conducted at the main parking lot to determine the number of visitors leaving the parking lot. Counts were separated into two categories: 1) departures from the parking lot and 2) departures from the park on the portion of the Bay Trail that runs along the north side of Peninsula Drive. • Shimada Park: On-site counts were conducted to determine the number of visitors and were separated into two categories: 1) departures from the Bay Trail and shoreline area, and 2) departures from the picnic area. For the visitors who are recorded as exiting the picnic area, field staff kept separate counts of visitors who used the shoreline during their visit and those who did not.
Eastshore State Park – Point Isabel	On-site counts were conducted at the two main parking lots. • At the Rydin Road lot, field staff stood at the parking lot entrance, counting all visitors leaving in vehicles, on bicycle, or on foot down Rydin Road. The individual posted at this location counted 1) number of departing vehicles, 2) number of people in each vehicle, and 3) number of departing walkers and bicyclists. • At the Isabel Street lot, field staff stood where the bike path crosses Isabel Street, and counted all visitors leaving in vehicles or on foot going east on Isabel Street.
Eastshore State Park – Albany Beach	On-site counts were conducted at the main parking lot. Field staff counted visitors exiting the park via the parking lot and via the path that runs along the northern side of Buchanan Street.
Berkeley Pier	On-site counts were conducted at the entrance to the pier to determine visitors leaving the pier.

SITE	APPROACH
Eastshore State Park – Gilman Drive & Brickyard Cove	On-site counts were conducted at the two parking areas to determine the number of visitors exiting the park. A single field staff person alternated every hour between the two parks, with the initial location randomly selected on the first day of sampling and alternating every day thereafter. The last sampling period of the day was 1 ½ hours long, from 4:00 to 5:30 p.m. • At Gilman Street, field staff counted visitors leaving the shoreline area. In addition, field staff maintained a separate count of visitors exiting the Bay Trail going east on Gilman Street. Field staff did not count individuals who exited the sports field located to the east of the parking lot. • At Brickyard Cove, field staff maintained separate counts of 1) visitors leaving the Brickyard Cove walking trails, and 2) visitors getting into their vehicles after leaving the Bay Trail.
Eastshore State Park – Berkeley Beach & Point Emery	On-site counts were conducted at the two parking lots to determine the number of visitors exiting. A single field staff person alternated every hour between the two parks, wit the initial location randomly selected on the first day of sampling and alternating every day thereafter. The last sampling period every day was 1 ½ hours long, from 4:00 to 5:30 p.m. Field staff maintained separate counts of visitors getting into their vehicles after leaving the Bay Trail.
Bay Trail	On-site counts were conducted at points where visitors exit the Bay Trail, including the pedestrian/bike bridge over I-80 at Bolivar Drive, several local avenues that intersect the Trail, and the southern/northern endpoints of the central portion of the Trail. There are five additional entry/exit points along the central section of the Bay Trail that are not already covered by sampling efforts: 51st Street, Central Avenue, Buchanan Street, University Avenue, and Frontage Road at Shorebird Park. On-site counts were conducted at each of these five sites for two hours a day. Field staff rotated through the five sites during the day, moving to a new site every two hours. The first site was randomly selected at the beginning of each day. Thereafter, the individual moved to the next closest site to the south, returning to the northernmost site after counting at the southernmost site. The final site on each sampling day was sampled for 2 ½ hours, from 3:00 to 5:30 p.m. • At the Bolivar Drive Bridge over I-80, on-site counts were conducted to determine the number of visitors leaving the Bay Trail. • 51st Street: Counted all individuals entering 51st Street from the Bay Trail. • Central Avenue: Counted all individuals leaving the Bay Trail (located both south of Central Avenue and east of Rydin Road) and heading east on Central Avenue. • Buchanan Street: Counted all individuals coming from the north on the Bay Trail and going under I-80 towards the east (either on Buchanan Street or on the bike trail located just north of Buchanan Street). • University Avenue: Counted all individuals leaving the Bay Trail (from the north or the south) and heading east on University Avenue over I-80. • Captain Drive at Frontage Road: Counted all individuals traveling south on the Bay Trail.

