San Francisco 2014 Litter Study

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Prepared for

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Introduction

The City and County of San Francisco (City) engaged the services of HDR to conduct a litter study to determine the relative proportion of tobacco-related litter to non-tobacco-related litter on the streets and sidewalks of San Francisco.

HDR had previously conducted citywide litter studies in 2007, 2008 and 2009. The 2007 and 2008 studies looked in detail at the composition of "large litter," classified as litter over four square inches in size, and examined smaller representative samples of "small litter," litter measuring four square inches or less. This methodology quantified all large litter on each 3,600 square foot site and quantified small litter on a portion of the site.

The 2009 study added a component at 32 "super sites" to thoroughly categorize the composition of all small and large litter throughout the site. At these sites every piece of litter (large and small) was documented and categorized.

For the 2014, HDR duplicated the "super site" methodology and documented every piece of litter on the 32 super sites. The 2014 litter study was conducted between April 9 and 14, 2014. Each of the previous litter studies had been conducted in April.

Methodology

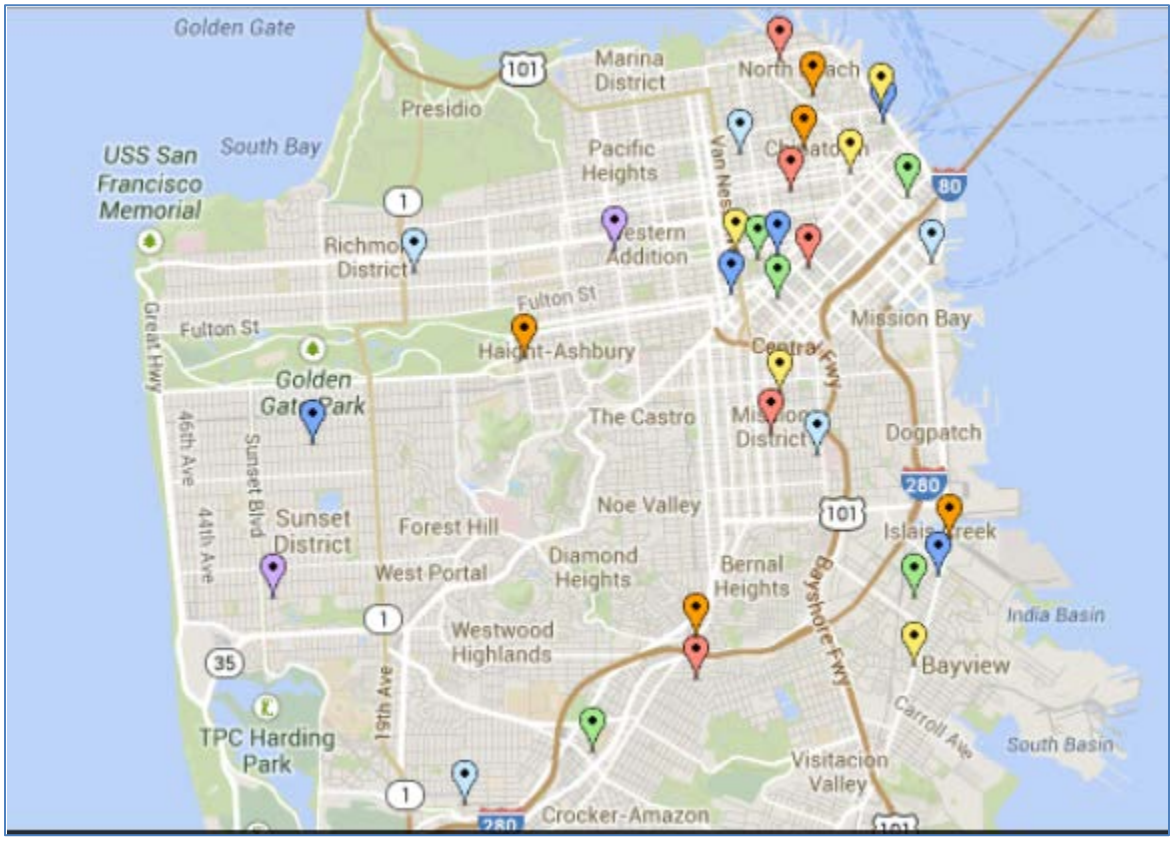
Site Selection Process

The 2014 litter study was conducted at the same 32 super sites that were surveyed in 2009. In 2009, the sites were randomly selected using, a geographical information system (GIS) database for the City of San Francisco (software used was ArcGIS 9.2 by Environmental Systems Research Institute Inc.). HDR used a computer sample generation program to randomly select the litter study sites from the 16,256 center-line coordinates for all potential public street locations within the City. The sites were plotted on computer generated maps using ArcGIS 9.2, and detailed locations were identified.

Sites were rejected if they were located:

- on major highways / freeways
