



The Florida Litter Study: 1996

April 1997

Conducted by

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

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Gainesville, FL 32609

for

THE FLORIDA LEGISLATURE

and

**FLORIDA DEPARTMENT OF
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EXECUTIVE SUMMARY

Litter is a stubborn and costly solid waste management problem that affects Florida's economy, environment, and quality of life. State agencies, local governments, and the business community spend millions of dollars each year to clean up litter on roadsides, city streets, loading docks, parking lots, public lands, rivers, streams, beaches, parks, and recreation areas.

The economic consequences of unsightly litter are far-reaching. To calculate the total annual costs of cleaning up litter throughout the state, it would be necessary to include the labor costs of thousands of small and large businesses cleaning up their sidewalks, parking lots, and loading docks on a daily basis; the costs of code enforcement and litter control personnel at the county and city levels; the Florida Department of Transportation's costs associated with the maintenance of roadsides throughout the state; and the efforts of thousands of volunteers who clean up adopted roads and parks.

In 1993 the Florida Legislature established a 50% litter reduction goal for the period of January 1, 1994 through January 1, 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 1996 study. Analysis of the data for 1994, 1995, and 1996 has indicated that the amount of litter along Florida's roadsides has remained fairly stable.

While roadsides are not the only places where litter accumulates, they are a useful indicator of the amount of litter in the environment. In 1996, the Center surveyed 10 roadside sites in each of Florida's 67 counties, for a total of 670 sites. The survey counted 42,047 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.

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 can be 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 16.72% of large litter

items in 1996.

Non-Beverage Containers include jars, bottles, boxes, cans and lids which are not related to any type of beverage. Non-beverage containers accounted for 2.03% of large litter items in 1996.

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 12.69% of large litter items in 1996.

Outer Packaging includes bags or boxes into which items from stores or restaurants are placed. Outer packaging accounted for 4.92% of large litter items in 1996.

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 22.59% of large litter items in 1996.

Printed Paper Items include newspapers, books, magazines, advertisements, school or business papers and lottery tickets. Printed paper items accounted for 5.48% of large litter items in 1996.

Debris Items include construction debris, vehicle debris, tire pieces and home items (appliances, furniture, clothing, etc.). Debris items accounted for 19.87% of large litter items in 1996.

Miscellaneous Items include all items that cannot be specifically identified, such as items made of paper, paperboard, cardboard, plastic, plastic film, poly styrene foam and glass. Miscellaneous items accounted for 15.75% of large litter items in 1996.

One of the major categories, beverage containers, has shown a notable reduction in percentage of total large litter. Beverage container items accounted for 21.07% of large litter items in 1994, 16.59% in 1995, and 16.72% in 1996. Debris items increased somewhat; they accounted for 14.90% in 1994, 20.73% in 1995, and 19.87% of large litter items in 1996. The other major categories have remained fairly consistent during the three annual surveys.

Large Litter by Material Type

For purposes of comparison, the 72 categories of large litter were grouped by material type. A decrease was seen in aluminum, while the results for the other material types were fairly consistent with previous years.

In 1996, paper items were the most numerous, accounting for 29.46% of large litter items identified. "Mixed" items, made with more than one material where the materials are not bonded together, accounted for 32.17%. Plastic items were the third most numerous, accounting for 23.34% of large litter items in 1996. Aluminum items accounted for 8.63% of large litter items in 1996, down from 10.20% in 1995 and 12.80% in 1994. Glass items accounted for 5.42% of large litter items in 1996. Materials accounting for less than 1% of large litter were steel and "composites," which are made with more than one material where the materials are bonded together.

Small Litter Categories

Items smaller than 4 square inches are classified either as specific items (cigarette butts, candy wrappers, bottle caps, straws, plastic film, polystyrene foam peanuts) or as "pieces" of a material (glass, paper, hard plastic, polystyrene foam, rubber/tire, aluminum, other metal). Cigarette butts, the most numerous small litter item, accounted for 23.86% of small litter in 1996, down from 25.37% in 1995 and 33.45% in 1994. Glass pieces accounted for 21.44% in 1996, up from 18.56% in 1995 and 8.89% in 1994. Paper accounted for 13.18%. Each of the remaining small litter categories contributed less than 10% to the overall total of small litter items.

Comparison of 1996 Data with Previous Years

The results of the 1996 roadside litter survey indicate that evidence of an overall reduction in litter is inconclusive. For large litter, a 4% reduction from 1994 to 1996 was not statistically significant because of the $\pm 11\%$ variability of the data.

For small litter, an increase of 24% from 1994 to 1996 was statistically significant, but this result should not be viewed as an increase in litter overall. Most of the small litter items identified in the survey are broken or mulched pieces of large litter.

While small litter is persistent in the environment, it is the large litter items that are more visible from passing cars. Large litter can be more effectively targeted in prevention and education campaigns, and an eventual reduction in large litter can be expected to produce a reduction in small litter.

1. INTRODUCTION

1.1 OVERVIEW

In 1993 the Florida Legislature established a 50% litter reduction goal for the period of January 1, 1994 through January 1, 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 third annual roadside litter survey, which the Center conducted in 1996. Two previous reports presented the results of the 1994 and 1995 surveys.

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

Chapter 2 of this report summarizes the methodology used in the roadside survey. Chapter 3 presents the results of the 1996 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 1996.

1.2 FLORIDA'S LITTER REDUCTION GOAL

In 1988, the Florida Legislature revised the 1971 Florida Solid Waste Disposal Act and changed the way solid waste was managed in Florida. The 1988 Solid Waste Management Act established an Advanced 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 also 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.

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 survey.

A review of litter studies conducted in other states 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 the site has 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.

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 1996 were representatives of business, industry, local government, and environmental interest groups:

Chair:

Ivan Lawyer, Executive Director, Business and Industry Recycling Program

Members:

Dwight Adams, Professor, University of Florida, Gainesville, and Chair, Sierra Club National Solid Waste Committee

Doug Bruce, Carlton Fields law firm, Tallahassee

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

Beth Kidder, Consumer Advocate, Florida Public Interest Research Group, Tallahassee

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

Norm Thomas, Alachua County Solid Waste Coordinator, Gainesville

1.4 MARINE DEBRIS STUDY

The 1993 legislation called for a 50% reduction in litter and marine debris. 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. Therefore, 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 study in 1996. The results of the 1996 beach litter survey are reported in Appendix B.

