
Washington State Litter Study




Volume Two – Litter Generation and Composition Report



Washington State Department of Ecology
Solid Waste & Financial Assistance Program

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Washington State Litter Study



Volume Two – Litter Generation and Composition Report

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Executive Summary

1. OVERVIEW OF LITTER STUDY

The 1998 Litter Act directed the Washington State Department of Ecology to conduct a statewide litter study. The goal of the litter study was to provide current and reliable data about:

- The distribution, amount, and composition of litter;
- Who is most likely to generate litter;
- Why those Washington residents who litter engage in this behavior; and
- What prevention strategies could be employed to reduce the amount of litter.

The current study relied on three different methods to gather data about littering:

- **Field research and sampling** to determine the generation rate and the composition of litter along roads and in selected public areas in Washington;
- **Focus groups** targeting admitted or potential litterers, designed to collect qualitative data regarding why Washington residents litter and to investigate litter prevention strategies; and
- **A telephone survey** of the general population to collect quantitative data regarding the types of people and situations that create littering behavior, and to test litter prevention messages.

The following sections summarize the objectives, methodology, and results of the field research and sampling.

2. OBJECTIVES OF FIELD RESEARCH AND SAMPLING

The objectives of the field research and sampling study were three-fold:

- To produce statistically valid data reflecting the overall annual amount, distribution and composition of litter in the state of Washington;
- To design and document a sampling methodology that would permit replication of the study in the future; and
- To draw conclusions about littering behavior in order to guide prevention and clean-up efforts.

3. SUMMARY OF THE METHODOLOGY

The method for the litter generation and composition study involved three steps. First, a comprehensive sampling plan was developed with input from stakeholders. Second, samples in three categories of sites were collected and their component materials were sorted and weighed. Third, samples were analyzed to determine their composition and the generation rates within the state on an annual basis.

Three principal site categories were defined for the study: *roadways*, *highway interchanges*, and *public areas*. Within each of these site categories, a number of subcategories also were defined as follows:

- **Roadways** were subdivided into interstate highways, state routes, and county roads.
- **Interchanges** included all interchanges along interstates and state routes.
- **Public Areas** were subdivided into parks (state and county), public access areas (Department of Natural Resource lands and Department of Fish & Wildlife lands), and rest areas.

Roadway subcategories and interchanges were further classified as urban and non-urban in order to identify differences between littering in urban and non-urban areas.

For roadways and interchanges, litter was collected from the sampling sites three times during the study year: an initial clean-up and two seasonal samples. For public areas, litter was collected from the sampling sites during two one-month periods, each with an initial cleaning at the beginning of the month. After litter was collected, it was sorted into litter component categories (e.g. paper beverage containers, metal automotive parts, cigarettes, etc.) and weighed. The resulting composition and weight information was entered into a database and analyzed to produce this report.

4. KEY FINDINGS

Litter generation and composition results are summarized below. Notable findings within the roadway, interchange, and public areas categories are discussed in Sections 4.1, 4.2, and 4.3, respectively. Overall findings are discussed in section 4.4.

4.1 ROADWAYS

- In Washington, almost one ton of litter accumulates each year along a typical mile of interstate highway. In urban areas accumulation rates on interstate highways approach 1.5 tons per mile.
- Litter generation rates for state routes and county roads are much lower than for interstates. State routes generate about 475 pounds per mile each year; county roads generate slightly more than 300 pounds per mile per year.
- Glass beverage containers constitute the largest single litter item by weight along roadways (all road categories combined), approximately 24% of the composition. (While glass beverage containers are the largest component by weight, the volume of glass beverage containers is actually less than the corresponding volume of aluminum cans and plastic beverage containers.)
- Wood products, other organics (including yard debris, stumps, firewood, branches and prunings, but excluding food and pet waste), tires and other metal/composite materials comprise approximately 35% of roadway litter; together with glass beverage containers, these materials make up almost 60% of litter along the state's roadways.
- On interstates, tires are the largest category of litter (nearly 25%). Metal and plastic automotive parts also make up over 8% of interstate litter. Interstate highways have a much higher volume of vehicle traffic per mile than county and state roads, which may explain the greater volume of tire and automotive litter.
- Glass beverage containers and tires represent a greater proportion of litter on non-urban roadways (including interstates, state routes, and county roads) than on urban roadways. Wood products comprise a greater percentage of litter on urban interstates and state routes than on non-urban interstates and state routes.

4.2 INTERCHANGES

- During a year, an average of about 2,500 pounds of litter accumulates within interchanges; 45% more litter accumulates on urban interchanges than on non-urban interchanges.

- Within interchanges, wood products and “other organics” are the largest litter components (about 15% each). Glass beverage containers, tires, and metal automotive parts also represent a substantial portion of litter. Combined, these five items constitute over 58% of interchange litter.

4.3 PUBLIC AREAS

- Public access areas (Department of Fish & Wildlife and Department of Natural Resources lands) accumulate more litter per acre of high-use area than do parks and rest areas.
- The main litter items in public areas mirror those found along roadways and in interchanges, with the exception of tires which were less common. Wood products, glass beverage containers and other organics account for approximately 35% to 50% by weight of all litter in these areas.
- Other significant components of public area litter include food, metal automotive parts, textiles, paper fast-food items, and cigarettes. Each of these items constitutes 5% or more of public area litter.

4.4 OVERALL FINDINGS

ONE-THIRD OF ROADSIDE WASTE IS NOT PERCEIVED AS "LITTER"

Wood and wood products, other organics (including items such as yard debris, stumps, firewood, branches and prunings, but excluding food and animal wastes) automotive parts and tires together make up approximately 33% of litter along Washington's roadsides. These items are also notable litter components in the state's public areas. According to citizen surveys, these items are not typically considered to be litter.

MUCH OF THE STATE'S ROADSIDE LITTERING MAY BE ACCIDENTAL

Items associated with driving vehicles or hauling uncovered loads (tires, wood products, other metal and composites, automotive parts and other organics, including items such as yard debris, stumps, firewood, branches and prunings) comprise almost 40% of roadside litter. These items are not necessarily the result of deliberate littering; they are more likely to result from “accidental” littering such as material falling from unsecured loads.

MORE LITTER ACCUMULATES IN URBAN AREAS

More litter accumulates along urban roadways and interchanges than on non-urban roadways and interchanges. Litter generation along urban interstate highways approaches 1.5 tons per mile each year; this is about twice the amount generated along non-urban interstates. State routes in urban areas generate about 1.0 tons of litter per mile; only 0.13 tons per mile are generated along non-urban state routes. Also, urban interchanges accumulate 45% more litter than do non-urban interchanges. This is most likely due to the higher volume of vehicles using these roads and interchange areas.

LITTER IS NOT JUST A ROADSIDE PROBLEM

High-activity areas in county parks, public access areas, and rest areas accumulate more litter per acre each year than roadways do. While vehicles are the primary mode of access to these areas, non-driving activities such as walking, boating, fishing and picnicking may generate the majority of litter at these sites. The composition of litter at some of these sites also suggests the possibility of illegal dumping.

Litter Generation & Composition Report

1. *OVERVIEW OF THE LITTER STUDY*

In 1997, a Litter Task Force was created to evaluate Washington's litter collection and prevention systems. Recommendations from the Task Force were incorporated into the 1998 Litter Act. One of the provisions of this legislation directs the Washington State Department of Ecology to conduct a statewide litter survey, which is to be used to guide prevention and clean-up efforts. Previous litter surveys were conducted in 1982, 1983, 1985, 1987, and 1990. The Task Force concluded that previous data may not be representative of today's situation, although it recommended that the goals of previous surveys be carried forward. Specifically, the goals were to collect "usable data on current litter volumes, composition, sources, the groups contributing to the problem, effectiveness of litter prevention, and levels of littering in different areas of the state."

This study was designed to achieve the Task Force's goals by using three different methods to gather data about littering:

- **Field research and sampling** to determine the generation and composition of litter along roads and in selected public areas in Washington;
- **Focus groups** targeting admitted or potential litterers, designed to collect qualitative data regarding why Washington residents litter and to investigate litter prevention strategies; and
- **A telephone survey** of the general population to collect quantitative data regarding the types of people and situations that create littering behavior, and to test litter prevention messages.

This report describes the field research and sampling portion of the litter study. The focus group and telephone survey activities are documented in separate reports. Supplemental information including Litter Component Categories and Definitions, the Sampling Methodology, the Sampling Site Directory, Composition Calculations, Composition Results by Subcategory, the Field Training Manual, and all the Field Forms are compiled in Appendices A through G.

Chapter 70.93 of the Revised Code of Washington defines litter as "all waste material including but not limited to disposable packages or containers thrown or deposited as herein prohibited and solid waste that is illegally dumped, but not including the wastes of the primary process of mining, logging, sawmilling, farming or manufacturing." This definition is applied throughout the study. It is important to note that illegally dumped materials are included in the state's definition of litter. Illegal dumps themselves were not included in the study. However, if illegally dumped materials were found within the study area, they were included in the composition analysis.

The objectives of this report are listed in Section 2. A summary of the methodology is presented in Section 3. Detailed generation and composition results are found in Sections 4 and 5, respectively. Overall results are presented in Section 6.

2. *OBJECTIVES OF THE LITTER GENERATION AND COMPOSITION REPORT*

The objectives of the field research and sampling study were three-fold:

- To produce statistically valid data reflecting the overall annual amount, distribution and composition of litter in the state of Washington;

- To design and document a sampling methodology that would permit replication of the study in the future; and
- To draw conclusions about littering behavior in order to guide prevention and clean-up efforts.

3. SUMMARY OF METHODOLOGY

Developing the methodology for the litter generation and composition study involved many steps and challenges which are described in detail in Appendix B. Three primary phases were identified:

- Designing a comprehensive sampling plan (Section 3.1);
- Collecting, sorting and weighing the litter (Section 3.2); and
- Analyzing the results (Section 3.3).

3.1 SAMPLING PLAN

Cascadia Consulting Group developed a sampling plan in association with Cunningham Environmental Consulting, E. Ashley Steel Consulting, and staff from the Department of Ecology's Solid Waste and Financial Assistance Program. The plan was reviewed by stakeholder groups including the Washington State Litter Task Force and the Committee for Litter Control and Recycling.

A sampling strategy was designed to incorporate litter samples from representative areas across the state. The design team first selected site categories to be included in the study. A number of factors and limitations governed the selection of site categories. It was essential that they:

- be similar to areas sampled in previous studies;
- provide information about diverse littering behaviors;
- be accessible to the general public;
- represent areas where litter typically accumulates;
- be accessible during different times of the year;
- represent a known "universe" (meaning that the size and quantity statewide is known)¹;
- be physically safe for collection crews to sample; and
- conform to the Department of Ecology's timeframe and resource constraints.

Three principal site categories were defined: roadways, highway interchanges (on and off ramps), and public areas. Within these three categories, a number of subcategories were also defined that represent common sites for littering both from driving and from non-driving or pedestrian behaviors:

- **Roadways** was divided into interstates, state routes, and county roads.
- **Interchanges** was not divided into subcategories, but was defined to include both "on" (entrance) and "off" (exit) ramps along interstates and state routes.
- **Public areas** was divided into parks (state and county), state-owned recreational public access areas, and highway rest areas.

¹ "Universe" refers to the total "set" or value of that being measured; i.e. all possible interstate miles in Washington would comprise the "universe" of interstate miles.

The design team considered many other site categories, but due to the factors listed above, the study had to be limited. As a consequence, other categories such as city streets, forest service roads, city parks, schoolyards, fairgrounds, and stadiums, were not included.

Once site categories were selected, the design team identified actual sample areas within each category. Individual sample areas were selected randomly within each site category, not geographically. However, some site categories were further divided into urban and non-urban areas, in order to identify differences in litter and littering between the two². Each roadway subcategory and the interchange category were divided to include urban and non-urban areas. Public areas were not divided into urban and non-urban because fewer than ten recreational public access areas are found in urban areas, and only two of the 41 rest areas are located in urban areas. Table 3-1 provides a summary of the site categories and their respective subcategories.

Table 3-1 Site Category and Subcategory Descriptions

Primary Site Category	Subcategory	Further Subcategories
Roadways	Interstates	Urban interstates
		Non-urban interstates
	State routes	Urban state routes
		Non-urban state routes
	County roads	Urban county roads
		Non-urban county roads
Interchanges	Interchanges	Urban interchanges
		Non-urban interchanges
Public Areas	Parks	State parks
		County parks
	Public access areas	Department of Fish & Wildlife recreational access areas
		Department of Natural Resources lands (campgrounds and trails)
	Rest areas	(No further subcategory)

An equal number of samples was selected in each subcategory (26 sample areas per subcategory as listed in Table 3-1). Once the “universe” of sites for each site category was defined, sample areas were randomly selected.³ When determining sample area size, the design team identified the amount of area needed to obtain 100-150 pounds of litter while also considering other environmental and logistical factors.⁴ This process is detailed in Appendix B and a listing of the sample areas that were selected is in Appendix C. Illustrations of the sample areas can be found in the Training Guide, in Appendix F. The sample areas were defined as follows:

² For the purposes of this study, the U.S. Census Bureau’s definition of an “urban area” was used. According to the Census Bureau, “an urban area comprises one or more places (central place) and the adjacent densely surrounding area (urban fringe) that together have a minimum of 50,000 persons. The urban fringe generally consists of contiguous territory having a density of at least 1,000 persons per square mile.” A “non-urban area” is any place outside the urban areas.

³ Random selection was used to prevent bias and to ensure that each possible sample area had an equal chance of being selected for study.

⁴ Other waste audit research suggests that 100-150 pounds of litter is needed for a representative sample.

- **Roadways:** All roadway sample areas were cross-sections, including both shoulders and the median if present. Urban interstate, urban state route, and urban county road sample areas were one tenth of a mile in length. Non-urban interstate sample areas were one-half mile long. Non-urban state route and county road sample areas were one mile long.
- **Interchanges:** Interchange sites usually included an on ramp, an off ramp, and a portion of the median.
- **Public areas:** The sample areas included high-use areas, which in some cases included the entire site.⁵

In attempt to account for seasonal variations and to minimize interference with routine litter collection activities during the sampling period, two different cleaning schedules were devised. Each schedule included an initial clean-up, when all the litter from each sample area was collected and disposed of; and a sample period, when the litter that had accumulated (since the initial clean-up) was collected for analysis. For **roadways** and **interchanges**, litter was collected from each sampling area three times: an initial clean-up and a spring and a fall sample collection⁶. The accumulation period between samples was approximately five months. For **public areas**, litter was collected from each sampling area during two one-month periods, each with an initial clean-up at the beginning of the month and a sample collection three to four weeks later.⁷ Both collection schedules were designed to provide comparable accumulation times for the wet season and the dry season and to minimize complications due to snow.

3.2 COLLECTION AND SORTING OF SAMPLES

Litter samples were collected between October 1998 and October 1999 by Department of Ecology Youth Corps (EYC) crews with assistance from Washington Departments of Transportation, Corrections, Natural Resources, and the Parks and Recreation Commission (State Parks). County parks departments and some local community crews also assisted. Each sample of litter was carefully labeled (“tagged”) by the crews, then transported to regional storage locations.⁸

Once each collection period was completed, all the samples were transported to sorting locations in Tacoma, Spokane, or Lacey. There, Sky Valley Associates, a professional waste audit company, sorted, weighed, and tabulated the litter into component categories (e.g., paper beverage containers, metal automotive parts, cigarettes, etc.). Throughout the course of the study, 356 samples, weighing a total of 21.7 tons, were collected. For details, please see Appendix B.

3.3 DATA ANALYSIS

The roadway subcategories surveyed in this study (interstate highways, state routes and county roads) represent the majority of roadways with high traffic volume and high speeds in the state. The combined data from the sampled roadway sites provide a general picture of overall statewide litter on roadways. Interchange data represent all interchanges in the state. Certain limitations were

⁵ Some public areas included many acres inaccessible to the public. For this reason, the sample areas were limited to “high-use” areas such as parking lots, campsites, and trailheads.

⁶ The word “sample” is used throughout this report to mean a quantity of litter collected from a sample area that was sorted and for which results were tabulated.

⁷ For public health reasons, aesthetic concerns, storage limitations, and other logistical constraints, litter could not be left at public areas for more than one month.

⁸ The litter samples were stored at landfills and transfer stations across the state.

identified during the course of the study that should be considered when viewing the results. These include the following:

- *Site interference*
While the Department of Ecology attempted to communicate with all groups that routinely or voluntarily collect litter from around the state, some of the groups may have removed litter from selected sites during the course of the study. As a result, litter accumulation rates may have been underestimated.
- *Items not recorded*
For safety reasons, collection crews were instructed to leave certain items on site, such as hazardous materials, explosives, “trucker bottles” (urine-filled bottles), knives, firearms, tissues containing human waste, and extra large items. These items were documented, but were not included in the composition data.

Public area data were not combined because the subcategories selected (state and county parks, recreational public access areas, and rest areas) represent only a small fraction of all public areas in the state. (Schools, fairgrounds, etc. were not included in the sampling.) Since the selected site categories do not represent *all* public areas in the state, the combined results may be misleading.

Litter generation rates were calculated for each of the thirteen site sub-categories by unit (mile, interchange, or acre) and for the total site category statewide (the “universe”).⁹ The average per-unit calculation was based on the total weights of the samples collected and sorted. The average total generation statewide was calculated using weighted averages. Weighted averages are explained in detail in Appendix B.

Composition estimates were calculated by weight (tons) and are presented as a percentage, which is how composition is typically reported in waste generation and composition studies. It is important to note that items with a higher unit weight (such as glass and wood) will typically constitute a larger percentage of the overall composition. However, the volume of these materials may be less than other litter components that have a lower unit weight (such as aluminum cans and plastic beverage containers.)

All composition and generation estimates were calculated using a 90% confidence interval. This means that there is a 90% certainty that the actual quantity is within the calculated range (between the low and high estimates).

4. DETAILED GENERATION RESULTS

The term “litter generation” refers to the quantity of litter that has accumulated over a specific time within a defined area. The quantity of litter generated per year was estimated for each site subcategory, both on a per unit basis (per mile for roads, per interchange for interchanges, and per high-use acre for public areas) and for a statewide total.

⁹ The thirteen subcategories are: urban interstates, non-urban interstates, urban state routes, non-urban state routes, urban county roads, non-urban county roads, urban interchanges, non-urban interchanges, state parks, county parks, Dept. of Natural Resource sites, Fish & Wildlife sites, and rest areas.

The generation results for each primary site category are presented in Section 4.1 for roadways, 4.2 for interchanges and 4.3 for public areas. Each of the following sections contains two tables: the quantity of litter generated per unit in pounds per year, and the total quantity of litter generated in each primary site category (roads, interchanges, and public areas) in tons per year. Following is a description of how each table was calculated:

- The amount of **litter generated per unit** was estimated for each of the thirteen site subcategories based on the total weights of the samples collected and sorted. Weighted averages were used to determine the average generation for the broader site categories (all roads combined, interstates, state routes, county roads, interchanges, state and county parks, recreational public access areas, and rest areas). The factors used for weighting included the number of road miles, interchanges, or acres of high-use areas defined in the universe of sites¹⁰. An explanation of weighted averages and a description of the “universe” are included in Appendix B.
- In order to calculate the **total tons** of litter generated per year for each category, the estimated per-unit generation was multiplied by the number of road miles, interchanges, or acres of high-use areas included in the universe.

In order to compare generation rates between site categories, the average annual quantity of litter generated per acre was also calculated for each of the categories. The values illustrated in Table 4-1 represent the average quantity of litter generated within an acre of roadside (including the median) for each road and interchange category¹¹, and within a high-use acre for public areas. In Table 4-1, the “total” pounds per acre per year for the roadway and interchange categories represents the weighted average between urban and non-urban roads.

¹⁰ An example of a weighted average is as follows: Litter generation on urban interstates is estimated to be 2,947 pounds per mile while the generation on non-urban interstates is estimated to be 1,534 pounds per mile. Since there are more non-urban interstate miles than urban, a weighted average must be used to calculate the average generation of litter per mile for interstates overall. Among the interstate miles included in this study, approximately 25% of the interstate miles are in urban areas while 75% are in non-urban areas. Thus the average generation rate for interstates overall is equal to:
 $(25\% \times 2,947) + (75\% \times 1,534)$, or roughly 1,884 pounds per mile per year.

¹¹ The rate of litter generation per acre for each road category was calculated by dividing the total amount of litter generated per year by the total acreage of roadside shoulders and medians in the universe. The total acreage of roadside shoulders and medians is equal to the average acreage of roadside shoulders and medians per mile (from the site measurements) multiplied by the number of miles in the universe of each category. For more information on the total number of miles in the universe of sites, please see Appendix B.

Table 4-1 Quantity of Litter Generated Per Acre, in Pounds per Year¹²

	<i>(Pounds per Acre per Year)</i>		
	Total	Urban	Non-Urban
Roads (Interstates, State Routes, & County Roads)	65		
Interstates	85	147	64
State Routes	54	137	43
County Roads	67	176	51
Interchanges	107	116	90
Public Areas			
State and County Parks	60		
State Parks	42		
County Parks	142		
Public Access (Fish & Wildlife and DNR)	470		
Fish & Wildlife	1,197		
DNR	366		
Rest Areas	125		

4.1 ROADWAYS

Roadway litter consists primarily of waste originating from moving vehicles. It includes litter presumably tossed from vehicles by drivers or passengers, parts that have fallen off vehicles, and litter from uncovered loads. To a much lesser extent, it reflects litter from pedestrians.¹³ Roadway litter generation was analyzed in three ways: generation per mile, total generation statewide, and generation per mile driven. Each of these is described below.

4.1.1 PER MILE GENERATION RATES

Table 4-2 shows the number of pounds of litter per mile that accumulates each year in the roadway categories. The greatest amount of litter accumulates on interstates; nearly one ton of litter accumulates each year along a typical interstate mile. Each year about a quarter of a ton of litter is discarded along each mile of state routes. Individually, urban interstates and urban state routes had the highest litter accumulation rates per mile per year, with an average of 2,947 pounds and 2,052 pounds, respectively (see Table 4-2). Non-urban county roads had the lowest accumulation rate (an estimated 221 pounds per mile per year)¹⁴.

As stated earlier, generation estimates detailed in the following tables were calculated using a 90% confidence interval. This means that there is a 90% certainty that the actual quantity is within the calculated range (between the low and high estimates). For example, an estimated 1,884 pounds of

¹² The 1,197 pound figure for Fish & Wildlife samples was affected by an outlier. This means one particular sample was extremely different from the other samples. If this sample was omitted from the calculations, the estimated generation rate would be similar to that of DNR.

¹³ Pedestrian traffic is prohibited from many of the interstate and state route miles in the state. There may be some pedestrian traffic on the county roads sampled as part of this study.

¹⁴ In the second sampling collection period, over 9,000 pounds of hay was collected from one non-urban interstate site. Because this sample was an anomaly, the total weight was reduced to the amount sorted for the generation and composition analyses.

litter are generated per interstate mile, plus or minus 280 pounds. In this case, the “calculated range” is between 1,604 and 2,164 pounds, with the most probable value – the mean – being 1,884 pounds per mile per year.

Table 4-2 Quantity of Litter Generated Per Mile on Roads (Interstates, State Routes, and County Roads), in Pounds per Year

Calculated at a 90% confidence interval

	<i>(Pounds per Mile per Year)</i>		
	Mean	Low	High
Interstates	1,884	1,604	2,164
Urban Interstates	2,947	2,238	3,657
Non-Urban Interstates	1,534	1,048	2,021
State Routes	475	389	561
Urban State Routes	2,052	1,136	2,967
Non-Urban State Routes	258	198	318
County Roads	312	223	401
Urban County Roads	929	528	1,330
Non-Urban County Roads	221	164	277
ROADS (Interstates, State Routes, & County Roads)	352	308	397

4.1.2 TOTAL GENERATION

Table 4-3 shows the total amount of litter generated per year on roads statewide.¹⁵ The figures in the table are greatly influenced by the total number of miles in each category. For example, the total estimated amount of litter generated in tons per year is larger for county roads because there are approximately 40,500 miles of county roads within Washington State (as compared to 600 miles of interstates and 6,200 miles of state routes). Non-urban county roads generate the most (an estimated 3,889 tons of litter per year), while urban interstates generate the least (an estimated 210 tons per year). Overall, an estimated 8,322 tons of litter is generated on interstates, state routes, and county roads annually.

¹⁵ The total tons statewide is calculated by multiplying the average pounds per mile, listed in Table 4-2, by the total number of miles in the state.

Table 4-3 Total Quantity of Litter Generated on Roads (Interstates, State Routes, and County Roads), in Tons per Year

Calculated at a 90% confidence interval

	<i>(Tons per Year)</i>		
	Mean	Low	High
Interstates	543	458	628
Urban Interstates	210	160	261
Non-Urban Interstates	333	227	438
State Routes	1,463	1,197	1,729
Urban State Routes	765	424	1,106
Non-Urban State Routes	698	536	860
County Roads	6,316	5,303	7,330
Urban County Roads	2,427	1,379	3,475
Non-Urban County Roads	3,889	2,894	4,883
ROADS (Interstates, State Routes, & County Roads)	8,322	7,719	8,925

4.1.3 GENERATION PER MILE DRIVEN

The total number of road miles in urban areas is less than non-urban areas (see Appendix B). However, traffic counts (the number of vehicles) in urban areas are higher than in non-urban areas. In order to account for the different volumes of traffic using urban and non-urban roads, litter generation rates per mile driven were calculated for interstates and state routes. Traffic counts were obtained from the *Washington State Department of Transportation 1998 Annual Traffic Report*.

Litter generation per mile driven incorporates the volume of traffic using the roads. Therefore, because there is more traffic in urban areas, one would expect more litter generated in urban areas than in non-urban areas. The data presented in Table 4-2 support this theory; the average pounds of litter generated per mile per year on urban roads exceeds that of non-urban roads in all three road categories.

Table 4-4 shows that for every 1,000 miles driven by vehicles using interstate highways, an average of 0.08 pounds of litter will be generated¹⁶. The generation rate on state routes was much higher with an average of 0.19 pounds of litter generated per 1,000 miles driven on state routes.

¹⁶ The amount of litter generated per mile driven was calculated for each site category by dividing the total amount of litter generated per year by the total number of miles driven on interstate or state highways per year.

Table 4-4 Quantity of Litter Generated per Mile Driven, in Pounds per 1000 Miles Driven

	Litter generated per Year (lbs)	Miles Driven per Year (in thousands)	Litter generated per mile driven (lbs/1 000 miles)
Interstates	1,086,079	14,184,131	0.08
Urban Interstates	420,572	9,778,155	0.04
Non-urban Interstates	665,507	4,405,976	0.15
State Routes	2,925,781	15,135,984	0.19
Urban State Routes	1,529,477	7,637,774	0.20
Non-Urban State Routes	1,396,304	7,498,210	0.19

On interstate highways, littering per vehicle mile driven is greater in non-urban areas than in urban areas. It may be that people are less likely to litter in urban areas where the likelihood of being seen or apprehended is higher; or they may perceive that littering in non-urban areas is less harmful.

4.2 INTERCHANGES

Litter from interchanges originates primarily from vehicles that are entering or exiting roadways. It also may represent litter discarded on overpasses.

4.2.1 PER INTERCHANGE GENERATION RATES

As with roads, the average pounds of litter generated per interchange per year were greater in urban areas than in non-urban areas. As illustrated in Table 4-5, urban interchanges generated an average of 2,859 pounds of litter per year, while non-urban interchanges generated an average of 1,965 pounds of litter per year.

Table 4-5 Quantity of Litter Generated per Interchange, in Pounds per Year

Calculated at a 90% confidence interval

	<i>(Pounds per Interchange per Year)</i>		
	Mean	Low	High
Interchanges	2,565	2,168	2,962
Urban Interchanges	2,859	2,237	3,480
Non-urban interchanges	1,965	1,377	2,552

4.2.2 TOTAL GENERATION

Table 4-6 indicates that almost three times as much litter was deposited on urban interchanges (462 tons) than on non-urban interchanges (155 tons) per year. Combined, an estimated 617 tons was generated on interchanges overall.

Table 4-6 Total Quantity of Litter Generated on Interchanges, in Tons per Year

Calculated at a 90% confidence interval

	<i>(Tons per Year)</i>		
	Mean	Low	High
Interchanges	617	541	693
Urban Interchanges	462	361	562
Non-Urban Interchanges	155	109	202

4.3 PUBLIC AREAS

Public area litter is generated by people arriving in their vehicles and using these selected areas. For public areas, litter was only collected from the most heavily used areas, and thus quantity estimates reflect only the estimated generation in “high-use” areas (as opposed to the entire state park, rest area, etc.) For example, Lake Sylvia State Park has a total area of 234 acres, but only 33 acres are considered “high-use”; therefore, litter was collected from the 33 “high-use” acres. A sum of all public areas was not calculated because parks, public access areas and rest areas do not represent all the state’s public areas, and to combine them would be misleading. (Other public areas might include public schools, stadiums, fairgrounds, etc.) However, general comparisons can be made among all the sampled categories.

4.3.1 PER PUBLIC AREA GENERATION RATES

As Table 4-7 indicates, public recreational access areas, Fish & Wildlife sites in particular, had the highest litter accumulation rate of all public areas sampled, nearly 470 pounds of litter per acre per year. Among the sampled categories, Fish & Wildlife sites had the highest annual generation rate (1,197 pounds per high-use acre¹⁷) while state parks had the lowest generation rate (42 pounds per high-use acre). The higher figures at the public recreational access areas may be linked to the occurrence of illegal dumping or lack of oversight by staff (many of these sites are unmanned).

Table 4-7 Quantity of Litter Generated per High-Use Acre, in Pounds per Year

Calculated at a 90% confidence interval

	<i>(Pounds per High Use Acre per Year)</i>		
	Mean	Low	High
State and County Parks	60	38	83
State Parks	42	26	58
County Parks	142	0	301
Public Access (Fish & Wildlife and DNR)	470	307	632
Fish & Wildlife	1,197	0	2,678
DNR	366	203	528
Rest Areas	125	92	158

4.3.2 TOTAL GENERATION

As in the other categories, the total amount of litter generated statewide for each site category is affected by the total number of acres (or miles) that exist in that category (in the “universe”). State parks generated more litter than the other public area categories, because they typically had more total acres of high-use areas. As Table 4-8 shows, the total average quantity of litter for state parks was 1,452 tons per year, while total average quantity of litter for rest areas was 14 tons per year.

¹⁷ There appeared to be an outlier among the Fish & Wildlife samples (a sample with a particularly large amount of litter generated per high-use acre). If this sample was omitted from the calculations, the estimated generation rate would be similar to that of DNR.

Table 4-8 Total Quantity of Litter Generated in High-Use Areas, in Tons per Year

Calculated at a 90% confidence interval

	<i>(Tons per Year)</i>		
	Mean	Low	High
State and County Parks	2,536	1,114	3,958
State Parks	1,452	333	2,571
County Parks	1,084	0	2,790
Public Access (Fish & Wildlife and DNR)	496	206	786
Fish & Wildlife	158	0	371
DNR	338	0	701
Rest Areas	14	8	21

5. DETAILED COMPOSITION RESULTS

Litter “composition” refers to the types of materials found in the litter (e.g. paper fast-food waste or glass beverage containers). For this study, the litter was classified into one of eight broad material categories: paper, plastic, glass, metal, organics, CDL (construction and demolition debris, otherwise known as C&D)¹⁸, and other materials. Within these broad material categories, the litter was further divided into various subcategories, called components, such as fast-food wastes, beverage containers, tires, etc. A total of 58 component categories of litter were identified for this study. The components were selected to gather information about different types of litter, its source, and littering behavior. The list of subcategories within each of the broad material types and their definitions can be found in Appendix A, “Litter Component Categories.”

To ensure the safety of both the collection and sorting crews, crews were instructed to leave certain items on site, such as hazardous materials, explosives, “trucker bottles” (urine-filled bottles), knives, firearms, hypodermic needles, tissues containing human waste, and extra large items. These items were documented, but were not included in the composition data. A tally of these items is detailed in Appendix B. In general, closed bottles containing liquids (including “trucker bottles”), condoms, and needles were found most frequently along roads and interchanges and in public areas.

