



The Florida Litter Study: 1997

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Conducted by

**FLORIDA CENTER FOR SOLID
AND HAZARDOUS WASTE MANAGEMENT**

2207-D N.W. 13th Street
Gainesville, FL 32609

for

THE FLORIDA LEGISLATURE

and

**FLORIDA DEPARTMENT OF
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EXECUTIVE SUMMARY

In 1993 the Florida Legislature established a 50% litter reduction goal for the period of 1994 through 1997. The Legislature directed the Florida Center for Solid and Hazardous Waste Management (the Center) to develop a scientifically reliable methodology and to conduct annual surveys to measure the state's progress toward the litter reduction goal. This report presents the results of the fourth annual survey, which was conducted in 1997. Previous reports published by the Center have presented the results of the 1994, 1995, and 1996 annual surveys.

Roadsides are a useful indicator of the amount of litter in the environment, although they are not the only places where litter accumulates. In 1997, the Center surveyed 10 roadside sites in each of Florida's 67 counties, for a total of 670 sites. The survey counted 46,035 large and small litter items and classified them into 86 categories. The survey covered 134,000 linear feet, or more than 25 miles of roadway. Taking into account the total area of the 670 sites, the survey covered more than 3.1 million square feet along Florida's roadways.

The frequent mowing of Florida's roadsides has a mulching effect on litter and it would be impractical to attempt to count every small piece of paper, glass, hard plastic, or polystyrene foam, for example. Therefore, items 4 square inches or larger in size were classified as "large litter" and items under 4 square inches were classified as "small litter." Most of the small litter items identified are broken or mulched pieces of large litter. Cigarette butts accounted for 24-33% of small litter items during the four years of the Center's study. Of the two classifications, large litter warrants more concern. Not only are large litter items more visible along the roadside, but they tend to become "small litter" when mowed.

Comparison of 1997 Data with Previous Years

The Center conducted a baseline roadside litter survey in 1994. The annual surveys conducted in 1995 and 1996 suggested that the amount of litter on Florida's roadsides was not decreasing but was remaining fairly stable. In 1997, the survey indicated a statistically significant increase in the amount of large litter items found on Florida's roadsides. The estimated increase was 17% based on litter density, and 18% based on the total number of items.

Major Large Litter Categories

Adherence to a uniform system of litter identification is essential because of the need to compare the data collected in the annual surveys. Through pilot studies, the Center identified 72 categories of large litter. For purposes of comparison, the 72 large litter categories were grouped into eight major categories:

Beverage Containers include all types of containers sealed by the manufacturer and used for beverages, including aluminum cans, glass and plastic bottles, gable-top containers, foil pouches, and aseptic drink boxes. Beverage containers accounted for 14.95% of large litter items in 1997.

Non-Beverage Containers include jars, bottles, boxes, cans, and lids which are not related to any type of beverage. Non-beverage containers accounted for 3.37% of large litter items in 1997.

Product Packaging includes all types of packaging associated with a product when it is removed from the shelf at a retail store. Product packaging accounted for 14.07% of large litter items in 1997.

Outer Packaging includes bags or boxes into which items from stores or restaurants are placed. Outer packaging accounted for 3.87% of large litter items in 1997.

Take-Out Food Items include packaging and other items associated with food that may be consumed in a vehicle or away from the home. Take-out food items accounted for 21.88% of large litter items in 1997.

Printed Paper Items include newspapers, books, magazines, advertisements, school or business papers and lottery tickets. Printed paper items accounted for 5.38% of large litter items in 1997.

Debris Items include construction debris, vehicle debris, tire pieces and home items (appliances, furniture, clothing, etc.). Debris items accounted for 22.01% of large litter items in 1997.

Miscellaneous Items include all items that cannot be specifically identified, such as items made of paper, paperboard, cardboard, plastic, plastic film, polystyrene foam and glass. Miscellaneous items accounted for 14.47% of large litter items in 1997.

Factors Affecting Litter Quantity and Composition

The Center's review of litter studies in Texas and Oklahoma indicated that in those states, where statewide mass media campaigns were conducted over a period of time, subsequent reductions in roadside litter were observed. Litter prevention and education efforts are largely dependent on state and local funding, and funding cutbacks can be expected to have an impact on litter quantity.

Changes in local recycling programs can affect litter composition, as recycling programs periodically change due to fluctuating markets and collections costs. Reductions in the availability of curbside or dropoff recycling for a particular material, such as glass or plastic, may contribute to increased littering of items made from those materials.

Volunteer-based adopted road programs at the state and local levels have made an important contribution to controlling roadside litter in many states, including Florida. In 1995, the litter density for large litter items on adopted sites was 36% less than on non-adopted sites, and adopted sites had 33% fewer items per site. In 1996, the litter density was 20% less on adopted sites than on non-adopted sites, and adopted sites had 19% fewer items per site. The data for 1997 did not show statistically significant difference between adopted and non-adopted sites.

The Legislature created Keep Florida Beautiful, Inc. (KFB) in 1993 and charged the organization with developing a statewide anti-littering media campaign and coordinating grass roots litter prevention efforts. KFB functions as a working environmental public-private partnership and serves as the umbrella organization coordinating Florida's efforts to reduce litter. KFB coordinates programs, such as the annual Great Florida Cleanup, that involve thousands of volunteers whose efforts save the state hundreds of thousands of dollars in avoided litter cleanup costs.

In 1993, the Legislature provided KFB with only 25% of the recommended funding for a statewide litter prevention program. The Legislature provided no funding to KFB for the litter prevention program in 1995, 1996, and 1997. Although many leading business, civic, government, and environmental organizations had agreed to participate in the program, KFB recognized that in the absence of adequate funding for the statewide campaign, progress toward the Legislature's litter reduction goal was not likely.

Future Plans

Litter is a costly problem. The state of Florida recognizes that resources expended to clean up litter could be better spent on more important services. Litter is especially undesirable in a state whose economy is heavily dependent upon tourism. Florida is a vacation destination for 43 million people a year from all over the world, and people want to visit a place that is clean and beautiful. The speed with which Florida's population is growing also lends urgency to the need for ongoing educational efforts to prevent littering on a statewide basis.

During FY 1997-98, the Center will build on what was learned during the past four years and broaden the scope of its research beyond the measurement of litter. The Center will conduct a comprehensive analysis of the costs of managing litter at the state and local levels, including costs to both the public and private sector. The project will include a review of the economic and social benefits associated with preventing litter and descriptions of successful litter prevention programs. The Center anticipates that the results of its research efforts will provide the Florida Legislature with needed information on successful, cost-effective litter prevention measures that would help to preserve and enhance Florida's economic and environmental well-being.

1. INTRODUCTION

1.1 OVERVIEW

Litter is a stubborn problem that affects Florida's environment and economy. Litter is generated by a variety of sources including motorists, pedestrians, and uncovered trucks. Litter collects in and around many areas, such as parking lots, vacant lots, loading docks, dumpsters, construction sites, residential neighborhoods, commercial streets, shorelines, and roadsides.

In 1993 the Florida Legislature established a 50% litter reduction goal for the period of 1994 through 1997. The Legislature directed the Florida Center for Solid and Hazardous Waste Management (the Center) to conduct annual litter surveys to measure progress toward that goal. This report presents the results of the fourth annual roadside litter survey, which the Center conducted in 1997. Previous reports presented the results of the 1994, 1995, and 1996 surveys.

Although litter collects in many places, the Center based its methodology on roadside litter because roadsides serve as a good collection point. Roadside litter is often used as an indicator of the amount of litter in the environment. Since roadsides are easy to access and measure, most litter surveys conducted in the United States have focused on roadside litter. Roadsides are relatively standard on a statewide basis and a statistically valid sampling program for roadsides was relatively easy to develop.

Chapter 2 of this report summarizes the methodology used in the roadside litter survey. Chapter 3 presents the results of the 1997 roadside survey. Chapter 4 presents the data analysis. Chapter 5 is a discussion of the survey results. Appendix A, Roadside Litter Study Procedures Manual, presents the step-by-step procedures the Center's survey technicians used to select the survey sites and collect the data. Appendix B presents the results of a beach litter survey conducted by the Center in 1997.

1.2 FLORIDA'S LITTER REDUCTION GOAL

In 1988, the Florida Legislature revised the 1971 Florida Solid Waste Disposal Act and changed the way the state managed solid waste. The 1988 Solid Waste Management Act established an Advance Disposal Fee, a one-cent fee at the retail level on all rigid containers that had not achieved a recycling rate of 50% in the state. As part of a 1993 rewrite of the 1988 Solid Waste Management Act, the Legislature revised the Advance Disposal Fee and, among other things, established a goal of reducing litter by 50% from January 1, 1994 through January 1, 1997.

The Legislature designated the Center as the entity responsible for measuring progress toward the goal of reducing litter and marine debris by 50%. The Legislature appropriated \$200,000 to fund the development and implementation of a baseline litter and marine debris survey. The Center entered into a contract with the Florida Department of Environmental Protection in 1993 for the development of the methodology and for conducting the first survey, and funding was

provided in subsequent years for conducting annual surveys.

The Legislature directed Keep Florida Beautiful, Inc. (KFB) to assist with the implementation of the Florida Solid Waste Management Act. To help reduce litter and marine debris, the Legislature established KFB as a working public/private partnership and designated KFB as the organization to coordinate Florida's efforts to reduce litter and marine debris by 50%. KFB uses mass media campaigns to create awareness about preventing litter. KFB, the state affiliate of Keep America Beautiful, Inc., works with affiliate organizations at the local level to encourage individuals, organizations, and businesses to prevent littering and clean up their communities.

In 1993, the Legislature provided KFB with only 25% of the recommended funding for a statewide litter prevention program. KFB's request, aimed at achieving the Legislature's litter reduction goal, was \$2 million for a mass media campaign, \$1 million for grants to affiliates, \$500,000 for KFB, and \$500,000 to purchase trash cans. The Legislature provided no funding to KFB for the litter prevention program in 1995, 1996, and 1997. Although many leading business, civic, government, and environmental organizations had agreed to participate in the program, KFB recognized that in the absence of adequate funding for the statewide campaign, progress toward the Legislature's litter reduction goal was not likely.

1.3 THE LITTER STUDY ADVISORY COMMITTEE

The Legislature directed the Center to design and implement the study and required that a seven-member Advisory Committee be established to advise the Center on the design and implementation. Members of the Advisory Committee during 1997 were representatives of business, industry, local government, and environmental interest groups:

Chair:

Ivan Lawyer, Executive Director, Business and Industry Recycling Program, Goldenrod

Members:

Dwight Adams, Chair, Sierra Club National Solid Waste Committee, Gainesville

Doug Bruce, Carlton Fields law firm, Tallahassee

Chet England, Group Director, Quality & Food Safety, Burger King Corp., Miami

Mark Ferrulo, Consumer Advocate, Florida Public Interest Research Group, Tallahassee

C.E. (Buddy) Rogers, Jr., Vice President, Coca-Cola Enterprises, Hollywood

Norm Thomas, Alachua County Assistant Public Works Director, Gainesville

1.4 MARINE DEBRIS STUDY

The measurement of marine debris presents challenges not encountered in the measurement of roadside litter. Marine debris studies can be extremely costly due to the need for boats and specialized equipment. In May and June of 1995, the Center conducted a pilot study of beach litter using a method adapted from the roadside litter study. Survey technicians visited public-access beaches in 14 Atlantic and Gulf of Mexico counties. The Litter Study Advisory Committee asked the Center to conduct a similar survey in 1996 and a similar survey was conducted in 1997. The results of the 1997 beach litter survey are presented in Appendix B.

2. ROADSIDE LITTER SURVEY METHODOLOGY

2.1 OVERVIEW

This chapter summarizes the methodology used to collect the data for the 1997 roadside litter study. Appendix A of this report provides a more detailed description of survey procedures, including the materials and forms used in gathering the data and step-by-step explanations of the procedures. The development of the methodology was described in more detail in the 1994 Florida Litter Study report.

