2019 Texas Litter Survey

A Survey of Litter at
253 Sites throughout
the State of Texas

Conducted for

GDC Marketing and Ideation
Don't mess with Texas®

by

Environmental Resources Planning, LLC
Gaithersburg, MD

Final Report

March 2020

Don't mess with Texas®

ER PLANNING

GDC MARKETING + IDEATION

Table of Contents

Tables

Figures

Acknowledgements

ERP would like to thank TxDOT along with all of the administrative, logistics and field personnel for their help and support of this project.

Thanks also to all of the ERP field crews for their hard work and dedication to this project and its goals.

Executive Summary

Environmental Resources Planning, LLC (ERP), in cooperation with GDC Marketing and Ideation (GDC) and the Texas Department of Transportation (TxDOT), conducted a Visible Litter Survey (VLS) to estimate the number, types and brand names of littered items found along Texas roadways in 2019. The results of this survey were compared to those from the 2013 VLS, which was also conducted by ERP.

In 2013, TxDOT had requested that ERP conduct two separate litter surveys and report on the changes in litter found between the two surveys. For 2019, TxDOT requested that ERP conduct a single litter survey and compare the results to the original survey conducted in 2013.

In each of these surveys, litter was tallied on 253 sites across Texas, each consisting of a one-tenth mile stretch of TxDOT-maintained roadway. This Executive Summary offers an overview of findings from the 2019 VLS. The full report provides a complete analysis of the data.

Study Highlights

Highlights from the 2019 VLS are shown below. Comprehensive data can be found in the full report and appendices.

- Visible Litter along TxDOT-maintained roadways decreased overall by 17% between 2013 and 2019.
- When Tire Debris is excluded, Visible Litter decreased by 28%.
- Tire Debris was the largest component of Visible Litter (29%) and was pervasive across all areas of Texas. It was most prevalent along interstates. Of the 32 sites that had more than 1,000 pieces of Tire Debris, 29 of them (91%) were Interstates.
- The decrease in Visible Litter occurred despite estimated rises in both adult population in Texas (10.3%) and traffic levels statewide (12.7%).
- Items discarded from cars and trucks account for 51% of all litter along TxDOT-maintained roadways, while Vehicle Debris, which includes blown tires, car accidents and DIY car maintenance, accounts for another 35%.
- Micro Litter found during the 2019 survey increased by 90%. This may be due, in part, to the fact that smaller items are more difficult to clean up than larger items.

- Cigarette Butts continued to comprise the largest portion of Micro Litter in 2019 (24%), compared to 28% from the initial survey conducted in 2013. Although the percentage dropped, the actual number of littered Cigarette Butts increased 63%
- Statistical tests show that sites near proximity indicators (e.g. beautified areas, traffic signals and signs, etc.) generally have lower levels of Vehicle Debris.
- The number of littered Beverage Containers (especially beer cans, water bottles and soda cans, etc.) tallied in 2019 was 31% lower than in 2013.
- Recyclables (Beverage Containers and Paper) comprised 25% of Visible Litter.
- Given the decrease in Visible Litter despite increases in both population and annual vehicle miles traveled, the *Don't mess with Texas* program is likely more effective than is realized.

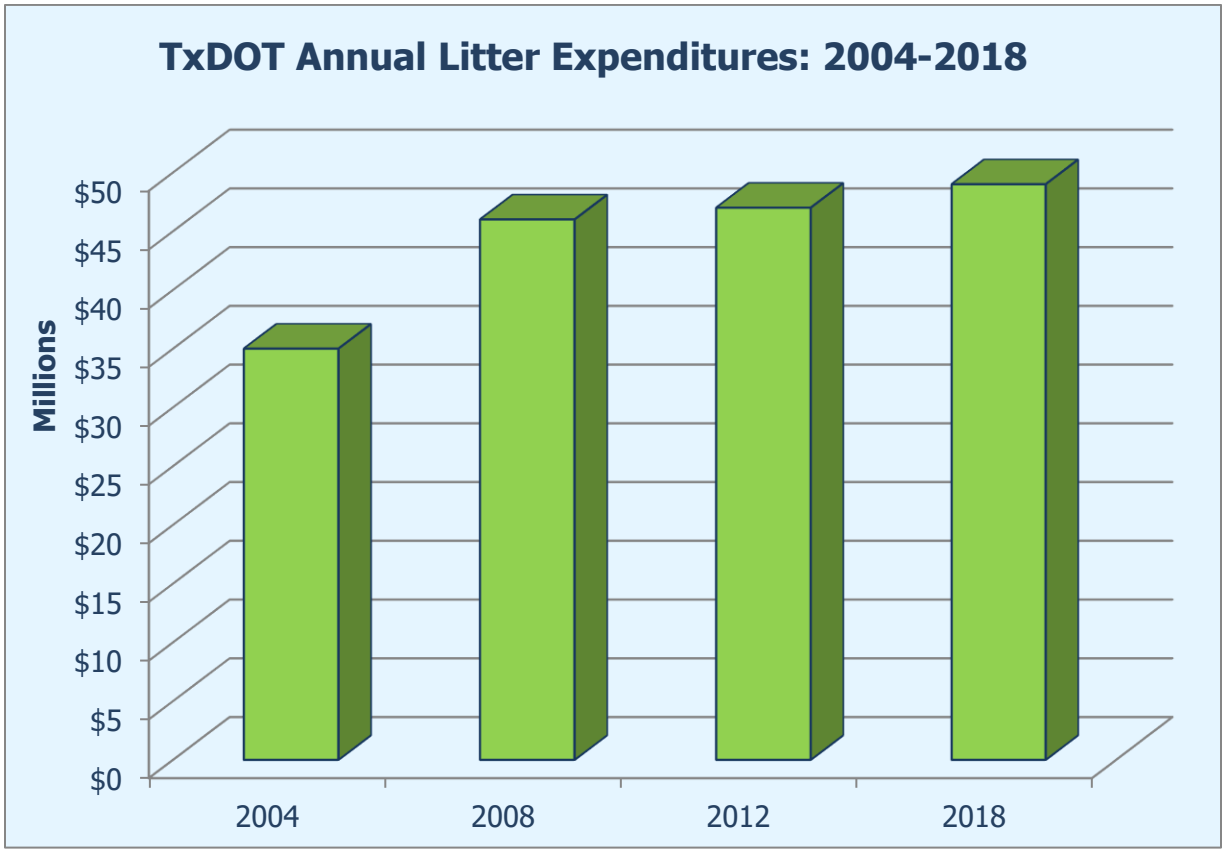
Litter Survey Results

Introduction

Environmental Resources Planning, LLC (ERP) was tasked to conduct a litter survey throughout the State of Texas in 2019 to gauge the rate, extent and composition of litter along roadways maintained by TxDOT and to compare the results of this survey to the results of the 2013 survey, which ERP also conducted. TxDOT has sponsored such statewide litter surveys since 1985. The methodology used for conducting these litter surveys has consisted of quantifying and characterizing Visible Litter (items two square inches and larger) and Micro Litter (items smaller than two square inches).

Cost of Litter

The cost to deal with roadside litter in Texas, as shown in Figure 1, is substantial: $49 million to TxDOT in 2018. Research conducted by ERP staff shows that cities, counties, institutions and businesses in Texas likely expend a significantly higher amount than this for their part in dealing with litter.



Source: TxDOT (2019)

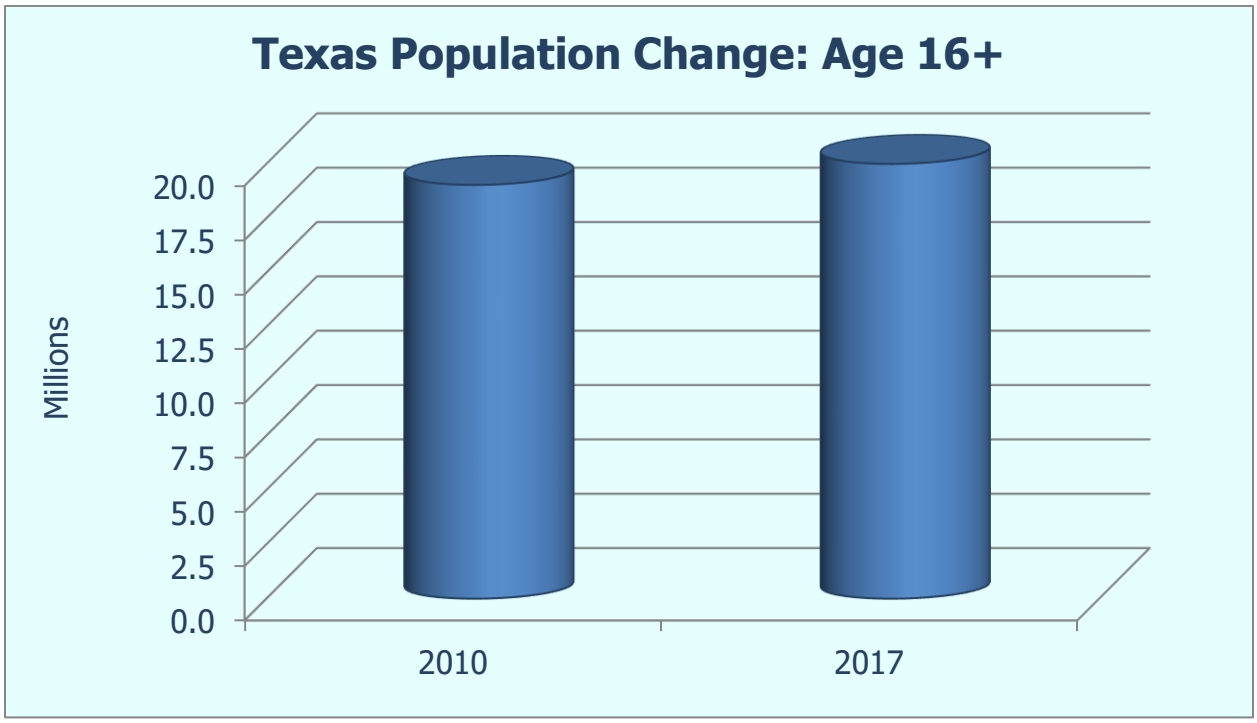
Figure 1 – TxDOT Litter-Related Costs

The State of Texas has a significant infrastructure of litter cleanups and educational efforts through TxDOT, Keep Texas Beautiful and its local affiliates. The state's Adopt-A-Highway program sponsors cleanups along 10% of Texas roadways.

No other state in the U.S. has consistently monitored roadside litter and provided high-profile litter abatement programs as Texas has done for more than 30 years and continues to do.

Traffic Data

The adult driving population in Texas (those ages 16 and older) increased 10.3% from 19 million in 2010 to 21 million in 2017 (the latest data available at the time each survey was conducted) as shown in Figure 2. Population growth generates higher traffic levels, which tends to correlate with higher rates of littering.



Source: TxDOT (2019)

Figure 2 – Texas Driving Population Changes: 2010 - 2017

Daily Vehicle Miles Traveled (DVMT) measures the average daily traffic on TxDOT-maintained roadways. Increases in DVMT also tend to correlate with higher rates of littering. Traffic levels decreased on US Highways (-5.4%) between 2012 and 2017, the most recent data available when each litter survey was conducted. This comparison of data from previous years is consistent with preceding litter surveys in Texas and was followed in 2019 to be comparable with data from those earlier surveys.

During that same period, vehicle traffic increased on Interstates (+22.8%), State Highways (+17.4%) and FM/RM[1] Roads (+11.7%). Overall, the traffic levels statewide increased by 60.6 million miles per day (12.7%) as shown in Table 1. This equates to 22.1 billion miles annually. This increase was slightly higher than the increase in adult population, suggesting slightly more travel on a per capita basis. This is not surprising since traffic levels tend to rise when economic conditions improve as they have over the past few years[2].

Table 1 – Daily Vehicle Miles Traveled

System	Daily Vehicle Mileage		Percent Change
	2012	2017	
FM/RM Roads	69,407,935	77,538,093	11.7%
Interstates	171,808,165	211,064,080	22.8%
State Highways	113,807,525	133,646,080	17.4%
U.S. Highways	123,634,294	117,008,016	-5.4%
Total:	**478,657,918**	**536,256,279**	**12.7%**

Source: TxDOT (2019)

Methodology

The 2019 Texas Litter Survey was conducted by surveying the same 253 sites that were surveyed in the 2013 litter study. At the request of TxDOT, a single litter survey was conducted in 2019 (May and June).

Field crews surveyed more than 2.4 million square feet along Texas roadways. Litter was classified as either Visible Litter (two square inches or more) or Micro Litter (less than two square inches). All sites were one-tenth mile in length and 18 feet deep.

Visible Litter was sampled on the entire site, while Micro Litter was sampled on three transects of each site. Each of the three transects comprised a 3' x 18' area. The area of the three transects totaled 162 square feet. For each site, the data from these three transects were extrapolated to the size of the entire site.

[1] Farm-to-Market and Ranch-to-Market Roads.
[2] Bureau of Economic Analysis

The following approach was used for conducting the 2019 litter survey:

1. Quantifying and characterizing litter;
2. Analyzing data; and
3. Evaluating the change in litter between the 2013 and 2019 surveys.

Brand names of items were recorded when visible. The map in Figure 3 shows the color-coded locations of the 253 sites. Of these, 163 were used in prior studies, while 90 new sites were added in 2013.