2. ROADSIDE LITTER METHODOLOGY

2.1 OVERVIEW

This chapter summarizes the methodology used to collect the data for the 1996 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.

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 and 1996 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. Survey 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 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 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 is 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 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 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, whether the site was a part of an Adopt-A-Highway or similar program, whether a traffic signal was visible from the site, and whether there was a fast food or convenience store within a 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 feet 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 1996 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 1996 the Center hired six surveyors as temporary employees for approximately 10 weeks to conduct the roadside survey. 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 1996 the training was conducted by the same litter surveyors

who conducted the training in 1995. Those surveyors had also participated in the first survey in 1994.

3. RESULTS

3.1 OVERVIEW

The 1996 survey counted 32,633 large litter items and 9,414 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 results in several formats. First, the distribution of large litter items is presented, followed by breakdowns according to material type and major category. Then the small litter results are presented. The chapter then presents the site characteristics for the 670 sites surveyed. The data analysis is presented in Chapter 4.

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 1996 study. The table includes data for 1994, 1995, and 1996 to allow comparisons between the three years. Increases and decreases for each category over the three years of the study have not been statistically analyzed; therefore, no conclusions should be drawn as to the statistical significance of an increase or decrease in any given item. The data for 1994 and 1995 are provided to allow for anecdotal comparisons only.

- The first column lists the large litter item categories.
- The second column shows the averaged number of items found in 1996 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.
- The third column presents the percentage of total large litter items for each category in 1996. For example, vehicle and tire debris accounted for 9.89% of all large litter items in 1996.
- The fourth column represents the percentage of total large items for each category in 1995. For example, vehicle and tire debris accounted for 11.80% of all large litter items in 1995.
- The fifth column represents the percentage of total large litter items for each category in 1994. For example, vehicle and tire debris accounted for 9.05% of all large litter items in 1994.

1994.

Table 3.1 Distribution of Large Litter Items

RANKING BY LARGE LITTER CATEGORY	1996 Average passes 1 & 2	1996 % of large litter	1995 % of large litter	1994 % of large litter
1 Vehicle and tire debris	3229.00	9.89	11.80	9.05
2 Snack packages	2159.50	6.62	6.96	6.46
3 Construction debris	2010.50	6.16	5.38	3.83
4 Misc paper	1973.50	6.05	5.39	10.13
5 Beer cans	1756.50	5.38	6.60	8.97
6 Towels/napkins	1547.50	4.74	4.46	3.13
7 Cigarette/cigar packages	1321.00	4.05	4.92	4.65
8 Home items	1247.50	3.82	3.55	2.02
9 Misc film	1123.00	3.44	4.43	3.01
10 Beer bottles	1049.50	3.22	2.99	2.01
11 Paper cups	979.50	3.00	3.09	3.04
12 Polystyrene foam cups	977.50	3.00	2.78	3.43
13 Newspaper/books/mags/ads	801.00	2.45	2.24	2.60
14 Stationary/school/business	754.50	2.31	2.03	1.45
15 Plastic packaging	748.00	2.29	1.08	0.68
16 Soda cans	668.50	2.05	2.68	2.57
17 Misc plastic	588.00	1.80	2.90	2.67
18 Sports/other plastic bottles	569.50	1.75	0.58	0.72
19 Misc cardboard	527.50	1.62	1.30	1.04
20 Paper beverage casings	499.00	1.53	1.10	0.74
21 Misc polystyrene foam	474.00	1.45	1.79	1.49
22 Plastic lids	457.00	1.40	1.44	1.71
23 Misc paperboard	430.50	1.32	1.80	1.64
24 Corrugated cardboard boxes	390.50	1.20	0.39	0.91

25 Plastic other bags	363.50	1.11	0.95	0.93
RANKING BY LARGE LITTER CATEGORY	1996 Average passes 1 & 2	1996 % of large litter	1995 % of large litter	1994 % of large litter
26 Paperboard boxes	351.50	1.08	0.99	1.48
27 Plastic cups	329.50	1.01	0.89	0.92
28 Soda plastic bottles	323.00	0.99	0.78	1.10
29 Paper small bags	318.00	0.97	1.13	1.03
30 Plastic retail bags	312.00	0.96	0.65	0.60
31 Sports/other glass bottles	312.00	0.96	0.49	0.58
32 Paper packaging	290.00	0.89	0.50	1.09
33 Plastic jars/bottles/boxes	289.00	0.89	1.10	0.73
34 Paper food wrap	266.00	0.82	0.74	0.65
35 Lottery tickets	233.50	0.72	0.82	0.56
36 Aluminum foil/foil tins	211.50	0.65	0.41	0.37
37 Zipper/sandwich bags	166.00	0.51	0.58	0.48
38 Soda glass bottles	165.50	0.51	0.64	1.69
39 Gable top containers	159.50	0.49	0.58	0.55
40 Dip/chew packages	154.00	0.47	0.39	0.42
41 Container lids	147.00	0.45	0.38	0.19
42 Paper other bags	137.50	0.42	0.12	0.10
43 Broken glass containers	131.50	0.40	0.27	1.28
44 Steel cans	127.50	0.39	0.30	0.39
45 Paper/foil food wrap	124.50	0.38	0.56	0.50
46 Milk jugs/water/juice (HDPE)	118.00	0.36	0.30	0.72
47 Condiments	110.00	0.34	0.44	1.00
48 Foil packaging	109.50	0.34	0.19	0.56
49 Plastic reusable cups	103.00	0.32	0.31	0.23
50 Ice bags	94.00	0.29	0.38	0.33
51 Polystyrene foam clam shells	90.00	0.28	0.33	0.23