SITE	APPROACH
Crown Memorial State Park	On-site counts were conducted at three sites to determine the number of visitors exiting. In addition, on-site counts were conducted at the bike trail along Shoreline Drive. During each shift, three field personnel counted visitors leaving the Crab Cove and Crown Beach areas: • At the Crab Cove parking area, on-site counts were conducted at the parking lot to determine the number of visitors exiting the park towards McKay Avenue (including pedestrians and bikers). • At the large parking lot off of Westline Drive on-site counts and interviews were conducted at the parking lot. For the first 45 minutes of each hour, field staff counted 1) the number of departing vehicles, 2) the number of people in each vehicle, and 3) the number of walkers and bicyclists exiting the main entrance onto Westline Drive. (Interviews were conducted for the last 15 minutes of each hour). • There are five additional principal entry/exit points to Crown Beach along Shoreline Drive: at the northern end of Shoreline Drive where it intersects with Westline Drive, at Shell Gate Road, at Grand Street, at Willow Street, and at Park Street. On-site counts were conducted at each of these five sites to determine exits from the beach. ○ Field staff rotated through the five sites during the day, moving to a new site every two hours. The first site was randomly selected at the beginning of the first day. Thereafter, the individual moved to the next closest site to the south, returning to the northernmost site after counting at the southernmost site. The final site on each sampling day was sampled for 2 ½ hours, from 3:00 to 5:30 p.m. ○ Field staff maintained two separate departure counts: 1) visitors exiting the beach and 2) visitors exiting the paved path that is parallel to the beach. The counts for the paved path included all visitors crossing the road and entering the local neighborhoods from the paved path. In addition, at the northernmost location, field staff also counted all visitors exiting the path and heading north on Westline Drive. At the southernmost location, field staff counted all visitors who exited the path south of this location, including visitors crossing the road and those heading northeast on Broadway. The counts did not include visitors exiting the path to enter Crown Beach.
Arrowhead Fishing Platform (MLK Jr.)	On-site counts were conducted at the fishing pier to determine the number of visitors exiting the pier. Individuals who passed by the pier on the walking path, but that did not go onto the pier were not counted. Sampling at MLK Jr. was conducted between 8:00 a.m. and 5:30 p.m. because the fishing pier can not be accessed until park staff open the gate to the parking lot in the morning.
SAN FRANCISCO, MARIN, SAN MATEO	
Tennessee Valley	On-site counts were conducted at the parking lot to determine the number of visitors exiting the walking trail.
Rodeo Beach	On-site counts were conducted to determine the number of visitors exiting the beach. One person equipped with binoculars observed all Rodeo Beach departures from a single vantage point. Departures occurred at the parking lot at the end of Mitchell Road, at the pedestrian bridge, at the Rodeo Lagoon trail, and at the Battery Smith-Guthrie Trail. Departures into the parking lot were tallied as visitors came off the beach and crossed the line of logs along the southern edge of Mitchell Road. Field personnel kept separate counts for three groups of visitors: 1) school groups, 2) visitors departing directly into the parking lot at the end of Mitchell Road, and 3) visitors departing on the pedestrian bridge or on either of the two trails.

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San Francisco Maritime	On-site counts were conducted at two separate areas:
	• At the stadium seating area just east of the Maritime Museum on-site counts and interviews were conducted. Interviews and counts were performed on an alternating schedule by a single person. For the first 45 minutes of each hour, field staff faced the lagoon and counted visitors passing along the promenade in one direction (either from west to east or from east to west). The counting direction alternated every hour, with the initial direction randomly selected on the first day of sampling and alternating every day thereafter. For the last 15 minutes of every hour, field staff conducted interviews with walkers passing along the promenade in the same direction as the most recent counting period.
	• At Municipal Pier and the beach at Aquatic Park, on-site counts were conducted to determine the number of visitors exiting.
	  ○ Departures from Municipal Pier were counted at the entrance to the pier.
	  ○ Departures from the beach at Aquatic Park were counted from a lamppost located near the midpoint of the beach. For ½ hour, field staff counted departures from the eastern half of the beach. Then, field staff counted departures from the western half of the beach for ½ hour.
	  ○ Field staff alternated every hour between the two sites, with the initial location randomly selected on the first day of sampling and alternating every day thereafter. The last sampling period every day was 1 ½ hours long, from 4:00 to 5:30 p.m.