The composition of litter was estimated for each broad material category (glass, paper, etc.) and subcategory based on weight. Typically, solid waste is measured by weight. Because of this, items with a higher weight per unit (such as glass beverage containers) will constitute a higher percentage of litter. For example, a cubic yard of glass bottles weighs from 600 to 1000 pounds, while a cubic yard of aluminum cans weighs just 50 to 75 pounds. Likewise, a cubic yard of mixed plastic bottles averages from 32 to 38 pounds. Consequently, glass beverage containers may be a larger litter component by weight while aluminum cans and plastic beverage containers may actually have a greater volume than the corresponding glass. Composition of litter along roadways illustrates this point. For roadways (interstates, state routes and county roads) the combined weight of glass beverage containers is equivalent to approximately 4,900 cubic yards; the volume of aluminum cans and plastic bottles is about 11,400 cubic yards and 7,500 cubic yards respectively. Table 5-1 lists weight to volume conversion factors and is included to allow the reader to make similar comparisons.

¹⁸ For the purposes of this study, CDL is used to refer to construction and demolition debris only. Land-clearing debris was not included.

Table 5-1 Estimated Litter Volume and Count to Weight Conversion Factors¹⁹

Material	Volume/Count	Weight in Pounds
Cigarette butts	2,000	1
Cardboard	1 cubic yard	100
One-time fast-food service item*	1	0.2
Mixed plastic containers	1 cubic yard	32-38
Glass bottles	1 cubic yard	600-1,000
Aluminum cans	1 cubic yard	50-75
Auto battery	1	36
Tire, passenger car	1	20
Tire, light truck	1	35
Tire, semi truck	1	105
Wood chips	1 cubic yard	500
Grass clippings	1 cubic yard	400

* One-time fast-food service item includes a typical fast-food "to-go" waste stream: paper bag, paper cup with plastic straw, wrapper, and french fry container.

As with the generation estimates, each composition estimate was calculated at a 90% confidence interval. Also, weighted averages based on the universe of road miles, number of interchanges, and acres of high-use areas were used to calculate composition estimates for each site category. Detailed composition results for all thirteen site subcategories are presented in tables in Appendix E.

Section 5.1 summarizes the overall composition results, and sections 5.2, 5.3 and 5.4 explain the detailed results of roads, interchanges and public areas, respectively. In each section, a pie chart reflects the composition by the eight broad **material categories**. A table reflects the ten highest **components** for each site category. The tables also include the estimated total amount of each component generated annually, presented in tons. While the first table only lists the ten largest litter components for each site category, a second, more comprehensive table, lists the values for all 58 components.

5.1 OVERALL COMPOSITION

By weight, glass beverage containers, wood and wood products, and "other organics" (items such as yard debris, stumps, firewood, branches and prunings) consistently accounted for the highest percentage of litter in all site categories. Wood products and "other organics" are not considered typical litter. Among those items that are typically considered litter (such as beverage containers, fast-food items, and packaging), beverage containers comprise the highest percentage.

Table 5-2 shows that, over all site categories, beverage containers comprise 14.6% to 31.4% of the litter. One-time fast food service items comprise 1.9% to 11.3%, food and beverage packaging comprise 1.0% to 2.7%, and non-food packaging comprises 1.1% to 3.8%. In addition, automotive items comprise 3.6% to 17.2%, with the largest percentage in public recreational access areas, which suggests a high incidence of illegal dumping. "Other organics" accounted for 6.5% to 15.0% of the litter. See Appendix A for a detailed definition of each of these litter component items.

¹⁹ Conversions between weight and volume were calculated by Ecology and Cascadia Consulting Group using data from the National Recycling Coalition and the U.S. Environmental Protection Agency.

Table 5-2 Composition by Weight, All Site Categories, Selected Litter Components Combined²⁰

	Roads			Interchanges Interchanges	Public Areas		
	Interstates	State Routes	County Roads		State & County Parks	Public Access (DNR + F&W)	Rest Areas
Beverage Containers	14.6%	20.9%	31.4%	15.2%	21.3%	23.0%	18.4%
One-Time Fast Food Service Items	2.3%	3.3%	3.1%	2.5%	5.5%	1.9%	11.3%
Other Food and Beverage Packaging	1.0%	2.1%	2.7%	1.1%	2.7%	2.1%	2.5%
Non-Food Packaging	1.1%	1.9%	3.8%	3.0%	2.4%	1.9%	1.9%
Automotive	9.9%	8.2%	4.2%	9.3%	3.6%	17.2%	4.2%
Tires	24.7%	7.3%	7.5%	9.8%	3.4%	3.9%	4.5%
Wood/lumber/particle board	13.3%	13.0%	10.8%	15.5%	26.1%	5.1%	9.8%
Food (Human and Pet)	0.4%	5.0%	1.5%	0.9%	6.8%	2.0%	6.3%
Cigarettes and Other Tobacco	0.2%	0.6%	0.8%	0.9%	2.2%	0.4%	7.6%
Other Organics	12.3%	8.6%	10.2%	15.0%	6.5%	14.8%	14.5%
Total	79.8%	70.9%	76.2%	73.2%	80.4%	72.4%	80.9%

5.2 ROADS

Data from interstates, state routes and county roads were analyzed separately, and then combined to provide an overall picture of roads. Section 5.2.1 provides an overall picture of road litter composition, including a summary of the largest components. Following the overall assessment, each road subcategory is analyzed separately in greater detail.

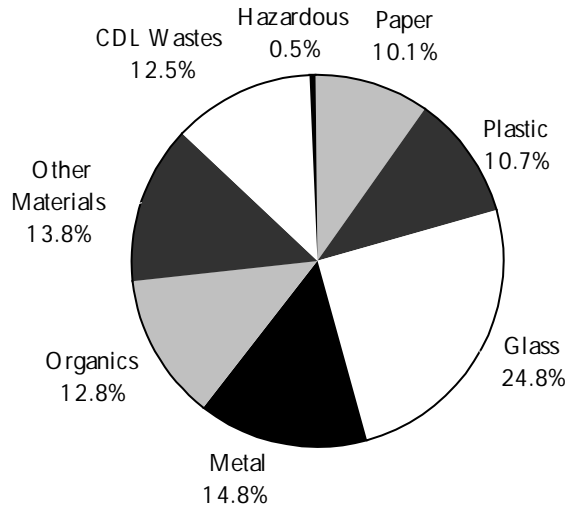
5.2.1 OVERALL ROADS (INTERSTATES, STATE ROUTES, AND COUNTY ROADS)

Figure 5-1 illustrates the composition of litter on overall roads (interstates, state routes, and county roads) by each of the broad material categories (paper, plastic, glass, etc.) Glass accounted for the highest percentage of litter (approximately 24%), while hazardous materials accounted for the lowest (nearly 1%). The other broad material categories (paper, plastic, metal, organics, "other materials,"²¹ and CDL) each accounted for about 10% to 15% of the litter deposited on overall roads.

²⁰ "Beverage containers" includes glass, plastic, paper and metal beverage containers. "One-time fast food service items" includes glass, plastic, paper and metal one-time fast food service items. "Other food & beverage packaging" includes glass, plastic, paper and metal other food and beverage packaging. "Non-food packaging" includes glass, plastic, paper and metal non-food packaging. "Automotive" includes plastic, glass and metal automotive parts, as well as auto rubber products (but not tires). "Other organics" includes yard debris, stumps, firewood, branches and prunings.

²¹ "Other materials" includes tires, auto rubber products, rubber and latex toiletries, other rubber and latex products, disposable diapers, textiles and leather, carpet, furniture/mattresses/appliances, ceramics and porcelain, toys and sporting goods, and other miscellaneous items.

Figure 5-1 Composition Summary Overall Roads (Interstates, State Routes, and County Roads)



5.2.1.1 LARGEST COMPONENTS

Table 5-3 illustrates the composition percentages of the ten largest components of litter found on overall roads (versus the broader material categories shown above in the pie chart) and the estimated tons generated in one year. The cumulative percentage column is the sum of each component’s composition percentage and those that are higher. The composition percentage for all 58 subcategories is shown in the next section in Table 5-4.

As shown in the cumulative percentage column, the ten largest litter components accounted for nearly three-fourths of the litter found on overall roads. Consequently, litter classified in the other 48 component categories comprised only about one-fourth of the litter deposited on overall roads. Glass beverage containers (23.7%), wood, lumber, and particleboard (11.1%), “other organics” (10.1%), and tires (7.7%) accounted for over half of the litter deposited on roadways (52.6%). Many of the items found on the road are not commonly associated with litter.

Table 5-3 Top 10 Largest Components by Weight, Overall Roads (Interstates, State Routes and County Roads)

Component	Composition Percent	Estimated Tons	Cumulative Percent
Glass Beverage Containers	23.7%	1974.4	23.7%
Wood /Lumber /Particleboard	11.1%	927.4	34.9%
Other Organics	10.1%	837.6	44.9%
Tires	7.7%	642.3	52.6%
Other Metal/Composite Materials	6.1%	507.5	58.7%
Metal Beverage Containers	4.2%	353.1	63.0%
Plastic Bags And Film	3.4%	283.1	66.4%
Metal Automotive Parts	2.6%	218.9	69.0%
Other Plastics/Composite Materials	2.6%	217.0	71.6%
Miscellaneous /Other	2.5%	208.9	74.1%

The detailed composition results of the litter collected along roadsides (including interstates, state routes, and county roads) are presented in Table 5-4. This table includes both the composition percentage and the estimated amount generated per year for each of the broad material categories and each of their component subcategories. The individual component categories are defined in Appendix A.

Table 5-4 Composition by Weight, Roads (Interstates, State Routes, and County Roads)

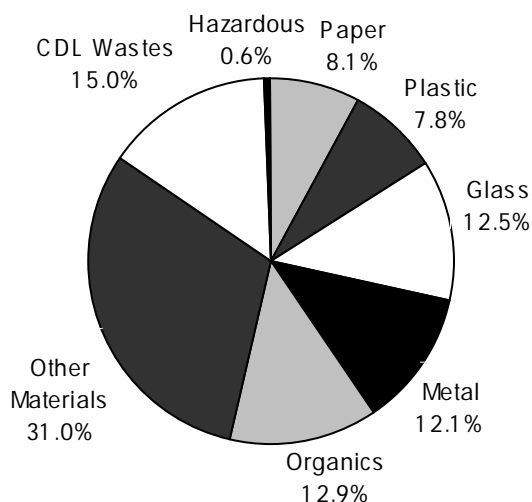
Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	840.1	10.1%			ORGANIC	1062.4	12.8%		
Beverage Containers	25.2	0.3%	0.2%	0.5%	Food (Human And Pet)	159.3	1.9%	1.0%	2.8%
One-Time Fast Food Service Items	203.6	2.4%	1.6%	3.3%	Cigarettes And Other Tobacco	65.5	0.8%	0.0%	1.7%
Other Food And Beverage Packaging	68.6	0.8%	0.5%	1.1%	Other Organics	837.6	10.1%	7.2%	12.9%
Non-Food Packaging	139.3	1.7%	0.1%	3.3%	CDL	1044.4	12.5%		
Other Cardboard Boxboard	180.4	2.2%	1.4%	3.0%	Wood /Lumber /Particleboard	927.4	11.1%	7.6%	14.7%
Paper Bags	72.4	0.9%	0.0%	1.9%	Mineral Aggregates	38.5	0.5%	0.0%	1.0%
Newspapers And Magazines	68.3	0.8%	0.5%	1.1%	Roofing	34.4	0.4%	0.0%	0.8%
Other Paper/Composite Materials	82.3	1.0%	0.6%	1.4%	Insulation	6.0	0.1%	0.0%	0.2%
PLASTIC	891.2	10.7%			Drywall	0.7	0.0%	0.0%	0.0%
Beverage Containers	132.2	1.6%	1.2%	1.9%	Other Construction / Demolition Debris	37.2	0.4%	0.2%	0.7%
One-Time Fast Food Service Items	47.9	0.6%	0.4%	0.8%	HAZARDOUS MATERIALS	41.2	0.5%		
Other Food And Beverage Packaging	56.1	0.7%	0.4%	0.9%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	74.4	0.9%	0.6%	1.2%	Oil Based Paints	0.9	0.0%	0.0%	0.0%
Plastic Bags And Film	283.1	3.4%	2.7%	4.1%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	80.5	1.0%	0.7%	1.3%	Batteries	15.0	0.2%	0.0%	0.4%
Other Plastics/Composite Materials	217.0	2.6%	1.6%	3.6%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	2065.7	24.8%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	1974.4	23.7%	18.1%	29.4%	Explosives	1.2	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.1	0.0%	0.0%	0.0%	Pesticides/Herbicides	2.2	0.0%	0.0%	0.1%
Other Food And Beverage Packaging	25.1	0.3%	0.0%	0.6%	Cleaners (Hazardous)	1.8	0.0%	0.0%	0.0%
Non-Food Packaging	6.3	0.1%	0.0%	0.1%	Medical Waste	1.2	0.0%	0.0%	0.0%
Automotive Parts	14.2	0.2%	0.0%	0.3%	Other	18.8	0.2%	0.1%	0.4%
Other Glass/Composite Materials	45.5	0.5%	0.0%	1.1%	OTHER MATERIALS	1148.8	13.8%		
METAL	1228.5	14.8%			Tires	642.3	7.7%	3.6%	11.9%
Beverage Containers	353.1	4.2%	3.5%	5.0%	Auto Rubber Products	86.2	1.0%	0.4%	1.7%
One-Time Fast Food Service Items	4.9	0.1%	0.0%	0.1%	Rubber /Latex Toiletries	7.0	0.1%	0.0%	0.2%
Other Food And Beverage Packaging	70.5	0.8%	0.3%	1.4%	Other Rubber /Latex Products	10.3	0.1%	0.1%	0.2%
Non-Food Packaging	73.6	0.9%	0.2%	1.6%	Disposable Diapers	20.8	0.2%	0.0%	0.5%
Automotive Parts	218.9	2.6%	1.7%	3.6%	Textiles /Leather	144.8	1.7%	1.3%	2.2%
Other Metal/Composite Materials	507.5	6.1%	4.3%	7.9%	Carpet	11.4	0.1%	0.1%	0.2%
					Furniture /Mattresses /Appliances	11.7	0.1%	0.0%	0.3%
					Ceramics /Porcelain	1.7	0.0%	0.0%	0.0%
					Toys /Sporting Goods	3.7	0.0%	0.0%	0.1%
<i>Estimated Tons</i>	8,322	<i>Sample Count</i>	162		Miscellaneous /Other	208.9	2.5%	1.1%	3.9%

5.2.2 INTERSTATE HIGHWAYS

Figure 5-2 illustrates the composition of litter on interstate highways by broad material category. As shown, the “other materials” category comprised the largest percentage of litter (31.0%), 24.7% percent of which was tires. CDL wastes also comprised a large percentage of litter (15.0%), followed by organics, glass, and metal, each at around 12% to 13%.

Figure 5-2 Composition Summary, Interstate Highways



5.2.2.1 LARGEST COMPONENTS

As shown in Table 5-5, tires accounted for a quarter of the litter collected along interstate highways (24.7%). Wood, lumber and particle board accounted for slightly over 13%. The “other organics” and glass categories followed at approximately 12% each.

Table 5-5 Top 10 Largest Components by Weight, Interstate Highways

Component	Composition Percent	Estimated Tons	Cumulative Percent
Tires	24.7%	134.3	24.7%
Wood /Lumber /Particleboard	13.3%	72.2	38.0%
Other Organics	12.3%	67.0	50.4%
Glass Beverage Containers	11.9%	64.7	62.3%
Metal Automotive Parts	6.1%	33.4	68.4%
Other Metal/Composite Materials	3.6%	19.8	72.1%
Other Cardboard Boxboard	3.6%	19.8	75.7%
Plastic Automotive Parts	2.1%	11.6	77.8%
Miscellaneous /Other	2.0%	11.1	79.9%
Other Plastics /Composite Materials	2.0%	11.1	81.9%

Table 5-6 presents the full composition results by individual component category. Component definitions are described in Appendix A.

Table 5-6 Composition by Weight, Interstate Highways

Calculated at a 90% confidence interval

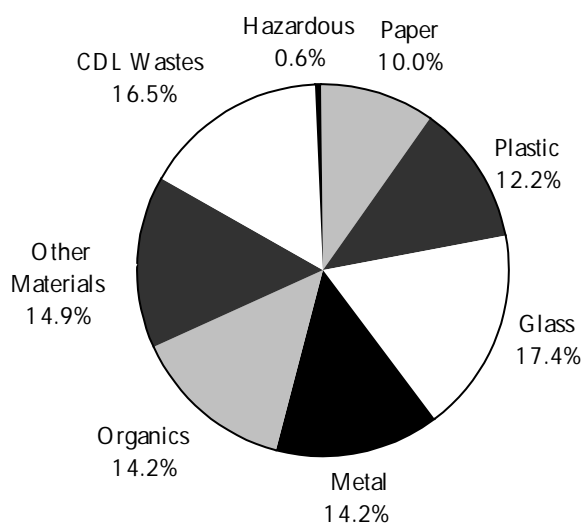
	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	44.1	8.1%			ORGANIC	70.1	12.9%		
Beverage Containers	0.5	0.1%	0.0%	0.1%	Food (Human And Pet)	2.1	0.4%	0.2%	0.5%
One-Time Fast Food Service Items	9.3	1.7%	1.0%	2.4%	Cigarettes And Other Tobacco	0.9	0.2%	0.1%	0.2%
Other Food And Beverage Packaging	2.7	0.5%	0.3%	0.7%	Other Organics	67.0	12.3%	4.9%	19.8%
Non-Food Packaging	2.2	0.4%	0.3%	0.5%	CDL	81.2	15.0%		
Other Cardboard Boxboard	19.8	3.6%	2.1%	5.2%	Wood /Lumber /Particleboard	72.2	13.3%	10.2%	16.3%
Paper Bags	1.0	0.2%	0.1%	0.3%	Mineral Aggregates	0.1	0.0%	0.0%	0.0%
Newspapers And Magazines	2.7	0.5%	0.3%	0.7%	Roofing	5.7	1.1%	0.7%	1.4%
Other Paper/Composite Materials	5.9	1.1%	0.8%	1.4%	Insulation	0.5	0.1%	0.0%	0.2%
PLASTIC	42.6	7.8%			Drywall	1.0	0.2%	0.0%	0.4%
Beverage Containers	4.0	0.7%	0.6%	0.9%	Other Construction /Demolition Debris	1.6	0.3%	0.1%	0.5%
One-Time Fast Food Service Items	2.6	0.5%	0.3%	0.6%	HAZARDOUS MATERIALS	3.2	0.6%		
Other Food And Beverage Packaging	1.7	0.3%	0.2%	0.4%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	2.8	0.5%	0.3%	0.7%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	9.9	1.8%	1.5%	2.2%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	11.6	2.1%	1.6%	2.6%	Batteries	0.7	0.1%	0.0%	0.3%
Other Plastics/Composite Materials	10.2	1.9%	1.4%	2.3%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	68.0	12.5%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	64.7	11.9%	7.3%	16.5%	Explosives	0.1	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.1	0.0%	0.0%	0.0%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.0	0.0%	0.0%	0.0%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	2.1	0.4%	0.1%	0.7%	Other	2.4	0.4%	0.1%	0.7%
Other Glass/Composite Materials	1.0	0.2%	0.0%	0.4%	OTHER MATERIALS	168.1	31.0%		
METAL	65.7	12.1%			Tires	134.3	24.7%	21.0%	28.4%
Beverage Containers	9.9	1.8%	1.3%	2.3%	Auto Rubber Products	6.8	1.3%	0.7%	1.8%
One-Time Fast Food Service Items	0.4	0.1%	0.0%	0.1%	Rubber /Latex Toiletries	0.8	0.1%	0.0%	0.4%
Other Food And Beverage Packaging	1.2	0.2%	0.1%	0.3%	Other Rubber /Latex Products	3.9	0.7%	0.2%	1.2%
Non-Food Packaging	1.0	0.2%	0.1%	0.3%	Disposable Diapers	0.4	0.1%	0.0%	0.1%
Automotive Parts	33.4	6.1%	3.9%	8.4%	Textiles /Leather	8.7	1.6%	1.2%	2.0%
Other Metal/Composite Materials	19.8	3.6%	2.7%	4.6%	Carpet	1.1	0.2%	0.0%	0.4%
					Furniture /Mattresses /Appliances	0.3	0.1%	0.0%	0.1%
					Ceramics /Porcelain	0.0	0.0%	0.0%	0.0%
					Toys /Sporting Goods	0.5	0.1%	0.0%	0.2%
					Miscellaneous /Other	11.1	2.0%	1.0%	3.1%
<i>Estimated Tons</i>	543	<i>Sample Count</i>	55						

A breakdown of urban/non-urban composition for the interstate site category can be found in Appendix E. To summarize, wood products represented a greater proportion of the total interstate litter in urban areas than in non-urban areas (about 21% in urban areas versus about 11% in non-urban areas). Glass beverage containers and tires were more prevalent in non-urban areas (beverage containers comprised about 15% in non-urban areas compared with about 3% in urban areas; and tires comprised about 30% in non-urban areas as compared to about 16% in urban areas).

5.2.3 STATE ROUTES

Among state routes, the composition percentage of nearly all the broad categories was relatively evenly distributed, ranging from approximately 10% to 17% (the exception being hazardous materials). Excluding hazardous materials, paper was lowest material category, at 10%, and glass was the largest material category, at slightly more than 17%.

Figure 5-3 Composition Summary, State Routes



5.2.3.1 LARGEST COMPONENTS

As shown in Table 5-7 glass beverage containers and wood, lumber and particleboard accounted for about 30% of the litter, by weight. "Other organics" and tires followed at nearly 9% and 7%, respectively.

Table 5-7 Top 10 Largest Components by Weight, State Routes

Component	Composition Percent	Estimated Tons	Cumulative Percent
Glass Beverage Containers	16.3%	237.8	16.3%
Wood /Lumber /Particleboard	13.0%	190.6	29.3%
Other Organics	8.6%	126.3	37.9%
Tires	7.3%	106.3	45.2%
Other Metal/Composite Materials	6.0%	87.6	51.2%
Food (Human And Pet)	5.0%	73.3	56.2%
Metal Automotive Parts	4.6%	67.2	60.8%
Plastic Bags And Film	3.4%	50.1	64.2%
Other Cardboard Boxboard	3.2%	46.6	67.4%
Other Plastics/Composite Materials	3.2%	46.5	70.6%

Table 5-8 presents the full composition results of each component category.

Table 5-8 Composition by Weight, State Routes

Calculated at a 90% confidence interval

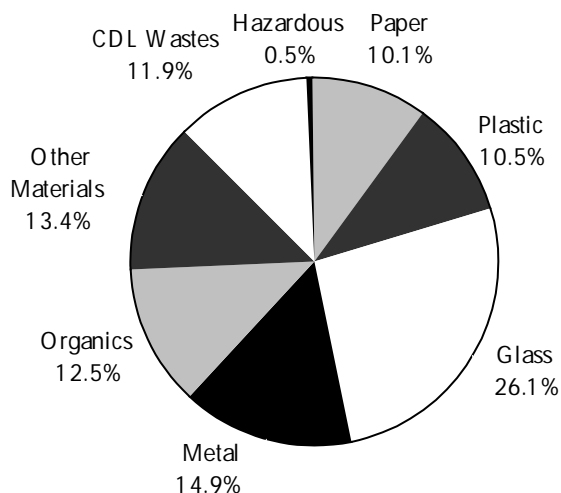
	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	145.7	10.0%			ORGANIC	207.9	14.2%		
Beverage Containers	2.4	0.2%	0.1%	0.2%	Food (Human And Pet)	73.3	5.0%	0.0%	10.6%
One-Time Fast Food Service Items	37.5	2.6%	2.0%	3.1%	Cigarettes And Other Tobacco	8.3	0.6%	0.0%	1.2%
Other Food And Beverage Packaging	12.1	0.8%	0.6%	1.1%	Other Organics	126.3	8.6%	4.5%	12.8%
Non-Food Packaging	9.3	0.6%	0.5%	0.8%	CDL	240.8	16.5%		
Other Cardboard Boxboard	46.6	3.2%	2.2%	4.2%	Wood / Lumber / Particleboard	190.6	13.0%	9.9%	16.2%
Paper Bags	6.5	0.4%	0.3%	0.6%	Mineral Aggregates	25.3	1.7%	0.0%	4.2%
Newspapers And Magazines	8.5	0.6%	0.3%	0.8%	Roofing	7.6	0.5%	0.2%	0.8%
Other Paper/Composite Materials	22.9	1.6%	1.0%	2.1%	Insulation	0.3	0.0%	0.0%	0.0%
PLASTIC	179.1	12.2%			Drywall	0.7	0.1%	0.0%	0.1%
Beverage Containers	18.6	1.3%	1.1%	1.5%	Other Construction / Demolition Debris	16.2	1.1%	0.0%	2.4%
One-Time Fast Food Service Items	10.6	0.7%	0.5%	0.9%	HAZARDOUS MATERIALS	8.6	0.6%		
Other Food And Beverage Packaging	15.7	1.1%	0.5%	1.6%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	14.5	1.0%	0.4%	1.6%	Oil Based Paints	0.1	0.0%	0.0%	0.0%
Plastic Bags And Film	50.1	3.4%	2.2%	4.7%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	23.2	1.6%	0.9%	2.3%	Batteries	0.5	0.0%	0.0%	0.1%
Other Plastics/Composite Materials	46.5	3.2%	1.9%	4.5%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	254.9	17.4%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	237.8	16.3%	13.2%	19.3%	Explosives	0.8	0.1%	0.0%	0.1%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	3.0	0.2%	0.0%	0.6%
Other Food And Beverage Packaging	0.5	0.0%	0.0%	0.1%	Cleaners (Hazardous)	0.7	0.1%	0.0%	0.1%
Non-Food Packaging	1.7	0.1%	0.0%	0.2%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	9.7	0.7%	0.1%	1.3%	Other	3.4	0.2%	0.1%	0.4%
Other Glass/Composite Materials	5.3	0.4%	0.1%	0.7%	OTHER MATERIALS	218.6	14.9%		
METAL	207.2	14.2%			Tires	106.3	7.3%	2.7%	11.9%
Beverage Containers	46.4	3.2%	2.5%	3.8%	Auto Rubber Products	19.4	1.3%	0.6%	2.0%
One-Time Fast Food Service Items	0.8	0.1%	0.0%	0.1%	Rubber / Latex Toiletries	7.1	0.5%	0.0%	1.1%
Other Food And Beverage Packaging	3.1	0.2%	0.1%	0.3%	Other Rubber / Latex Products	3.3	0.2%	0.1%	0.4%
Non-Food Packaging	2.2	0.2%	0.1%	0.2%	Disposable Diapers	0.3	0.0%	0.0%	0.0%
Automotive Parts	67.2	4.6%	2.6%	6.6%	Textiles / Leather	24.2	1.7%	1.3%	2.1%
Other Metal/Composite Materials	87.6	6.0%	3.4%	8.6%	Carpet	10.1	0.7%	0.2%	1.2%
					Furniture / Mattresses / Appliances	2.4	0.2%	0.0%	0.3%
					Ceramics / Porcelain	0.3	0.0%	0.0%	0.0%
					Toys / Sporting Goods	0.7	0.0%	0.0%	0.1%
					Miscellaneous / Other	44.4	3.0%	1.8%	4.3%
<i>Estimated Tons</i>	1,463	<i>Sample Count</i>	52						

A breakdown of urban/non-urban composition for the state route site category can be found in Appendix E. As with interstates, wood products represented a larger proportion of state route litter in urban areas than in non-urban areas (about 21% in urban areas versus about 12% in non-urban areas). Glass beverage containers and tires were more prominent on non-urban state routes (beverage containers comprised about 18% in non-urban areas compared with about 8% in urban areas; and tires comprised about 8% in non-urban areas as compared to about 3% in urban areas).

5.2.4 COUNTY ROADS

Glass comprised the largest percentage of litter on county roads among the broad material categories (26.1%). Metals followed at just under 15%. With the exception of hazardous waste, all other categories were distributed fairly evenly, ranging from 10.1% to 13.4%.

Figure 5-4 Composition Summary, County Roads



5.2.4.1 LARGEST COMPONENTS

As shown in Table 5-9, glass beverage containers comprised the largest percentage of litter deposited on county roads (25%). The wood, lumber and particleboard and "other organics" categories also comprised a large percentage, at approximately 11% and 10%, respectively. All other categories in the top ten accounted for about 2% to 8% of the litter.

Table 5-9 Top 10 Largest Components by Weight, County Roads

Component	Composition Percent	Estimated Tons	Cumulative Percent
Glass Beverage Containers	25.0%	1 580.9	25.0%
Wood /Lumber /Particleboard	10.8%	683.8	35.9%
Other Organics	10.2%	647.3	46.1%
Tires	7.5%	476.5	53.6%
Other Metal/Composite Materials	6.2%	388.5	59.8%
Plastic Bags And Film	3.4%	216.0	63.2%
Other Plastics/Composite Materials	2.5%	159.9	65.7%
Paper One-Time Fast Food Service Items	2.4%	154.0	68.2%
Miscellaneous /Other	2.4%	153.9	70.6%
Metal Automotive Parts	2.3%	144.1	72.9%

Table 5-10 presents the full composition results by component category for county roads.

Table 5-10 Composition by Weight, County Roads

Calculated at a 90% confidence interval

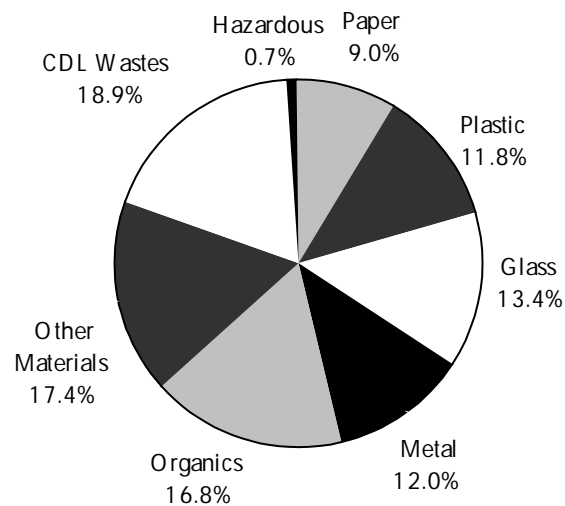
	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	640.6	10.1%			ORGANIC	792.3	12.5%		
Beverage Containers	20.7	0.3%	0.2%	0.5%	Food (Human And Pet)	92.5	1.5%	0.8%	2.1%
One-Time Fast Food Service Items	154.0	2.4%	1.4%	3.4%	Cigarettes And Other Tobacco	52.4	0.8%	0.0%	1.9%
Other Food And Beverage Packaging	52.3	0.8%	0.5%	1.2%	Other Organics	647.3	10.2%	7.0%	13.5%
Non-Food Packaging	116.8	1.8%	0.0%	3.7%	CDL	752.9	11.9%		
Other Cardboard Boxboard	125.8	2.0%	1.1%	2.9%	Wood /Lumber /Particleboard	683.8	10.8%	6.7%	14.9%
Paper Bags	59.7	0.9%	0.0%	2.1%	Mineral Aggregates	17.5	0.3%	0.0%	0.7%
Newspapers And Magazines	54.4	0.9%	0.5%	1.2%	Roofing	24.6	0.4%	0.0%	0.8%
Other Paper/Composite Materials	56.8	0.9%	0.4%	1.4%	Insulation	5.1	0.1%	0.0%	0.2%
PLASTIC	664.2	10.5%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	104.2	1.6%	1.3%	2.0%	Other Construction / Demolition Debris	22.0	0.3%	0.1%	0.6%
One-Time Fast Food Service Items	35.0	0.6%	0.3%	0.8%	HAZARDOUS MATERIALS	30.3	0.5%		
Other Food And Beverage Packaging	39.1	0.6%	0.3%	0.9%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	55.9	0.9%	0.5%	1.2%	Oil Based Paints	0.7	0.0%	0.0%	0.0%
Plastic Bags And Film	216.0	3.4%	2.6%	4.3%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	54.2	0.9%	0.5%	1.2%	Batteries	12.9	0.2%	0.0%	0.4%
Other Plastics/Composite Materials	159.9	2.5%	1.3%	3.7%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	1649.9	26.1%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	1580.9	25.0%	18.4%	31.6%	Explosives	0.6	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.1	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	21.9	0.3%	0.0%	0.7%	Cleaners (Hazardous)	1.1	0.0%	0.0%	0.0%
Non-Food Packaging	4.5	0.1%	0.0%	0.1%	Medical Waste	1.0	0.0%	0.0%	0.0%
Automotive Parts	5.9	0.1%	0.0%	0.2%	Other	14.0	0.2%	0.1%	0.4%
Other Glass/Composite Materials	36.6	0.6%	0.0%	1.2%	OTHER MATERIALS	845.6	13.4%		
METAL	940.5	14.9%			Tires	476.5	7.5%	2.7%	12.4%
Beverage Containers	280.4	4.4%	3.5%	5.3%	Auto Rubber Products	62.5	1.0%	0.2%	1.8%
One-Time Fast Food Service Items	3.7	0.1%	0.0%	0.1%	Rubber /Latex Toiletries	1.4	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	60.2	1.0%	0.3%	1.6%	Other Rubber /Latex Products	6.3	0.1%	0.0%	0.2%
Non-Food Packaging	63.5	1.0%	0.2%	1.8%	Disposable Diapers	18.1	0.3%	0.0%	0.5%
Automotive Parts	144.1	2.3%	1.2%	3.3%	Textiles /Leather	110.8	1.8%	1.2%	2.3%
Other Metal/Composite Materials	388.5	6.2%	4.1%	8.2%	Carpet	3.3	0.1%	0.0%	0.1%
					Furniture /Mattresses /Appliances	8.8	0.1%	0.0%	0.3%
					Ceramics /Porcelain	1.3	0.0%	0.0%	0.0%
					Toys /Sporting Goods	2.7	0.0%	0.0%	0.1%
					Miscellaneous /Other	153.9	2.4%	0.9%	4.0%
<i>Estimated Tons</i>	6,316	<i>Sample Count</i>	55						

A breakdown of urban/non-urban composition for the county road site category can be found in Appendix E. On urban county roads, "other organics" represented a greater proportion of the total litter than on non-urban county roads (about 19% in urban areas versus 9% in non-urban areas). Glass beverage containers were more prevalent in non-urban areas (beverage containers comprised about 27% in non-urban areas as compared to 14% in urban areas). Tires also comprised a somewhat higher percentage of litter in non-urban areas (8% in non-urban areas and 4.7% in urban areas).