A review of litter studies conducted in other states had indicated that there are two approaches for documenting litter. One approach is to document "accumulated litter," which is litter at a site at the time a count is made. Another approach is to measure "fresh litter," which is litter that accumulates along the roadside shortly after the accumulated litter has been cleaned from the site. Measuring fresh litter requires considerable effort as sites have to be cleaned and then recleaned at periodic intervals. Measurements of fresh litter are also subject to a higher degree of variability as there are fewer litter items to count. Therefore, the Center designed a methodology that measures accumulated litter.

2.2 SITE SELECTION AND LOCATION

During the first year of the study, the Center selected the county as the geographic unit in which random sites would be located. If the Center had used a population-based site selection approach, sites would have been concentrated in urban areas with large populations and many areas of the state would not have been surveyed.

In 1994, the survey sample consisted of four sites in each of Florida's 67 counties, for a total of 268 sites. After data analysis of the 1994 results was completed, project statisticians recommended increasing the number of survey sites to reduce statistical variability to an acceptable level. The 1995, 1996, and 1997 studies included 10 survey sites in each county, for a total of 670 sites each year.

2.2.1 Random Site Selection

The Center adopted a randomized site selection methodology with assistance from Info Tech, a statistical consulting firm in Gainesville, Florida. Sites were located on Florida Department of Transportation General Highway Maps using a spatially random sample of coordinates, given to the nearest 1/4" to enable easy location using a ruler.

Info Tech used a SAS computer procedure to randomly select a list of map coordinates and a random directional (N,S,E, or W) to proceed from the random point. From the random point, if a coordinate did not fall directly on a hard-surfaced numbered or named road, then the designated direction (N,S,E, or W) was followed from the random point to the first hard-surfaced numbered

or named road. The procedure was repeated for each site. Although 10 sites were to be surveyed in each county, additional sites were selected as potential replacements for sites that might have to be rejected based on the criteria described below. This methodology provided a consistent and statistically useful random sample.

The site selection procedure included several precautions to avoid any possible bias in site location due to a surveyor selecting either clean or littered sites for the survey. Center staff wrote directions to each site to ensure that surveyors would not drive by and thus "preview" any of the first 10 sites. The locations of "replacement" sites did not appear on the surveyor's map and the surveyor was unaware of their locations. Those sites were photocopied from the master map and cutouts of each site were placed in sealed envelopes to be opened one at a time in numerical order as needed after the surveyor had visited the first 10 sites. These procedures ensured that the surveyors would approach each site with no previous knowledge of the condition of the site.

2.2.2 Site Location

Surveyors followed the directions provided and selected a reference point at which to begin recording the mileage. Surveyors used hazard lights and roof flashers when approaching a site to gain the attention of following traffic so that they could pull off onto the roadside safely. If the surveyor was not able to pull off the road because of a curb, the surveyor would continue to drive and look for a place to pull off within the next mile. If it was not possible to pull off the road within one mile of the original starting point, the site was rejected. (See Section 2.4 for a list of site rejection criteria.) The mileage to the site was documented if it was moved from the original mileage location due to a curb. If the site was not found due to inaccurate maps or mismarked roads, the site was rejected.

2.3 SITE LENGTH AND WIDTH

Prior to the first year of the study, it was determined that a site length of 200 feet along one side of a road would provide adequate data for the survey. The decision to survey only one side of the road was based on concerns about surveyor safety associated with crossing a highway or a median.

Daniel Syrek, a California-based researcher who has conducted numerous litter studies and who conducted a litter survey in Florida in 1989, reported that the average roadside width in Florida was 18 feet. However, using a fixed width for all sites would result in a bias against sites having a width less than 18 feet. Some urban sites, for example, have a curb and gutter configuration with a more narrow section of right-of-way than rural sites. Also, some litter items, such as plastic bags and paper, tend to blow beyond the set width of the site and be trapped in a feature such as a fence, a line of tall grass, or brush.

To accurately account for differences in litter accumulation associated with site width, half the sites in the study have a fixed width of 18 feet and half the sites vary in width from 1 to 40 feet. The width is measured from the edge of the paved surface where the pavement meets the

grass or soil. The width of the variable sites is determined by the presence of a litter catchpoint, such as a fence or a line of taller grass; if none exists, the maximum site width is 40 feet.

2.4 SITE REJECTION CRITERIA

After the surveyors determined whether the site was a fixed-width or variable-width site, they visually inspected the site to determine whether any element was present that would make the site unsuitable for inclusion in the study. The rejection criteria included:

- 1) surveyor safety and security concerns,
- 2) construction on site,
- 3) site location on a bridge,
- 4) highway cleanup crews within one mile of the site,
- 5) evidence of Adopt-A-Highway litter cleanup activity within the site,
- 6) majority of site submerged in water,
- 7) site located on an interstate highway within one mile of an interchange, and
- 8) no grass or soil on the right-of-way

2.5 SITE SET-UP

Once a site was accepted, the surveyor documented the site's exact location by noting the mileage from the reference point and additions to the driving directions that would allow the site to be located again.

The beginning point of the site was established by painting an X on the edge of the roadway opposite the front driver's-side tire of the surveyor's vehicle and measuring 50 feet from the X. This method prevented any bias that might result from determining the starting point in a subjective manner that might either include or exclude litter items from the survey site.

Surveyors placed a large paint dot at the beginning point (0 feet), a 6-inch line perpendicular to the road at the midpoint (100 feet), and a large paint dot at the endpoint (200 feet) of the site. The width of the site was measured from each of the three marks according to the site type conventions described in Section 2.3 above. A stake was placed at each site boundary point and in the absence of a boundary or catchpoint, a string was stretched along the stakes to establish a distinct, visible boundary. The use of the string allowed surveyors to accurately judge whether or not a litter item was within the site.

2.6 LITTER CLASSIFICATION

Florida's abundant rainfall and warm climate require that roadsides be mowed frequently. Mowing roadsides causes litter to be chopped into small pieces and a great deal of litter is effectively "mulched" through the mowing process. Once litter has become chopped, identification of the litter is much more difficult.

One of the goals of this study was to identify the composition of litter. Therefore, a decision was made to classify items greater than or equal to 4 square inches as "large litter." Items smaller than 4 square inches were classified as "small litter." This methodology tracks a study done in Oregon in which litter was measured in various pre-established sizes. In general, large litter items are much easier to assign to a category than are small litter items. Round, square, and rectangular wooden templates 4 square inches in size were constructed to aid the field staff in determining whether an item was a large litter or small litter item. The Litter Study Advisory Committee encouraged the Center to include the measurement of small litter, specifically cigarette butts.

2.7 LARGE LITTER SURVEY

Large litter was surveyed over the entire site. For the large litter survey, the surveyor began at the corner of the site nearest to his or her vehicle and walked through the site in a meandering fashion. The surveyor recorded on a tape recorder a description of each piece of litter observed on the site that was equal to or larger than 4 square inches in size. Each site was surveyed twice by making two separate passes, one beginning at the side nearest the vehicle and the second pass going back toward the vehicle. This method provided a check on the surveyor's accuracy. Items not visible on the first pass because of the light or lay of the grass might be visible on the second pass in the opposite direction. An average was taken of the items counted on the two passes.

In addition to describing the litter items, surveyors recorded information about evidence of mowing, grass height, and whether the site was a part of an adopted road program, such as Adopt-A-Highway, Adopt-A-County Road, etc. Surveyors also noted whether a traffic signal was visible from the site, and whether there was a fast food or convenience store within one mile of the site. Surveyors transcribed the recorded data on a data sheet within a week of conducting the survey.

2.8 SMALL LITTER SURVEY

Surveying small litter over the entire site would have taken considerable time and would have dramatically increased the cost of conducting the survey. Prior to conducting the first study in 1994, Center staff determined that data on small litter quantity and composition could be accurately collected by surveying three 1-foot by 15-foot transects within the site.

The transects were located at the beginning point, midpoint, and endpoint of the site. Using a 1-foot by 5-foot PVC frame, the surveyor placed the 1-foot edge of the frame along the roadway's edge at the site's beginning point and recorded the small litter that was inside the frame. Then the surveyor flipped the frame and again surveyed the 1-foot by 5-foot area within the frame for small litter. The surveyor then flipped the frame again and surveyed the small litter, for a maximum transect area of 15 square feet. The procedure was repeated at the midpoint and endpoint of the site. If a transect was less than 15 feet wide, a flip was eliminated to accommodate the reduced site width.

2.9 LITTER CATEGORIES

Seventy-two categories of large litter were identified in the 1994 survey. Those categories have been used in each subsequent year. Adherence to a uniform system of litter identification is essential because of the need to compare the data collected in the annual surveys.

Fourteen categories of small litter were identified. Most of the small litter categories are based on material type because of the difficulty of identifying a very small piece of what in many cases was a larger item. For example, a piece of a glass bottle or container smaller than 4 square inches was identified as a "glass piece."

2.9.1 Large Litter Categories

Table 2.1 lists the 72 categories of large litter items and includes examples of the common items within each category. The categories are listed in the order in which they appear on the data sheets. The examples listed are not all-inclusive but are intended to clarify the procedure used to categorize items based on their original intended use.

2.9.2 Small Litter Categories

Small litter items were identified based on the following categories:

- Aluminum pieces
- Bottle caps
- Candy wrappers
- Cigarette butts
- Glass pieces
- Metal pieces (other than aluminum)
- Paper pieces
- Plastic pieces (hard plastic)
- Plastic film
- Polystyrene peanuts
- Polystyrene pieces
- Rubber/tire pieces
- Straws
- Other

Table 2.1 Examples of Litter Items for the 72 Large Litter Categories

BEVERAGES

Beer cans

beer, malt liquor, or malt beverage

Beer bottles

beer, malt liquor, or malt beverage

Soda cans

carbonated beverages such as cola, ginger ale, etc.

Soda glass bottles

carbonated beverages such as cola, ginger ale, etc.

Soda plastic bottles

carbonated beverages such as cola, ginger ale, etc.

Sports/other cans

fruit or vegetable juices, iced teas, health shakes, health drinks, chocolate drinks, bottle water, etc.

Sport/other glass bottles

fruit or vegetable juices, iced teas, health shakes, health drinks, chocolate drinks, bottle water, etc.

Sports/other plastic bottles (NOT HDPE)

fruit or vegetable juices, iced teas, health shakes, health drinks, chocolate drinks, bottle water, etc.

Wine/liquor glass bottles

wine, wine coolers, liquor, and also pre-mixed, pre-packaged liquor drinks such as whiskey and lemonade

Wine/liquor plastic bottles

wine, wine coolers, liquor, and also pre-mixed, pre-packaged liquor drinks such as whiskey and lemonade

Milk jugs/water/juice (HDPE)

clear or yellow HDPE containers that hold milk, juice, tea, water, etc.

Gable top container

paper cartons that contain milk, tea, orange juice, milk duds, etc.

Foil pouch

pouches made of a combination of plastic and foil that contain fruit drinks, etc.

Aseptic box

drink boxes made of a combination of paper, plastic, and foil that contain fruit juice, punch, milk, health drinks, etc.

Broken glass container

any broken glass beverage container

Six pack plastic ring

plastic rings holding beer, soda or other containers together

CUPS

Plastic

any plastic cups not intended for reuse

Plastic reusable

thick plastic cups intended for reuse such as souvenir cups often with pictures on sides of cup

Polystyrene foam cups

cups from restaurants, take-out food, convenience stores, etc. composed of various types of polystyrene foam

Paper

cups from restaurants, take-out food, convenience stores, etc. composed primarily of paper

Plastic lids

various types of plastic lids used on beverage cups or other containers

BAGS

Plastic retail

bags from retail, convenience, grocery stores, etc.