52 Sports/other cans	87.50	0.27	0.26	0.50
RANKING BY LARGE LITTER CATEGORY	1996 Average passes 1 & 2	1996 % of large litter	1995 % of large litter	1994 % of large litter
53 Paper retail bags	86.00	0.26	0.13	0.41
54 Wine/liquor glass bottles	74.50	0.23	0.23	0.21
55 Aluminum cans	71.00	0.22	0.32	0.32
56 Plastic/paper combo packaging	71.00	0.22	0.30	0.24
57 Polystyrene foam trays	65.00	0.20	0.10	0.13
58 Utensils	59.00	0.18	0.17	0.19
59 Polystyrene foam packaging	58.00	0.18	0.50	0.40
60 Six pack rings	44.50	0.14	0.18	0.18
61 Polystyrene foam plates	43.00	0.13	0.10	0.10
62 Misc glass	23.50	0.07	0.09	0.04
63 Plastic clam shells	20.50	0.06	0.05	0.05
64 Feed bags	16.00	0.05	0.12	0.10
65 Paper trays	15.00	0.05	0.02	0.08
66 Paper plates	13.50	0.04	0.02	0.08
67 Foil pouches	12.50	0.04	0.08	0.03
68 Wine/liquor plastic bottles	12.00	0.04	0.09	0.06
69 Glass jars/bottles	12.00	0.04	0.26	0.03
70 Aseptic boxes	11.00	0.03	0.02	0.08
71 Aerosol cans	10.00	0.03	0.03	0.06
72 Plastic plates	8.00	0.02	0.02	0.03
TOTALS	32633.00	100.00	100.00	100.00

3.3 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." Table 3.2 provides a list of the large litter items comprising each of the material types.

"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, vehicle debris, 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 1996 with the results of the 1994 and 1995 surveys. 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 for 1994 and 1995 are included in Figure 3.1 to allow for anecdotal comparisons only.

The following table shows the percentages for the material types in Figure 3.1. (Totals may not equal 100% due to rounding.)

	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

Figure 3.1 Large Litter Items by Material Type

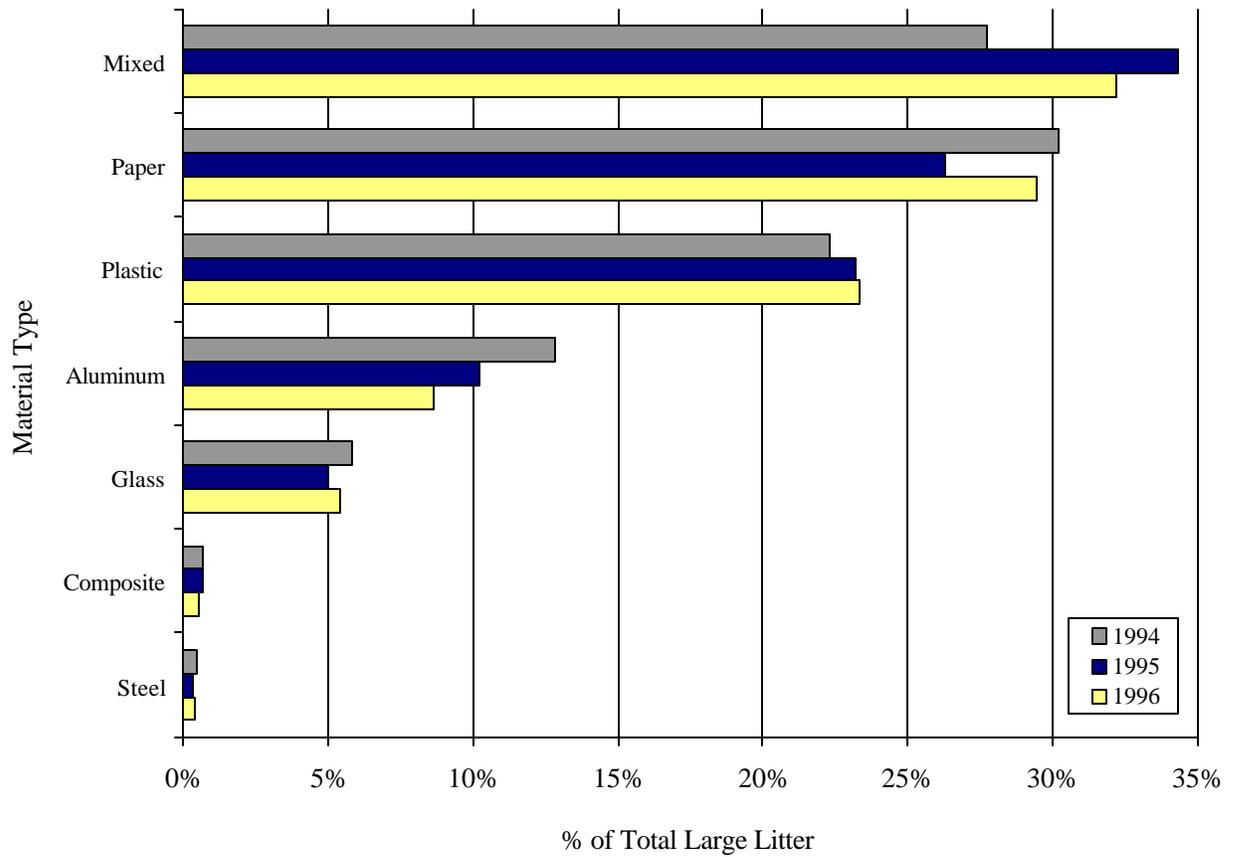


Table 3.2 Classification of Large Litter Items by Material Type

<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</p>	<p>Paper food wrap Paper grocery bags 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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3.4 MAJOR LARGE LITTER CATEGORIES