5.3 INTERCHANGES

Interchanges were designated as a distinct site category since vehicles slow down or accelerate as they enter or exit another highway or street. CDL materials comprised the largest percentage of litter within interchanges (18.9%). The "other materials" category totaled slightly more than 17%. As with other categories sampled, hazardous materials comprised less than 1% of the litter, by weight.

Figure 5-5 Composition Summary, Interchanges



5.3.1.1 LARGEST COMPONENTS

Table 5-11 shows that wood, lumber and particleboard and "other organics" accounted for about 30% of the litter sampled from interchanges. Glass beverage containers and tires also comprised a large percentage (approximately 13% and 10%, respectively).

Table 5-11 Top 10 Largest Components by Weight, Interchanges

Component	Composition Percent	Estimated Tons	Cumulative Percent
Wood /Lumber /Particleboard	15.5%	95.6	15.5%
Other Organics	15.0%	92.7	30.5%
Glass Beverage Containers	12.6%	77.7	43.1%
Tires	9.8%	60.2	52.9%
Metal Automotive Parts	5.7%	34.9	58.5%
Other Metal/Composite Materials	4.3%	26.8	62.9%
Other Cardboard Boxboard	3.2%	19.7	66.1%
Other Plastics/Composite Materials	3.1%	19.3	69.2%
Plastic Bags And Film	3.0%	18.5	72.2%
Textiles /Leather	2.2%	13.8	74.5%

Table 5-12 presents the full composition results by component category for interchanges.

Table 5-12 Composition by Weight, Interchanges

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	55.4	9.0%			ORGANIC	103.9	16.8%		
Beverage Containers	0.9	0.1%	0.1%	0.2%	Food (Human And Pet)	5.8	0.9%	0.6%	1.3%
One-Time Fast Food Service Items	11.7	1.9%	1.5%	2.3%	Cigarettes And Other Tobacco	5.4	0.9%	0.4%	1.3%
Other Food And Beverage Packaging	3.0	0.5%	0.4%	0.6%	Other Organics	92.7	15.0%	11.4%	18.7%
Non-Food Packaging	4.1	0.7%	0.5%	0.9%	CDL	116.7	18.9%		
Other Cardboard Boxboard	19.7	3.2%	2.7%	3.7%	Wood /Lumber /Particleboard	95.6	15.5%	12.4%	18.6%
Paper Bags	1.8	0.3%	0.2%	0.4%	Mineral Aggregates	8.0	1.3%	0.2%	2.4%
Newspapers And Magazines	4.4	0.7%	0.5%	0.9%	Roofing	4.8	0.8%	0.5%	1.1%
Other Paper/Composite Materials	9.7	1.6%	1.2%	2.0%	Insulation	0.4	0.1%	0.0%	0.1%
PLASTIC	72.6	11.8%			Drywall	3.9	0.6%	0.1%	1.2%
Beverage Containers	5.6	0.9%	0.8%	1.1%	Other Construction / Demolition Debris	4.0	0.7%	0.2%	1.1%
One-Time Fast Food Service Items	3.3	0.5%	0.4%	0.7%	HAZARDOUS MATERIALS	4.3	0.7%		
Other Food And Beverage Packaging	3.0	0.5%	0.3%	0.6%	Latex Paint	0.3	0.0%	0.0%	0.1%
Non-Food Packaging	11.8	1.9%	0.3%	3.5%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	18.5	3.0%	2.3%	3.7%	Oil	0.2	0.0%	0.0%	0.1%
Automotive Parts	11.0	1.8%	1.3%	2.2%	Batteries	0.3	0.0%	0.0%	0.1%
Other Plastics/Composite Materials	19.3	3.1%	2.4%	3.8%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	82.4	13.4%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	77.7	12.6%	9.1%	16.1%	Explosives	0.5	0.1%	0.0%	0.2%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.1	0.0%	0.0%	0.0%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	1.0	0.2%	0.0%	0.3%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	2.2	0.4%	0.1%	0.7%	Other	3.0	0.5%	0.1%	0.9%
Other Glass/Composite Materials	1.4	0.2%	0.0%	0.5%	OTHER MATERIALS	107.4	17.4%		
METAL	74.3	12.0%			Tires	60.2	9.8%	7.9%	11.6%
Beverage Containers	9.7	1.6%	1.4%	1.7%	Auto Rubber Products	9.2	1.5%	0.9%	2.1%
One-Time Fast Food Service Items	0.1	0.0%	0.0%	0.0%	Rubber /Latex Toiletries	0.1	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.9	0.1%	0.1%	0.2%	Other Rubber /Latex Products	2.8	0.5%	0.1%	0.8%
Non-Food Packaging	1.8	0.3%	0.1%	0.5%	Disposable Diapers	5.3	0.9%	-0.5%	2.2%
Automotive Parts	34.9	5.7%	4.2%	7.1%	Textiles /Leather	13.8	2.2%	1.7%	2.8%
Other Metal/Composite Materials	26.8	4.3%	3.2%	5.5%	Carpet	2.4	0.4%	0.0%	0.8%
					Furniture /Mattresses /Appliances	0.2	0.0%	0.0%	0.1%
					Ceramics /Porcelain	0.5	0.1%	0.0%	0.1%
					Toys /Sporting Goods	0.1	0.0%	0.0%	0.0%
					Miscellaneous /Other	12.7	2.1%	0.8%	3.3%
<i>Estimated Tons</i>	617	<i>Sample Count</i>	47						

A breakdown of urban/non-urban composition for the interchange site category can be found in Appendix E. There were few notable differences between urban and non-urban litter composition on interchanges, with the exception of tires (about 12% on non-urban interchanges versus approximately 4% on urban interchanges.)

5.4 PUBLIC AREAS

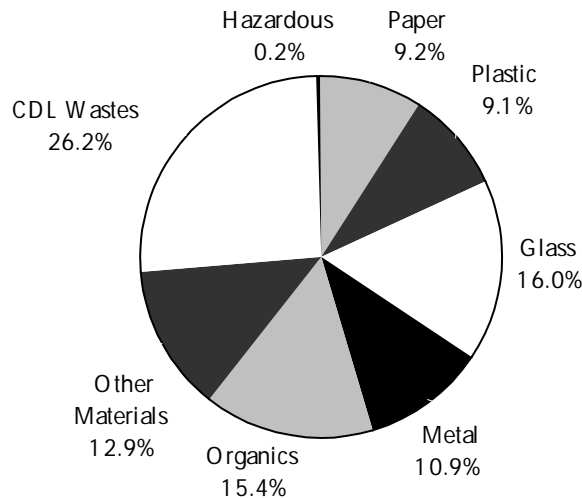
In public areas there is both vehicular and pedestrian activity. In this study, representative public areas included state and county parks, Fish & Wildlife and DNR recreational public access areas, and rest areas. Composition estimates were calculated for these five individual areas; the five areas were not combined into an overall public area category. Since composition estimates for the five areas are not representative of other public areas such as athletic fields or fairgrounds, an overall category would not provide a complete profile of the state's public area litter.

It is also important to remember that the litter samples analyzed as part of this study were collected from the "high-use" areas of each site. Therefore, the results represent litter in "high-use" areas in parks for example, not the entire park.²² The sections that follow highlight the results from the three primary public area site categories: state and county parks in section 5.4.1, Fish & Wildlife and Department of Natural Resources recreational public access sites in section 5.4.2, and highway rest areas in section 5.4.3.

5.4.1 STATE AND COUNTY PARKS

As shown in Figure 5-6, more than a quarter of the litter deposited in high-use areas of state and county parks was CDL materials. Glass accounted for an additional 16%, followed by organics and "other materials" which accounted for approximately 15% and 13%, respectively. Metal, plastic and paper account for about 10% each.

Figure 5-6 Composition Summary, State and County Parks



5.4.1.1 LARGEST COMPONENTS

The top five categories by composition percentage account for roughly 55% of the litter found in state and county parks. The wood, lumber and particleboard category comprised the greatest share at 26.1%. Glass beverage containers also constituted a sizable proportion of litter at 15.4%, followed by food and "other organics" at nearly 7% each.

²² Refer to Appendix B for a more detailed explanation.

Table 5-13 Top 10 Largest Components by Weight, State and County Parks

Component	Composition Percent	Estimated Tons	Cumulative Percent
Wood /Lumber /Particleboard	26.1 %	662.0	26.1 %
Glass Beverage Containers	15.4%	389.5	41.5%
Food (Human And Pet)	6.8%	172.2	48.2%
Other Organics	6.5%	163.8	54.7%
Metal Beverage Containers	4.4%	110.4	59.1 %
Paper One-Time Fast Food Service Items	4.2%	106.2	63.3%
Textiles /Leather	4.0%	101.1	67.2%
Tires	3.4%	86.3	70.6%
Metal Automotive Parts	3.0%	76.9	73.7%
Plastic Bags And Film	2.9%	72.6	76.5%

Table 5-14 presents the full composition results of litter deposited in state and county park high-use areas.

Table 5-14 Composition by Weight, State and County Parks

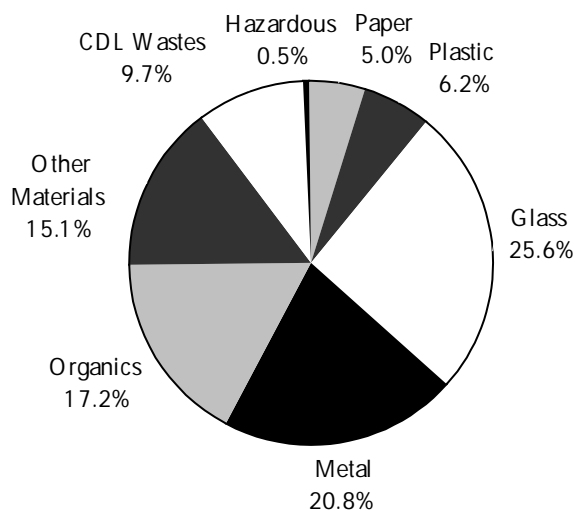
Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	233.9	9.2%			ORGANIC	390.7	15.4%		
Beverage Containers	3.9	0.2%	0.0%	0.3%	Food (Human And Pet)	172.2	6.8%	3.7%	9.8%
One-Time Fast Food Service Items	106.2	4.2%	2.8%	5.6%	Cigarettes And Other Tobacco	54.6	2.2%	1.2%	3.1%
Other Food And Beverage Packaging	26.2	1.0%	0.7%	1.3%	Other Organics	163.8	6.5%	4.1%	8.8%
Non-Food Packaging	14.9	0.6%	0.3%	0.8%	CDL	665.1	26.2%		
Other Cardboard Boxboard	6.8	0.3%	0.1%	0.4%	Wood /Lumber /Particleboard	662.0	26.1%	9.5%	42.7%
Paper Bags	7.1	0.3%	0.1%	0.4%	Mineral Aggregates	0.9	0.0%	0.0%	0.1%
Newspapers And Magazines	38.5	1.5%	0.6%	2.4%	Roofing	1.0	0.0%	0.0%	0.1%
Other Paper/Composite Materials	30.3	1.2%	0.4%	2.0%	Insulation	0.1	0.0%	0.0%	0.0%
PLASTIC	231.5	9.1%			Drywall	0.2	0.0%	0.0%	0.0%
Beverage Containers	37.4	1.5%	0.8%	2.1%	Other Construction /Demolition Debris	0.7	0.0%	0.0%	0.1%
One-Time Fast Food Service Items	26.7	1.1%	0.5%	1.6%	HAZARDOUS MATERIALS	6.1	0.2%		
Other Food And Beverage Packaging	16.5	0.7%	0.4%	0.9%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	29.5	1.2%	0.3%	2.0%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	72.6	2.9%	1.9%	3.8%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	1.4	0.1%	0.0%	0.1%	Batteries	3.9	0.2%	0.0%	0.3%
Other Plastics/Composite Materials	47.4	1.9%	1.3%	2.5%	Flammable Gas	1.1	0.0%	0.0%	0.1%
GLASS	404.8	16.0%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	389.5	15.4%	10.5%	20.2%	Explosives	0.0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	6.6	0.3%	0.1%	0.5%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	1.8	0.1%	0.0%	0.2%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.0	0.0%	0.0%	0.0%	Other	1.2	0.0%	0.0%	0.1%
Other Glass/Composite Materials	7.0	0.3%	0.0%	0.6%	OTHER MATERIALS	327.3	12.9%		
METAL	277.0	10.9%			Tires	86.3	3.4%	1.3%	5.5%
Beverage Containers	110.4	4.4%	3.3%	5.4%	Auto Rubber Products	12.6	0.5%	0.1%	0.9%
One-Time Fast Food Service Items	6.2	0.2%	0.1%	0.4%	Rubber /Latex Toiletries	1.6	0.1%	0.0%	0.1%
Other Food And Beverage Packaging	20.3	0.8%	0.3%	1.3%	Other Rubber / Latex Products	13.5	0.5%	0.0%	1.3%
Non-Food Packaging	14.0	0.6%	0.2%	0.9%	Disposable Diapers	15.4	0.6%	0.2%	1.0%
Automotive Parts	76.9	3.0%	0.0%	6.1%	Textiles /Leather	101.1	4.0%	2.1%	5.9%
Other Metal/Composite Materials	49.2	1.9%	1.0%	2.9%	Carpet	8.4	0.3%	0.1%	0.6%
					Furniture /Mattresses /Appliances	37.3	1.5%	0.1%	2.8%
					Ceramics /Porcelain	1.3	0.1%	0.0%	0.1%
					Toys /Sporting Goods	5.3	0.2%	0.1%	0.4%
					Miscellaneous / Other	44.6	1.8%	0.5%	3.0%
<i>Estimated Tons</i>	2,536	<i>Sample Count</i>	48						

5.4.2 PUBLIC ACCESS AREAS (FISH & WILDLIFE AND DNR SITES)

As shown in Figure 5-7, just over a quarter of the litter deposited in highest used areas of Fish & Wildlife and DNR sites was glass (25.6%). Metal and organics also accounted for large percentages, at 20.8% and 17.2% respectively. CDL, plastic and paper littered in public access areas appears lower relative to the other sample categories.

Figure 5-7 Composition Summary, Public Access (Fish & Wildlife and DNR)



5.4.2.1 LARGEST COMPONENTS

Glass beverage containers accounted for about 20% of the litter found in the highest used areas of Fish & Wildlife and DNR sites. "Other organics" and metal automotive parts also accounted for a high proportion of the litter, at nearly 15% each. All other categories in the top ten accounted for about 3% to 6% of the litter in public access areas.

Table 5-15 Top 10 Largest Components by Weight, Public Access (Fish & Wildlife and DNR)

Component	Composition Percent	Estimated Tons	Cumulative Percent
Glass Beverage Containers	19.9%	98.8	19.9%
Other Organics	14.8%	73.4	34.7%
Metal Automotive Parts	14.7%	73.0	49.4%
Textiles /Leather	5.6%	27.9	55.1%
Wood /Lumber /Particleboard	5.1%	25.5	60.2%
Tires	3.9%	19.3	64.1%
Other Construction /Demolition Debris	3.4%	16.9	67.5%
Other Glass/Composite Materials	3.1%	15.4	70.6%
Toys /Sporting Goods	2.9%	14.3	73.5%
Other Metal/Composite Materials	2.8%	13.8	76.3%

Table 5-16 presents the full composition results of litter deposited in the highest used areas of public access sites (Fish & Wildlife and DNR sites).

Table 5-16 Composition by Weight, Public Access Areas (Fish & Wildlife & DNR)

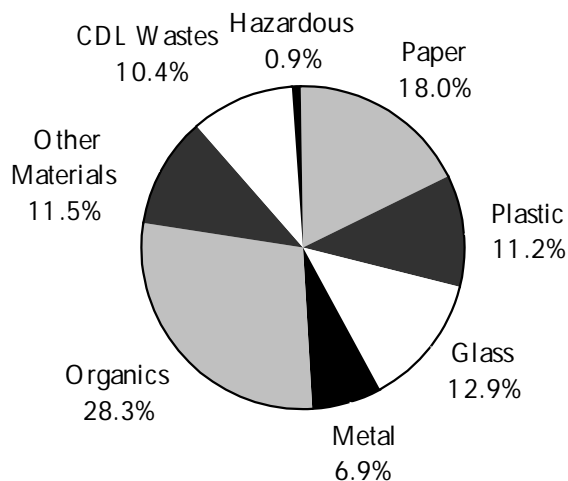
Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	24.7	5.0%			ORGANIC	85.1	17.2%		
Beverage Containers	0.6	0.1%	0.0%	0.3%	Food (Human And Pet)	9.9	2.0%	0.8%	3.2%
One-Time Fast Food Service Items	7.6	1.5%	0.7%	2.4%	Cigarettes And Other Tobacco	1.8	0.4%	0.0%	0.7%
Other Food And Beverage Packaging	4.6	0.9%	0.4%	1.4%	Other Organics	73.4	14.8%	6.6%	23.0%
Non-Food Packaging	2.3	0.5%	0.2%	0.7%	CDL	48.4	9.7%		
Other Cardboard Boxboard	4.7	0.9%	0.4%	1.5%	Wood /Lumber /Particleboard	25.5	5.1%	0.2%	10.1%
Paper Bags	0.6	0.1%	0.0%	0.2%	Mineral Aggregates	5.5	1.1%	0.2%	2.1%
Newspapers And Magazines	1.9	0.4%	0.1%	0.6%	Roofing	0.4	0.1%	0.0%	0.2%
Other Paper/Composite Materials	2.4	0.5%	0.2%	0.8%	Insulation	0.0	0.0%	0.0%	0.0%
PLASTIC	30.6	6.2%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	3.6	0.7%	0.6%	0.9%	Other Construction /Demolition Debris	16.9	3.4%	0.0%	7.1%
One-Time Fast Food Service Items	1.7	0.3%	0.2%	0.5%	HAZARDOUS MATERIALS	2.4	0.5%		
Other Food And Beverage Packaging	1.4	0.3%	0.1%	0.4%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	2.1	0.4%	0.1%	0.7%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	9.4	1.9%	1.0%	2.8%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	3.1	0.6%	0.0%	1.3%	Batteries	0.3	0.1%	0.0%	0.1%
Other Plastics/Composite Materials	9.4	1.9%	0.5%	3.3%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	126.8	25.6%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	98.8	19.9%	11.7%	28.1%	Explosives	1.7	0.3%	0.0%	0.9%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	2.0	0.4%	0.1%	0.7%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	2.5	0.5%	0.0%	1.2%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	8.0	1.6%	0.0%	4.3%	Other	0.5	0.1%	0.0%	0.2%
Other Glass/Composite Materials	15.4	3.1%	0.0%	7.3%	OTHER MATERIALS	74.9	15.1%		
METAL	103.0	20.8%			Tires	19.3	3.9%	0.2%	7.6%
Beverage Containers	11.3	2.3%	1.6%	2.9%	Auto Rubber Products	1.5	0.3%	0.0%	0.6%
One-Time Fast Food Service Items	0.1	0.0%	0.0%	0.1%	Rubber /Latex Toiletries	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	2.2	0.4%	0.3%	0.6%	Other Rubber /Latex Products	2.9	0.6%	0.0%	1.4%
Non-Food Packaging	2.6	0.5%	0.2%	0.9%	Disposable Diapers	2.9	0.6%	0.0%	1.1%
Automotive Parts	73.0	14.7%	0.3%	29.1%	Textiles /Leather	27.9	5.6%	3.4%	7.9%
Other Metal/Composite Materials	13.8	2.8%	1.2%	4.4%	Carpet	0.1	0.0%	0.0%	0.0%
					Furniture /Mattresses /Appliances	1.1	0.2%	0.0%	0.6%
					Ceramics /Porcelain	1.0	0.2%	0.0%	0.5%
					Toys /Sporting Goods	14.3	2.9%	0.0%	7.7%
					Miscellaneous /Other	3.9	0.8%	0.0%	1.7%
<i>Estimated Tons</i>	496	<i>Sample Count</i>	51						

5.4.3 REST AREAS

Figure 5-8 illustrates the percentage of each of the broad material categories littered at rest areas. As shown, organics comprised the largest proportion of materials, approximately 28%. Paper litter also accounted for a large percentage at 18%.

Figure 5-8 Composition Summary, Rest Areas



5.4.3.1 LARGEST COMPONENTS

As Table 5-17 illustrates, the “other organics” category constituted the largest composition of waste littered at rest areas in Washington (almost 15%). Even so, this material accounted for as little as 2 tons of litter at rest areas each year. Cigarettes and other tobacco accounted for almost 8%.²³

Table 5-17 Top 10 Largest Components by Weight, Rest Areas

Component	Composition Percent	Estimated Tons	Cumulative Percent
Other Organics	14.5%	2.1	14.5%
Glass Beverage Containers	12.6%	1.8	27.1%
Wood /Lumber /Particleboard	9.8%	1.4	36.9%
Paper One-Time Fast Food Service Items	9.3%	1.3	46.2%
Cigarettes And Other Tobacco	7.6%	1.1	53.8%
Food (Human And Pet)	6.3%	0.9	60.1%
Tires	4.5%	0.6	64.6%
Textiles /Leather	3.0%	0.4	67.6%
Plastic Bags And Film	3.0%	0.4	70.6%
Metal Beverage Containers	2.8%	0.4	73.4%

²³ One pound of dry cigarette butts equals approximately 2,000 cigarette butts.

Table 5-18 presents the full composition results of litter deposited in rest areas by component category.

Table 5-18 Composition by Weight, Rest Areas

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	2.6	18.0%			ORGANIC	4.1	28.3%		
Beverage Containers	0.1	0.8%	0.1%	1.5%	Food (Human And Pet)	0.9	6.3%	4.5%	8.0%
One-Time Fast Food Service Items	1.3	9.3%	7.3%	11.3%	Cigarettes And Other Tobacco	1.1	7.6%	5.6%	9.5%
Other Food And Beverage Packaging	0.1	1.0%	0.7%	1.3%	Other Organics	2.1	14.5%	10.4%	18.6%
Non-Food Packaging	0.1	0.9%	0.7%	1.1%	CDL	1.5	10.4%		
Other Cardboard Boxboard	0.2	1.6%	0.1%	3.1%	Wood /Lumber /Particleboard	1.4	9.8%	5.5%	14.2%
Paper Bags	0.1	0.6%	0.4%	0.8%	Mineral Aggregates	0.0	0.2%	0.0%	0.4%
Newspapers And Magazines	0.3	1.8%	1.1%	2.5%	Roofing	0.0	0.2%	0.0%	0.4%
Other Paper/Composite Materials	0.3	2.0%	1.3%	2.7%	Insulation	0.0	0.0%	0.0%	0.0%
PLASTIC	1.6	11.2%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	0.3	2.2%	1.8%	2.7%	Other Construction / Demolition Debris	0.0	0.2%	0.0%	0.4%
One-Time Fast Food Service Items	0.3	1.9%	1.3%	2.4%	HAZARDOUS MATERIALS	0.1	0.9%		
Other Food And Beverage Packaging	0.1	0.9%	0.7%	1.2%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.1	0.7%	0.5%	1.0%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	0.4	3.0%	2.6%	3.4%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.2	1.1%	0.0%	2.3%	Batteries	0.0	0.1%	0.0%	0.2%
Other Plastics/Composite Materials	0.2	1.4%	0.8%	1.9%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	1.9	12.9%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	1.8	12.6%	10.2%	15.0%	Explosives	0.0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.0	0.1%	0.0%	0.2%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.0	0.1%	0.0%	0.2%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.0	0.0%	0.0%	0.0%	Other	0.1	0.8%	0.3%	1.3%
Other Glass/Composite Materials	0.0	0.1%	0.0%	0.1%	OTHER MATERIALS	1.6	11.5%		
METAL	1.0	6.9%			Tires	0.6	4.5%	1.4%	7.6%
Beverage Containers	0.4	2.8%	2.4%	3.2%	Auto Rubber Products	0.1	0.5%	0.3%	0.7%
One-Time Fast Food Service Items	0.0	0.1%	0.0%	0.1%	Rubber /Latex Toiletries	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.1	0.5%	0.3%	0.6%	Other Rubber /Latex Products	0.0	0.3%	0.1%	0.5%
Non-Food Packaging	0.0	0.2%	0.0%	0.4%	Disposable Diapers	0.1	0.7%	0.4%	1.1%
Automotive Parts	0.4	2.6%	0.2%	5.0%	Textiles /Leather	0.4	3.0%	2.4%	3.7%
Other Metal/Composite Materials	0.1	0.7%	0.3%	1.0%	Carpet	0.0	0.3%	0.0%	0.6%
					Furniture /Mattresses /Appliances	0.0	0.0%	0.0%	0.0%
					Ceramics /Porcelain	0.0	0.0%	0.0%	0.1%
					Toys /Sporting Goods	0.0	0.3%	0.1%	0.5%
					Miscellaneous /Other	0.3	1.8%	0.4%	3.2%
<i>Estimated Tons</i>	14	<i>Sample Count</i>	48						

6. SUMMARY OF RESULTS

Litter generation and composition results are summarized below. Notable findings within the roadway, interchange, and public areas categories are discussed in sections 6.1, 6.2 and 6.3, respectively. Overall findings are discussed in section 6.4.

6.1 ROADWAYS

- In Washington, almost one ton of litter accumulates each year along a typical mile of interstate highway. In urban areas accumulation rates on interstate highways approach 1.5 tons per mile.
- Litter generation rates for state routes and county roads are much lower than for interstates. State routes generate about 475 pounds per mile each year; county roads generate slightly more than 300 pounds per mile per year.

- Glass beverage containers constitute the largest single litter item by weight along roadways (all road categories combined), approximately 24% of the composition. (While glass beverage containers are the largest component by weight, the volume of glass beverage containers is actually less than the corresponding volume of aluminum cans and plastic beverage containers.)
- Wood products, other organics (including yard debris, stumps, firewood, branches and prunings, but excluding food and pet waste), tires and other metal/composite materials comprise approximately 35% of roadway litter; together with glass beverage containers, these materials make up almost 60% of litter along the state's roadways.
- On interstates, tires are the largest category of litter (nearly 25%). Metal and plastic automotive parts also make up over 8% of interstate litter. Interstate highways have a much higher volume of vehicle traffic per mile than county and state roads, which may explain the greater volume of tire and automotive litter.
- Glass beverage containers and tires represent a greater proportion of litter on non-urban roadways (including interstates, state routes, and county roads) than on urban roadways. Wood products comprise a greater percentage of litter on urban interstates and state routes than on non-urban interstates and state routes.

6.2 INTERCHANGES

- During a year, an average of about 2,500 pounds of litter accumulates within interchanges; 45% more litter accumulates on urban interchanges than on non-urban interchanges.
- Within interchanges, wood products and "other organics" are the largest litter components (about 15% each). Glass beverage containers, tires, and metal automotive parts also represent a substantial portion of litter. Combined, these five items constitute over 58% of interchange litter.

6.3 PUBLIC AREAS

- Public access areas (Department of Fish & Wildlife and Department of Natural Resources lands) accumulate more litter per acre of high-use area than do parks and rest areas.
- The main litter items in public areas mirror those found along roadways and in interchanges, with the exception of tires which are less common. Wood products, glass beverage containers and other organics account for approximately 35% to 50% by weight of all litter in these areas.
- Other significant components of public area litter include food, metal automotive parts, textiles, paper fast-food items, and cigarettes. Each of these items constitutes 5% or more of public area litter.

6.4 OVERALL FINDINGS

ONE-THIRD OF ROADSIDE WASTE IS NOT PERCEIVED AS "LITTER"

Wood and wood products, other organics (including items such as yard debris, stumps, firewood, branches and prunings, but excluding food and animal wastes) automotive parts and tires together make up approximately 33% of litter along Washington's roadsides. These items are also notable litter components in the state's public areas. According to citizen surveys, these items are not typically considered to be litter.

MUCH OF THE STATE'S ROADSIDE LITTERING MAY BE ACCIDENTAL

Items associated with driving vehicles or hauling uncovered loads (tires, wood products, other metal and composites, automotive parts and other organics, including items such as yard debris, stumps, firewood, branches and prunings) comprise almost 40% of roadside litter. These items are not necessarily the result of deliberate littering; they are more likely to result from "accidental" littering such as material falling from unsecured loads.

MORE LITTER ACCUMULATES IN URBAN AREAS

More litter accumulates along urban roadways and interchanges than on non-urban roadways and interchanges. Litter generation along urban interstate highways approaches 1.5 tons per mile each year; this is about twice the amount generated along non-urban interstates. State routes in urban areas generate about 1.0 tons of litter per mile; only 0.13 tons per mile are generated along non-urban state routes. Also, urban interchanges accumulate 45% more litter than do non-urban interchanges. This is most likely due to the higher volume of vehicles using these roads and interchange areas.

LITTER IS NOT JUST A ROADSIDE PROBLEM

High-activity areas in county parks, public access areas, and rest areas accumulate more litter per acre each year than roadways do. While vehicles are the primary mode of access to these areas, non-driving activities such as walking, boating, fishing and picnicking may generate the majority of litter at these sites. The composition of litter at some of these sites also suggests the possibility of illegal dumping.

Appendix A: Litter Component Categories

1. PAPER

1.1 Beverage containers

Alcoholic: Any paperboard carton or other container of any size (excluding paper cups and packaging materials) designed to contain wine or wine cooler beverages.

Non-alcoholic: Any paperboard carton or other container of any size (excluding paper cups) designed to contain non-alcoholic beverages. This includes such items as juice boxes and milk cartons, but excludes paper used as packaging material.

Unknown: Any paperboard carton or other container of any size (excluding paper cups and packaging material) designed to contain beverages, but whose previous contents are unknown.

1.2 One-time/fast food service items: All paper items used to serve one-time or fast-food service items originating from restaurants, taverns, drive-ins, concessions, the fast-food section of a grocery store, and other such establishments. Examples include paper cups, plates, bowls, wrappings, individual serving condiment packages, cup and beverage holders, napkins or towels, and paper bags known to be from such establishments.

1.3 Other food and beverage packaging: Any paperboard boxes or cartons, wrappings, or other papers designed to hold food or beverages not originating from fast-food service establishments. This includes, but is not limited to, paperboard boxes used to hold 12 or more individual soda pop or beer cans, and wrappings, bags, or boxes used to package gum, chips, crackers or other snack items.

1.4 Non-food packaging

Tobacco products: Paper boxes, wrappings, bags, or other papers used to package cigarettes, cigars, chewing or pipe tobacco, and other tobacco products. Includes individual cigarette packages.

Cleaning agents (non-hazardous): Paper boxes, wrappings, bags, or other papers that contained cleaning agents such as soaps, shampoos, or detergents, that are primarily used for cleaning buildings, places, persons, animals, or things.

Hazardous material packaging: Paper boxes, wrappers, bags, or other papers that contained hazardous items such as pesticide.

Other packaging: Paper boxes, wrappings, bags, or other papers used to package items that are not food, tobacco, cleaning agents, or hazardous; or whose previous contents are unknown.

1.5 Other cardboard/boxboard: Any other corrugated or paper boxes either not used for packaging or whose purpose is unknown.

1.6 Paper bags: All other paper bags (brown, bleached, or colored) not used known to be used as packaging materials or serving fast-food items. Examples are hardware store bags and grocery bags.