Paper retail

large paper bags, grocery, office supply store, clothing store, other

Paper small

small paper bags, fast food, restaurant, convenience, other

Feed

animal feed or litter bags composed of paper, plastic, or a mix of the two

Ice

plastic ice bags

Zipper/sandwich

plastic bags that have a zipper seal or are pleated sandwich bags

Plastic other

any other plastic bags such as garbage bags, bread bags, newspaper bags

Paper other

any other paper bags

CONTAINERS

Corrugated cardboard boxes

corrugated cardboard boxes such as pizza boxes, storage boxes, etc.

Paperboard boxes

any container composed of a low density paperboard material such as cereal, pastry, or deli boxes, chicken buckets, french fry cartons, egg cartons, etc.

Paper beverage casing

beverage cases of either paperboard or corrugated cardboard such as 12, 18 or 24 pack casings

Polystyrene foam clam shell

polystyrene foam clam shell container such as egg cartons, restaurant carry out, hamburger boxes, etc.

Plastic clam shell

plastic clam shell container such as restaurant carry out and hamburger boxes

Plastic jars/bottles/boxes

plastic containers used to contain a wide variety of products such as peanut butter, pill bottles, oil bottles, etc.

Glass jars/bottles

glass containers used to contain a wide variety of products

Cans - steel

steel cans containing food as well as other products such as household paint or chemicals

Cans - aluminum

aluminum cans containing food as well as other products such as household paint or chemicals

Lids

any screw on, pop down, or metal lid to a bottle, jar, can, aerosol can, etc.

Aerosol can

aerosol cans used to contain air freshener, paint, hair spray, hair mousse, etc.

FOOD WRAPS

Paper

paper wraps such as take-out food wrappers, freezer paper, etc.

Paper/Foil Composite

primarily food wraps that are paper and foil combined such as some hamburger wrappers

TRAYS

Polystyrene foam

meat, fruit, bakery trays, etc.

Paper

any tray made of a heavy paper or paperboard such as produce trays

FAST FOOD EXTRAS

Condiments packages

catsup, mustard, duck sauce, etc.

Utensils

plastic spoons, forks, knives, etc.

PLATES

Paper

take-out food or picnic plates, etc.

Polystyrene foam

take-out food or picnic plates, etc.

Plastic

take-out food or picnic plates, etc.

PACKAGING

Snacks

any snack food packaging such as chip bags, gum wrappers, candy bar wrappers, cookie bags, etc.

Plastic

plastic packaging not mounted to paper where, during manufacturing, the product is placed in and the plastic sealed around the whole product such as shrink wrap packaging on batteries or soft drinks, ramen noodles, cookie trays, etc.

Paper

paper packaging that is used for either the package itself such as cookie or sugar bags or as packing material such as crinkled paper used inside a box to cushion contents

Plastic/paper combo

a combination of paper and plastic packaging such as battery packaging or mounting hardware for pictures

Polystyrene foam

polystyrene foam packing used as cushioning material used to protect products (not polystyrene foam peanuts)

Foil

sealable foil wrap used for packaging, toner wrapping, toaster pastry wrappers, etc.

PAPER

Towel/napkin

paper towel, napkins, tissue

Lottery

lottery tickets and ticket forms

Newspapers/books/magazines/advertisements

pieces or entire items

Stationery/school/business

letters, school papers, hand written receipts, cash register receipts, business cards, etc.

TOBACCO

Cigarette/cigar

cigarette/cigar related items such as cigarette/cigar boxes, cartons, packages, films from packages, cigar wrappers

Dip/chew/snuff

containers, pouches, snuff boxes and other related nonsmokable products/packaging

FOIL/PIE TINS

Foil/pie tins

foil food wraps, ready made pie tins

MISCELLANEOUS

Miscellaneous

items whose original use cannot be identified are classified by the following material types:

paper	film
paperboard	polystyrene foam
cardboard	glass
plastic	

Construction debris

construction related materials such as lumber, insulation material, road construction materials, PVC piping, tarps, etc.

Vehicle

parts of a vehicle such as reflectors, name plates, hub caps, etc. but NOT tire pieces

Tires

whole tires, pieces of tires, or inner tube pieces

Home items

clothing, records, videos, china dishes, appliances, toys, cigarette lighters, matches, etc.

2.10 PHOTOGRAPHS

Photographs were taken at each site to provide documentation of the site and to enable someone to locate the site in the future if necessary.

2.11 DATA TRANSCRIPTION AND ANALYSIS

Surveyors transcribed their site data onto data sheets within one week of data collection. The survey tapes are kept on file as a permanent record of the original data collection. Information from the data sheets was later entered into a Foxpro 2.6 database. The Center subcontracted with Info Tech, a statistical consulting firm, for the analysis of the data. Results are presented and discussed in Chapters 3 and 4 of this report.

2.12 QUALITY CONTROL

Two of the 10 survey sites in each county were surveyed a second time by a quality control surveyor within 24 hours of the original survey. Quality control surveys were conducted without prior notice to the original surveyor. The quality control surveyor checked the location and dimensions of the site (evident from the paint dots used to mark the site) and performed large and small litter surveys.

The quality control procedure ensures that sites are located accurately in accordance with the random selection procedure and that the site setup and litter item surveys were conducted uniformly and consistently. Variations in litter item counts are expected due to factors such as weather (especially wind), mowing, and newly accumulated litter. Discrepancies during the 1997 survey were deemed acceptable.

The transcription of the collected data also was checked. For each surveyor, several tapes were re-transcribed by a quality control surveyor and compared with the surveyor's data sheets to check the accuracy of data transcription.

2.13 TRAINING

In a multiyear study, the methodology must be followed strictly from year to year to ensure that the data can be compared. Prior to the 1994 survey, the Center had determined that hiring and training paid employees rather than relying on volunteers would help to ensure quality and consistency in the collection of the data. In 1995, the Center designed a comprehensive week-long training program based on the Roadside Litter Survey Procedures Manual (Appendix A). The training program included classroom sessions at the Center's offices in Gainesville as well as field sessions at selected urban and rural sites in and around Gainesville.

In 1997 the Center hired six surveyors as temporary employees for approximately 10 weeks to conduct the roadside survey. In 1997, as in 1995 and 1996, the training was conducted by litter surveyors who had been involved in the litter study since 1994.

3. RESULTS

3.1 OVERVIEW

The 1997 survey counted 34,794 large litter items and 11,241 small litter items. Surveyors visited 10 sites in each Florida county for a total of 670 sites. The survey covered 134,000 linear feet, or more than 25 miles of roadway. Taking into account the total area of the 670 sites, the survey covered more than 3.1 million square feet along Florida's roadways.

This chapter presents the 1997 roadside survey results in several formats. Table 3.1 presents the distribution of large litter items by category. Table 3.2 presents the comparative rankings of the 72 large litter categories, by percentage of total large litter items. Graphs show the large litter results according to material type and major litter category. The small litter results are then presented. Finally, the chapter presents the site characteristics for the 670 sites. The data analysis is presented in Chapter 4. A discussion of the results is presented in Chapter 5.

3.2 LARGE LITTER RESULTS: DISTRIBUTION BY ITEM

Table 3.1 presents, in descending order, the distribution of the large litter items identified in the 1997 survey. The table includes data for the four years of the study to allow for comparisons; however, the differences for each category from year to year were not statistically analyzed. Therefore, no conclusions should be drawn as to the statistical significance of an increase or decrease for any given category. The table includes the following information:

- The first column lists the large litter categories in descending order according to the average number of items found in that category in 1997.
- The second column shows the average number of items found in 1997 in each category. To achieve a high level of accuracy, the methodology requires surveying each site twice. The two sets of data are recorded as "Pass 1" and "Pass 2," and the two counts are averaged. The number is not rounded after averaging. For example, averaging Pass 1 and Pass 2 for all sites produced a total of 4,129 vehicle and tire debris items.
- The third column presents the percentage of total large litter items for each category in 1997. For example, vehicle and tire debris accounted for 11.87% of all large litter items in 1997.
- The fourth, fifth, and sixth columns represent the percentages of total large items for each category in 1996, 1995, and 1994 respectively. For example, vehicle and tire debris accounted for 9.89% of all large litter items in 1996, 11.80% in 1995, and 9.05% in 1994.

Table 3.1 Distribution of Large Litter Items

RANKING BY LARGE LITTER CATEGORY	Average items, passes 1&2	% of total large litter items			
	1997	1997	1996	1995	1994
1 Vehicle and tire debris	4129.0	11.87	9.89	11.80	9.05
2 Snack packages	2139.0	6.15	6.62	6.96	6.46
3 Construction debris	2112.5	6.07	6.16	5.38	3.83
4 Beer cans	1873.0	5.38	5.38	6.60	8.97
5 Towels/napkins	1846.0	5.31	4.74	4.46	3.13
6 Cigarette/cigar packages	1593.0	4.58	4.05	4.93	4.65
7 Misc paper	1523.0	4.38	6.05	5.39	10.13
8 Home items	1414.5	4.07	3.82	3.55	2.02
9 Misc film	1304.5	3.75	3.44	4.43	3.01
10 Beer bottles	973.5	2.80	3.22	2.99	2.01
11 Paper cups	943.5	2.71	3.00	3.09	3.04
12 Polystyrene foam cups	918.0	2.64	3.00	2.78	3.43
13 Soda cans	887.0	2.55	2.05	2.68	2.57
14 Misc plastic	883.5	2.54	1.80	2.90	2.67
15 Plastic packaging	878.5	2.52	2.29	1.08	0.68
16 Stationary/school/business	834.5	2.40	2.31	2.03	1.45
17 Newspaper/books/mags/ads	741.5	2.13	2.45	2.24	2.60
18 Paper packaging	520.0	1.49	0.89	0.50	1.09
19 Plastic jars/bottles/boxes	510.0	1.47	0.89	1.10	0.73
20 Misc cardboard	491.5	1.41	1.62	1.30	1.04
21 Paperboard boxes	471.0	1.35	1.08	0.99	1.48
22 Plastic lids	467.0	1.34	1.40	1.44	1.71
23 Corrugated cardboard boxes	446.0	1.28	1.20	0.39	0.91
24 Paper beverage casings	416.5	1.20	1.53	1.10	0.74
25 Misc polystyrene foam	407.5	1.17	1.45	1.79	1.49
26 Misc paperboard	379.5	1.09	1.32	1.79	1.64
27 Sports/other plastic bottles	353.5	1.02	1.75	0.58	0.72

RANKING BY LARGE LITTER CATEGORY	Average items, passes 1&2	% of total large litter items			
	1997	1997	1996	1995	1994
28 Lottery tickets	296.5	0.85	0.72	0.82	0.56
29 Plastic cups	295.0	0.85	1.01	0.89	0.92
30 Soda plastic bottles	288.5	0.83	0.99	0.77	1.10
31 Condiments	287.0	0.82	0.34	0.44	1.00
32 Plastic other bags	283.0	0.81	1.11	0.96	0.93
33 Aluminum foil/foil tins	267.5	0.77	0.65	0.41	0.37
34 Paper small bags	255.5	0.73	0.97	1.13	1.03
35 Paper food wrap	235.0	0.68	0.82	0.74	0.65
36 Aluminum cans	228.5	0.66	0.22	0.32	0.32
37 Plastic retail bags	197.0	0.57	0.96	0.65	0.60
38 Zipper/sandwich bags	182.5	0.52	0.51	0.58	0.48
39 Container lids	176.0	0.51	0.45	0.38	0.19
40 Foil packaging	167.0	0.48	0.34	0.19	0.56
41 Gable top containers	159.0	0.46	0.49	0.58	0.55
42 Broken glass containers	151.5	0.44	0.40	0.27	1.28
43 Dip/chew packages	150.5	0.43	0.47	0.39	0.42
44 Glass jars/bottles	139.5	0.40	0.04	0.26	0.03
45 Sports/other glass bottles	139.0	0.40	0.96	0.49	0.58
46 Paper other bags	130.0	0.37	0.42	0.12	0.10
47 Plastic reusable cups	112.5	0.32	0.32	0.31	0.23
48 Soda glass bottles	109.0	0.31	0.51	0.64	1.69
49 Steel cans	107.0	0.31	0.39	0.31	0.39
50 Milk jugs/water/juice (HDPE)	92.0	0.26	0.36	0.30	0.72
51 Paper/foil food wrap	90.5	0.26	0.38	0.56	0.50
52 Wine/liquor glass bottles	85.0	0.24	0.23	0.23	0.21
53 Ice bags	72.0	0.21	0.29	0.38	0.33
54 Polystyrene foam clam shells	69.0	0.20	0.28	0.32	0.23
55 Utensils	66.0	0.19	0.18	0.17	0.19
56 Sports/other cans	63.5	0.18	0.27	0.26	0.50