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

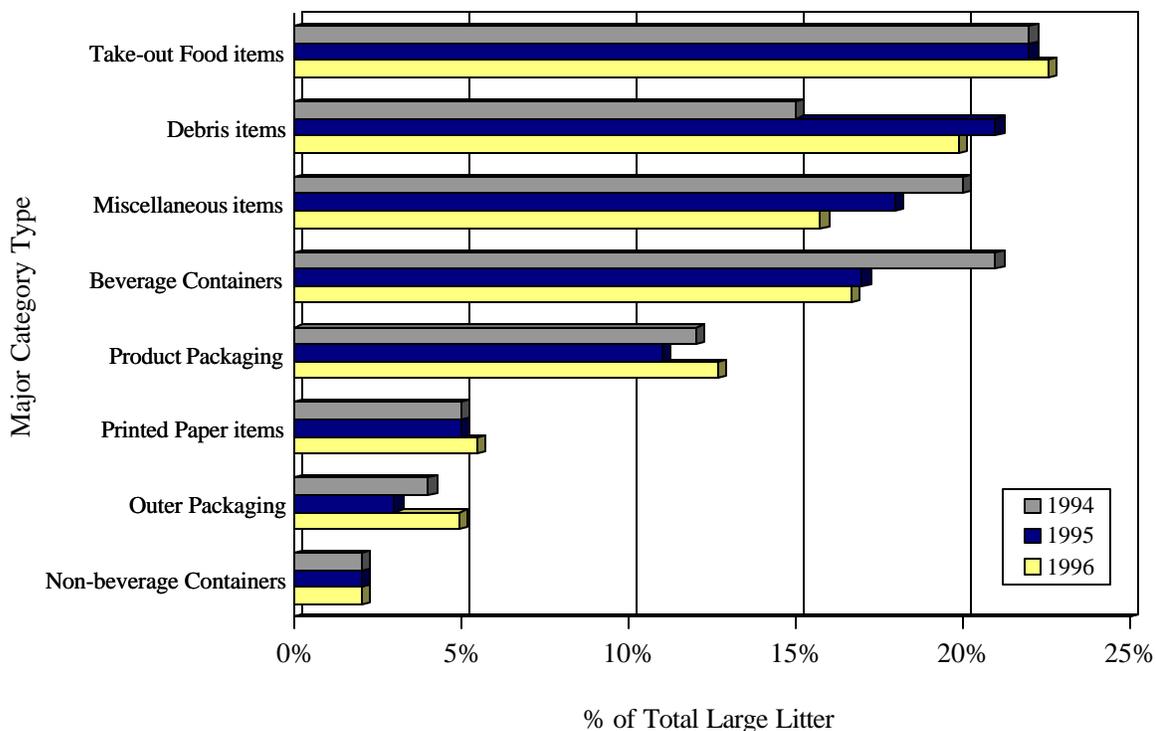
Figure 3.2 shows the distribution of litter by major category for the 1994, 1995, and 1996 surveys. Differences in major category percentages over the three years of the survey have not been statistically analyzed; therefore, no conclusions should be drawn as to the statistical significance of an increase or decrease in a given major category. The data from 1994 and 1995 are provided in Figure 3.2 to allow for anecdotal comparisons only.

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

The following table shows the percentages for the material types in Figure 3.2. (Totals may not equal 100% due to rounding.)

	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

Figure 3.2 Large Litter Items by Major Category Type



The following sections present the 1996 results for each of the major categories. The tables present each item's percentage within the major category and each item's percentage of total large litter. (For a comparison of 1994, 1995, and 1996 results for all large litter items, see Table 3.1.)

3.4.1 Take-Out Food Items

Table 3.3 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 represent the largest component of take-out food litter items (29.31%), followed by towel/napkins (20.98%), paper cups (13.28%), and polystyrene foam cups (13.28%).

Table 3.3 Distribution of Take-Out Food Items

TAKE-OUT FOOD ITEM	1996 % of total Take- out Food items	1996 % of large litter	1995 % of large litter	1994 % of large litter
Snack packages	29.31	6.62	6.96	6.46
Towels/napkins	20.98	4.74	4.46	3.13
Paper cups	13.28	3.00	2.78	3.43
Polystyrene foam cups	13.28	3.00	3.09	3.04
Plastic lids	6.20	1.40	1.44	1.71
Plastic cups	4.47	1.01	0.89	0.92
Paper food wrap	3.63	0.82	0.74	0.65
Paper/foil food wrap	1.68	0.38	0.56	0.50
Condiments	1.51	0.34	0.44	1.00
Plastic reusable cups	1.42	0.32	0.31	0.23
Polystyrene foam clam shells	1.24	0.28	0.33	0.23
Polystyrene foam trays	0.89	0.20	0.10	0.13
Utensils	0.80	0.18	0.17	0.19
Polystyrene foam plates	0.58	0.13	0.10	0.10
Plastic clam shells	0.27	0.06	0.05	0.05
Paper trays	0.22	0.05	0.02	0.08
Paper plates	0.18	0.04	0.02	0.08
Plastic plates	0.09	0.02	0.02	0.03
TOTAL	100.00	22.59	22.48	21.96

3.4.2 Beverage Containers

Table 3.4 presents the results for beverage containers. 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 32.18% of the beverage containers identified, followed by beer bottles (19.26%), soda cans (12.26%) and sports/other plastic bottles (10.47%).

Table 3.4 Distribution of Beverage Container Items

BEVERAGE CONTAINER ITEM	1996 % of total Beverage Containers	1996 % of large litter	1995 % of large litter	1994 % of large litter
Beer cans	32.18	5.38	6.60	8.97
Beer bottles	19.26	3.22	2.99	2.01
Soda cans	12.26	2.05	2.68	2.57
Sports/other plastic bottles	10.47	1.75	0.58	0.72
Soda plastic bottles	5.92	0.99	0.78	1.10
Sports/other glass bottles	5.74	0.96	0.49	0.58
Soda glass bottles	3.05	0.51	0.64	1.69
Gable top containers	2.93	0.49	0.58	0.55
Broken glass containers	2.39	0.40	0.27	1.28
Milk jugs/water/juice (HDPE)	2.15	0.36	0.30	0.72
Sports/other cans	1.61	0.27	0.26	0.50
Wine/liquor glass bottles	1.38	0.23	0.23	0.21
Foil pouches	0.24	0.04	0.09	0.06
Wine/liquor plastic bottles	0.24	0.04	0.08	0.03
Aseptic boxes	0.18	0.03	0.02	0.08
TOTAL	100.00	16.72	16.59	21.07

3.4.3 Miscellaneous Items

Table 3.5 presents the results for the miscellaneous item category, 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. More than one-third of the miscellaneous items in 1996 were paper items that could not be identified.

