

CASE STUDY

Innovative Highway Litter Study Gives Tennessee Insight Into Progress to Date and Challenges That Remain

Tennessee is making a serious commitment to reduce the amount of litter along its roads and highways. A statewide study by Burns & McDonnell has documented progress while providing crucial data needed to make further improvements, as well as identified a need to address a growing problem of waste items washing into waterways along transit corridors.



Challenge

Like many states, Tennessee has faced a growing volume of materials littering its highways and roads. In 2016, state transportation officials commissioned a study to document the amount of litter along its transportation corridors as a first step in developing a program with funding needed to begin reversing the trend. That study was instrumental in helping Tennessee transportation and environmental leaders establish a litter reduction campaign dubbed Nobody Trashes Tennessee.

As part of an effort to document and verify the effectiveness of that campaign, the Tennessee Department of Transportation (TDOT) commissioned a second litter study in 2022 designed to:

- Identify how litter has changed over time.
- Determine the relationship between roadside litter and site characteristics.
- Assess the impact of litter on nearby infrastructure.
- Identify socioeconomic factors that can strengthen litter prevention and abatement programs.

Project Stats

Client

Tennessee Department of Transportation

Location

Tennessee

Solution

A novel approach utilizing geographic information system (GIS) protocols enabled Burns & McDonnell data scientists to structure the new survey so that it met TDOT requirements to focus on the state's scenic byways and roads within designated at-risk and distressed locations.

The GIS platform provided much more flexibility for real-time analysis of the data gathered within the field while expanding the ability to sample more categories of waste materials identified along roads. The electronic data entry also eliminated several time-consuming and cumbersome steps for field sampling that would have been required if crews had been utilizing paper forms.

These approaches replicated best practices that were developed during a 2020 national Keep America Beautiful study that was executed by Burns & McDonnell.

A statistically valid sampling plan was developed for Tennessee's four basic road types — interstates, U.S. highways, state highways and county roads — and targeted 120 locations within the state's Eastern, Middle and Western regions. The sampling plan included some litter hot spots identified by Tennessee officials in Memphis, Nashville, Knoxville and Chattanooga.

The 2022 study was expanded from the 2016 study to analyze the number of litter types, separated into groups of materials that were 4 inches or greater or less than 4 inches, and was consistent with the methodology incorporated in the 2020 national study. The increase in litter types analyzed in the later study enabled a more robust analysis of influencing factors that provided a clear understanding of how composition and quantity of litter has changed over time.

Key Findings

After all the sample zones had been counted, the data indicated that there had been a 12% reduction in the overall volume of large litter (4-inches or greater) from the overall total identified in the 2016 study. The 2022 study showed clearly that a litter awareness and abatement campaign launched following the 2016 study had effectively resulted in less litter along Tennessee roadways.

However, a more granular analysis of the sampling data indicated that the volume of smaller litter items had increased since 2016. Data that led to this finding was subjected to further statistical analysis and econometric modeling to understand the key influencing factors that were causing this trend. This was supported by notes from observations

of the sampling crews that were intended to quantify factors in the surrounding areas that might account for a large amount of litter. For example, observations that some heavier concentrations were located near bus stops, convenience stores or gas stations were later validated through statistical analysis and econometric modeling.

The study categorized litter as both intentional and unintentional. For example, tire particles left along the shoulder of a highway were likely the result of a blowout and clearly unintentional. However, fast-food wrappers, cups and other similar refuse clearly had been thrown out of a passing vehicle and were classed as intentional.

The study also validated that 88% of litter on Tennessee's roadways was smaller than 4 inches. Though the study did not formally address waterways, it documented an increase in litter along transit routes where waterways were observed. This finding points to a risk that these smaller waste items can easily wash into streams, rivers and lakes where they would then likely settle into sediment, becoming much more difficult to remove.

The more robust analysis enabled by the digital tools and expanded data also revealed greater insights into the types of litter along Tennessee roadways. For example, plastic and paper items together account for an estimated 59% of the litter (an estimated 450.5 million items) found along roadways. The study pointed out that this is likely due to an increase in plastic soft drink and juice containers as well as changes in plastics recycling and how those materials are handled in Tennessee and nationally.

The amount of intentional litter (defined as items that are thrown out or dropped from vehicles primarily) also was found to have increased by 18% compared with the 2016 study. This finding was attributed to recent changes in product packaging rather than to any changes in behavior.

Outcomes for the Future

TDOT is continually iterating its ongoing Nobody Trashes Tennessee litter abatement campaign and the results of this recent study will help focus future efforts and investment to address hot spots where litter volume is increasing.

The campaign already is investing significant sums for public awareness and outreach to encourage the public to become more aware of responsible behavior and practices. The study results will help address future deliberations over where to concentrate outdoor marketing efforts, how to beef up digital marketing spending levels and analysis of litter in waterways.

The study also will help address other questions such as:

- Are there potential collaborative partnerships with community groups for additional litter abatement?
- Are partnerships with trade associations a feasible alternative that might help leverage outreach efforts?

Tennessee is seeking collaborative partnerships that increase the effectiveness of existing cleanup and Adopt-A-Highway programs in distressed and at-risk areas of the state. Based on data compiled in the 2022 study, the effectiveness of the ongoing litter abatement effort should continue to show progress.

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