Crissy Field	On-site counts were conducted at Crissy Field to determine the number of visitors using the waterfront area (i.e., waterfront promenade, pier, and beaches). During each shift, five field personnel counted visitors leaving the waterfront area of Crissy Field:
	• One person was stationed at the eastern border of Crissy Field on the promenade in a location that provided a view of the two trails exiting the park (one exiting at the northeast corner near the waterfront and one exiting via a diagonal path off of Mason Drive at the southeast corner).
	• One person was stationed at the one-way road used by vehicles to exit the East Beach parking lot. The individual posted at this location counted 1) number of departing vehicles, 2) number of people in each vehicle and, 3) number of departing walkers and bicyclists.
	• One person rotated among four promenade locations between the lagoon and the West Bluff parking lot:
	  ○ Near the northwest corner of the lagoon, where two paths leave the promenade heading towards Mason Street.
	  ○ At the promenade end of the path that runs perpendicular to Mason Street and ends at Battery Sherwood.
	  ○ At the promenade end of the path that begins just east of the NOAA building.
	  ○ At the promenade end of the path opposite the NOAA building.
	When at location A, field staff counted departures on both the diagonal path and the path that runs along the western edge of the lagoon. When at location D, the individual counted departures along the path opposite the NOAA building and any visitors leaving the waterfront area to head east on Mason Street. Visitors who spend time on the grassy field without entering the waterfront area were not counted. Field staff rotated through the four locations (A, B, C, D) during the day, moving to a new location every ½ hour. The first location was randomly selected on the first sampling day. Thereafter, field staff moved to the next closest location to the west, returning to the easternmost location (A) after counting at the westernmost location (D).
	• One person rotated every two hours between two locations:
	  ○ The intersection of the hiking trail descending from Battery East and Long Avenue.
	  ○ The trail intersection between the lagoon and the East Beach parking lot.

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	When at location A, the person counted all walk-in and bike-in visitors exiting the waterfront area via Long Avenue or the hiking trail. When at location B, the person counted all visitors exiting the waterfront area (heading towards Mason Street) on the trails between the lagoon and the East Beach lot. The initial location was randomly selected on the first day of sampling and alternate every day thereafter. The final site on each sampling day was sampled for 2 ½ hours, from 3:00 to 5:30 p.m. • One person was stationed at the exit from the West Bluff parking lot. The individual posted at this location counted 1) number of departing vehicles, 2) number of people in each vehicle and, 3) number of departing walkers and bicyclists.
Baker Beach	On-site counts were conducted at two locations: • At the entrance to the main parking lot, on-site counts determined 1) number of departing vehicles, 2) number of people in each vehicle and, 3) number of departing walkers and bicyclists. • At the entrance to the Sand Ladder Trail, on-site counts determined the number of visitors exiting. Departures from the Sand Ladder Trail and the Coastal Trail were counted from a single vantage point where the Sand Ladder Trail meets Lincoln Boulevard. All departures were counted on a single form. Field staff alternated every two hours between counting departures at the main parking lot and counting departures at the Sand Ladder and Coastal Trails. The initial counting location was randomly selected on the first day of sampling and alternated every day thereafter. The final site on each sampling day was sampled for 2 ½ hours, from 3:00 to 5:30 p.m. On the two weekend days of the survey, the main parking lot filled to capacity and some vehicles that entered the parking lot subsequently exited without finding a parking space, then re-entered the beach on foot. The enumerator located at the main entrance likely counted a portion of the individuals exiting the main parking area on two occasions – once when they exited the parking lot in their vehicle and once when they exited the parking lot on foot. When calculating the counts at this site on these days, we adjust our counts to remove potential extra counts.
China Beach	On-site counts were conducted to determine the number of visitors exiting the beach.
Ocean Beach	On-site counts were conducted to determine the number of visitors exiting the beach. During each shift, six field personnel counted visitors completing trips to Ocean Beach: • In the northern section, on-site counts were conducted from 14 subsections between the Cliff House and Lincoln Way. The fourteen subsections were divided into three contiguous groups, each with dedicated field staff: o The first group (A) consisted of the four northern subsections, from Stairwell 1 to Stairwell 8. o The second group (B) consisted of the five central subsections, from Stairwell 9 to Stairwell 18. o The third group (C) consisted of the five southern subsections, from Stairwell 19 to Stairwell 28. Field staff were stationed at the southernmost stairwell in the subsection being counted. They looked north along the boardwalk during the ½ hour counting period and recorded all departures from the beach via the two stairwells in the subsection. In addition, field staff counted all visitors exiting the boardwalk/promenade that is parallel to Ocean Beach. This included separate counts of a) all departures from the beach via the two stairwells and b) all departures from the boardwalk to the parking lot. In the northernmost subsection, counts for (b) also included all visitors exiting the boardwalk heading north towards the Cliff House. In the southernmost subsection, counts for (b) also included all visitors exiting the boardwalk heading south towards Lincoln Way. The section of boardwalk that was monitored stretched from the counter's position just south of a stairwell to a point just south of the third stairwell north of the counter. For example, when monitoring departures from Stairwells 3 and 4, the counter observed