RANKING BY LARGE LITTER CATEGORY	Average items, passes 1&2	% of total large litter items			
	1997	1997	1996	1995	1994
57 Plastic/paper combo packaging	56.0	0.16	0.22	0.30	0.24
58 Polystyrene foam trays	47.5	0.14	0.20	0.10	0.13
59 Feed bags	47.0	0.14	0.05	0.12	0.10
60 Misc glass	44.5	0.13	0.07	0.09	0.04
61 Six pack rings	39.5	0.11	0.14	0.18	0.18
62 Polystyrene foam packaging	38.0	0.11	0.18	0.50	0.40
63 Paper retail bags	37.5	0.11	0.26	0.13	0.41
64 Polystyrene foam plates	34.5	0.10	0.13	0.09	0.10
65 Plastic clam shells	31.0	0.09	0.06	0.05	0.05
66 Paper trays	15.5	0.04	0.05	0.02	0.08
67 Paper plates	12.0	0.03	0.04	0.02	0.08
68 Aseptic boxes	10.0	0.03	0.03	0.02	0.08
69 Wine/liquor plastic bottles	9.5	0.03	0.04	0.09	0.06
70 Aerosol cans	8.5	0.02	0.03	0.08	0.03
71 Foil pouches	6.5	0.02	0.04	0.03	0.06
72 Plastic plates	4.5	0.01	0.02	0.02	0.03
TOTALS	34794.0	100.00	100.00	100.00	100.00

3.3 LARGE LITTER RESULTS: COMPARATIVE RANKINGS, 1994-1997

Table 3.2 presents the comparative rankings of each large litter category for the four years of the study. This table was designed in response to requests for information about the comparative contribution of particular items to the overall amount of large litter identified in the annual surveys.

The first column lists the large litter category. The other four columns list the comparative rank for 1997, 1996, 1995, and 1994 respectively. For example, vehicle and tire debris was the most numerous item in 1997, 1996, and 1995, and it was the second most numerous item in 1994.

Table 3.2 Comparative Rankings for Large Litter Items, 1994-1997

LARGE LITTER CATEGORY	1997 Rank	1996 Rank	1995 Rank	1994 Rank
Vehicle and tire debris	1	1	1	2
Snack packages	2	2	2	4
Construction debris	3	3	5	6
Beer cans	4	5	3	3
Towels/napkins	5	6	7	8
Cigarette/cigar packages	6	7	6	5
Misc paper	7	4	4	1
Home items	8	8	9	14
Misc film	9	9	8	10
Beer bottles	10	10	11	15
Paper cups	11	11	10	9
Polystyrene foam cups	12	12	13	7
Soda cans	13	16	14	13
Misc plastic	14	17	12	11
Plastic packaging	15	15	22	35
Stationary/school/business	16	14	16	21
Newspaper/books/mags/ads	17	13	15	12
Paper packaging	18	32	39	24
Plastic jars/bottles/boxes	19	33	24	32
Misc cardboard	20	19	20	25
Paperboard boxes	21	26	25	20
Plastic lids	22	22	19	16
Corrugated cardboard boxes	23	24	42	30
Paper beverage casings	24	20	23	31
Misc polystyrene foam	25	21	18	19
Misc paperboard	26	23	17	18
Sports/other plastic bottles	27	18	33	34
Lottery tickets	28	35	28	40

LARGE LITTER CATEGORY	1997 Rank	1996 Rank	1995 Rank	1994 Rank
Plastic cups	29	27	27	29
Soda plastic bottles	30	28	29	23
Condiments	31	47	41	27
Plastic other bags	32	25	26	28
Aluminum foil/foil tins	33	36	40	49
Paper small bags	34	29	21	26
Paper food wrap	35	34	30	36
Aluminum cans	36	55	47	51
Plastic retail bags	37	30	31	37
Zipper/sandwich bags	38	37	36	44
Container lids	39	41	44	56
Foil packaging	40	48	56	39
Gable top containers	41	39	34	41
Broken glass containers	42	43	52	22
Dip/chew packages	43	40	43	45
Glass jars/bottles	44	68	53	71
Sports/other glass bottles	45	31	38	38
Paper other bags	46	42	61	61
Plastic reusable cups	47	49	48	53
Soda glass bottles	48	38	32	17
Steel cans	49	44	49	48
Milk jugs/water/juice (HDPE)	50	46	50	33
Paper/foil food wrap	51	45	35	42
Wine/liquor glass bottles	52	54	55	55
Ice bags	53	50	45	50
Polystyrene foam clam shells	54	51	46	54
Utensils	55	58	58	57
Sports/other cans	56	52	54	43
Plastic/paper combo packaging	57	56	51	52
Polystyrene foam trays	58	57	62	59

LARGE LITTER CATEGORY	1997 Rank	1996 Rank	1995 Rank	1994 Rank
Feed bags	59	64	60	60
Misc glass	60	62	64	69
Six pack rings	61	60	57	58
Polystyrene foam packaging	62	59	37	47
Paper retail bags	63	53	59	46
Polystyrene foam plates	64	61	63	62
Plastic clam shells	65	63	67	68
Paper trays	66	65	69	64
Paper plates	67	66	71	65
Aseptic boxes	68	70	70	63
Wine/liquor plastic bottles	69	69	65	67
Aerosol cans	70	71	68	66
Foil pouches	71	67	66	70
Plastic plates	72	72	72	72

3.4 LARGE LITTER ITEMS BY MATERIAL TYPE

To allow for comparisons based on material type, the 72 large litter categories were grouped according to seven material types: paper, plastic, aluminum, glass, steel, mixed, and composite.

"Mixed" and "composite" items consist of a combination of material types. "Mixed" items are defined as those in which the materials are not bonded together. Examples of mixed items include cigarette/cigar packaging, some vehicle debris items, and foil/paper food wrap. "Composite" items are defined as those in which the materials are bonded together. Examples of composite items include aseptic boxes and foil/plastic pouches.

Figure 3.1 compares the material type results for 1997 with the results of the surveys from previous years. Increases and decreases in litter items by material type have not been statistically analyzed; therefore, no conclusions should be drawn as to the statistical significance of an increase or decrease for a given material type. The data are provided in this format to allow for anecdotal comparisons only. Table 3.3 below shows the actual percentages for the material types presented Figure 3.1. (Totals may not equal 100% due to rounding.) Table 3.4 shows the large litter items that comprise each of the material types.

Table 3.3 Large Litter Items by Material Type

	Steel	Composite	Glass	Aluminum	Plastic	Paper	Mixed
1994	.50	.70	5.80	12.80	22.30	30.20	27.70
1995	.34	.68	4.98	10.20	23.22	26.26	34.33
1996	.42	.56	5.42	8.63	23.34	29.46	32.17
1997	.33	.50	4.72	9.84	22.78	27.58	34.25

Figure 3.1 Large Litter Items by Material Type

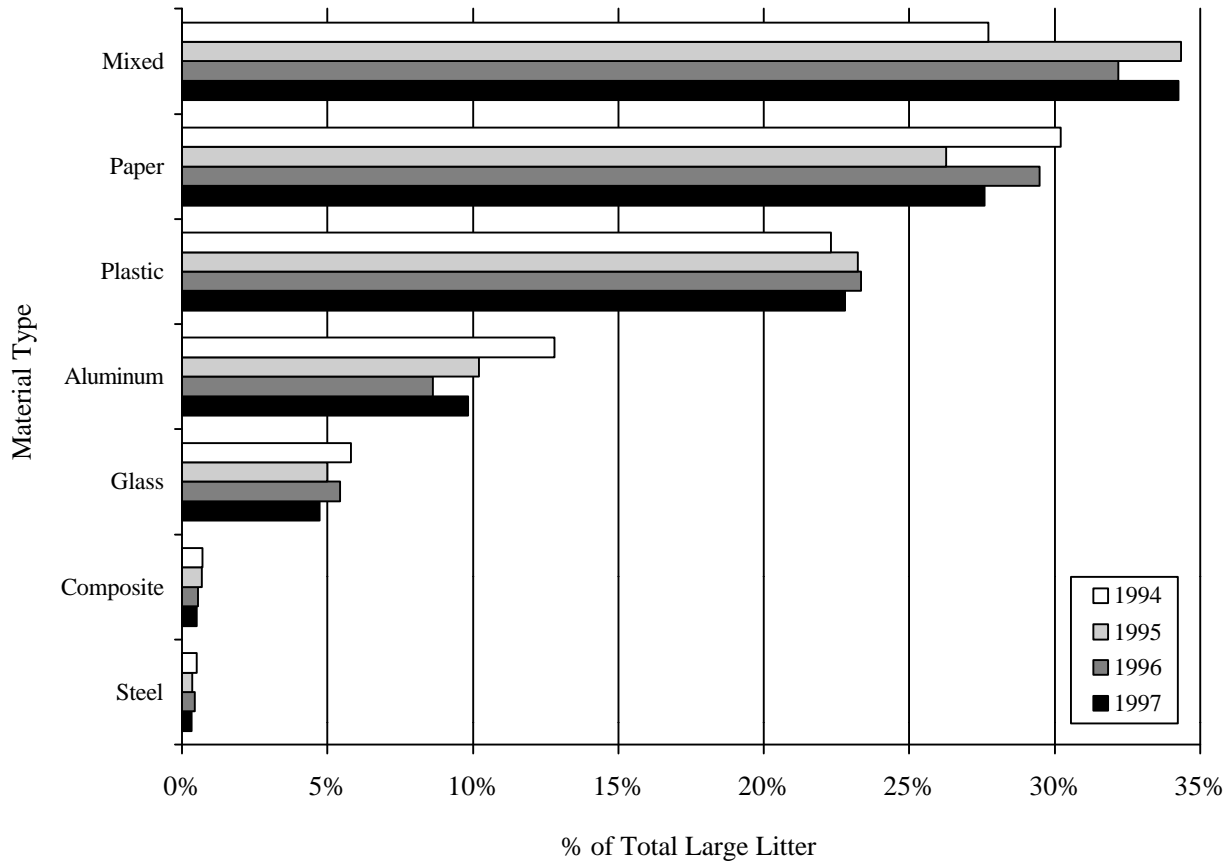


Table 3.4 Classification of Large Litter Items by Material Type

<p>ALUMINUM</p> <p>Aluminum cans Beer cans Foil packaging Foil/pie tins Soda cans</p> <p>COMPOSITE</p> <p>Aseptic boxes Foil pouches Gable top containers</p> <p>GLASS</p> <p>Beer bottles Broken glass containers Glass jars/bottles Misc glass Soda glass bottles Sports/other glass bottles Wine/liquor glass bottles</p> <p>MIXED</p> <p>Cigarette/cigar Construction debris Dip/chew Feed bags Foil food wrap Home items Lids Snack packages Sports/other cans Vehicle debris</p> <p>PAPER</p> <p>Corrugated cardboard boxes Lottery Misc cardboard Misc paper Misc paperboard Newspaper/books/mags/adver Paper beverage casings Paper cups Paper food wrap Paper grocery bags</p>	<p>Paper other bags Paper packaging Paper plates Paper small bags Paper trays Paperboard boxes Stationary/school/business Towels/napkins</p> <p>PLASTIC</p> <p>Condiments Ice bags Milk jugs/water/juice (HDPE) Misc film Misc plastic Misc polystyrene foam Plastic clam shells Plastic cups Plastic grocery bags Plastic jars/bottles/boxes Plastic lids Plastic other bags Plastic packaging Plastic plates Plastic reusable cups Plastic/paper combo packaging Polystyrene foam clam shells Polystyrene foam cups Polystyrene foam packaging Polystyrene foam plates Polystyrene foam trays Six pack rings Soda plastic bottles Sports/other plastic bottles Utensils Wine/liquor plastic bottles Zipper/sandwich bags</p> <p>STEEL</p> <p>Aerosol cans Steel cans</p>
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3.5 LARGE LITTER ITEMS BY MAJOR CATEGORY

The 72 large litter categories were classified into eight "major categories" and a percentage of total large litter was calculated for each major category.

