RESEARCH

UDOT Keeping Utah Moving

Utah Department of Transportation - Research Division
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Report No. UT-21.01

SOURCES OF HIGHWAY LITTER IN UTAH

Prepared For:

Utah Department of Transportation
Research & Innovation Division

Final Report
February 2021

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16. Abstract

The research described in this report was undertaken at the request of UDOT in order to estimate the sources and major contributors to highway litter in Utah. The research involved outreach to each of the four UDOT Regions to understand the issues with highway litter and litter cleanup. Nine highway sites were selected for a detailed litter survey. At each site, field staff recorded each item of large litter (>4") within areas ranging from 5,000-10,000 square feet. Based on the composition of the litter, information from interviews with UDOT Region staff and a review of proximate land uses, the sources of litter (i.e., trash/recycling vehicles, unsecured loads, vehicle debris, construction debris haulers, motorists, pedestrians) were estimated.

The research finds that the two largest contributors to highway litter are trash/recycling vehicles and motorists, contributing 43% and 27% respectively, statewide. The relative contributions from these sources varied by region, with a relatively higher amount from trash/recycling vehicles (53%) in Region 2 and from motorists (32%) in Region 4. Overall litter volume tracks closely with population and traffic, with the highest volumes measured in Region 2 and the lowest volumes in Region 4. Of note is the amount of highway litter that consists of recyclable materials, ranging from 22.4% to 47.6%.

The key research limitation is that the survey sites were known highway litter "hotspots" that may not accurately reflect the litter situation along other highway segments in Utah. Further, most of the surveyed areas were on limited access facilities where contributions to litter by pedestrians were negligible. Pedestrians as a source of litter will likely be higher along non-access-controlled highways.

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UNIT CONVERSION FACTORS

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. (Adapted from FHWA report template, Revised March 2003)

LIST OF ACRONYMS

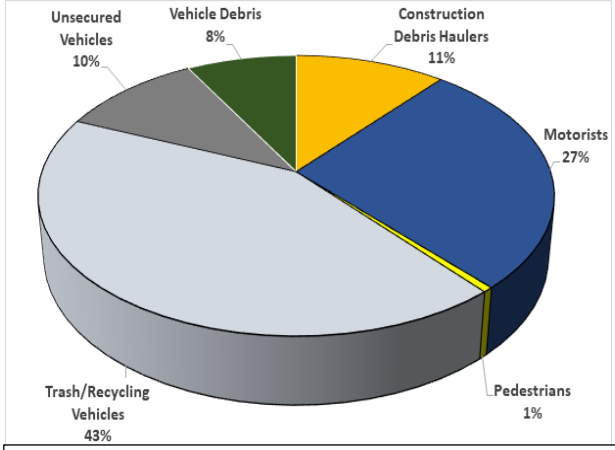
FHWA	Federal Highway Administration
UDOT	Utah Department of Transportation

EXECUTIVE SUMMARY

The research described in this report was undertaken at the request of UDOT in order to estimate the sources and major contributors to highway litter in Utah. The research involved outreach to each of the four UDOT Regions to understand the issues with highway litter and litter cleanup. Nine highway sites were selected for a detailed litter survey. At each site, field staff recorded each item of large litter (>4") within areas ranging from 5,000-10,000 square feet.

Based on the composition of the litter, information from interviews with UDOT Region staff, input from field staff and a review of proximate land uses, the sources of litter (i.e., trash/recycling vehicles, unsecured loads, vehicle debris, construction debris haulers, motorists, pedestrians) were estimated.

The research finds that the two largest contributors to highway litter are trash/recycling vehicles and motorists, contributing 43% and 27% respectively, statewide. The relative contributions from these sources varied by region, with a relatively higher amount from trash/recycling vehicles (53%) in Region 2 and from motorists (32%) in Region 4. Although there are differences across the four UDOT Regions, plastic debris and paper items are the largest components of highway litter.



Estimated % Contributing Sources to Highway Litter

Overall litter volume tracks closely with population and traffic, with the highest volumes measured in Region 2 and the lowest volumes in Region 4. Of note is the amount of highway litter that consists of recyclable materials, ranging from 22.4% to 47.6%.

The key research limitation is that the survey sites were known highway litter "hotspots" that may not accurately reflect the litter situation along other highway segments in Utah. Further, most of the surveyed areas were on limited access facilities where contributions to litter by pedestrians were negligible. Pedestrians as a source of litter will likely be higher along non-access-controlled highways.

1.0 INTRODUCTION

1.1 Problem Statement

Highway litter is a pervasive problem in Utah and across the globe. Litter abatement activities are costly to the taxpayers of Utah. Staying informed on the latest trends in this area is considered a fiscally responsible and environmentally sound action that enables UDOT to make better data-driven decisions.

Figure 1: Large Highway Litter Dumpster at Region 3 Station

In 2012-2013, UDOT Report No. UT-13.11 Reducing Highway Litter (THE REPORT) was created. THE REPORT is a comprehensive study aimed at reducing highway litter. It is thorough in its analysis and findings, but an update of section 2.3 "Sources of Litter" is needed for designated litter hotspots where litter accumulation rates are currently known to be high.

1.2 Objectives

The objective of this research is to systematically study identified litter hotspot areas in Utah by capturing, recording, and logging litter generation sources and major contributors to litter problems. In this context, "source" and "major contributor" refer to both the behavior and to the type of material. In the case of vehicle and construction debris, "source" and "type" are the same.

In similar studies of highway littering, "sources" are typically classified as follows: motorists, pedestrians, improperly covered loads, vehicle debris, or other (e.g., improperly secured containers). Other potential sources and major contributors will be developed from experience in past highway litter studies. Field work conducted for this project supports an analysis of sources and also supports quantifying and characterizing litter including its composition.

"Litter generation sources" and a useful classification of litter types are described for each litter hotspot surveyed. This research does not classify litter by whether the behavior was unintentional or intentional, though litter sources determined to be from pedestrians or motorists

are usually intentional. This research also does not investigate programs or policies designed to mitigate highway litter.

1.3 Scope

Prior to initiating this research, UDOT asked each UDOT Region for a list of the highway litter "hotspots", which are identified in Table 1. The areas cited below have some overlap with the field verification conducted in the REPORT, and the present research will highlight any similarities or differences between field investigations conducted for this research when compared to those conducted in 2012.

Region #	Location 1	Location 2	Location 3
1	I-84 @ US-89 Interchange	I-15 from SR-193 to Roy	21st Street (I-15 to Wall Ave)
2	I-215 west side (4700 S to 3500 S)	SR-201 urban area	
3	NB I-15 near Exit 278	SB I-15 near Exit 263	
4	I-15 MP 4-13	SR-7 MP 0-10	

Table 1: Identified Highway Litter Hotspots in UDOT's Four Regions

Prior to conducting field investigations of each hotspot, the research team interviewed UDOT Region personnel charged with highway litter cleanup to learn more about each site and to solicit their ideas on predominant litter sources. In some cases, UDOT advised the research team to conduct field surveys in different hotspot areas for a variety of reasons. For example, for Region 1, the litter hotspot on I-15 from SR-193 to Roy was under construction and the team was advised instead to survey a nearby section of SR-193. The final set of surveyed hotspots is shown in Table 2. Also provided is the date of the survey, the milepost location, and the UDOT staff that assisted with the survey.

Region	Site	Site Location (MPs)	Date	Contact	Date of Prior Clean-Up
1	SR 193	~MP 6.9-7.0	23-Dec-20	David Bills	Within 1 month of survey
1	21st-Wall Street	~MP 1.2	1-Jan-21	Rick Pro	
2	I-215	MP 16.6-16.7	1-Dec-20	Stephan Foster	
2	SR 201 Site A	MP 14.7-14.9	1-Dec-20	Stephan Foster	March/April 2020
2	SR 201 Site B	MP 13.1-13.3	1-Dec-20	Stephan Foster	
3	I-15 NB near Exit 278	MP 278.0-278.2	3-Dec-20	David (Shawn) Bright	11/16/20
3	I-15 SB near Exit 263	~MP 263.5	15-Dec-20	Chad Gasser	Less than a week before the survey
4	I-15	~MP 11.2-113	30-Dec-20	Josh Brooks	Thanksgiving week
4	SR 7 Site B	~MP 2.4-2.5	30-Dec-20	Josh Brooks	Thanksgiving week

Table 2: Field-Surveyed Highway Litter Hotspots in UDOT's Four Regions

Field investigations occurred within selected sample sections for each of the nine hotspots where detailed highway litter data were recorded and subsequently analyzed for the nine hotspot locations shown in Figure 2.

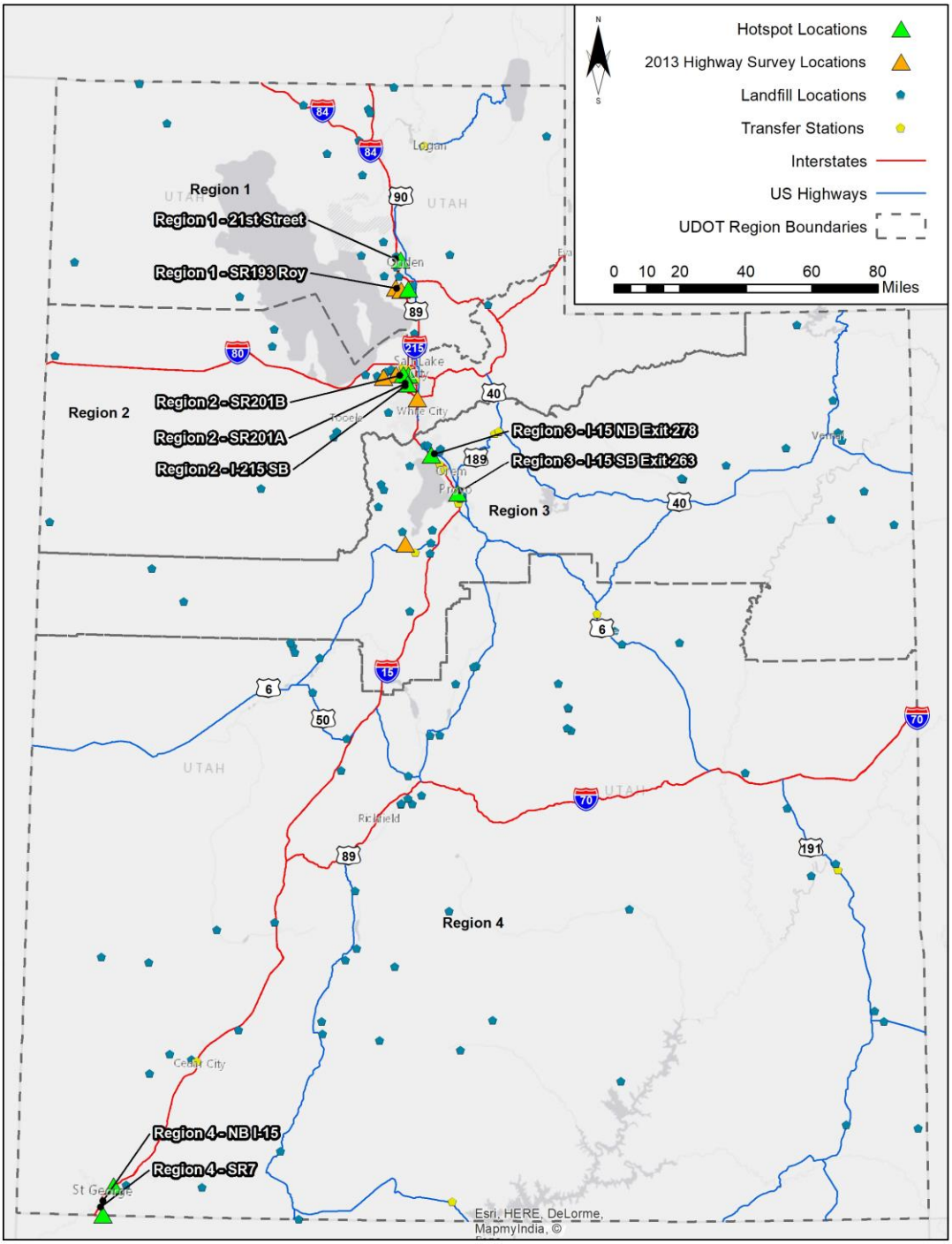


Figure 2: Highway Litter Hotspot Locations Surveyed in the Research

Also shown in Figure 2 are the locations of six litter areas that were windshield surveyed as part of the 2013 highway litter study conducted for THE REPORT. There was no overlap in the two litter survey areas, though different sections of SR-193 in Region 1 and SR-201 in Region 2 were surveyed for both studies. Also, of note, the survey methods differed in both studies: The 2013 study consisted of a windshield survey over, in many cases, several miles. The present study (2021) consisted of actual field surveys of representative highway sections.

Of note is that large litter items that fall onto the highway surface and present a travel hazard are cleared as soon as UDOT and/or the Utah Highway Patrol can be mobilized. These items most typically come from unsecured loads and represent household items, such as furniture, and construction materials or debris. Vehicle debris, such as tires or treads, fall into this category as well. These larger items are cleared as quickly as possible and, as such, are not included in the highway litter survey conducted as part of this research.

The following major tasks were accomplished as part of the research:

1. Project Approach and Narrative: The research team developed a detailed narrative describing the workplan for the field investigations (Task 4). This narrative described how data collected in the field would be analyzed to estimate litter sources.

2. Region Interviews: The research team conducted interviews with UDOT Region staff who are familiar with litter cleanup and with the identified hotspot areas.

3. Field Verification Preparation: Based on mapping analysis and information gained from the Region interviews, the team identified sampling areas within each of the hotspot locations. Sampling areas typically encompassed an area 20’ deep by 350-750’ wide. Exact dimensions were determined from mapping and field visits.

4. After the detailed sampling areas were identified, the team prepared for the field data collection process. The hotspot areas and detailed survey sample sections were depicted visually and are shown in later sections of the report.

5. Field Data Collection: The project team conducted field data collection for the sample sites identified for each of the nine litter hotspots. Using protocols provided by ER Planning, field staff cataloged highway litter data and obtained photos from each site. Data was recorded on litter volume, extent, and composition.

6. The project team systematically identified major litter contributors and specific litter generators associated with the hotspot focus area. Forensic research methods that have been developed in past highway litter studies have been utilized for correlating litter volume and type with the litter source. Litter items less than 4" are classified as "small litter". Small litter consists of cigarette butts, candy wrappers, and glass shards, for example, but also occurs if a roadside area is not cleared prior to mowing. Field data provides composition and a source analysis in each hotspot area.

7. In some cases, a "proximity analysis" has been conducted to determine whether any land uses proximate to litter hotspots are relevant for explaining the litter problem. From past highway litter studies, the proximity to land uses such as landfills, waste transfer facilities, and other commercial establishments, are often correlated to roadside litter.

8. Field data was analyzed as soon as data collection was completed for each site.

9. Reports and Presentation: Project deliverables included the project approach memo, two interim progress reports, a final report, and a final slide deck.

10. Meetings: A total of four project meetings occurred, held virtually, which included a kickoff meeting, two interim meetings, and a final meeting to present results.

1.4 Outline of Report

This final report consists of the following sections:

- Research Methods
- Data Collection and Analysis
- Region and State Summaries
- Conclusions

2.0 RESEARCH METHODS

2.1 Overview

This chapter discusses the process used to estimate litter sources from field data collection.

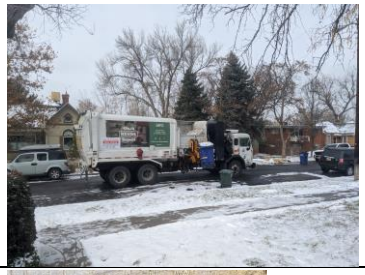
2.2 Estimating Litter Sources

Understanding the sources of litter found along roadways is a key to effective litter abatement. An assessment of these sources will help UDOT to focus limited funding more effectively on the likely sources of litter on DOT-maintained roadways throughout the state.

While motorists and pedestrians are known sources of intentional littering, litter is also known to be caused by vehicles with loads that are being transported without tarps or are otherwise improperly secured, resulting in loss of material. Some of this unintentional loss of litter originates from vehicles of homeowners or small businesses carrying trash or construction debris to solid waste facilities. Other sources of unintentional litter can occur when trash and recyclables fall off or are otherwise blown off commercial collection vehicles.

At UDOT's request, this survey focused primarily on litter hotspots along high-traffic, limited access highways and interstates. For this project, the following possible sources of litter were considered:

Construction debris: loose construction or demolition debris originating from construction sites or from home projects.	

Improperly secured loads: pickup trucks with beds that are not covered properly and from which trash can unintentionally be released while in motion, or flat-bed trailers transporting loads that are insufficiently secured.	
Motorists: drivers or passengers intentionally tossing trash out of the window while traveling.	
Pedestrians: individuals intentionally discarding trash while walking along roadways.	
Trash and recyclables collection vehicles: commercial trucks transporting trash or recyclables that are insufficiently secured, whose compartments have loose trash or whose tarp does not prevent wind-blown trash from flying out of the top of an open-top container.	
Vehicle debris: automobile or truck parts from vehicle accidents, tire blowouts along roadways, or debris left over from roadside maintenance on cars or trucks.	

Unless littering is witnessed, the sources may be uncertain. Still, it is possible to estimate the suspected sources of litter based on guidelines and context clues developed over time by research team member, ER Planning. These include, but are not limited to:

1. Amount and composition of debris found,
2. Proximity to known litter sources such as solid waste facilities, fast-food establishments, etc.,
3. Input from field crews while surveying,

4. Input from local DOT personnel,
5. Type of roadway (interstate, state road, etc.),
6. Proximity to other high-traffic roadways,
7. Type of area (urban, suburban, rural), and
8. Analysis of the resulting litter data and the physical area surrounding each site using mapping software.

Specific guidelines are also utilized. For example, cigarette butts found on interstates would have been discarded by motorists since pedestrian traffic is not allowed on interstates. However, on low-volume state roads, pedestrians would be considered a potential source.

The presence of a number of beverage containers may indicate spillage from a curbside recycling vehicle. In cases where local participation in residential recycling is not significant, such items are more likely to have fallen from a trash collection vehicle. Spillage of trash or recyclables tends to occur more often on collection days.

When a significant amount of paper and/or plastic debris is unidentifiable, this may suggest that these materials have been in dumpsters and subsequently in trash trucks. In addition, these items may have been mixed with other materials some of which are wet creating a garbage stew.

The extent to which items have been exposed to the elements is evaluated as well. This tends to be dependent upon factors such as recent weather conditions, the state's unique climate, the season of the year in which the litter survey is being conducted and the timing of the most recent cleanup of the roadways being surveyed.

The sources of litter in this study have been allocated based on these guidelines. They are estimates and the exact breakdown may vary.

2.2.1 Components and Categories

Litter was characterized using 122 components (104 for Large Litter and 18 for Small Litter). These components are consistent with those used in other recent litter surveys. These components were subsequently rolled up into 15 major categories of litter that are listed below along with some common examples of each.

Fast-food-related items were broken down into three categories for clarity: Cups and Lids, Straws and Wrappers, and (other) Fast-Food Packaging.

1. Beverage containers: beer, soda, sports and energy, water, wine and liquor, juice, coffee,

tea, etc. Each one was further classified by material type (metal, plastic, glass, composite).

2. Beverage related: beverage cartons and six-pack rings. These are minor components but were classified separately to avoid confusion with the beverage containers themselves.
3. Cups and lids: cups used solely for hot drinks, cups used solely for cold drinks, and lids found without cups. Each of these was further classified by material type (paper, plastic, foam).
4. Straws and wrappers: straws and wrappers tallied separately. Each was further classified by material type (paper, plastic).
5. Fast-food packaging: clamshells, condiments, burger wraps, utensils, napkins, plates, and trays. Each of these was further classified by material type (paper, foil, plastic, etc.).
6. Snack wrappers: sweet snacks (candy, cakes), salty snacks (chips, crackers), and gum. Each of these was further classified by material type (paper, plastic, composite).
7. Home food: food jars, cans, bottles, lids, and tea packets. Each was further classified by material type (glass, metal, plastic, composite).
8. Paper: all non-food/beverage paper items including newspapers, magazines, flyers, lottery tickets, business, school, receipts, packaging, paperboard, corrugated boxes, unidentifiable paper, and paperboard. Each was individually classified.
9. Vehicle Debris: automobile parts from accidents, do-it-yourself car maintenance debris, and tire debris. Each was individually classified.
10. Construction: construction and demolition debris (e.g., shingles, wood, electrical, drywall, Tyvek, insulation, industrial rags, tarps, etc.)
11. Commercial/Industrial Plastics (e.g., shrink wrap, film wrapping, plastic pieces, foam insulation, etc.).
12. Home items: lamps, clothes, toiletries, home packing materials, and drug-related items. Each was individually classified.
13. Bags: paper, plastic, and reusable bags separated by those used for shopping, trash, and leaves. Those with brand names were separately tallied from generic bags such as “thank you” bags. Each was further classified by material (paper, plastic, cloth).
14. Tobacco related: lighters, packages, and matchbooks along with any cigarette or cigar butts that were one inch or larger. Each was separately classified.
15. Other: any items not otherwise classified.

3.0 DATA COLLECTION AND ANALYSIS

3.1 Overview

This chapter describes the data collection process employed at each of the nine highway litter hotspots. The chapter also presents the results of the data analysis for each site and statewide summaries.

3.2 Region Interviews

Prior to the interviews, the research team developed a list of questions and issues covered during each interview:

1. Are there specific areas within each hotspot that are representative of the entire hotspot or that have a greater amount of littering?
2. When was the last time this area was cleared of litter?
3. What are the suspected sources/causes of litter for the hotspot?
4. Are there nearby land uses that are directly or indirectly contributing to the litter problem?
5. How often does UDOT pick up litter here?

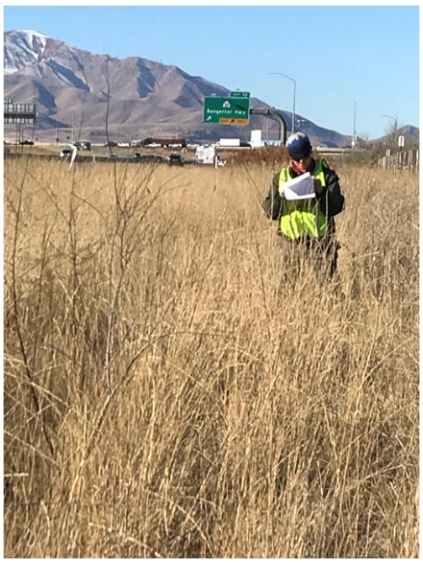
Region staff discussed the reasons for selecting the hotspot areas as well as the potential sources of highway litter in each area. The interviews also helped narrow down the specific survey locations within each hotspot.