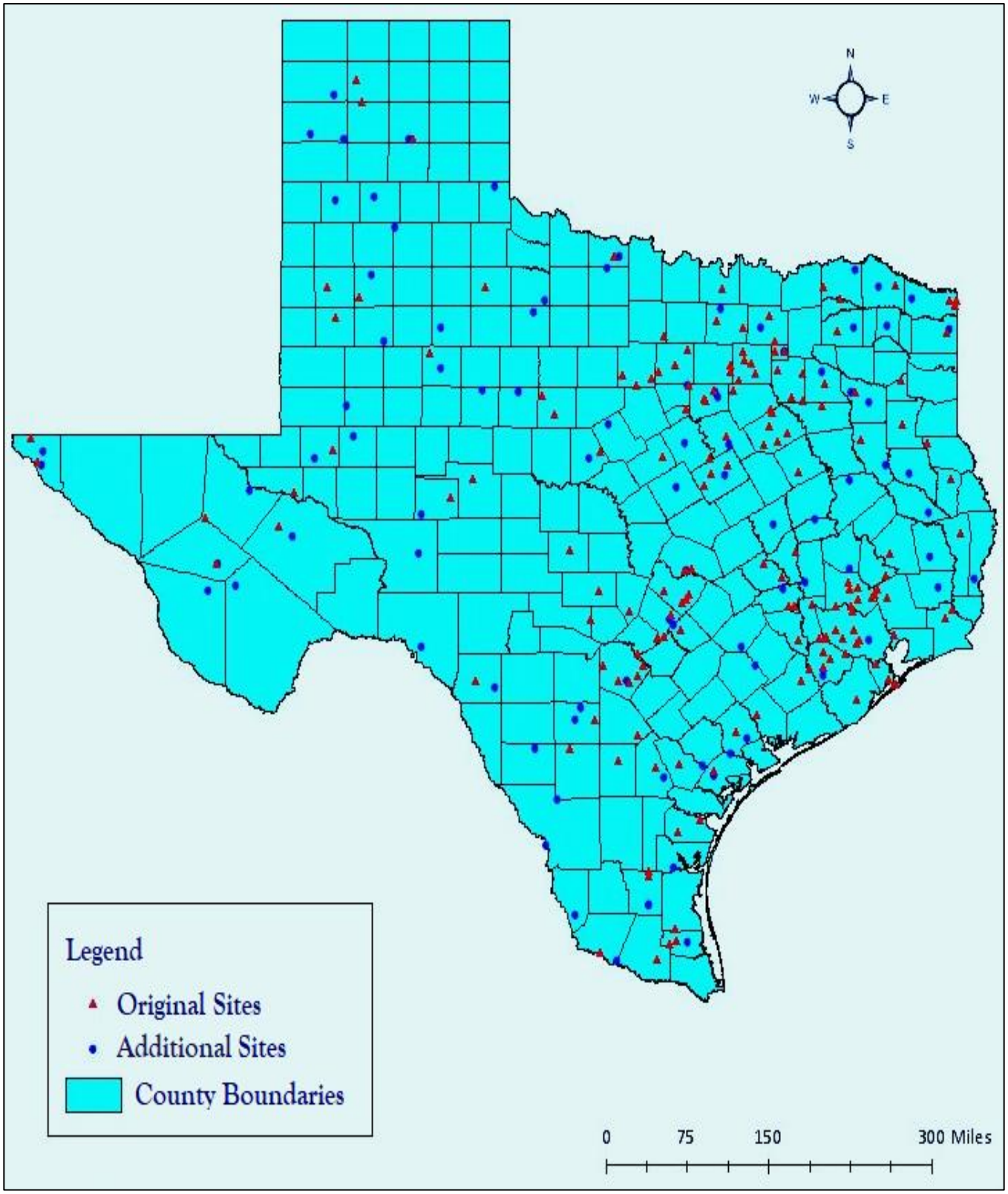


Figure 3 – Sites Distribution Map

Components and Categories

Litter was characterized using 108 components (90 for Visible Litter and 18 for Micro Litter). These components are consistent with those used in previous Texas litter surveys and other recent litter surveys. These components were subsequently rolled up into 14 major categories of litter that are listed below along with some common examples of each:

1. Beverage containers: 18 individual components including beer, soda, sports and energy, water, wine and liquor, juice, and tea. Each one was further classified by material type (metal, plastic, glass, composite).
2. Beverage-related: beverage cartons and six-pack rings. These are minor components but were classified separately to avoid confusion with the beverage containers themselves.

Fast-food related items were broken down into three categories for clarity: cups and lids, straws and wrappers, and other fast food packaging.

3. Cups and lids: cups used solely for hot drinks, cups used solely for cold drinks and lids found without cups. Each of these was further classified by material type (paper, plastic, foam).
4. Straws and wrappers: straws and wrappers tallied separately. Each was further classified by material type (paper, plastic).
5. Other fast-food packaging: clamshells, condiments, burger wraps, utensils, napkins, plates, and trays. Each of these was further classified by material type (paper, foil, plastic, etc.).
6. Snack wrappers: sweet snacks (candy, cakes), salty snacks (chips, crackers), and gum. Each of these was further classified by material type (paper, plastic, composite).
7. Home food: food jars, cans, bottles, lids and tea packets. Each was further classified by material type (glass, metal, plastic, composite).
8. Paper: all non-food/beverage paper items including newspapers, magazines, flyers, lottery tickets, business, school, receipts, packaging, paperboard, corrugated boxes, unidentifiable paper, and paperboard. Each was individually classified.
9. Vehicle: automobile parts from accidents, do-it-yourself car maintenance debris, and tire debris. Each was individually classified.
10. Construction and Industrial: construction and demolition debris (e.g., shingles, wood, electrical, drywall, Tyvek, foam insulation, industrial rags, and tarps, etc.).

11. Home items: lamps, clothes, toiletries, home packing materials, and drug-related items. Each was individually classified.
12. Bags: paper, plastic and reusable bags separated by those used for shopping, trash, and leaves. Those with brand names were separately tallied from generic bags such as "thank you" bags. Each was further classified by material (paper, plastic, cloth).
13. Tobacco-related: lighters, packages, and matchbooks along with any cigarette or cigar butts that were one inch or larger. Each was separately classified.
14. Other: any items not otherwise classified.

Analysis of Visible Litter

Findings

The largest component of Visible Litter was Tire Debris (29%), as shown in Table 2. This was followed by Misc. Plastic (9%) and Vehicle & Metal Road Debris (7%). The top 10 of the 90 components of litter comprised 66% of Visible Litter. All other components not listed in Table 2 comprised less than 2% each of Visible Litter.

Table 2 – Visible Litter: Top 10 Components

Visible Litter Items	% of Litter	Rank
Tire Debris	29%	1
Misc. Plastic	9%	2
Vehicle & Metal Road Debris	7%	3
Misc. Paper	6%	4
Beer Cans	4%	5
Plastic Water Bottles	3%	6
Construction Debris	3%	7
Cups, Lids, Straws	2%	8
Home Articles	2%	9
Soft Drink Cans	2%	10
Subtotal - Top 10 Items	**66%**	

Visible Litter by Roadway Type

The average number of Visible Litter items found on sites at all four roadway types showed noticeable reductions between 2013 and 2019. The most substantial decline in littering rates was along FM Roads. All other roadway types reflected similar declines as shown in Table 3.

Table 3 – Visible Litter per Mile by Roadway: 2013 vs. 2019

Road Type	2013	2019	Change	% Change
FM Roads	770	620	(150)	-19.5%
Interstates	1,773	1,481	(292)	-16.5%
State Highways	1,007	832	(175)	-17.4%
U.S. Highways	921	765	(156)	-16.9%

Visible Litter by Material Composition

Table 4 compares the most littered items in 2019 by roadway, showing that Rubber was much higher on Interstates than on any other roadway, causing the percentage of Paper and Paperboard items to be lower. The higher incidence of Rubber is likely due to the large number of eighteen-wheelers and the high speed of traffic on Interstates.

Table 4 – Litter Composition by Roadway

Percent of Visible Litter by Road Type - 2019				
Composition	**FM**	**IH**	**SR**	**US**
Plastics	26%	21%	31%	25%
Rubber	22%	38%	20%	30%
Metals	20%	14%	14%	12%
Paper & Paperboard	19%	15%	20%	19%
Other	10%	10%	12%	11%
Textiles	2%	2%	2%	2%
Glass	1%	1%	2%	1%
Wood	<1%	<1%	<1%	<1%
Total	**100%**	**100%**	**100%**	**100%**

The physical composition of littered items in 2019 is shown in Figure 4 below. Due to the pervasiveness of Tire Debris, the largest category is Rubber (29%) followed by Plastic (25%) and Paper (18%). Other includes items made from multiple materials.

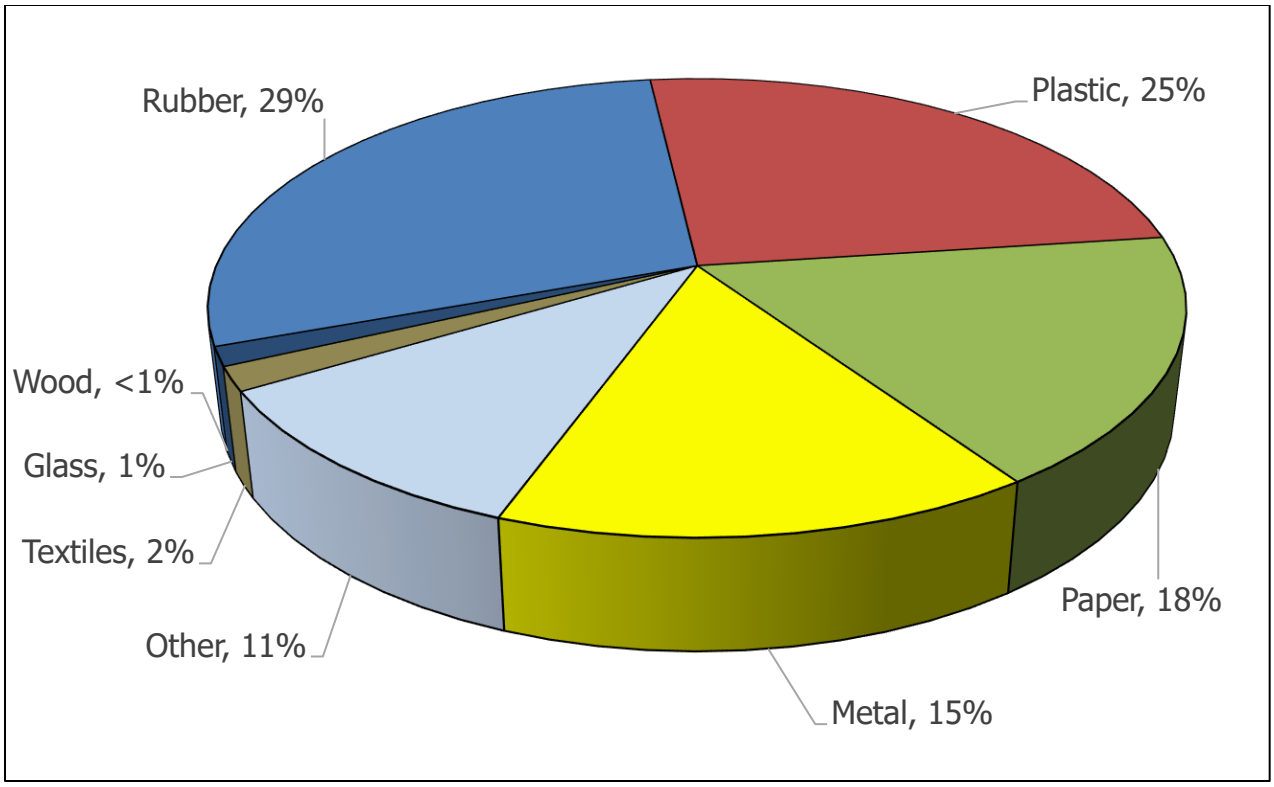


Figure 4 - Composition of Visible Litter

Table 5 shows how the composition of litter has changed since 2013. This table shows the relative percentage of litter by materials. Although the percentage of items may be higher, the actual number of items, in most categories, still declined. Metal items are almost twice what they were in 2013, while Rubber items also showed a notable increase.

Table 5 – Visible Litter Composition

Material	2013	2019
Paper & Paperboard	20%	18%
Plastic	22%	25%
Metal	8%	15%
Rubber	20%	29%
Glass	3%	1%
Textiles	3%	2%
Wood	<1%	<1%
Other	23%	11%
Total	**100%**	**100%**

Visible Litter without Tire Debris

While Visible Litter overall was reduced by 17%, Tire Debris, its largest component actually increased by 35%. When that one component is removed, the remaining components showed a reduction of 28%. This is significant since Tire Debris is the one component that could be best considered as unintentional litter that litter abatement messaging is unlikely to affect.

Once that is taken into consideration, the reduction in Visible Litter is more evident as shown in Table 6. It is interesting that Interstates, which have the highest traffic levels and the highest littering rates of all four roadway types, showed the largest reduction in litter.

Table 6 – Visible Litter without Tire Debris per Mile by Roadway

Road Type	2013	2019	Change	% Change
FM Roads	749	580	(169)	-22.6%
Interstates	1,334	906	(428)	-32.1%
State Highways	888	703	(185)	-20.8%
U.S. Highways	775	528	(247)	-31.8%

Recyclables in Visible Litter

Visible Litter tends to include a significant percentage of recyclable items, particularly Beverage Containers and Paper that could easily have been recovered rather than discarded.