- location was on a bridge
- location clearly within a construction area
- on railway / subway rights-of-way
- on hydroelectric power line rights-of-way
- on / within water (ponds, rivers, streams/ lakes)
- access was difficult or impossible
- if located on industrial or private lands

Litter Study Super Sites



Detailed directions to each of the selected sites were provided to the litter study team. Directions were written in a manner that would allow any field team to find each site easily. The team was asked to travel to the sites using these directions so that no bias (towards whether the site was dirty or clean) would be introduced.

Surveying the Site

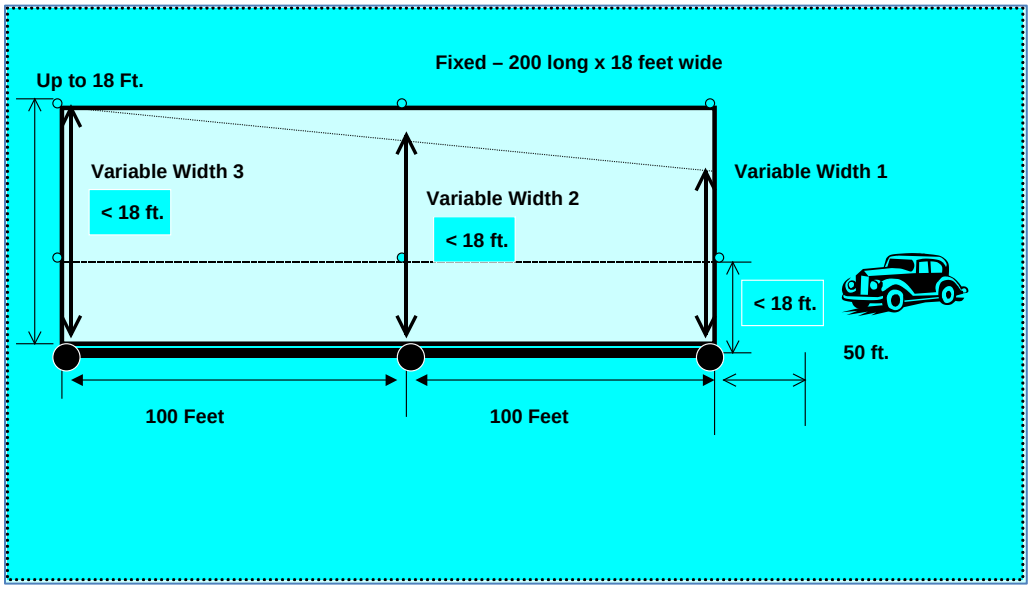
Upon arriving at a site, the team safely parked its vehicle or bicycles. Team members dressed in fluorescent yellow traffic vests to increase their visibility.

Beginning at the start of the site, the team used a measuring device to measure 200 feet ahead to the end of the site. Using street chalk, a mark was drawn on the pavement ahead to denote the staring point of the audit site. From this point the team measured ahead 100 feet, marking the pavement with another identifier to show the mid-point of the site. A final measurement of an additional 100 feet denoted the end of the audit site. Each site was 200 feet in length.

The width of the site was measured from 1.5 feet inside the curb towards the outer edge of the site, up to a maximum width of 18 feet. The rule was set to include 1.5 feet into the street since the curb is a normal

catchments structure, for which the municipality is responsible for litter clean up. Sites with a width of 18 feet and 200 feet long were designated as a "fixed" site. In many instances a site was less than 18 feet wide. This occurred in commercial areas where storefronts provide less than 18 feet from the roadways (plus 1.5 feet into the road). Sites less than 18 feet in width are designated as "variable" sites. Based on the space constraints within the City, most of the super sites turned out to be variable, slightly narrower than 18 feet in width.