Table 3.5 Distribution of Miscellaneous Items

MISCELLANEOUS ITEM	1996 % of total Miscellaneous items	1996 % of large litter	1995 % of large litter	1994 % of large litter
Misc paper	38.41	6.05	5.39	10.13
Misc film	21.84	3.44	4.43	3.01
Misc plastic	11.43	1.80	2.90	2.67
Misc cardboard	10.29	1.62	1.30	1.04
Misc polystyrene foam	9.21	1.45	1.79	1.49
Misc paperboard	8.38	1.32	1.80	1.64
Misc glass	0.44	0.07	0.09	0.04
TOTAL	100.00	15.75	17.70	20.02

3.4.4 Debris Items

Table 3.6 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 half of the debris items identified in 1996.

Table 3.6 Distribution of Debris Items

DEBRIS ITEM	1996 % of total debris items	1996 % of large litter	1995 % of large litter	1994 % of large litter
Vehicle and tire debris	49.77	9.89	11.80	9.05
Construction debris	31.00	6.16	5.38	3.83
Home items	19.23	3.82	3.55	2.02
TOTAL	100.00	19.87	20.73	14.90

3.4.5 Product Packaging

Table 3.7 presents the results for product packaging items. This category consists 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 31.91% of packaging items, followed by plastic packaging (18.05%), paper beverage casings (12.06%), and paperboard boxes (8.51%).

Table 3.7 Distribution of Product Packaging Items

PRODUCT PACKAGING ITEM	1996 % of total Product Packaging Items	1996 % of large litter	1995 % of large litter	1994 % of large litter
Cigarette/cigar packages	31.91	4.05	4.92	4.65
Plastic packaging	18.05	2.29	1.08	0.68
Paper beverage casings	12.06	1.53	1.10	0.74
Paperboard boxes	8.51	1.08	0.99	1.48
Paper packaging	7.01	0.89	0.50	1.09
Aluminum foil/foil tins	5.12	0.65	0.41	0.37
Zipper/sandwich bags	4.02	0.51	0.58	0.48
Dip/chew packages	3.70	0.47	0.39	0.42
Foil packaging	2.68	0.34	0.19	0.56
Ice bags	2.29	0.29	0.38	0.33
Plastic/paper combo packaging	1.73	0.22	0.30	0.24
Polystyrene foam packaging	1.42	0.18	0.50	0.40

Six pack rings	1.10	0.14	0.19	0.18
Feed bags	0.39	0.05	0.12	0.10
TOTAL	100.00	12.69	11.65	11.72

3.4.6 Printed Paper Items

Table 3.8 presents the results for printed paper items identified in the survey, which include newspapers, books, magazines, advertisements, school papers, business papers, and lottery tickets. Newspapers, books, magazines, and advertisements together account for about 45% of the printed paper items identified in 1996.

Table 3.8 Distribution of Printed Paper Items

PRINTED PAPER ITEM	1996 % of total Printed Paper items	1996 % of large litter	1995 % of large litter	1994 % of large litter
Newspaper/books/mags/ads	44.71	2.45	2.24	2.60
Stationary/school/business	42.15	2.31	2.03	1.45
Lottery tickets	13.14	0.72	0.82	0.56
TOTAL	100.00	5.48	5.09	4.61

3.4.7 Outer Packaging Items

Table 3.9 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 (24.39%), plastic other bags (22.56%), and paper small bags (19.72%) were the largest components in this category.

Table 3.9 Distribution of Outer Packaging Items

OUTER PACKAGING ITEM	1996 % of total Outer Packaging	1996 % of large litter	1995 % of large litter	1994 % of large litter
Corrugated cardboard boxes	24.39	1.20	0.39	0.91
Plastic other bags	22.56	1.11	0.95	0.93
Paper small bags	19.72	0.97	1.13	1.03
Plastic retail bags	19.51	0.96	0.65	0.60
Paper other bags	8.54	0.42	0.12	0.10
Paper retail bags	5.28	0.26	0.13	0.41
TOTAL	100.00	4.92	3.37	3.98

3.4.8 Non-Beverage Containers

Table 3.10 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. Non-beverages containers account for 1.72% of the large litter items surveyed. Plastic jars, bottles, and boxes combined account for 44.06% of non-beverage container items, followed by container lids (22.28%) and steel cans (19.31%).

Table 3.10 Distribution of Non-Beverage Container Items

NON-BEVERAGE CONTAINER ITEM	1996 % of Non-Beverage Containers	1996 % of large litter	1995 % of large litter	1994 % of large litter
Plastic jars/bottles/boxes	44.06	0.89	1.10	0.73
Container lids	22.28	0.45	0.38	0.19
Steel cans	19.31	0.39	0.30	0.39
Aluminum cans	10.89	0.22	0.32	0.32
Glass jars/bottles	1.98	0.04	0.26	0.03
Aerosol cans	1.49	0.03	0.03	0.06
TOTAL	100.00	2.02	2.39	1.72

3.5 SMALL LITTER RESULTS

Table 3.11 presents the results of the small litter survey. For the small litter survey, up to three transects of each site were surveyed. The transects were 1 foot long and up to 15 feet wide. The small litter survey documented 9,414 pieces of litter smaller than 4 square inches in 1996. Cigarette butts accounted for almost one-fourth of the small litter items (23.86%), followed by glass pieces (21.44%), paper (13.18%), and hard plastic pieces (9.03%).