Table 7 shows the percentage of recyclables in Visible Litter and compares that to what was found in the 2013 survey. As shown below, the number of recyclables per mile was reduced by 41.6%, a significant reduction.

Table 7 - Recyclables in Visible Litter

Survey Year	Recyclables per Mile	Percent of Visible Litter
2013	434	35.6%
2019	253	25.0%
Change	(181)	-41.6%

Visible Litter

Based on contextual site conditions including the types, amounts and location of littered items, the likely sources of litter are identified at each site. Compiling the weighted percentages from each site yields a total survey-wide estimate. As shown in Figure 5, items discarded from cars and trucks account for half of all litter. Vehicle Debris, which includes items such as blown tires and car parts from accidents, accounts for 35% of all litter and is generally considered unintentional.

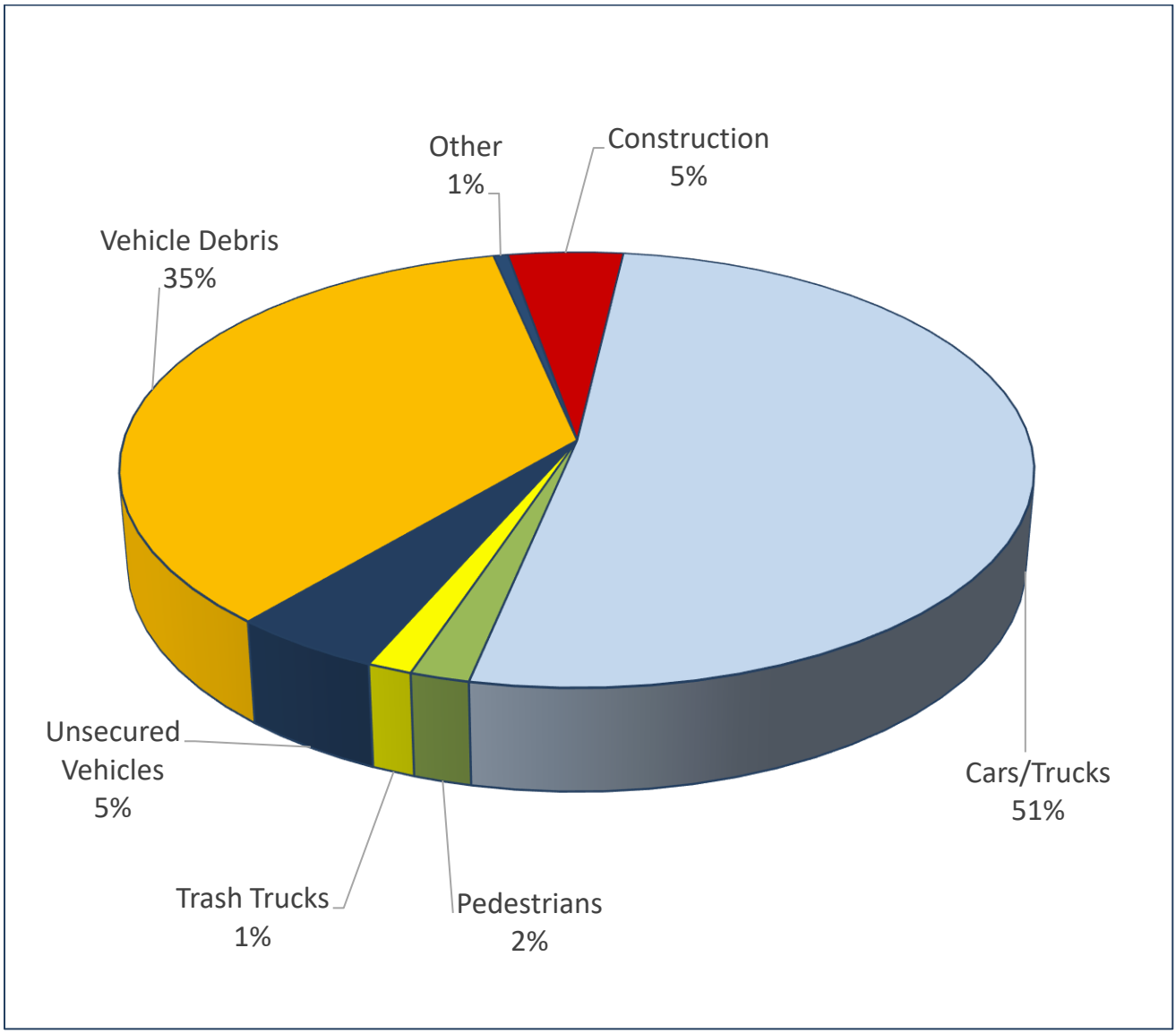


Figure 5 - Sources of Visible Litter

Micro Litter

All littered items smaller than two square inches were tallied as components of Micro Litter and were analyzed separately from the larger Visible Litter items.

Findings

Table 8 shows that the components of Micro Litter sorted by ranking. As was true in past surveys, Cigarette Butts (28.2%) were found to be the most pervasive type of Micro Litter by a large margin. Rubber (15%), in the form of tire scraps, and Paper (14.9%) were also notable components as well. Together these three components comprised 58.1% of Micro Litter.

Table 8 - Components of Micro Litter

Micro Litter	Items	Percent
Cigarette Butts	72,277	28.2%
Tire Pieces	38,309	15.0%
Paper	38,133	14.9%
Plastic - Hard	22,469	8.8%
Polystyrene Pieces	18,187	7.1%
Plastic - Film	12,144	4.7%
Glass	11,381	4.4%
Candy Wrappers	8,272	3.2%
Aluminum	7,157	2.8%
Bottle Caps	6,805	2.7%
Gum Wrappers	4,576	1.8%
Cigar Butts	4,224	1.6%
Packing Peanuts	3,989	1.6%
Straws	3,168	1.2%
Metal	3,051	1.2%
Tobacco Packaging	1,232	0.5%
Other Items	645	0.3%
Food	117	<0.2%
Total	**256,136**	**100.0%**

Since 2013, Micro Litter increased by almost 90% as shown in Table 9. This increase was almost across the board. In terms of numbers, rubber (tire debris) and cigarette butts increased the most. Only three components showed a decrease: aluminum, gum wrappers, packing peanuts and straws (usually the paper wrappers).

Table 9 - Changes in Micro Litter

Micro Litter	2013	2019	Change	% Change
Aluminum	7,157	5,872	(1,285)	-18.0%
Bottle Caps	6,805	10,571	3,766	+55.3%
Candy Wraps	8,272	23,765	15,493	+187.3%
Cigar Butts	4,224	17,079	12,855	+304.3%
Cigarette Butts	72,277	117,573	45,296	+62.7%
Food	117	1,585	1,468	+1,254.7%
Glass	11,381	34,969	23,588	+207.3%
Gum Wrappers	4,576	998	(3,578)	-78.2%
Metal	3,051	9,689	6,638	+217.6%
Other	645	10,505	9,860	+1,528.7%
Packing Peanuts	3,989	3,816	(173)	-4.3%
Paper	38,133	61,195	23,062	+60.5%
Plastic - Film	12,144	18,192	6,048	+49.8%
Plastic - Hard	22,469	49,929	27,460	+122.2%
Poly - Other	18,187	32,273	14,086	+77.5%
Tire Pieces	38,309	85,248	46,939	+122.5%
Straws	3,168	824	(2,344)	-74.0%
Tobacco Packging	1,232	2,056	824	+66.9%
Total	**258,136**	**486,139**	**230,003**	**+89.8%**

Unlike Visible Litter, Micro Litter showed a significant increase between 2013 and 2019, particularly along Interstates (+105.2%) and U.S. Highways (+101.2%) as shown in Table 10. The rise of Micro Litter in the face of declining Visible Litter could occur when there are consistent litter cleanups, which remove large items of litter, but typically not the small ones.

Table 10 - Micro Litter - Average per Mile by Roadway

Road Type	2013	2019	Change	% Change
FM Roads	667	975	308	+46.1%
Interstates	1,385	2,842	1,457	+105.2%
State Highways	1032	1,749	717	+69.5%
U.S. Highways	817	1,644	827	+101.2%

Micro Litter by Material Composition

Tobacco (30%) was the largest component of Micro Litter, followed closely by Plastic (28%) as shown in Figure 6. Paper (16%) and Rubber (15%) were also notable components. Of these components, the Paper components were deemed recyclable at the time they were discarded, while the Rubber components were tire shreds.

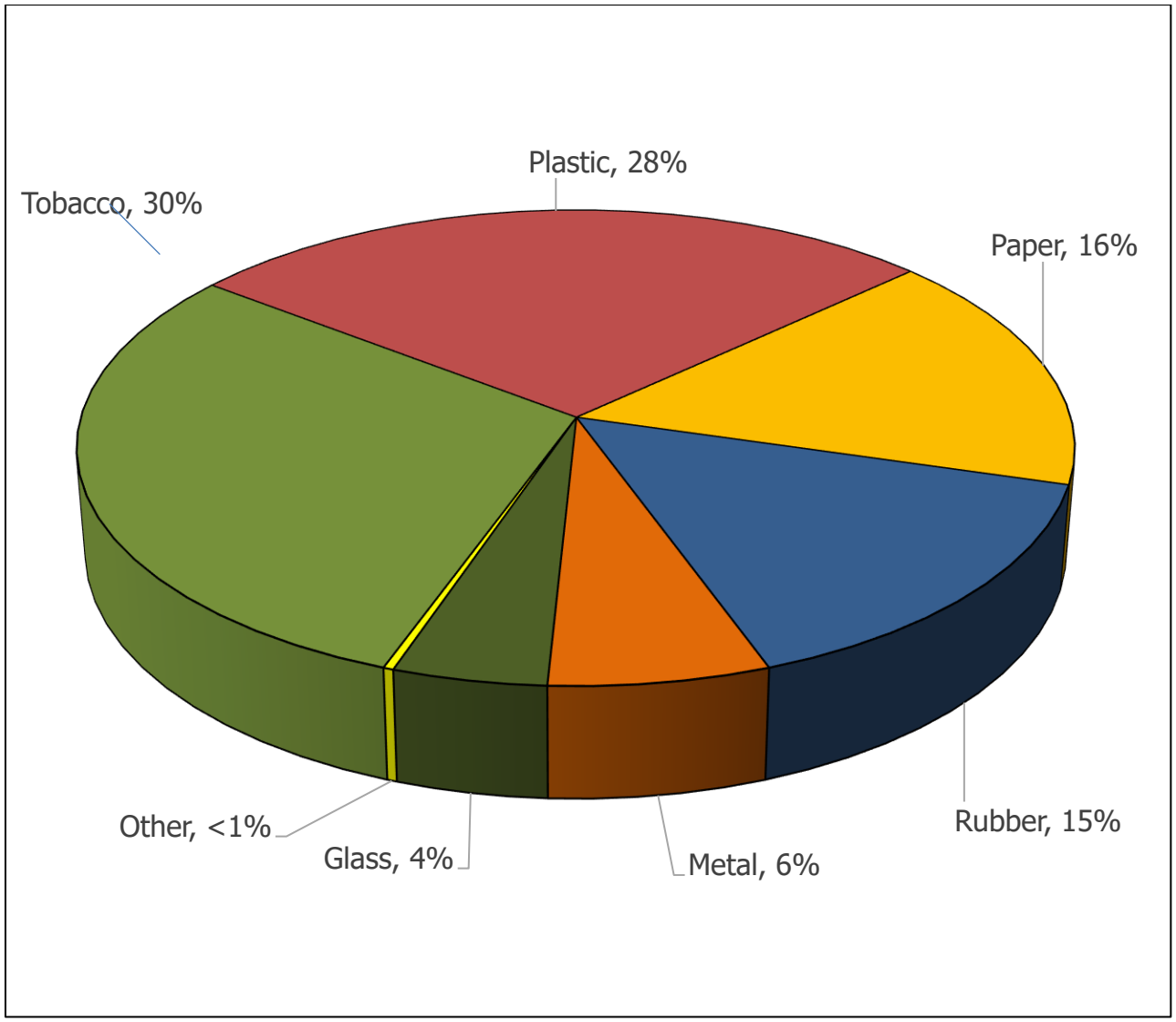


Figure 6 - Composition of Micro Litter

Statistical Tests

Sampling

In statistical studies, a sample is normally taken, studied, and analyzed in order to draw inferences or make conclusions about an entire population. For the purposes of this study, it would be prohibitive to survey every roadside in the State of Texas. Thus, a representative sample of 253 survey sites was chosen, data were obtained and recorded, and tabulations and analyses were conducted to reach conclusions about Texas roadways overall.

Statistical Significance

When a statistical test is performed, one result is typically a value or number (statistic) which aids in interpretation and understanding of the outcome of that test. In particular, it is usually asked if the resulting value is "statistically significant." One factor in determining the answer for a given value is the size of the sample. Another is the chosen "level of significance." Often, a level of .05 is the favored choice.

Suppose, hypothetically, we are wondering if roads with a "double" center line are littered to a different extent than roads with a "single" center line. We survey a sample of each kind, tally the results, compare the averages and run a statistical test. If we get a number "significant" at the .05 level, then the conclusion is reached that double-line roads are, on the average, more heavily littered. The chosen significance level of 0.05 means that there is only a 5% risk (one chance in 20) that such a conclusion is incorrect and that no actual difference exists.