Following the interviews with Region staff, the research team scheduled a time for the field data collection, at which UDOT staff were always present.

3.3 Field Data Collection Process

The research team selected a roadside area that measured 350-750 feet in length and covered the depth of the right-of-way, usually to a fence, barrier, or sound wall. Survey depths typically were 18-25'. The first step was to flag the begin and end points of the survey area.

The survey process involved walking the length of the survey area and systematically covering the length in 3' passes until the entire area was canvassed.



The field staff was equipped with a clipboard and tally sheet. Every piece of large litter was tallied by component and classification. Field surveys typically were one hour in duration, and also included obtaining photo documentation.

After large litter was tallied, the site was sampled for small litter (<4"). Small litter sampling involved walking the depth of the survey area at three locations, typically at each end and in the middle.

Because the surveyed area differed between the nine survey sites, the litter totals reported in this report for all sites are adjusted to an area of 9,000 square feet for consistency when comparing the number of items between sites.

3.4 Region 1

3.4.121st Street

The first site surveyed in Region 1 was located on 21st Street between I-15 and Wall Street in West Haven, approximately 1,700 feet west of the border with Ogden City along 21st Street. This area is primarily industrial and directly adjacent to a transfer station as shown in Figure 3.

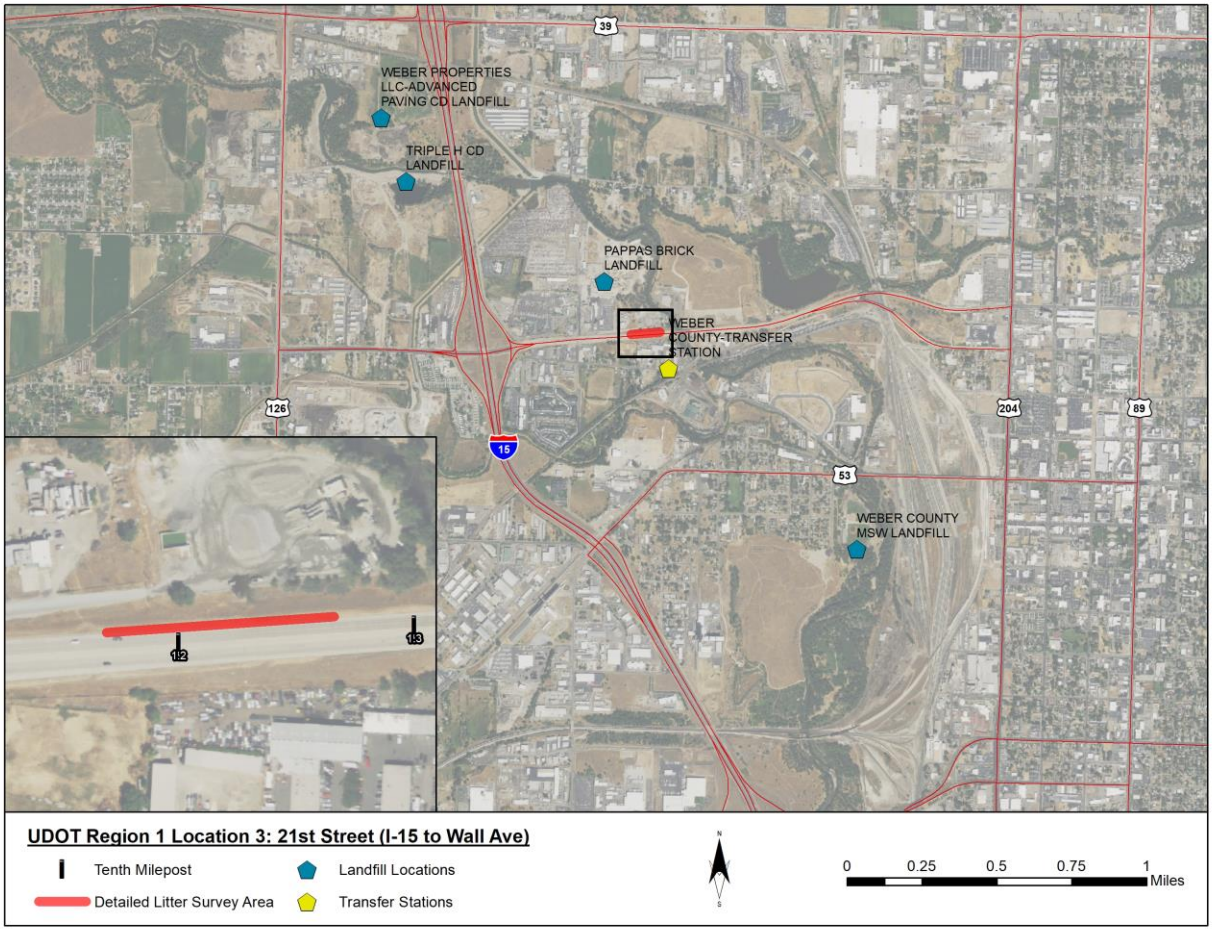


Figure 3: Region 1, 21st Street (WB MP1) Survey Site and Area Map

This site was 500 feet long and 15 feet deep totaling an area of 7,500 square feet.

3.4.1.1 Large Litter - Categories

A total of 390 pieces of Large Litter were tallied at the site consisting primarily of Plastic Commercial/Industrial Debris (18.2 percent) and Paper Items (17.4 percent) as shown in Table 3.

These two categories comprised more than one-third of all Large Litter (35.6 percent) at this site. There was an average of 4.3 Large Litter items per 100 square feet.

Table 3: Large Litter Components at the 21st Street Site (R1)

Category	Items	Percent
Beverage Containers	26	6.7%
Beverage-Related Items Items	0	0.0%
Cups & Lids	33	8.5%
Straws & Wrappers	14	3.6%
Fast-Food Packaging	16	4.1%
Home Food Packaging	7	1.8%
Snack Packaging	39	10.0%
Paper Items	68	17.4%
Vehicle Debris	11	2.8%
Plastic Comm./Ind. Debris	71	18.2%
Construction Debris	42	10.8%
Home Items	47	12.1%
Paper & Plastic Bags	7	1.8%
Tobacco-Related Items	8	2.1%
Other (Misc.)	1	0.3%
Total	**390**	**100.0%**

3.4.1.2 Large Litter - Components

The largest individual component of Large Litter at the site was Polystyrene Bulk Packing (9.2 percent), as shown in Table 4. This was followed by Unidentifiable Plastic Pieces (7.9 percent) and Construction Wood (6.2 percent). These three components comprised 23.3 percent of all Large Litter.

Of the 104 components surveyed, the top 10 comprised 53.3 percent of Large Litter at the site. In addition to Plastic Water Bottles, Industrial Rags also comprised 3.3 percent of Large Litter. All other components not listed in Table 4 each comprised less than 3.3 percent of the total.

Table 4: Top 10 Large Litter Components, 21st Street, Region 1

Component	Items	Percent
Polystyrene Bulk Packing	36	9.2%
Unidentifiable Plastic Pieces	31	7.9%
C&D – Wood	24	6.2%
Corrugated Boxes/Pieces	20	5.1%
Sweet Snack Wraps (Candy, Cake)	19	4.9%
Unidentifiable Paper Pieces	17	4.4%
Plastic Packaging - Other (Film, etc.)	17	4.4%
Polystyrene Foam Insulation	17	4.4%
Straws/Wrappers	14	3.6%
Plastic Water Bottles	13	3.3%
Total	**208**	**53.3%**

3.4.1.3 Recyclables in Large Litter

Recyclable items comprised 26.4 percent of Large Litter at this site as shown in Table 5. These were predominantly Paper items (17.4 percent). The largest components of Paper items were Corrugated Boxes/Pieces (5.1 percent) and Unidentifiable Paper Pieces (4.4 percent).

Table 5: Recyclable Large Litter Components, 21st Street (R1)

Components	Items	Percent
Beverage Containers	26	6.7%
Paper	68	17.4%
Home Food Containers	9	2.3%
Total	**103**	**26.4%**

3.4.1.4 Small Litter - Components

Of the 18 components of Small Litter, the largest were Cigarette Butts (45.7 percent) and Paper (17.2 percent). These two components totaled 62.8 percent of all Small Litter at the site as shown in Table 6. The total number of Small Litter items (1,946) represents an average of 21.6 pieces per 100 square feet.

Table 6: Small Litter Components, 21st Street (R1)

Component	Items	Percent
Aluminum	0	0.0%
Bottle Caps	55	2.8%
Candy Wrappers	112	5.8%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	889	45.7%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	277	14.2%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	334	17.2%
Plastic Film	112	5.8%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	167	8.6%
Tire Pieces	0	0.0%
Straws	0	0.0%
Total	**1,946**	**100.0%**

3.4.1.5 Litter Source Estimates at 21st Street

Trash/Recycling Vehicles (45 percent) and Motorists (30 percent) were estimated to be the largest contributors to litter at the site as shown in Figure 4.

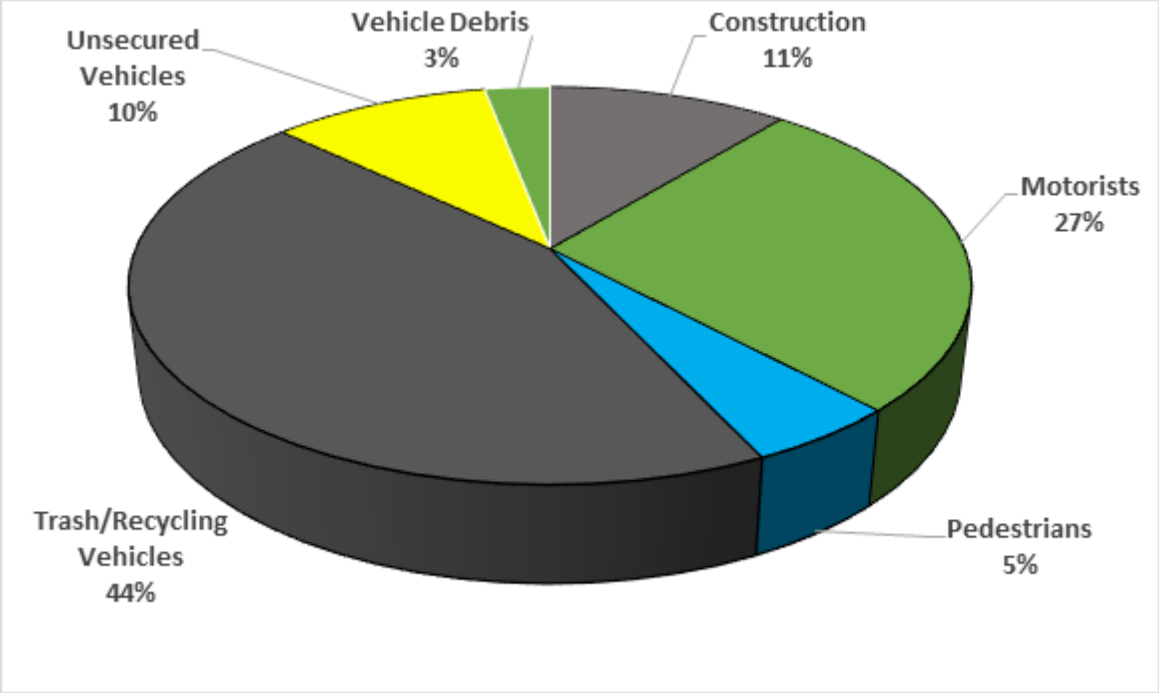


Figure 4: Sources of Large Litter at 21st Street (R1)

3.4.2 SR-193

The second site surveyed in Region 1 was located on SR-193 (MP 6.9-7.0) approximately 2.5 miles east of I-15 in a suburban area of Layton in Davis County. The area surveyed was proximate to the southern fence of Hill Air Force Base (Figure 5). This site was 500 feet long and 12 feet deep totaling an area of 6,000 square feet.

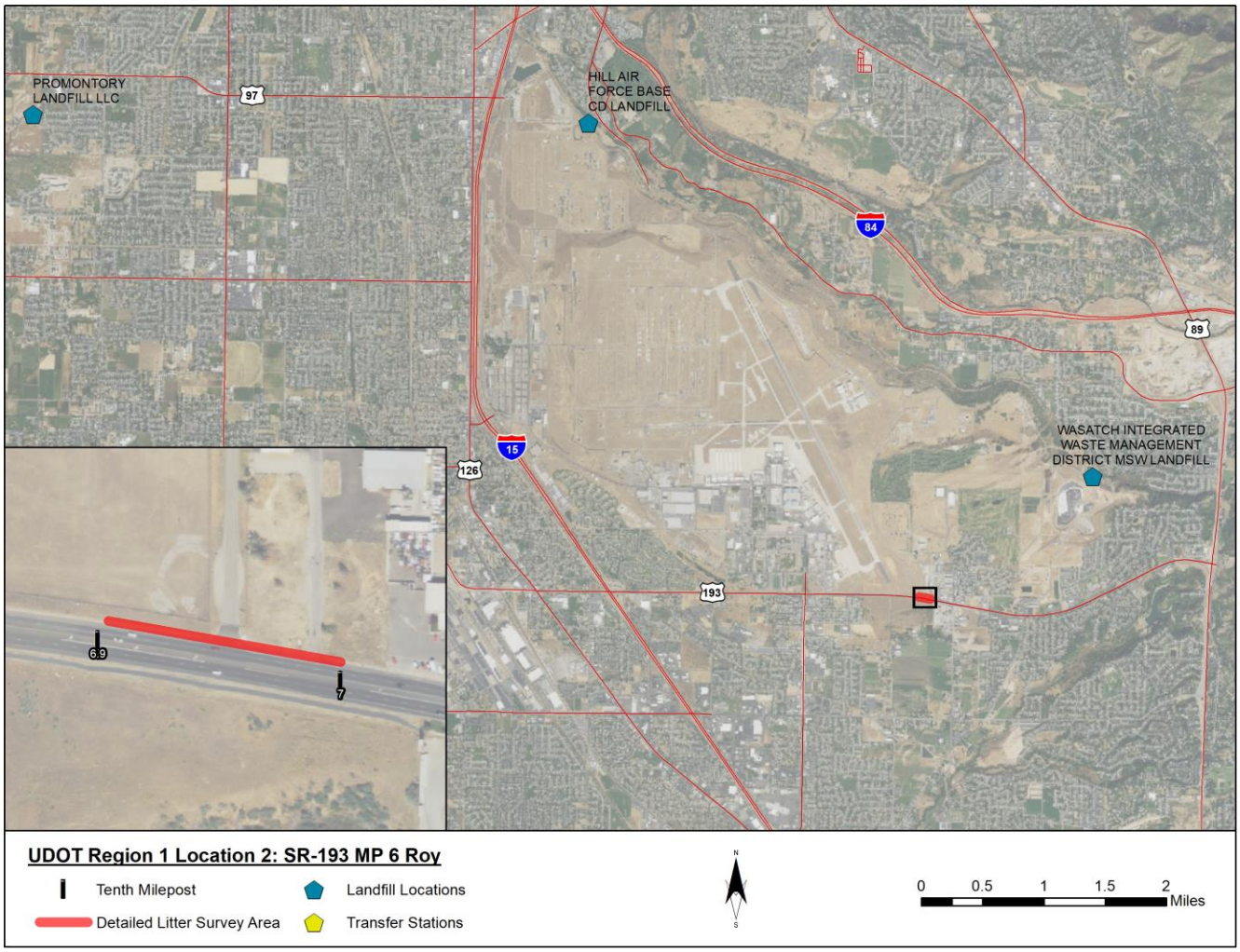


Figure 5: Region 1, SR-193 (WB MP7) Survey Site and Area Map

3.4.2.1 Large Litter - Categories

A total of 219 pieces of Large Litter were tallied at this site consisting primarily of Plastic Commercial/Industrial Debris (24.7 percent) and Paper Items (18.7 percent) as shown in Table 7. These two categories comprised 43.4 percent of Large Litter found at this site. There was an average of 2.4 Large Litter items per 100 square feet, much less than the amount found at the other Region 1 site on 21st Street (4.3 items per 100 square feet).

Table 7: Large Litter by Category, SR-193 (R1)

Category	Items	Percent
Beverage Containers	16	7.3%
Beverage-Related Items Items	0	0.0%
Cups & Lids	16	7.3%
Straws & Wrappers	2	0.9%
Fast-Food Packaging	2	0.9%
Home Food Packaging	0	0.0%
Snack Packaging	12	5.5%
Paper Items	41	18.7%
Vehicle Debris	5	2.3%
Plastic Comm/Ind. Debris	54	24.7%
Construction Debris	27	12.3%
Home Items	32	14.6%
Paper & Plastic Bags	5	2.3%
Tobacco-Related Items	2	0.9%
Other (Misc.)	5	2.3%
Total	**219**	**100.0%**

3.4.2.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (13.2 percent), as shown in Table 8. This was followed by Unidentifiable Paper Pieces (9.6 percent) and Home Items (5.5 percent). These three components of unidentifiable litter totaled 28.3 percent of all Large Litter at the site.

Of the 104 components surveyed, the top 10 percent comprised 58.4 percent of Large Litter found at this site. In addition to the items shown in Table 8, Polystyrene Bulk Packing also comprised 3.7 percent. All other components not listed each comprised 2.7 percent or less of the total.

Table 8: Top 10 Large Litter Components, SR-193 (R1)

Component	Items	Percent
Unidentifiable Plastic Pieces	29	13.2%
Unidentifiable Paper Pieces	21	9.6%
Home Articles	12	5.5%
Plastic Shrink Wrap	11	5.0%
Plastic Packaging - Other (Film, etc.)	11	5.0%
Other Cloth (Rags, Tarps, Industrial)	11	5.0%
Plastic Water Bottles	9	4.1%
Polystyrene Cups (Foam)	8	3.7%
Sweet Snack Wraps (Candy, Cake)	8	3.7%
Paper Packaging - Other	8	3.7%
	128	**58.4%**

3.4.2.3 Recyclables in Large Litter

Recyclable items comprised 26.0 percent of Large Litter at this site as shown in Table 9. These were predominantly Paper items (18.7 percent). The largest components of these Paper items were Unidentifiable Paper Pieces (9.6 percent) and Paper Packaging (3.7 percent).

Table 9: Large Litter: Recyclable Components

Components	Items	Percent
Beverage Containers	16	7.3%
Paper	41	18.7%
Total	**57**	**26.0%**

3.4.2.4 Small Litter - Components

Of the 18 components of Small Litter, Cigarette Butts comprised almost half of all Small Litter (49.9 percent) followed by Hard Plastic items (25.0 percent). These two components totaled 74.9 percent of all Small Litter on the site as shown in Table 10. The total number of Small Litter items (668) represents an average of 7.4 pieces per 100 square feet, about one-third of the amount found at the 21st Street site.

Table 10: Small Litter Components, SR-193 (R1)

Components	Items	Percent
Aluminum	0	0.0%
Bottle Caps	0	0.0%
Candy Wrappers	56	8.4%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	333	49.9%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	167	25.0%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	56	8.4%
Plastic Film	0	0.0%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	56	8.4%
Tire Pieces	0	0.0%
Straws	0	0.0%
Total	**668**	**100.0%**

3.4.2.5 Litter Source Estimates

The sources of litter were primarily Trash/Recycling Vehicles (43 percent) and Motorists (33 percent) as shown in Figure 6.

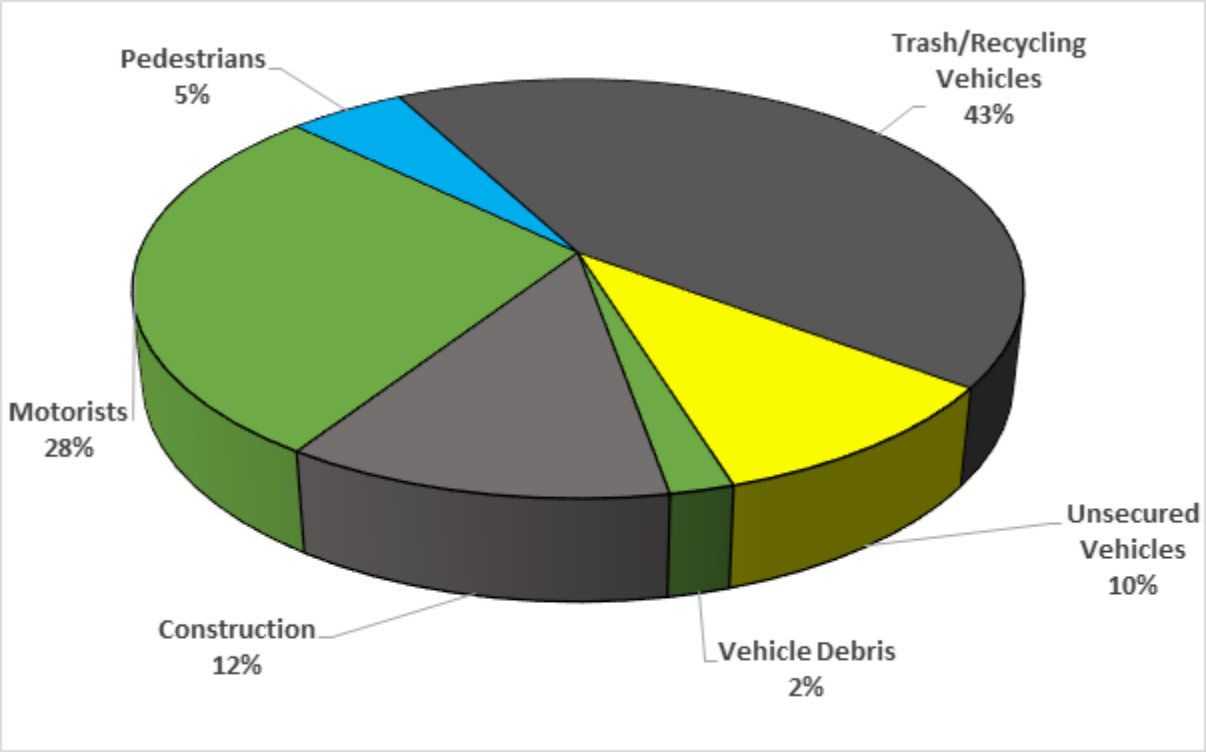


Figure 6: Sources of Large Litter at SR-93 Site (R1)

3.4.3 Region 1 Summary

3.4.3.1 Large Litter - Categories

A total of 609 pieces of Large Litter were tallied at the Region 1 sites, consisting primarily of Plastic Commercial/Industrial Debris (20.5 percent) and Paper Items (17.9 percent) as shown in Table 11. These two categories comprised 38.4 percent of Large Litter found at these sites. There was an average of 3.4 Large Litter items per 100 square feet.