Table 3.11 Distribution of Small Litter Items

SMALL LITTER ITEM	1996 Total number of items	1996 % of small litter	1995 % of small litter	1994 % of small litter
Cigarette butts	2246	23.86	25.37	33.45
Glass pieces	2018	21.44	18.56	8.89
Paper	1241	13.18	14.06	16.75
Hard plastic pieces	856	9.09	10.04	9.20
Other/miscellaneous	643	6.83	0.46	2.39
Plastic film	625	6.64	8.25	5.70
Polystyrene foam pieces	620	6.59	8.55	9.13
Rubber pieces	500	5.31	5.37	4.99
Aluminum pieces	276	2.93	4.74	3.35
Candy wrappers	115	1.22	1.01	2.15
Other metal pieces	80	0.85	1.04	1.48
Polystyrene foam peanuts	75	0.80	0.77	1.36
Bottle caps	62	0.66	0.95	1.24
Straws	57	0.61	0.82	0.92
TOTAL	9414	100.00	100.00	100.00

3.6 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 1996 survey.

3.6.1 Site Type

The site type distribution is presented in Table 3.12. About 81% of the sites were rural sites. Urban/business and residential sites together represented about 18% 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 3.12 Site Type Distribution

SITE TYPE	1996 Number of Sites	1996 % of Total Sites	1995 %of Total Sites	1994 % of Total sites
Rural	545	81.3	82.8	79.1
Urban/Business	65	9.7	9.3	10.8
Residential	56	8.4	7.3	8.2
Industrial	4	0.6	0.6	1.9

3.6.2 Number of Lanes

Table 3.13 presents the site distribution by 2-lane, 4-lane and 6-lane roads. Approximately 80% of the sites were located on 2-lane roads, 18% were on 4-lane roads, and 3% were on 6-lane roads. The sample did not include roads with more than 6 lanes.

Table 3.13 Distribution by Number of Lanes

NUMBER OF LANES	1996 Number of Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
2	532	79.4	81.9	81.4
4	119	17.8	17.3	16.4
6	19	2.8	0.8	2.2

3.6.3 Divided Roads

Table 3.14 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 3.14 Divided Roads Distribution

DIVIDED ?	1996 Number of Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Yes	128	19.1	17.6	17.2
No	542	80.9	82.4	82.8

3.6.4 Adopted Road Programs

Before this study began, interest had been expressed in determining whether fewer litter items were found on adopted sites, since they are cleaned at various times throughout the year. 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 Adopt-A-Highway sites.

Table 3.15 presents the distribution of adopted roads. Volunteer groups that collect litter from the sites on a regular basis have adopted many stretches of roadways in Florida through programs such as Adopt-A-Highway and Adopt-A-Road. At 74 of the 670 survey sites (11%), surveyors noted a sign indicating that the site was an "adopted" area.

Table 3.15 Adopted Road Distribution

ADOPTED ROAD	1996 Number of Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Yes	74	11.0	10.8	10.8
No	596	89.0	89.2	89.2

3.6.5 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 3.16 shows the number and percentage of these sites. In 1996, 16% of the sites surveyed were within a mile of a fast-food or convenience store.

Table 3.16 Distribution of Sites Within One Mile of a Fast-Food or Convenience Store

WITHIN 1 MILE OF FAST FOOD/CONVENIENCE?	1996 Number of Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Yes	107	16.0	13.7	28.7
No	563	84.0	86.3	71.3

3.6.6 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. About 14% of the sites surveyed were in this category, as shown in Table 3.17.

Table 3.17 Distribution of Sites within One Mile of a Visible Traffic Signal

VISIBLE TRAFFIC SIGNAL	1996 Number of Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Yes	91	13.6	12.1	16.4
No	579	86.4	87.9	83.6

3.6.7 Grass Height

Table 3.18 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. More than half the sites had a grass height of 3-6 inches; about 90% of the sites had grass heights of 6 inches or less.

Table 3.18 Distribution of Sites by Grass Height

GRASS HEIGHT	1996 Number of Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Under 3 inches	180	26.9	33.0	29.9
3-6 inches	420	62.7	51.9	55.6
More than 6 inches	70	10.4	15.1	14.5

3.6.8 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 57% of the sites surveyed had no catchpoint, as shown in Table 3.19.

Table 3.19 Distribution of Sites by Catchpoint

CATCHPOINT	1996 Number of Sites	1996 % of Total Sites	1995 % of Total Sites	1994 % of Total Sites
Fence	44	6.6	9.3	14.2
Hedge	66	9.9	6.1	13.4
Mow Line	110	16.4	20.9	18.3
Other	65	9.7	16.3	11.9
None	385	57.4	47.5	42.2

Figure 3.3

4. DATA ANALYSIS

Info Tech, Inc., a statistical consulting firm in Gainesville, Florida, has analyzed the roadside litter survey data for 1994, 1995 and 1996.

In 1996 the Center surveyed 10 sites per county, providing a total of 670 sites. There were 268 sites sampled in 1994 and 670 sites sampled in 1995. As in the 1994 and 1995 data analyses, the items per square foot (density) and total number of items per site were analyzed in 1996. Analyzing the total number of items per site is equivalent to analyzing the data on a linear foot basis, as all of the sites are of the same length. This section summarizes the results and the implications of the statistical analysis. The results are discussed further in Chapter 5.

The statistical analysis for the 1994 survey 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 in 1994 to 670 in 1995 and 1996, and as predicted, variability decreased to approximately 11%. Increasing the number of sites beyond 670 would probably result in an even lower variability; however, the Center has determined that doing so would not be cost effective as the current level of variability is considered acceptable.

4.1 LARGE LITTER RESULTS

4.1.1 Comparison of 1994, 1995, and 1996 Data

The objective of the Florida Litter Study is to measure progress toward the Legislature's litter reduction goal. Therefore, the first analysis undertaken was to estimate the change in litter amounts from 1994 to 1995, 1994 to 1996, and 1995 to 1996, and to determine whether the change was statistically significant.

To accurately estimate this change, adjustments were made for differences in site characteristics. (Site effects are discussed in the following section.)

Two analyses were performed on the large litter results: litter density and total number of items.

Litter Density: For large litter items, an estimated 9% reduction in litter density occurred from 1994 to 1995, a 4% reduction occurred from 1994 to 1996, and a 5% increase from 1995 to 1996. These are not statistically significant differences.