1.7 Newspapers and magazines: Printed newsprint, including “glossy” ad slicks and bound or individual pages of magazines.

1.8 Other paper/composite materials: Products made entirely of paper that are not elsewhere described, such as computer paper, envelopes, and paperback books. Products made predominantly of paper, but also including other materials, such as hardback books and photographs.

2. PLASTIC

2.1 Beverage containers

Alcoholic: Plastic bottles or containers of any size designed to contain beer or other malt beverages, wine, wine coolers, vodka, gin, rum, and liqueurs.

Non-alcoholic: Any plastic bottle or container of any size (excluding plastic cups) designed to contain non-alcoholic beverages, such as soda pop, juice, and sports drinks.

Unknown: Any plastic bottle or other container of any size (excluding plastic cups and packaging materials) designed to contain beverages, but whose previous contents are unknown.

2.2 One-time/fast food service items: All plastic items (including Styrofoam) used to serve one-time or fast-food service items originating from restaurants, taverns, drive-ins, concessions, the fast-food section of a grocery store, and other such establishments. Examples include plastic cups, lids, straws, utensils, plates, bowls, wrappings, individual serving condiment packages, cup and beverage holders, and plastic bags known to be from such establishments.

2.3 Other food and beverage packaging: Any plastic containers (including Styrofoam) or film wrappings designed to hold food or beverage items not originating from fast-food service establishments. This includes, but is not limited to, 6-ringed beverage holders, yogurt cups, and wrappings or bags used to package candy, chips, or other snack items.

2.4 Non-food packaging

Tobacco products: Plastic wrappings, bags, or other plastic packaging materials used to package cigarettes, cigars, chewing or pipe tobacco, or other tobacco products.

Cleaning agents (non-hazardous): Plastic boxes, wrappings, bags, or other plastic packaging materials that contained cleaning agents such as soaps, shampoos, or detergents, that are primarily used for cleaning buildings, places, persons, animals, or things.

Hazardous material packaging: Plastic bottles, boxes or bags that contained hazardous products, such as motor oil bottles.

Other packaging: Paper boxes, wrappings, bags, or other plastics used to package items that are not food, tobacco, cleaning agents; or hazardous materials, or whose previous contents are unknown.

2.5 Plastic bags and film: Plastic films not known to be used for packaging materials or serving fast-food service items. Examples include plastic grocery bags, plastic garbage bags, and tarps.

2.6 Automotive parts: Plastic molding, exterior light covers, and any other plastic part known to be from an automobile.

2.7 Other plastic/composite materials: Products made entirely of plastic that are not elsewhere described, such as multiple-use water bottles. Products made predominantly of plastic, but that also include other materials.

3. GLASS

3.1 Beverage containers

Alcoholic: Any glass bottle or other container of any size designed to contain beer or other malt beverages, wine or wine coolers, vodka, gin, rum, and other liqueurs..

Non-alcoholic: Any glass bottle or other container of any size designed to contain non-alcoholic beverages such as juice, milk or soda pop.

Unknown: Any glass bottle or other container of any size designed to contain a beverage, but whose previous contents is unknown.

3.2 One-time/fast food service items: All glass items used to serve one-time or fast-food service items originating from restaurants, taverns, drive-ins, concessions, fast-food section of a grocery store and other such establishments.

3.3 Other food and beverage packaging: Any glass containers or other glass designed to hold food items not originating from fast-food service establishments. This includes, but is not limited to, jam jars, condiment bottles (e.g. mustard), and spices.

3.4 Non-food packaging

Tobacco products: Glass containers or other glass used to contain cigarettes, cigars, chewing tobacco, or other tobacco products.

Cleaning agents (non-hazardous): Glass containers or other glass used to contain cleaning agents such as soaps, shampoos, or detergents, that are primarily used for cleaning buildings, places, persons, animals, or things.

Hazardous material packaging: Glass containers that contained hazardous materials.

Other packaging: Other glass used to package items that are not food, tobacco, cleaning agents, or hazardous materials, or whose previous contents were unknown.

3.5 Automotive parts: Rearview mirrors, lights, or window glass known to be from an automobile or other motorized vehicle.

3.5 Other glass/composite materials: Glass pieces or products made entirely of glass that are nowhere else classified. Products predominantly made from glass but also include other materials.

4. METAL

4.1 Beverage containers

Alcoholic: Any metal can or other container of any size designed to contain beer or other malt beverages, wine or wine coolers, vodka, gin, rum, and other liqueurs.

Non-alcoholic: Any metal can or other container of any size designed to contain non-alcoholic beverages such as juice, milk or soda pop.

Unknown: Any metal can or other container of any size designed to contain beverages, although the type of beverage is unknown.

4.2 One-time/fast food service items: All metal containers or foils used to serve one-time or fast-food service items originating from restaurants, taverns, drive-ins, concessions, the fast-food section of a grocery store, and other such establishments. Examples include foil wrappings, aluminum bowls, and condiment packaging known to be from such an establishment.

4.3 Other food packaging: Any metal container or foil designed to hold food items not originating from fast-food service establishments. Examples include canned food containers and chocolate bar wrappings.

4.4 Non-food packaging

Tobacco products: Metal containers or foils used to package cigarettes, cigars, chewing tobacco, or other tobacco products.

Cleaning agents (non-hazardous): Metal containers or foils used to contain cleaning agents such as soaps, shampoos, or detergents, that are primarily used for cleaning buildings, places, persons, animals, or things.

Hazardous materials packaging: Metal containers that contained hazardous items, such as oven cleaner.

Other packaging: Other glass used to package items that are not food, tobacco, cleaning agents, or hazardous materials, or whose previous contents were unknown.

4.5 Automotive parts: Any metals known to originate from automobiles. Examples include hubcaps, tailpipes, and wheels.

4.6 Other metal/composite materials: Products made entirely from metal and are not elsewhere described. Predominantly metal products, but containing other materials as well.

5. ORGANICS

5.1 Food (human or pet): Food wastes and scraps including bones, rinds, etc. for human or pet consumption. Excludes the weight of food containers, except when the container weight is negligible compared to the food inside.

5.2 Cigarettes and other tobacco products: All tobacco products including used and unused cigarettes, cigars, chewing tobacco, and pipe tobacco, excluding their packaging, except when the weight is negligible when compared to the weight of the tobacco product.

5.3 Other organics: All organic materials, not elsewhere classified, non-native to the site in which it was collected. This includes yard debris, stumps, firewood, branches, and prunings.

6. CDL

6.1 Wood/lumber/particleboard: Milled lumber and wood products, including treated, untreated, and painted wood.

6.2 Mineral aggregates: Concrete, cinder blocks, and brick.

6.3 Roofing: Roofing materials, asphalt roofing, shingles, tarpaper and tiles.

6.4 Insulation: Fiberglass insulation.

6.5 Drywall: Gypsum drywall (new or used).

6.6 Other construction/demolition debris: Other construction/demolition materials not elsewhere classified.

7. HAZARDOUS MATERIALS

7.1 Latex paint: Water-based paints.

7.2 Oil-based paint: Oil-based paints, varnishes, stains, and similar products.

7.4 Oil: Motor oil and other fuel oils.

7.4 Batteries: Batteries known to be from automobiles.

7.5 Flammable gas: Propane canisters.

7.6 Flammable liquids: Gas, turpentine, and non-chlorinated solvents, including paint strippers and solvents contaminated with other products (such as paints, degreasers and some other cleaners) if the primary ingredient is (or was) the solvent or an alcohol such as methanol or propanol.

7.7 Explosives: Fireworks, firecrackers, or any potentially explosive material other than fireworks, including gunpowder, unspent ammunition, and picric acid.

7.8 Pesticides/herbicides: Variety of poisons whose purpose is to discourage or kill pests, weeds, or microorganisms. Fungicides and wood preservatives are also included.

7.9 Cleaners (hazardous): Cleaning agents such as drain cleaners and mildew removers. This does not include the packaging unless it is negligible by weight.

7.10 Medical wastes: Needles, syringes, I.V. tubing, and other medical waste materials used in connection with treating a patient (or animal). Also includes medications, ointments, creams, etc. used to heal persons or other animals, but does not include their packaging unless negligible by weight.

7.11 Other hazardous: Other hazardous materials that do not fit into the above categories, including unidentifiable materials, such as non-automotive batteries and adhesives/glue.

8. OTHER MATERIALS

8.1 Textiles and leather: Fabrics and products made from leather and/or textiles, such as clothing, shoes, and purses.

8.2 Carpet: General category of flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material.

8.3 Furniture/mattresses/appliances: Mixed material furniture, mattresses, box springs, and refrigerators.

8.4 Tires: Vehicle tires of all types.

8.5 Auto rubber products: Rubber products that originate from vehicles, such as tire shards.

8.6 Rubber and latex toiletries: Rubber or latex products for grooming or health purposes, such as make-up sponges, gloves, and condoms.

8.7 Other rubber or latex products: Finished products and scrap materials made of rubber, such as bath mats, inner tubes, rubber hoses, and foam rubber.

8.8 Disposable diapers: Disposable baby diapers and adult protective undergarments.

8.9 Ceramics/porcelain: Finished ceramic or porcelain products such as dishware, toilets, etc.

8.10 Toys/sporting goods: Items such as golf balls, frisbees and toy cars.

8.11 Miscellaneous materials: Any other material not otherwise described.

Appendix B: Sampling Methodology

The sampling methodology designed and used for the field research and sampling phase of the Washington State Litter Study is described in the sections below. Developing the sampling plan consisted of 5 steps: **Section 1** details the criteria used for developing the sampling strategy; **Section 2** outlines the site category stratification process; **Section 3** summarizes the sample allocation across site categories; **Section 4** describes the sampling schedule; and **Section 5** documents the process employed to identify specific sampling locations for the study. After developing the sampling plan, the actual sampling occurred. **Section 6** defines the “universe” of sites. **Section 7** describes the collection and sorting methodology. Lastly, **Section 8** explains how data were analyzed.

1 SAMPLING STRATEGY

The 1998 Litter Act directed the Washington State Department of Ecology to conduct a litter study to assess the composition and generation of litter in different areas of the state. One of the challenges in designing such a study was to ensure that the litter analyzed was representative of different areas of the state and indicative of littering behavior. In order to complete the study within time and resource constraints, limits had to be set. Representatives from the Washington State Department of Ecology, the Committee for Litter Control and Recycling, and the Litter Task Force worked with Cascadia Consulting Group to shape the following guidelines for the study:

- *Precedent of previous studies*
When appropriate, areas sampled in previous studies were included in the current work. However, changes were made due to stakeholders’ input and ability to gather reliable data as discussed below.
- *Diverse littering behaviors*
Because state legislation directs the state to move toward zero litter in public areas statewide, stakeholders wanted to gain information about littering originating from both driving and non-driving activities. Information about deliberate, accidental, and negligent littering was also sought. Therefore, site categories that would capture many different types of littering behavior were chosen.
- *Public accessibility*
Areas accessible to the general public were included in the study. Residential and private property, private forests, and other areas that are not accessible to the public were excluded.
- *Ability to gather samples in different seasons*
Parks and other public areas that are open most of the year were included.
- *Ability to define the “universe”*
In order to extrapolate the sample data to the state as a whole, the “universe” of sites must be defined. For instance, the total number of county road miles is known, and defines the “universe” of county roads. But similar information regarding the location and size of illegal dumpsites is not available. Site categories were included only if the full “universe” could be quantified.

- *Safety of collection crews*
Only sites where crews could safely collect litter were designated for sampling. Specific locations posing a physical threat to the safety of collection crews (such as roadways with narrow shoulders) were excluded. In these cases an alternate site was randomly selected.
- *Timeframe constraints*
The study was designed to collect as much information possible with the staff and budgetary resources available to the Washington State Department of Ecology. Constraints included weather (snow), the availability of collection crews, storage capacity for the litter samples, and the level of coordination required among the large number of people involved.

One of the primary goals of the sampling was to gain information about the composition and generation rate of litter in different areas of the state. This information could be used to coordinate litter clean-up activities. Additionally, the design team hoped to gain information about different littering behaviors so that prevention strategies could be developed. The design team placed a higher priority on gaining information about littering behavior than making geographical comparisons. For this reason, **site categories** were designated.

2 SITE CATEGORY STRATIFICATION

The consultants, with input from the stakeholders, went through a series of steps to determine which site categories to include in the study. A variety of potential site categories were considered, including public schools, athletic fields, city streets, and more. In the end, three principal categories were defined: **roadways**, highway **interchanges**, and **public areas**. Within each of these, a number of subcategories also were defined. Table 2-1 defines each site subcategory.

Table 2-1 Definitions of Site Categories and Subcategories

Primary Site Category	Subcategory	Further Subcategories
Roadways	Interstates	Urban interstates
		Non-urban interstates
	State routes	Urban state routes
		Non-urban state routes
	County roads	Urban county roads
		Non-urban county roads
Interchanges	Interchanges	Urban interchanges
		Non-urban interchanges
Public Areas	Parks	State parks
		County parks
		Department of Fish & Wildlife recreational access areas
	Public access areas	Department of Natural Resources lands (campgrounds and trails)
		Rest areas

The Department of Ecology was interested in getting at diverse littering behaviors in different parts of the state. The design team agreed to examine the differences in littering behaviors between urban and non-urban areas instead of comparing litter behaviors geographically.¹ For that reason, each roadway site category and the interchange site category were further subdivided into urban and non-urban areas. The public area site categories were not divided into urban and non-urban groups because so few of the sites were located in urban areas.²

Indian reservations were excluded from the study unless an interstate or state route crossed reservation lands. The exclusion was made because reservation lands are not public property. Waterways and private forests were also excluded.

3 SAMPLE ALLOCATION

To obtain comparable data among site categories, an equal number of **samples** was allocated to each site subcategory. In order to be representative and to meet the time and resource constraints of the litter collection crews, 26 sites were allocated to each site subcategory. The road and interchange site categories were further divided equally between urban and non-urban (13 sites each). The park sites and public recreational access sites were divided equally among state and county parks, and Fish & Wildlife and DNR sites, respectively. Table 3-1 shows the sample allocation.

¹ For the purposes of this study, the U.S. Census Bureau's definition of an **"urban area"** was used. According to the Census Bureau, "an urban area comprises one or more places (central place) and the adjacent densely surrounding area (urban fringe) that together have a minimum of 50,000 persons. The urban fringe generally consists of contiguous territory having a density of at least 1,000 persons per square mile." A **"non-urban area,"** then, is any place outside the urban areas. In Washington there are ten urban areas: Bellingham, Bremerton, Longview-Kelso, Olympia, Richland-Kennewick-Pasco, Seattle, Spokane, Tacoma, Vancouver, and Yakima. Maps produced for the 1990 census were used in determining whether a site or road segment fell within "urban" boundaries. Some areas may appear to be non-urban by casual observance (for instance, farmland in King and Snohomish County); however, according to Census definitions, these areas are classified as urban.

² Fewer than ten public recreational access areas are found in urban areas, and only two of the state's 41 rest areas are in urban areas.

Table 3-1 Sample Allocation

Roadside Sampling Locations <i>Composition and Generation</i>					
Interstate Highway 26 sites		State Routes 26 sites		County Roads 26 sites	
<i>Urban</i> 13 sites	<i>Non-urban</i> 13 sites	<i>Urban</i> 13 sites	<i>Non-urban</i> 13 sites	<i>Urban</i> 13 sites	<i>Non-urban</i> 13 sites

Interchange Sampling Locations <i>Composition and Generation</i>	
Interchanges 26 sites	
<i>Urban</i> 13 sites	<i>Non-urban</i> 13 sites

Public Areas Sampling Locations <i>Composition and Generation</i>				
State and County Parks 26 sites		Public Access Areas 26 sites		Rest Areas 26 sites
<i>State</i> 13 sites	<i>County</i> 13 sites	<i>Fish & Wildlife</i> 13 sites	<i>DNR</i> 13 sites	

4 SAMPLING SCHEDULE

A number of factors influenced the development of the sampling schedule, most importantly the availability of collection crews and the time constraints of the study. Two different sampling schedules were used: one sampling schedule for roadways and interchanges, and a separate sampling schedule for public areas. Both litter collection schedules were designed to provide comparable accumulation times for the wet/winter season and the dry/summer season. They were also designed to minimize complications due to snow.

Both schedules began with an initial clean-up. The purpose of the initial clean-up was to start each sampling period with a clean slate—with zero litter. This way true litter accumulation was measurable over a known time period. Litter from the initial clean-ups was not analyzed. It was disposed of according to routine procedures.

4.1 ROADWAY AND INTERCHANGE SITE SCHEDULE

Litter was collected from the roadway and interchange sampling areas three times during the study year: an initial clean-up and two seasonal samples. Crews were deployed in the fall of 1998 to perform the initial clean-ups. During the initial clean-ups, crews verified the site boundaries and reported any oversized items that could potentially remain on the site

throughout the accumulation period. The two accumulation periods were each approximately five months long. The sampling schedule for roadways is shown in Table 4-1. The “litter collections” identified in March and August 1999 indicate when the crews began to collect the seasonal samples. It took several weeks for the crews to visit all of the sites within a sample period.

Table 4-1 Roadway and Interchange Sampling Schedule

OCT '98	NOV '98	DEC '98	JAN '99	FEB '99	MAR '99	APR '99	MAY '99	JUN '99	JUL '99	AUG '99
	Wet Season Litter Accumulation Number of Months					Dry Season Litter Accumulation Number of Months				
Initial Clean-up	1	2	3	4	Litter Collection 5	1	2	3	4	Litter Collection 5

4.2 PUBLIC AREAS SITE SCHEDULE

Sampling of the public area sites was planned for two one-month periods, each with an initial clean-up at the beginning, and a clean-up and collection at the end of the month accumulation. The shorter accumulation period was necessary for aesthetic and public health reasons, as well as logistical considerations. Due to the number of sites, it was difficult for the crews to visit all the sites within an exact one-month period. While sampling was targeted for April and September, actual sampling was extended a few weeks before and after each month.

The public area sites required a great deal more coordination with on-site personnel before the initial clean-ups, than the roadway and interchange sites. Ecology personnel arranged meetings and site visits to explain the litter survey project, to arrange storage for litter picked up during the accumulation period, and to coordinate pick-up schedules. This coordination took place several weeks before each sampling period. The sampling schedule for public areas is shown in Table 4-2.

Table 4-2 Public Areas Sampling Schedule

APR '99	SEP '99
Wet Season Litter Accumulation – 1 month	Dry Season Litter Accumulation – 1 month

5 SITE SELECTION PROCESS

After determining site categories, allocation and a sampling schedule, an involved process ensued to select the exact sampling sites. This section describes the site selection process in detail. Section 5.1 provides an overview of the site selection process. Sections 5.2, 5.3, and 5.4 provide full details for the roadway, interchange and public area sites, respectively.

5.1 OVERVIEW

Just as the general site categories were defined in order to be representative of the state as whole, the chosen sampling locations needed to be representative of the corresponding site category. To avoid potential bias, the sites were chosen using a random selection process.

As described in Section 1, site categories were selected only if the “universe” could be defined. In the random selection process, all potential sampling locations within the universe have an equal chance of being chosen for the study. The “**universe**” of sites is described in detail in Section 6.

Using available data, all potential sampling locations within each site category universe were inventoried and assigned a unique numeric identifier. Next, random numbers were generated through a computer program. The first random number on the list was used to find the starting point of the first site. (For example, if “15” was the first number randomly generated by the computer for urban interstate sites, then the urban interstate site that had been assigned the identifier “15” would be chosen.) This process was repeated until the planned sample allocation—plus alternates—for each site category had been filled.

Next, Ecology Youth Corps (EYC) coordinators inspected the sites located within their regions.³ Sites could be rejected at this point due to safety hazards, or shifted to avoid “overlapping populations.” An **overlapping population** area is any interstate or state route site that includes portions of or an entire interchange (overlap of roadway and interchange populations). Please refer to the Field Training Manual in Appendix E for more detail regarding site verification.

Several “extra” sites were selected in the early stages of the study in the event that a particular site had to be dropped at a later date due to construction or a hazard.

5.2 SITE SELECTION OF ROADWAYS

Site selection for each of the roadway litter sites was conducted in September/October 1998, and the initial clean-up of the sites was performed in November/December 1998.

The selection of roadway sites began with first identifying a milepost or a specific road section which was to serve as a “starting point” for the site included in the survey. Section 5.2.1 details the procedure for selecting starting points for interstates and state routes, and Section 5.2.2 details the procedure for county roads.

From the starting point, the length of the road site was determined by moving a specified distance (depending on the site category) in the increasing direction of the numbered milepost markers (north on a north/south road, east on an east/west road). In order to account for traffic variations and wind-blown litter, the width of the road site was a cross section of the road, including both shoulders and the median if one existed.

The site lengths for each road categories were specified prior to the start of the sampling based on the amount of litter expected to accumulate. Based on input from the EYC Coordinators, it was estimated that an average of 100 pounds of litter could be collected from one-tenth of a road mile within urban areas and from one mile within non-urban areas. After the initial collection period in the fall of 1998, the length of the non-urban interstate sites was reduced to one-half of a mile due to the large amount of litter collected within those sites.

³ The Ecology Youth Corps (EYC) is a long-standing program that employs teens and young adults across the state to pick up litter. There is an Ecology Youth Corps coordinator in each of Ecology's four regions to administer the program. The coordinators were an integral part of the litter survey design team, and the EYC crews performed a majority of the field work associated with the survey.

5.2.1 INTERSTATES AND STATE ROUTES

The miles of interstate and state routes were catalogued by milepost. Each milepost on a given route was designated as a unique site. Milepost information was obtained through Washington Department of Transportation (WSDOT) from the following sources: *Trips System Mileage Summary Detail Report, April 1998*; a map entitled *Mileposts 1998 - Washington State Highway System, June 1998*, and a detailed map of the Puget Sound region entitled *Mileposts 1998 - Puget Sound Area, July 1998*. The statewide map shows milepost markers at every ten-mile segment, while the Puget Sound map shows the mileposts more frequently at every five miles. Additional milepost designations are shown for intersections with other highways and county boundaries.

The *Mileage Summary Detail Report* is a computer printout indicating the beginning and ending mileposts for each state route. For many routes, the mileposts are sequential, without any breaks in the numbering. Other routes, however, contain breaks in the sequence of mileposts because of sections where two or three routes overlap. In those cases, WSDOT assigns a route to take precedence and shows no interruption in the milepost miles of that dominant route. In the case of a state route overlapping with an interstate, WSDOT gives the interstate precedence. In this way, WSDOT avoids double-counting of highway miles.

The list of potential interstate and state route sites was devised by constructing a spreadsheet that contained three columns: the route number, the number of milepost miles, and the cumulative milepost miles. The inventory contains 751 interstate sites and 6,377 state route sites.

5.2.2 COUNTY ROADS

The extensive network of county roads statewide (more than 40,000 miles) made inventorying the universe of all sites impractical. Therefore, a more feasible procedure was devised to select the sites.

The method for selecting county road sites was based on randomly selecting geographic areas of equal size beginning with large areas, and winnowing down to smaller and smaller areas. The starting point was the *Washington Atlas and Gazetteer, DeLorme (1995)*, which divides the state into 119 grids of approximate equal size. After these large grids were selected randomly, a transparent grid with 16 cells was placed over the selected grid and a cell was randomly selected. This narrowed the area of interest to the size of a section based on the range and township system. A second transparent overlay containing 36 cells was used to select the final 1 square mile section from which a county road was selected.

The *Washington Atlas and Gazetteer* does not identify county roads specifically. It identifies state routes and forest service roads by number; the other listed roads could be tribal, county or city roads. Therefore, when a road was selected, the county public works department was contacted to verify that it was a county-maintained road, not a tribal or city road. If it was a tribal or city road, another site was selected.

5.3 SITE SELECTION OF INTERCHANGES

WSDOT provided a listing of all on- and off-ramps from interstates and state routes. The information for each ramp included the milepost location to the 1/100th mile of the entrance or exit point, type of ramp, and a description of other roads connecting to the ramp. The ramp types fall into one of four categories:

- Off-ramp in the ascending direction of the highway
- On-ramp in the ascending direction of the highway
- Off-ramp in the descending direction of the highway
- On-ramp in the descending direction of the highway

The ascending and descending direction of the highway refers to the milepost designations. In general, the mileposts of north-south routes ascend in a northerly direction while the mileposts of east-west routes ascend in an easterly direction.

The listing included a total of 2,170 ramps. Originally, this sampling site category was defined as individual ramps. Therefore, specific ramps were selected from this pool using random numbers. Afterwards, based on input from EYC coordinators, the litter sampling area was expanded to include an off-ramp, an on-ramp, and the adjacent median area within a particular interchange, rather than a single ramp. Thus each interchange site included in the study was, essentially, “half an interchange.” Please see the Field Training Manual (Appendix F) for special litter collection procedures that occur at interchanges.

5.4 SITE SELECTION OF PUBLIC AREAS

The objective for choosing public area sites was to include outdoor sites that contain a variety of pedestrian activities (e.g. water access, recreation, stretching) and sites that are accessible to the general public. The design team believed that different types of littering behaviors occurred in public areas than on roadways. Three categories of public areas were chosen: parks, state recreation areas and rest areas. A fourth category – business districts – was also chosen but was not a part of this current study due to budget and time constraints. However, the methodology has been developed and is outlined in section 5.3.4 for future use.

Each public area site was a specific state or county park, Washington State Department of Fish & Wildlife site, Washington State Department of Natural Resources (DNR) site, or rest area. Because each public area differs in both size and features, only the “high-use areas” were cleaned as part of this study. For the purpose of this study, **high-use areas** are defined as “areas in the park that generally have visitors every day in the summer.” These may include picnic areas, ballfields, play areas, campsites, trails, parking lots, beaches, etc.

Some sites, particularly rest areas and Fish & Wildlife sites, were cleaned in their entirety. For the state parks, county parks, and DNR sites, personnel from the specific site were consulted to find out the high-use areas (e.g. park rangers). The Consultants determined relative proportions between the high-use area to the total site area based on the maps drawn by the EYC Coordinators and Supervisors in the field and information provided by the individual site managers.

5.4.1 PARKS

Parks were divided into state parks and county parks, with 13 sites selected in each category. Because the parks varied in their size and features, typically only the high-use areas were sampled.

- **State Parks**

An inventory of state parks was compiled by contacting the Washington State Parks and Recreation Commission, which manages these lands. The data were obtained through a guide and map entitled *Adventures for a Lifetime: A Comprehensive Guide to Washington State*

Parks, March 1998. For state parks, criteria needed to be established to screen for accessible sites. Some sites in the guide were not included in the inventory of potential sites because of logistical issues, such as access or because the recreational activity was not outdoors. Parks that had the following characteristics were thus excluded:

- Parks which are only accessible by boat;
- Recreation sites that have to be hiked into; and
- Parks which are not open to the general public.

For example, there are 41 marine parks in Washington, but 39 are accessible only by boat and thus were eliminated from the list of potential sites. When the above criteria were applied, an inventory of 135 potential sites were identified in the following categories:

- State parks with camping - 85 sites
- State parks without camping - 39 sites
- Heritage sites and interpretive centers - 9 sites
- Saltwater marine parks - 2 sites

• **County Parks**

The Parks Departments of all 39 Washington counties were contacted by phone to obtain a listing of all county parks. Of the 39 counties, the following 12 counties do not manage any parks: Adams, Asotin, Columbia, Ferry, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Stevens, and Walla Walla. The remaining 27 counties manage at least one park. Most counties have brochures on their park systems, which made obtaining the information relatively easy. A number of county park offices were helpful in providing site maps and, in some cases, aerial photographs.

The counties manage a more diverse group of parks than do the state agencies, which meant that additional criteria needed to be established to screen for accessible sites. The screening criteria for county parks are listed in Table 5-1.

Table 5-1 Screening Criteria for County Parks

Inclusions	Exclusions
<ul style="list-style-type: none"> • Parks greater than 1 acre in size • Parks developed with facilities for outdoor activities • Seasonal parks • Parks that are open to the general public on a regular basis 	<ul style="list-style-type: none"> • Community buildings or indoor swimming pools • Golf courses • Trails • County fairgrounds

The list of potential sites included 331 county parks. Approximately 40% (135 parks) are located in King County. Ten counties (Benton, Chelan, Douglas, Franklin, Grays Harbor, Pacific, Pend Oreille, Thurston, Wahkiakum, and Whitman) have fewer than five parks each.

5.4.2 PUBLIC ACCESS AREAS

State Recreation Areas were divided into Department of Natural Resources (DNR) lands and Department of Fish and Wildlife (F&W) access areas, with 13 sites selected in each category. For the purposes of this study, no urban/non-urban distinction was made for these public access area sites.

- **DNR Lands**

DNR manages more than 5 million acres of trust land. These lands are managed to provide resources and recreational opportunities. Within the DNR managed lands, there are 3,086 acres of recreation sites. An inventory of recreation sites was obtained by using the Washington DNR brochure entitled *Recreation Guide, 1996*. The DNR manages several large state forests that contain multiple recreation sites. These individual recreation sites were each counted as one site in the inventory of potential sites. The inventory contains 117 recreation sites that include a mix of camping sites, trailheads and water activities. Thirteen sites were randomly selected from the 117 sites.

DNR lands are similar to parks in that they are large and contain various features within them. Therefore, only the high-use areas were sampled for the majority of DNR sites.

- **Fish & Wildlife areas**

The Department of Fish & Wildlife also manages recreation access areas around the state. An inventory of the areas was obtained through the Department of Fish & Wildlife. The inventory contains 573 access points totaling 330 acres that include a mix of wildlife sites, trailheads and boat ramps. Thirteen F&W sites were randomly selected from the list of 573 sites.

5.4.3 REST AREAS

An inventory of state-run rest areas was compiled from data provided by the Washington State Department of Transportation. The list includes the route, milepost, name of rest area, and the direction it can be accessed (for example, southbound, multi-directional, etc.). There are a total of 41 rest areas on interstate and state routes, with 28 located on interstates and 13 located on state routes. As mentioned in Section 2.2, all but two of these are located in non-urban areas. The 26 rest areas chosen for the study were randomly selected from this pool of 41 sites.

Typical rest areas consist of five sections: off-ramp, parking lot, grassy area, restroom/information area, and on-ramp. If the rest area was small enough, all sections were included as the litter sample area; otherwise, the high-use area was identified as the litter sample area.

5.4.4 BUSINESS DISTRICTS

Business districts were not included in the 1999 study, but the methodology was developed and is outlined here for future use.

Business districts are defined as the commercial areas within places defined by the Census Bureau. Business districts would be sampled by collecting litter along the city streets that run through the commercial areas. Therefore, the procedure used to select business districts is similar to that used to select the other roadway categories.

As with county roads, it is not feasible to inventory all the city streets within commercial business districts in the state. The first step in selecting business districts was to randomly pick 13 urban and 13 non-urban places as defined by the Census Bureau. Two types of places are recognized by the Census Bureau: incorporated places and census designated places. Incorporated places are those that are incorporated as cities and towns in Washington state. Census designated places must have a population of 2,500 or more persons if inside the boundaries of an urbanized area and 1,000 or more persons if outside the boundaries.

Washington has 146 places within urbanized areas and 267 places outside the urbanized area boundaries.

Maps from the Census Bureau were overlaid with existing street maps to identify the boundaries of each of the 26 selected places. Depending on the size of the place and the available maps, one of the following methods was used to select a city street (1/10 mile in length) within each place:

- 1) A zoning map was obtained from the city or county planning department. Commercial areas were then identified on the corresponding street map. The city streets within the commercial areas were divided into 1/10 mile segments. One road segment and up to four alternates were randomly selected.
- 2) For small cities which did not have zoning maps easily obtainable, a map of the city or census-designated place was faxed to the city or county planning department. *Street Atlas USA Version 5.0 (Delorme)* was used for all the small cities. Streets with commercial activity were indicated on the map, and each of these streets was divided into 1/10 mile segments. One road segment and up to four alternates were randomly selected.

For larger cities, it was not feasible to identify all road segments with commercial activity on them. Therefore, a transparent grid was placed over the city map and a cell was randomly selected. A representative of the city planning department was contacted to determine which streets within the cell had commercial activity on them. These streets were then divided into one-tenth of a mile segments and one was selected at random. Alternates were also selected in that original cell. If no commercial area existed within the selected cell, another cell was chosen and the process was repeated.

6 “UNIVERSE” OF SITES

In order to extrapolate the quantity and composition results derived from field sampling, the universe of each site category was documented. The “universe” represents all possible sites and includes the total number of:

- Urban and non-urban interstate, state route and county road miles (minus those miles associated with interchanges).
- Urban and non-urban interchanges.
- Acres of high-use areas in state parks, county parks, Department of Fish & Wildlife sites, Department of Natural Resource sites, and rest areas.