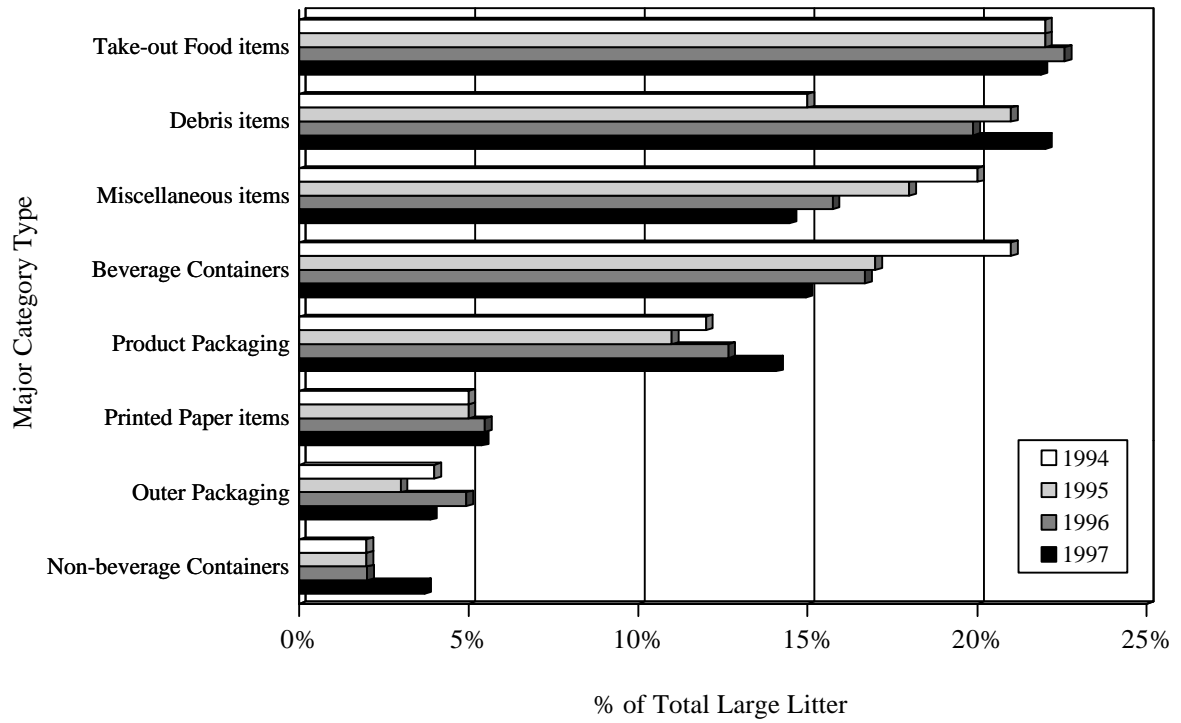
Figure 3.2 shows the distribution of litter by major category for the four years of the study. Differences in major category percentages during the four years have not been statistically analyzed; therefore, no conclusions should be drawn as to the statistical significance of an increase or decrease in a given major category. The data are provided in this format to allow for anecdotal comparisons only. Table 3.5 below shows the actual percentages for the major categories presented in Figure 3.2. (Totals may not equal 100% due to rounding.)

The items comprising each major category are described in more detail in the tables provided on the following pages.

Table 3.5 Large Litter Items by Major Category

	Take-out food	Debris	Misc.	Beverage Containers	Product Packaging	Printed Paper	Outer Packaging	Non-Beverage Containers
1994	21.96	14.90	20.02	21.07	11.72	4.61	3.98	1.72
1995	22.48	20.73	17.70	16.59	11.65	5.09	3.37	2.39
1996	22.59	19.87	15.75	16.72	12.69	5.48	4.92	2.03
1997	21.88	22.01	14.47	14.95	14.07	5.38	3.87	3.37

Figure 3.2 Large Litter Items by Major Category



The following sections present the 1997 results for each of the eight major categories. The tables present each large litter item's percentage within the major category and each large litter item's percentage of total large litter. (For a comparison of 1994-1997 results for specific items, see Table 3.1.)

3.5.1 Take-Out Food Items

Table 3.6 presents the results for take-out food items, which include packaging and other items associated with foods that may be consumed in a vehicle or in locations away from the home. (This table does not include bags, which are part of the Outer Packaging category.) Snack packages are the largest component of take-out food litter items (28.11%), followed by towel/napkins (24.27%), paper cups (12.39%), and polystyrene foam cups (12.07%).

Table 3.6 Distribution of Take-Out Food Items

TAKE-OUT FOOD ITEM	1997 % of total Take-out Food Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
Snack packages	28.11	6.15	6.62	6.96	6.46
Towels/napkins	24.27	5.31	4.74	4.46	3.13
Paper cups	12.39	2.71	3.00	3.09	3.04
Polystyrene foam cups	12.07	2.64	3.00	2.78	3.43
Plastic lids	6.12	1.34	1.40	1.44	1.71
Plastic cups	3.88	0.85	1.01	0.89	0.92
Condiments	3.75	0.82	0.34	0.44	1.00
Paper food wrap	3.11	0.68	0.82	0.74	0.65
Plastic reusable cups	1.46	0.32	0.32	0.31	0.23
Paper/foil food wrap	1.19	0.26	0.38	0.56	0.50
Polystyrene foam clam shells	0.91	0.20	0.28	0.32	0.23
Utensils	0.87	0.19	0.18	0.17	0.19
Polystyrene foam trays	0.64	0.14	0.20	0.10	0.13
Polystyrene foam plates	0.46	0.10	0.13	0.09	0.10
Plastic clam shells	0.41	0.09	0.06	0.05	0.05
Paper trays	0.18	0.04	0.05	0.02	0.08
Paper plates	0.14	0.03	0.04	0.02	0.08
Plastic plates	0.05	0.01	0.02	0.02	0.03

TAKE-OUT FOOD ITEM	1997 % of total Take-out Food Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
TOTAL	100.00	21.88	22.59	22.46	21.96

3.5.2 Beverage Containers

Table 3.7 presents the results for beverage container items. This category is comprised of all types of containers sealed by the manufacturer and used for beverages, including aluminum cans, glass bottles, plastic bottles, gable top containers, foil pouches, and aseptic boxes. Beer cans, the largest component in this category, accounted for 35.99% of the beverage containers identified, followed by beer bottles (18.73%), soda cans (17.06%) and sports/other plastic bottles (6.82%).

Table 3.7 Distribution of Beverage Container Items

BEVERAGE CONTAINER ITEM	1997 % of total Beverage Container Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
Beer cans	35.99	5.38	5.38	6.60	8.97
Beer bottles	18.73	2.80	3.22	2.99	2.01
Soda cans	17.06	2.55	2.05	2.68	2.57
Sports/other plastic bottles	6.82	1.02	1.75	0.58	0.72
Soda plastic bottles	5.55	0.83	0.99	0.77	1.10
Gable top containers	3.08	0.46	0.49	0.58	0.55
Broken glass containers	2.94	0.44	0.40	0.27	1.28
Sports/other glass bottles	2.68	0.40	0.96	0.49	0.58
Soda glass bottles	2.07	0.31	0.51	0.64	1.69
Milk jugs/water/juice (HDPE)	1.74	0.26	0.36	0.30	0.72
Wine/liquor glass bottles	1.61	0.24	0.23	0.23	0.21
Sports/other cans	1.20	0.18	0.27	0.26	0.50
Aseptic boxes	0.20	0.03	0.03	0.02	0.08
Wine/liquor plastic bottles	0.20	0.03	0.04	0.09	0.06
Foil pouches	0.13	0.02	0.04	0.08	0.03
TOTAL	100.00	14.95	16.72	16.58	21.07

3.5.3 Miscellaneous Items

Table 3.8 presents the results for miscellaneous items, which includes all large litter items that could not be identified. This category includes items of paper, paperboard, cardboard, plastic, plastic film, polystyrene foam, and glass. Almost one-third of the miscellaneous items were paper items that could not be identified.

Table 3.8 Distribution of Miscellaneous Items

MISCELLANEOUS ITEM	1997 % of total Miscellaneous Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
Misc paper	30.27	4.38	6.05	5.39	10.13
Misc film	25.92	3.75	3.44	4.43	3.01
Misc plastic	17.55	2.54	1.80	2.90	2.67
Misc cardboard	9.74	1.41	1.62	1.30	1.04
Misc polystyrene foam	8.09	1.17	1.45	1.79	1.49
Misc paperboard	7.53	1.09	1.32	1.79	1.64
Misc glass	0.90	0.13	0.07	0.09	0.04
TOTAL	100.00	14.47	35.71	37.64	39.96

3.5.4 Debris Items

Table 3.9 presents the results for debris items. The debris category combines three large litter subcategories: construction debris, vehicle and tire pieces, and home items. Construction debris consists of any materials related to the construction industry, such as insulation, wood, and drywall mud buckets. Vehicle and tire items consist of items such as broken reflectors, headlights, inner tubes, and tire pieces. The home item category covers such items as appliances, furniture pieces, and clothing items. Vehicle and tire debris accounted for about 50% or over half of the debris items identified in this study.

Table 3.9 Distribution of Debris Items

DEBRIS ITEM	1997 % of total Debris Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
Vehicle and tire debris	53.93	11.87	9.89	11.80	9.05
Construction debris	27.58	6.07	6.16	5.38	3.83
Home items	18.49	4.07	3.82	3.55	2.02
TOTAL	100.00	22.01	19.87	20.73	14.90

3.5.5 Product Packaging Items

Table 3.10 presents the results for product packaging items. This category consists of all types of packaging associated with a product at the time it is removed from the shelf at a retail store. Cigarette and cigar packages accounted for 32.55% of packaging items, followed by plastic packaging (17.91%), paper packaging (10.59%), and paperboard boxes (9.59%).

Table 3.10 Distribution of Product Packaging Items

PRODUCT PACKAGING ITEM	1997 % of total Product Packaging Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
Cigarette/cigar packages	32.55	4.58	4.05	4.93	4.65
Plastic packaging	17.91	2.52	2.29	1.08	0.68
Paper packaging	10.59	1.49	0.89	0.50	1.09
Paperboard boxes	9.59	1.35	1.08	0.99	1.48
Paper beverage casings	8.53	1.20	1.53	1.10	0.74
Aluminum foil/foil tins	5.47	0.77	0.65	0.41	0.37
Zipper/sandwich bags	3.70	0.52	0.51	0.58	0.48
Foil packaging	3.41	0.48	0.34	0.19	0.56
Dip/chew packages	3.06	0.43	0.47	0.39	0.42
Ice bags	1.49	0.21	0.29	0.38	0.33
Plastic/paper combo packaging	1.14	0.16	0.22	0.30	0.24
Feed bags	1.00	0.14	0.05	0.12	0.10
Six pack rings	0.78	0.11	0.14	0.18	0.18
Polystyrene foam packaging	0.78	0.11	0.18	0.50	0.40
TOTAL	100.00	14.07	12.69	11.65	11.72

3.5.6 Printed Paper Items

Table 3.11 presents the results for printed paper items identified in the survey, which include newspapers, books, magazines, advertisements, school papers, business papers, and lottery tickets. Stationary, school, and business paper together account for about 45% of the printed paper items identified.