A 95% confidence interval provides a range within which the "true change" in litter density may fall. The ranges for the years analyzed were:

1994 to 1995:	True change ranged from a 23% reduction to a 3% increase, for an estimated 9% reduction.
1994 to 1996:	True change ranged from a 17% reduction to a 8% increase, for an estimated 4% reduction.
1995 to 1996:	True change ranged from a 4% reduction to a 13% increase, for an estimated 5% increase.

Total Number of Items: An analysis of large litter items by total number of items similarly did not yield statistically significant differences between the three years of the study. An estimated 7% reduction occurred from 1994 to 1995, a 2% reduction occurred from 1994 to 1996, and a 5% increase occurred from 1995 to 1996. The ranges of true change at a 95% confidence interval were:

1994 to 1995:	True change ranged from a 20% reduction to a 4% increase, with an estimated 7% reduction.
1994 to 1996:	True change ranged from a 14% reduction to a 9% increase, with an estimated 2% reduction.
1995 to 1996:	True change ranged from a 4% reduction to a 13% increase, with an estimated 5% increase.

Further study of the site characteristics across years revealed that the sites surveyed in 1996 with a grass height of less than three inches had the least amount of litter and sites with a grass height of greater than six inches had the most litter when compared to the other classification of grass heights surveyed for all three years.

4.1.2 Significant Effects: Large Litter Items

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

Characteristics evaluated include many of those previously discussed in Chapter 3: site type, grass height, adopt-a-highway, visual signal, fast food/convenience store, number of lanes, divided highway, and catchpoint. Several other characteristics were also evaluated, including: area of the site, whether the site was of fixed or mixed width, differences among surveyors, and differences among counties.

The statistical analysis of the 1994 survey data had indicated significant differences in litter amounts with respect to the number of lanes and grass height.

The significant differences in 1995 were grass height, number of lanes, adopt-a-highway, and catchpoint.

The significant differences for 1996 were adopt-a-highway and grass height, with number of lanes and catchpoint being of borderline significance.

Area: In 1996, the mean density of litter decreased as the area of the site increased, but the total litter per site increased as the area increased.

Adopted Roads: In 1996, the mean litter amount for adopted sites was less than for non-adopted sites. Approximately 11% of the sites surveyed in 1996 were adopted sites.

The estimated mean reduction litter density was 20% (ranging from 0% to 36% at a 95% confidence level) for litter density.

The estimated mean reduction for total number of items per site was 19% (ranging from 0% to 34% at a 95% confidence level).

The significance (i.e., the reduction) for 1996 was not as strong as in 1995, but still strong enough to be declared statistically significant.

Grass Height: The mean litter amount increased (statistically significantly) as grass height increased.

Grass Height of 3-6 Inches Compared to Less Than 3 Inches: Sites with a grass height of 3-6 inches had an estimated 43% more litter density (ranging from 33% to 52% at a 95% confidence level) than sites with a grass height of less than 3 inches. These sites had 41% more litter items per site (ranging from 32% to 50%) than sites with a grass height of less than 3 inches.

Grass Height of More Than 6 Inches Compared to Less Than 3 Inches: Sites with a grass height of more than 6 inches had an estimated 57% more litter density (ranging from 45% to 67%) than sites with a grass height of less than 3 inches. These sites had 55% more items per site (ranging from 42% to 65%) than sites with a grass height of 3 inches or less.

Grass Height of More Than 6 Inches Compared to 3-6 Inches: Sites with grass height

of more than 6 inches had had an estimated 24% more litter density (ranging from 5% to 40%) than sites with a grass height of 3-6 inches. These sites had 23% more items per site (ranging from 4% to 38%).

Only 10.4% of the sites had a grass height of greater than six inches, and 26.9% had a grass height of less than three inches.

Number of Lanes: The mean litter amount increased as the number of lanes increased, but not at a strong significance level. The mean litter amount for sites on six-lane roads was higher than sites on two or four lane roads.

Catchpoint: Sites with mow line or hedge catchpoints had more litter than sites without catchpoints, but as with the number of lanes, the significance was not sufficiently strong.

4.2 SMALL LITTER RESULTS

4.2.1 Comparison of 1994, 1995, and 1996 Data

A statistically significant increase in small litter became apparent when 1996 results were compared to 1994 and 1995. However, it should be noted that there was no statistically significant change in small litter from 1994 to 1995.

Litter Density: For small litter items, an estimated 24% increase occurred in litter density from 1994 to 1996, and a 20% increase occurred from 1995 to 1996.

A 95% confidence interval provides the following ranges of "true change":

1994 to 1996: True change ranged from a 14% to a 33% increase, with an estimated increase of 24%.

1994 to 1995: True change ranged from a 9% reduction to a 17% increase, for an estimated increase of 5%.

1995 to 1996: True change ranged from a 12% to a 28% increase, with an estimated increase of 20%.

Total Number of Items: Similar results were found in terms of total number of small litter items. An estimated 23% increase occurred from 1994 to 1996; a 5% increase occurred from 1994 to 1995, and a 19% increase occurred from 1995 to 1996.

1994 to 1996: True change ranged from a 13% to a 31% increase, for an estimated

increase of 23%.

1994 to 1995: True change ranged from a 7% reduction to a 15% increase, for an estimated 5% increase.

1995 to 1996: True change ranged from an 11% to a 26% increase, for an estimated increase of 19%.

4.2.2 Significant Effects: Small Litter Items

The statistical analysis of the 1994 survey data showed significant differences with respect to the following site characteristics: presence of a traffic signal, presence of a fast food or convenience store, and number of lanes. Differences in mean litter amounts by traffic signal, fast food/convenience store, and number of lanes persisted in 1995. Significant differences in 1996 were presence of a traffic signal, number of lanes, and the type of site.

Analysis of the site characteristics across years revealed that the sites away from a fast-food or convenience store had more litter in 1996 than in 1994 to 1995. But for the sites near a fast-food or convenience store the rates had not changed over time. In fact, the litter amounts away from a fast-food or convenience store have now reached the rates near a fast-food or convenience store.

Number of Lanes: The mean litter amount increased as the number of lanes increased. The mean litter amount for sites on six lane roads was significantly more than sites on two lane roads. The sites on two lane roads had an estimated 92% (13% to 227%) less litter density than sites on six lane roads, and 80% (12% to 190%) less litter per site. Only 2.8% of the sampled sites were on six lane roads and 17.8% were on four lane roads.