The method used to identify the “universe” for each of the sampled categories is outlined below.

6.1.1 ROADS

The number of road miles was obtained from the Washington State Department of Transportation for each of the sampled categories (see Table 6-1). Because interchanges were sampled as a separate category (and no road sampling occurred within an interchange), the mileage associated with interchanges had to be subtracted from the total number of road miles. The number of interchange miles was calculated by multiplying the average length of an urban

or non-urban interchange (obtained from the maps of all the sample sites) by the total number of interchanges in each road category (urban and non-urban interstates and state routes)⁴.

On a per mile basis, the area of the road shoulders and the medians differ between road categories. For example, some sites have large shoulders or medians, while others may have a small shoulder or median (for example, there may be a jersey barrier or a rock wall). In order to compare the relative sizes of the sites, an average cross-sectional area was calculated based on the sites included in the study. The average cross-sectional area, measured in square feet, represents sum of the median and shoulder portions of a stretch of road one-mile in length⁵. Since the area per mile is an average, it is representative of road miles both with and without a median. The average cross-sectional area per road mile is also presented in Table 6-1.

Table 6-1 Universe of Road Miles

	<i>(Miles)</i>			<i>(Square Feet)</i>
	Total	Interchange	"Universe"	Area per Mile
<i>Interstates</i>	764	188	576	1,000,100
Urban Interstates	260	117	143	871,514
Non-Urban Interstates	504	70	434	1,042,404
<i>State Routes</i>	6,283	123	6,160	310,636
Urban State Routes	851	106	745	653,637
Non-Urban State Routes	5,432	18	5,414	263,410
<i>County Roads</i>	40,495	0	40,495	194,343
Urban County Roads	5,225	0	5,225	229,892
Non-Urban County Roads	35,270	0	35,270	189,077
Total Roads (Interstates, State Routes, County Roads)	47,542	311	47,231	219,344

Data for interstate highways, state routes and county roads can only be applied to these specific road subcategories in the state, and should not be applied to city streets, forest service roads, and other roads which were not included in this study.

⁴ Based on the maps, the average length of an urban interchange was approximately 0.70 miles and the average length of a non-urban interchange was approximately 0.56 miles. An example of calculating the universe of interstate miles is as follows. There are 764 total interstate miles in Washington which include 170 urban and 126 non-urban interchanges. Therefore, the "universe" of interstate miles is approximately equal to (764 interstate miles) – (0.70 miles/urban interchange) x (170 urban interchanges) – (0.56 miles/non-urban interchange) x (126 non-urban interchanges), or 576 miles.

⁵ For the roadway sites that were measured over an entire mile (non-urban county roads and state routes), the average cross-sectional area was calculated based on the site maps. For the urban road categories and non-urban interstate categories, an average cross-sectional area was computed for the site length measured (either 1/10 or 1/2 mile) and then extrapolated to a full mile. Site subcategories were weighted to determine the average cross-sectional area for interstates, state routes, county roads, and overall roads.

6.1.2 INTERCHANGES

There are 481 interchanges on interstates and state routes in Washington (see Table 6-2). Of those, 323 are in urban areas and 158 are in non-urban areas⁶. The average area for both is roughly the same, approximately one million square feet (based on those included in the study). A standard interchange includes two on-ramps, two off-ramps, and the median; but there is variety in configurations (e.g. an interchange may have only one on-ramp and one off-ramp).

Table 6-2 Universe of Interchanges

	Number	<i>(Square Feet)</i> Area per Interchange
Urban Interchanges	323	1,076,087
Non-Urban Interchanges	158	949,005
Total Interchanges	481	1,034,343

Because interchanges represent a unique sector of the population, they were not combined with the road categories. This is because they relate to road categories that were not included in the sample design. For example, litter deposited within an interchange could be coming from a city street, and city streets were not included in this study. Data from interchanges was kept separate from all other categories, and was not combined with data from other site categories.

6.1.3 PUBLIC AREAS

The total number of state parks, county parks, Fish & Wildlife sites, DNR sites, and rest areas in the state are listed in Table 6-3. Combined, state and county parks include a total of 264,033 acres, public recreational access areas include 3,416 acres and rest areas include 296 acres⁷.

Public area sites ranged in size and features. Since some of the sites were hundreds of acres, the sampling areas were limited to only the most heavily used areas. For the purpose of this study, these high-use areas are defined as “areas that generally have visitors every day in the summer.” The total high-use acreage for each category was calculated based on the proportion of high-use area to the total area in the sites sampled⁸.

⁶ Of the 323 urban interchanges, 170 are on interstates and 153 are on state routes. Of the 158 non-urban interchanges, 126 are on interstates and 32 are on state routes.

⁷ The total acreage of state parks, DNR recreation sites, and Fish & Wildlife sites in Washington were known and are described in detail in Section 5.4. The total acreage of county parks was determined by summing the areas of each county park in the state. An average value (based on the county parks in the state for which the area was known) was assigned to the parks for which the area was not known. The total acreage of rest areas was estimated by multiplying the average size of a rest area (based on those mapped in this study) by the total number of rest areas in the state.

⁸ From the field maps, an average percentage of high-use area was calculated for each subcategory. For example, among the state park maps, the average percentage of high-use areas was roughly 29.6%. To determine the total number of high-use acres for state parks overall, this percentage was multiplied by the total number of acres in state parks. Therefore, the estimated number of high-use acres within state parks is approximately equal to (29.6%) x (232,000 acres), or 68,600 acres.

Table 6-3 Universe of Public Areas Sampled

	Number	(Acres)	
		Total	High Use
<i>State and County Parks</i>	466	264,033	83,888
State Parks	135	232,000	68,608
County Parks	331	32,033	15,279
<i>Public Access (Fish & Wildlife and DNR)</i>	690	3,416	2,112
Fish & Wildlife	573	330	264
DNR	117	3,086	1,847
<i>Rest Areas</i>	42	296	230

Data for state parks, county parks, Fish and Wildlife sites, DNR lands, and rest areas can only be applied to these specific categories in the state, and should not be applied to athletic fields, fairgrounds, public schools, etc. which were not included in this study.

7 COLLECTION AND SORTING OF SAMPLES

Samples of litter were collected between October 1998 and October 1999. Litter samples were collected by Department of Ecology Youth Corps (EYC) crews with assistance from crews from the Department of Transportation, Department of Corrections, Department of Natural Resources, Parks and Recreation Commission, County Parks departments, and some local community crews.

Certain limitations were identified during the course of the collecting activities that should be considered when viewing the results. These include the following:

- *Site interference*
While the Department of Ecology attempted to communicate with all groups that routinely or voluntarily collect litter from around the state, some of the groups may have cleaned up litter from selected sites during the course of the study. As a result, litter accumulation rates may have been underestimated.⁹
- *Items not collected*
For safety reasons, collection crews were instructed to leave certain items on site, such as hazardous materials, explosives, “trucker bottles” (urine-filled bottles), knives, firearms, tissues containing human waste, and extra large items. These items were documented, but were not included in the composition data. Table 7-1 details the number of each type of item found but not collected for sorting. “Items too large or heavy to be carried safely” included items such as railroad ties, pallets, and concrete blocks. “Other” includes such items as gloves, human wastes, and pipes.

⁹ All sites were subject to “scavenging” by individuals collecting materials for recycling. This may be especially true for aluminum beverage containers, which may be profitably recycled.

Table 7-1 Litter Found, but Not Collected

	Roads			Interchanges	Public Areas		
	Interstates	State Routes	County Roads		State & County Parks	Public Access (DNR + F&W)	Rest Areas
Hazardous or potentially hazardous materials	2	5	5	11	0	0	0
Closed bottles containing liquid	10	9	4	5	0	0	4
Trucker bottles	56	7	11	56	0	0	20
Explosives	0	10	1	1	0	0	0
Knives	3	0	0	2	0	1	0
Firearms	0	0	0	1	0	0	0
Items too large or heavy to be carried safely	9	9	7	25	9	1	1
Condoms	5	28	6	14	1	3	13
Needles	13	8	9	32	0	0	4
Razors	5	3	2	9	0	0	7
Broken Glass	2	1	1	5	0	0	0
Other	7	17	3	21	2	7	2

Other than the limitations listed above, crews cleaned everything from each site larger than one square inch. Certain smaller items like bottle caps, polystyrene peanuts, and cigarette butts were also collected. On the roadways, crews participating in litter collection followed appropriate safety procedures advised by state law. Safety procedures were modified in public areas as appropriate.

Crews collected the litter samples in plastic bags with a two-cubic-foot capacity. Portable items too large for the bags were secured with twine or duct tape into bundles. Broken glass was collected separately in buckets for safety reasons. After completing each site, crews carefully tagged the full bags, bundles and buckets containing each sample, and transported them to regional storage locations. Crew supervisors were also responsible for documenting the collection activity on a *Site Verification and Litter Inventory Form*. More information about these procedures can be found in Appendix F, the Training Manual.

Due to the quantity and level of effort required for their removal, cigarette butts were only collected from a designated sub-sample area. Cigarette butt sub-sample areas were designated and marked as follows:

- For urban roadways, the sub-sample was the first 10% of the site area (originating at the lower milepost) all the way across the site, including both shoulders and the median. It measured 52 feet (10% of 1/10 of a mile).
- For non-urban roadways, the sub-sample measured 528 feet (10% of 1 mile for state routes and county roads and 20% of ½ mile for interstates).
- For interchanges, the sub-sample was one of three sections: the on-ramp, the off-ramp, or the median. The section was randomly selected.
- For public areas, the sub-sample was the entire site.

At the end of each collection period, the samples were transported to Tacoma, Lacey, or Spokane, to be sorted, weighed and tabulated by Sky Valley Associates, a professional waste audit company. A total of 356 samples were collected during the two collection periods. As Table 7-2 indicates, the weight of all samples totaled 43,376 pounds (or 21.7 tons), with an average sample weight of 122 pounds.

Table 7-2 Number of Samples Sorted, Total Sample Weight, and Average Weight per Sample

Category	Sample Count	Total Sample Weight (Lbs)	Average Sample Weight (Lbs)
ROADS			
<i>Interstates</i>	55	11,396	207
Urban Interstates	28	2,935	105
Non-Urban Interstates	27	8,460	313
<i>State Routes</i>	52	4,039	78
Urban State Routes	27	1,403	52
Non-Urban State Routes	25	2,636	105
<i>County Roads</i>	55	2,991	54
Urban County Roads	28	885	32
Non-Urban County Roads	27	2,106	78
INTERCHANGES	47	19,428	413
Urban Interchanges	23	10,133	461
Non-Urban Interchanges	24	9,295	387
PUBLIC AREAS			
<i>State and County Parks</i>	48	1,984	41
State Parks	23	930	40
County Parks	25	1,054	42
<i>Public Access (Fish & Wildlife and DNR)</i>	51	1,736	34
Fish & Wildlife	26	988	38
DNR	25	747	30
<i>Rest Areas</i>	48	1,802	38
TOTAL	356	43,376	122

Each sample was sorted and weighed separately. First, all bundles, glass buckets and cigarette butts were weighed separately. If the remaining bags of the sample weighed less than 150 pounds, the entire contents were weighed. If the bags weighed more than 150 pounds, Sky Valley first weighed all the bags, then dumped all the contents onto a tarp, mixed them, and selected a 150-pound sub-sample. This procedure was chosen in order to streamline the sorting process and still obtain a representative sample. All items from the 150-pound mix were then sorted into their respective litter component categories (see Appendix A for the categories).

The weights for each component in the sorted material were recorded on a *Sorting Form* (see Appendix G) and later entered into a database. If a sub-sample was taken, then the total weight of all the collected bags was also documented. After the total weight of the bags was entered into the database, an average bag weight of 0.22 pounds was subtracted. Bundle weights were recorded separately. The total bag and bundles weights were then added together to make a total sample weight.¹⁰

¹⁰ Two examples follow of how sample weights were calculated.

Example 1- Total sample weighs less than 150 pounds: IN-015 had 21 bags and 3 bundles, and the total sample weight was less than 150 pounds. The bags were weighed, the number of bags was multiplied by the average bag weight (21 bags x 0.22), and the latter number was subtracted from the former to get a total bag weight. The bundle weights were summed for a total bundle weight. The total bag weight and total bundle weight were then added together for a total sample weight.

8 DATA ANALYSIS

The litter sampled and sorted from roadways, interchanges and public areas was analyzed to estimate the quantity of litter generated per year, the total quantity generated, and the composition of the litter generated for each site category.

Weighted averages based on road miles were used to combine the site categories for analysis across interstate, state route and county road categories. Separate weighted averages were used for interchanges because interchanges represent a unique sector of the population: they are related to county roads, interstates, city streets, and other roads that were not included in the sample plan.

Public areas were not combined because the subcategories selected (state and county parks, recreational public access sites, and rest areas) represent only a small fraction of all public areas in the state. Since the site categories selected do not represent all public areas in the state (for instance, schools, fairgrounds, and other public areas were left out of the sampling), it would be misleading to present combined results.

Example 2 – Total sample weighs more than 150 pounds: IN-001 had 6 bags and 6 bundles, and the total sample weight was 206 pounds. The content of the bags was thus emptied onto a tarp, mixed, and approximately 150 pounds of it were sorted and recorded. Bundles were weighed separately, and the total bundle weight was recorded. Since the total sample weight was already known (206 pounds), the total sub-sampled bag weight and total bundle weight were not added together.

Appendix C: Site Directory

The following tables list the sites that were randomly selected to be part of the study. A separate database of sites was created detailing their location, size and other information. Please note that in the roadway and interchange site categories, there are 28 sites instead of the 26 prescribed sites. Eight extra sites were selected (two in each category) in anticipation of losing sites due to construction during the course of the study. All litter samples collected were analyzed.

1 ROADS

Table 1-1 Interstate Site Locations

<u>Urban/Non-Urban</u>	<u>Site Number</u>	<u>Site Name</u>	<u>Closest City</u>	<u>County</u>
Non-urban	IN-014	90 MP 127	Vantage	Kittitas
Non-urban	IN-015	5 MP 239	Mount Vernon	Skagit
Non-urban	IN-016	90 MP 146	George	Grant
Non-urban	IN-018	90 MP 190	Moses Lake	Grant
Non-urban	IN-020	90 MP 266	Cheney	Spokane
Non-urban	IN-021 ¹	90 MP 121	Kittitas	Kittitas
Non-urban	IN-022	90 MP 204	Ritzville	Adams
Non-urban	IN-023	5 MP 216	Mount Vernon	Snohomish
Non-urban	IN-024	90 MP 234	Ritzville	Adams
Non-urban	IN-025	82 MP 80	Prosser	Benton
Non-urban	IN-026	90 MP 227	Ritzville	Adams
Non-urban	IN-119	82 MP 77	Grandview	Benton
Non-urban	IN-137	5 MP 244	Southern border of county	Whatcom
Non-urban	IN-143	82 MP 45	Buena	Yakima
Urban	IN-001	5 MP 146	Federal Way	King
Urban	IN-002	82 MP 116	Kennewick	Benton
Urban	IN-003	5 MP 171	North Seattle	King
Urban	IN-005	90 MP 294	Opportunity	Spokane
Urban	IN-006	5 MP 37	Kelso	Cowlitz
Urban	IN-008	5 MP 7	Vancouver	Clark
Urban	IN-009	5 MP 111	Lacey	Thurston
Urban	IN-010	5 MP 102	Tumwater	Thurston
Urban	IN-011	5 MP 44	Kelso	Cowlitz
Urban	IN-012	405 MP 21	Bothell	King
Urban	IN-118	5 MP 143	Federal Way	King
Urban	IN-132	5 MP 10	Duluth	Clark
Urban	IN-133	205 MP 27	Oregon border	Clark
Urban	IN-153	205 MP 36	Vancouver	Clark

¹ No fall sample due to construction.

Table 1-2 State Route Site Locations

<u>Urban/Non-Urban</u>	<u>Site Number</u>	<u>Site Name</u>	<u>Closest City</u>	<u>County</u>
Non-urban	SR-053	105 MP 36	Westport	Grays Harbor
Non-urban	SR-054	28 MP 32	Quincy	Grant
Non-urban	SR-055	97 MP 50	Toppenish	Yakima
Non-urban	SR-056 ²	20 MP 165	Mazama	Okanogan
Non-urban	SR-058	20 MP 8	Port Townsend	Jefferson
Non-urban	SR-059	97 MP 180	Blewett Pass	Chelan
Non-urban	SR-060	272 MP 17	Palouse	Whitman
Non-urban	SR-061	101 MP 189	Forks	Clallam
Non-urban	SR-062	6 MP 15	Lebam	Pacific
Non-urban	SR-063	395 MP 255	Orient	Ferry
Non-urban	SR-064 ³	410 MP 58	Mt Rainier	Pierce
Non-urban	SR-123	23 MP 27	St. John	Whitman
Non-urban	SR-136	305 MP 1	Bainbridge Is.	Kitsap
Non-urban	SR-144	2 MP 86	Coles Corner	Chelan
Urban	SR-040	16 MP 26	Port Orchard	Kitsap
Urban	SR-041	542 MP 5	Bellingham	Whatcom
Urban	SR-042	509 MP 23	Normandy Park	King
Urban	SR-044	3 MP 46	Keyport	Kitsap
Urban	SR-045	524 MP 7	Alderwood Manor	Snohomish
Urban	SR-048 ⁴	224 MP 4	Benton City	Benton
Urban	SR-049	18 MP 6	Auburn	King
Urban	SR-120	99 MP 12	Federal Way	King
Urban	SR-121	509 MP 7	Tacoma	Pierce
Urban	SR-122	99 MP 8	Federal Way	King
Urban	SR-134	167 MP 5	Puyallup	Pierce
Urban	SR-138	104 MP 31	Bothell	King
Urban	SR-139	900 MP 15	Renton	King
Urban	SR-152	99 MP 48	Lynnwood	Snohomish

² No spring sample due to road closure (snow).

³ Both spring and fall samples were accidentally lost.

⁴ No fall sample due to construction.

Table 1-3 County Road Site Locations

<u>Urban/Non-Urban</u>	<u>Site Number</u>	<u>Site Name⁵</u>	<u>Closest City</u>	<u>County</u>
Non-urban	CR-079 ⁶	Whitehall Road	Baird	Douglas
Non-urban	CR-080	Yakima Valley Highway	Zillah	Yakima
Non-urban	CR-081	Eatonville Highway	Eatonville	Pierce
Non-urban	CR-082	Williams Lake Road	Colville	Stevens
Non-urban	CR-083	Shelton Matlock Brady Road	Shelton	Mason
Non-urban	CR-084	Leavenworth Road	Leavenworth	Chelan
Non-urban	CR-085	Quillayute Road	Forks	Clallam
Non-urban	CR-086	Winona South Road	Winona	Whitman
Non-urban	CR-088	E. Zillah Drive	Zillah	Yakima
Non-urban	CR-089	Hoko-Ozette Road	Neah Bay	Clallam
Non-urban	CR-090	Loomis Oroville Road	Oroville	Okanogan
Non-urban	CR-091	E. Camano Drive	Camano Island	Island
Non-urban	CR-142	Le Clerc Creek Road	lone	Pend Oreille
Non-urban	CR-151	Cache Creek Road	Nespelem	Okanogan
Urban	CR-066	Illahee Road	Bremerton	Kitsap
Urban	CR-067	124th Ave. NE	Kirkland-Kingsgate	King
Urban	CR-068	Auburn-Black Diamond Rd	Auburn	King
Urban	CR-070	Central Valley Road	Silverdale	Kitsap
Urban	CR-071	Yew Street Road	Bellingham	Whatcom
Urban	CR-072	Steilacoom-DuPont Road	Fort Lewis	Pierce
Urban	CR-073	Hatch Road	Spokane	Spokane
Urban	CR-074	Petrovisky Road	Renton	King
Urban	CR-075	Harris Street Road	Kelso	Cowlitz
Urban	CR-076	Chico Way	Silverdale	Kitsap
Urban	CR-077	Toad Lake Road	Bellingham	Whatcom
Urban	CR-078	Sunnyside Boulevard	Marysville	Snohomish
Urban	CR-124	Bigelow Gulch Road	Spokane	Spokane
Urban	CR-141	Kitsap Lake Road	Bremerton	Kitsap

⁵ Although not listed in this table, particular 1-mile or 1/10-mile segments were selected, not the entire road.

⁶ No fall sample due to construction.

2 INTERCHANGES

Table 2-1 Interchange Site Locations

<u>Urban/Non-Urban</u>	<u>Site Number</u>	<u>Site Name</u>	<u>Closest City</u>	<u>County</u>
Non-urban	OR-105	5 MP 82.1	Centralia	Lewis
Non-urban	OR-106	5 MP 52.9	Castle Rock	Cowlitz
Non-urban	OR-107 ⁷	90 MP 71.0	Cle Elum	Kittitas
Non-urban	OR-108 ⁸	90 MP 80.7	Cle Elum	Kittitas
Non-urban	OR-109	90 MP 264.6	Medical Lake	Spokane
Non-urban	OR-110	5 MP 70.7	Chehalis	Lewis
Non-urban	OR-111	5 MP 274.8	Blaine	Whatcom
Non-urban	OR-112	5 MP 32.0	Kalama	Cowlitz
Non-urban	OR-113	5 MP 205.8	Arlington	Snohomish
Non-urban	OR-114	90 MP 32.1	North Bend	King
Non-urban	OR-115	82 MP 53.6	Zillah	Yakima
Non-urban	OR-116 ⁹	90 MP 70.0	Cle Elum	Kittitas
Non-urban	OR-117	90 MP 149.3	George	Grant
Non-urban	OR-131	2 MP 8.8	Snohomish	Snohomish
Urban	OR-094 ¹⁰	5 MP 258.0	Bellingham	Whatcom
Urban	OR-095 ¹¹	599 MP 22.7	Tukwila	King
Urban	OR-096 ¹²	16 MP 0.7	Tacoma	Pierce
Urban	OR-100	405 MP 17.6	Kirkland	King
Urban	OR-101	18 MP 6.1	Auburn	King
Urban	OR-102	90 MP 17.4	Issaquah	King
Urban	OR-126	518 MP 2.8	Tukwila	King
Urban	OR-127	5 MP 130.7	Tacoma	Pierce
Urban	OR-129	3 MP 41.4	Silverdale	Kitsap
Urban	OR-130	167 MP 19.9	Kent	King
Urban	OR-140	90 MP 291.1	Opportunity	Spokane
Urban	OR-147	99 MP 26.0	Duwamish Industrial Area	King
Urban	OR-149	509 MP 26.0	Tukwila	King
Urban	OR-150	5 MP 182.3	Lynnwood	Snohomish

⁷ No spring sample due to snow.

⁸ No fall sample due to snow.

⁹ No spring sample due to snow.

¹⁰ No fall sample due to construction.

¹¹ No spring or fall samples due to construction.

¹² No spring sample.

3 PUBLIC AREAS

Table 3-1 State Park Site Locations

<u>Site Number</u>	<u>Site Name</u>	<u>Closest City</u>	<u>County</u>
SP-201	Camano Island	Camano Island	Island
SP-202	Chief Timothy	Clarkston	Asotin
SP-203	Fields Spring	Anatone	Asotin
SP-205	Illahee	Bremerton	Kitsap
SP-206	Lake Sylvia	Montesano	Grays Harbor
SP-207	Paradise Point	Woodland	Clark
SP-208 ¹³	Twin Harbors	Woodland	Grays Harbor
SP-209	Wallace Falls	Gold Bar	Snohomish
SP-210	Federation Forest	Enumclaw	King
SP-211	Steptoe Butte	Garfield	Whitman
SP-212	Lake Lenores Cave	Soap Lake	Grant
SP-213	Pleasant Harbor Marine Park	Quilcene	Jefferson
SP-274	Wanapum	Vantage	Kittitas

Table 3-2 County Park Site Locations

<u>Site Number</u>	<u>Site Name</u>	<u>Closest City</u>	<u>County</u>
CP-188	Freeland Park	Freeland	Island
CP-189	County Line Park	Oak Point	Cowlitz
CP-190 ¹⁴	Lakeland Park	Algona	King
CP-191	Pine Lake Park	Issaquah	King
CP-192	Stillwater	Duvall	King
CP-193	Vance Creek Park	Elma	Grays Harbor
CP-194	Liberty Lake	Spokane	Spokane
CP-195	Rose County Park	Adna	Lewis
CP-196	Odlin Park	Lopez Island	San Juan
CP-197	Otis Perkins Day Use Area	Lopez Island	San Juan
CP-198	Grandy Lake	Concrete	Skagit
CP-199	Metzler Park	Black Diamond	King
CP-200	Sunny View Park	Sunnyside	Yakima

¹³ No samples taken due to flooding and non-cooperation of park personnel.

¹⁴ No spring sample due to construction.

Table 3-3 Fish & Wildlife Site Locations

<u>Site Number</u>	<u>Site Name</u>	<u>Closest City</u>	<u>County</u>
FW-214	Boggan, R.	Asotin	Asotin
FW-215	Burke Lake East	Quincy	Grant
FW-216	Dodson-Frenchman	Ephrata	Grant
FW-217	Heart Lake	Moses Lake	Grant
FW-218	McLeary/Pixlee	Soap Lake	Grant
FW-219	Pearygin Lake	Winthrop	Okanogan
FW-220	Lower Monitor	Cashmere	Chelan
FW-221	South Emerald	Yakima	Yakima
FW-222	Bass Lake	Enumclaw	King
FW-223	Big Lake	Mt. Vernon	Skagit
FW-224	Harksell Rd (Chappell)	Ferndale	Whatcom
FW-225	Loomis Lake	Oceanpark	Pacific
FW-226	Adrian - South	Soap Lake	Grant

Table 3-4 Department of Natural Resource Site Locations

<u>Site Number</u>	<u>Site Name</u>	<u>Closest City</u>	<u>County</u>
NR-227	Wildcat Trailhead	Silverdale	Kitsap
NR-228	Black River Canoe Access	Littlerock	Thurston
NR-229	Mima Mounds Natural Area	Littlerock	Thurston
NR-230	Butte Creek	Pacific	Pacific
NR-231	Snag Lake	Pacific	Pacific
NR-232 ¹⁵	Reflection Ponds & Grieder Lake Trailhead	Sultan	Snohomish
NR-233	Blanchard Hill Trailhead	Bellingham	Whatcom
NR-236	3 Corner Rock Trailhead	Washougal	Skamania
NR-237	Upper Sheep Creek	Northport	Stevens
NR-238	Beverly Dunes	Beverly	Grant
NR-239	Buck Creek Trailhead	White Salmon	Klickitat
NR-272	Tarbell	Yacolt	Skamania
NR-273	Hutchinson Creek	Acme	Whatcom

¹⁵ No spring sample due to snow.

Table 3-5 Rest Area Site Locations

Site Number	Site Name	Closest City	County
RA-244 ¹⁶	Washington Pass (20 MP 162)	Washington Pass	Chelan
RA-245	Indian John Hill - Westbound (I-90 MP 89)	Cle Elum	Kittitas
RA-246	Chamberlain Lake (14 MP 74)	Lyle	Klickitat
RA-248	Vernita (24 MP 43)	Mattawa	Benton
RA-249	Sprague Lake - Westbound (I-90 MP 242)	Sprague	Lincoln
RA-250	Winchester - Westbound (I-90 MP 162)	George	Grant
RA-251	Indian John Hill - Eastbound (I-90 MP 89)	Cle Elum	Kittitas
RA-252	Bow Hill - Northbound (I-5 MP 238)	Mt. Vernon	Skagit
RA-253	Prosser (I-82 - Exit 80)	Prosser	Benton
RA-254	Toutle River - Northbound (I-5 MP 55)	Castle Rock	Cowlitz
RA-255	Schrag - Westbound (I-90 MP 180)	Moses Lake	Grant
RA-256 ¹⁷	Snoquamie Pass (I-90 Exit 53)	Snoqualmie Pass	Kittitas
RA-257	Elma - Eastbound (8 MP 2)	Elma	Grays Harbor
RA-258	SeaTac - Northbound (I-5 MP 140)	Federal Way	King
RA-259	Nason Creek (2 MP 82)	Cole's Corner	Chelan
RA-260	Custer - Northbound (I-5 MP 268)	Ferndale	Whatcom
RA-261	Telford (2 MP 238)	Wilbur	Lincoln
RA-262 ¹⁸	Megler (401 MP 1)	Columbia River	Pacific
RA-263	Blue Lake (17 MP 89)	Coulee City	Grant
RA-264	Fire Interpretive Center (20 MP 316)	Republic	Ferry
RA-265	Silver Lake - Southbound (I-5 MP 188)	Everett	Snohomish
RA-266	Quincy Valley (28 MP 25)	Quincy	Grant
RA-267	Rye Grass - Westbound (I-90 MP 125)	Kittitas	Kittitas
RA-268	Smokey Point - Southbound (I-5 MP 207)	Marysville	Snohomish
RA-269	Selah Creek - Eastbound (I-82 MP 24)	Yakima	Yakima
RA-271	Toutle River - Southbound (I-5 MP 55)	Castle Rock	Cowlitz

¹⁶ No spring sample due to snow.

¹⁷ No samples taken due to snow and logistical difficulties.

¹⁸ No spring sample – interim bags were not saved by rest area personnel.

Appendix D: Composition and Generation Calculations

COMPOSITION CALCULATIONS

The composition estimates represent the **ratio of the components' weight to the total waste** for each noted substream. They are derived by summing each component's weight across all of the selected records and dividing by the sum of the total weight of waste, as shown in the following equation:

$$r_j = \frac{\sum_i c_{ij}}{\sum_i w_i}$$

where:

c = weight of particular component

w = sum of all component weights

for i = 1 to n

where n = number of selected samples

for j = 1 to m

where m = number of components

The confidence interval for this estimate is derived in two steps. First, the variance around the estimate is calculated, accounting for the fact that the ratio includes two random variables (the component and total sample weights). The **variance of the ratio estimator** equation follows:

$$\hat{V}_{r_j} = \left(\frac{1}{n}\right) \cdot \left(\frac{1}{\bar{w}^2}\right) \cdot \left(\frac{\sum_i (c_{ij} - r_j w_i)^2}{n-1}\right)$$

where:

$$\bar{w} = \frac{\sum_i w_i}{n}$$

Second, **precision levels** at the 90% confidence interval are calculated for a component's mean as follows:

$$r_j \pm \left(t \cdot \sqrt{\hat{V}_{r_j}}\right)$$

where:

t = the value of the t-statistic (1.645) corresponding to a 90% confidence level

For more detail, please refer to Chapter 6 "Ratio, Regression and Difference Estimation" of *Elementary Survey Sampling* by R.L. Scheaffer, W. Mendenhall and L. Ott (PWS Publishers, 1986).

WEIGHTED AVERAGES

The overall roads, interstates, state routes, county roads, parks (state and county), and public access (Fish & Wildlife and DNR) composition estimates were calculated by performing a weighted average across the relevant categories.

The **weighted average for an overall composition estimate** is performed as follows:

$$O_j = (p_1 * r_{j1}) + (p_2 * r_{j2}) + (p_3 * r_{j3}) + \dots$$

where:

p = the proportion of tonnage contributed by the noted substream

r = ratio of component weight to total waste weight in the noted substream

for j = 1 to m

where m = number of components

The **variance of the weighted average** is calculated:

$$VarO_j = (p_1^2 * \hat{V}_{r_{j1}}) + (p_2^2 * \hat{V}_{r_{j2}}) + (p_3^2 * \hat{V}_{r_{j3}}) + \dots$$

COMPARISON CALCULATIONS

Identifying statistically significant differences requires a two-step calculation. First, assuming that the two groups to be compared have the same variance, a **pooled sample variance** is calculated:

$$S_{pool}^2 = \frac{[(n1 - 1) \cdot (n1 \cdot \hat{V}_{r_{j1}})] + [(n2 - 1) \cdot (n2 \cdot \hat{V}_{r_{j2}})]}{n1 + n2 - 2}$$

Next, the **t-statistic** is constructed:

$$t = \frac{(r1 - r2)}{\sqrt{\frac{S_{pool}^2}{n1} + \frac{S_{pool}^2}{n2}}}$$

The **p-value** of the t-statistic is calculated based on (n1+n2 -2) degrees of freedom.

Appendix E: Composition Results, by Subcategory

Table 1 through Table 12 provides the unweighted composition estimates for each individual category (except rest areas which is included in the main body of the report) sampled in the study.