Correlation Analyses

A correlation analysis is a type of statistical test that yields a correlation coefficient, a number (statistic) used to measure the strength of a relationship between two variables. The most common type of correlation is the Pearson Product Moment Correlation, which examines the linear relationship between two sets of data and is the one used in this analysis.

A correlation coefficient can be positive or negative but is never less than -1 and never greater than +1. A positive correlation means that high scores on one variable are associated with high scores on the other variable, while low scores on one are associated with low scores on the other. On the other hand, a negative correlation means that high scores on one variable are associated with low scores on the other.

Note that a correlation can only indicate the presence or absence of a relationship, not the exact nature of the relationship. A high correlation in itself does not mean that one variable necessarily causes the other.

A correlation of zero, or close to it (either positive or negative), suggests that there is little or no relationship between the variables. Any result between -0.1 and 0.1 would typically be considered weak. The closer you get to +1 or -1, the stronger the relationship. However, the significance of any result would also depend largely on the size of the sample (that is, the number of measurements). Given the large number (253) of roadway sites surveyed in this study, it would only require a correlation coefficient of approximately 0.13 to be statistically significant at the .05 level.

Therefore, in some cases a statistically significant value may be found where that result is, in itself, not necessarily meaningful. Nonetheless, it may suggest a closer look at the data.

Proximity Indicators

At each survey site, it was determined whether a proximity indicator was, as the phrase suggests, nearby. The presence of twelve such indicators was tallied: Beautification, Convenience stores, Fast Food establishments, Traffic signals, Retail Establishments, Residences, Churches, Schools, Construction sites, Farms, Restaurants, and Motels. The only proximity indicators that occurred at enough sites to warrant analysis were the first four: Beautification, Convenience stores, Fast Food establishments, and Traffic Signals.

Correlation analyses were conducted to determine whether the proximity and quantity of these indicators was associated with the amount of litter found at the sites surveyed. An additional analysis was conducted to consider any relationship between the amount of Visible Litter found and the total number of proximity indicators identified. This latter number included data from all twelve original proximity indicators.

In this statistical analysis section, Vehicle Debris refers to a broader category that includes Vehicle & Metal Road Debris along with Tire Debris.

Table 11 - Correlations: Proximity Indicators and Litter Counts by Category

Litter Category	Proximity Indicator				
	Beautification	Conv. Store	Fast Food Est.	Traffic Signal	Total Prox.
Bev. Container	-.104	-.055	.030	-.102	-.070
Fast Food	-.053	.097	**.133**	.038	.090
Snack Wraps	.040	**.181**	**.197**	.037	**.187**
Misc. Paper	.069	.090	.108	.013	**.140**
Other Plastic	-.068	.095	**.207**	-.051	.063
Vehicle Debris	**-.242**	-.081	-.035	**-.151**	**-.197**
Construction Debris	-.109	.044	.045	-.017	-.051
All Visible Litter	**-.172**	-.004	.068	-.113	-.071
Vis. Litter w/o Vehicle Debris	-.064	.060	**.132**	-.049	.053
Micro Litter	.041	.092	.102	-.118	.070

Note 1. The "Total Prox." column represents the total number of proximity indicators across all 12 original designated indicators.

Note 2. The highlighted values are statistically significant at the .05 level.

To clarify, a positive correlation coefficient in Table 11 means that, on the average, more litter of the designated category is found at sites where more of the designated proximity indicators are found. A negative correlation means less overall litter where those proximity indicators occur.

Some results in Table 11 are to be expected. For example, the correlation between Fast Food litter and Fast Food establishments is significant (.133). Simply put, more fast food litter is found near Fast Food establishments – not surprisingly. Note that the correlations for Beautification sites are mostly negative, two of them significantly so. This suggests that, overall, less litter is found in proximity to such sites, as would be hoped.

The category of Snack Wraps litter has positive correlations for all listed proximity indicators, and three of the values are statistically significant. Thus, snack wraps tend to be littered more often near such sites. The proximity indicator that perhaps seems most problematic is Fast Food Establishments, which has positive correlations for all categories of litter except vehicle debris. Indeed, three of those correlations (even Other Plastic) are statistically significant.

The category of Vehicle Debris stands out: all correlations are negative, and three of them are statistically significant. Thus, less vehicle debris tends to be found at sites near the

given proximity indicators. To determine how substantial this result may be calls for performing another analysis.

T-tests for Averages

A t-test is a type of statistical procedure used to examine the average values of two sets of data obtained through sampling. The t-test directly compares the difference between those averages or means, but also takes into account other factors. One factor is the standard deviation of each set of values, which is basically a measure of how widely dispersed the values are. The other factor is the number of values within each data set.

Based on these considerations, the t-test addresses the extent to which a true difference exists between the populations of values from which the data have been sampled and expresses the significance that can be attributed to such differences.

Average litter values were calculated across sites for each of the four proximity indicators examined above. Most differences were small and of little meaning. However, the averages for Vehicle Debris, Visible Litter, and Micro Litter were examined more closely. T-tests were performed on the proximity indicator data in these categories. Results are reported in Table 12.

Table 12 – Average Litter Values Associated with Proximity Indicators

Proximity Indicator	Y/N	Average Litter Values		
		Vehicle Debris	Visible Litter	Micro Litter
Beautified Site	Yes	**20.6**	**79.8**	2,036
	No	**43.7**	**110.4**	1,842
Convenience Store	Yes	26.1	98.6	2,438
	No	36.3	97.7	1,791
Fast Food Est.	Yes	30.1	105.2	2,362
	No	34.7	97	1,869
Traffic Sign/Signal	Yes	**24.7**	84.7	**1,534**
	No	**39.6**	105.2	**2,139**

Note. The highlighted averages are statistically different at the .05 level of significance.

As Table 12 indicates, at Beautified sites the average value for Vehicle Debris, as well as for Visible Debris, is significantly less that at sites that are not beautified. Indeed, Vehicle Debris is less than half that found at other sites. Vehicle Debris is less for all of the Proximity Indicator sites tested.

Table 12 also shows that Micro Litter is actually greater at Beautified sites, but not significantly so. As noted above, the difference in averages is not the only factor that determines significance in a t-test. Micro Litter is also greater at sites in proximity to Convenience Stores and Fast Food Establishments, as might be expected – again, however, not significantly so. An interesting result is that Micro Litter is significantly less at sites in proximity to a traffic signal.

Roadway Types

Certain tables regarding litter rates by roadway type were presented above. The data suggested that there exist substantial differences in littering tendencies among the four different types of roadways. Table 13 displays the average litter counts by roadway types obtained in the 2019 survey.

Table 13 – Average Litter Counts by Roadway Type

Type of Litter	FM	IH	SR	US	All
Visible Litter	62.0	148.1	83.2	76.5	97.8
Non-Vehicle Debris	55.0	81.2	65.8	46.8	63.6
Vehicle Debris only	7.0	66.9	17.3	29.7	34.2
Micro Litter	974.7	2,841.6	1,748.8	1,643.9	1,921.5

Farm-to-Market

Farm-to-Market Roads had less average Visible Litter than each of the other three roadway types. A t-test was conducted to compare the average litter rates for FM Roads with all other roadways combined. The difference was statistically significant at the .01 level, allowing the conclusion that FM Roads statewide have substantially less Visible Litter than found on other roadways overall.

However, when Visible Litter is broken down into Vehicle Debris and Non-Vehicle Debris (Visible Litter excluding Vehicle Debris), a more detailed picture comes to light. Note from Table 13 that the FM average for Vehicle Debris (7.0) is considerably less than for any other roadway type. Indeed, a t-test confirmed that the difference is statistically significant with a high level of confidence. And yet, the FM average for Non-Vehicle Debris (55.0) is not the lowest average among roadway types (the US Highway average is 46.8). Although the FM average for Non-Vehicle Debris is lower than that for all other roadways combined, a t-test confirmed that the difference is not statistically significant.

Finally, a t-test confirmed what might seem apparent from Table 13: the FM average count for Micro Litter is significantly lower than the average Micro Litter count for all other roadways combined.

Interstates

The situation is somewhat reversed for Interstates. As seen in Table 13, the average Visible Litter count for Interstate Highways (148.1) easily exceeds the average for any other roadway type. As expected, a t-test confirmed that the Interstate average is significantly higher than that for all other roadway types combined, with a high level of confidence. Furthermore, t-tests confirm that this result holds true for both Vehicle Debris and Non-Vehicle Debris as well.

The figures for Micro Litter tell a similar story. The Interstate average count for Micro Litter (2,841.6) is over 1,000 greater than the next highest Micro Litter average (1,748.8 for State Highways). Thus, a t-test confirmed what Table 13 suggests: the average Micro Litter count for Interstates is significantly higher than the average for all other roadways combined.

State Roads

State Roads only had slightly more Non-Vehicle Debris on average than FM roads although their traffic levels tend to be higher, but the amount of Vehicle Debris was more than double the amount on FM roads. The amount of Micro Litter was more similar to the overall average than was true with FM roads and Interstates.

U.S. Highways

U.S. Highways had the lowest amount of Non-Vehicle Debris of all roadway types although their traffic levels tend to be higher than FM roads. In terms of Vehicle Debris, only Interstates had a higher average amount of debris. As was true with State Roads, the amount of Micro Litter found on U.S. Highways was more similar to the overall average than was true with FM roads and Interstates.

Litter by Districts and Regions

Litter Rates by TXDOT District

TXDOT divides Texas into 25 regions for construction and maintenance purposes. Each district consists of between six and 17 counties.

The map below (Figure 7) shows the breakdown of TXDOT districts used to analyze littering rates.

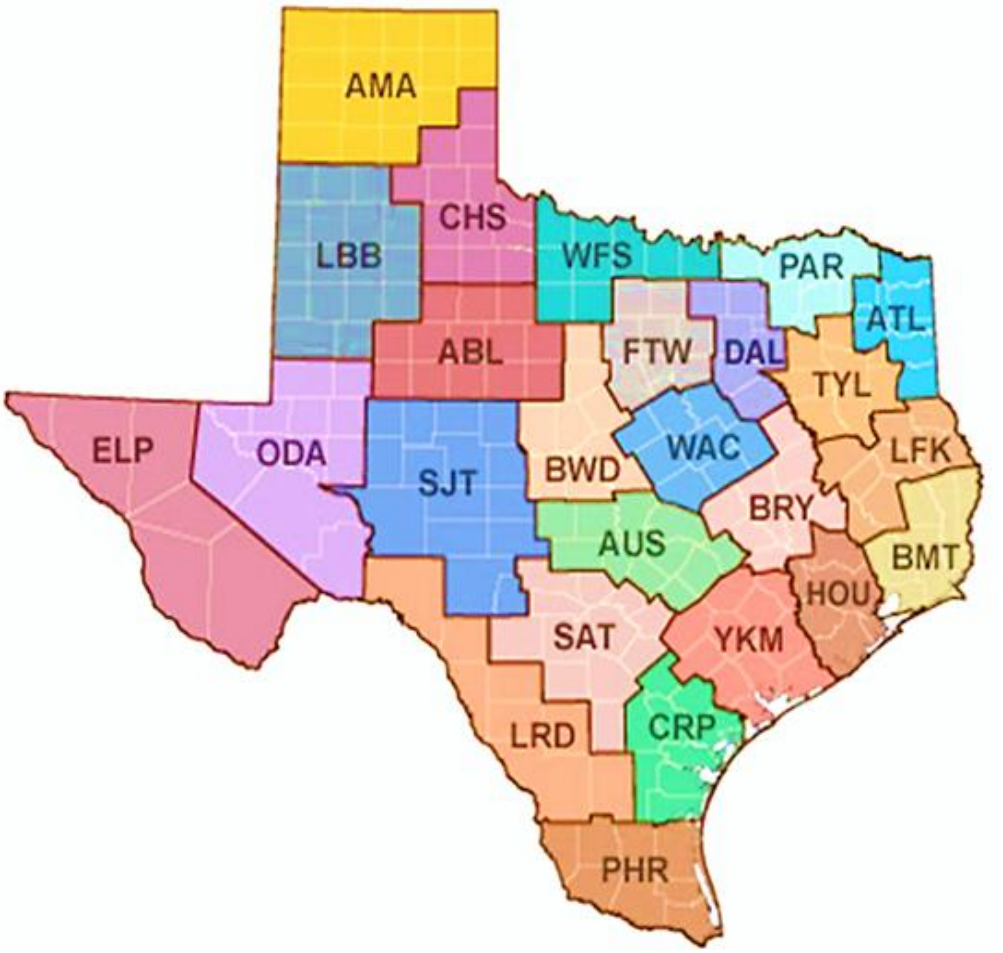


Figure 7 – TXDOT Districts

Since tire debris comprised such a large portion of both Visible Litter (29 percent) and Micro Litter (15 percent) overall, it was deemed more useful to show average litter rate per site in three ways: (1) all litter, (2) tire debris only and (3) All Litter except for tire debris.

Table 14 below shows the average tally of litter by site in each of the TXDOT districts. The most littered of each is highlighted in yellow, the second most littered in orange and the third most littered in blue.