Table 11: Region 1 Large Litter by Category

Category	Items	Percent
Beverage Containers	42	6.9%
Beverage-Related Items Items	0	0.0%
Cups & Lids	49	8.0%
Straws & Wrappers	16	2.6%
Fast-Food Packaging	18	3.0%
Home Food Packaging	7	1.1%
Snack Packaging	51	8.4%
Paper Items	109	17.9%
Vehicle Debris	16	2.6%
Plastic Comm/Ind. Debris	125	20.5%
Construction Debris	69	11.3%
Home Items	79	13.0%
Paper & Plastic Bags	12	2.0%
Tobacco-Related Items	10	1.6%
Other (Misc.)	6	1.0%
Total	**609**	**100.0%**

3.4.3.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (9.9 percent), as shown in Table 12. This was followed by Polystyrene Bulk Packing (7.2 percent) and Unidentifiable Paper Pieces (6.2 percent). These three components of unidentifiable litter totaled 23.3 percent of all Large Litter at Region 1 sites.

Of the 104 components surveyed, the top 10 items comprised 51.7 percent of Large Litter found at Region 1 sites. All other components not listed in Table 12 each comprised 2.8 percent or less of the total.

Table 12: Region 1 Top 10 Large Litter Components

Component	Items	Percent
Unidentifiable Plastic Pieces	60	9.9%
Polystyrene Bulk Packing	44	7.2%
Unidentifiable Paper Pieces	38	6.2%
C&D – Wood	30	4.9%
Plastic Packaging - Other (Film, etc.)	28	4.6%
Sweet Snack Wraps (Candy, Cake)	27	4.4%
Other Cloth (Rags, Tarps, Industrial)	24	3.9%
Plastic Water Bottles	22	3.6%
Corrugated Boxes/Pieces	22	3.6%
Polystyrene Foam Insulation	20	3.3%
	315	**51.7%**

3.4.3.3 Recyclables in Large Litter

Recyclable items comprised 26.3 percent of Large Litter at the two Region 1 sites as shown in Table 13. These were predominantly Paper items (17.9 percent). The largest components of Paper items were Unidentifiable Paper Pieces (6.2 percent) and Corrugated Boxes (3.6 percent).

Table 13: Region 1 Recyclable Components of Large Litter

Components	Items	Percent
Beverage Containers	42	6.9%
Paper	109	17.9%
Home Food Containers	9	1.5%
Total	**160**	**26.3%**

3.4.3.4 Region 1: Small Litter - Components

Of the 18 components of Small Litter, Cigarette Butts comprised 46.7 percent followed by Hard Plastic Items (17.0 percent) and Paper (14.9 percent). These three components totaled

78.7 percent of all Small Litter on Region 1 site as shown in Table 14. The total number of Small Litter items (2,614) represents an average of 14.5 pieces per 100 square feet.

Table 14: Region 1 Small Litter Components

Components	Items	Percent
Aluminum	0	0.0%
Bottle Caps	55	2.1%
Candy Wrappers	168	6.4%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	1,222	46.7%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	444	17.0%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	390	14.9%
Plastic Film	112	4.3%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	223	8.5%
Tire Pieces	0	0.0%
Straws	0	0.0%
Total	**2,614**	**100.0%**

3.4.3.5 Litter Source Estimates

Trash/Recycling Vehicles (42 percent) and Motorists (30 percent) were estimated to be the largest contributors to litter on Region 1 sites as shown in Figure 7.

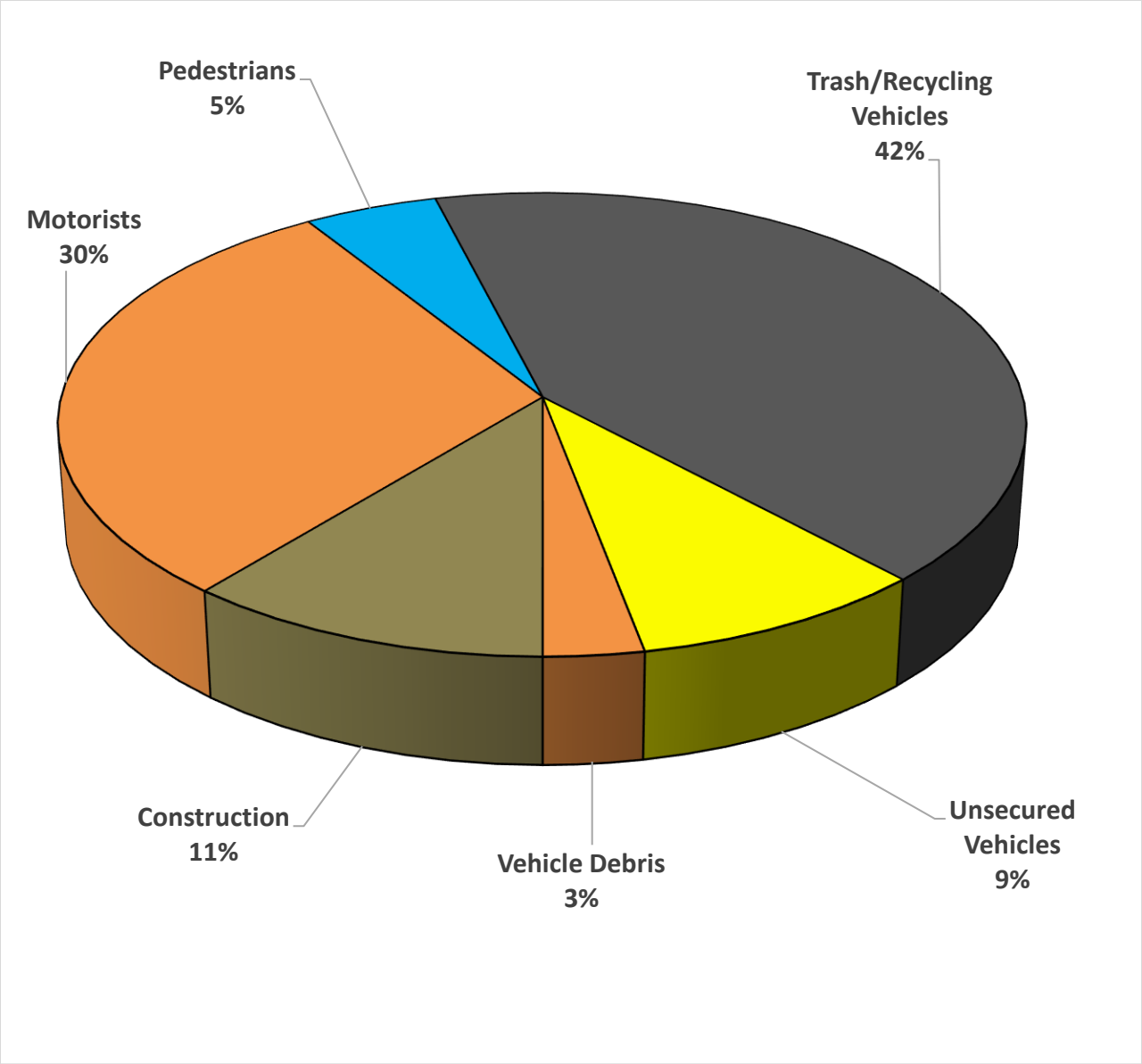


Figure 7: Sources of Large Litter in Region 1

3.5 Region 2

3.5.1I-215 SB (MP16)

The first site surveyed in Region 2 was located on I-215 in a densely-populated residential area of West Valley City immediately north of the 4100 South overpass (Figure 8). This site was 500 feet long and 18 feet deep totaling an area of 9,000 square feet.

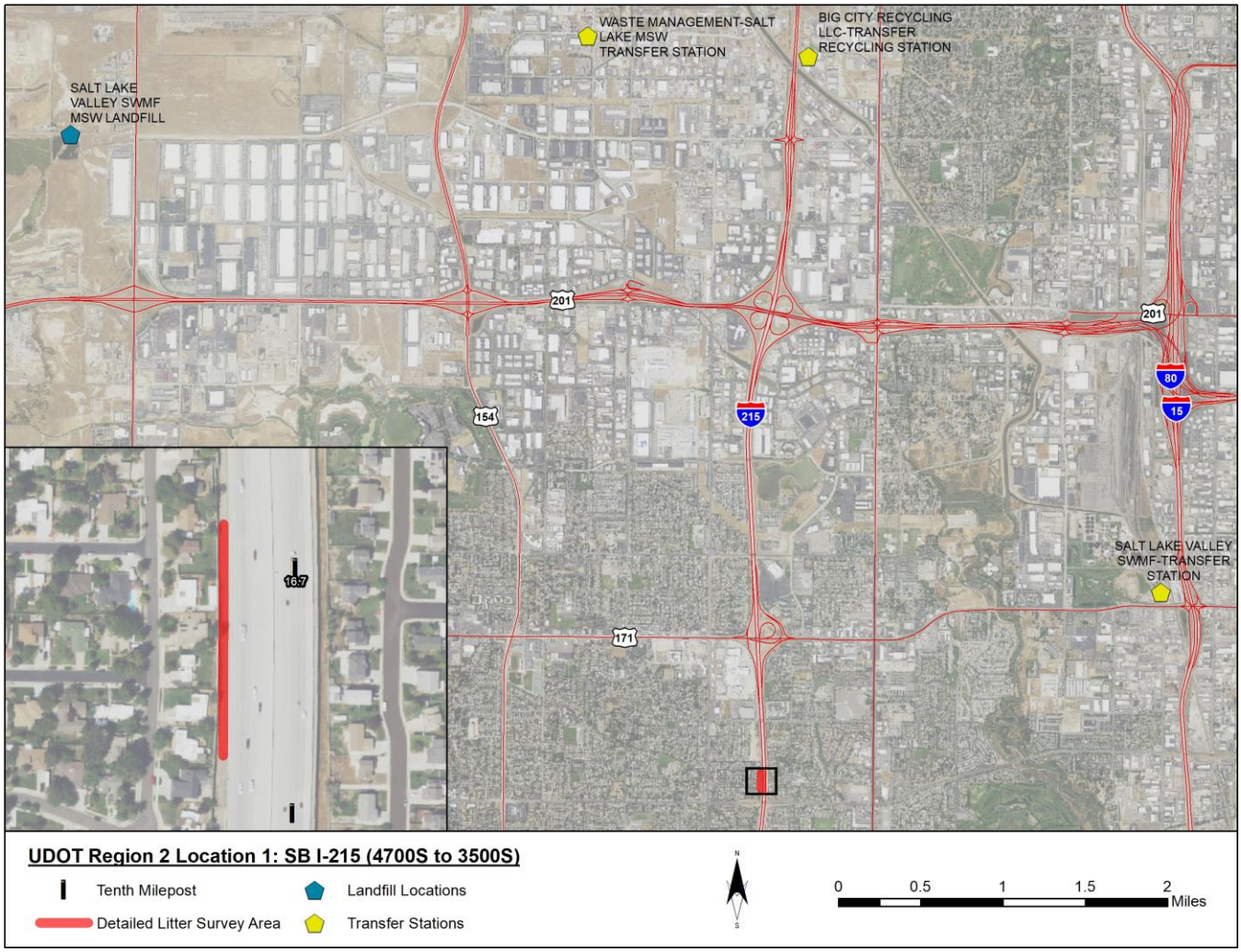


Figure 8: Region 2, I-215 (SB MP16) Survey Site and Area Map

3.5.1.1 Large Litter - Categories

A total of 514 pieces of Large Litter were tallied at the I-215 site consisting primarily of Plastic Commercial/Industrial Debris (27.8 percent) and Paper Items (21.2 percent) as shown in

Table 15. These two categories comprised almost half of all Large Litter (49.0 percent) found at this site. There was an average of 5.7 Large Litter items per 100 square feet.

Table 15: Large Litter at Site I-215 (R2)

Large Litter Categories		
Category	**Items**	**Percent**
Beverage Containers	45	8.8%
Beverage-Related Items Items	0	0.0%
Cups & Lids	17	3.3%
Straws & Wrappers	9	1.8%
Fast-Food Packaging	19	3.7%
Home Food Packaging	1	0.2%
Snack Packaging	5	1.0%
Paper Items	109	21.2%
Vehicle Debris	50	9.7%
Plastic Comm./Ind. Debris	143	27.8%
Construction Debris	34	6.6%
Home Items	43	8.4%
Paper & Plastic Bags	30	5.8%
Tobacco-Related Items	4	0.8%
Other (Misc.)	5	1.0%
Total	**514**	**100.0%**

3.5.1.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (20.6 percent), as shown in Table 16, followed by Unidentifiable Paper Pieces (9.7 percent). The top two components comprised 30.3 percent of all Large Litter. The fact that so many pieces of litter could not be identified suggests that these items had likely been mixed and compacted with other items and had also been exposed to the elements, suggesting that a major source would be garbage collection vehicles.

The top 10 of the 104 components surveyed comprised 64.8 percent of Large Litter at the I-215. All other components not listed in Table 15 each comprised 2.5 percent or less of the total.

Table 16: Large Litter: Top 10 Components, I-215 Site (R2)

Top 10 Large Litter Components		
Component	**Items**	**Percent**
Unidentifiable Plastic Pieces	106	20.6%
Unidentifiable Paper Pieces	50	9.7%
Vehicle Debris	37	7.2%
Corrugated Boxes/Pieces	27	5.3%
Plastic Water Bottles	24	4.7%
Clothing or Clothing Pieces	21	4.1%
Plastic Packaging - Other (Film, etc.)	20	3.9%
Plastic Retail Bags - Brand Name	20	3.9%
Polystyrene Foam Insulation	14	2.7%
Polystyrene Bulk Packing	14	2.7%
Total	**333**	**64.8%**

3.5.1.3 Recyclables in Large Litter

Recyclable items comprised 30.2 percent of Large Litter at the site (Table 17). These were predominantly Paper items (21.2 percent). The Paper items were primarily Corrugated Boxes (9.7 percent) and Unidentifiable Paper Pieces (5.3 percent) in particular.

Table 17: Recyclable Components, I-215 (R2)

Recyclable Large Litter Components		
Components	**Items**	**Percent**
Beverage Containers	45	8.8%
Paper	109	21.2%
Home Food Containers	1	0.2%
Total	**155**	**30.2%**

3.5.1.4 Small Litter - Components

Of the 18 components of Small Litter, Cigarette Butts comprised 55.4 percent followed by Hard Plastic, which comprised 23.1 percent. These two components totaled 78.5 percent of all Small Litter on the site as shown in Table 18. The total number of Small Litter items (3,611) represents an average of 40.1 pieces per 100 square feet.

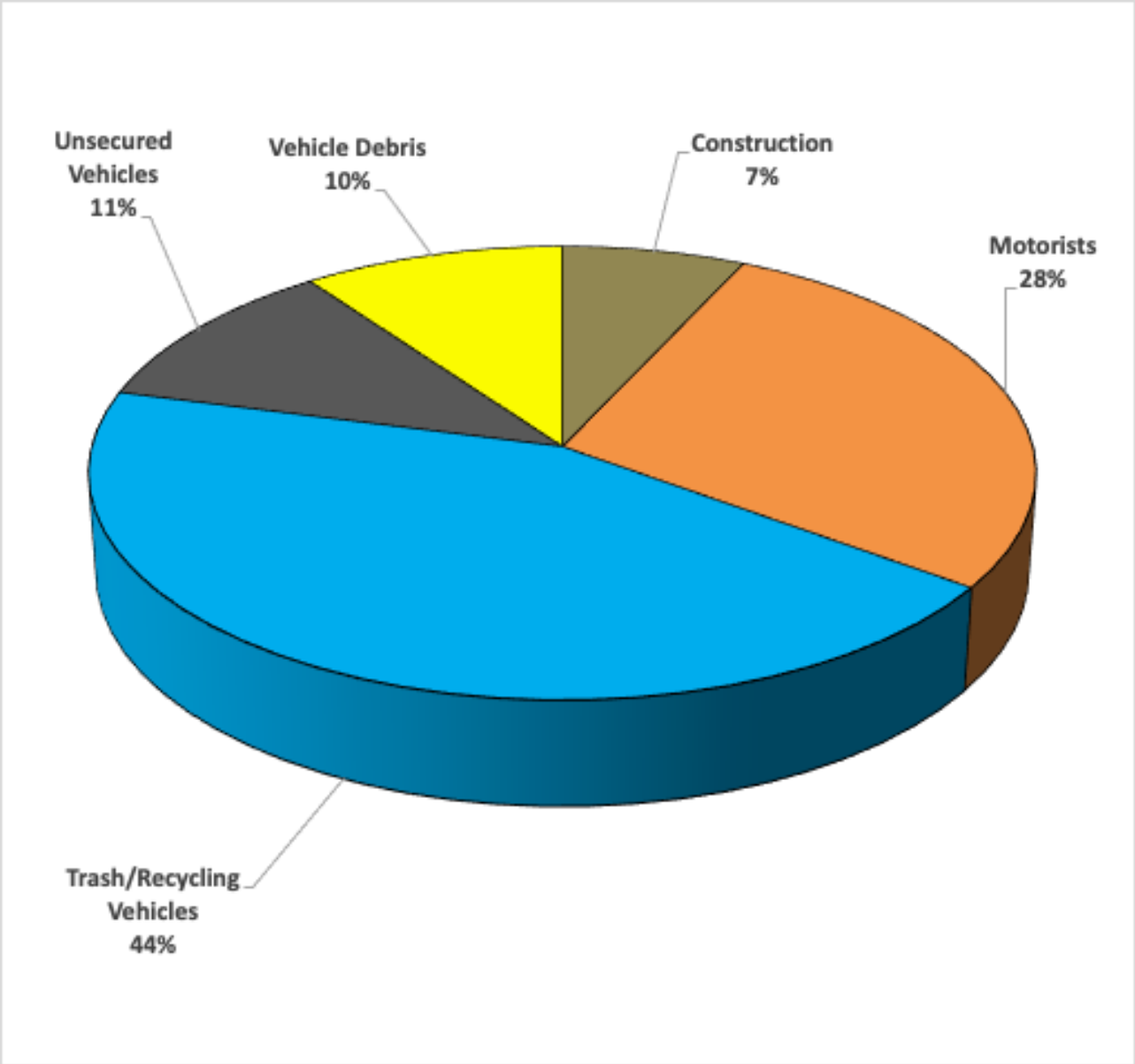
Table 18: Small Litter Components, Site I-215 (R2)

Small Litter Components		
Category	**Items**	**Percent**
Aluminum	111	3.1%
Bottle Caps	0	0.0%
Candy Wrappers	0	0.0%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	1,999	55.4%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	833	23.1%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	167	4.6%
Plastic Film	111	3.1%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	167	4.6%
Tire Pieces	167	4.6%
Straws	56	1.6%
Total	**3,611**	**100.0%**

3.5.1.5 Litter Source Estimates at I-215 Site (R2)

Unsecured Vehicles (34 percent) and Trash/Recycling Vehicles (30 percent) were estimated to be the largest contributors to litter on the site as shown in Figure 9.

Figure 9: Sources of Large Litter at I-215 (MP16)



3.5.2 SR-201 East (Site A)

The second site surveyed in Region 2 was located on SR-201 East in an urban area on the border of Salt Lake City and West Valley City near the intersection with I-215 as shown in Figure 10. This site was 350 feet long and 20 feet deep totaling an area of 7,000 square feet.

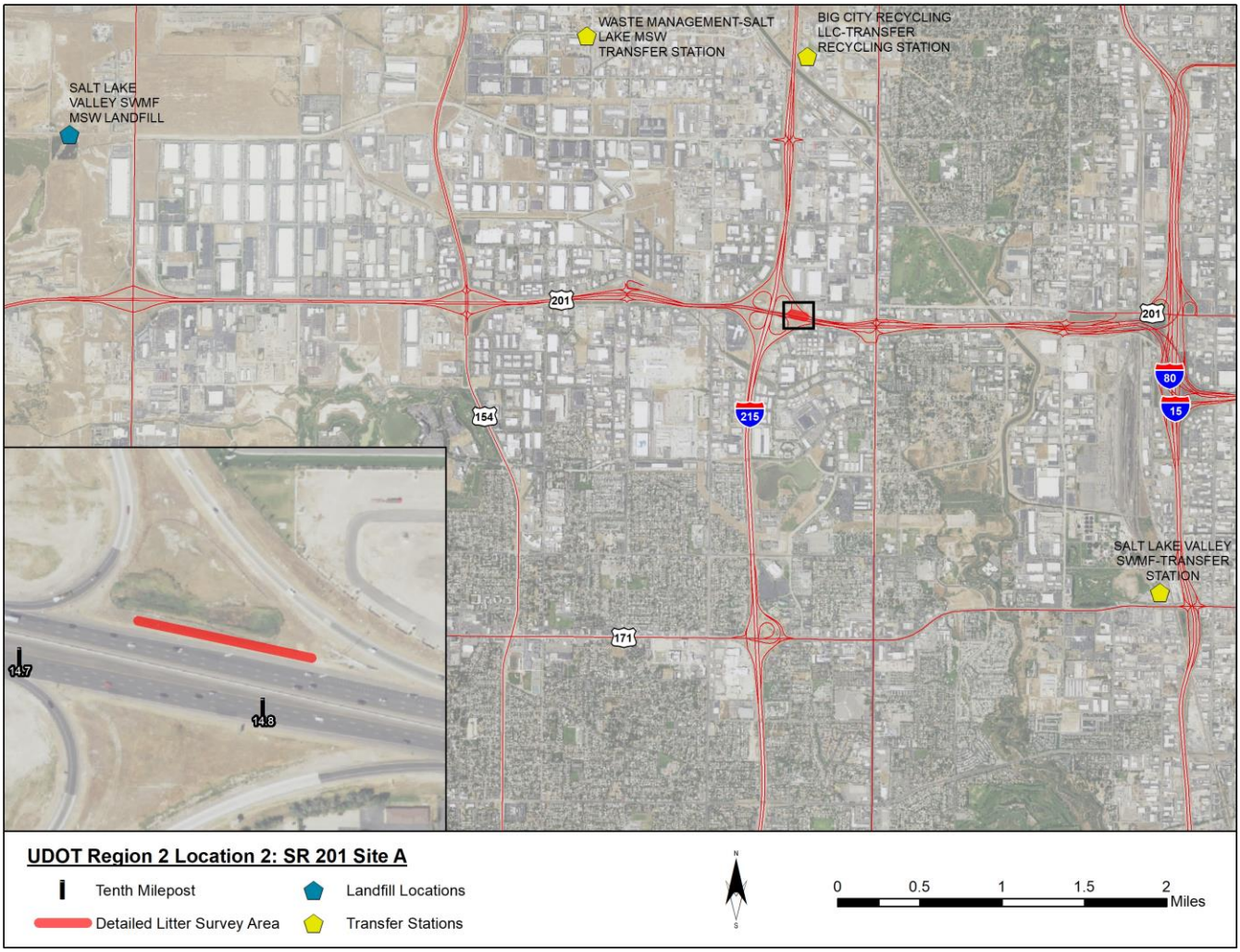


Figure 10: Region 2, SR-201(A) (WB MP14) Survey Site and Area Map

3.5.2.1 Large Litter - Categories

A total of 1,063 pieces of Large Litter were tallied at the first site on SR-201 consisting primarily of Plastic Commercial/Industrial Debris (30.5 percent) and Paper Items (29.6 percent) as shown in Table 19. These two categories comprised well over half of all Large Litter (60.1

percent) found at this site. There was an average of 11.8 Large Litter items per 100 square feet, more than twice the amount found at the I-215 site.