Table 3.11 Distribution of Printed Paper Items

PRINTED PAPER ITEM	1997 % of total Printed Paper Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
Stationary/school/business	44.61	2.40	2.31	2.03	1.45
Newspaper/books/mags/ads	39.59	2.13	2.45	2.24	2.60
Lottery tickets	15.80	0.85	0.72	0.82	0.56
TOTAL	100.00	5.38	5.48	5.09	4.61

3.5.7 Outer Packaging Items

Table 3.12 presents the results for outer packaging items, which consist of the bags or boxes into which items from stores or restaurants are placed. There may be some overlap between this category and the product packaging category. For example, a cardboard box may have contained an off-the-shelf item, such as a small appliance. However, for the purposes of this study, all cardboard items were categorized as outer packaging. Paper bags represent another example of possible overlap. Many paper bags used specifically to hold take-out food items were categorized generically as "paper bags." Corrugated cardboard boxes (33.07%), plastic other bags (20.93%), and paper small bags (18.86%) were the largest components in this category.

Table 3.12 Distribution of Outer Packaging Items

OUTER PACKAGING ITEM	1997 % of total Outer Packaging Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
Corrugated cardboard boxes	33.07	1.28	1.20	0.39	0.91
Plastic other bags	20.93	0.81	1.11	0.96	0.93
Paper small bags	18.86	0.73	0.97	1.13	1.03
Plastic retail bags	14.73	0.57	0.96	0.65	0.60
Paper other bags	9.56	0.37	0.42	0.12	0.10
Paper retail bags	2.84	0.11	0.26	0.13	0.41
TOTAL	100.00	3.87	4.92	3.38	3.98

3.5.8 Non-beverage Containers

Table 3.13 presents the results for non-beverage container items, which include all jars, bottles, boxes, cans, and lids that are unrelated to containing any type of beverage. Plastic jars, bottles, and boxes combined account for 43.62% of non-beverage container items, followed by aluminum cans (19.58%) and container lids (15.13%).

Table 3.13 Distribution of Non-Beverage Container Items

NON-BEVERAGE CONTAINER ITEM	1997 % of total Non-Beverage Container Items	1997 % of large litter	1996 % of large litter	1995 % of large litter	1994 % of large litter
Plastic jars/bottles/boxes	43.62	1.47	0.89	1.10	0.73
Aluminum cans	19.58	0.66	0.22	0.32	0.32
Container lids	15.13	0.51	0.45	0.38	0.19
Glass jars/bottles	11.87	0.40	0.04	0.26	0.03
Steel cans	9.20	0.31	0.39	0.31	0.39
Aerosol cans	0.59	0.02	0.03	0.03	0.06
TOTAL	100.00	3.37	2.02	2.40	1.72

3.6 SMALL LITTER RESULTS

Table 3.14 presents the results of the small litter survey. For this part of the study, three transects 1-foot long and up to 15 feet wide were surveyed. The small litter survey documented 11,241 pieces of litter smaller than 4 square inches. Cigarette butts accounted for one-fourth of the small litter items (24.49%), followed by glass pieces (18.48%), paper (10.79%), and other/miscellaneous pieces (9.58%).

Table 3.14 Distribution of Small Litter Items

SMALL LITTER ITEM	1997 Total number of items	1997 % if small litter	1996 % of small litter	1995 % of small litter	1994 % of small litter
Cigarette butts	2753	24.49	23.86	25.37	33.45
Glass pieces	2077	18.48	21.44	18.56	8.89
Paper	1213	10.79	13.18	14.06	16.75
Other/miscellaneous	1077	9.58	6.83	0.46	2.39
Hard plastic pieces	941	8.37	9.09	10.04	9.20
Rubber pieces	782	6.96	5.31	5.37	4.99
Polystyrene foam pieces	766	6.81	6.59	8.55	9.13
Plastic film	651	5.79	6.64	8.25	5.70
Aluminum pieces	449	3.99	2.93	4.74	3.35
Bottle caps	122	1.09	0.66	0.95	1.24
Candy wrappers	115	1.02	1.22	1.01	2.15
Polystyrene foam peanuts	114	1.01	0.80	0.77	1.36
Other metal pieces	95	0.85	0.85	1.04	1.48
Straws	86	0.77	0.61	0.82	0.92
TOTAL	11241	100.00	100.00	100.00	100.00

3.7 SITE CHARACTERISTICS

Each of the following characteristics is considered to be a factor that potentially could affect the accumulation of litter:

1. Site type
2. Number of lanes
3. Whether a road was divided or undivided
4. Whether a site was part of an Adopt-A-Highway or similar program
5. Whether a site was within a mile of a fast-food or convenience store
6. Whether there was a visible traffic signal
7. Grass height
8. Whether there was a catchpoint in or at the edge of a site.

These characteristics were used as variables in the data analysis to determine whether they were statistically significant factors in the amount of litter at a particular site. The following sections describe each site characteristic and present the number of sites and the percentage of total sites for each characteristic for the 1994-1997 survey. Figure 3.3 on page 37 shows the approximate locations of the 1997 survey sites.

3.7.1 Site Type

The site type distribution is presented in Table 3.15. About 83% of the sites were rural sites. Urban/business and residential sites together represented about 17% of the sites, and less than 1% were industrial sites. The four site type classifications were defined as follows:

Rural: Roads along primarily agricultural land with some houses in the area.

Urban/Business: Roads in higher population areas where there was a significant concentration of businesses.

Residential: Roads in areas where the primary land use was housing.

Industrial: Roads in areas where the primary activity was industry.

Table 3.15 Site Type Distribution

SITE TYPE	1997 Number of Sites	1997 % of Total Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total sites
Rural	555	82.8	81.3	82.8	79.1
Urban/Business	65	9.7	9.7	9.3	10.8
Residential	48	7.2	8.4	7.3	8.2
Industrial	2	0.3	0.6	0.6	1.9

3.7.2 Number of Lanes

Table 3.16 presents the site distribution by number of lanes. Approximately 79% of the sites were located on 2-lane roads, 18% were on 4-lane roads, and 2% were on 6-lane roads. The sample in 1997 included five sites on 8-lane roads, which had not been encountered in previous years.

Table 3.16 Distribution by Number of Lanes

NUMBER OF LANES	1997 Number of Sites	1997 % of Total Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
2	530	79.1	79.4	81.9	81.4
4	121	18.1	17.8	17.3	16.4
6	14	2.1	2.8	0.8	2.2
8	5	0.7	0.0	0.0	0.0

3.7.3 Divided Roads

Table 3.17 presents the distribution of sites on divided and undivided roads. About 81% of the sites were located on undivided roads and 19% were on divided roads.

Table 3.17 Divided Roads Distribution

DIVIDED ?	1997 Number of Sites	1997 % of Total Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Yes	126	18.8	19.1	17.6	17.2
No	544	81.2	80.9	82.4	82.8

3.7.4 Adopted Road Programs

Table 3.18 presents the distribution of adopted roads. Volunteer groups that collect litter from the sites on a regular basis have adopted many stretches of roadways throughout Florida through programs such as "Adopt-A-Highway" and "Adopt-A-Road." At 66 of the 670 survey sites (9.9%), surveyors noted a sign indicating that the site was an "adopted" area. For the purposes of this study, no distinction was made between Adopt-A-Highway and other similar litter cleanup programs; all such sites are described as adopted road sites.

Table 3.18 Adopted Road Distribution

ADOPTED ROAD	1997 Number of Sites	1997 % of Total Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Yes	66	9.9	11.0	10.8	10.8
No	604	90.1	89.0	89.2	89.2

3.7.5 Fast-Food or Convenience Store Within One Mile

Sites were classified as to whether they were within one mile of a fast-food or convenience store so that it could be determined whether there was a significant difference in the amount of litter found on these sites. Table 3.19 shows the number and percentage of these sites. In 1997, 16.7% of the sites surveyed were within a mile of a fast-food or convenience store.

Table 3.19 Distribution of Sites Within One Mile of a Fast-Food or Convenience Store

WITHIN 1 MILE OF FF/CONV ?	1997 Number of Sites	1997 % of Total Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Yes	112	16.7	16.0	13.7	28.7
No	558	83.3	84.0	86.3	71.3

3.7.6 Visible Traffic Signal Within One Mile

Interest was expressed in determining whether the amount of litter was greater in areas near roadway intersections. Therefore, surveyors noted whether sites were located within one mile of a visible traffic signal, and about 15% of the sites surveyed were in this category, as shown in Table 3.20.

Table 3.20 Distribution of Sites within One Mile of a Visible Traffic Signal

VISIBLE TRAFFIC SIGNAL ?	1997 Number of Sites	1997 % of Total Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Yes	97	14.5	13.6	12.1	16.4
No	573	85.5	86.4	87.9	83.6

3.7.7 Grass Height

Table 3.21 presents the distribution of sites by grass height. Grass height affects the visibility of litter, and may also provide information with which to estimate how recently a site was mowed. Therefore, surveyors noted whether the grass height at each survey site was less than 3 inches, 3-6 inches, or more than 6 inches. About 85% of the sites had grass heights of 6 inches or less.

Table 3.21 Distribution of Sites by Grass Height

GRASS HEIGHT	1997 Number of Sites	1997 % of Total Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Under 3 inches	286	42.7	26.9	33.0	29.9
3-6 inches	282	42.1	62.7	51.9	55.6
More than 6 inches	102	15.2	10.4	15.1	14.5

3.7.8 Catchpoints

The five classifications for catchpoints were fence, hedge, mow line, other, and none. "Other" refers to any catchpoint not identifiable as a fence, hedge, or mow line. For example, the catchpoint might be a ditch located in the site or at the edge of the site. About 58% of the sites surveyed had no catchpoint, as shown in Table 3.22.

Table 3.22 Distribution of Sites by Catchpoint

CATCHPOINT	1997 Number of Sites	1997 % of Total Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Fence	36	5.4	5.4	9.3	14.2
Hedge	26	3.9	3.9	6.1	13.4
Mow Line	154	23.0	23.0	20.9	18.3
Other	64	9.5	9.6	16.3	11.9
None	390	58.2	57.4	47.5	42.2