Table 14 – Average Litter Counts by TXDOT District

TXDOT	Total Litter			Tire Debris			Litter w/o Tire Debris		
District	Visible	Micro	All	Visible	Micro	All	Visible	Micro	All
ABL	40	1,159	1,200	24	389	412	17	771	787
AMA	79	529	608	37	198	235	42	331	373
ATL	101	780	880	27	25	52	74	755	829
AUS	42	361	403	6	8	15	36	352	388
BMT	75	3,325	3,399	27	697	725	47	2,627	2,675
BRY	77	1,682	1,759	16	189	205	61	1,493	1,554
BWD	84	1,027	1,112	11	132	143	74	895	969
CHS	39	685	724	14	117	131	25	568	593
CRP	46	206	251	6	6	12	40	200	239
DAL	**217**	3,310	**3,527**	**56**	601	657	**161**	2,709	2,869
ELP	67	2,738	2,805	29	**991**	**1,020**	38	1,747	1,785
FTW	**181**	3,124	3,304	**63**	286	349	**118**	**2,837**	**2,955**
HOU	102	**3,364**	3,466	20	369	388	**82**	**2,996**	**3,078**
LRD	90	428	518	**40**	277	316	50	151	202
LBB	60	1,430	1,490	8	220	228	52	1,210	1,262
LFK	72	1,274	1,346	26	117	143	47	1,157	1,203
ODA	**106**	**5,303**	**5,408**	34	**1,115**	**1,148**	72	**4,188**	**4,260**
PHR	52	368	421	12	43	55	40	326	366
PAR	93	252	344	38	17	55	55	235	290
SAT	98	888	985	36	183	220	62	704	766
SJT	54	1,497	1,550	22	470	491	32	1,027	1,059
TYL	73	640	713	15	24	39	58	616	674
WAC	90	**3,450**	**3,541**	29	704	733	61	2,746	2,808
WFS	98	1,892	1,990	27	**748**	**775**	71	1,144	1,215
YKM	88	536	625	14	318	333	74	218	292
TEXAS	**98**	**1,921**	**2,019**	**28**	**337**	**365**	**70**	**1,585**	**1,654**

Because Micro Litter was such a dominant portion of litter, in almost every case the three districts with the highest amount of Micro Litter also had the highest amount of Total Litter as well. The one exception was for Total Litter where the HOU district had the third highest amount of Micro Litter, while the DAL district had the highest amount of Total Visible Litter and Total Visible Litter when Tire Debris was excluded.

The high values in the ODA district are of particular interest since its DVM and district population are both close to the median for the state. The final line in Table 14 represents the average litter count per site for the entire state of Texas.

Correlation Tests

When statistical tests were run, statistically significant correlations were found between the average amount of Visible Litter observed and the average daily traffic in each district. These values are highlighted in yellow in Table 15.

Table 15 – Correlations to Traffic and Population

Correlation Test	Total Litter			Tire Debris			Total Litter w/o Tire Debris		
	Visible	Micro	All	Visible	Micro	All	Visible	Micro	All
Daily Vehicle Miles	**0.53**	0.34	0.35	0.27	0.02	0.03	**0.588**	**0.41**	**0.42**
District Pop.	**0.56**	0.35	0.36	0.34	0.05	0.06	**0.593**	**0.42**	**0.43**

There was also a moderate correlation between Micro Litter and traffic and population levels when tire debris was excluded. Those values are highlighted in orange. None of the other values are considered statistically significant. It is of interest that all of the correlation values in Table 15 are slightly higher for population compared to daily vehicle miles. The values for Total Litter without Tire Debris are displayed with three decimal points to show that this was true even when the values were close.

Litter Rates by Region

The 25 TXDOT districts were rolled up into four regional areas as shown in Table 16. The regional breakdown was done to allow each of the four field crews to focus their surveying on one geographical area of the state. This also provided the opportunity to compare resulting data among the four different areas of the state.

Fewer sites were allocated to the West Region since the travel time between sites was much greater. The West Region was also more sparsely populated and much less traveled. Despite these demographics, littering was much higher than expected in this region due in part to the high littering rate observed in the ODA District.

Table 16 – Regional Demographics

Region	Daily Vehicle Miles	Population	Area (miles^2)	# of Sites
East	138,307,335	8,337,653	27,332	57
North	187,810,033	11,157,845	54,785	83
South	165,950,347	6,737,361	63,305	65
West	65,133,934	2,469,384	115,811	48
Total	**557,201,649**	**28,702,243**	**261,233**	**253**

The districts included in each region is shown in Figure 8.

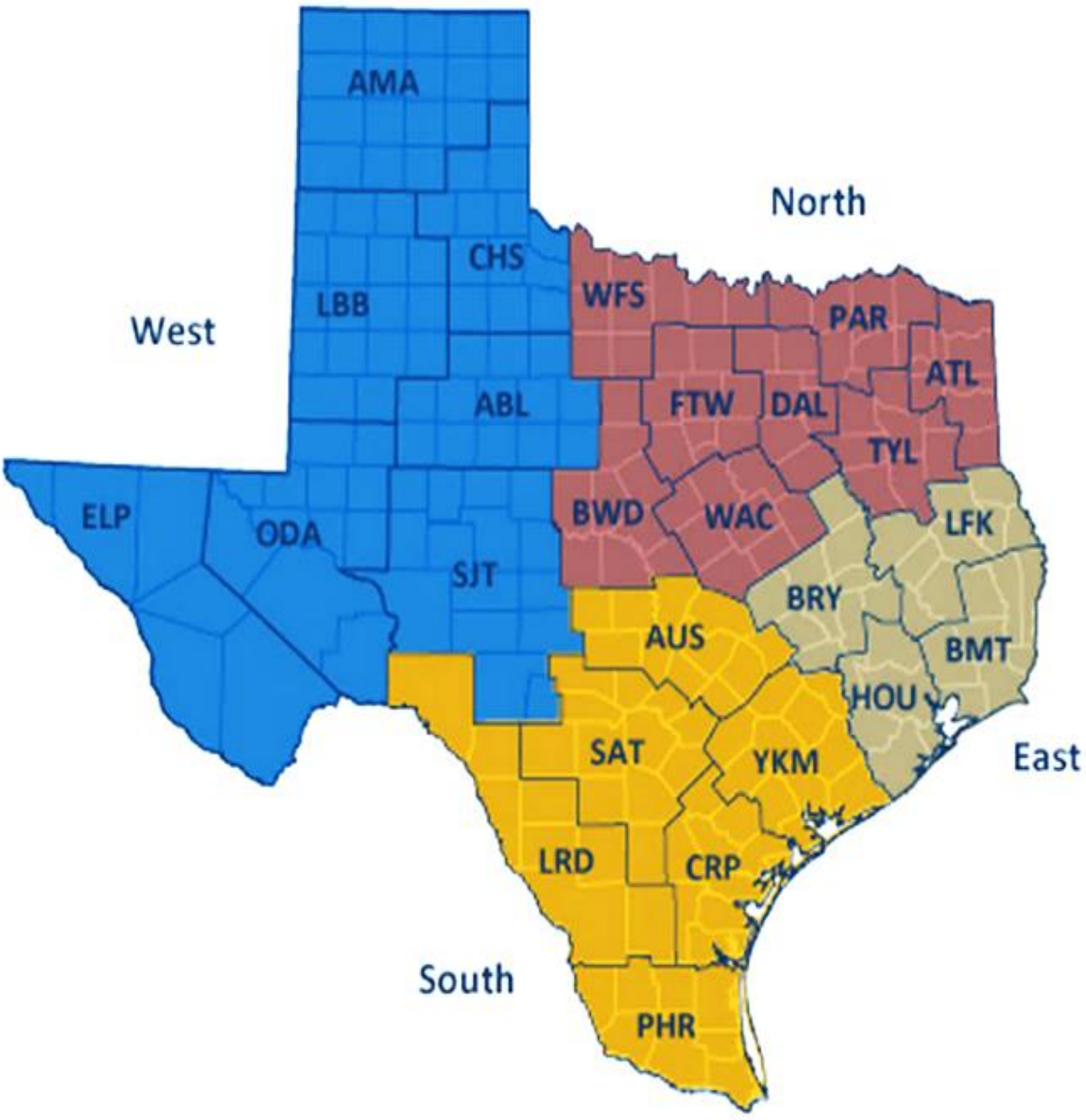


Figure 8 – TXDOT Regions

Table 17 shows the average litter rates per site by region. The North Region, which includes the Dallas and Fort Worth metropolitan areas, yielded the highest average rate of Total Visible Litter (144). This was followed distantly by the East Region, which includes the Houston area.

While the North Region had the highest average rate of visible Tire Debris (42), the other three regions all had about one-half that amount.

Table 17 – Average Litter Counts by Region

TXDOT Region	Total Litter			Tire Debris			Litter w/o Tire Debris		
	Visible	Micro	All	Visible	Micro	All	Visible	Micro	All
East	90	2,836	2,926	21	361	382	69	2,475	2,543
North	144	2,317	2,462	42	366	408	103	1,951	2,054
South	68	767	835	20	225	245	48	542	590
West	67	1,934	2,000	24	451	475	43	1,482	1,525
Texas	**98**	**1,921**	**2,019**	**28**	**337**	**365**	**70**	**1,585**	**1,654**

If tire debris was excluded, the North Region would still have the highest average rate of Visible Litter by far (103), while the East Region had the highest amount of Micro Litter (2,475).

Branded Litter

Prior Visible Litter studies performed in Texas have recorded both the brand name as well as the quantity of items within that brand name to provide a better understanding of which brands contribute most to litter. As was done in 2013, field crews noted the brand name of each item of litter collected where recognizable for both small and large items as shown in Figure 9.

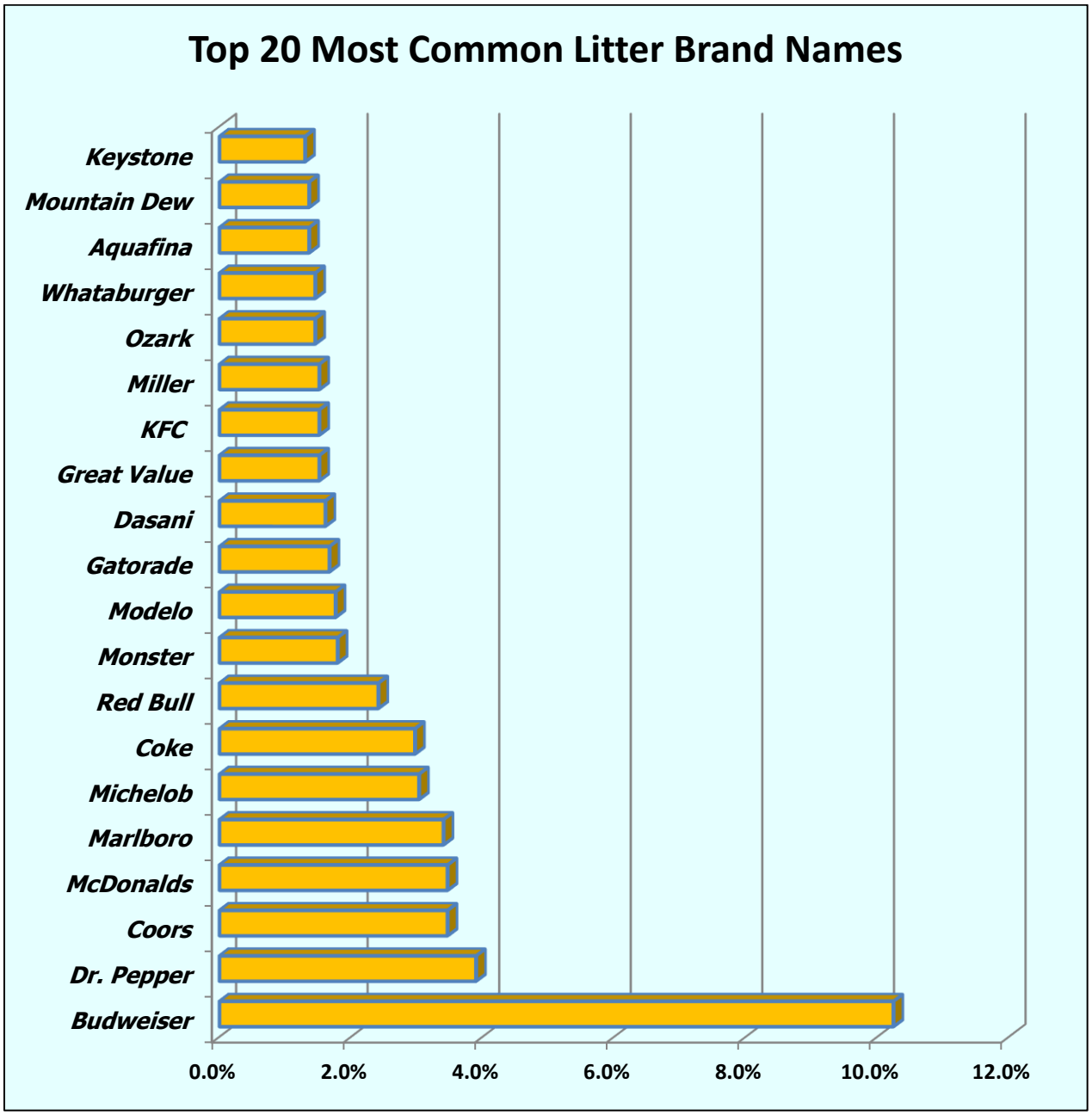


Figure 9 – Branded Litter

In the 2019 survey, 475 unique brands were identified. The most pervasive brand name observed in litter, as shown in Figure 7, was Budweiser, which accounted for more than 10% of all branded items identified. This is not surprising as beer cans were the most littered type of beverage container in 2019.