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	boardwalk departures from just south of Stairwell 4 to just south of Stairwell 2. The northern boundary of the monitored section was marked with traffic cones.
	Field staff assigned to each group (A, B, or C) rotated through that group's subsections during the day, moving to a new subsection every ½ hour. The initial subsection for each group was randomly selected on the first sampling day. Thereafter, field staff moved to the next closest subsection to the south, returning to the northernmost subsection after counting at the southernmost subsection.
	• In the central section (grouped with the northern section in the visitation estimates in the main body of the report), on-site counts were conducted at eight access points between Lincoln Way and Sloat Boulevard. The eight access points were: Lincoln Street, Judah Street, Lawton Street, Noriega Street, Pacheco Street, Rivera Street, Taraval Street, and Vicente Street. Field staff rotated through the eight access points during the day, moving to a new access point every hour. The first access point was randomly selected on the first sampling day. Thereafter, field staff moved to the next closest access point to the south, returning to the northernmost access point after counting at the southernmost access point. The final access point on each day was counted for 1 ½ hours, from 4:00 p.m. to 5:30 p.m.
	• In the southern section, on-site counts were conducted at the Sloat Boulevard and Second Overlook parking lots. Field staff generated counts of a) all departures from the beach via the two stairwells and b) all departures from the overlook area (bluff) to the parking lot.
	  ○ At Sloat one field staff was stationed on the beach at the base of the path that ascends to the parking lot. This individual counted all visitors exiting the beach. A second field staff was stationed on the bluff between the parking lot and the beach. This individual counted all visitors exiting the bluff to the parking lot.
	  ○ At Second Overlook parking one field staff was stationed on the bluff near the northern end of the parking lot. This individual looked south along the bluff to a point defined by a traffic cone and recorded all departures from the beach via the paths leading up from the beach within this zone. In addition, this individual counted all visitors exiting the bluff between the parking lot and the beach in this same area. A second field staff was stationed on the bluff at the traffic cone. This individual looked south along the bluff in the remainder of the parking area and record all departures from the beach via the paths leading up from the beach. In addition, this individual counted all visitors exiting the bluff between the parking lot and the beach in this same area.
	Field staff alternated every hour between the two parking lots, with the initial location randomly selected on the first day of sampling and alternating every day thereafter. The last sampling period every day was 1 ½ hours long, from 4:00 p.m. to 5:30 p.m.

Pacifica Pier	On-site counts were conducted at the entrance to the pier to determine the number of visitors exiting the pier.