- **Roads**
 - Urban Interstates
 - Non-Urban Interstates
 - Urban State Routes
 - Non-Urban State Routes
 - Urban County Roads
 - Non-Urban County Roads
- **Interchanges**
 - Urban Interchanges
 - Non-urban Interchanges
- **Public Areas**
 - State Parks
 - County Parks
 - Fish & Wildlife
 - DNR
 - Rest Areas

Tables 1 and 2 show the composition of urban and non-urban interstates. To summarize, wood products represented a greater proportion of the total interstate litter in urban areas than in non-urban areas (about 21% in urban areas versus about 11% in non-urban areas). Glass beverage containers and tires were more prevalent in non-urban areas (beverage containers comprised about 15% in non-urban areas compared with about 3% in urban areas; and tires comprised about 30% in non-urban areas as compared to about 16% in urban areas).

Table 1 Composition by Weight, Urban Interstates

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	22	10.4%			ORGANIC	26	12.4%		
Beverage Containers	0	0.1%	0.0%	0.2%	Food (Human And Pet)	1	0.6%	0.3%	1.0%
One-Time Fast Food Service Items	4	2.1%	1.5%	2.6%	Cigarettes And Other Tobacco	1	0.3%	0.2%	0.5%
Other Food And Beverage Packaging	1	0.4%	0.3%	0.6%	Other Organics	24	11.5%	7.2%	15.7%
Non-Food Packaging	1	0.6%	0.4%	0.7%	CDL	49	23.1%		
Other Cardboard Boxboard	9	4.5%	3.0%	6.0%	Wood / Lumber / Particleboard	43	20.5%	15.7%	25.3%
Paper Bags	1	0.3%	0.2%	0.4%	Mineral Aggregates	0	0.0%	0.0%	0.1%
Newspapers And Magazines	1	0.5%	0.3%	0.6%	Roofing	3	1.4%	0.5%	2.3%
Other Paper/Composite Materials	4	1.9%	1.5%	2.4%	Insulation	0	0.2%	0.0%	0.4%
PLASTIC	22	10.4%			Drywall	2	0.7%	0.0%	1.8%
Beverage Containers	1	0.4%	0.3%	0.5%	Other Construction / Demolition Debris	1	0.3%	0.0%	0.6%
One-Time Fast Food Service Items	1	0.5%	0.3%	0.6%	HAZARDOUS MATERIALS	2	0.8%		
Other Food And Beverage Packaging	1	0.5%	0.3%	0.6%	Latex Paint	0	0.0%	0.0%	0.0%
Non-Food Packaging	1	0.4%	0.2%	0.7%	Oil Based Paints	0	0.0%	0.0%	0.0%
Plastic Bags And Film	7	3.2%	2.6%	3.9%	Oil	0	0.0%	0.0%	0.0%
Automotive Parts	6	3.0%	1.9%	4.1%	Batteries	0	0.0%	0.0%	0.0%
Other Plastics/Composite Materials	5	2.4%	1.8%	3.0%	Flammable Gas	0	0.0%	0.0%	0.0%
GLASS	9	4.0%			Flammable Liquids	0	0.0%	0.0%	0.0%
Beverage Containers	6	2.8%	2.0%	3.6%	Explosives	0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0	0.0%	0.0%	0.0%	Cleaners (Hazardous)	0	0.0%	0.0%	0.0%
Non-Food Packaging	0	0.0%	0.0%	0.0%	Medical Waste	0	0.0%	0.0%	0.0%
Automotive Parts	2	1.1%	0.1%	2.1%	Other	2	0.8%	0.0%	1.8%
Other Glass/Composite Materials	0	0.1%	0.0%	0.2%	OTHER MATERIALS	52	24.6%		
METAL	30	14.2%			Tires	33	15.7%	12.1%	19.3%
Beverage Containers	2	0.8%	0.6%	0.9%	Auto Rubber Products	4	1.9%	0.8%	3.1%
One-Time Fast Food Service Items	0	0.0%	0.0%	0.0%	Rubber / Latex Toiletries	0	0.1%	0.0%	0.1%
Other Food And Beverage Packaging	0	0.1%	0.0%	0.1%	Other Rubber / Latex Products	1	0.5%	0.0%	1.1%
Non-Food Packaging	0	0.2%	0.0%	0.3%	Disposable Diapers	0	0.1%	0.0%	0.2%
Automotive Parts	16	7.8%	5.2%	10.4%	Textiles / Leather	6	2.9%	1.8%	4.0%
Other Metal/Composite Materials	11	5.4%	3.3%	7.4%	Carpet	1	0.4%	0.1%	0.8%
					Furniture / Mattresses / Appliances	0	0.2%	0.0%	0.5%
					Ceramics / Porcelain	0	0.0%	0.0%	0.0%
					Toys / Sporting Goods	0	0.1%	0.0%	0.2%
					Miscellaneous / Other	6	2.6%	0.2%	5.1%
Estimated Tons	210	Sample Count	28						

Table 2 Composition by Weight, Non-Urban Interstates

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	24.6	7.4%			ORGANIC	43.5	13.1%		
Beverage Containers	0.3	0.1%	0.0%	0.1%	Food (Human And Pet)	1.0	0.3%	0.1%	0.5%
One-Time Fast Food Service Items	5.4	1.6%	0.7%	2.5%	Cigarettes And Other Tobacco	0.4	0.1%	0.1%	0.2%
Other Food And Beverage Packaging	1.7	0.5%	0.3%	0.7%	Other Organics	42.0	12.6%	2.8%	22.5%
Non-Food Packaging	1.2	0.3%	0.2%	0.5%	CDL	40.9	12.3%		
Other Cardboard Boxboard	11.2	3.4%	1.4%	5.4%	Wood / Lumber / Particleboard	36.3	10.9%	7.2%	14.7%
Paper Bags	0.5	0.1%	0.1%	0.2%	Mineral Aggregates	0.1	0.0%	0.0%	0.0%
Newspapers And Magazines	1.7	0.5%	0.2%	0.8%	Roofing	3.2	0.9%	0.5%	1.4%
Other Paper/Composite Materials	2.7	0.8%	0.5%	1.2%	Insulation	0.3	0.1%	0.0%	0.2%
PLASTIC	23.3	7.0%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	2.8	0.8%	0.6%	1.1%	Other Construction / Demolition Debris	1.0	0.3%	0.1%	0.5%
One-Time Fast Food Service Items	1.6	0.5%	0.3%	0.7%	HAZARDOUS MATERIALS	1.7	0.5%		
Other Food And Beverage Packaging	0.9	0.3%	0.1%	0.4%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	1.8	0.5%	0.3%	0.7%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	4.5	1.4%	0.9%	1.8%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	6.1	1.8%	1.3%	2.4%	Batteries	0.6	0.2%	0.0%	0.4%
Other Plastics/Composite Materials	5.7	1.7%	1.2%	2.2%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	51.0	15.3%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	49.6	14.9%	8.8%	21.0%	Explosives	0.1	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.1	0.0%	0.0%	0.0%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.0	0.0%	0.0%	0.0%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.5	0.2%	0.0%	0.4%	Other	1.1	0.3%	0.1%	0.6%
Other Glass/Composite Materials	0.7	0.2%	0.0%	0.5%	OTHER MATERIALS	109.9	33.0%		
METAL	37.9	11.4%			Tires	92.2	27.7%	22.9%	32.5%
Beverage Containers	7.2	2.2%	1.5%	2.8%	Auto Rubber Products	3.4	1.0%	0.4%	1.7%
One-Time Fast Food Service Items	0.3	0.1%	0.0%	0.2%	Rubber /Latex Toiletries	0.6	0.2%	0.0%	0.5%
Other Food And Beverage Packaging	0.9	0.3%	0.1%	0.4%	Other Rubber /Latex Products	2.6	0.8%	0.2%	1.4%
Non-Food Packaging	0.6	0.2%	0.1%	0.3%	Disposable Diapers	0.3	0.1%	0.0%	0.2%
Automotive Parts	18.6	5.6%	2.7%	8.5%	Textiles /Leather	3.9	1.2%	0.8%	1.6%
Other Metal/Composite Materials	10.2	3.1%	2.0%	4.1%	Carpet	0.4	0.1%	0.0%	0.3%
					Furniture /Mattresses /Appliances	0.0	0.0%	0.0%	0.0%
					Ceramics /Porcelain	0.0	0.0%	0.0%	0.0%
					Toys /Sporting Goods	0.3	0.1%	0.0%	0.2%
					Miscellaneous / Other	6.2	1.9%	0.6%	3.1%
Total Tons	333	Sample Count	27						

Tables 3 and 4 show the composition of urban and non-urban state routes. As with interstates, wood products represented a larger proportion of state route litter in urban areas than in non-urban areas (about 21% in urban areas versus about 12% in non-urban areas). Glass beverage containers and tires were more prominent on non-urban state routes (beverage containers comprised about 18% in non-urban areas compared with about 8% in urban areas; and tires comprised about 8% in non-urban areas as compared to about 3% in urban areas).

Table 3 Composition by Weight, Urban State Routes

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	102.0	13.3%			ORGANIC	115.7	15.1%		
Beverage Containers	1.5	0.2%	0.0%	0.3%	Food (Human And Pet)	10.8	1.4%	0.3%	2.6%
One-Time Fast Food Service Items	15.7	2.1%	1.2%	2.9%	Cigarettes And Other Tobacco	27.5	3.6%	0.0%	8.4%
Other Food And Beverage Packaging	3.2	0.4%	0.1%	0.7%	Other Organics	77.4	10.1%	6.4%	13.8%
Non-Food Packaging	3.5	0.5%	0.3%	0.6%	CDL	176.6	23.1%		
Other Cardboard Boxboard	46.0	6.0%	4.2%	7.9%	Wood / Lumber / Particleboard	159.9	20.9%	14.0%	27.9%
Paper Bags	4.0	0.5%	0.2%	0.8%	Mineral Aggregates	2.4	0.3%	0.0%	0.8%
Newspapers And Magazines	11.0	1.4%	0.7%	2.2%	Roofing	7.0	0.9%	0.0%	1.8%
Other Paper/Composite Materials	17.1	2.2%	1.3%	3.2%	Insulation	0.8	0.1%	0.0%	0.2%
PLASTIC	115.4	15.1%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	7.0	0.9%	0.6%	1.2%	Other Construction / Demolition Debris	6.5	0.8%	0.0%	2.0%
One-Time Fast Food Service Items	7.8	1.0%	0.7%	1.3%	HAZARDOUS MATERIALS	2.1	0.3%		
Other Food And Beverage Packaging	5.0	0.6%	0.4%	0.9%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	6.4	0.8%	0.4%	1.2%	Oil Based Paints	0.5	0.1%	0.0%	0.2%
Plastic Bags And Film	47.6	6.2%	3.5%	9.0%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	6.7	0.9%	0.6%	1.2%	Batteries	0.8	0.1%	0.0%	0.3%
Other Plastics/Composite Materials	35.0	4.6%	2.8%	6.4%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	69.7	9.1%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	61.1	8.0%	5.8%	10.2%	Explosives	0.0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.0	0.0%	0.0%	0.0%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.0	0.0%	0.0%	0.0%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	7.5	1.0%	0.0%	2.5%	Other	0.7	0.1%	0.0%	0.2%
Other Glass/Composite Materials	1.0	0.1%	0.0%	0.3%	OTHER MATERIALS	105.0	13.7%		
METAL	78.2	10.2%			Tires	19.4	2.5%	1.1%	4.0%
Beverage Containers	9.0	1.2%	0.9%	1.5%	Auto Rubber Products	17.0	2.2%	0.6%	3.8%
One-Time Fast Food Service Items	0.2	0.0%	0.0%	0.1%	Rubber / Latex Toiletries	0.9	0.1%	0.0%	0.2%
Other Food And Beverage Packaging	1.5	0.2%	0.0%	0.4%	Other Rubber / Latex Products	2.1	0.3%	0.0%	0.5%
Non-Food Packaging	1.9	0.2%	0.0%	0.5%	Disposable Diapers	0.0	0.0%	0.0%	0.0%
Automotive Parts	26.5	3.5%	1.5%	5.5%	Textiles / Leather	25.0	3.3%	1.9%	4.6%
Other Metal/Composite Materials	39.1	5.1%	1.1%	9.2%	Carpet	16.0	2.1%	0.0%	4.4%
					Furniture / Mattresses / Appliances	4.5	0.6%	0.0%	1.5%
					Ceramics / Porcelain	0.4	0.1%	0.0%	0.1%
					Toys / Sporting Goods	0.9	0.1%	0.0%	0.2%
					Miscellaneous / Other	18.8	2.5%	0.8%	4.1%
<i>Estimated Tons</i>	765	<i>Sample Count</i>	27						

Table 4 Composition by Weight, Non-Urban State Routes

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	66.3	9.5%			ORGANIC	98.3	14.1%		
Beverage Containers	1.1	0.2%	0.1%	0.2%	Food (Human And Pet)	38.4	5.5%	0.0%	11.8%
One-Time Fast Food Service Items	18.4	2.6%	2.0%	3.3%	Cigarettes And Other Tobacco	1.0	0.1%	0.1%	0.2%
Other Food And Beverage Packaging	6.1	0.9%	0.6%	1.2%	Other Organics	58.9	8.4%	3.7%	13.1%
Non-Food Packaging	4.6	0.7%	0.5%	0.8%	CDL	108.6	15.5%		
Other Cardboard Boxboard	19.5	2.8%	1.7%	3.9%	Wood / Lumber / Particleboard	83.4	11.9%	8.5%	15.4%
Paper Bags	3.0	0.4%	0.3%	0.6%	Mineral Aggregates	13.5	1.9%	0.0%	4.8%
Newspapers And Magazines	3.2	0.5%	0.2%	0.7%	Roofing	3.2	0.5%	0.2%	0.7%
Other Paper/Composite Materials	10.3	1.5%	0.9%	2.1%	Insulation	0.1	0.0%	0.0%	0.0%
PLASTIC	82.8	11.9%			Drywall	0.4	0.1%	0.0%	0.1%
Beverage Containers	9.2	1.3%	1.1%	1.6%	Other Construction / Demolition Debris	8.0	1.1%	0.0%	2.6%
One-Time Fast Food Service Items	4.8	0.7%	0.5%	0.9%	HAZARDOUS MATERIALS	4.4	0.6%		
Other Food And Beverage Packaging	7.9	1.1%	0.5%	1.8%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	7.1	1.0%	0.4%	1.7%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	21.2	3.0%	1.7%	4.4%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	11.7	1.7%	0.9%	2.5%	Batteries	0.2	0.0%	0.0%	0.1%
Other Plastics/Composite Materials	20.9	3.0%	1.5%	4.4%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	129.6	18.6%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	121.4	17.4%	13.9%	20.9%	Explosives	0.4	0.1%	0.0%	0.1%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	1.6	0.2%	0.0%	0.6%
Other Food And Beverage Packaging	0.3	0.0%	0.0%	0.1%	Cleaners (Hazardous)	0.4	0.1%	0.0%	0.2%
Non-Food Packaging	0.9	0.1%	0.0%	0.3%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	4.3	0.6%	0.0%	1.3%	Other	1.8	0.3%	0.1%	0.4%
Other Glass/Composite Materials	2.7	0.4%	0.0%	0.7%	OTHER MATERIALS	105.5	15.1%		
METAL	102.7	14.7%			Tires	55.3	7.9%	2.7%	13.1%
Beverage Containers	24.1	3.4%	2.7%	4.2%	Auto Rubber Products	8.4	1.2%	0.4%	2.0%
One-Time Fast Food Service Items	0.4	0.1%	0.0%	0.1%	Rubber / Latex Toiletries	3.7	0.5%	0.0%	1.3%
Other Food And Beverage Packaging	1.5	0.2%	0.1%	0.3%	Other Rubber / Latex Products	1.5	0.2%	0.1%	0.4%
Non-Food Packaging	1.0	0.1%	0.0%	0.2%	Disposable Diapers	0.2	0.0%	0.0%	0.1%
Automotive Parts	33.2	4.7%	2.4%	7.1%	Textiles / Leather	10.0	1.4%	1.0%	1.9%
Other Metal/Composite Materials	42.6	6.1%	3.2%	9.0%	Carpet	3.5	0.5%	0.0%	1.0%
					Furniture / Mattresses / Appliances	0.7	0.1%	0.0%	0.3%
					Ceramics / Porcelain	0.1	0.0%	0.0%	0.0%
					Toys / Sporting Goods	0.3	0.0%	0.0%	0.1%
<i>Estimated Tons</i>	698	<i>Sample Count</i>	25		Miscellaneous / Other	21.7	3.1%	1.7%	4.5%

Tables 5 and 6 show the composition of urban and non-urban county roads. On urban county roads, "other organics" represented a greater proportion of the total litter than on non-urban county roads (about 19% in urban areas versus 9% in non-urban areas). Glass beverage containers were more prevalent in non-urban areas (beverage containers comprised about 27% in non-urban areas as compared to 14% in urban areas). Tires also comprised a somewhat higher percentage of litter in non-urban areas (8% in non-urban areas and 4.7% in urban areas).

Table 5 Composition by Weight, Urban County Roads

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	213.7	8.8%			ORGANIC	506.8	20.9%		
Beverage Containers	3.5	0.1%	0.0%	0.2%	Food (Human And Pet)	23.2	1.0%	0.4%	1.5%
One-Time Fast Food Service Items	52.2	2.1%	1.0%	3.3%	Cigarettes And Other Tobacco	20.7	0.9%	0.1%	1.6%
Other Food And Beverage Packaging	22.0	0.9%	0.1%	1.7%	Other Organics	462.8	19.1%	4.9%	33.3%
Non-Food Packaging	7.7	0.3%	0.2%	0.4%	CDL	323.7	13.3%		
Other Cardboard Boxboard	58.5	2.4%	1.1%	3.7%	Wood / Lumber / Particleboard	296.7	12.2%	7.4%	17.1%
Paper Bags	6.0	0.2%	0.1%	0.4%	Mineral Aggregates	1.4	0.1%	0.0%	0.2%
Newspapers And Magazines	41.3	1.7%	0.7%	2.7%	Roofing	3.3	0.1%	0.0%	0.2%
Other Paper/Composite Materials	22.4	0.9%	0.3%	1.6%	Insulation	0.0	0.0%	0.0%	0.0%
PLASTIC	375.7	15.5%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	23.3	1.0%	0.6%	1.3%	Other Construction / Demolition Debris	22.2	0.9%	0.0%	1.8%
One-Time Fast Food Service Items	14.9	0.6%	0.3%	0.9%	HAZARDOUS MATERIALS	13.2	0.5%		
Other Food And Beverage Packaging	18.9	0.8%	0.5%	1.0%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	15.3	0.6%	0.2%	1.1%	Oil Based Paints	2.2	0.1%	0.0%	0.2%
Plastic Bags And Film	189.0	7.8%	4.9%	10.6%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	38.8	1.6%	0.8%	2.4%	Batteries	3.1	0.1%	0.0%	0.2%
Other Plastics/Composite Materials	75.4	3.1%	2.2%	4.0%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	455.7	18.8%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	344.8	14.2%	9.0%	19.4%	Explosives	1.7	0.1%	0.0%	0.2%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	31.6	1.3%	0.0%	3.5%	Cleaners (Hazardous)	3.3	0.1%	0.0%	0.3%
Non-Food Packaging	0.4	0.0%	0.0%	0.0%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	1.2	0.0%	0.0%	0.1%	Other	2.8	0.1%	0.0%	0.2%
Other Glass/Composite Materials	77.7	3.2%	0.0%	8.2%	OTHER MATERIALS	250.0	10.3%		
METAL	288.8	11.9%			Tires	113.8	4.7%	0.0%	11.2%
Beverage Containers	40.7	1.7%	1.0%	2.3%	Auto Rubber Products	6.3	0.3%	0.1%	0.4%
One-Time Fast Food Service Items	1.0	0.0%	0.0%	0.1%	Rubber / Latex Toiletries	1.0	0.0%	0.0%	0.1%
Other Food And Beverage Packaging	5.1	0.2%	0.0%	0.4%	Other Rubber / Latex Products	1.2	0.0%	0.0%	0.1%
Non-Food Packaging	3.6	0.1%	0.0%	0.3%	Disposable Diapers	1.1	0.0%	0.0%	0.1%
Automotive Parts	89.9	3.7%	1.2%	6.2%	Textiles / Leather	49.8	2.1%	0.9%	3.2%
Other Metal/Composite Materials	148.5	6.1%	1.5%	10.8%	Carpet	3.8	0.2%	0.0%	0.3%
					Furniture / Mattresses / Appliances	26.1	1.1%	0.0%	2.4%
					Ceramics / Porcelain	2.7	0.1%	0.0%	0.3%
					Toys / Sporting Goods	3.5	0.1%	0.0%	0.3%
					Miscellaneous / Other	40.8	1.7%	0.7%	2.6%
<i>Estimated Tons</i>	2,427	<i>Sample Count</i>	28						

Table 6 Composition by Weight, Non-Urban County Roads

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	402.2	10.3%			ORGANIC	439.8	11.3%		
Beverage Containers	13.8	0.4%	0.2%	0.6%	Food (Human And Pet)	59.9	1.5%	0.8%	2.3%
One-Time Fast Food Service Items	96.5	2.5%	1.3%	3.6%	Cigarettes And Other Tobacco	32.1	0.8%	0.0%	2.0%
Other Food And Beverage Packaging	31.8	0.8%	0.5%	1.2%	Other Organics	347.8	8.9%	5.9%	12.0%
Non-Food Packaging	80.8	2.1%	0.0%	4.2%	CDL	455.4	11.7%		
Other Cardboard Boxboard	75.1	1.9%	0.9%	3.0%	Wood / Lumber / Particleboard	413.0	10.6%	6.0%	15.3%
Paper Bags	40.7	1.0%	0.0%	2.4%	Mineral Aggregates	12.0	0.3%	0.0%	0.8%
Newspapers And Magazines	28.6	0.7%	0.4%	1.1%	Roofing	16.6	0.4%	0.0%	0.9%
Other Paper/Composite Materials	34.9	0.9%	0.4%	1.4%	Insulation	3.6	0.1%	0.0%	0.2%
PLASTIC	380.4	9.8%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	68.1	1.8%	1.3%	2.2%	Other Construction / Demolition Debris	10.3	0.3%	0.0%	0.5%
One-Time Fast Food Service Items	21.2	0.5%	0.3%	0.8%	HAZARDOUS MATERIALS	18.3	0.5%		
Other Food And Beverage Packaging	23.1	0.6%	0.3%	0.9%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	35.9	0.9%	0.5%	1.3%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	107.9	2.8%	1.9%	3.7%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	29.1	0.7%	0.4%	1.1%	Batteries	8.3	0.2%	0.0%	0.5%
Other Plastics/Composite Materials	95.1	2.4%	1.1%	3.8%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	1058.2	27.2%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	1035.7	26.6%	19.1%	34.2%	Explosives	0.0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.1	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	8.0	0.2%	0.0%	0.4%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	3.1	0.1%	0.0%	0.2%	Medical Waste	0.7	0.0%	0.0%	0.1%
Automotive Parts	3.9	0.1%	0.0%	0.3%	Other	9.2	0.2%	0.1%	0.4%
Other Glass/Composite Materials	7.5	0.2%	0.0%	0.4%	OTHER MATERIALS	538.4	13.8%		
METAL	596.3	15.3%			Tires	309.8	8.0%	2.5%	13.4%
Beverage Containers	188.6	4.8%	3.8%	5.9%	Auto Rubber Products	42.7	1.1%	0.2%	2.0%
One-Time Fast Food Service Items	2.4	0.1%	0.0%	0.1%	Rubber / Latex Toiletries	0.7	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	41.4	1.1%	0.3%	1.8%	Other Rubber / Latex Products	4.2	0.1%	0.0%	0.2%
Non-Food Packaging	44.1	1.1%	0.2%	2.1%	Disposable Diapers	12.6	0.3%	0.0%	0.6%
Automotive Parts	80.5	2.1%	0.9%	3.2%	Textiles / Leather	66.5	1.7%	1.1%	2.3%
Other Metal/Composite Materials	239.4	6.2%	3.9%	8.4%	Carpet	1.4	0.0%	0.0%	0.1%
					Furniture / Mattresses / Appliances	0.0	0.0%	0.0%	0.0%
					Ceramics / Porcelain	0.3	0.0%	0.0%	0.0%
					Toys / Sporting Goods	1.1	0.0%	0.0%	0.1%
					Miscellaneous / Other	99.1	2.5%	0.7%	4.4%
<i>Estimated Tons</i>	3,889	<i>Sample Count</i>	27						

Tables 7 and 8 show the composition of urban and non-urban interchanges. There were few notable differences between urban and non-urban litter composition on interchanges, with the exception of tires (about 12% on non-urban interchanges versus approximately 4% on urban interchanges.).

Table 7 Composition by Weight, Urban Interchanges

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	59.4	12.9%			ORGANIC	73.5	15.9%		
Beverage Containers	0.4	0.1%	0.0%	0.1%	Food (Human And Pet)	2.8	0.6%	0.3%	0.9%
One-Time Fast Food Service Items	9.9	2.1%	1.8%	2.4%	Cigarettes And Other Tobacco	4.9	1.1%	0.2%	1.9%
Other Food And Beverage Packaging	1.9	0.4%	0.3%	0.5%	Other Organics	65.7	14.2%	10.3%	18.2%
Non-Food Packaging	4.5	1.0%	0.5%	1.5%	CDL	102.1	22.1%		
Other Cardboard Boxboard	26.9	5.8%	4.7%	7.0%	Wood / Lumber / Particleboard	80.3	17.4%	13.3%	21.5%
Paper Bags	1.7	0.4%	0.3%	0.5%	Mineral Aggregates	9.6	2.1%	0.2%	4.0%
Newspapers And Magazines	3.5	0.7%	0.5%	1.0%	Roofing	1.9	0.4%	0.1%	0.7%
Other Paper/Composite Materials	10.6	2.3%	1.7%	2.9%	Insulation	0.1	0.0%	0.0%	0.1%
PLASTIC	61.8	13.4%			Drywall	3.4	0.7%	0.0%	1.7%
Beverage Containers	3.6	0.8%	0.6%	0.9%	Other Construction / Demolition Debris	6.7	1.5%	0.2%	2.7%
One-Time Fast Food Service Items	2.4	0.5%	0.4%	0.6%	HAZARDOUS MATERIALS	1.6	0.3%		
Other Food And Beverage Packaging	1.8	0.4%	0.3%	0.5%	Latex Paint	0.6	0.1%	0.0%	0.3%
Non-Food Packaging	3.2	0.7%	0.3%	1.1%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	20.8	4.5%	3.6%	5.4%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	12.7	2.7%	1.6%	3.8%	Batteries	0.5	0.1%	0.0%	0.2%
Other Plastics/Composite Materials	17.4	3.8%	2.5%	5.0%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	65.1	14.1%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	59.4	12.9%	7.9%	17.8%	Explosives	0.2	0.0%	0.0%	0.1%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.0	0.0%	0.0%	0.0%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.0	0.0%	0.0%	0.0%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	2.8	0.6%	0.0%	1.3%	Other	0.4	0.1%	0.0%	0.2%
Other Glass/Composite Materials	2.8	0.6%	0.0%	1.3%	OTHER MATERIALS	46.2	10.0%		
METAL	52.0	11.3%			Tires	20.1	4.4%	2.4%	6.3%
Beverage Containers	5.6	1.2%	1.0%	1.4%	Auto Rubber Products	2.0	0.4%	0.2%	0.7%
One-Time Fast Food Service Items	0.1	0.0%	0.0%	0.0%	Rubber / Latex Toiletries	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.6	0.1%	0.1%	0.2%	Other Rubber / Latex Products	1.3	0.3%	0.0%	0.5%
Non-Food Packaging	2.0	0.4%	0.1%	0.8%	Disposable Diapers	0.6	0.1%	0.0%	0.3%
Automotive Parts	20.2	4.4%	2.9%	5.9%	Textiles / Leather	9.6	2.1%	1.7%	2.4%
Other Metal/Composite Materials	23.5	5.1%	3.7%	6.5%	Carpet	0.9	0.2%	0.0%	0.5%
					Furniture / Mattresses / Appliances	0.4	0.1%	0.0%	0.2%
					Ceramics / Porcelain	0.5	0.1%	0.0%	0.2%
					Toys / Sporting Goods	0.1	0.0%	0.0%	0.0%
					Miscellaneous / Other	10.7	2.3%	0.4%	4.2%
<i>Estimated Tons</i>	462	<i>Sample Count</i>	23						

Table 8 Composition by Weight, Non-Urban Interchanges

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	11.0	7.1%			ORGANIC	26.8	17.3%		
Beverage Containers	0.3	0.2%	0.1%	0.2%	Food (Human And Pet)	1.7	1.1%	0.6%	1.6%
One-Time Fast Food Service Items	2.8	1.8%	1.2%	2.4%	Cigarettes And Other Tobacco	1.2	0.8%	0.2%	1.3%
Other Food And Beverage Packaging	0.8	0.5%	0.4%	0.7%	Other Organics	23.9	15.4%	10.3%	20.5%
Non-Food Packaging	0.8	0.5%	0.3%	0.7%	CDL	26.9	17.4%		
Other Cardboard Boxboard	3.0	1.9%	1.3%	2.5%	Wood / Lumber / Particleboard	22.6	14.6%	10.4%	18.7%
Paper Bags	0.4	0.2%	0.1%	0.3%	Mineral Aggregates	1.4	0.9%	0.0%	2.2%
Newspapers And Magazines	1.1	0.7%	0.4%	1.0%	Roofing	1.5	1.0%	0.5%	1.4%
Other Paper/Composite Materials	1.9	1.2%	0.7%	1.7%	Insulation	0.1	0.1%	0.0%	0.2%
PLASTIC	17.0	11.0%			Drywall	0.9	0.6%	0.0%	1.2%
Beverage Containers	1.5	1.0%	0.8%	1.2%	Other Construction / Demolition Debris	0.4	0.3%	0.0%	0.7%
One-Time Fast Food Service Items	0.8	0.5%	0.4%	0.7%	HAZARDOUS MATERIALS	1.3	0.9%		
Other Food And Beverage Packaging	0.8	0.5%	0.3%	0.8%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	3.9	2.5%	0.1%	4.9%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	3.5	2.3%	1.3%	3.2%	Oil	0.1	0.0%	0.0%	0.1%
Automotive Parts	2.0	1.3%	0.9%	1.7%	Batteries	0.0	0.0%	0.0%	0.0%
Other Plastics/Composite Materials	4.4	2.8%	2.0%	3.7%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	20.2	13.0%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	19.3	12.5%	7.8%	17.1%	Explosives	0.2	0.1%	0.0%	0.2%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.0	0.0%	0.0%	0.1%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.4	0.2%	0.0%	0.5%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.4	0.2%	0.0%	0.5%	Other	1.1	0.7%	0.1%	1.3%
Other Glass/Composite Materials	0.1	0.1%	0.0%	0.1%	OTHER MATERIALS	32.6	21.0%		
METAL	19.3	12.4%			Tires	19.3	12.4%	9.8%	15.0%
Beverage Containers	2.7	1.8%	1.5%	2.0%	Auto Rubber Products	3.1	2.0%	1.1%	2.9%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Rubber /Latex Toiletries	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.2	0.2%	0.1%	0.2%	Other Rubber /Latex Products	0.8	0.5%	0.0%	1.1%
Non-Food Packaging	0.4	0.2%	0.1%	0.4%	Disposable Diapers	1.9	1.2%	0.0%	3.2%
Automotive Parts	9.8	6.3%	4.3%	8.3%	Textiles /Leather	3.6	2.3%	1.5%	3.1%
Other Metal/Composite Materials	6.2	4.0%	2.4%	5.6%	Carpet	0.8	0.5%	0.0%	1.0%
					Furniture /Mattresses /Appliances	0.0	0.0%	0.0%	0.0%
					Ceramics /Porcelain	0.1	0.1%	0.0%	0.1%
					Toys /Sporting Goods	0.0	0.0%	0.0%	0.0%
					Miscellaneous / Other	3.0	1.9%	0.3%	3.6%
<i>Estimated Tons</i>	155	<i>Sample Count</i>	24						

Tables 9 and 10 show the composition of state parks and county parks separately. There is no distinction between urban and non-urban.