Dr. Pepper bottles, the fourth most commonly littered brand item in 2013, was the second most littered brand in 2019, found more often than Coca-Cola. This is expected given that Dr. Pepper was founded in and has its headquarters in Texas. Coors was third followed by McDonald's. Branded water bottles grew as a component of the top 20 branded items found in litter, from one brand in 2013 to four brands found in 2019.

In total, the top 20 most common brand names comprised 51% of all brand name items counted.

Conclusions

- Visible Litter along TxDOT-maintained roadways decreased overall by 17% between 2013 and 2019. This is a major accomplishment given the increase in age eligible drivers and the number of roadway miles driven in the state.
- When Tire Debris is excluded, Visible Litter decreased by 28%.
- Tire Debris was the largest component of Visible Litter (29%) and was pervasive across all areas of Texas. It was most prevalent along interstates. Of the 32 sites that had more than 1,000 pieces of Tire Debris, 29 of them (91%) were interstates.
- Tire Debris is the one component that could be best considered as unintentional litter that litter abatement messaging is unlikely to affect.
- The decrease in Visible Litter occurred despite estimated rises in both adult population in Texas (10.3%) and traffic levels statewide (12.7%).
- Items discarded from cars and trucks account for 51% of all litter along TxDOT-maintained roadways, while Vehicle Debris, which includes items such as blown tires and car parts from accidents, accounts for another 35%.
- The average litter rates for sites in the ODA district were very high considering that its DVM and district population are both close to the median for the state.
- Micro Litter found during the 2019 survey increased by 90%. This may be due, in part, to the fact that smaller items are more difficult to clean up than larger items.
- Cigarette Butts continued to comprise the largest portion of Micro Litter in 2019 (24%), compared to 28% from the initial survey conducted in 2013. Although the percentage dropped, the actual number of littered Cigarette Butts increased 63%
- Statistical tests show that sites near proximity indicators (e.g. beautified areas, traffic signals and signs, etc.) generally have lower levels of Vehicle Debris.
- The number of littered Beverage Containers (especially beer cans, water bottles and soda cans, etc.) tallied in 2019 was 31% lower than in 2013.
- The littering rate for both Visible Litter and Micro Litter varied widely among roadway types. Interstates were the heavily trafficked and the most heavily littered roadway type.
- The growing amount of Micro Litter suggests that crews continue to disregard existing litter prior to mowing grassy areas along TxDOT roadways.

- Recyclables (primarily Beverage Containers and Paper) comprised 25% of Visible Litter.
- All of the correlation values for average district litter rates were slightly higher for population compared to daily vehicle miles.
- Given the decrease in Visible Litter despite increases in both population and annual vehicle miles traveled, the *Don't mess with Texas* program is likely more effective than is realized.

Recommendations

- Tire Debris, although not an intentional form of litter, continues to deface Texas roadways statewide and calls for a different abatement strategy. It is recommended that TxDOT work with technical experts to determine the causes of excessive tire blowouts and implement programs to mitigate this problem.
- If not already doing so, litter cleanup crews should be instructed to safely remove tire and rubber debris along with other items of litter.
- More effective programs are needed to reduce the amount of Cigarette Butt litter.
- Removing litter before mowing along TxDOT roadsides will help reduce the incidence of Micro Litter.
- Continue to promote Beautification since sites that were not beautified had 38% more Visible Litter on average compared to beautified sites.
- Continue to promote the recycling of Beverage Containers and Paper.
- Further investigation into litter at sites in ODA district is warranted given its high litter rates.
- Continuing to promote the *Don't mess with Texas* program will help ensure ongoing momentum for future efforts.

APPENDICES

Appendix A – Methodology

The methodology used for the 2019 Texas Litter Survey is based on the methodology that used in the 2013 and most statistically-based litter surveys conducted throughout North America.

Conducting the Litter Survey

Each survey team was comprised of two people. Upon arriving at a site, the team safely parked their vehicle. Large worker signs were posted and traffic cones or flags were used to define site parameters. Team members were required to wear fluorescent orange/yellow traffic vests to increase visibility. The optimal site size was one-tenth mile (528 feet) x 18 feet. Conditions limiting access to a site's optimal width (e.g. walls or fences) were so noted.

Paint provided by TxDOT was used to mark the beginning, midpoint and end of each site. This helped identify sites that should not be cleaned and helped the survey teams return to the same survey points for the second survey.

The width of each site was measured from 1.5 feet inside the curb or the start of the pavement, towards the outer edge of the site, up to a maximum width of 18 feet and marked to indicate the boundary. This rule was set to include 1.5 feet into the street since curbs are normal catchment structures, for which DOTs typically ensure litter cleanup.

Litter Classification

For the 2019 Texas Litter Survey, litter was classified as Visible Litter (>= two square inches) and Micro Litter (< two square inches). This breakdown helps define and clarify the extent to which litter item size is a factor in the evaluation of resultant data.

The litter tallies were recorded into 90 categories of Visible Litter and 18 categories of Micro Litter. Utilizing these categories will allow comparison to litter in other areas and will for future litter surveys in Texas. A detailed description of each litter category is included in the Appendix.

Micro Litter was examined in three segments of each site: at the beginning, middle and end of each site. Each of these three segments comprised a 3' x 18' area. For each site, the resulting data from these three transects were then extrapolated to the total site area.

Survey Count

At each site, the ambient site information was recorded on the appropriate form, describing the site number, size and proximity to conditions (e.g. traffic signal, fast food or convenience stores, etc.) and providing a subjective visual rating.

Appendix B – Visible Litter Components

All components of Visible Litter are shown in Table 18. This represents the data for the all 253 sites.

Table 18 – Visible Litter Components

Visible Litter Item	Percent
Tire Debris	28.7%
Misc. Plastic	9.4%
Vehicle & Metal Road Debris	6.6%
Misc. Paper	6.3%
Beer Cans	4.0%
Water (Plastic)	3.2%
Construction Debris	2.7%
Cup Lids, Pieces Lids, Straws	1.9%
Home Articles	1.8%
Soft Drink (Cans)	1.8%
Tobacco Packaging (Packs, Matches, Etc.)	1.7%
Other Paper Cups	1.6%
Sweet Snack Packaging	1.6%
Misc. Cardboard	1.3%
Paper Cups (Hot)	1.1%
Plastic Packaging - Film (Shrink Wrap, etc.)	1.1%
Non-Brand Napkins	1.0%
Foil Materials/Foil Pieces	1.0%
Composite Materials - Other	1.0%
Zipper Bags/ Sandwich	1.0%
Soft Drink (Plastic)	0.9%
Corrugated Boxes/ Box Material	0.9%
Other Cloth	0.9%
Clothing/Clothing Pieces	0.8%
Misc. Paperboard	0.8%
Plastic Drink Cups	0.8%
Polystyrene Cups (Foam)	0.7%
Gum Wrappers	0.7%

Visible Litter Item	Percent
Condiment Package (Salt, Etc.)	0.7%
Cigarette / Cigar Debris (>2")	0.7%
Food Items	0.7%
Sport/Energy Drink (Plastic)	0.6%
Paper Packaging - Other	0.6%
Sport/Energy Drink (Glass/Cans)	0.6%
Beer Bottles (Glass/Plastic)	0.6%
Printed Material (Newspapers, Etc.)	0.5%
Foil Containers	0.5%
Plastic Retail Bags - Branded	0.5%
Misc. Glass	0.5%
Plastic Wrap	0.5%
Paper/Foil Wraps (Burger Wrappers)	0.4%
Milk/Juice (Plastic)	0.4%
Paper Cups (Cold)	0.4%
Snack Food Packaging	0.4%
Receipts (Business, Transfers, Etc.)	0.4%
Polystyrene Block Pieces	0.4%
Name Brand FF Towels/Napkins	0.4%
Plastic Retail Bags - No Brand Name	0.3%
Paper Food Wrap (Meat Wrap)	0.3%
Wine/ Liquor (Plastic/Other)	0.3%
Paperboard (Cereal Type)	0.3%
Lottery Ticket Debris	0.3%
Stationary (School, Business Etc.)	0.3%
Other Plastic Shells/Boxes	0.2%
Paper Bags - Fast Food	0.2%
Paper Clamshells	0.2%
Other Material Trays	0.2%
Paper Beverage Cases	0.2%
Polystyrene Clamshells/Pieces	0.2%
Plastic Bags - Not Retail (Leaf, Trash)	0.1%
Utensils (Plastic or Otherwise)	0.1%
Paper Retail Bags - No Brand Name	0.1%

Visible Litter Item	Percent
Cans - Aluminum (Non-Beverage)	0.1%
Broken Glass Container	0.1%
Tea (Plastic)	0.1%
Paper Fast Food Plates	0.1%
Tea/Coffee (Can)	0.1%
Paper Bags - Not Retail	0.1%
Aerosol Cans (Paint, Oils, Etc.)	0.1%
Milk/Juice (Gable Top)	0.1%
Cigar Butts/Tips	0.1%
Paper Retail Bags - Branded	0.1%
Foil Pouches	0.1%
Container Lids	0.1%
Juice Can	0.1%
Plates - Other Materials	0.1%
Tea/Coffee (Glass)	0.0%
Poly Fast Food Plates	0.0%
Wine/ Liquor (Glass)	0.0%
Six Pack Plastic Rings	0.0%
Plastic Jars / Bottles/ Lids (Non-Beverage)	0.0%
Water (Glass)	0.0%
Cans - Steel	0.0%
Polystyrene Trays	0.0%
Glass Jars/ Bottles Misc.	0.0%
Soft Drink (Glass)	0.0%
Other Plastic FF Plates	0.0%
Paper Trays	0.0%
Milk/Juice (Glass)	0.0%
Aseptic (Box)	0.0%
Total Visible Litter	**100.0%**

Appendix C – Litter Categories and Descriptions

Table 19 includes a detailed description of the categories used for Visible Litter in the 2019 Texas Litter Survey. These categories and descriptions have been used for a number of recent litter surveys including Texas. Descriptions are also included for the categories of Micro Litter although many of those items are identifiable only by material.

Table 19 – Litter Categories and Descriptions

Litter Item	Category	Material	Description
Beer Cans	Beverage	Metal	Beer in aluminum cans
Beer Bottles (Glass)	Beverage	Glass	Beer in glass bottles
Soft Drink (Glass)	Beverage	Glass	Soft drinks in glass bottles
Soft Drink (Cans)	Beverage	Metal	Soft drinks in aluminum cans
Soft Drink (Plastic)	Beverage	Plastic	Soft drinks in plastic bottles
Sport/Energy Drink (Metal)	Beverage	Metal	Sport drinks in aluminum cans
Sport/energy Drink (Plastic)	Beverage	Plastic	Sport drinks in plastic bottles
Tea/Coffee (Metal)	Beverage	Metal	Tea or coffee drinks in aluminum cans
Tea/Coffee (Plastic)	Beverage	Plastic	Tea or coffee drinks in plastic bottles
Tea/Coffee (Glass)	Beverage	Glass	Tea or coffee drinks in glass bottles
Water (Glass)	Beverage	Glass	Packaged water in glass bottles
Water (Plastic)	Beverage	Plastic	Packaged water in plastic bottles
Wine/ Liquor (Glass)	Beverage	Glass	Wine & liquor in glass bottles
Wine/ Liquor (Plastic)	Beverage	Plastic	Wine & liquor in plastic bottles
Milk/Juice (Plastic)	Beverage	Plastic	Milk or juice containers in plastic bottles
Milk/Juice (Glass)	Beverage	Glass	Milk or juice containers in glass bottles
Milk/Juice (Gable)	Beverage	Paper	Milk/juice in gable top cartons
Foil Pouches	Other Bev. Packaging	Composite	Packaged goods and pieces of foil packaging
Aseptic (Box)	Other Bev. Packaging	Composite	Drink-in-box, juice, fluids, other
Broken Cont. Glass	Other Bev. Packaging	Glass	Glass bottle fragments
Six Pack Plastic Rings	Other Bev. Packaging	Plastic	Retainer plastic for carrying cans
Foil Containers	Other Bev. Packaging	Metal	Foil wraps (e.g., ice cream)
Plastic Drink Cups	Cups	Plastic	Cups, all resin types