Visual 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 increases the mean litter density by an estimated 56% (17% to 109%), and the mean items per site by an estimated 53% (18% to 98%). Only 13.6% of the sites were within visibility of a traffic signal.

Site Type: The mean litter amount on rural roads was less than urban/business and residential roads. The rural roads had an estimated 37% (10% to 55%) less litter density than urban/business roads, and 33% (9% to 51%) less litter per site. They had an estimated 30% (7% to 47%) less litter density than sites on residential roads, and 27% (6% to 43%) less litter per site.

5. DISCUSSION

5.1 OVERVIEW

The results of the 1996 roadside litter survey suggest that the amount of litter in Florida overall has remained fairly stable. The results for adopted road sites provide solid evidence for the second year in a row that volunteer efforts are an effective way to reduce roadside litter. Furthermore, with Florida's population increasing daily and with tourism thriving, the results may be viewed somewhat optimistically when viewed from a per capita standpoint.

Prevention is the key to reducing litter. Research has shown that people are more likely to litter in places where litter is already present than in clean, attractive environments. The presence of litter, trash and debris in an area contributes to indifference, vandalism, and crime. Clean environments, on the other hand, foster a sense of community pride.

This chapter presents a discussion of the survey results, including a discussion of research on the causes of littering and effective preventive measures.

5.2 ADOPTED ROADS

The results of the 1996 survey, together with the results of the 1995 survey, indicate that grass roots litter prevention programs such as adopt-a-road programs play an important role in reducing the most visible litter along Florida's roadsides.

In 1995, litter density for large litter items on adopted road sites was 36% less than on non-adopted sites; in 1996, the litter density was 20% less on adopted sites than on non-adopted sites. Similar results were found when the data were analyzed on the basis of total items per site. In 1995, adopted sites has 33% fewer items per site, and in 1996, adopted sites had 19% fewer items per site, than non-adopted sites.

These positive results are consistent with results in other states that have invested significant resources in the development and promotion of adopted road programs.

5.3 LARGE LITTER VS. SMALL LITTER

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 such materials as paper, glass, hard plastic and polystyrene foam. Additionally, the Center's pilot studies showed that cigarette butts were the most numerous small litter item in Florida. Nevertheless, the Litter Study Advisory Committee encouraged the Center to include small litter in the survey. In response to the Committee's concerns, items 4 square inches or larger in size were classified as "large litter" and items under 4 square inches were classified as

"small litter."

Because of the differences in the data collection for large and small litter, the data analysis produces separate results for large and small litter. In 1996, the data analysis showed that compared to the two previous years of the study, there was no statistically significant change in large litter. However, there was a 24% increase in small litter.

It should be noted that of the two classifications, large litter warrants more concern than small litter. Large litter is more visible from passing cars, and most of the small litter items identified are broken or mulched pieces of large litter. For example, of the study's 14 small litter categories, five categories - glass pieces, paper pieces, hard plastic pieces, aluminum pieces and polystyrene foam pieces - together accounted for more than half of all small litter items in 1996.

5.4 FACTORS AFFECTING LITTER QUANTITY AND COMPOSITION

A variety of factors may affect the quantity and composition of the litter along Florida's roadsides. Concerns have been expressed about the potential effects of changes in local recycling programs as well as the effects of changes in the availability of resources for litter cleanup and prevention efforts.

Local recycling programs undergo changes from time to time as result of changes in collection costs and changes in markets for recovered materials, among other things. Changes in the availability of curbside or dropoff recycling for a particular material, such as glass or plastic, may contribute to a change in the number of glass or plastic items found along the road in a given county.

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

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 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. The cost benefit for Florida's local KAB affiliates for each dollar provided in government funding is \$4.45 in services generated primarily through volunteers and the private sector.

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

During 1994-95, the first year of the Florida Litter Study, only 25% of the funds needed for a statewide anti-litter campaign were provided, and no funding was provided during 1995-96. Although many leading business, civic, government and environmental organizations have agreed to participate in the program, KFB recognizes that without funding for the statewide campaign, progress toward the Legislature's litter reduction goal is not likely.

5.6 LITTER REDUCTION EFFORTS IN OTHER STATES

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

"Don't Mess With Texas": A Litter Reduction Model

Texas was the first state to develop an Adopt-A-Highway Program. Texas also developed an effective media campaign 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 has spent \$2 million per year on its media campaign and has saved approximately \$2-4 million/year on litter cleanup over and above the cost of the media campaign. Surveys showed that roadside litter was reduced by 72% over a five-year period as a result of the state's efforts.

The success of Texas's litter reduction campaign has been attributed to: (1) a continuing commitment of funds to support the statewide media campaign; and (2) close coordination between the volunteer efforts of Keep America Beautiful affiliates and the Texas Department of Transportation.

"Don't Lay that Trash on Oklahoma": An Appeal to Community Spirit

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. A study 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.

5.7 LITTERING BEHAVIOR: RESEARCH HIGHLIGHTS

Research shows 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.

Researchers who have given handbills to people under a variety of conditions have reported that people are less likely to litter in clean environments than in environments where litter is already present. Some researchers have suggested that littering, like vandalism, is contagious, and that the presence of litter, trash and debris in an area encourages crime.

Positively worded messages (such as, "Please deposit trash in the green can") have been found to be somewhat more effective than negatively worded messages (such as, "Please don't litter"). However, both types of messages have been shown to reduce litter by as much as 50%.

When waste receptacles are conveniently located, littering is reduced. In one experiment, people sitting closer to a waste receptacle in a cafeteria littered less than people sitting further away. 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 PLANS

The 1997 roadside litter survey will begin in January 1997 and is expected to be completed in April. Ten sites will be surveyed in each of Florida's 67 counties, for a total of 670 sites. The Center will hire survey technicians and will conduct a week-long training program prior to starting the 1997

survey to ensure consistency in the collection of the data. The training will take place at the Center's offices in Gainesville and in several field locations.