Table 19: Large Litter at SR-201 Site A (R2)

Large Litter Categories		
Category	**Items**	**Percent**
Beverage Containers	74	7.0%
Beverage-Related Items Items	0	0.0%
Cups & Lids	34	3.2%
Straws & Wrappers	10	0.9%
Fast-Food Packaging	52	4.9%
Home Food Packaging	4	0.4%
Snack Packaging	23	2.2%
Paper Items	315	29.6%
Vehicle Debris	40	3.8%
Plastic Comm/Ind. Debris	324	30.5%
Construction Debris	45	4.2%
Home Items	96	9.0%
Paper & Plastic Bags	36	3.4%
Tobacco-Related Items	5	0.5%
Other (Misc.)	5	0.5%
Total	**1,063**	**100.0%**

3.5.2.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (15.3 percent), as shown in Table 20. This was followed by Unidentifiable Paper Pieces (12.1 percent) and Unidentifiable Paperboard/Cardboard Pieces (9.6 percent). These three components of unidentifiable litter totaled 37.1 percent of all Large Litter at the site.

The fact that so many pieces of litter could not be identified suggests that these items had likely been mixed and compacted with other items and had also been exposed to the elements, suggesting that a major source would be garbage collection vehicles.

The top 10 of the 104 components surveyed comprised 71.1 percent of Large Litter found at the site. All other components not listed in Table 20 each comprised 2.1 percent or less of the total.

Table 20: Large Litter: Top 10 Components

Top 10 Large Litter Components		
Component	**Items**	**Percent**
Unidentifiable Plastic Pieces	163	15.3%
Unidentifiable Paper Pieces	129	12.1%
Unidentifiable Paperboard/Cardboard	102	9.6%
Polystyrene Bulk Packing	79	7.4%
Polystyrene Foam Insulation	78	7.3%
Plastic Packaging - Other (Film, etc.)	55	5.2%
Corrugated Boxes/Pieces	53	5.0%
Plastic Water Bottles	41	3.9%
Vehicle Debris	28	2.6%
Plastic Shrink Wrap	28	2.6%
Total	**756**	**71.1%**

3.5.2.3 Recyclables in Large Litter

Recyclable items comprised 37.2 percent of Large Litter at R2L2A as shown in Table 21. These were predominantly Paper items (29.8 percent). The Paper items were primarily Unidentifiable Paper Pieces (12.1 percent) and Unidentifiable Paperboard/Cardboard Pieces (9.6 percent) in particular.

Table 21: Large Litter: Recyclable Components

Recyclable Large Litter Components		
Components	**Items**	**Percent**
Beverage Containers	74	7.0%
Paper	317	29.8%
Home Food Containers	4	0.4%
Total	**395**	**37.2%**

3.5.2.4 Small Litter - Components

Of the 18 components of Small Litter, Paper items comprised 37.0 percent followed by Cigarette Butts (21.7 percent) and Plastic Film (21.7 percent). These three components totaled

80.4 percent of all Small Litter on the site as shown in Table 22. The total number of Small Litter items (2,555) represents an average of 28.4 pieces per 100 square feet.

Table 22: Small Litter Components, SR-201 Site A (R2)

R2L2A: Small Litter Components		
Components	**Items**	**Percent**
Aluminum	0	0.0%
Bottle Caps	0	0.0%
Candy Wrappers	111	4.3%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	555	21.7%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	388	15.2%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	946	37.0%
Plastic Film	555	21.7%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	0	0.0%
Tire Pieces	0	0.0%
Straws	0	0.0%
Total	**2,555**	**100.0%**

3.5.2.5 Litter Source Estimates

Trash/Recycling Vehicles (54 percent) and Motorists (24 percent) and were estimated to be the largest contributors to litter on the site as shown in Figure 11.

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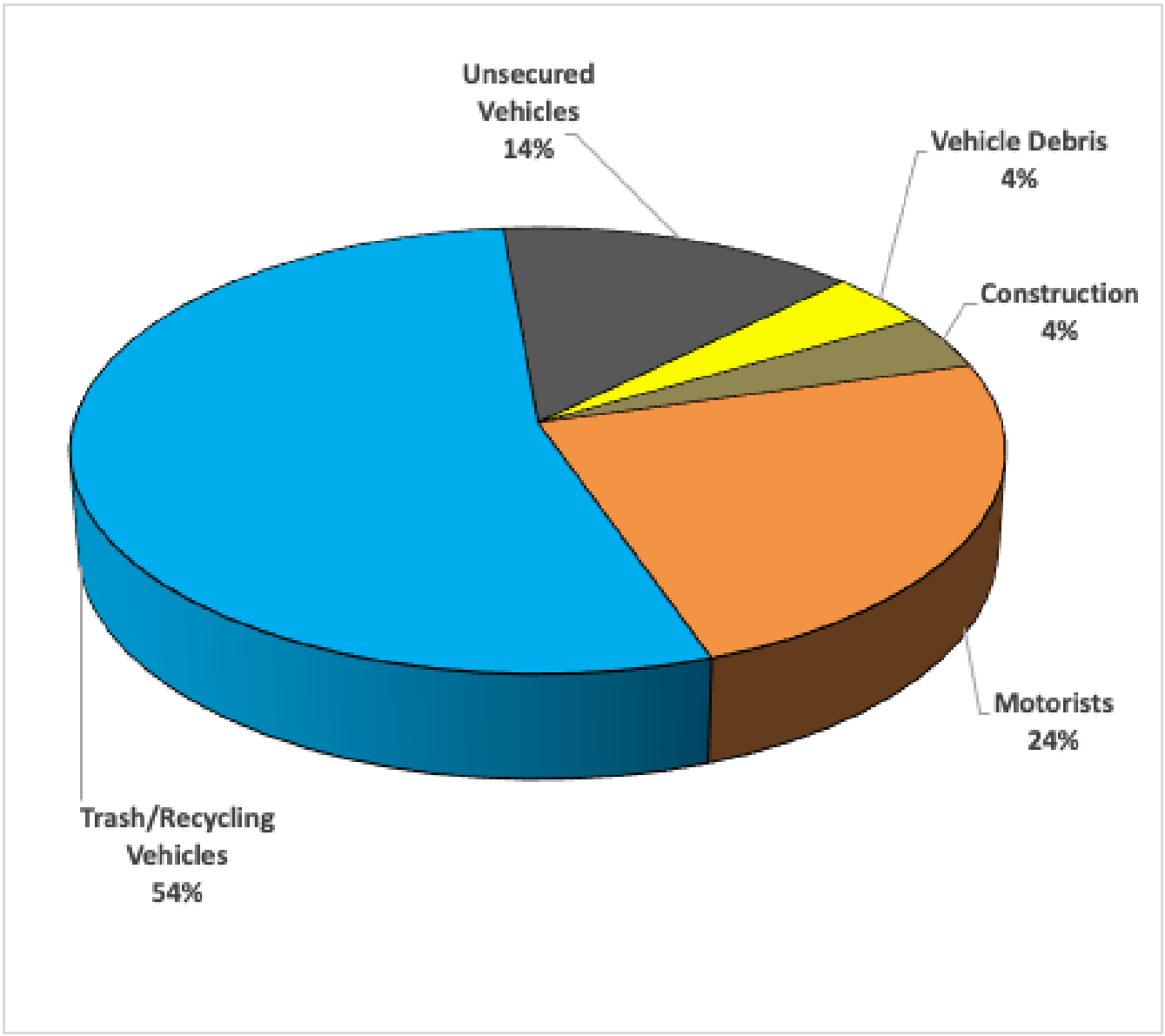
Figure 11: Sources of Large Litter at SR-201 Site A (R2)



3.5.3 SR-201 West (Site B)

The third site surveyed in Region 2 was located on SR-201 West in an industrial/commercial area of Salt Lake City near the intersection with Bangerter Highway as shown in Figure 12. This site was 500 feet long and 18 feet deep totaling an area of 9,000 square feet.

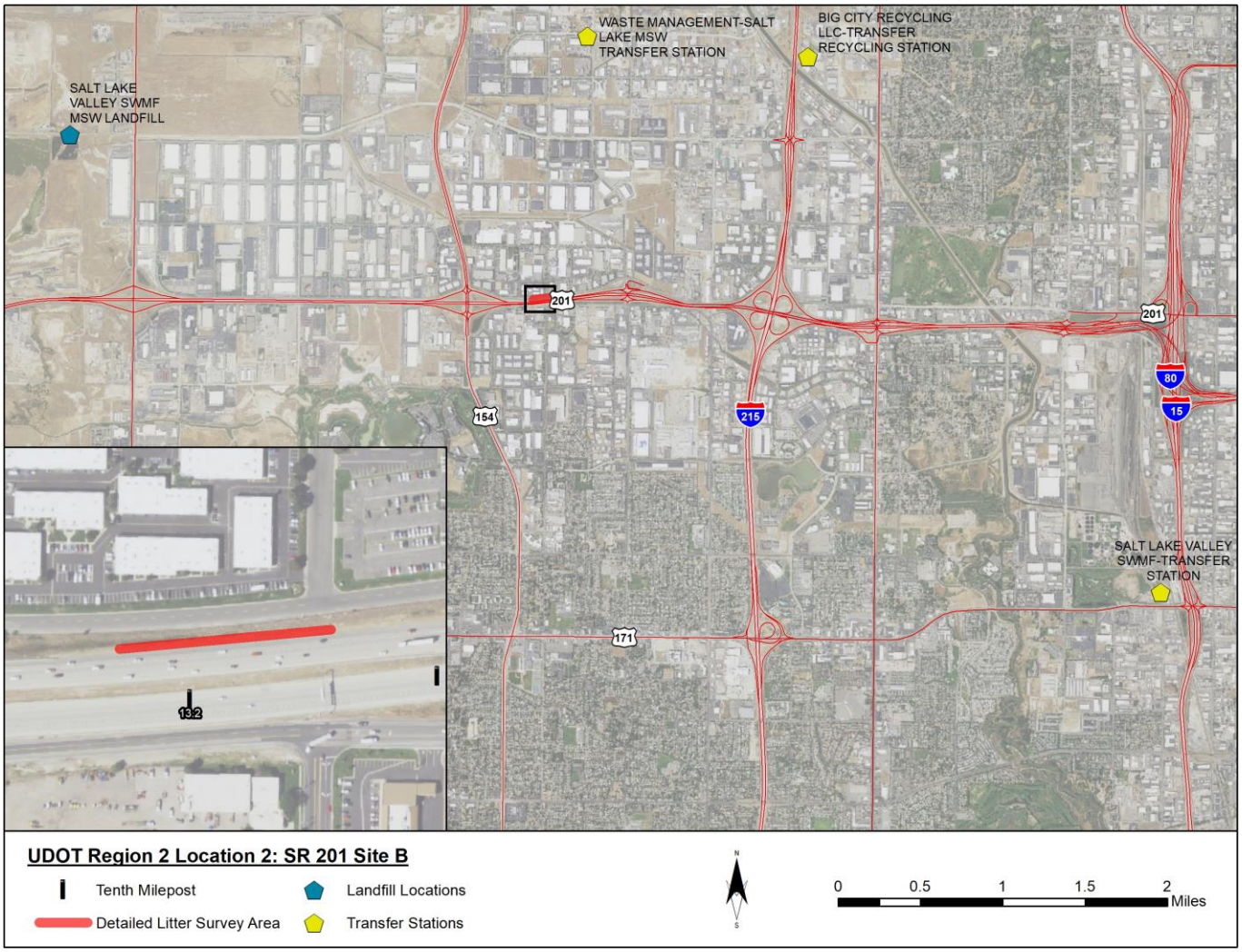


Figure 12: Region 2, SR-201(B) (WB MP13) Survey Site and Area Map

3.5.3.1 Large Litter - Categories

A total of 1,342 pieces of Large Litter were tallied at this site consisting primarily of Plastic Commercial/Industrial Debris (38.7 percent) and Paper Items (28.5 percent) as shown in Table 23.

These two categories comprised more than two-thirds of all Large Litter (67.2 percent) found at this site. There was an average of 14.9 Large Litter items per 100 square feet, 26 percent more than the amount found at SR-201 Site A.

Table 23: Large Litter at Site SR-201 Site B

Large Litter Categories		
Category	**Items**	**Percent**
Beverage Containers	86	6.4%
Beverage-Related Items Items	8	0.6%
Cups & Lids	40	3.0%
Straws & Wrappers	3	0.2%
Fast-Food Packaging	52	3.9%
Home Food Packaging	0	0.0%
Snack Packaging	13	1.0%
Paper Items	383	28.5%
Vehicle Debris	46	3.4%
Plastic Comm./Ind. Debris	520	38.7%
Construction Debris	67	5.0%
Home Items	78	5.8%
Paper & Plastic Bags	38	2.8%
Tobacco-Related Items	4	0.3%
Other (Misc.)	4	0.3%
Total	**1,342**	**100.0%**

3.5.3.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (25.0 percent), as shown in Table 24. This was followed by Unidentifiable Paper Pieces (13.9 percent) and Unidentifiable Paperboard/Cardboard Pieces (11.9 percent). These three components of unidentifiable litter totaled 50.7 percent of all Large Litter.

The fact that so many pieces of litter could not be identified suggests that these items had likely been mixed and compacted with other items and had also been exposed to the elements, suggesting that a major source would be garbage collection vehicles.

The top 10 of the 104 components surveyed comprised 76.1 percent of Large Litter at the site. All other components not listed in each comprised 2.1 percent or less of the total.

Table 24: Large Litter: Top 10 Components, SR-201 Site B (R2)

Top 10 Large Litter Components		
Component	**Items**	**Percent**
Unidentifiable Plastic Pieces	335	25.0%
Unidentifiable Paper Pieces	186	13.9%
Unidentifiable Paperboard/Cardboard	160	11.9%
Plastic Packaging - Other (Film, etc.)	87	6.5%
Polystyrene Foam Insulation	55	4.1%
Polystyrene Bulk Packing	55	4.1%
Plastic Shrink Wrap	43	3.2%
Plastic Water Bottles	40	3.0%
Vehicle Debris	31	2.3%
Corrugated Boxes/Pieces	29	2.2%
Total	**1,342**	**76.1%**

3.5.3.3 Recyclables in Large Litter

Recyclable items comprised 35.5 percent of Large Litter at SR-201 Site B as shown in Table 25. These were predominantly Paper items (28.5 percent). The Paper items were primarily Unidentifiable Paper Pieces (13.9 percent) and Unidentifiable Paperboard/Cardboard Pieces (11.9 percent) in particular.

Table 25: Large Litter: Recyclable Components, SR-201 Site B (R2)

Recyclable Large Litter Components		
Components	**Items**	**Percent**
Beverage Containers	86	6.4%
Paper	383	28.5%
Home Food Containers	8	0.6%
Total	**477**	**35.5%**

3.5.3.4 Small Litter – Components

Of the 18 components of Small Litter, Poly Foam – Other Pieces comprised 37.5 percent followed by Cigarette Butts (33.3 percent). These two components totaled 70.8 percent of all Small Litter on the site as shown in Table 26. The total number of Small Litter items (1,333) represents an average of 14.8 pieces per 100 square feet.

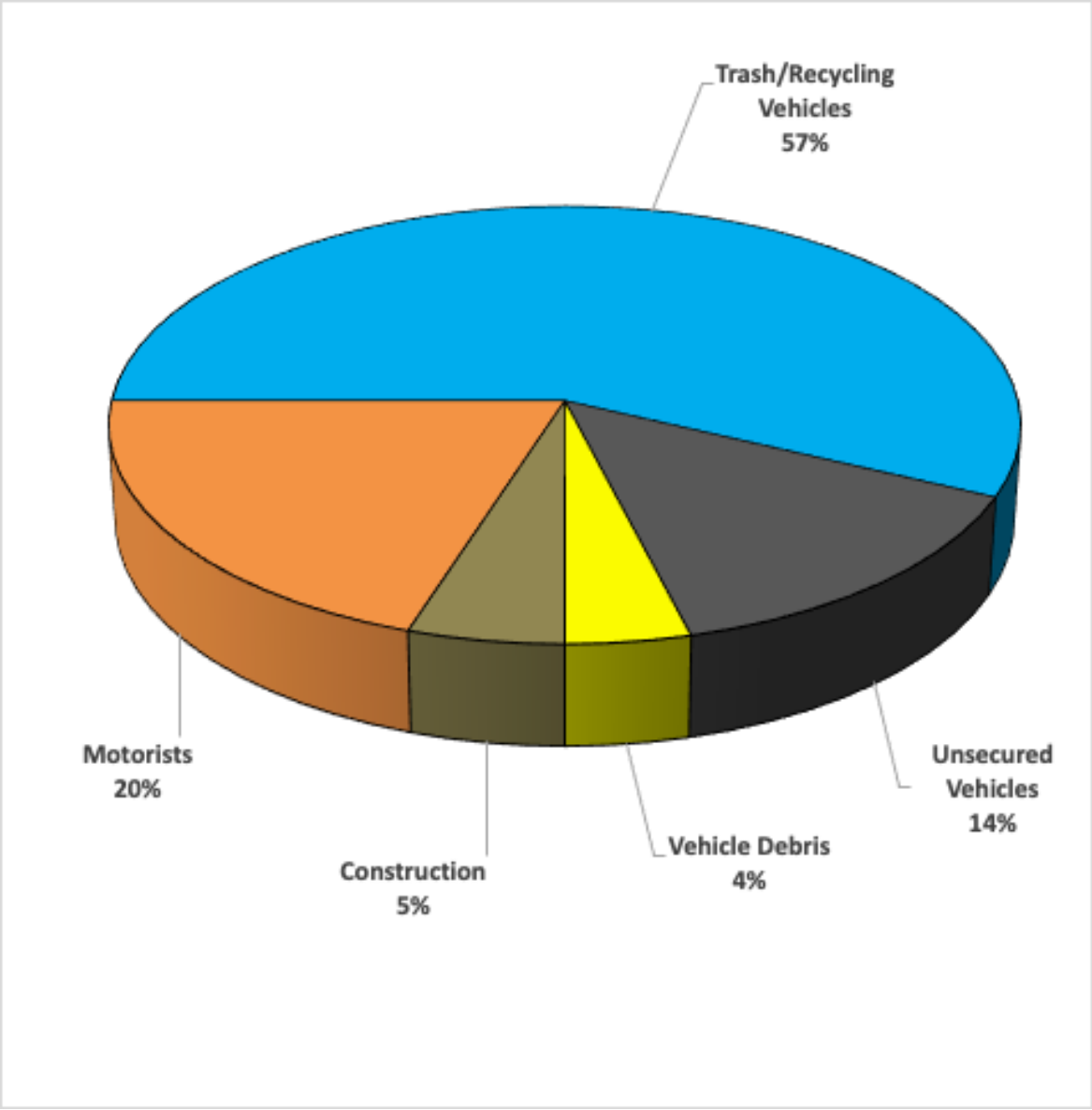
Table 26: Small Litter Components, SR-201 Site B (R2)

Small Litter Components		
Components	**Items**	**Percent**
Aluminum	0	0.0%
Bottle Caps	0	0.0%
Candy Wrappers	0	0.0%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	444	33.3%
Food	0	0.0%
Glass	222	16.7%
Hard Plastic	0	0.0%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	167	12.5%
Plastic Film	0	0.0%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	500	37.5%
Tire Pieces	0	0.0%
Straws	0	0.0%
Total	**1,333**	**100.0%**

3.5.3.5 Litter Source Estimates

Trash/Recycling Vehicles (57 percent) and Motorists (20 percent) were estimated to be the largest contributors to litter on the site as shown in in Figure 13.

Figure 13: Sources of Large Litter, SR-201 Site B (R2)



3.5.4 Region 2 Summary

Region 2 comprises three counties. Salt Lake County is Utah's most densely populated county. Summit County and Tooele County, to the east and west of Salt Lake County respectively, are sparsely populated. The three sites surveyed in Region 2 were located on SR-201 and I-215.

3.5.4.1 Large Litter - Categories

A total of 2,919 pieces of Large Litter were tallied at the three Region 2 sites consisting primarily of Plastic Commercial/Industrial Debris (33.8 percent) and Paper Items (27.6 percent) as shown in Table 27. These two categories comprised more than half of all Large Litter (61.4 percent) found at the three sites. There was an average of 10.8 Large Litter items per 100 square feet across the three Region 2 sites.

Table 27: Large Litter at Region 2 Sites

Region 2: Large Litter Categories		
Category	**Items**	**Percent**
Beverage Containers	205	7.0%
Beverage-Related Items Items	8	0.3%
Cups & Lids	91	3.1%
Straws & Wrappers	22	0.8%
Fast-Food Packaging	123	4.2%
Home Food Packaging	5	0.2%
Snack Packaging	41	1.4%
Paper Items	807	27.6%
Vehicle Debris	136	4.7%
Plastic Comm./Ind. Debris	987	33.8%
Construction Debris	146	5.0%
Home Items	217	7.4%
Paper & Plastic Bags	104	3.6%
Tobacco-Related Items	13	0.4%
Other (Misc.)	14	0.5%
Total	**2,919**	**100.0%**

3.5.4.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (20.7 percent), as shown in Table 28. This was followed by Unidentifiable Paper Pieces (12.5 percent) and Unidentifiable Paperboard/Cardboard Pieces (9.2 percent). These three components of unidentifiable litter totaled 42.4 percent of all Large Litter.