2019 Texas Litter Survey

Litter Item	Category	Material	Description
Paper Cups (Cold)	Cups	Paper	Cups, all paper types - cold drinks
Paper Cups (Hot)	Cups	Paper	Cups, all paper types - hot drinks
Polystyrene Cups (Foam)	Cups	Plastic	Cups, all polystyrene types - hot drinks
Other Paper Cups	Cups	Paper	Cups, other materials
Cup Lids, Pieces Lids	Cups	Plastic	Cups, lids, straws and pieces
Plastic Retail Bags - Brand Name	Bags	Plastic	Whole\pieces of branded retail plastic bags
Plastic Retail Bags - No Brand	Bags	Plastic	Whole\pieces of non-branded retail plastic bags
Paper Retail Bags - Brand Name	Bags	Paper	Whole\pieces of branded retail paper bags
Paper Retail Bags - No Brand	Bags	Paper	Whole\pieces of non-branded retail paper bags
Paper Bags - Fast Food	Bags	Paper	Whole\pieces of fast food paper bags
Plastic Bags - Not Retail	Bags	Plastic	Whole\pieces of non-retail plastic bags (e.g., leaf, trash, etc.)
Paper Bags - Not Retail	Bags	Paper	Paper bags & sacks (e.g., leaf debris)
Zipper Bags/ Sandwich	Bags	Plastic	Plastic lunch bags and sacks
Plastic Packaging - Film	Bags	Plastic	Stretch wrap, dry cleaner bags, commercial/industrial non-bag plastic film
Corrugated Boxes & Material	Other Packaging	Paper	All cardboard and box materials
Paperboard	Other Packaging	Paper	Cereal, shoe boxes and pieces etc.
Paper Beverage Cases	Other Packaging	Paper	Paper material outer packaging for beverage products
Polystyrene Clamshells	Other Packaging	Plastic	Whole and pieces of expanded foam containers
Paper Clamshells	Other Packaging	Paper	Whole and pieces of take-away or other paper containers
Other Plastic Shells/Boxes	Other Packaging	Plastic	PET, PVC, HDPE, other material shells
Plastic Jars / Bottles/ Lids	Other Containers	Plastic	Non-beverage plastic jars/bottles, (e.g., detergent bottles)
Glass Jars/ Bottles Misc.	Other Containers	Glass	Glass jars/bottles not described above
Cans - Steel	Other Containers	Metal	Steel food/non-food containers
Cans - Aluminum	Other Containers	Metal	Aluminum food/non-food containers
Container Lids	Other Containers	Plastic	All lids, closures, and pieces > 4 sq. in.
Aerosol Cans	Other Containers	Metal	Aerosol cans, tops, lids for spray paints, oils, etc.
Paper Food Wrap	Food Wraps/Containers	Paper	Commercial/Non-commercial food wrap (e.g., meat wrap)
Paper / Foil Composite Wrap	Food Wraps/Containers	Composite	Wrap for food/non-food (e.g., hamburger paper/foil)
Plastic Wrap	Food Wraps/Containers	Plastic	All retail plastic wrap types, food, non-food
Condiment Package	Take-Out Extras	Plastic	Pouches and containers (e.g., ketchup, salt, creamers, etc.)
Utensils	Take-Out Extras	Plastic	Forks, knives, chop sticks etc.
Branded Fast Food Towels/Napkins	Take-Out Extras	Paper	Towels & napkins with identifiable brand

2019 Texas Litter Survey

Litter Item	Category	Material	Description
Paper Fast Food Plates	Take-Out Extras	Paper	Paper Plates used to serve fast food
Polystyrene Fast Food Plates	Take-Out Extras	Plastic	Polystyrene Plates used to serve fast food
Other Plastic Fast Food Plates	Take-Out Extras	Plastic	Other Material Plates used to serve fast food
Plates - Other Materials	Take-Out Extras	Composite	Plates - not fast food (e.g., picnic plates)
Polystyrene Trays	Trays	Plastic	Take-out/non-take out, microwavable, display trays
Paper Trays	Trays	Paper	Take-out/non-take out, microwavable, display trays
Other Material Trays	Trays	Plastic	Take-out/non-take out, microwavable, display trays
Gum Wrappers	Confectionary/ Snack	Composite	Packaging used to seal, sell gum products
Sweet Snack Wraps and Pouches	Confectionary/ Snack	Composite	Packaging used to seal, sell candy and cake products
Snack Food Packaging	Confectionary/ Snack	Composite	Snack foods such as chips, etc.
Food Items	Confectionary/ Snack	Organic	Apple cores, banana peels, etc.
Clothing or Clothing Pieces	Cloth	Cloth	All cloth, clothing pieces, and clothing discarded on site
Other Cloth	Cloth	Cloth	Tarps, industrial fabrics etc.
Non-Brand Towels & Napkins	Paper	Paper	Napkins and towels - no brand identification
Paper Packaging - Other	Paper	Paper	Paper packaging otherwise not described
Lottery Ticket Debris	Paper	Paper	Tickets, and gaming items
Printed Materials	Paper	Paper	Commercially printed materials (newspapers, flyers, etc.)
Stationary	Paper	Paper	School papers, business forms, etc.
Receipts	Paper	Paper	Receipts, tickets, bus transfers, invoices, packing slips
Cigarette Debris	Tobacco	Tobacco	Cigarette butts and discarded cigarettes (>= 2 inches^2)
Cigar Debris	Tobacco	Tobacco	Cigar butts, tips and discarded cigars items (>= 2 inches^2)
Tobacco Packaging	Tobacco	Composite	All other tobacco packaging, matches, lighters, matchboxes
Misc. Paper	Other Miscellaneous	Paper	All other paper whole or shredded, unidentifiable
Misc. Plastic	Other Miscellaneous	Plastic	All other plastic whole or shredded, unidentifiable
Misc. Paperboard	Other Miscellaneous	Paper	All other paperboard whole or shredded, unidentifiable
Misc. Cardboard	Other Miscellaneous	Paper	All other cardboard whole or shredded, unidentifiable
Misc. Glass	Other Miscellaneous	Glass	All other glass, whole or broken, unidentifiable
Vehicle & Metal Road Debris	Other Miscellaneous	Composite	Auto parts, debris from auto accidents, other transportation-related
Composite Materials	Other Miscellaneous	Composite	Items made of multiple materials (e.g. metal and plastic, etc.)
Foil Materials/Foil Pieces	Other Miscellaneous	Metal	Foils and pieces, aluminum food foils, industrial foils
Construction Debris	Other Miscellaneous	Composite	Debris associated with construction
Tire Debris	Other Miscellaneous	Rubber	Tires and tire pieces

Litter Item	Category	Material	Description
Home Articles	Other Miscellaneous	Composite	All non-described household items, (e.g., lamps, etc.)
Aluminum	Micro Litter	Metal	Micro pieces of aluminum (less than two inches^2)
Bottle Caps	Micro Litter	Composite	Metal or plastic caps for bottles and containers (less than two inches^2)
Candy Wrappers	Micro Litter	Composite	Micro pieces of candy wrappers (less than two inches^2)
Cigar Butts/Tips	Micro Litter	Tobacco	Cigar butts, tips and discarded cigars items (less than two inches^2)
Cigarette Butts	Micro Litter	Tobacco	Cigarette butts and discarded cigarettes (less than two inches^2)
Food	Micro Litter	Organic	Food scraps (less than two inches^2)
Glass	Micro Litter	Glass	Micro pieces of glass (less than two inches^2)
Metal (not Aluminum)	Micro Litter	Metal	Micro pieces of metal other than aluminum (less than two inches^2)
Other Materials	Micro Litter	Composite	Other small materials not otherwise categorized (less than two inches^2)
Tobacco Packaging	Micro Litter	Composite	Micro pieces of tobacco-related materials (less than two inches^2)
Paper	Micro Litter	Paper	Micro paper scraps (less than two inches^2)
Plastic – Film	Micro Litter	Plastic	Micro pieces of plastic film (less than two inches^2)
Plastic – Hard	Micro Litter	Plastic	Micro pieces of hard plastic (less than two inches^2)
Polystyrene Foam - Packaging	Micro Litter	Plastic	Micro pieces of polystyrene packaging (less than two inches^2)
Polystyrene Foam – Food Service	Micro Litter	Plastic	Micro pieces of polystyrene food service items (less than two inches^2)
Tire Debris	Micro Litter	Rubber	Micro pieces of tires (less than two inches^2)
Straws	Micro Litter	Composite	Micro pieces of straws (less than two inches^2)

Appendix D – Site Locations

Table 20 provides a description of the site locations used for the 2019 Texas Litter Survey. The locations for each site was based on the points used in the 2013 survey.

Table 20 – Site Locations

ID	District	County	Site Description
Abl01	Abilene	Callahan	IH-20: near FM-603
Abl02	Abilene	Scurry	US-84: near FM-612
Abl03	Abilene	Callahan	SH-36: near US-283
Abl04	Abilene	Nolan	IH-20: near Exit 241
Abl05	Abilene	Taylor	IH-20: near Exit 277
Abl06	Abilene	Kent	US-380: near FM-1081
Abl07	Abilene	Scurry	SH-350: near US-180
Abl08	Abilene	Haskell	FM-617: near US-277
Ama02	Amarillo	Carson	IH-40: near FM-2880
Ama03	Amarillo	Potter	US-287: near the Potter County Line
Ama04	Amarillo	Moore	SH-152: near FM-1284
Ama05	Amarillo	Oldham	IH-40: near Exit 49
Ama06	Amarillo	Carson	IH-40: near SH-207
Ama08	Amarillo	Hartley	US-385: near US-354
Ama09	Amarillo	Oldham	SH-214: near SH 214
Atl01	Atlanta	Bowie	US-59: near Loop 14
Atl03	Atlanta	Bowie	SH-93: near FM-558
Atl05	Atlanta	Bowie	IH-30: near FM-989
Atl06	Atlanta	Cass	FM-251: near SH-77

2019 Texas Litter Survey

ID	District	County	Site Description
Atl07	Atlanta	Titus	IH-30: near US-271
Atl08	Atlanta	Bowie	FM-44: near US-259
Atl09	Atlanta	Bowie	FM-74: near CR 3775
Aus00	Austin	Gillespie	SH-16: near Triple Creek Road
Aus01	Austin	Travis	FM-2244: near SH-71
Aus04	Austin	Travis	US-183: near FM-812
Aus05	Austin	Travis	FM-969: near FM-973
Aus08	Austin	Hays	IH-35: near SH-4 Loop
Aus10	Austin	Travis	SH-71: near FM-973
Aus11	Austin	Williamson	US-79: near FM-685
Aus12	Austin	Mason	SH-29: near FM-1222
Aus15	Austin	Williamson	US-79: near FM-1460
Aus17	Austin	Caldwell	FM-2720: near SH-142
Aus18	Austin	Blanco	FM-2766: near US-281
Aus19	Austin	Hays	IH-35: near FM-150
Aus20	Austin	Williamson	US-79: near FM-1460
Aus21	Austin	Hays	SH-21: near SH-21
Bmt01	Beaumont	Orange	IH-10: near Neches River Bridge
Bmt02	Beaumont	Liberty	US-59: near SH-105
Bmt03	Beaumont	Liberty	SH-321: near FM-1008
Bmt04	Beaumont	Liberty	FM-1960: near FM-686
Bmt05	Beaumont	Jasper	US-96: near FM-2800
Bmt06	Beaumont	Jefferson	IH-10: near FM-364
Bmt07	Beaumont	Tyler	US-69: near FM-1013
Bmt08	Beaumont	Hardin	US-69: near SH-327

2019 Texas Litter Survey

ID	District	County	Site Description
Bmt09	Beaumont	Newton	SH-87: near FM-253
Bry01	Bryan	Freestone	IH-45: near SH-179
Bry02	Bryan	Burleson	FM-50: near FM-1361
Bry04	Bryan	Washington	US-290: near Loop 2447
Bry05	Bryan	Burleson	FM-1362: near SH-21
Bry06b	Bryan	Brazos	FM-2038: near Marker 628
Bry07	Bryan	Grimes	SH-90: near SH-6
Bry08	Bryan	Madison	SH-75: near IH-45
Bry09	Bryan	Robertson	US-79: near FM-46
Bry10	Bryan	Washington	FM-50: near FM-390
Bwd01	Brownwood	Brown	US-67: near FM-1467
Bwd02	Brownwood	Comanche	SH-16: near FM-R 3200
Bwd03	Brownwood	Brown	US-183: near US-67
Bwd04	Brownwood	Comanche	FM-587: near CR 679
Chs01	Childress	King	US-82: near US-83
Chs02	Childress	Knox	US-277: near FM-266
Chs03	Childress	Childress	SH-256: near US-62
Crp01	Corpus-Christi	Live Oak	IH-37: near FM-799
Crp02	Corpus-Christi	Nueces	SH-358: near IH-37
Crp04	Corpus-Christi	Nueces	US-77: near FM 892
Crp05	Corpus-Christi	Refugio	US-183: near SH-202
Crp06	Corpus-Christi	Bee	SH-359: near US-181
Crp07	Corpus-Christi	Live Oak	IH-37: near Mile Marker 48
Crp08	Corpus-Christi	Goliad	US-183: near SH-239
Crp09	Corpus-Christi	Refugio	US-77: near FM-774

2019 Texas Litter Survey

ID	District	County	Site Description
Crp10	Corpus-Christi	Bee	SH-202: near FM-2441
Crp11	Corpus-Christi	Kleberg	FM-771: near US-77
Dal01	Dallas	Collin	SH-121 near FM-2933
Dal02	Dallas	Collin	SH-78: near SH-205
Dal03	Dallas	Dallas	IH-35E: near IH-635 loop
Dal04	Dallas	Dallas	IH-20: near FM-1382
Dal05a	Dallas	Dallas	IH-20: near IH-45
Dal06	Dallas	Ellis	US-287: near US-67
Dal08	Dallas	Kaufman	IH-20: near FM-2932
Dal09	Dallas	Kaufman	IH-20: near FM-2965
Dal10	Dallas	Kaufman	US-175: near US-175 Business
Dal11	Dallas	Kaufman	SH-274: near FM-148
Dal12	Dallas	Navarro	IH-45: near exit 242
Dal13	Dallas	Navarro	US-287: near FM-3243
Dal14	Dallas	Navarro	SH-22: near FM-1839
Dal15	Dallas	Rockwall	IH-30: near FM-740
Dal16	Dallas	Ellis	IH-45: near FM-1182
Dal17	Dallas	Denton	US-380: near FM-156
Dal18	Dallas	Denton	FM-720: near FM-423
Dal19	Dallas	Navarro	IH-45: near FM-1394
Dal21	Dallas	Dallas	US-175: near IH-45
Dal22	Dallas	Dallas	SH-356: near SH-183
Dal23	Dallas	Rockwall	SH-276: near FM-548
Dal24	Dallas	Dallas	IH-30: near Exit 34
Dal25	Dallas	Collin	US-75: near SH-121