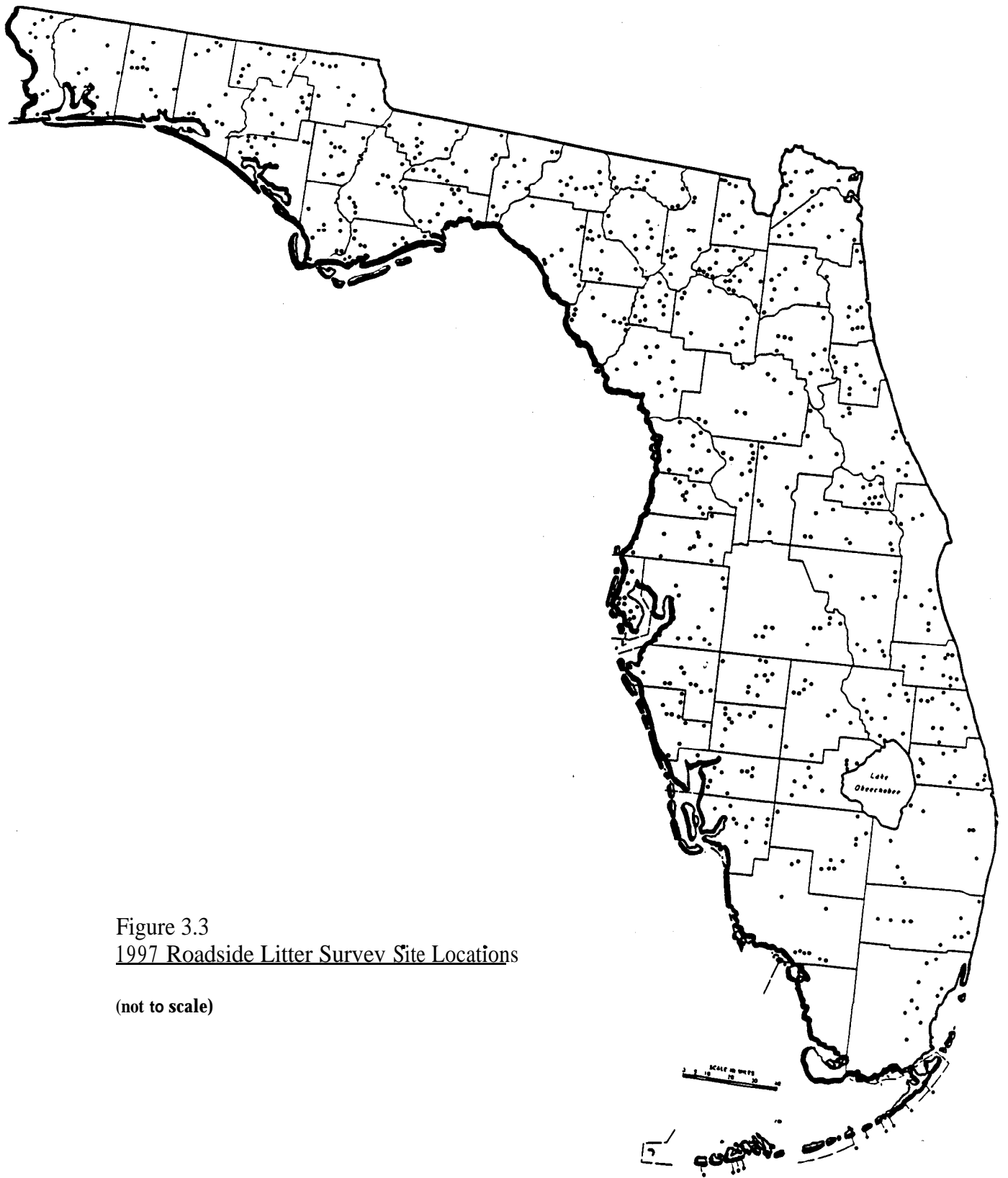


Figure 3.3
1997 Roadside Litter Survey Site Locations

(not to scale)

4. DATA ANALYSIS

The objective of the Florida Litter Study is to measure progress toward the Legislature's litter reduction goal. Info Tech, Inc., a statistical consulting firm in Gainesville, Florida, has analyzed the roadside litter survey data each year to determine whether a reduction has occurred.

This chapter presents the results of the statistical analysis of the 1997 data, including comparisons of the 1997 with the data collected in previous years. In 1997 the Center surveyed 10 sites per county, providing a total of 670 sites. The 1995 and 1996 surveys also sampled 670 sites; the 1994 survey sampled 268 sites (four per county).

The data are analyzed in two ways:

The litter density analysis is equivalent to analyzing the data on "square foot" basis. The total area surveyed varies from year to year depending on the widths of the variable-width sites.

The total number of items analysis is equivalent to analyzing the data on a "linear foot" basis because all the sites are equal in length (200 feet).

To accurately determine any changes, and to determine whether the changes were statistically significant, Info Tech uses a very sophisticated computer-based statistical program which enables the statistician to make subtle adjustments in the data so that one year's data can be compared to another year's data. This allows the statistician to make a determination as to whether the changes were due to a difference in the characteristics of the sites that were sampled or whether the difference is due to the presence of more or less litter. Adjustments are made for differences in a number of site characteristics, including site type, grass height, adopted roads, proximity to a visible traffic signal, proximity to a fast food/convenience store, number of lanes, divided highway, and catch point. (For a description of the site characteristics, see Chapter 3.) Several other characteristics were also evaluated, including area of the site, whether the site had a fixed or variable width, and differences among counties.

4.1 LARGE LITTER RESULTS

4.1.1 1997 Data Compared to Previous Years

The analysis showed that for large litter items, there was significantly more litter in 1997 than in 1994, 1995, and 1996. It should be noted that the two statistical approaches - litter density and total number of items - yielded almost identical results.

Litter Density: There was an estimated 17% increase from 1994 to 1997, a 24% increase from 1995 to 1997, and a 19% increase from 1996 to 1997. A 95% confidence level provides a range within which the "true change" in litter density may fall. The ranges for the 1997 data were:

- 1994 to 1997: True change ranged from an 7% increase to a 26% increase, for an estimated 17% increase.
- 1995 to 1997: True change ranged from a 17% increase to a 30% increase, for an estimated 24% increase.
- 1996 to 1997: True change ranged from a 11% increase to a 26% increase, for for an estimated 19% increase.

Other year-to-year comparisons were statistically non-significant, with an estimated 8% reduction from 1994 to 1995, a estimated 2% reduction from 1994 to 1996, and an estimated 6% increase from 1995 to 1996.

Total Number of Items: There was an estimated 18% increase from 1994 to 1997, a 23% increase from 1995 to 1997, and an 18% increase from 1996 to 1997. A 95% confidence level provides a range within which the "true change" in total number of items may fall. The ranges for the 1997 data were:

- 1994 to 1997: True change ranged from an 8% increase to a 26% increase, with an estimated 18% increase.
- 1995 to 1997: True change ranged from a 16% increase to a 29% increase, with an estimated 23% increase.
- 1996 to 1997: True change ranged from a 11% increase to a 24% increase, with an estimated 18% increase.

Other year-to-year comparisons were statistically non-significant, with an estimated 6% reduction from 1994 to 1995, an estimated 0.2% reduction from 1994 to 1996, and an estimated 6% increase from 1995 to 1996.

A total of 34,794 large litter items were identified in the 1997 study, compared to 32,633 in 1996, for an increase of 2161 items. A review of the item counts revealed that 42% of the overall 1996-to-1997 increase, or 901 of the 2161 items, were vehicle and tire debris items. Many other large litter categories also showed large increases in the number of items counted in 1997. However, because vehicle and tire debris was the most numerous item, the Center asked project statisticians to determine whether the statistically significant increase in large litter could be disproportionately attributed to the vehicle and tire debris counts. A re-analysis showed that removing vehicle and tire debris from the statistical models for 1994-97 would still produce the statistically significant increases in large litter reported above.

4.1.2 Significant Effects for Large Litter Items

The effects of various site characteristics were evaluated to determine their relationship with the amount of large litter on the survey sites. Analyses were performed for both litter density and total number of items.

In 1997, the sites classified as rural had significantly higher amounts of litter than the urban and residential site types surveyed in 1997. Other significant effects were grass height and divided highway. In 1997, the divided highway effect replaced the number of lanes effect that was present in previous years. This is not surprising since the two effects are highly correlated, i.e., the greater the number of lanes, the greater the chance that the highway will be divided. Sites on adopted roads had 36% less large litter in 1995 and 20% less large litter in 1996; in 1997, a statistically significant effect for adopted roads was not found. Two site characteristics, proximity to a fast-food or convenience store and proximity to a visible traffic signal, were not significant effects for large litter in any of the survey years.

Table 4.1 summarizes the statistically significant effects for large litter during the four years of the study.

Area: In 1997, the mean density of large litter decreased as the area of the site increased; the total number of large litter items per site increased as the area increased.

Site Type: The mean density of large litter and the total number of items for rural sites was greater than for urban and residential sites. Rural sites had a 37% (9% to 72%)¹ higher litter density than urban sites, and 34% (7% to 67%) more litter items per site. Rural sites had a 43% (14% to 79%) higher litter density than residential sites, and 42% (14% to 76%) more large litter items per site.

Grass Height: The mean litter amount increased (statistically significantly) as grass height increased. Sites with a grass height of 3-6 inches had an estimated 22% higher litter density (9% to 33%) than sites with a grass height of less than 3 inches, and 21% (9% to 32%) more large litter items per site.

Divided Highway: The mean litter amount for divided roads was greater than for undivided roads. The divided road sites had 44% (21% to 72%) more litter density than undivided roads, and 43% (20% to 69%) more large litter items per site.

¹The numbers in parenthesis are 95% confidence intervals; this convention will be throughout this chapter.

Table 4.1 Significant Effects for Large Litter, 1994-1997

Effects	1994	1995	1996	1997
Number of Lanes	X	X	*	
Grass Height	X	X	X	X
Adopted Roads		X	X	
Catch Point		X	*	
Site Type				X
Divided Highway				X
Traffic Signal				
Fast-Food/Convenience				

X = Statistically significant.

* = Borderline statistical significance.

4.2 SMALL LITTER RESULTS

4.2.1 1997 Data Compared to Previous Years

The analysis showed that for small litter items, there was significantly more litter in 1997 than in 1994, 1995, and 1996. As with large litter, the two statistical approaches - litter density and total number of items - yielded almost identical results.

Litter Density: There was an estimated 42% increase from 1994 to 1997, a 39% increase from 1995 to 1997, and a 24% increase from 1996 to 1997. A 95% confidence interval provides the following ranges of "true change":

1994 to 1997: True change ranged from a 34% increase to a 44% increase, with an estimated increase of 42%.

1995 to 1997: True change ranged from a 33% increase to a 45% increase, with an estimated increase of 39%.

1996 to 1997: True change ranged from a 16% increase to a 31% increase, with an estimated increase of 24%.

Other year-to-year comparisons for small litter were also statistically significant. From 1994 to 1996, there was an estimated 24% increase, and from 1995 to 1996, there was an estimated 21% increase. There was a non-significant difference between 1994 and 1995, when there was an estimated 4% increase.

Total Number of Items: There was an estimated 40% increase from 1994 to 1997; a 37% increase from 1995 to 1997, and a 21% increase from 1996 to 1997.

1994 to 1997: True change ranged from a 33% increase to a 47% increase, for an estimated increase of 40%.

1995 to 1997: True change ranged from a 32% increase to a 43% increase, for an estimated increase of 37%.

1996 to 1997: True change ranged from a 14% increase to a 28% increase, for an estimated increase of 21%.

Other year-to-year comparisons were also significant. There was an estimated 25% increase from 1994 to 1996, and an estimated 21% increase from 1995 to 1996. There was a non-significant estimated increase of 5% from 1994 to 1995.

4.2.2 Significant Effects for Small Litter Items

The effects of various site characteristics were evaluated to determine their relationship with the amount of small litter on the site. Analyses were performed for both litter density and total number of items.

In 1997, the characteristics for which significant differences were found were: proximity to a visible traffic signal, number of lanes, grass height. Proximity to a fast-food/convenience store showed a borderline statistical significance. Three site characteristics - catch point, divided highway, and adopted road - were not significant effects for small litter in any of the survey years.

Table 4.2 summarizes the statistically significant effects for small litter for the four years of the study.

Number of Lanes: The mean litter amount increased as the number of lanes increased. The mean litter amount for sites on four-lane roads was significantly more than for sites on two-lane roads. The sites on four-lane roads had an estimated 58% (29% to 93%) higher litter density than sites on two-lane roads, and 53% (28% to 84%) more litter per site.

Visible Signal: The mean litter amount within visibility of a traffic signal was greater than that outside the visibility of a traffic signal. The presence of a traffic signal increased the mean litter density by an estimated 52% (17% to 99%), and the mean items per site by an estimated 44% (13% to 84%).

Grass Height: The mean litter amount decreased (statistically significantly) as grass height increased. The sites with a grass height less than 3 inches had an estimated 25% (4% to 50%) more litter density than sites with a grass height of between 3 and 6 inches, and 24% (5% to 46%) more litter per site. They had 67% (27% to 121%) more litter density than sites with a grass height of greater than 6 inches, and 58% (23% to 104%) more litter per site. The sites with a grass height of between 3 and 6 inches had an estimated 34% (5% to 71%) more litter density than sites with a grass height of greater than 6 inches and 28% (3% to 60%) more litter per site.