Table 9 Composition by Weight, State Parks

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	145.5	10.0%			ORGANIC	237.6	16.4%		
Beverage Containers	2.5	0.2%	0.0%	0.3%	Food (Human And Pet)	100.4	6.9%	3.3%	10.6%
One-Time Fast Food Service Items	66.0	4.5%	2.9%	6.2%	Cigarettes And Other Tobacco	35.5	2.4%	1.2%	3.7%
Other Food And Beverage Packaging	16.7	1.1%	0.8%	1.5%	Other Organics	101.6	7.0%	4.1%	9.9%
Non-Food Packaging	9.5	0.7%	0.3%	1.0%	CDL	394.9	27.2%		
Other Cardboard Boxboard	3.6	0.2%	0.1%	0.4%	Wood / Lumber / Particleboard	393.9	27.1%	7.0%	47.2%
Paper Bags	4.2	0.3%	0.1%	0.5%	Mineral Aggregates	0.0	0.0%	0.0%	0.0%
Newspapers And Magazines	22.7	1.6%	0.5%	2.6%	Roofing	0.6	0.0%	0.0%	0.1%
Other Paper/Composite Materials	20.4	1.4%	0.5%	2.4%	Insulation	0.1	0.0%	0.0%	0.0%
PLASTIC	115.0	7.9%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	18.4	1.3%	0.7%	1.8%	Other Construction / Demolition Debris	0.3	0.0%	0.0%	0.1%
One-Time Fast Food Service Items	17.6	1.2%	0.5%	1.9%	HAZARDOUS MATERIALS	3.2	0.2%		
Other Food And Beverage Packaging	10.1	0.7%	0.4%	1.0%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	9.7	0.7%	0.1%	1.2%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	38.0	2.6%	1.7%	3.6%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.9	0.1%	0.0%	0.1%	Batteries	2.6	0.2%	0.0%	0.4%
Other Plastics/Composite Materials	20.4	1.4%	0.9%	1.9%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	238.3	16.4%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	232.1	16.0%	10.1%	21.8%	Explosives	0.0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	1.8	0.1%	0.0%	0.3%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	1.2	0.1%	0.0%	0.2%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.0	0.0%	0.0%	0.0%	Other	0.6	0.0%	0.0%	0.1%
Other Glass/Composite Materials	3.1	0.2%	0.0%	0.6%	OTHER MATERIALS	159.2	11.0%		
METAL	158.3	10.9%			Tires	20.8	1.4%	0.0%	3.2%
Beverage Containers	67.5	4.6%	3.4%	5.9%	Auto Rubber Products	4.6	0.3%	0.0%	0.6%
One-Time Fast Food Service Items	4.0	0.3%	0.1%	0.4%	Rubber / Latex Toiletries	0.9	0.1%	0.0%	0.2%
Other Food And Beverage Packaging	11.9	0.8%	0.2%	1.4%	Other Rubber / Latex Products	8.9	0.6%	0.0%	1.6%
Non-Food Packaging	8.0	0.5%	0.2%	0.9%	Disposable Diapers	9.1	0.6%	0.2%	1.1%
Automotive Parts	41.1	2.8%	0.0%	6.5%	Textiles / Leather	59.2	4.1%	1.8%	6.3%
Other Metal/Composite Materials	25.9	1.8%	0.7%	2.8%	Carpet	3.1	0.2%	0.0%	0.5%
					Furniture / Mattresses / Appliances	20.2	1.4%	0.0%	2.9%
					Ceramics / Porcelain	0.9	0.1%	0.0%	0.1%
					Toys / Sporting Goods	3.5	0.2%	0.0%	0.4%
					Miscellaneous / Other	28.1	1.9%	0.4%	3.5%
<i>Estimated Tons</i>	1,452	<i>Sample Count</i>	23						

Table 10 Composition by Weight, County Parks

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	61.1	5.6%			ORGANIC	120.3	11.1%		
Beverage Containers	0.6	0.1%	0.0%	0.1%	Food (Human And Pet)	67.4	6.2%	2.6%	9.9%
One-Time Fast Food Service Items	28.0	2.6%	0.9%	4.3%	Cigarettes And Other Tobacco	9.0	0.8%	0.3%	1.3%
Other Food And Beverage Packaging	5.4	0.5%	0.1%	0.9%	Other Organics	43.8	4.0%	2.3%	5.7%
Non-Food Packaging	2.9	0.3%	0.1%	0.4%	CDL	236.8	21.8%		
Other Cardboard Boxboard	4.0	0.4%	0.1%	0.7%	Wood / Lumber / Particleboard	233.0	21.5%	8.8%	34.2%
Paper Bags	2.8	0.3%	0.1%	0.4%	Mineral Aggregates	2.1	0.2%	0.0%	0.4%
Newspapers And Magazines	14.4	1.3%	0.2%	2.4%	Roofing	0.4	0.0%	0.0%	0.1%
Other Paper/Composite Materials	3.0	0.3%	0.1%	0.5%	Insulation	0.0	0.0%	0.0%	0.0%
PLASTIC	157.6	14.5%			Drywall	0.6	0.1%	0.0%	0.1%
Beverage Containers	26.3	2.4%	0.0%	5.0%	Other Construction / Demolition Debris	0.7	0.1%	0.0%	0.1%
One-Time Fast Food Service Items	3.8	0.4%	0.1%	0.6%	HAZARDOUS MATERIALS	3.4	0.3%		
Other Food And Beverage Packaging	5.0	0.5%	0.3%	0.7%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	36.7	3.4%	0.0%	7.2%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	43.0	4.0%	1.2%	6.7%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.2	0.0%	0.0%	0.0%	Batteries	0.4	0.0%	0.0%	0.1%
Other Plastics/Composite Materials	42.7	3.9%	1.5%	6.4%	Flammable Gas	2.5	0.2%	0.0%	0.6%
GLASS	151.2	13.9%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	136.1	12.5%	7.1%	18.0%	Explosives	0.0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	9.3	0.9%	0.0%	1.8%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.0	0.0%	0.0%	0.0%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.0	0.0%	0.0%	0.0%	Other	0.6	0.1%	0.0%	0.2%
Other Glass/Composite Materials	5.9	0.5%	0.0%	1.5%	OTHER MATERIALS	234.4	21.6%		
METAL	119.5	11.0%			Tires	132.9	12.3%	3.9%	20.6%
Beverage Containers	33.0	3.0%	1.9%	4.2%	Auto Rubber Products	14.4	1.3%	0.0%	2.9%
One-Time Fast Food Service Items	1.2	0.1%	0.0%	0.2%	Rubber / Latex Toiletries	0.6	0.1%	0.0%	0.1%
Other Food And Beverage Packaging	7.7	0.7%	0.2%	1.2%	Other Rubber / Latex Products	1.9	0.2%	0.0%	0.4%
Non-Food Packaging	6.2	0.6%	0.0%	1.3%	Disposable Diapers	5.8	0.5%	0.0%	1.1%
Automotive Parts	42.7	3.9%	0.7%	7.2%	Textiles / Leather	38.7	3.6%	1.7%	5.5%
Other Metal/Composite Materials	28.7	2.6%	0.3%	5.0%	Carpet	9.1	0.8%	0.0%	1.7%
					Furniture / Mattresses / Appliances	20.0	1.8%	0.0%	4.9%
					Ceramics / Porcelain	0.0	0.0%	0.0%	0.0%
					Toys / Sporting Goods	0.8	0.1%	0.0%	0.1%
					Miscellaneous / Other	10.4	1.0%	0.1%	1.8%
<i>Estimated Tons</i>	1,084	<i>Sample Count</i>	25						

Tables 11 and 12 show the composition of Fish & Wildlife and Department of Natural Resource sites separately.

Table 11 Composition by Weight, Fish & Wildlife

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	6.9	4.3%			ORGANIC	28.7	18.1%		
Beverage Containers	0.2	0.1%	0.0%	0.3%	Food (Human And Pet)	3.4	2.1%	0.7%	3.6%
One-Time Fast Food Service Items	2.1	1.4%	0.4%	2.4%	Cigarettes And Other Tobacco	0.6	0.4%	0.0%	0.7%
Other Food And Beverage Packaging	1.5	0.9%	0.4%	1.5%	Other Organics	24.7	15.6%	5.8%	25.3%
Non-Food Packaging	0.6	0.4%	0.1%	0.7%	CDL	17.4	11.0%		
Other Cardboard Boxboard	1.4	0.9%	0.3%	1.5%	Wood / Lumber / Particleboard	9.7	6.1%	0.1%	12.1%
Paper Bags	0.2	0.1%	0.0%	0.2%	Mineral Aggregates	1.1	0.7%	0.1%	1.3%
Newspapers And Magazines	0.3	0.2%	0.0%	0.3%	Roofing	0.2	0.1%	0.0%	0.3%
Other Paper/Composite Materials	0.6	0.4%	0.1%	0.7%	Insulation	0.0	0.0%	0.0%	0.0%
PLASTIC	9.0	5.7%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	1.0	0.6%	0.4%	0.8%	Other Construction / Demolition Debris	6.5	4.1%	0.0%	8.5%
One-Time Fast Food Service Items	0.6	0.4%	0.2%	0.6%	HAZARDOUS MATERIALS	0.8	0.5%		
Other Food And Beverage Packaging	0.4	0.3%	0.1%	0.4%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.7	0.4%	0.1%	0.8%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	2.9	1.8%	0.8%	2.9%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.2	0.1%	0.0%	0.3%	Batteries	0.0	0.0%	0.0%	0.0%
Other Plastics/Composite Materials	3.2	2.0%	0.4%	3.7%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	37.4	23.7%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	27.7	17.5%	7.8%	27.2%	Explosives	0.7	0.4%	0.0%	1.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.7	0.4%	0.0%	0.8%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.2	0.1%	0.0%	0.2%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	3.1	2.0%	0.0%	5.2%	Other	0.1	0.1%	0.0%	0.2%
Other Glass/Composite Materials	5.8	3.6%	0.0%	8.6%	OTHER MATERIALS	23.3	14.7%		
METAL	34.8	22.0%			Tires	5.0	3.1%	0.0%	7.2%
Beverage Containers	3.0	1.9%	1.2%	2.7%	Auto Rubber Products	0.4	0.2%	0.0%	0.6%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.1%	Rubber / Latex Toiletries	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.6	0.3%	0.2%	0.5%	Other Rubber / Latex Products	1.0	0.6%	0.0%	1.6%
Non-Food Packaging	0.1	0.1%	0.0%	0.2%	Disposable Diapers	0.2	0.1%	0.0%	0.3%
Automotive Parts	26.7	16.9%	0.0%	34.2%	Textiles / Leather	10.0	6.3%	3.6%	9.0%
Other Metal/Composite Materials	4.4	2.8%	0.8%	4.7%	Carpet	0.0	0.0%	0.0%	0.0%
					Furniture / Mattresses / Appliances	0.0	0.0%	0.0%	0.0%
					Ceramics / Porcelain	0.4	0.3%	0.0%	0.6%
					Toys / Sporting Goods	5.5	3.5%	0.0%	9.2%
					Miscellaneous / Other	0.9	0.5%	0.0%	1.4%
Estimated Tons	158	Sample Count		26					

Table 12 Composition by Weight, DNR

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	27.6	8.2%			ORGANIC	42.2	12.5%		
Beverage Containers	0.1	0.0%	0.0%	0.1%	Food (Human And Pet)	4.4	1.3%	0.4%	2.2%
One-Time Fast Food Service Items	7.9	2.3%	0.8%	3.9%	Cigarettes And Other Tobacco	0.9	0.3%	0.0%	0.5%
Other Food And Beverage Packaging	3.0	0.9%	0.2%	1.6%	Other Organics	36.9	10.9%	4.4%	17.4%
Non-Food Packaging	2.7	0.8%	0.2%	1.4%	CDL	12.4	3.7%		
Other Cardboard Boxboard	4.5	1.3%	0.0%	2.8%	Wood /Lumber /Particleboard	1.4	0.4%	0.1%	0.7%
Paper Bags	1.0	0.3%	0.0%	0.5%	Mineral Aggregates	10.5	3.1%	0.0%	8.0%
Newspapers And Magazines	5.1	1.5%	0.4%	2.7%	Roofing	0.0	0.0%	0.0%	0.0%
Other Paper/Composite Materials	3.4	1.0%	0.3%	1.7%	Insulation	0.0	0.0%	0.0%	0.0%
PLASTIC	28.6	8.5%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	4.1	1.2%	0.8%	1.7%	Other Construction /Demolition Debris	0.5	0.1%	0.0%	0.3%
One-Time Fast Food Service Items	0.7	0.2%	0.1%	0.3%	HAZARDOUS MATERIALS	1.9	0.6%		
Other Food And Beverage Packaging	1.3	0.4%	0.3%	0.5%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	1.1	0.3%	0.1%	0.5%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	7.2	2.1%	0.7%	3.5%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	10.3	3.1%	0.0%	6.9%	Batteries	0.9	0.3%	0.0%	0.6%
Other Plastics/Composite Materials	3.8	1.1%	0.2%	2.0%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	117.8	34.9%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	106.8	31.6%	22.1%	41.2%	Explosives	0.0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.2	0.1%	0.0%	0.1%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.9	0.3%	0.0%	0.5%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	8.4	2.5%	0.0%	6.6%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.0	0.0%	0.0%	0.0%	Other	0.9	0.3%	0.0%	0.6%
Other Glass/Composite Materials	1.5	0.5%	0.0%	1.2%	OTHER MATERIALS	57.5	17.0%		
METAL	49.7	14.7%			Tires	25.7	7.6%	0.0%	16.6%
Beverage Containers	13.6	4.0%	3.0%	5.1%	Auto Rubber Products	1.8	0.5%	0.0%	1.2%
One-Time Fast Food Service Items	0.2	0.1%	0.0%	0.1%	Rubber /Latex Toiletries	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	3.1	0.9%	0.3%	1.5%	Other Rubber /Latex Products	1.4	0.4%	0.0%	1.1%
Non-Food Packaging	9.2	2.7%	0.7%	4.7%	Disposable Diapers	9.4	2.8%	0.0%	6.0%
Automotive Parts	13.6	4.0%	1.3%	6.7%	Textiles /Leather	7.4	2.2%	0.8%	3.5%
Other Metal/Composite Materials	10.0	2.9%	1.0%	4.9%	Carpet	0.3	0.1%	0.0%	0.2%
					Furniture /Mattresses / Appliances	4.2	1.3%	0.0%	3.3%
					Ceramics /Porcelain	0.0	0.0%	0.0%	0.0%
					Toys / Sporting Goods	0.4	0.1%	0.0%	0.3%
					Miscellaneous /Other	6.8	2.0%	0.0%	4.6%
<i>Estimated Tons</i>	338	<i>Sample Count</i>	25						

Table 13 shows the composition of Rest Areas. There is no distinction between urban and non-urban.

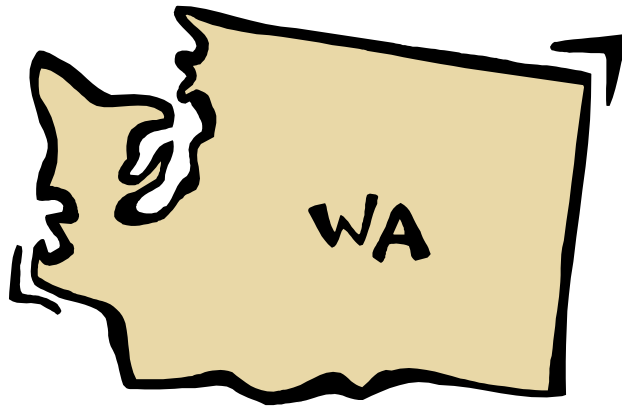
Table 13 Composition by Weight, Rest Areas

Calculated at a 90% confidence interval

	Tons	Mean %	Low %	High %		Tons	Mean %	Low %	High %
PAPER	2.6	18.0%			ORGANIC	4.1	28.3%		
Beverage Containers	0.1	0.8%	0.1%	1.5%	Food (Human And Pet)	0.9	6.3%	4.5%	8.0%
One-Time Fast Food Service Items	1.3	9.3%	7.3%	11.3%	Cigarettes And Other Tobacco	1.1	7.6%	5.6%	9.5%
Other Food And Beverage Packaging	0.1	1.0%	0.7%	1.3%	Other Organics	2.1	14.5%	10.4%	18.6%
Non-Food Packaging	0.1	0.9%	0.7%	1.1%	CDL	1.5	10.4%		
Other Cardboard Boxboard	0.2	1.6%	0.1%	3.1%	Wood / Lumber / Particleboard	1.4	9.8%	5.5%	14.2%
Paper Bags	0.1	0.6%	0.4%	0.8%	Mineral Aggregates	0.0	0.2%	0.0%	0.4%
Newspapers And Magazines	0.3	1.8%	1.1%	2.5%	Roofing	0.0	0.2%	0.0%	0.4%
Other Paper/Composite Materials	0.3	2.0%	1.3%	2.7%	Insulation	0.0	0.0%	0.0%	0.0%
PLASTIC	1.6	11.2%			Drywall	0.0	0.0%	0.0%	0.0%
Beverage Containers	0.3	2.2%	1.8%	2.7%	Other Construction / Demolition Debris	0.0	0.2%	0.0%	0.4%
One-Time Fast Food Service Items	0.3	1.9%	1.3%	2.4%	HAZARDOUS MATERIALS	0.1	0.9%		
Other Food And Beverage Packaging	0.1	0.9%	0.7%	1.2%	Latex Paint	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.1	0.7%	0.5%	1.0%	Oil Based Paints	0.0	0.0%	0.0%	0.0%
Plastic Bags And Film	0.4	3.0%	2.6%	3.4%	Oil	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.2	1.1%	0.0%	2.3%	Batteries	0.0	0.1%	0.0%	0.2%
Other Plastics/Composite Materials	0.2	1.4%	0.8%	1.9%	Flammable Gas	0.0	0.0%	0.0%	0.0%
GLASS	1.9	12.9%			Flammable Liquids	0.0	0.0%	0.0%	0.0%
Beverage Containers	1.8	12.6%	10.2%	15.0%	Explosives	0.0	0.0%	0.0%	0.0%
One-Time Fast Food Service Items	0.0	0.0%	0.0%	0.0%	Pesticides/Herbicides	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.0	0.1%	0.0%	0.2%	Cleaners (Hazardous)	0.0	0.0%	0.0%	0.0%
Non-Food Packaging	0.0	0.1%	0.0%	0.2%	Medical Waste	0.0	0.0%	0.0%	0.0%
Automotive Parts	0.0	0.0%	0.0%	0.0%	Other	0.1	0.8%	0.3%	1.3%
Other Glass/Composite Materials	0.0	0.1%	0.0%	0.1%	OTHER MATERIALS	1.6	11.5%		
METAL	1.0	6.9%			Tires	0.6	4.5%	1.4%	7.6%
Beverage Containers	0.4	2.8%	2.4%	3.2%	Auto Rubber Products	0.1	0.5%	0.3%	0.7%
One-Time Fast Food Service Items	0.0	0.1%	0.0%	0.1%	Rubber /Latex Toiletries	0.0	0.0%	0.0%	0.0%
Other Food And Beverage Packaging	0.1	0.5%	0.3%	0.6%	Other Rubber /Latex Products	0.0	0.3%	0.1%	0.5%
Non-Food Packaging	0.0	0.2%	0.0%	0.4%	Disposable Diapers	0.1	0.7%	0.4%	1.1%
Automotive Parts	0.4	2.6%	0.2%	5.0%	Textiles /Leather	0.4	3.0%	2.4%	3.7%
Other Metal/Composite Materials	0.1	0.7%	0.3%	1.0%	Carpet	0.0	0.3%	0.0%	0.6%
					Furniture / Mattresses / Appliances	0.0	0.0%	0.0%	0.0%
					Ceramics / Porcelain	0.0	0.0%	0.0%	0.1%
					Toys / Sporting Goods	0.0	0.3%	0.1%	0.5%
					Miscellaneous / Other	0.3	1.8%	0.4%	3.2%
Estimated Tons	14	Sample Count	48						

Appendix F

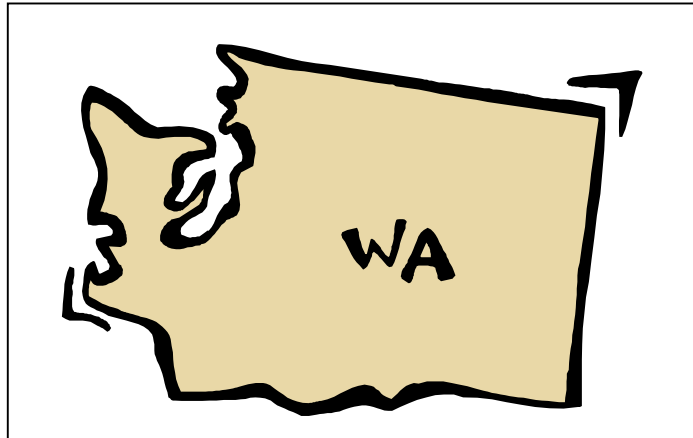
Washington State Litter Study



Training Manual

Project Background

In 1997, the Litter Task Force was created to evaluate Washington's litter collection and prevention systems. Recommendations from the Task Force were incorporated into the 1998 Litter Act. One of the provisions of this legislation directs the Washington State Department of Ecology to conduct a statewide litter survey, which will be used to guide prevention and clean-up efforts.



In response to the Legislature's directive, Ecology, in cooperation with an independent contractor, designed a study to collect information on (1) how much litter is being discarded in the state, (2) where this litter is being discarded, (3) who is littering, and (4) what the composition of the litter is. Information collected through the study will be used, among other things, to develop litter prevention campaigns.

Ecology Youth Corps, Department of Corrections crews, and others have been asked to collect litter for the study. Many different crews will collect litter across the state. If the study is to be successful, **all collection crews must follow the same procedures**. As litter crew supervisors, your role will be to ensure that collection is carried out in a manner consistent with the procedures set forth in this training manual. Thank you in advance for helping to make this study a success!

Note: Unlike the usual litter pick-up, which requires that your crew clean sites to meet a certain aesthetic standard, the goal of this study is to collect unbiased data. Therefore, some procedures for this study will be different than the standard litter collection methods.

Three types of sites will be included in the study: roadways, interchanges, and public areas. Litter will be collected from these sites, then transported to a temporary storage facility, and eventually moved to a facility where it will be sorted into various material categories and weighed.

General Information

Site Categories

Seven types of sites will be included in the study:

Roadways

- Interstates
- State Routes
- County Roads

Interchanges

- Highway entry and exit ramps (On/Off Ramps)

Public Areas

- Parks (including state parks and county parks)
- State Recreation Areas (including Dept. of Natural Resources campgrounds and trailheads and Dept. of Fish & Wildlife recreational access areas)
- Highway Rest Areas

The sites were selected randomly and are located throughout the state. The roadway and interchange site categories were further divided into “urban” and “non-urban” areas. The size of the sampling area will vary, according to the type of site and whether it is classified as “urban” or “non-urban” as defined by the 1980 Census. When you arrive at a site, it may not look “non-urban” or “urban” to you, but we used Census Bureau designations for objectivity.

General Schedule

Litter will be collected from the sample areas several times during the course of the study, with an “initial clean” in the beginning, and subsequent “sample cleans.” The purpose of the initial clean is to remove all litter from the sample area, to start with a clean slate. **Litter collected during the initial clean will be discarded.** The day of the initial clean is the first day of the “accumulation period.” Litter collected during subsequent sample cleans will measure how much litter has accumulated since the initial clean. Litter from sample cleans will be saved, tagged, and transported to a storage facility.

For **roadways** and **interchanges**, litter will be collected from each sampling area three times: an initial clean, and a spring and fall sample. The accumulation period between samples should be approximately five months. For **public areas**, litter will be collected from each sampling area during two one-month periods (spring and fall), each with an initial clean at the beginning of the month, and a sample clean three to four weeks later. Both collection schedules were designed to provide comparable accumulation times for the wet season and the dry season and to minimize complications due to snow.

In certain locations, it may not be possible to allow litter to accumulate between cleanings. In these cases, site personnel should be asked to save any litter that is collected between the initial clean and the sample clean. Ecology will schedule interim collections if necessary. When the crew returns to perform a sample clean, the supervisor needs to remember to pick up any interim bags that may have been saved.

EYC coordinators or supervisors will visit each site before a crew collects litter from the site. During this initial visit, a site map will be sketched and important information about the site’s characteristics will be recorded on the *Site Documentation Form*. Photocopies of the relevant maps and *Site Verification and Litter Inventory Forms* will be provided to the supervisors for their reference when leading the litter collection events. The EYC coordinators will notify supervisors of the collection schedule, including the specific date and location of sampling.

The general schedule is outlined on the next page.

Litter collection at **roadway** and **interchange** sites will take place in five steps:

1. **Initial site visit** to determine whether site is workable (regional coordinators)
2. **Site mapping, documentation, and marking** (coordinators and/or supervisors, depending on region)
3. **Initial Clean-up (Fall)**
 - A. Site verification (supervisors)
 - B. Litter clean-up – no tagging required (supervisors and crews)
4. **1st Sample Clean (Spring)**
 - A. Site verification (supervisors)
 - B. Litter collection, bagging and tagging (supervisors and crews)
5. **2nd Sample Clean (Late Summer/Early Fall)**
 - A. Site verification (supervisors)
 - B. Litter collection, bagging and tagging (supervisors and crews)

Litter collection at **public area** sites will take place in six steps:

1. **Initial site visit** to determine whether site is workable (regional coordinators)
2. **Site mapping, documentation, and marking** (coordinators and/or supervisors, depending on region)
3. **Initial Clean-up (Spring)**
 - A. Site verification (supervisors)
 - B. Litter clean-up - no tagging required (supervisors and crews)
4. **1st Sample Clean (Spring Final Clean-up)**
 - A. Site verification (supervisors)
 - B. Litter collection, bagging and tagging (supervisors and crews)
5. **Initial Clean-up (Late Summer/Early Fall)**
 - A. Site verification (supervisors)
 - B. Litter clean-up - no tagging required (supervisors and crews)
6. **2nd Sample Clean (Late Summer/Early Fall Final Clean-up)**
 - A. Site verification (supervisors)
 - B. Litter collection, bagging and tagging (supervisors and crews)

Steps 1 and 2 or 2 and 3 may be combined, if absolutely necessary.

Note: It is of utmost importance that you follow all of the safety procedures set forth in the EYC Supervisor's Manual.

Materials

Before going out to a litter survey site, be sure you have all the materials listed on the following checklist. Feel free to photocopy the checklist.

Equipment Checklist

Basic Equipment:

- Road map to the site
- Hand-drawn site map of the precise sampling area
- Measuring device to confirm site boundaries
- Photocopy of the *Site Documentation Form* which was completed during Ecology's initial inspection of the site
- Site Verification and Litter Inventory Form*
- Camera and film
- Photograph Log Form*
- Write In the Rain notebook
- Pencil

Site Demarcation Tools:

- Orange spray paint
- Black spray paint
- Extra flags to replace lost ones

Safety Equipment:

- Cones
- Vests
- Hard hats, if required
- Warning signs
- Proper protective PPE gloves (2 sets/person)
- Hand-sanitizing lotion

Collection Equipment:

- Sharps kit
- Bucket for glass
- Collection bags
- Bag Identification Tags
- A permanent marker
- Heavy-duty twine or duct tape for tying together bundles of oversized objects
- Litter pickers

Procedures

1. Initial Site Visit

Before the litter survey site lists are finalized, EYC coordinators visit each site to determine whether or not it meets the following criteria:

Rule #1: If more than 10% of a site is deemed unsafe during the initial visit, then the site will be discarded and an alternate site will be selected.

Rule #2: If the site is located within an “overlapping population” area (roadway sites only), the sampling site will be shifted. If the site remains within an “overlapping population” area after one shift, it will be discarded and an alternate site will be selected.

Definition of “overlapping population” area: Interstate or state route sites that include portions of or an entire on- or off-ramp (overlap of roadway and ramp populations).

How to shift the site: The area shifted must be equal to the area of the sampling site located within the “overlapping population” area. Shift the site away from the overlap. For instance, if 50 feet of the north end of a sampling site is located within the “overlapping population” area, the site must be shifted 50 feet to the south.

*Note: Sites may be shifted during the initial inspection only. **During subsequent visits to the site, the boundaries must not be moved.***

2. Site Mapping, Documentation and Marking

A. Roadways and Interchanges

Site Mapping and Documentation

Before litter can be collected at a site, it is necessary to designate and measure site boundaries and to document site peculiarities. Maps and documentation define the litter catchment area and are thus vital to the accuracy of the study.

In some regions, the Regional Coordinator will be responsible for all site mapping and documentation, while in other regions, supervisors may be asked to map and document sites. Your Regional Coordinator will discuss mapping and documentation responsibilities with you further. If you are not provided with a specific site map and a completed *Site Documentation Form* for a site to which you are assigned, then you should fill out a blank *Site Documentation Form* and measure and map the site on the *Site Map Form*.

If mapping is done on the same visit as the initial clean-up (which is less than optimal), **collection should not begin until mapping is complete.** The supervisor must give his or her full attention to maintaining quality control during pick-up. All roadway sites begin at mileposts and are measured from a lower-numbered milepost toward a higher-numbered milepost and will be a cross-section of the road (including both shoulders and median, if present). Roadway sites will be 1 mile long if they occur in Census-designated “non-urban”

areas – except for interstates, which will be ½ mile long; and 1/10 mile long if they occur in “urban” areas.¹

Note: Roadway site locations will often refer to mileposts. Mileposts increase from West to East and from South to North. Our sites are measured from a given milepost toward the higher number. For example, if the site is referred to as milepost 12, the sampling area would begin at milepost 12 and continue toward milepost 13 (which would be toward either the East or the North).

It is important to use the Census distinction between “urban” and “non-urban.” Some sites may appear to be in a rural area, but if the Census classifies it as urban, it should be considered urban for this study. Refer to the official site lists to verify whether a site is urban or non-urban.

Typically, roadway sites are bounded by a fence or the edge of a right-of-way. If no boundary is apparent, then the edge of the site should be defined as a line 30 feet from the center-line or 20 feet from the fog line. Table 1 provides further detail on site dimensions by site type. Use your measuring wheel or tape measure to measure boundaries.

Note: The site lengths in the following table refer to the length of the cross-section, not to total shoulder miles. The distance in shoulder miles may be two to four times as great as the cross-sectional distance, depending on the site. For example, an urban interstate site is 1/10 mile in cross-section, but is 4/10 mile in terms of shoulder miles (two 1/10-mile lengths of shoulder and two 1/10-mile lengths of median).

Table 1 - Site Collection Area Dimensions by Site Type

Site Type	Collection Area (refer to following diagrams)	Outer Limit of Collection Area (refer to following diagrams)	Length of Collection Area
<i>Interstate</i>	Both sides of highway and median (if present)	Fence line/barrier	Urban: 1/10 mile Non-urban: 1/2 mile
<i>State Route</i>	Both sides of highway and median (if present)	Fence line/barrier	Urban: 1/10 mile Non-urban: 1 mile
<i>County Road</i>	Both sides of road and median (if present)	20' from fogline (30' from center line)	Urban: 1/10 mile Non-urban: 1 mile
<i>Interchange*</i>	One off-ramp, one on-ramp (opposing) and median between them. ²	Fence line (see interchange diagram on pg. 8)	Varies for each interchange

*Interchanges are diagrammed in the “Special Procedures for Determining Sample Areas at Interchanges” section on page 10.