2019 Texas Litter Survey

ID	District	County	Site Description
Dal26	Dallas	Denton	FM-455: near IH-35
Elp01	El Paso	Reeves	IH-10: near IH-20
Elp02	El Paso	El Paso	US-54: near New Mexico State line
Elp04	El Paso	El Paso	IH-10: near Spur 375
Elp05	El Paso	Jeff Davis	SH-17: near Front Street
Elp06	El Paso	El Paso	IH-10: near Exit 42
Elp07	El Paso	Hudspeth	US-180: near Ranch Rd 659
Elp08	El Paso	Presidio	US-67: near US-90
Elp09	El Paso	Brewster	SH-118: near US-67
Elp10	El Paso	Jeff Davis	SH-17: near US-118
Ftw01	Fort Worth	Johnson	US-67: near FM-2331
Ftw02	Fort Worth	Johnson	SH-171: near
Ftw03	Fort Worth	Johnson	FM-2331: near FM-4
Ftw04	Fort Worth	Palo Pinto	IH-20: near SH-193
Ftw05	Fort Worth	Parker	IH-20: near FM-113
Ftw06	Fort Worth	Parker	SH-199: near FM-2257
Ftw07	Fort Worth	Parker	SH-171: near FM-51
Ftw08	Fort Worth	Tarrant	IH-30 East: near SH-360
Ftw09	Fort Worth	Tarrant	IH-20 East: near SH-360
Ftw10	Fort Worth	Johnson	IH-35 west: near FM-917
Ftw11	Fort Worth	Somervell	US-67: near FM-199
Ftw12	Fort Worth	Palo Pinto	IH-20: near US-281
Ftw13b	Fort Worth	Jack	FM-2210: near SH-199
Ftw14	Fort Worth	Palo Pinto	SH-16: near FM-207
Ftw15	Fort Worth	Johnson	IH-35W: near US-67

2019 Texas Litter Survey

ID	District	County	Site Description
Ftw16	Fort Worth	Johnson	IH-35E: near Exit 391
Ftw17	Fort Worth	Hood	US-377: near SH-171
Hou03	Houston	Harris	SH-529: near SH-6
Hou04r	Houston	Harris	IH-10: near Exit 741
Hou05	Houston	Harris	IH-45: near W Parker Road
Hou06	Houston	Harris	IH-45: near FM-2920
Hou07	Houston	Harris	IH-10: near HARRIS COUNTY Line
Hou08	Houston	Harris	US-59: near SH-288
Hou09	Houston	Harris	SH-288: near US-90A
Hou11	Houston	Montgomery	FM-2854: near SH-105
Hou12	Houston	Harris	IH-10: near SH-8
Hou13r	Houston	Harris	IH-10: near SH-99
Hou14	Houston	Harris	US-90: near SH-8
Hou15	Houston	Waller	IH-10: near WALLER COUNTY Line
Hou16	Houston	Waller	US-290: near WALLER/ COUNTY Line
Hou17	Houston	Montgomery	SH-249: near HARRIS/ COUNTY Line
Hou18	Houston	Montgomery	IH-45: near the MONTGOMERY COUNTY line
Hou21	Houston	Montgomery	FM-1314: near SH-242
Hou22	Houston	Montgomery	FM-2090: near US-59
Hou25	Houston	Fort Bend	SH-36: near FM-361
Hou26	Houston	Galveston	IH-45: near FM-646
Hou27	Houston	Montgomery	IH-45: near FM-830
Hou28	Houston	Fort Bend	US-59: near Williams Way
Hou29	Houston	Fort Bend	US-59: near FM-2919
Hou30	Houston	Harris	IH-10: near SH-99

2019 Texas Litter Survey

ID	District	County	Site Description
Hou31	Houston	Galveston	IH-45: near SH-275
Hou32	Houston	Montgomery	SH-105: near Millmac Rd
Hou33	Houston	Galveston	SH-146: near SH-197
Hou34	Houston	Fort Bend	FM-723: near FM-359
Hou35	Houston	Brazoria	FM-2004: near FM-523
Hou36	Houston	Waller	FM-1488: near FM-1736
Hou37	Houston	Harris	IH-10: near FM-526
Hou38	Houston	Montgomery	IH-45: near Exit 103
Hou39	Houston	Fort Bend	SH-36: near FM-442
Ldo01	Laredo	Kinney	US-90: near FM-693
Ldo02	Laredo	La Salle	IH-35: near FM-469
Ldo03	Laredo	La Salle	IH-35: near SR 44
Ldo04	Laredo	Webb	IH-35: near Mile Marker 25
Ldo05	Laredo	Kinney	US-90: near FM-1572
Ldo06	Laredo	Val Verde	SH-163: near US-90
Ldo07	Laredo	Dimmit	SH-85: near FM-65
Lub01	Lubbock	Hockley	SH-114: near FM-303
Lub02	Lubbock	Lubbock	FM-179: near US-82
Lub03	Lubbock	Terry	US-385: near Ranch Road 2196
Lub04	Lubbock	Lubbock	IH-27: near exit 14
Lub05	Lubbock	Swisher	IH-27: near exit 77
Lub06	Lubbock	Castro	SH-194: near SH-86
Lub07	Lubbock	Lynn	FM-1054: near FM-213
Lub08	Lubbock	Floyd	FM-788: near FM-2301
Luf03	Lufkin	San Jacinto	US-59: near LIBERTY COUNTY Line

2019 Texas Litter Survey

ID	District	County	Site Description
Luf04	Lufkin	Polk	SH-146: near City of Livingston
Luf06	Lufkin	Shelby	US-84: near FM-1970
Luf07	Lufkin	San Augustine	FM-2213: near Texas Avenue
Luf08	Lufkin	Nacogdoches	US-259: near US-59
Luf09	Lufkin	Houston	US-287: near FM-227
Luf10	Lufkin	Angelina	SH-63: near SH-147
Oda01	Odessa	Ector	IH-20: near US-385
Oda03	Odessa	Ward	SH-18: near Ranch Road -1219
Oda04	Odessa	Pecos	US-285: near FM-1776
Oda05	Odessa	Midland	IH-20: near Exit 136
Oda06	Odessa	Ector	IH-20: near Exit 101
Oda07	Odessa	Reeves	US-285: near FM-1450
Oda08	Odessa	Martin	SH-176: near SH-349
Oda09	Odessa	Pecos	SH-18: near IH-10
Oda10	Odessa	Pecos	US-285: near FM-1776
Phr01	Pharr	Brooks	US-281: near FM-3066
Phr02	Pharr	Hidalgo	SH-107: near FM-493
Phr03	Pharr	Willacy	FM-1762: near US-77
Phr04	Pharr	Starr	US-83: near Blanca Road
Phr05	Pharr	Brooks	US-281: near FM-1418
Phr06	Pharr	Hidalgo	FM-490: near FM-1425
Phr07	Pharr	Brooks	US-281: near FM-755
Phr08	Pharr	Zapata	US-83: near FM-2687
Phr09	Pharr	Cameron	US-83: near Guadalupe Flores Road
Phr10	Pharr	Willacy	SH-186: near FM-1420

2019 Texas Litter Survey

ID	District	County	Site Description
Phr11	Pharr	Brooks	FM-755: near US-281
Prs01	Paris	Lamar	US-82: near FM-38
Prs02	Paris	Lamar	SH-19: of the DELTA COUNTY Line
Prs04	Paris	Hopkins	IH-30W: near SH-19
Prs05	Paris	Red River	FM-114: near FM-44
Prs06	Paris	Hopkins	IH-30: near Exit 137
Prs07	Paris	Red River	SH-37: near US-82
Prs08	Paris	Lamar	FM-195: near FM-2648
Sat02	San Antonio	Comal	IH-35: near HAYS COUNTY Line
Sat03	San Antonio	Bexar	SH-16: near IH-410 Loop
Sat05	San Antonio	Comal	FM-3009: near FM-2252
Sat06	San Antonio	Bexar	US-181: near SH-122
Sat07	San Antonio	Bexar	US-87: near FM-1628
Sat08	San Antonio	Bexar	IH-35: near FM-Loop 1604
Sat09	San Antonio	Bexar	IH-10/US-90: near FM-1518
Sat10	San Antonio	Guadalupe	SH-123: near HAYS COUNTY Line
Sat11	San Antonio	Kerr	IH-10: near Mile Marker 522
Sat12	San Antonio	McMullen	SH-72: near SH-16
Sat13	San Antonio	Guadalupe	IH-10: near FM-1104
Sat14	San Antonio	Atascosa	IH-37: near FM-1099
Sat15	San Antonio	Frio	FM-140: near FM-472
Sat16	San Antonio	Frio	IH-35: near Exit 111
Sat17	San Antonio	Bexar	IH-410: near Southton Road
Sat18	San Antonio	Frio	US-57: near FM-140
Sjt02	San Angelo	Tom Green	US-87: near FM-2105

2019 Texas Litter Survey

ID	District	County	Site Description
Sjt03	San Angelo	Irion	FM-853: near US-67
Sjt04	San Angelo	Crockett	IH-10: near Exit 372
Sjt05	San Angelo	Irion	SH-163: near US-67
Tyl01	Tyler	Cherokee	FM-747: near US-79
Tyl02	Tyler	Gregg	SH-300: near Spur 281
Tyl03	Tyler	Henderson	SH-19: near FM-2709
Tyl04	Tyler	Smith	US-69: near IH-20
Tyl05	Tyler	Van Zandt	IH-20: near FM-1255
Tyl06	Tyler	Rusk	US-259: near FM-3310
Tyl07	Tyler	Van Zandt	US-80: near SH-19
Tyl08	Tyler	Cherokee	FM-241: near SH-21
Tyl09	Tyler	Smith	FM-849: near IH-20
Tyl10	Tyler	Smith	FM-850: near SH-31
Wac03	Waco	McLennan	US-84: near SH-317
Wac04	Waco	McLennan	SH-6: near FM-185
Wac05	Waco	McLennan	IH-35: near FM-308
Wac06	Waco	Bosque	FM-2490: near CR 3650
Wac07	Waco	McLennan	IH-35: near US-77
Wac08	Waco	Hamilton	SH-22: near FM-1602
Wac09	Waco	Hill	IH-35: near FM-1242
Wac10	Waco	McLennan	IH-35: near FM-434
Wac11	Waco	Coryell	US-84: near FM-116
Wac12	Waco	Bosque	SH-22: near SH-6
Wfs01	Wichita Falls	Cooke	IH-35: near FM-1306
Wfs02	Wichita Falls	Wichita	US-287: near FM-369

ID	District	County	Site Description
Wfs03	Wichita Falls	Wichita	IH-44: near US-287
Wfs04	Wichita Falls	Archer	FM-368: near US-277
Ykm01	Yoakum	Jackson	US-59: near FM-234
Ykm02	Yoakum	Victoria	SH-185: near US-59
Ykm03	Yoakum	Wharton	FM-102: near US-59
Ykm04	Yoakum	Austin	IH-10: near SH-36
Ykm05	Yoakum	Fayette	IH-10: near Mile Marker 670
Ykm06	Yoakum	Lavaca	FM-155: near US-90 Alt.
Ykm07	Yoakum	Victoria	FM-616: near US-87

Appendix E – Company Background

Environmental Resources Planning, LLC focuses exclusively on litter-related research, studies, surveys and technical assessment reports. Our staff led litter surveys and studies in the Anacostia Watershed, Georgia, Honolulu, Maine, Malibu, New Hampshire, New Jersey, North Carolina, Oakland, Ohio, Rhode Island, San Francisco, Santa Monica, Tennessee, Texas, Toronto, Vermont, Virginia and Washington, D.C. in addition to leading the Keep America Beautiful 2009 National Litter Survey and Litter Cost Study.

Field crews under our direction have surveyed more than 40 million square feet of roadways and recreational areas across North America. Our senior staff has authored a number of key litter-related publications including "Litter: Literature Review" for Keep America Beautiful. Our litter-related work has been featured in National Geographic, Time and the New York Times as well as on NPR and ABC's Good Morning America.

The 2019 Texas Litter Survey was led by Steven R. Stein. The statistical aspects of this project were overseen by Dr. Ron Visco, who holds a Ph.D. in Research Design and Statistics. The field work planning was overseen by Emilie Knapp and Kristian Ferguson. Each of these senior staff has worked on at least 15 litter surveys.

For further information, visit: www.erplanning.com

Steven R. Stein, Principal
Environmental Resources Planning, LLC
624-B Main Street
Gaithersburg, MD 20878

Office: (240) 631-6532

sstein@erplanning.com

ER PLANNING