The fact that so many pieces of litter could not be identified suggests that these items had likely been mixed and compacted with other items and had also been exposed to the elements, suggesting that a major source would be garbage collection vehicles.

The top 10 of the 104 components surveyed comprised 71.2 percent of Large Litter. All other components not listed in Table 28 each comprised 2.0 percent or less of the total.

Table 28: Large Litter: Top 10 Components

Region 2: Top 10 Large Litter Components		
Component	**Items**	**Percent**
Unidentifiable Plastic Pieces	604	20.7%
Unidentifiable Paper Pieces	365	12.5%
Unidentifiable Paperboard/Cardboard	269	9.2%
Plastic Packaging - Other (Film, etc.)	162	5.5%
Polystyrene Bulk Packing	148	5.1%
Polystyrene Foam Insulation	147	5.0%
Corrugated Boxes/Pieces	109	3.7%
Plastic Water Bottles	105	3.6%
Vehicle Debris	96	3.3%
Plastic Shrink Wrap	74	2.5%
Total	**2,079**	**71.2%**

3.5.4.3 Recyclables in Large Litter

Recyclable items comprised 35.2 percent of Large Litter at Region 2 as shown in Table 29. These were predominantly Paper items (27.7 percent). The Paper items were primarily

Unidentifiable Paper Pieces (12.5 percent) and Unidentifiable Paperboard/Cardboard Pieces (9.2 percent).

Table 29: Large Litter: Recyclable Components

Region 2: Recyclable Large Litter Components		
Category	**Items**	**Percent**
Beverage Containers	205	7.0%
Paper	809	27.7%
Home Food Containers	13	0.4%
Total	**1,027**	**35.2%**

3.5.4.4 Small Litter - Components

Of the 18 components of Small Litter, the dominant item was Cigarette Butts (40.0 percent) followed by Paper items (17.1 percent). These two components totaled 57.1 percent of all Small Litter on the three Region 2 sites as shown in Table 30.

The total number of Small Litter items (7,499) represents an average of 20.8 pieces per 100 square feet.

Table 30: Small Litter Components

Region 2: Small Litter Components		
Components	**Items**	**Percent**
Aluminum	111	1.5%
Bottle Caps	0	0.0%
Candy Wrappers	111	1.5%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	2,998	40.0%
Food	0	0.0%
Glass	222	3.0%
Hard Plastic	1,221	16.3%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	1,280	17.1%
Plastic Film	666	8.9%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	667	8.9%
Tire Pieces	167	2.2%
Straws	56	0.7%
Total	**7,499**	**100.0%**

3.5.4.5 Litter Source Estimates

Trash/Recycling Vehicles (53 percent) and Motorists (24 percent) were estimated to be the largest contributors to litter on the Region 2 sites as shown in Figure 14. These two sources account for more than 75 percent of Large Litter.

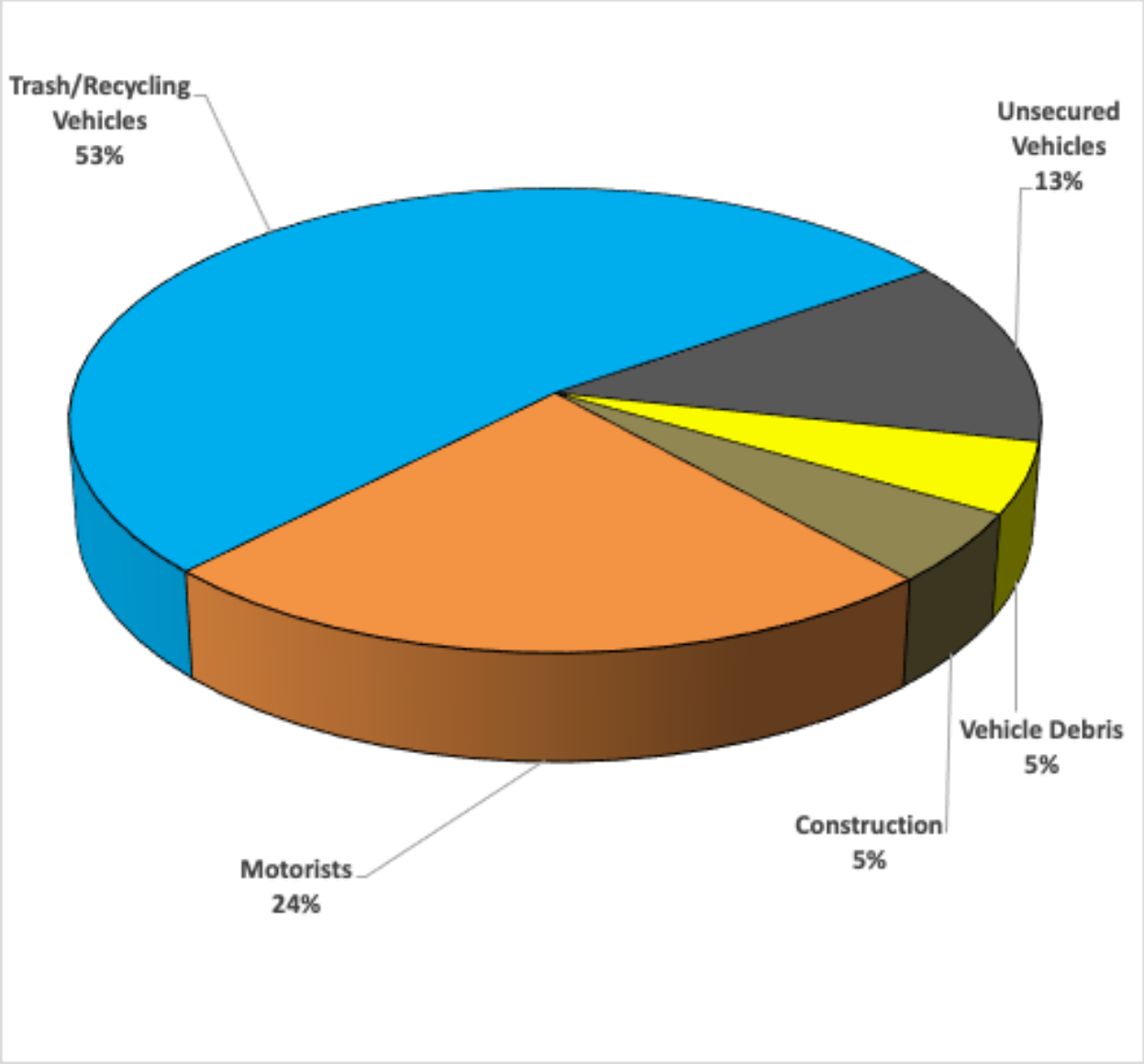


Figure 14: Sources of Large Litter at Region 2 Sites

3.6 Region 3

3.6.1 I-15 NB (MP278)

The first site surveyed in Region 3 is located on I-15 near Exit 278 N in an area of American Fork that consists of a moderately populated residential area but is also adjacent to an area that is predominantly commercial. This site was 500 feet long and 15 feet deep totaling an area of 7,500 square feet Figure 15.

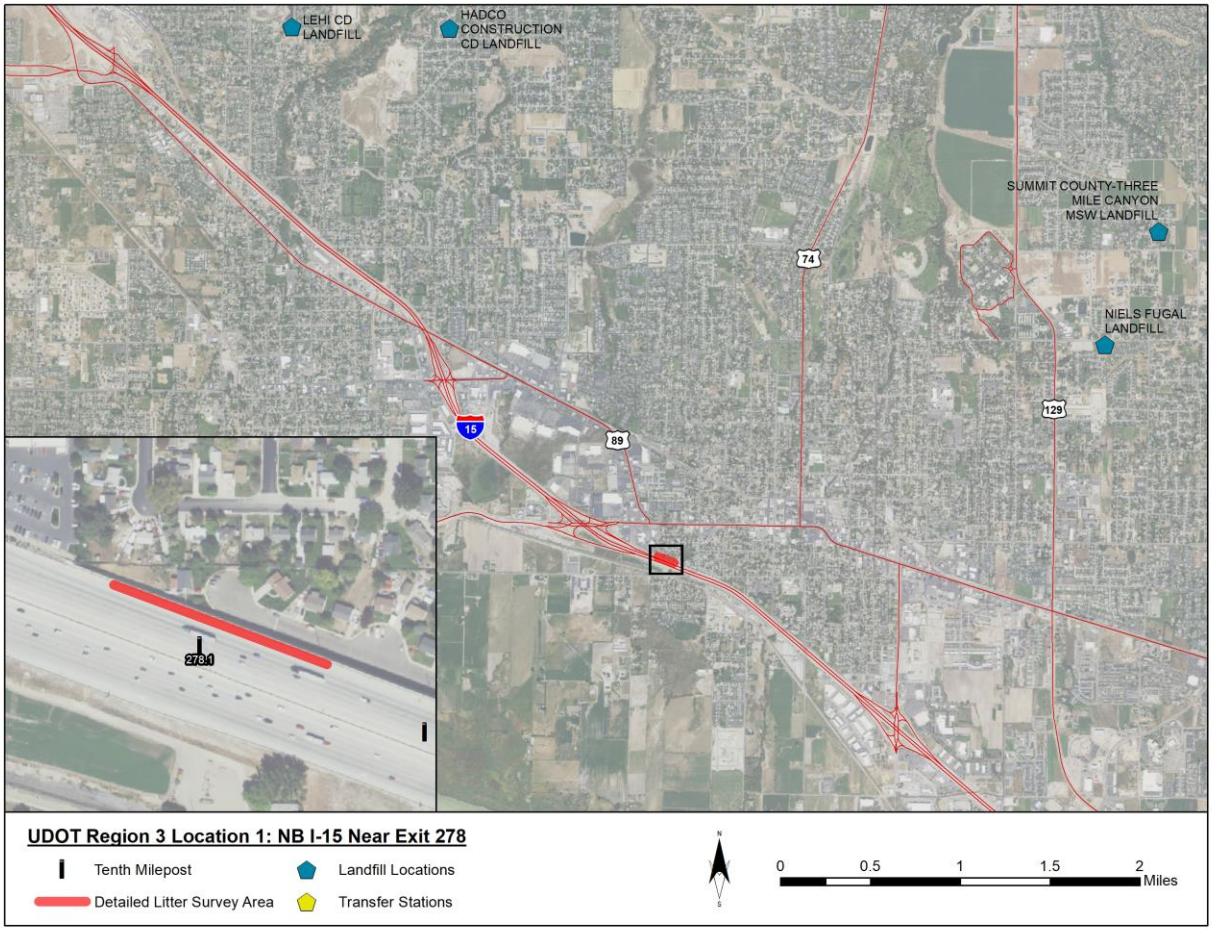


Figure 15: Region 3, I-15 (NB MP278) Survey Site and Area Map

3.6.1.1 Large Litter - Categories

A total of 380 pieces of Large Litter were tallied at the site consisting primarily of Plastic Commercial/Industrial Debris (25.0 percent) and Paper Items (21.1 percent) as shown in Table 31. These two categories comprised almost half of all Large Litter (46.1 percent) found at this site. There was an average of 4.2 Large Litter items per 100 square feet.

Table 31: Large Litter Cataloged at I-15 (MP278) NB (R3)

Category	Items	Percent
Beverage Containers	21	5.5%
Beverage-Related Items	2	0.5%
Cups & Lids	32	8.4%
Straws & Wrappers	1	0.3%
Fast-Food Packaging	11	2.9%
Home Food Packaging	4	1.1%
Snack Packaging	12	3.2%
Paper Items	80	21.1%
Vehicle Debris	35	9.2%
Plastic Comm./Ind. Debris	95	25.0%
Construction Debris	59	15.5%
Home Items	23	6.1%
Paper & Plastic Bags	4	1.1%
Tobacco-Related Items	1	0.3%
Other (Misc.)	0	0.0%
Total	**380**	**100.0%**

3.6.1.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (19.5 percent), as shown in Table 32 followed by Unidentifiable Paperboard/Cardboard Pieces (13.9 percent). The top two components comprised slightly more than one-third (33.4 percent) of all Large Litter.

The fact that so many pieces of litter could not be identified suggests that these items may have been compacted with other items and subsequently exposed to the elements, indicating that a major source could be trash collection vehicles.

Of the 104 components surveyed, the top 10 comprised 72.6 percent of Large Litter at the site. While Paper Drink Cups comprised 2.6 percent, both Clothing and Foam Insulation also

comprised 2.6 percent of Large Litter. All other components not listed in Table 32 comprised 2.1 percent or less of the total.

Table 32: Top Ten Litter Components at I-15 (MP278) NB (R3)

Component	Items	Percent
Unidentifiable Plastic Pieces	74	19.5%
Unidentifiable Paperboard/Cardboard Pieces	53	13.9%
Tires and Pieces	29	7.6%
Construction & Demolition Debris – Metal	26	6.8%
Unidentifiable Paper Pieces	24	6.3%
Construction & Demolition Debris – Wood	22	5.8%
Plastic Water Bottles	14	3.7%
Plastic Cup Lids	13	3.4%
Plastic Shrink Wrap	11	2.9%
Paper Drink Cups	10	2.6%
Total	**276**	**72.6%**

3.6.1.3 Recyclables in Large Litter

Recyclable items comprised 28.2 percent of Large Litter at R3L1 as shown in Table 33. These were predominantly Paper items (21.1 percent). The Paper items were primarily Unidentifiable Paperboard/Cardboard Pieces (13.9 percent) and Unidentifiable Paper Pieces (6.3 percent) in particular.

Table 33: Recyclable Large Litter Components at I-15 (MP278) NB (R3)

Components	Items	Percent
Beverage Containers	21	5.5%
Paper	80	21.1%
Home Food Containers	6	1.6%
Total	**107**	**28.2%**

3.6.1.4 Small Litter - Components

Of the 18 components of Small Litter, Cigarette Butts and Hard Plastic items each comprised 28.5 percent. These two components totaled 57.0 percent of all Small Litter at the site as shown in Table 34.

The total number of Small Litter items (778) represents an average of 8.6 pieces per 100 square feet.

Table 34: Small Litter Components at I-15 (MP278) NB (R3)

Category	Items	Percent
Aluminum	0	0.0%
Bottle Caps	0	0.0%
Candy Wrappers	0	0.0%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	222	28.5%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	222	28.5%
Metal (not Aluminum)	111	14.3%
Other Materials	111	14.3%
Tobacco Packaging, etc.	0	0.0%
Paper	56	7.2%
Plastic Film	0	0.0%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	0	0.0%
Tire Pieces	0	0.0%
Straws	56	7.2%
Total	**778**	**100.0%**

3.6.1.5 Litter Source Estimates

Trash/Recycling Vehicles (38 percent) and Motorists (27 percent) were estimated to be the largest contributors to litter on the site as shown in Figure 16.

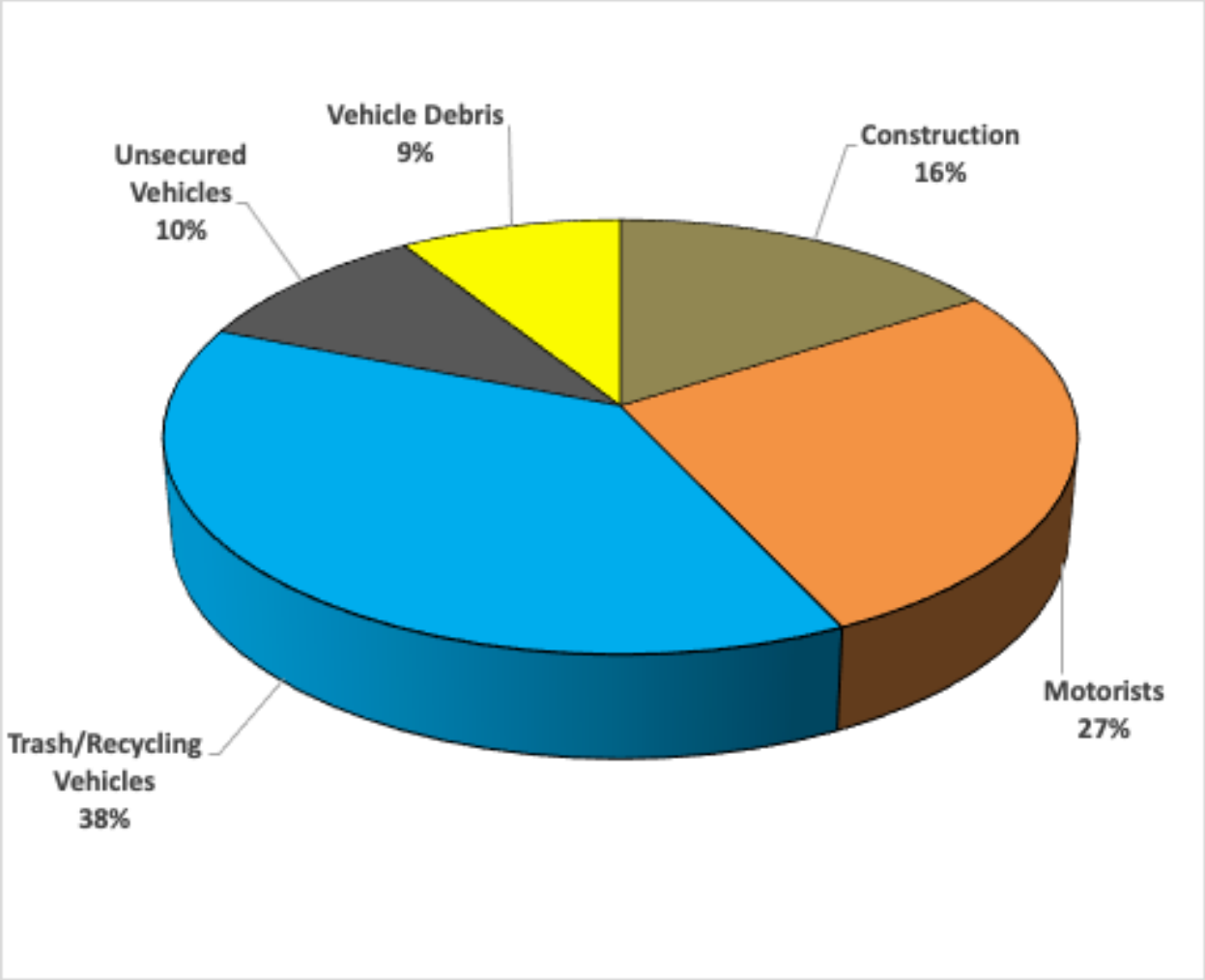


Figure 16: Sources of Large Litter at I-15 MP278 (R3)

3.6.2 I-15 SB (MP 263)

The second site surveyed in Region 3 was located on I-15 near Exit 263 S in a sparsely populated industrial area of Provo. The area surveyed was directly south of Lakeview Parkway (E 1860 S) and one-half mile south of a densely populated residential area as shown in Figure 17. This site was 500 feet long and 20 feet deep totaling an area of 10,000 square feet.

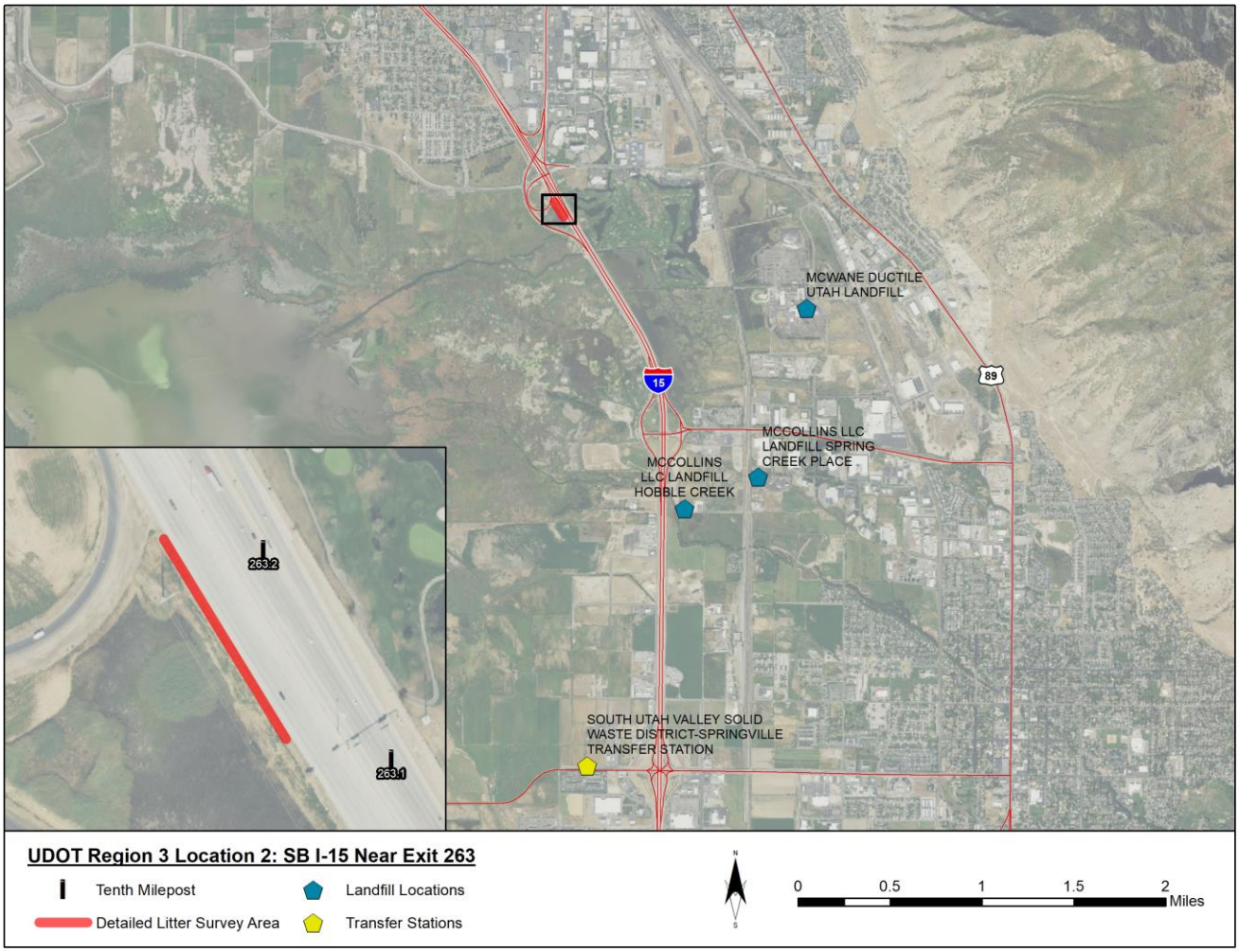


Figure 17: Region 3, I-15 (SB MP263) Survey Site and Area Map

3.6.2.1 Large Litter - Categories

A total of 468 pieces of Large Litter were tallied at this site consisting primarily of Plastic Commercial/Industrial Debris (21.2 percent) and Vehicle Debris (19.7 percent) as shown in Table 35. These two categories comprised 40.9 percent of Large Litter found at this site. There was an average of 5.2 Large Litter items per 100 square feet, slightly more than the amount found at the site (4.2 items).