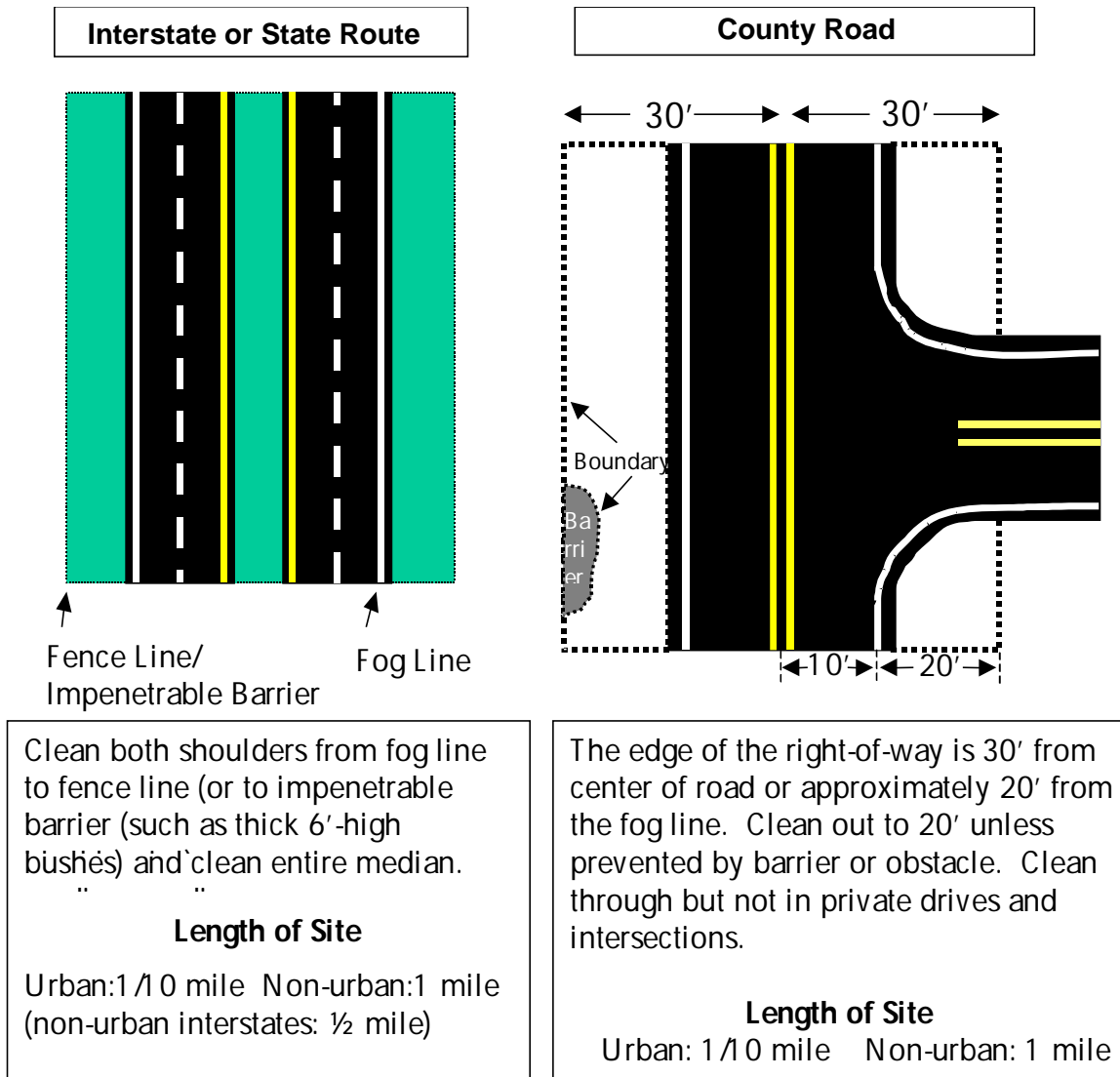
¹ Originally, non-urban interstate sample areas were to be one mile long as well. After the first sampling, the size was reduced to adjust for the large volume of material collected.

² Due to high volumes of litter associated with this site category, interchange sites were also reduced by half; from the entire interchange to a cross-section: one on-ramp, the off-ramp across the freeway from it, and the median stretch (if present) between the two.

Figure 1 shows typical roadway sites and the areas to be sampled. If you are asked to map a site, please refer to the example drawing presented in Figure .

Note: The diagram of the county road in Figure 1 is of a two-lane county road. If the county road is more than two lanes, use 20 feet from the fog line as a guide to the site boundaries, not 30 feet from the centerline.

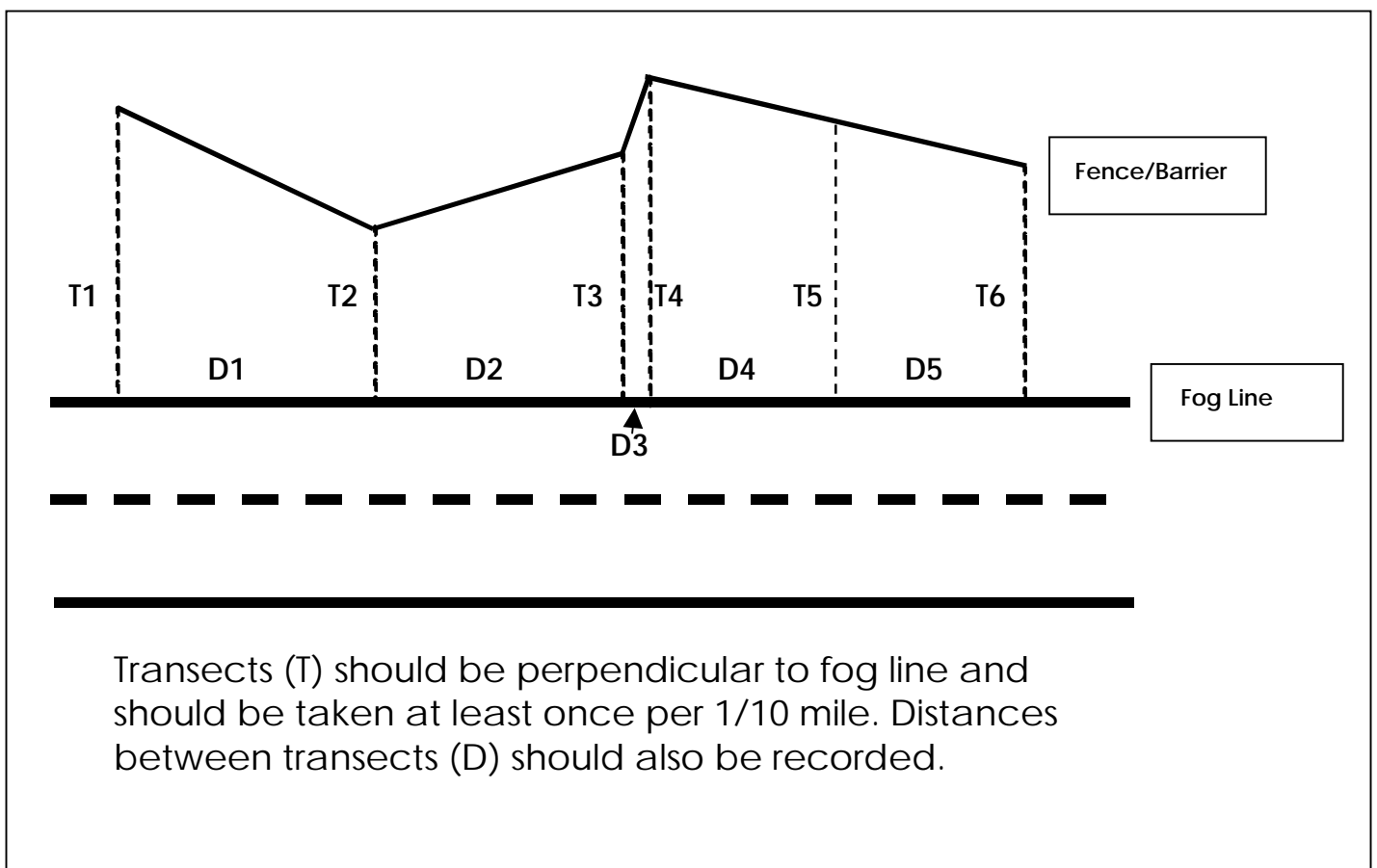
Figure 1 - Roadway Site Boundaries



Once you have determined the site boundaries, map these boundaries on the *Site Map Form*, marking any obstacles, barriers, or oddities on both the map and the *Site Documentation Form*. Though linear distance (site length) is predetermined, width may vary within a given site. For example, the fence may be 25 feet from the fog line at one end of a site and 15 feet away at the other end of the site. Always measure the distance from the fog line to the boundary at each end of the sites and **at least once every 1/10-mile** in between (measure perpendicular to the fog line). If the outer boundary changes direction at certain points, additional measurements should be taken from the fog line to these points of direction change. Notice in Figure that a measurement is taken at each end of the site (T1 and T6), three measurements are taken in between where the fence changes direction (T2, T3, T4), and one additional measurement was taken in between where the distance between transects would otherwise have been greater than 1/10 mile (T5). Don't forget to take the linear distances between width measurements; indicated by "D" in Figure 3.

Note: The area of the sample site will be calculated from the measurements on your map. Please make certain that you have the required measurements on your map and that they are legible.

Figure 2 - Sample Site Mapping Procedure



Permanently Marking the Site

Each site should be permanently marked by painting a fluorescent red stripe on the paved shoulder at the beginning and end of the site. Marking transects with an orange dot on the pavement is also recommended.³ Flags may be used in addition to paint to mark the site and are best placed out of the path of mowers or other road maintenance vehicles.

Special Procedures for Determining Sample Areas at Interchanges

A standard interchange consists of five sub-areas, including four quadrants and the median. These areas are numbered 1 through 5 in Figure . Three areas at each interchange will be cleaned. During pick-up, collect and bag each area separately. The areas are numbered as follows:

1. Both sides of the **off-ramp** on the **ascending** side of the highway
2. Both sides of the **on-ramp** on the **ascending** side of the highway
3. Both sides of the **off-ramp** on the **descending** side of highway
4. Both sides of the **on-ramp** on the **descending** side of highway
5. The **median**, divided into “a” and “b” by the bisecting road.

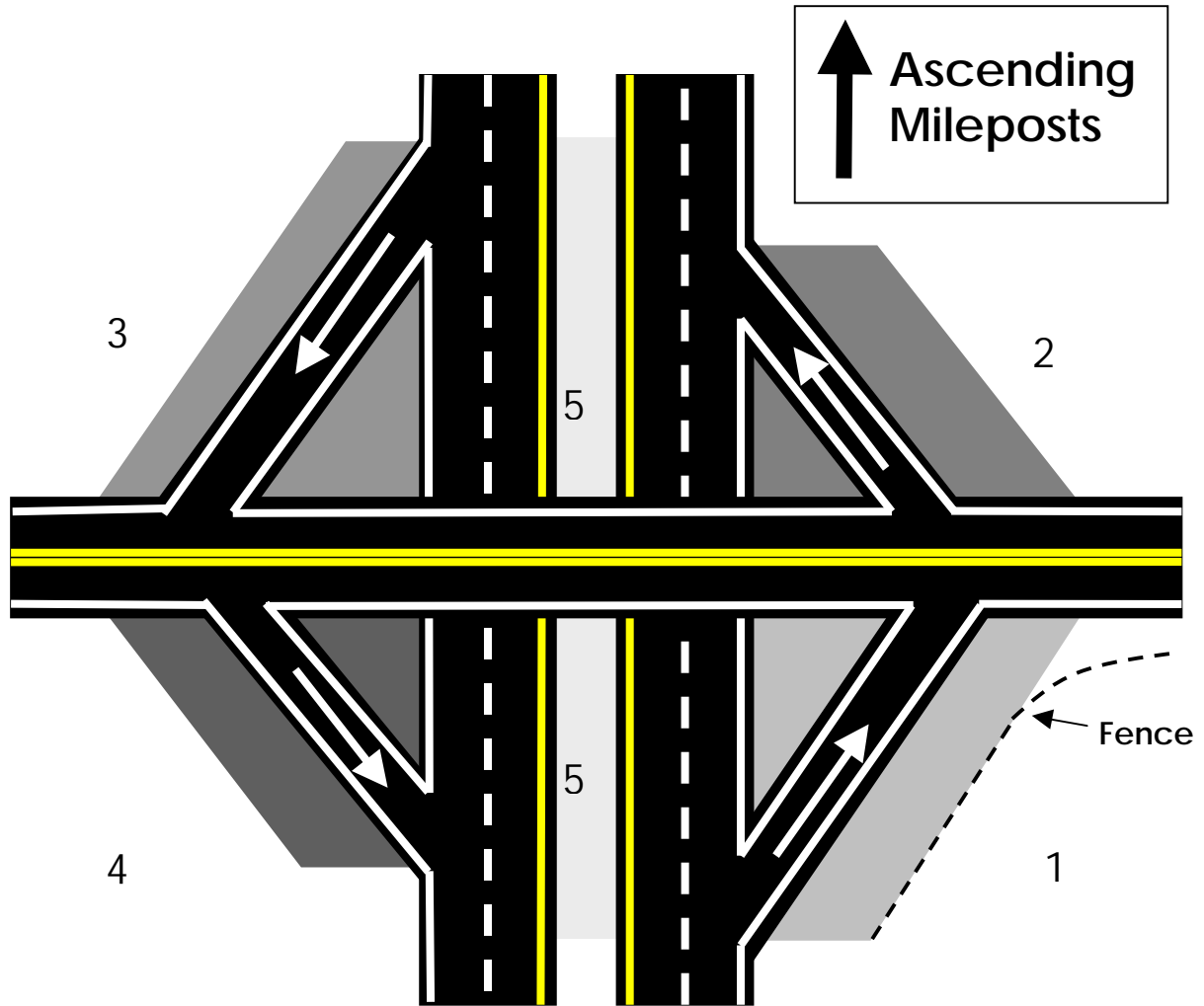
The study area on each side of the interchange site begins at the sign just before the road starts to curve for the off-ramp and ends where the on-ramp merges with the highway. The median section starts where the ascending off ramp begins, and it ends where the descending off-ramp meets the bisecting road (overpass, underpass or bridge). Interchanges have many different configurations. Use the descriptions of areas 1-5 to help determine which areas to sample.

The following sampling strategy has been developed for interchanges:

- If the ascending milepost occurs at section 1, cleaning should occur in sections 1, 4, and the corresponding portion of section 5.
- If the ascending milepost occurs with section 2, cleaning should occur in sections 2, 3, and the corresponding portion of section 5.
- If there is no corresponding on/off-ramp, then choose the on/off-ramp on the other side of the freeway, and note this clearly on the form. The goal is to sample one on-ramp, one off-ramp and a median from each interchange.

³ The orange dots can be used to mark 1/10-mile segments or indicate where a width measurement was taken.

Figure 3 - Sample Interchange



B. Public Areas

Site Mapping and Documentation

Each public area has its unique characteristics, so the mapping procedures should be handled slightly differently for each.

Parks

Due to the large acreage of some parks, the entire park cannot be cleaned. Instead, litter samples should be collected from “high-use” areas within the park. “High-use” areas are defined as “areas in the park that generally have visitors every day in the summer.” These may include picnic areas, ballfields, play areas, campsites, trails, parking lots, beaches, etc. Ask the park supervisor or ranger to help you identify the high-use areas. Also ask the park supervisor or ranger to provide a map of the whole park and to mark (outline or highlight) the high-use areas. Also ask the park personnel the total acreage of the park, and to estimate how many of the total acres could be classified as “high-use.” Please fill out a *Site Map Form* in order to describe each site in detail, and attach the park’s map to it.

State Recreation Areas

These are Department of Natural Resource (DNR) lands (campgrounds and trailheads) and Department of Fish & Wildlife (F&W) recreational access points. Use the Parks mapping procedures above. The F&W sites tend to be smaller (usually parking lots), so the entire area might be considered high-use. You may need to figure out high-use areas for large DNR sites with help from a ranger or area maintenance crew. As with parks, mark the high-use areas on the map, and include this with a filled-out *Site Map* form.

Rest Areas

Rest areas consist of several sections or “high-use areas” including: an off-ramp, parking lot, restroom and information area, surrounding area (usually grassy), and an on-ramp. If the rest area is small enough, sample the entire rest area; otherwise, identify the “high-use” areas as the litter sample area. As with roadways, the boundary of each rest area should be the fence line or 20 feet from the fog line.

Permanently Marking the Site

Parks

You do not need to permanently mark the parks’ high-use area boundaries for a number of reasons: many parks will not want to have markers on their sites; markers would probably disappear over the course of the year due to pedestrian traffic or mowing; and the boundaries of high-use areas are fairly obvious anyway (usually a tree line or curb).

State Recreation Areas

Same as Parks procedures above.

Rest Areas

See Parks procedures above for the parking lot, grassy area and restroom sections. Use roadway procedures to mark the on- and off-ramps. You should mark the on-ramp and off-ramp, and the fence line or fog line 20-foot boundary with paint or tags to further delineate the site boundaries.

3. Clean-ups (Initial Clean-up, 1st and 2nd Samples)

A. Site Verification

Inspecting the Site

It is crucial that you follow the precise sample boundaries as defined on the *Site Map Form*.

If you are unable to locate a sample boundary, immediately call the EYC coordinator or the supervisor who sketched the site. Do not collect litter until you are positive the correct location boundaries have been identified.

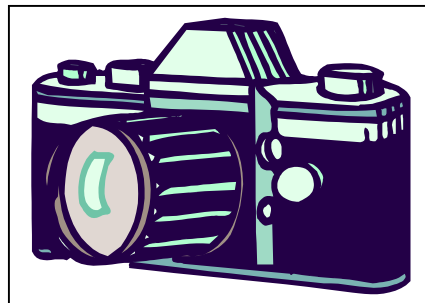
Using the hand-drawn site map, inspect the sampling area. Find the boundaries and verify the location of any entrapments, waste receptacles and/or obstacles that were previously noted on the site map. If there are any changes, mark those on the map and provide a description on the *Site Verification and Litter Inventory Form*. Once you have updated the map, complete the “Upon Arrival” section of the *Site Verification and Litter Inventory Form*.

Indicate the site boundaries clearly to your crew. You may chose to walk the site boundaries with your crew and mark all boundaries clearly with cones and/or flags.

Assessing Site Hazards

If more than 10% of the sampling area is inaccessible (due to construction or a hazard), call your EYC coordinator immediately. The collection of litter will have to be delayed. Examples of hazards/obstacles include:

- Snow;
- Active mowing;
- Active or recent spraying; or
- Accident scenes.



Photographing the Site

In order to better document litter collection at designated sites, supervisors are asked to take site photographs before and after litter collection whenever possible. Each site must be photographed at least once during the study year. You will be provided with a *Photograph Log Form* for each roll of film. Please follow the steps below (also refer to the *Photograph Log Form*).

1. Photograph the site from a number of angles, taking photographs of each site **before collection** and **after collection**. Taking pictures of collected bags will document your efforts. In addition, please take an occasional “action shot” of a crewmember at work.
2. On the *Photograph Log Form*, record the following information for each photograph:
 - Site number;
 - Whether the shot was taken **before (B)** or **after (A)** clean-up;
 - Relevant descriptive information; and
 - Date.

B. Litter Collection, Bagging and Tagging

Deploying Your Crew

Emphasize to your crew the differences between this collection and their normal routine. Your Coordinator will suggest a deployment method, whether shoulder-to-shoulder, in a zigzag pattern, or in a circular pattern. If no pattern has been assigned, use the advice of your Coordinator, or your best judgement to determine which pattern to use. Tips include cleaning in both directions to account for the impact of the sun or litter visibility.

Note: Be sure that your crew collects all the way to, but not beyond, the designated site boundaries.

Which Materials to Collect

Litter collection for the Statewide Litter Study differs from typical collection in terms of the materials that your crew is expected to collect. **You will be collecting more items than usual.** See Table 22 for items to be collected. You should not collect the specific materials listed in the bottom portion of Table 2 as they may pose a danger to you or members of your crew or may be too small or large to pick up. All large litter items that are not collected should be marked with black spray paint and recorded on the Site Verification and Litter Inventory Form, as described under the heading "Marking litter that is left behind."

This study uses the definition of litter as set forth in Chapter 70.93 the Revised Code of Washington, which states:

Litter – All waste material including but not limited to disposable packages or containers thrown or deposited as herein prohibited and solid waste that is illegally dumped, but not including the wastes of the primary processes of mining, logging, sawmilling, farming, or manufacturing.

Table 2 - Items To Be Collected

<i>Items to be Collected</i>	
<p>1. Items larger than 1 square inch, including:</p> <ul style="list-style-type: none"> • Broken glass, metal, and plastic pieces greater than 1 square inch (please refer to section entitled “Collecting Glass” for specific instructions on glass) • Wood or organic materials not originating in the area (e.g. firewood, yard debris) • All food items, even if biodegradable • Diapers • Sharps (picked up by supervisor only) • Condoms (treated as sharps) • All other litter not posing safety risks for crews <p>2. The following items smaller than 1 square inch:</p> <ul style="list-style-type: none"> • Cigarette butts (<i>see “Special sampling for cig. butts” on next page</i>) • Bottle caps and pull tabs • Polystyrene peanuts • All shiny items except broken glass 	
<i>Items to be Recorded, but Not Collected</i>	
<p>1. Hazardous or potentially hazardous materials, such as:</p> <ul style="list-style-type: none"> • Trucker bottles • Containers and closed bottles containing unknown liquid • Hazardous or potentially hazardous materials • Tissues used for human waste • Explosives • Knives/firearms • Items too large or heavy to be carried safely <p>2. Large amounts of very small items, such as tiny glass fragments</p>	
<i>Items to Ignore</i>	
<ul style="list-style-type: none"> • Human/animal waste • Road kill 	<ul style="list-style-type: none"> • Waste from mining, logging, manufacturing and farming.

Special Sampling for Cigarette Butts

Experience has shown that collecting all cigarette butts at a given site is excessively time consuming. Therefore, the following sampling protocol has been developed for cigarette butts. We will only collect cigarette butt from a portion of the sample area.

- For *urban road sites*, the sub-sample will be the first 10% of the site (originating at the lower milepost) all the way across the site, including both shoulders and the median. It will measure 52 ft. (10% of 1/10 mile).
- For *non-urban road sites*, it will measure 528 ft. (10% of 1 mile for state routes and county roads, and 20% of ½ mile for interstates).
- For *interchanges*, the sub-sample will be one of the 3 sections that were selected to be sampled from. In other words, if you are collecting litter from section 1, section 4 and section 5, one of those three sections will be randomly selected as the cigarette butt sample area.
- For *public areas*, cigarette butts should be collected from the entire sample area.

Be sure the cigarette butt sample area is clearly indicated on each map.

Collecting Glass

In contrast to your usual duties, you will be picking up broken glass for this study. In order to treat all materials equitably, it is necessary to **pick up all glass larger than one square inch**. Glass will be collected in a separate bucket to ensure the safety of the crew and the integrity of the litterbags. Be sure to cap buckets tightly when you are through collecting. For the initial clean, please take buckets full of glass with you and dump them as soon as you are able, saving the bucket for future clean-ups. Small glass samples from several survey sites may be stored in one bucket, **if clearly segregated (double bagged) and clearly labeled**. Please refer to the "Exception to Policy" letter on the next page.

Exception to Policy

Glass Handling Procedures for the Litter Survey

The 1998 Waste Reduction, Recycling and Model Litter Control Act directs the Department of Ecology to conduct a biennial litter survey targeted at litter composition, sources, demographics, and geographic trends. Ecology Youth Corps (EYC) crews (supervisors and crewmembers) will be participating in litter clean-up activities in support of the survey.

Since one of the goals of the survey is to get an accurate accounting of litter composition in the state, litter crews will be asked to pick-up items that would not normally be picked up during routine litter clean-up activities. **As part of the litter survey, litter crews will be asked to pick-up all glass greater than one square inch. This differs from current EYC operating procedures that prohibits crewmembers from picking up broken glass.**

Glass poses a unique safety hazard to the crews picking it up as well as to crews loading the litterbags onto trucks for disposal. Litter crews handling broken glass should wear normally required personal protective equipment (PPE): long pants, safety shoes, gloves, hard hats, and safety goggles. Special handling procedures must also be followed. Litter crews working on the litter survey will be provided with extra equipment to handle broken glass.

Hazards Posed by Glass & Safety Precautions

When picked up, glass may cut, scrape, or stab a crewmember. Use extra care when picking up glass, or use a litter picker.

If dropped, glass may shatter. Be sure you are wearing all proper PPE. Gloves should be nitrile palm coated gloves or leather.

Glass put in bags may break through the bag and cut, scrape, or scratch the bag handler. For that reason, broken glass that is collected should be placed in a plastic bucket that has been provided.

When carrying buckets of glass, crewmembers must be cautious, watch his/her step, and not jostle or swing the bucket. Use a bucket lid to prevent glass from falling out of the bucket. If a lid is not available, do not fill the bucket more than halfway, to minimize the chance of glass falling out of the bucket.

Disposal of Litter Collected During the Initial Clean

Roadways & Interchanges

The initial site cleaning of roadway sites is designed to clear the sample areas of litter. Litter from this initial clean will not be analyzed, so no special tagging is necessary. Simply bag litter as usual and leave bags on the side of the highway for DOT to collect. Be sure your coordinator has notified DOT of your activity. Be sure to place bags “downstream” of the site you have just cleaned, to prevent contamination of the site in case the bags are broken open by animals or vehicles.

Public Use Areas

The initial site cleaning of public use areas is also designed to clear the test sites of litter. As with roadways, litter will not be collected, so no special tagging is necessary. You will need to make arrangements to dispose of the litter collected during the initial clean.

In order to ensure that the litter that accumulates over the next month is sampled, you need to advise the supervisor or ranger at each site to not throw away any litter, but instead to collect it in bags and store it for you. You will need to coordinate the following for each site:

- where the storage site will be;
- how long you can store litter there; and
- when you will return to do the final clean and take away the stored bags.

If the public use area supervisor is unable or unwilling to store the litter for the month-long accumulation period, you may need to work out a way to haul away some of the litter during the middle of the accumulation period.

Bagging, Tagging and Bundling Collected Litter

Recyclable materials will not be collected separately from non-recyclables for this study. Instead, all items (with the exception of sharps and broken glass) will be collected in the same bag. Sharps should be collected in a separate sharps container and handled by the supervisor only, as usual. Broken glass will be collected in plastic buckets. **Cigarette butts should also be collected in a separate bag.**

All litter that can fit in a bag should be put in a bag (e.g. a toaster oven). Litter items that do not fit into a bag but must still be collected (e.g. an eight-foot 2x4, a six-foot branch that fell off a truck, a large truck tire), should be bundled together with the heavy-duty twine or duct tape. Each bundle should be tagged (and counted). Even if your crew collects only a single oversized item, it should still be tagged.

When your crew is finished with a site, tie off each bag, close each bucket, **count the total number of bags, bundles, and buckets, and attach a completed marker tag to each.** Be sure the tag is secure, so that all bags can be easily identified. The loss of a single bag from a site could invalidate the results from the entire site.

The tag is a green “luggage tag.” Write the information listed below on this tag **with a permanent marker.** You may also want to write the information directly on the bag with

a permanent marker, in case the tag gets lost. Attach a green tag to each bag, bundle and bucket in a secure spot.

To complete this tag, fill in the following information:

Your name;

The date;

The site number;

The bag, bundle, or bucket number (e.g. **1** of 14); and

The total number of pieces for that site (e.g. 1 of **14**).

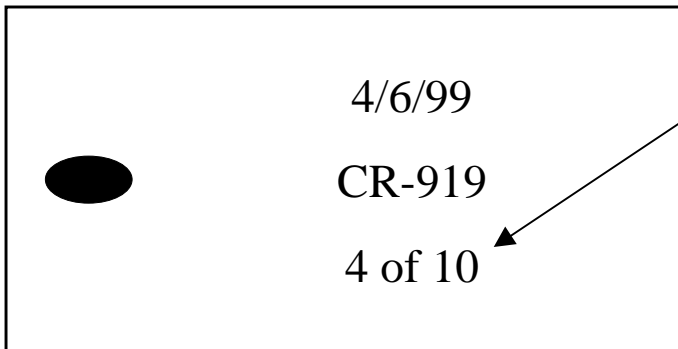
If writing space is an issue, the “name” is not critical, but the other information definitely **must** be on the tag. Next, record the total number of bags, the total number of bundles, and the total number of buckets on the *Site Verification and Litter Inventory Form*.

On tags for interchanges, include the interchange area number (remember that each ramp and the median of interchanges are numbered). **For example, OR-817-5, or OR-456-1.**

Example One:

There are 6 bags, 3 bundles, and 1 bucket of glass of material from CR-919.

Tag might look like this:



NOTE that the **total** number of pieces for the site is reflected on the tag (6 bags + 3 bundles + 1 bucket).

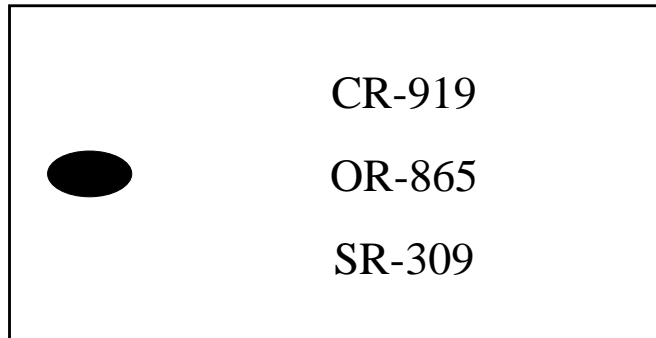
Bags, bundles and buckets from a particular site may get separated in a dumpster or during transport. The first step in sorting a sample is locating all the bags, bundles, and buckets associated with that site. It is critical that each tag contain the piece number as well as the total number of pieces, so the sorting crew knows what to look for.

Using the same example, the information entered on the *Litter Inventory and Site Verification Form* would look like this:

E. <u>Bag Tagging and Identification</u>			
	How many?	Tag Numbers	17. Describe bundles:
16a. Bags:	___ 7 ___	___ 1-6, 10 ___	<u>1 tire, 1 reflector, 1 bundle of wood</u>
b. Bundles:	___ 3 ___	___ 7-9 ___	_____
c. TOTAL NUMBER:	___ 10 ___		_____

Example Two:

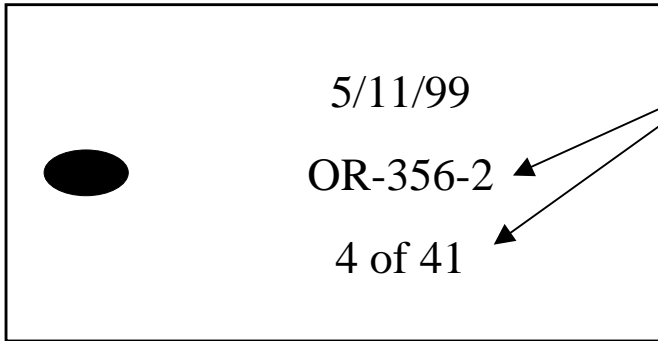
In order to conserve buckets, some crew supervisors decided to consolidate the broken glass from several sites in one bucket. The glass was double bagged and tagged following the procedures above. Then the bags of glass from more than one site were put in a bucket. In this case, each bag of glass inside the bucket must have a tag, as described above. Then, the bucket must have a tag, identifying which sites are included inside. The bucket tag might look like this tag:



[If only one bucket per site is used, with unbagged glass in the bucket, the bucket gets a tag as described in Example 1.]

Example Three:

You are cleaning ramp 2 (on-ramp ascending milepost) and ramp 3 (off-ramp descending) of an interchange. On ramp 2 you have 14 bags, 2 bundles and 1 bucket. On off ramp 3 you have 23 bags and 1 bucket. The total number of pieces for the site is 41 (14+2+1+23+1). An example of a tag from ramp 2 would look like this:



The "2" indicates the bag is from ramp 2, but the total number of bags from the site (ramps 2 and 3) is listed.

Using the same example, the information entered on the Litter Inventory and Site Verification Form would look like this:

<u>E. Bag Tagging and Identification</u>			
	How many?	Tag Numbers	17. Describe bundles:
16a. Bags:	___ 39 ___	___ 1-15, 18-41 ___	___ 1 chair, 1 cooler ___
b. Bundles:	___ 2 ___	___ 16-17 ___	_____
c. TOTAL NUMBER:	___ 41 ___		_____

Checking Your Tags

If you are picking up bags that someone else collected (park or DOT personnel), please check the tags to see that they contain the required information and remark them if necessary. Please be sure the information is printed in permanent ink. The tags can take a lot of abuse while in storage from moisture and slugs. You may try writing the information directly on the bag as a backup. Permanent markers should write directly onto the plastic.

Marking Litter That is Left Behind

Collection crews will work at each site a minimum of three times. For the study to accurately measure the amount of litter discarded in a certain area over a given length of time, items that are left behind from one collection must be marked so that they are not counted in future collections. Markings must be discreet, so as not to attract attention from passers by, but permanent and clear for easy identification by future crews. Mark items with black spray paint. When possible, paint the item in a spot that is not visible from the road. As you paint each item, be sure to inventory that item on the *Site*

Inventory and Litter Inventory Form. Only the Supervisor should mark and inventory items. **All items left behind must be inventoried.**

Note: If you are working on the spring or fall collection, be sure to check objects to see if they have been marked and counted on a previous visit. Refer to the litter inventory forms from previous visits to know if items have been left behind. Do not re-count these items.

Quality Control

As litter is collected, the supervisor should inspect areas that have been cleaned to be sure that crewmembers are picking up all required materials. The supervisor should also make sure that the crew is collecting litter all the way to the site boundary, but not beyond it.

If re-cleaning is necessary, it is recommended you deploy different crewmembers and have them switch locations, so “new” eyes can look for and find missed litter.

Final Inspection

Before departing a site, complete the “Upon Departure” section of the *Site Verification and Litter Inventory* form. Once again, be sure to note how many of each type of bag your crew has collected. You will need to transport the tagged bundles, bags, and buckets to the storage location indicated by your Coordinator.

Thank you for your help in this statewide effort!

Appendix G: Field Forms

Site Documentation Form – Roadways
Site Documentation Form – Public Areas
Site Mapping Form
Site Verification and Litter Inventory
Photograph Log Form
Public Areas Site Conformation and Coordination
Public Areas Flyer
Sorting Form

For those accessing this report electronically, Appendix G is only available in hard copy. Please call the Dept. of Ecology Solid Waste & Financial Assistance Program at (360) 407-6900.