Fast-Food/Convenience Store: The mean litter amount for sites within one mile of a fast-food or convenience store was greater than for other sites. The statistical level was just under the .05 level at .048 for litter density and .035 for litter per site. The presence of a fast-food/convenience store increased the mean small litter density by an estimated 27% (0% to 62%), and the mean items per site by an estimated 26% (1% to 57%).

Table 4.2 Significant Effects for Small Litter, 1994-1997

Effects	1994	1995	1996	1997
Number of Lanes	X	X	X	X
Grass Height		X		X
Traffic Signal	X	X	X	X
Fast-Food/Convenience	X	X		*
Site Type			X	X
Catch Point				
Divided Highway				
Adopted Road				

X = Statistically significant.

* = Borderline statistical significance.

4.3 VARIABILITY

In 1994, the statistical analysis revealed a data variability of $\pm 15\%$. Project statisticians

advised the Center that an increase in the number of sites surveyed would be likely to reduce the variability. The Center increased the number of survey sites from 268 (four per county) in 1994 to 670 (10 per county) in 1995.

As predicted, the variability decreased to approximately 11%. Increasing the number of sites beyond 670 may have resulted in an even lower variability; however, the Center determined that doing so would not be cost effective, and $\pm 11\%$ was considered an acceptable level of variability.

In 1996 and 1997, the Center continued to survey 670 sites each year, and the variability has remained in the range of 9-10%.

5. DISCUSSION

5.1 OVERVIEW

The cornerstone of the 1993 legislation that created the Florida Litter Study was a statewide litter reduction goal of 50%, to be accomplished between 1994 to 1997. The Florida Center for Solid and Hazardous Waste Management conducted a baseline litter survey in 1994, and the surveys conducted in 1995 and 1996 indicated that the amount of litter on Florida's roadsides was not decreasing but was remaining fairly stable. In 1997, the survey indicated a statistically significant increase in the amount of litter large litter items found on Florida's roadsides. The estimated increase for 1994-1997 was 17% based on litter density, and 18% based on the total number of items.

This chapter presents a discussion of the results in the context of what was learned during the four years of the Florida Litter Study. The chapter also outlines the issues that need to be addressed during the course of future research.

5.2 LARGE LITTER vs. SMALL LITTER

The Center's pilot studies had indicated that cigarette butts were the most numerous single small litter item. Also, the frequent mowing of Florida's roadsides has a mulching effect on litter. Nevertheless, the Litter Study Advisory Committee encouraged the Center to include cigarette butts and other small litter items in the study.

In response to the Committee's concerns, the Center's methodology made a distinction between "large litter" and "small litter," because it would be impractical to attempt to count every small piece of paper, glass, hard plastic, or polystyrene foam, for example. Items 4 square inches or larger in size were classified as "large litter" and items under 4 square inches were classified as "small litter." The data analysis is performed independently for large and small litter.

Most of the "small" litter items identified in the study are broken or mulched pieces of "large" litter. For example, eight of the study's 14 small litter categories (pieces of glass, paper, hard plastic, aluminum and other metal, rubber, polystyrene foam, and plastic film) together accounted for about 60-70% of all small litter items during the 1994-97 surveys. Cigarette butts accounted for 24-33% of small litter items. The other "whole" small litter items - bottle caps, candy wrappers, polystyrene foam peanuts, and straws - together accounted for less than 6% of small litter items.

Of the two classifications, it is obvious that large litter warrants more concern. Large litter items more visible along the roadside, and they tend to become "small litter" when mowed. Large litter items can be easily targeted in educational efforts to prevent littering behavior.

5.3 FACTORS AFFECTING LITTER QUANTITY AND COMPOSITION

The Center's previous reports have briefly discussed the factors that may affect the quantity and composition of litter along Florida's roadsides. The Center's review of litter studies in Texas and Oklahoma indicated that in states where statewide mass media campaigns were conducted over a period of time, subsequent reductions in the quantity of litter were observed.

State and local government agencies in Florida spend millions of dollars each year cleaning up litter along Florida's roadsides. Cutbacks in either state or local funding of existing litter control programs can be expected to contribute to an increase in litter. Volunteer efforts also require substantial resources, as local government staff are needed to coordinate and support volunteer litter education and prevention efforts.

With regard to the composition of litter, changes in local recycling programs, or in the availability of resources for litter cleanup and prevention efforts, can have predictable effects on litter. Local recycling programs periodically change as result of fluctuating markets for recovered items and changes in collections costs. Reductions in the availability of curbside or dropoff recycling for a particular material, such as glass or plastic, may contribute to increased littering of items made from those materials.

5.4 ADOPTED ROADS

Volunteer-based adopted road programs have made an important contribution to controlling roadside litter in many states, including Florida. The results from the Center's 1995 and 1996 annual surveys provided evidence of the strong connection between adopted road programs and reductions in litter.

In 1995, the litter density for large litter items on adopted sites was 36% less than on non-adopted sites, and the adopted sites had 33% fewer items per site than non-adopted sites. In 1996, the litter density for large litter items was 20% less on adopted sites than on non-adopted sites, and adopted sites had 19% fewer items per site than non-adopted sites. The data for 1997 did not show a statistically significant difference between the amount of litter on adopted and non-adopted sites.

5.5 KEEP FLORIDA BEAUTIFUL, INC.

In 1993 the Legislature created Keep Florida Beautiful, Inc. (KFB) and charged the organization with developing a statewide anti-littering media campaign and coordinating grass roots litter prevention efforts. KFB is governed by a broad-based Board of Directors which includes representatives from business, government, civic, and environmental organizations.

KFB functions as a working environmental public-private partnership and serves as the umbrella organization coordinating Florida's efforts to reduce litter. KFB coordinates a variety of

programs, such as the annual Great Florida Cleanup, that involve thousands of volunteers whose efforts save the state hundreds of thousands of dollars in avoided litter cleanup costs.

KFB is the state affiliate of Keep America Beautiful, Inc. (KAB). KFB organizes and provides support for Florida's local KAB affiliates. These local affiliates provide the volunteer-driven grass roots infrastructure that supports and sustains educational programs to prevent litter. KAB estimates that the cost benefit for Florida's local affiliates for each dollar provided in government funding is \$4.45 in services generated primarily through volunteers and the private sector.

In 1993, the Legislature provided KFB with only 25% of the recommended funding for a statewide litter prevention program, and no funding was provided in subsequent years. Although many leading business, civic, government and environmental organizations have agreed to participate in the program, KFB recognized that without funding for the statewide campaign, progress toward the Legislature's litter reduction goal was not likely.

Local KAB affiliates continue to promote and coordinate the adopted roads programs which have been shown to substantially reduce the litter found on Florida's roadsides. Local affiliates also organize community clean-ups and promote litter education efforts in schools and in the business community.

5.6 LITTER REDUCTION EFFORTS IN OTHER STATES

During the past 10 years, several states have conducted successful litter reduction campaigns. Programs in Texas, Oklahoma, and Pennsylvania, for example, have provided evidence that grass roots participation combined with a statewide media campaign can be effective in reducing litter.

Texas was the first state to develop an Adopt-A-Highway Program. Texas also developed an effective media campaign, "Don't Mess With Texas," aimed at the group it had determined to be the most likely source of roadside litter: white blue-collar males in the 18-34 age group who drove pickup trucks. Texas spent \$2 million per year on its media campaign and calculated that the state saved approximately \$2-4 million/year on litter cleanup costs over and above the cost of the media campaign.

Surveys conducted in Texas showed that roadside litter was reduced by 72% over a five-year period. Funding cuts for 1997 reduced annual spending on the media campaign to \$1.5 million. Staff at the Texas Department of Transportation, who manage the state's litter prevention efforts, are concerned about the potential impacts of the cut in funding as the frequency of radio and television ads is reduced.

Oklahoma initiated a two-pronged litter reduction campaign in 1987. An Adopt-A-Highway program was started to get citizens involved in litter cleanups. At the same time, the state initiated a media campaign centered around the slogan, "Don't Lay That Trash on

Oklahoma." The media campaign was based on appeals to conscience and a sense of community

spirit.

A litter survey conducted by the Oklahoma Department of Transportation in 1989 showed that litter decreased by 23% from 1988 to 1989. Studies conducted in 1982 and 1989 by University of Oklahoma researchers found that in 1989, people were more likely to feel guilty about littering and were more likely to believe they would lose the respect of other people if they littered.

In 1997, the Pennsylvania Department of Environmental Protection launched "Don't Be a Litterbug," a new statewide litter education and awareness campaign. The state is concerned about litter's impacts on tourism, on real estate values, on economic development, and on safety and health. Concerns about roadside littering have also been heightened in recent years as the state's farmers began reporting losses of millions of dollars as a result of glass and metal litter that has damaged equipment and injured animals.

One of the innovative features of the Pennsylvania program is a toll-free hotline citizens can use to report the license plate numbers of littering motorists. Reported offenders receive a litter bag for their car and a letter explaining the economic and environmental impacts of littering. During its first seven months, the hotline received 4,740 calls.

5.7 LITTERING BEHAVIOR: RESEARCH HIGHLIGHTS

Research has shown that litter is a behavioral problem. Attitudes can be changed through volunteer-based community education programs and a targeted statewide media campaign.

In most studies performed with subjects of various ages, young people littered more than older subjects. Researchers suggest that younger people are less affected by societal norms and have less fear of negative consequences. In many studies, males were more likely to litter than females, although in a few studies, there was no significant difference between male and female littering behavior.

Some researchers have found that littering, like vandalism, is contagious, and that the presence of litter, trash, and debris in an area encourages crime. It has also been shown that when waste receptacles are conveniently located, littering is reduced. Researchers suggest that a nearby receptacle catches a person's attention, and that when people become aware of that option, they are more likely to "do the right thing."

5.8 FUTURE RESEARCH

Litter is a costly problem. Many states, including Florida, recognize that resources expended to clean up litter could be better spent on more important services. Litter is especially undesirable in a state whose economy is heavily dependent upon tourism. Florida is a vacation destination for 43 million people a year from all over the world, and people want to visit a place that is clean and beautiful. The speed with which Florida's population is growing also lends urgency to the need for ongoing educational efforts to prevent littering on a statewide basis.

During 1997-98, the Center will build on what was learned during the past four years and and broaden the scope of its research beyond the measurement of litter. The Center will conduct a comprehensive analysis of the costs of managing litter at the state and local levels, including costs to both the public and private sectors. The project will include a review of the economic and social benefits associated with preventing litter and descriptions of successful litter prevention programs.

The Center's research efforts will include:

1. Community Programs: Survey selected Florida counties and municipalities to identify litter cleanup, prevention and enforcement programs and costs. A sufficient number of counties and municipalities will be contacted to determine differences, if any, in litter management between smaller and larger communities. The survey will include contacts with organizations involved in litter cleanup and prevent efforts. The effectiveness of community-based programs will be examined, and to the extent possible, differences between communities with Keep Florida Beautiful affiliate organizations and those without such organizations will be identified.
2. State Programs in Florida: Perform a comprehensive review of current litter management efforts and expenditures by state agencies, including the Department of Transportation's Adopt-A-Highway program, the Adopt-A-Shore Program, litter cleanup efforts in state parks and other state lands.
3. Industry Programs: Contact trade associations and businesses representative of Florida's private sector, including the fast food and convenience store industry, the hotel/motel industry, theme parks, and shopping centers to obtain information on private sector litter management programs and costs.
4. Programs in Other States: Contact selected states within the United States to obtain and review litter legislation and to identify litter management programs, program costs, and measures of effectiveness. Emphasis will be placed on identifying innovative and successful litter management programs in other states.
5. Economic and Social Impacts of Litter: Conduct a literature review of previous research on the economic and social impacts of litter. Potential impacts include increased crime, neighborhood decline, reduction of property values, and a lowering of quality of life. The

Center will also examine the reasons for littering behavior and effective methods of changing such behavior.

The Center anticipates that the results of this research will provide the Florida Legislature with needed information on successful, cost-effective litter prevention measures that would help to preserve and enhance Florida's economic and environmental well-being.