Schematic of Litter Audit Site



Quantifying and Classifying the Litter

The 2014 litter study used the same methodology for quantifying litter as the 2009 litter study. Every piece of litter on each super site was documented. In 2009, the litter was also classified according to 90 different material types.

For the 2014 litter study, the litter study team documented and classified each piece of litter as either tobacco-related or non-tobacco-related. Tobacco-related litter included, cigarette butts, cigar butts, cigarette packs, cellophane from cigarette packs, wrappers, tobacco foil products, lighters, matchboxes, and matches. Non-tobacco-related litter consisted of all other litter (bottles, cans, paper, glass, food packaging, etc.).

Using handheld mobile phones, the team surveyed the entire site documenting every piece of litter. One team member photographed every piece of tobacco-related litter and the other team member photographed every piece of non-tobacco-related litter. After photographing every piece of litter on the site, the team duplicated the exercise using hand-held counters. The purpose of duplicating the count was to ensure that there would be back-up manual count data available in case the electronic data was lost or the mobile phones were stolen. The data from the manual counts also served to validate the data from the photo counts as there was less

than two percent variation in the total counts between the two data sets. The photo counts were used for the analysis, since there was a photographic record of every piece of litter observed.

After each piece of litter was photographed and counted, the site was swept clean and the litter was recycled or disposed of appropriately.

Findings

Overall, there was a significant 68% decrease in the total amount of litter observed in 2014 compared to 2009. Table 1 lists the total number of pieces of litter documented in 2009 compared to 2014. Both tobacco-related litter and non-tobacco related litter decreased. However, non-tobacco related litter decreased more dramatically. Table 2 shows the relative decrease.

Table 1 Total Litter Count Comparison

2014	2009	Percentage increase/decrease
Total Litter	Total Litter	Total Litter
3,881	12,123	-68%

Table 2 Percentage increase/decrease of Litter by Type in 2014 (compared to 2009)

Total Litter	Non-Tobacco	Tobacco
-68%	-81%	-24%

The 2014 litter study found that 53 percent of litter consisted of tobacco-related litter. This result differed substantially from the results of the 2009 litter study which found that 22 percent of all litter was tobacco-related. The primary reason for this difference was that the sites were substantially cleaner in 2014 (with a total of 3,881 individual pieces of litter) than they were in 2009 (with 12,123 individual pieces of litter).

One key difference between the 2009 and 2014 study results was that there was significantly less broken glass from smashed car windows observed in 2014. Approximately, 34 percent of all litter in 2009 consisted of broken glass from smashed car windows (4,100 pieces of glass out of 12,123 pieces of litter). The 2014 litter study did not classify non-tobacco-related litter. However, the litter study team observed that there was very little broken glass on the City's streets and sidewalks in 2014.

The litter study team also observed that there was a substantial amount of clean-up activity around some of the super sites. Business owners approached the team during the site analysis to inform them that they took responsibility for cleaning the sidewalks and streets near their places of business. Overall, the sites were cleaner in 2014 than they were in 2009.

Figure 1 compares the findings from 2014 and 2009. Table 3 provides the details of the litter counts by site.