Table 35: Large Litter by Category: I-15 MP263

Category	Items	Percent
Beverage Containers	12	2.6%
Beverage-Related Items	0	0.0%
Cups & Lids	7	1.5%
Straws & Wrappers	3	0.6%
Fast-Food Packaging	11	2.4%
Home Food Packaging	5	1.1%
Snack Packaging	32	6.8%
Paper Items	88	18.8%
Vehicle Debris	92	19.7%
Plastic Comm/Ind. Debris	99	21.2%
Construction Debris	68	14.5%
Home Items	34	7.3%
Paper & Plastic Bags	13	2.8%
Tobacco-Related Items	3	0.6%
Other (Misc.)	1	0.2%
Total	**468**	**100.0%**

3.6.2.2 Large Litter - Components

The largest individual component of Large Litter was Tire Pieces (17.7 percent), as shown in Table 36. This was followed by Unidentifiable Plastic Pieces (12.8 percent) and Construction and Demolition Wood items (8.8 percent). These three components of unidentifiable litter totaled 39.3 percent of all Large Litter at this site.

The top 10 of the 104 components surveyed comprised 72.0 percent of Large Litter found at the site. All other components not listed in Table 36 each comprised 2.4 percent or less of the total.

Table 36: Top 10 Large Litter Components, I-15 MP 263 (R3)

Component	Items	Percent
Tire Pieces	83	17.7%
Unidentifiable Plastic Pieces	60	12.8%
Construction & Demolition Wood	41	8.8%
Unidentifiable Paper Pieces	34	7.3%
Corrugated Boxes/Pieces	32	6.8%
Polystyrene Bulk Packing	23	4.9%
Plastic Packaging – Other (Film, etc.)	19	4.1%
Plastic Shrink Wrap	17	3.6%
Gum Wrappers	16	3.4%
Snack Food Packaging	12	2.6%
	337	**72.0%**

3.6.2.3 Recyclables in Large Litter

Recyclable items comprised 22.4 percent of Large Litter at the site as shown in Table 37. These were predominantly Paper items (18.8 percent). The Paper items were primarily Unidentifiable Paper Pieces (7.3 percent) and Corrugated Boxes (6.8 percent).

Table 37: Recyclable Large Litter Components, I-15 MP 263 (R3)

Components	Items	Percent
Beverage Containers	12	2.6%
Paper	88	18.8%
Home Food Containers	5	1.1%
Total	**105**	**22.4%**

3.6.2.4 Small Litter - Components

Of the 18 components of Small Litter, Cigarette Butts comprised 58.9 percent followed by Plastic Film (12.5 percent). These two components totaled 71.4 percent of all Small Litter on the site as shown in Table 38. The total number of Small Litter items (3,112) represents an average of 34.6 pieces per 100 square feet.

Table 38: Small Litter Components, I-15 MP 263 (R3)

Components	Items	Percent
Aluminum	0	0.0%
Bottle Caps	0	0.0%
Candy Wrappers	167	5.4%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	1,833	58.9%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	278	8.9%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	0	0.0%
Plastic Film	389	12.5%
Poly Foam - Peanuts	56	1.8%
Poly Foam - Other Pieces	222	7.1%
Tire Pieces	167	5.4%
Straws	0	0.0%
Total	**3,112**	**100.0%**

3.6.2.5 Litter Source Estimates

Trash/Recycling Vehicles (34 percent) and Motorists (23 percent) and were estimated to be the largest contributors to litter at the site as shown in Figure 18.

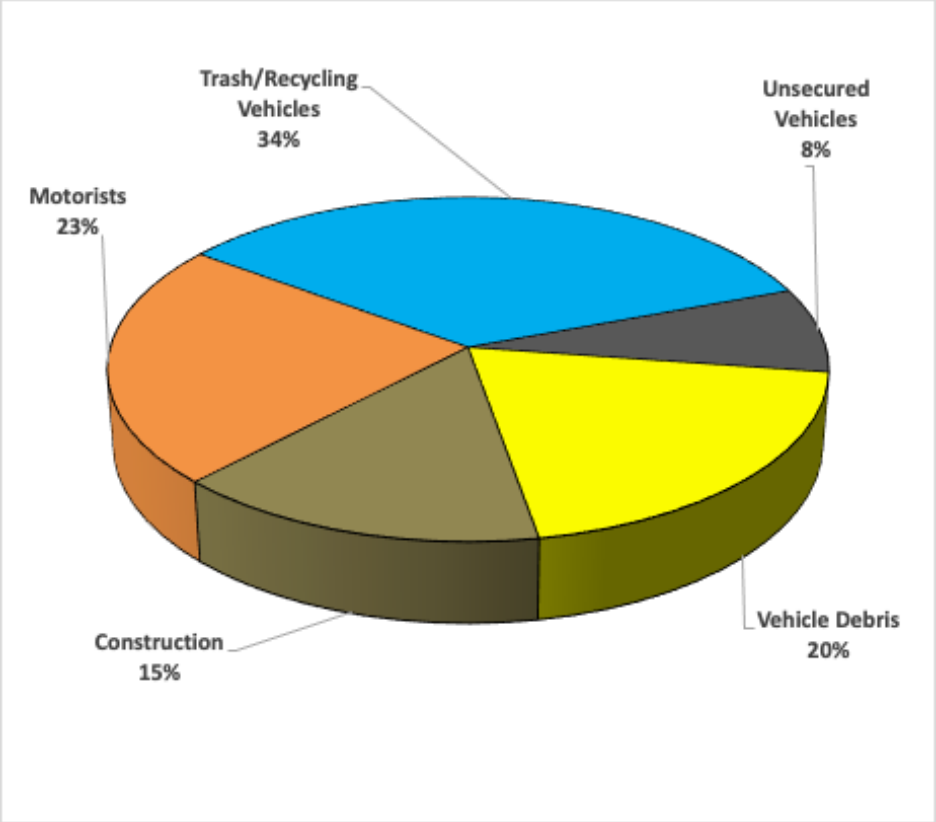


Figure 18: Sources of Large Litter at I-215 MP 263 (R3)

3.6.3 Region 3 Summary

Region 3 is comprised of six counties: Daggett, Juab, Duchesne, Uintah, Utah and Wasatch. Utah County is the second most populated county in the state with approximately 20 percent of the state's residents and an estimated population density of 317.6 people per square mile in 2019. The other five counties are all sparsely populated. Wasatch has a population density of 20.0 people per square mile while each of the other four have less than 10.0 people per square mile. The two sites surveyed were both located on different sections of I-15 in Utah County.

3.6.3.1 Large Litter - Categories

A total of 848 pieces of Large Litter were tallied at the Region 3 sites consisting primarily of Plastic Commercial/Industrial Debris (22.9 percent) and Paper items (19.8 percent) as shown in Table 39. These two categories comprised 42.7 percent of Large Litter found at

Region 3 sites. There was an average of 4.7 Large Litter items per 100 square feet, less than half the amount found at Region 2 sites (10.8 items).

Table 39: Region 3 Large Litter by Category

Category	Items	Percent
Beverage Containers	33	3.9%
Beverage-Related Items	2	0.2%
Cups & Lids	39	4.6%
Straws & Wrappers	4	0.5%
Fast-Food Packaging	22	2.6%
Home Food Packaging	9	1.1%
Snack Packaging	44	5.2%
Paper Items	168	19.8%
Vehicle Debris	127	15.0%
Plastic Comm/Ind. Debris	194	22.9%
Construction Debris	127	15.0%
Home Items	57	6.7%
Paper & Plastic Bags	17	2.0%
Tobacco-Related Items	4	0.5%
Other (Misc.)	1	0.1%
Total	**848**	**100.0%**

3.6.3.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (15.8 percent), as shown in Table 40.

This was followed by Tire Pieces (13.2 percent) and Construction and Demolition Wood items (7.4 percent). These three components totaled 36.4 percent of all Large Litter at Region 3 sites.

The top 10 of the 104 components surveyed comprised 67.5 percent of Large Litter found at Region 3 sites. Snack Wrappers also comprised 2.4 percent of Large Litter. All other components not listed in Table 40 each comprised 2.2 percent or less of the total.

Table 40: Region 3 Top 10 Large Litter Components

Component	Items	Percent
Unidentifiable Plastic Pieces	134	15.8%
Tires – Pieces	112	13.2%
C&D – Wood	63	7.4%
Unidentifiable Paperboard/Cardboard	58	6.8%
Unidentifiable Paper Pieces	58	6.8%
C&D – Metal	37	4.4%
Corrugated Boxes/Pieces	34	4.0%
Plastic Shrink Wrap	28	3.3%
Polystyrene Bulk Packing	28	3.3%
Gum Wrappers	20	2.4%
	572	**67.5%**

3.6.3.3 Recyclables in Large Litter

Recyclable items comprised 25.0 percent of Large Litter in Region 3 as shown in Table 41. These were predominantly Paper items (19.8 percent). The Paper items were primarily Unidentifiable Paperboard/Cardboard Pieces (6.8 percent) and Unidentifiable Paper pieces (6.8 percent).

Table 41: Large Litter: Recyclable Components

Components	Items	Percent
Beverage Containers	33	3.9%
Paper	168	19.8%
Home Food Containers	11	1.3%
Total	**212**	**25.0%**

3.6.3.4 Small Litter - Components

Of the 18 components of Small Litter, Cigarette Butts comprised 52.8 percent, more than half of all Small Litter. This was followed by Hard Plastic items (12.9 percent) and Plastic Film (10.0 percent). These three components totaled 75.7 percent of all Small Litter on Region 3 sites

as shown in Table 42. The total number of Small Litter items (3,890) represents an average of 21.6 pieces per 100 square feet.

Table 42: Region 3 Small Litter Components

Components	Items	Percent
Aluminum	0	0.0%
Bottle Caps	0	0.0%
Candy Wrappers	167	4.3%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	2,055	52.8%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	500	12.9%
Metal (not Aluminum)	111	2.9%
Other Materials	111	2.9%
Tobacco Packaging, etc.	0	0.0%
Paper	56	1.4%
Plastic Film	389	10.0%
Poly Foam - Peanuts	56	1.4%
Poly Foam - Other Pieces	222	5.7%
Tire Pieces	167	4.3%
Straws	56	1.4%
Total	**3,890**	**100.0%**

3.6.3.5 Litter Source Estimates

Trash/Recycling Vehicles (36 percent) and Motorists (25 percent) and were estimated to be the largest contributors to litter on Region 3 sites as shown in Figure 19.

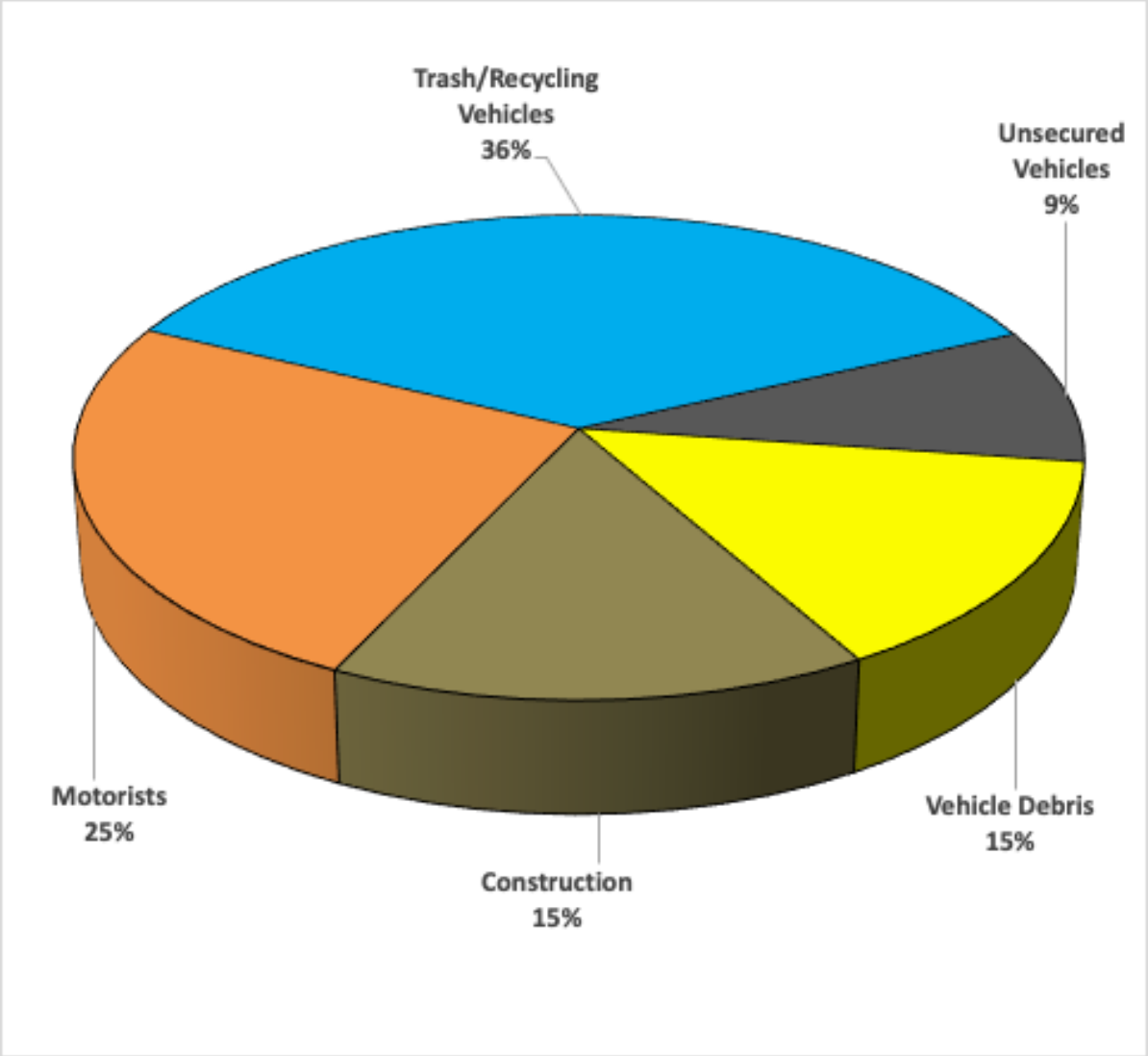


Figure 19: Sources of Large Litter at Region 3 Survey Sites

3.7 Region 4

3.7.1 I-15 NB (MP11)

The first site surveyed in Region 4 was located on I-15 near MP 11 in a fast-growing residential area of Washington County (Figure 20), whose population has almost doubled since 2010. This site was 350 feet long and 30 feet deep totaling an area of 10,500 square feet.

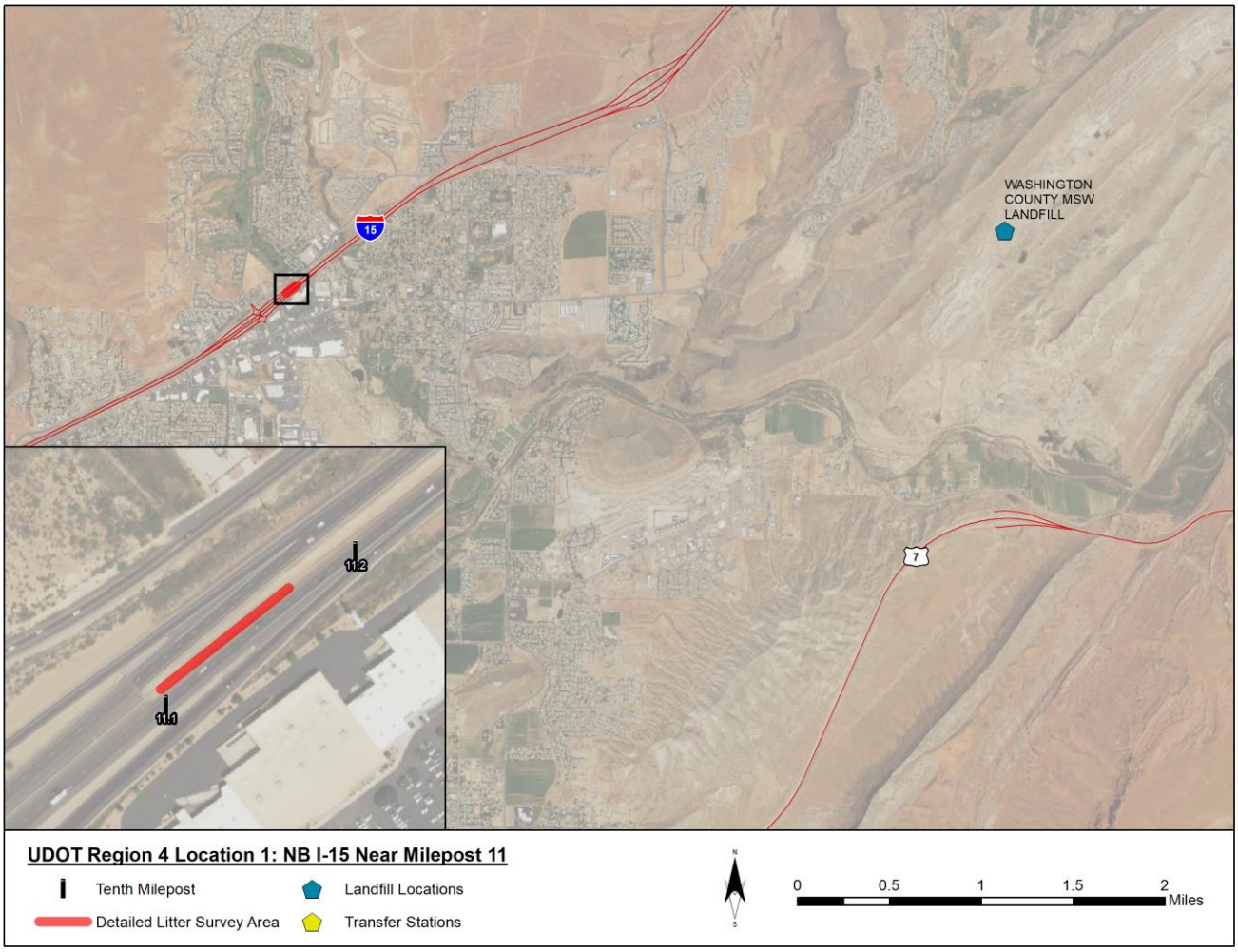


Figure 20: Region 4, 1-15 (NB MP11) Survey Site and Area Map

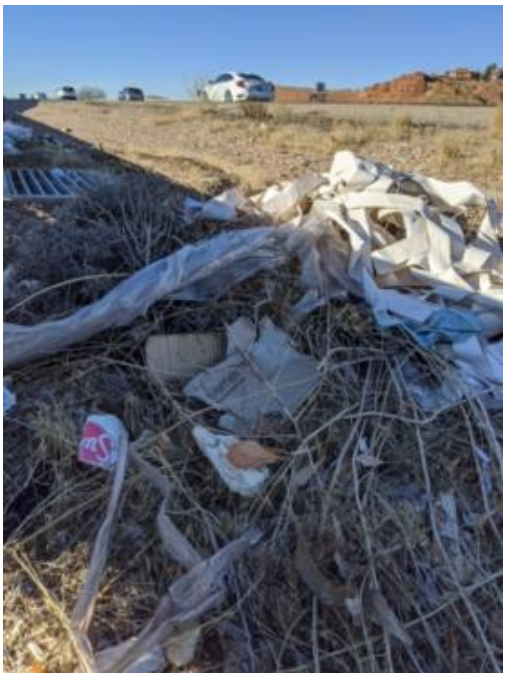
3.7.1.1 Large Litter - Categories

A total of 765 pieces of Large Litter were tallied at the site consisting primarily of Paper Items (28.5 percent) and Plastic Commercial/Industrial Debris (16.3 percent) as shown in Table 43. These two categories comprised almost half of all Large Litter (44.8 percent) found at this site. There was an average of 8.5 Large Litter items per 100 square feet.

Table 43: Large Litter, I-15 MP11 (R4)

Category	Items	Percent
Beverage Containers	140	18.3%
Beverage-Related Items	2	0.3%
Cups & Lids	35	4.6%
Straws & Wrappers	5	0.7%
Fast-Food Packaging	21	2.7%
Home Food Packaging	4	0.5%
Snack Packaging	12	1.6%
Paper Items	218	28.5%
Vehicle Debris	49	6.4%
Plastic Comm./Ind. Debris	125	16.3%
Construction Debris	60	7.8%
Home Items	73	9.5%
Paper & Plastic Bags	7	0.9%
Tobacco-Related Items	9	1.2%
Other (Misc.)	5	0.7%
Total	**765**	**100.0%**

3.7.1.2 Large Litter - Components



The largest individual component of Large Litter was Unidentifiable Paper Pieces (12.4 percent), as shown in Table 44, followed by Plastic Water Bottles (10.6 percent) and Unidentifiable Plastic Pieces (9.0 percent). The top three components comprised almost one-third (32.0 percent) of all Large Litter.

The fact that so many pieces of litter could not be identified suggests that these items may have been compacted with other items and subsequently exposed to the elements, indicating that a major source could be trash collection vehicles.

Of the 104 components surveyed, the top 10 comprised 63.3 percent of Large Litter at the site. It is notable that Plastic Water Bottles (10.6 percent) were the second most littered component. All components not listed in Table 44 each comprised 2.4 percent or less of the total.

Table 44: Top 10 Large Litter Components, I-15 MP11 (R4)

Component	Items	Percent
Unidentifiable Paper Pieces	95	12.4%
Plastic Water Bottles	81	10.6%
Unidentifiable Plastic Pieces	69	9.0%
Unidentifiable Paperboard/Cardboard	50	6.5%
Tires - Pieces	46	6.0%
Polystyrene Bulk Packing	45	5.9%
Corrugated Boxes/Pieces	31	4.1%
Plastic Shrink Wrap	27	3.5%
Clothing or Clothing Pieces	21	2.7%
Aluminum Soda Cans	19	2.5%
Total	**484**	**63.3%**

3.7.1.3 Recyclables in Large Litter

Recyclable items (47.6 percent) comprised almost half of all Large Litter at R4L1 as shown in Table 45. While these items were predominantly Paper items (28.5 percent), Beverage Containers comprised 18.3 percent. The largest components of Paper items were Unidentifiable Paper Pieces (12.4 percent) and Unidentifiable Paperboard/ Cardboard Pieces (6.5 percent).