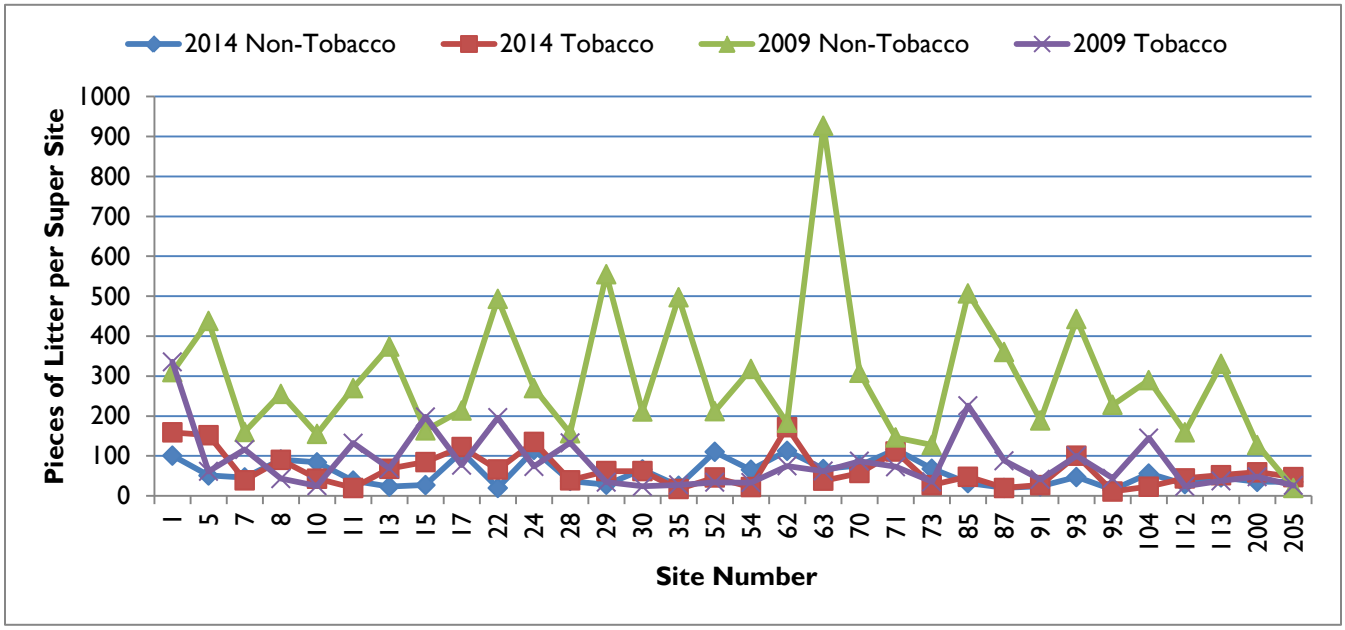


Figure 1 Litter Study Findings by Site (2014 compared to 2009)

Figure 2 shows the relative proportion of glass compared to all litter observed in 2009.

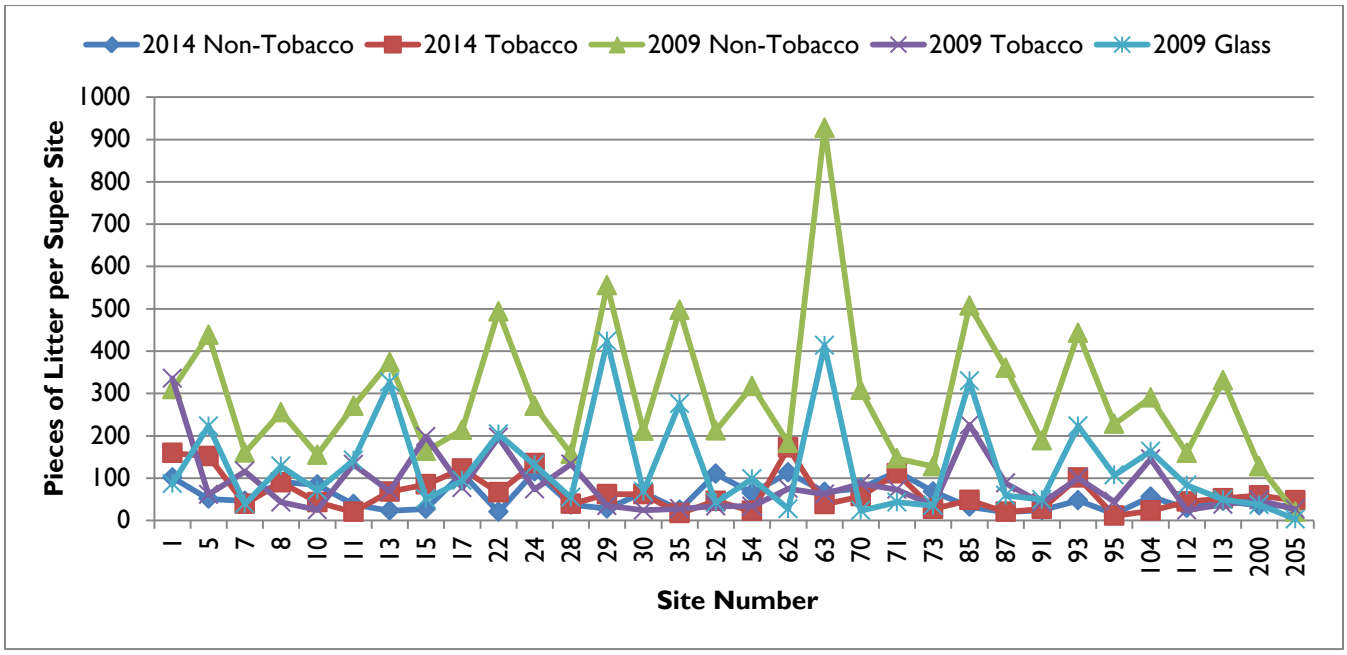


Figure 2 Litter Study Findings including 2009 Glass Counts

Table 3 Litter Study Findings by Site (2014 compared to 2009)

Site#	Address	2014				2009			
		Total Litter	Non-Tobacco	Tobacco	% Tobacco	Total Litter	Non-Tobacco	Tobacco	% Tobacco
1	Francisco St and Mason St	260	101	159	61%	645	310	335	52%
5	Jasper Place	203	51	152	75%	499	438	61	12%
7	Washington St and Larkin St	85	46	39	46%	276	160	116	42%
8	Powell St and Clay St	181	91	90	50%	299	256	43	14%
10	Broadway and The Embarcadero	127	84	43	34%	180	155	25	14%
11	Jackson St and Drumm St	58	38	20	34%	402	270	132	33%
13	Fremont St and Folsom St	91	23	68	75%	443	374	69	16%
15	Montgomery at Bush St	112	27	85	76%	362	164	198	55%
17	Taylor St and Sutter St	233	111	122	52%	291	214	77	26%
22	2nd St and King St	86	20	66	77%	690	494	196	28%
24	Natoma St and Russ St	250	115	135	54%	344	270	74	21%
28	McAllister St and Levenworth St	76	37	39	51%	290	157	133	46%
29	Larkin St and McCallister St	90	28	62	69%	590	555	35	6%
30	Golden Gate Ave and Van Ness Ave	128	66	62	48%	235	211	24	10%
35	Fell St and Franklin St	42	25	17	40%	525	497	28	5%
52	3rd St and Cargo Way	156	110	46	29%	246	212	34	14%
54	Phelps St and La Salle Ave	87	65	22	25%	351	318	33	9%
62	20th St and Folsom St	285	113	172	60%	258	183	75	29%
63	Treat Ave and 17th St	105	67	38	36%	989	927	62	6%
70	Mission St and Bosworth St	133	76	57	43%	395	308	87	22%
71	Silver Avenue and Edinburgh St	227	116	111	49%	219	146	73	33%
73	Cauga Ave and Seneca Ave	95	68	27	28%	163	128	35	22%
85	Orizaba Ave and Broad St	80	32	48	60%	733	507	226	31%
87	Vicente St and 35th Ave	40	20	20	50%	449	361	88	20%
91	Lawton and 28th Ave	51	24	27	53%	230	189	41	18%
93	Stanyan St and Waller St	148	47	101	68%	543	443	100	18%
95	Ellis St and Divisadero St	26	15	11	42%	272	228	44	16%
104	12th Ave and Anza St	79	56	23	29%	435	290	145	33%
112	3rd St and Galvez Ave	73	29	44	60%	184	160	24	13%
113	3rd St and Underwood Ave	98	46	52	53%	368	331	38	10%
200	Natoma St and 9th St	94	35	59	63%	176	128	48	27%
205	22nd St and Hampshire St	82	35	47	57%	46	20	26	57%
	Total	**3,881**	**1,817**	**2,064**	**53%**	**12,123**	**9,399**	**2,724**	**22%**