Table 45: Recyclable Large Litter Components, I-15 MP 11 (R4)

Components	Items	Percent
Beverage Containers	140	18.3%
Paper	218	28.5%
Home Food Containers	6	0.8%
Total	**364**	**47.6%**

3.7.1.4 Small Litter - Components

Of the 18 components of Small Litter, the items most often found were Hard Plastic items (29.3 percent) and Cigarette Butts (24.4 percent). These two components (53.7 percent) totaled more than half of all Small Litter on the site as shown in Table 46. The total number of Small Litter items (1,628) represents an average of 18.1 pieces per 100 square feet.

Table 46: Small Litter Components, I-15 MP 11 (R4)

Category	Items	Percent
Aluminum	80	4.9%
Bottle Caps	0	0.0%
Candy Wrappers	0	0.0%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	397	24.4%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	477	29.3%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	238	14.6%
Plastic Film	0	0.0%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	119	7.3%
Tire Pieces	317	19.5%
Straws	0	0.0%
Total	**1,628**	**100.0%**

3.7.1.5 Litter Source Estimates, I-15 MP11 (R4)

Trash/Recycling Vehicles (42 percent) and Motorists (34 percent) were estimated to be the largest contributors to litter on the site as shown in Figure 21.

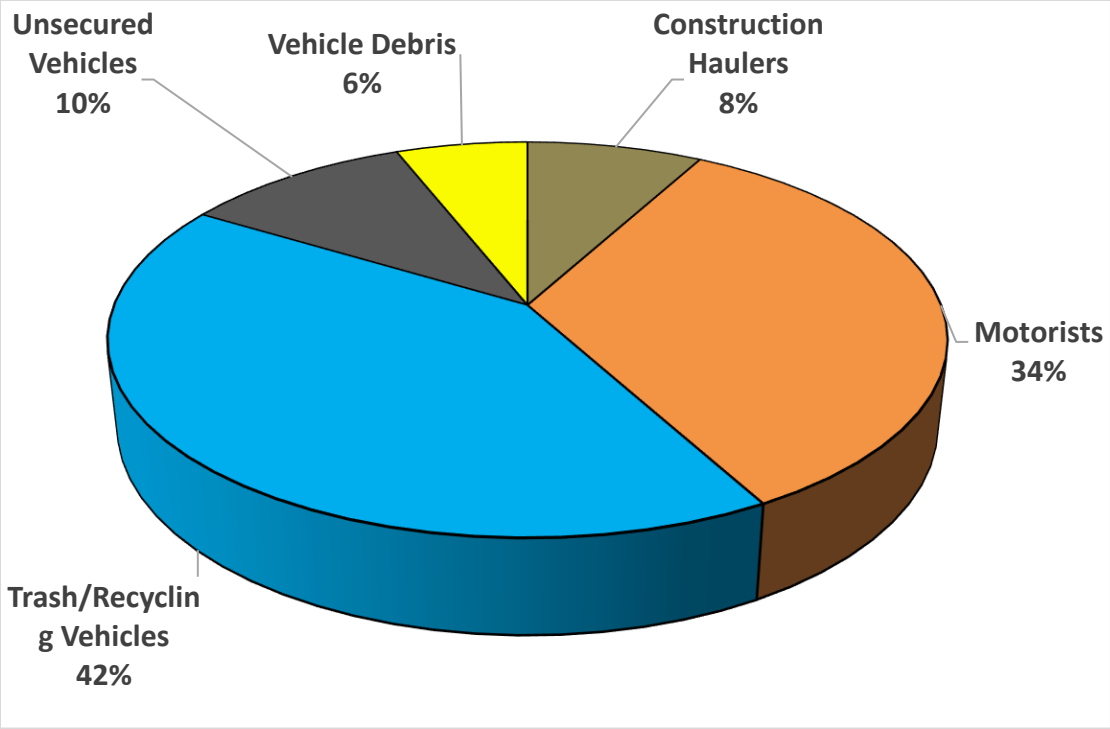


Figure 21: Sources of Large Litter at I-15 MP11 (R4)

3.7.2 SR-7 (MP2)

The second site surveyed in Region 4 was located on SR-7 approximately 2.4 miles southeast of I-15 (Exit 2). This site is located in an area of St. George that was sparsely populated in the past but is now growing at a fast rate. The area surveyed is about one-tenth of a mile north of the Arizona border as shown in Figure 22. This site was 500 feet long and 50 feet deep totaling an area of 25,000 square feet.

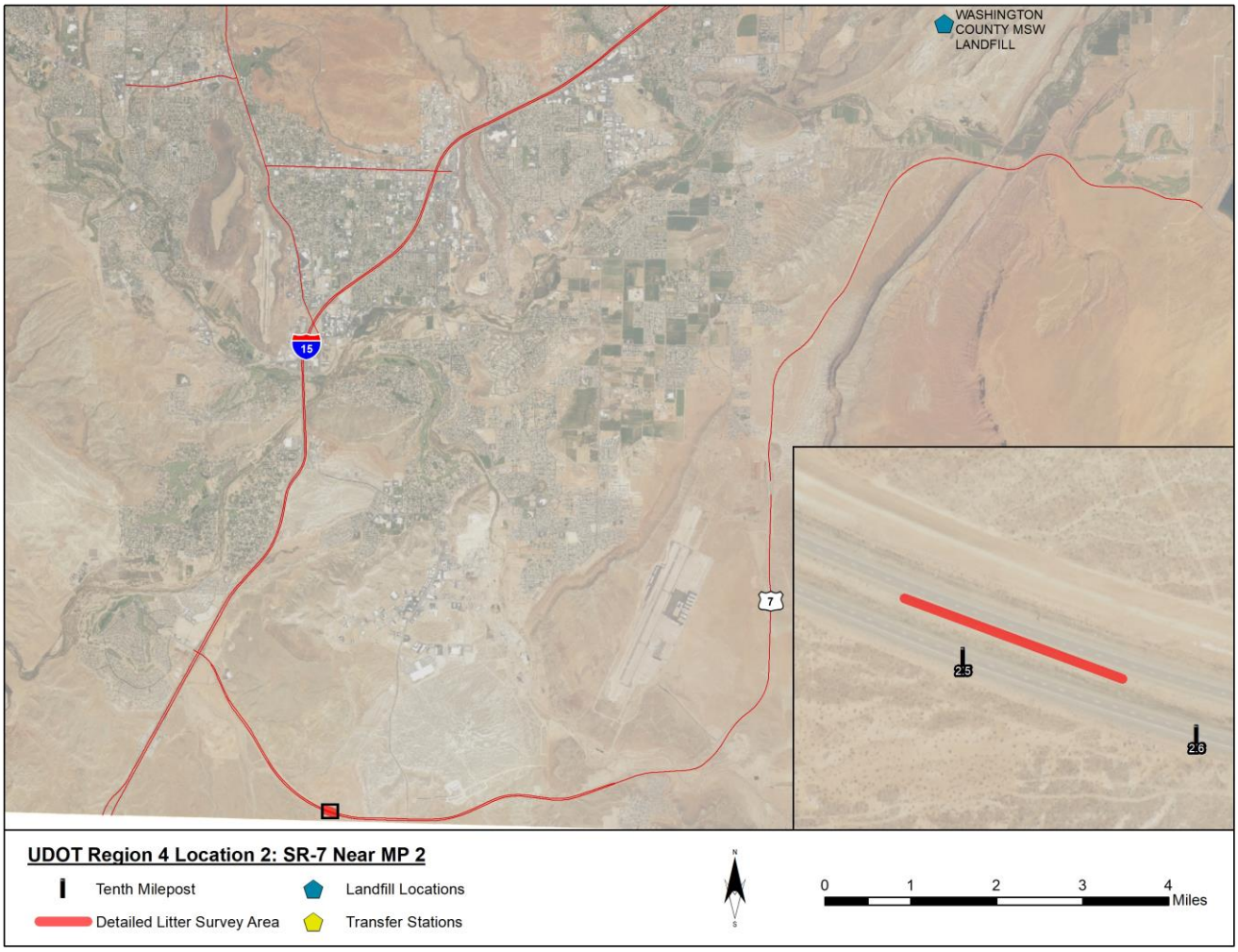


Figure 22: Region 4, SR-7 (Median MP2) Survey Site and Area Map

3.7.2.1 Large Litter – Categories, SR-7 (R4)

A total of just 81 pieces of Large Litter were tallied at the SR-7 site consisting primarily of Construction Debris (22.2 percent) and Paper Items (17.3 percent) as shown in Table 47. These two categories comprised 39.5 percent of Large Litter found at this site. There was an average of 0.9 Large Litter items per 100 square feet, the lowest amount of the nine sites surveyed.

Table 47: Large Litter by Category, SR-7 (R4)

Category	Items	Percent
Beverage Containers	13	16.0%
Beverage-Related Items	0	0.0%
Cups & Lids	0	0.0%
Straws & Wrappers	2	2.5%
Fast-Food Packaging	3	3.7%
Home Food Packaging	3	3.7%
Snack Packaging	2	2.5%
Paper Items	14	17.3%
Vehicle Debris	12	14.8%
Plastic Comm/Ind. Debris	6	7.4%
Construction Debris	18	22.2%
Home Items	3	3.7%
Paper & Plastic Bags	2	2.5%
Tobacco-Related Items	2	2.5%
Other (Misc.)	1	1.2%
Total	**81**	**100.0%**

3.7.2.2 Large Litter - Components

The largest individual component of Large Litter was Construction Wood (18.5 percent) as shown in Table 48. This was followed by Tires – Pieces (12.3 percent) and Unidentifiable Paper Pieces (11.1 percent). These three components totaled about 42.0 percent of all Large Litter at the site.

Of the 104 components surveyed, the top 10 comprised 69.1 percent of Large Litter found at the site. Although Vehicle Debris also comprised 2.5 percent, all other components not listed in Table 48 each comprised 2.5 percent or less of the total.

Table 48: Top 10 Large Litter Components, SR-7 (R4)

Component	Items	Percent
C&D – Wood	15	18.5%
Tires – Pieces	10	12.3%
Unidentifiable Paper Pieces	9	11.1%
Plastic Water Bottles	5	6.2%
Paper Packaging – Other	4	4.9%
Unidentifiable Plastic Pieces	4	4.9%
Aluminum Soda Cans	3	3.7%
Aluminum Beer Cans	2	2.5%
Straws/Wrappers	2	2.5%
Plastic Retail Bags - Generic	2	2.5%
Total	**56**	**69.1%**

3.7.2.3 Recyclables in Large Litter

Recyclable items comprised 37.0 percent of Large Litter at the site as shown in Table 49. These were predominantly Paper items (17.3 percent). The Paper items were primarily Unidentifiable Paper Pieces (11.1 percent) and Paper Packaging (4.9 percent).

Table 49: Recyclable Large Litter Components, SR-7 (R4)

Components	Items	Percent
Beverage Containers	13	16.0%
Paper	14	17.3%
Home Food Containers	3	3.7%
Total	**30**	**37.0%**

3.7.2.4 Small Litter - Components

Of the 18 components of Small Litter, Cigarette Butts comprised 40.0 percent followed by Hard Plastic (28.1 percent). These two components totaled 68.1 percent of all Small Litter on the site as shown in Table 50. The total number of Small Litter items (555) represents an average of 6.2 pieces per 100 square feet.

Table 50: Small Litter Components, SR-7 (R4)

Components	Items	Percent
Aluminum	22	4.0%
Bottle Caps	0	0.0%
Candy Wrappers	0	0.0%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	222	40.0%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	156	28.1%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	133	24.0%
Plastic Film	0	0.0%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	22	4.0%
Tire Pieces	0	0.0%
Straws	0	0.0%
Total	**555**	**100.0%**

3.7.2.5 Litter Source Estimates

Motorists (29 percent) and Trash/Recycling Vehicles (27 percent) were estimated to be the largest contributors to litter on the site as shown in Figure 23.

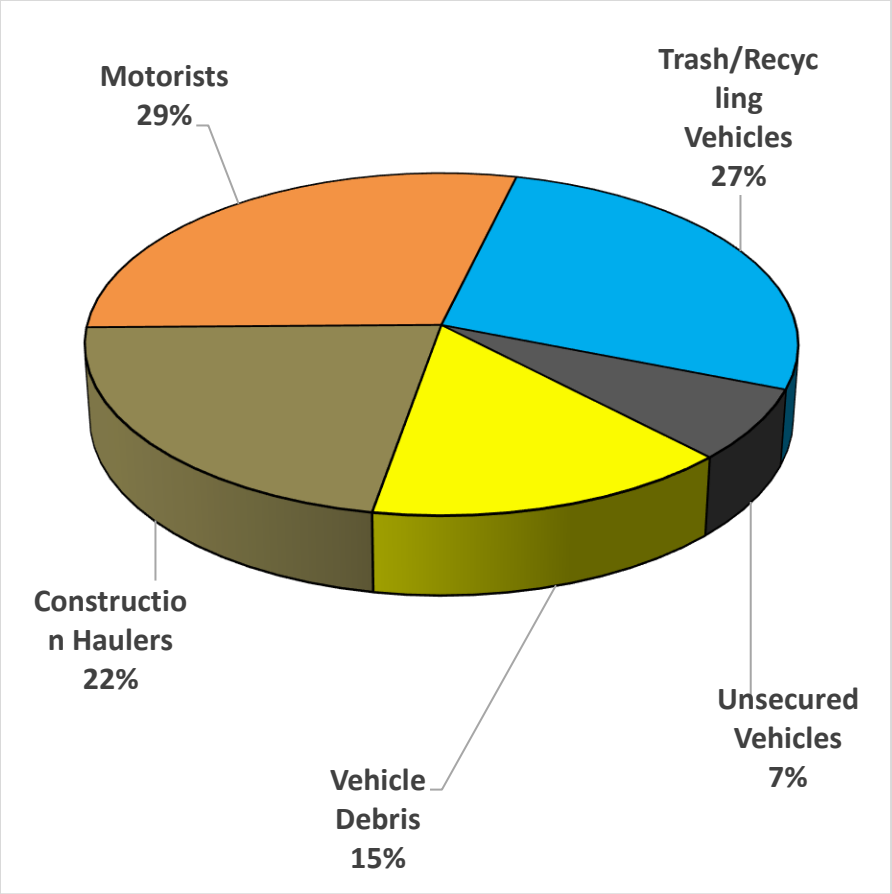


Figure 23: Sources of Large Litter at SR-7 (R4)

3.7.3 Region 4 Summary

Region 4 is comprised of 14 counties in southern Utah. Of those, Washington County is the most populated (177,556) and the most densely populated (73.2 people per square mile) in Region 4 as of 2019. Nine of the counties in Region 4 have a population density of less than 3.0 people per square mile. The two sites surveyed were both located in Washington County where significant construction activities are ongoing.

3.7.3.1 Large Litter - Categories

A total of 846 pieces of Large Litter were tallied at the Region 4 sites consisting primarily of Paper items (27.4 percent) and Beverage Containers (18.1 percent) as shown in Table 51. These two categories comprised 45.5 percent of Large Litter found at Region 4 sites. There was an average of 4.7 Large Litter items per 100 square feet, the same as was true for Region 3.

Table 51: Region 4: Large Litter by Category

Category	Items	Percent
Beverage Containers	153	18.1%
Beverage-Related Items	2	0.2%
Cups & Lids	35	4.1%
Straws & Wrappers	7	0.8%
Fast-Food Packaging	24	2.8%
Home Food Packaging	7	0.8%
Snack Packaging	14	1.7%
Paper Items	232	27.4%
Vehicle Debris	61	7.2%
Plastic Comm/Ind. Debris	131	15.5%
Construction Debris	78	9.2%
Home Items	76	9.0%
Paper & Plastic Bags	9	1.1%
Tobacco-Related Items	11	1.3%
Other (Misc.)	6	0.7%
Total	**846**	**100.0%**

3.7.3.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Paper Pieces (12.3 percent), as shown in Table 52. This was followed by Plastic Water Bottles (10.2 percent) and Unidentifiable Plastic Pieces (8.6 percent). These three components totaled 31.1 percent of all Large Litter at Region 4 sites.

Of the 104 components surveyed, the top 10 comprised 62.4 percent of Large Litter found at Region 4 sites. While Paper Packaging and Clothing also comprised 2.6 percent of Large Litter, all other components not listed in Table 52 each comprised 2.2 percent or less of the total.

Table 52: Region 4 Top 10 Large Litter Components

Component	Items	Percent
Unidentifiable Paper Pieces	104	12.3%
Plastic Water Bottles	86	10.2%
Unidentifiable Plastic Pieces	73	8.6%
Tires – Pieces	56	6.6%
Unidentifiable Paperboard/Cardboard	51	6.0%
Polystyrene Bulk Packing	45	5.3%
C&D – Wood	33	3.9%
Corrugated Boxes/Pieces	31	3.7%
Plastic Shrink Wrap	27	3.2%
Aluminum Soda Cans	22	2.6%
Total	**528**	**62.4%**

3.7.3.3 Recyclables in Large Litter

Recyclable items comprised almost half (46.6 percent) of Large Litter in Region 4 as shown in Table 53. These were predominantly Paper items (27.4 percent). The Paper items were primarily Unidentifiable Paper pieces (12.3 percent) and Unidentifiable Paperboard/Cardboard Pieces (6.0 percent). Plastic Water Bottles accounted for more than half of the Beverage Containers (10.2 percent).

Table 53: Region 4 Recyclable Components of Large Litter

Components	Items	Percent
Beverage Containers	153	18.1%
Paper	232	27.4%
Home Food Containers	9	1.1%
Total	**394**	**46.6%**

3.7.3.4 Region 4: Small Litter - Components

Of the 18 components of Small Litter, Hard Plastic items comprised 29.0 percent, followed by Cigarette Butts (28.4 percent). These two components totaled 57.4 percent of all Small Litter on Region 4 sites as shown in Table 54. The total number of Small Litter items (2,183) represents an average of 12.1 pieces per 100 square feet.

Table 54: Region 4: Small Litter Components

Components	Items	Percent
Aluminum	102	4.7%
Bottle Caps	0	0.0%
Candy Wrappers	0	0.0%
Gum	0	0.0%
Cigar Butts/Tips	0	0.0%
Cigarette Butts	619	28.4%
Food	0	0.0%
Glass	0	0.0%
Hard Plastic	633	29.0%
Metal (not Aluminum)	0	0.0%
Other Materials	0	0.0%
Tobacco Packaging, etc.	0	0.0%
Paper	371	17.0%
Plastic Film	0	0.0%
Poly Foam - Peanuts	0	0.0%
Poly Foam - Other Pieces	141	6.5%
Tire Pieces	317	14.5%
Straws	0	0.0%
Total	**2,183**	**100.0%**

3.7.3.5 Litter Source Estimates

Trash/Recycling Vehicles (34 percent) and Motorists (32 percent) were estimated to be the largest contributors to litter on Region 4 sites as shown in Figure 24.

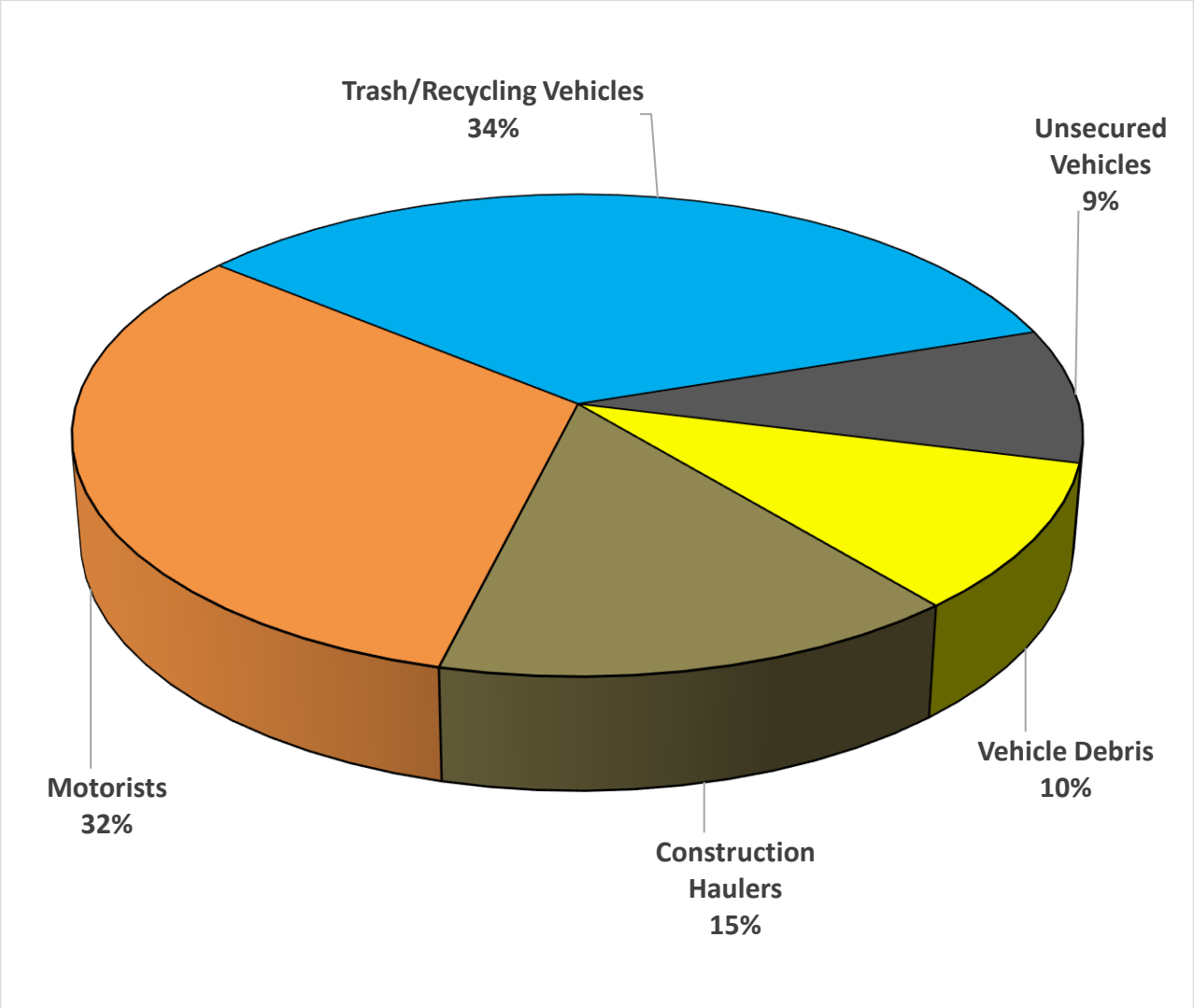


Figure 24: Sources of Large Litter at Region 4

3.8 Statewide Summary

3.8.1 Large Litter - Categories

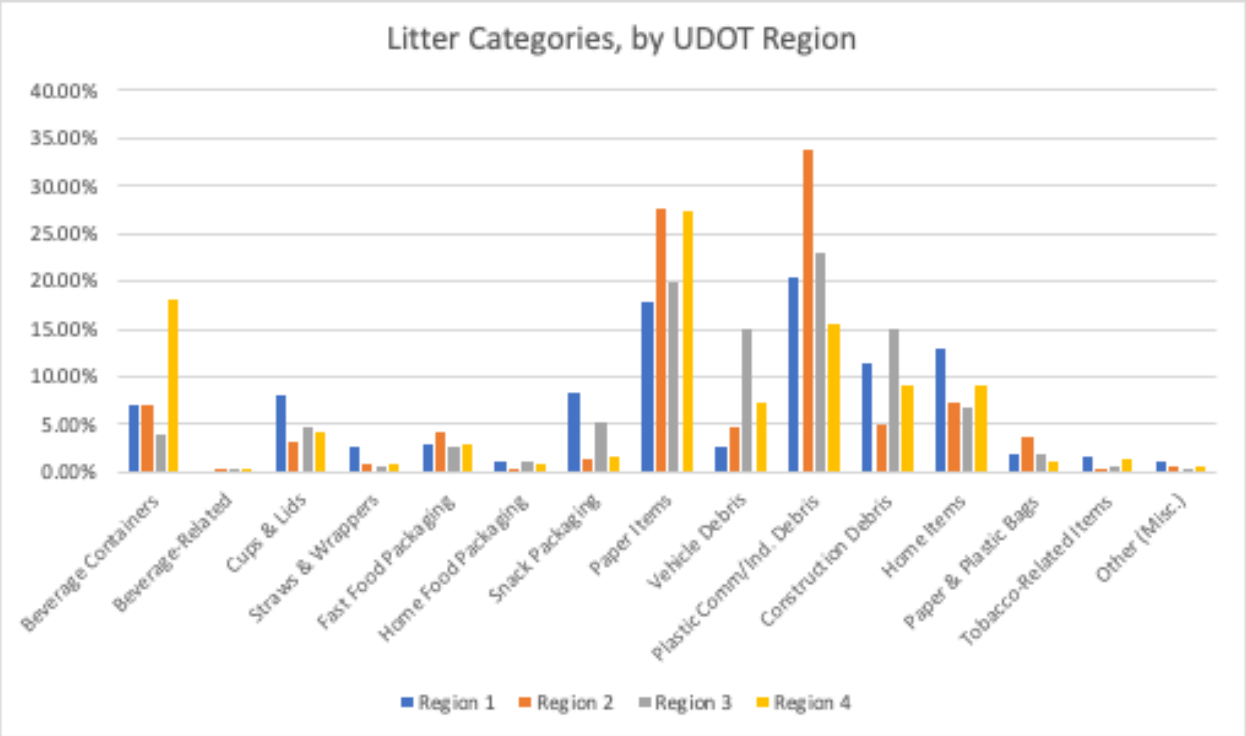
Note that the totals are weighted averages based on the percentages of litter at each site as shown in Table 55. Overall, there was an average of 6.4 Large Litter items per 100 square feet. For the most part, each category tended to stay within an expected range. Exceptions to this are the two Region 4 sites, which yielded a high number of Plastic Water Bottles. Another exception is the high percentage of Construction Debris at R4L2, which reflected significant construction activities in that area. Similarly, Industrial litter was very low at R4L2, which may reflect a lower level of matured commercial/industrial activities.

Table 55: All Sites: Large Litter by Category

Category	R1 21st St.	R1 SR193	R2 I-215	R2 SR201a	R2 SR201b	R3 I15(278)	R3 I15(263)	R4 I15	R4 SR7	Total
Bev. Containers	6.7%	7.3%	8.8%	7.0%	6.4%	5.5%	2.6%	18.3%	16.0%	8.3%
Bev. Related	0.0%	0.0%	0.0%	0.0%	0.6%	0.5%	0.0%	0.3%	0.0%	0.2%
Cups, Lids	8.5%	7.3%	3.3%	3.2%	3.0%	8.4%	1.5%	4.6%	0.0%	4.1%
Straws/Wrappers	3.6%	0.9%	1.8%	0.9%	0.2%	0.3%	0.6%	0.7%	2.5%	0.9%
Fast Food	4.1%	0.9%	3.7%	4.9%	3.9%	2.9%	2.4%	2.7%	3.7%	3.6%
Home Food	1.8%	0.0%	0.2%	0.4%	0.0%	1.1%	1.1%	0.5%	3.7%	0.6%
Snacks	10.0%	5.5%	1.0%	2.2%	1.0%	3.2%	6.8%	1.6%	2.5%	2.7%
Paper	17.4%	18.7%	21.2%	29.6%	28.5%	21.1%	18.8%	28.5%	17.3%	25.2%
Vehicle	2.8%	2.3%	9.7%	3.8%	3.4%	9.2%	19.7%	6.4%	14.8%	6.5%
Industrial	18.2%	24.7%	27.8%	30.5%	38.7%	25.0%	21.2%	16.3%	7.4%	27.5%
C&D	10.8%	12.3%	6.6%	4.2%	5.0%	15.5%	14.5%	7.8%	22.2%	8.0%
Home	12.1%	14.6%	8.4%	9.0%	5.8%	6.1%	7.3%	9.5%	3.7%	8.2%
Paper/Plastic Bags	1.8%	2.3%	5.8%	3.4%	2.8%	1.1%	2.8%	0.9%	2.5%	2.7%
Tobacco-Related	2.1%	0.9%	0.8%	0.5%	0.3%	0.3%	0.6%	1.2%	2.5%	0.7%
Other	0.3%	2.3%	1.0%	0.5%	0.3%	0.0%	0.2%	0.7%	1.2%	0.5%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Figure 25 shows this same information, aggregated by UDOT Region. Generally, paper items and plastic debris are the highest components of highway litter statewide. The one notable exception to this is the large amount of beverage containers sampled in Region 4.

Figure 25: Highway Litter Categories, by UDOT Region



3.8.2 Large Litter - Components

The largest individual component of Large Litter was Unidentifiable Plastic Pieces (16.7 percent), as shown in Table 56. This was followed by Unidentifiable Paper Pieces (10.8 percent) and Unidentifiable Paperboard/Cardboard (7.5 percent). These three components of unidentifiable litter totaled 35.4 percent of all Large Litter at the nine sites.

Of the 104 components surveyed, the top 10 items comprised 63.8 percent of Large Litter. All other components not listed in Table 56 each comprised 2.8 percent or less of the total.

Table 56: All Sites: Top 10 Large Litter Components

Component	Items	Percent
Unidentifiable Plastic Pieces	858	17.0%
Unidentifiable Paper Pieces	545	10.8%
Unidentifiable Paperboard/Cardboard	385	7.6%
Polystyrene Bulk Packing	259	5.1%
Plastic Packaging - Other (Film, etc.)	224	4.4%
Plastic Water Bottles	217	4.3%
Tires - Pieces	201	4.0%
Corrugated Boxes/Pieces	192	3.8%
Polystyrene Foam Insulation	190	3.8%
C&D - Wood	156	3.1%
	3,227	**63.8%**

The density of litter (piece/100 sq ft), by Region, measured from the field survey are shown in Figure 26.

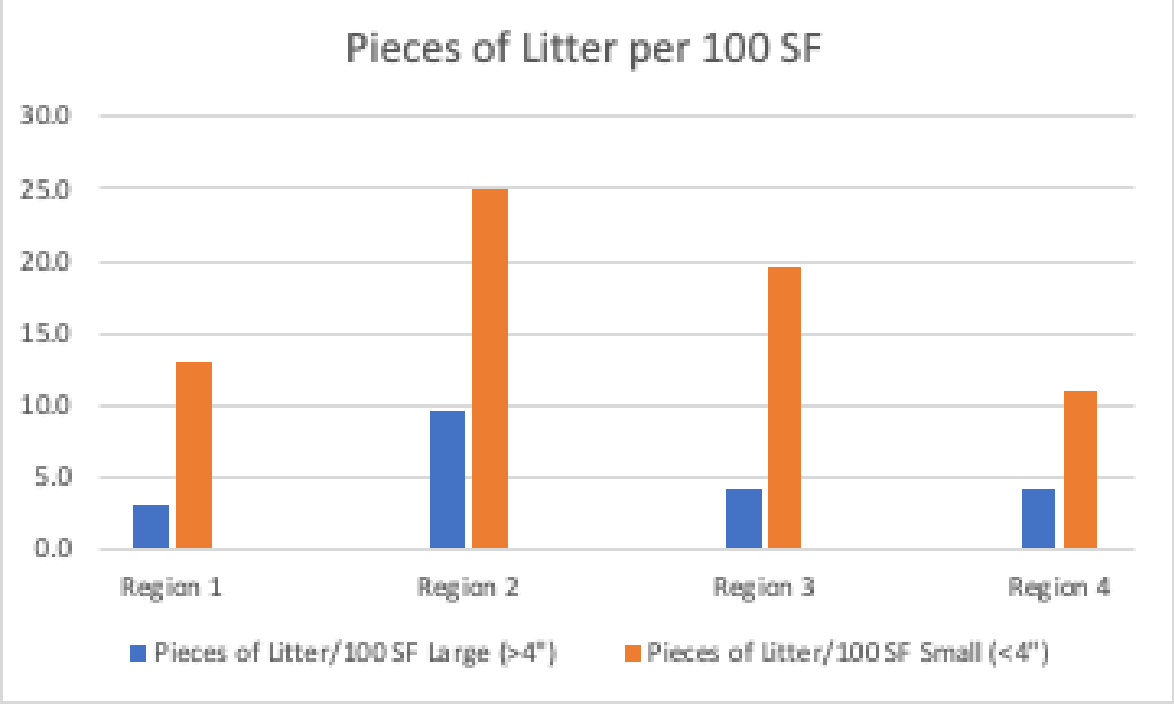


Figure 26: Litter Density (Pieces/100 SF) by UDOT Region

3.8.3 Recyclables in Large Litter

Recyclable items comprised 34.3 percent of Large Litter at the nine sites as shown in Table 57. These were predominantly Paper items (25.2 percent). The largest components of Paper items were Unidentifiable Paper Pieces (10.8 percent) and Unidentifiable Paperboard/Cardboard (7.6 percent). Plastic Water Bottles (4.3 percent) comprised more than half of all Beverage Containers, which were an unusually high component of litter at the Region 4 sites. This information is also summarized in Figure 27.

Rec Component	R1 21st St.	R1 SR193	R2 I-215	R2 SR201a	R2 SR201b	R3 I15(278)	R3 I15(263)	R4 I15	R4 SR7	Total
Bev. Containers	6.7%	7.3%	8.8%	7.0%	6.4%	5.5%	2.6%	18.3%	16.0%	8.3%
Paper	17.4%	18.7%	21.2%	29.8%	28.5%	21.1%	18.8%	28.5%	17.3%	25.2%
Other	1.5%	0.9%	0.2%	0.2%	0.7%	1.6%	1.1%	0.8%	3.7%	0.8%
Total	**25.6%**	**26.9%**	**30.2%**	**37.0%**	**35.6%**	**28.2%**	**22.4%**	**47.6%**	**37.0%**	**34.3%**

Table 57: Percent Recyclable Materials in Highway Litter, Nine Sites

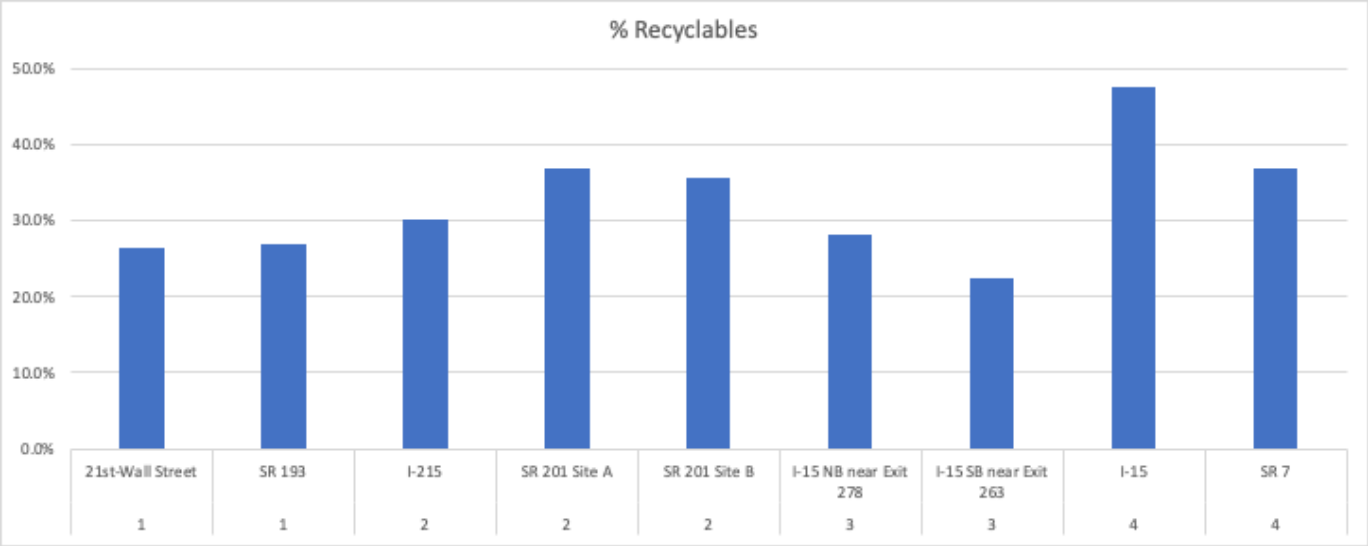


Figure 27: % of Highway Litter That Is Recyclable, by Site

3.8.4 Small Litter – Components

Of the 18 components of Small Litter, Cigarette Butts comprised 42.6 percent followed by Hard Plastic Items (17.3 percent) and Paper (12.9 percent). These three components totaled 72.8 percent of all Small Litter on all nine sites overall as shown in Table 58. The total number of Small Litter items (16,186) represents an average of 20.0 pieces per 100 square feet.

Table 58: All Sites Small Litter Components

Category	R1 21st St.	R1 SR193	R2 I-215	R2 SR201a	R2 SR201b	R3 I15(278)	R3 I15(263)	R4 I15	R4 SR7	Total
Aluminum	0.0%	0.0%	3.1%	0.0%	0.0%	0.0%	0.0%	4.9%	4.0%	1.3%
Bottle Caps	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Candy Wrappers	5.8%	8.4%	0.0%	4.3%	0.0%	0.0%	5.4%	0.0%	0.0%	2.8%
Gum	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cigar Butts/Tips	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cigarette Butts	45.7%	49.9%	55.4%	21.7%	33.3%	28.5%	58.9%	24.4%	40.0%	42.6%
Food	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Glass	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	1.4%
Hard Plastic	14.2%	25.0%	23.1%	15.2%	0.0%	28.5%	8.9%	29.3%	28.1%	17.3%
Metal	0.0%	0.0%	0.0%	0.0%	0.0%	14.4%	0.0%	0.0%	0.0%	0.7%
Other Materials	0.0%	0.0%	0.0%	0.0%	0.0%	14.4%	0.0%	0.0%	0.0%	0.7%
Tobacco Pkg.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Paper	17.2%	8.4%	4.6%	37.0%	12.5%	7.1%	0.0%	14.6%	24.0%	12.9%
Plastic Film	5.8%	0.0%	3.1%	21.7%	0.0%	0.0%	12.5%	0.0%	0.0%	7.2%
Poly Foam Peanuts	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%	0.3%
Poly Foam Pieces	8.6%	8.4%	4.6%	0.0%	37.5%	0.0%	7.1%	7.3%	4.0%	7.7%
Tire Pieces	0.0%	0.0%	4.6%	0.0%	0.0%	0.0%	5.4%	19.5%	0.0%	4.0%
Straws	0.0%	0.0%	1.6%	0.0%	0.0%	7.1%	0.0%	0.0%	0.0%	0.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

3.8.5 Litter Source Estimates

Trash/Recycling Vehicles (42 percent) and Motorists (27 percent) were estimated to be the largest contributors to litter on the nine sites overall as shown in Figure 28. The data in this chart represent the following range estimates:

- Trash/Recycling Vehicles: 37-47 percent
- Motorists: 22-32 percent
- Unsecured Vehicles: 6-16 percent
- Pedestrians: 1-5 percent

Vehicle Debris and Construction Debris are not subject to range estimates since each of them constitutes both a source and a type of litter. Thus, the source estimates for each of these two categories will always correspond directly to the amounts tallied as a percent of Large Litter.

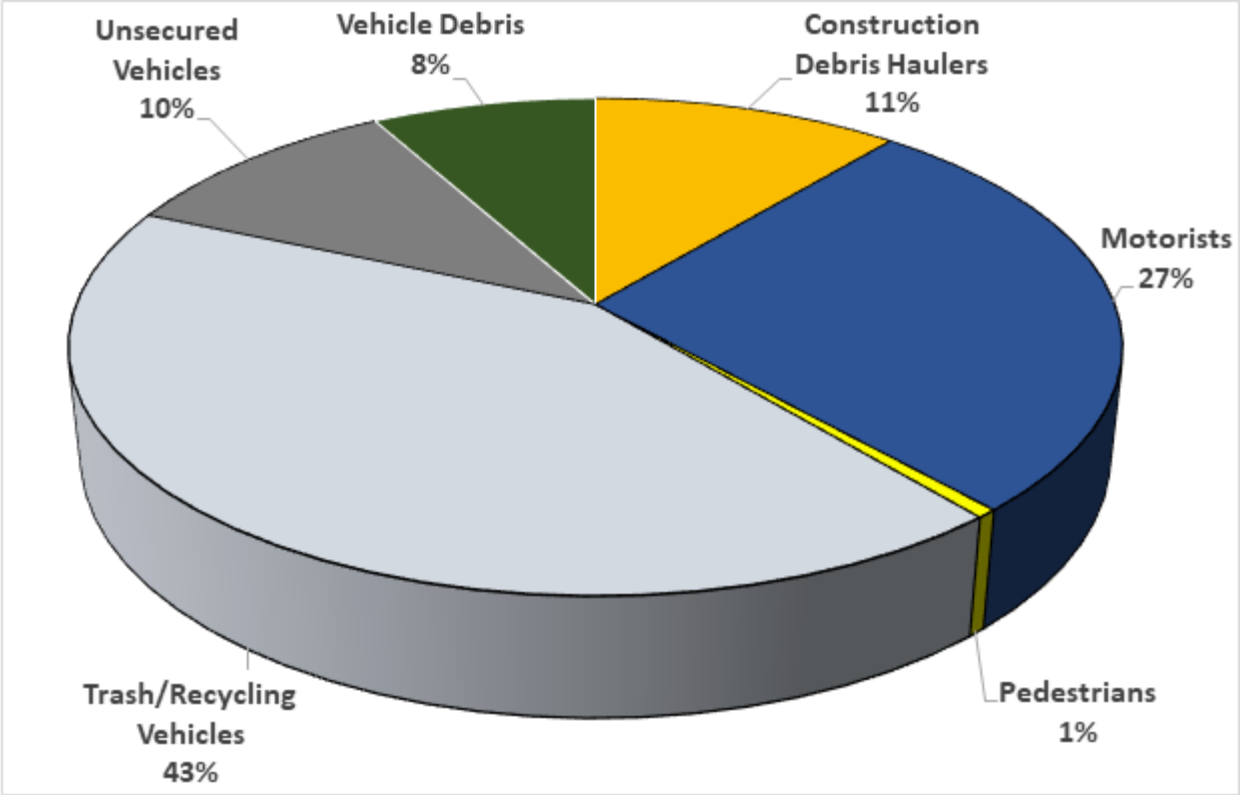


Figure 28: Statewide - Sources of Highway Litter

4.0 CONCLUSIONS

4.1 Summary

The research described in this report was undertaken at the request of UDOT in order to estimate the sources and major contributors to highway litter in Utah. The research involved outreach to each of the four UDOT Regions to understand the issues with highway litter and litter cleanup. Nine highway sites were selected for a detailed litter survey. At each site, field staff recorded each item of large litter (>4") within areas ranging from 5,000-10,000 square feet.

Based on the composition of the litter, information from interviews with UDOT Region staff, input from field staff, and a review of proximate land uses, the sources of litter (i.e., trash/recycling vehicles, unsecured loads, vehicle debris, construction debris haulers, motorists, pedestrians) were estimated.

The research finds that the two largest contributors to highway litter are trash/recycling vehicles and motorists, contributing 42% and 27% respectively, statewide. The relative contributions from these sources varied by region, with a relatively higher amount from trash/recycling vehicles (53%) in Region 2 and from motorists (32%) in Region 4. Overall litter volume tracks closely with population and traffic, with the highest volumes measured in Region 2 and the lowest volumes in Region 4. Of note is the amount of highway litter that consists of recyclable materials, ranging from 22.4% to 47.6%.

4.2 Findings

There are three key findings from this research:

1. Across all four UDOT Regions, the top two highway litter sources are trash/recycling vehicles (42% average across all Regions) and motorists (27% average across all four regions). Unsecured loads and construction debris haulers are estimated to generate 11% of highway litter, each, statewide.

2. Plastic debris and paper items are the largest components of highway litter across the four UDOT Regions, with the notable exception of beverage containers contributing 18% to highway litter in Region 4.

3. Another important finding of the research is the prevalence of recyclable material in the highway litter. Recyclable materials are estimated to range from a low of 22.4% (R3) to a high of 47.6% (R4).

These findings should help UDOT focus their messaging and communications with the intent of reducing highway litter and the costs of litter cleanup in the future.

4.3 Limitations and Challenges

The research into Utah's highway litter is based on a detailed review of nine litter "hotspots" that were identified across the four UDOT regions. Most of the sites represented locations on grade-separated highway facilities, which directly affects the types of litter sources that might be plausible. As the surveyed sites were not randomly selected, care should be taken in applying the conclusions of the research across all Utah highways.