The Virginia Department of Transportation (VDOT) annually removes and disposes of countless animal carcasses, primarily deer, along its state road system. VDOT spends more than $4 million a year to remove them.

Many of these “deer mortalities” are the result of deer-vehicle crashes. In 2010 and 2011, the commonwealth recorded more than 48,700 deer-vehicle crashes, the fifth-highest number in the nation.

VDOT’s primary disposal methods have included delivering the carcasses to landfills or burying them on the side of the road. Both have several disadvantages: long travel distances to landfills, increasing landfill restrictions and a general lack of viable burial areas, among others.

Because of the growing volume and costs, VDOT maintenance facilities need additional carcass-management strategies that are practical, environmentally compliant and cost-effective.

A VDOT research study published in 2010 found that agency field personnel are quite interested in adopting new techniques to dispose of deer and other animal carcasses. *

This fact sheet contains synopses of two recent VDOT research reports concerning carcass-management methods that employ composting – specifically, static compost windrows and vessel composting – which the agency plans to use, where appropriate, around the state.

With completion of the second study, VDOT is working with the Virginia Department of Environmental Quality (DEQ) to get state approval for both the static windrows and the composting vessels.

VDOT’s research division, the Virginia Center for Transportation Innovation and Research (VCTIR), will work with VDOT to create usage guidelines and video training for both methods. This will increase their implementation prospects and provide maintenance areas with more options for carcass management.

* An Assessment of the Animal Carcass Disposal Practices of the Virginia Department of Transportation and Guidance for the Selection of Alternative Carcass Management Options, VTRC 10-R7
The previously referenced 2010 research report determined that transportation agencies should consider “static compost windrows” as an applicable alternative for carcass management. Static compost windrows are passively aerated stationary piles. With static windrows, it is not necessary to turn the materials as with the traditional covered-bin composting method.

The U.S. Environmental Protection Agency (EPA) promotes composting of animal carcasses and its use in state and local roadside applications. A report from an EPA-funded project described the benefits of composting programs within a state transportation department, stating that carcass composting provides an alternative waste-management strategy to using valuable landfill space and can reduce greenhouse-gas production.

Other states have found static compost windrows an easy and cost-effective carcass-management method. One purpose of this study was to determine the extent of pathogen destruction and contaminant loss from the process of “deer-mortality static windrow composting.”

During the study, the research team monitored static compost windrows containing deer carcasses for one year under conditions typical of a VDOT area maintenance headquarters. The researchers analyzed the windrows for pathogen destruction and the degree to which the underlying soil filtered contaminants leaching from the piles (known as leachate).

In response to high temperatures within the windrows, indicator pathogens E. coli and Salmonella were reduced by 99.99 percent the first sampling day (day 7) and round worms were deemed nonviable by day 77. Soil filtration of the leachate effectively reduced concentrations of ammonia, chloride and total organic carbon. Nitrate, a contaminant of particular regulatory concern, had an estimated mass contaminant loss of only 1.9 pounds per acre, compared to the eight to 45 pounds per acre of nitrate estimated to be lost from fertilizer applied to crops in Virginia.

Results from this study indicate that with properly constructed static compost windrows, (1) high temperatures destroy indicator pathogens; (2) the natural filtration of leachate through the soil reduces contaminant concentrations from the deer carcasses; and (3) the low volume of leachate from the windrows results in nominal losses of nitrate and other contaminants.

The study recommended that VDOT share these results with DEQ to discuss options for a statewide carcass-composting program.
Cost and time savings

Providing VDOT the option of constructing windrows on bare ground would meet the needs of some maintenance areas with limited availability of nearby disposal sites or viable burial areas. It also has the potential to reduce carcass-management costs.

The 2010 study used survey responses from VDOT area maintenance personnel to calculate potential savings from implementing windrow composting. The research team calculated that if VDOT replaced its current carcass-disposal practices with windrow composting at the 46 area headquarters that currently use a disposal facility and have to travel to reach the facility or pay a fee to use the facility, VDOT could save approximately $515,440 annually.

That estimate would be substantially higher if the 21 percent of area headquarters that occasionally use a landfill were included in the calculation. Additionally, if all area headquarters, whose staff has to travel to disposal facilities, composted deer carcasses at a maintenance area, VDOT could eliminate the fuel used and carbon emissions produced from an estimated 252,000 miles of driving per year.

Meeting water-quality standards

VDOT also would satisfy “total maximum daily load” (TMDL) requirements regulated by DEQ, an indirect benefit from removing carcasses from the right of way (as opposed to carcass burial).

TMDLs calculate the maximum amount of a pollutant that a water body can receive and still comply with water-quality standards, according to EPA. To comply with TMDL requirements, VDOT must identify outfall structures, such as stormwater pipes, in a water body and determine the annual stormwater and pollutant discharge for such outfalls.

The process of calculating and identifying TMDLs costs VDOT up to several hundred thousand dollars per project, depending on the size of the particular watershed.

According to VDOT, DEQ has stated that VDOT’s removal and proper management of animal carcasses (as opposed to burying them in the right of way, causing the carcasses to become a potential source of pathogens in the watershed) will satisfy TMDL requirements in those areas where bacteria comprise the “pollutant of concern.” This will relieve VDOT from conducting expensive studies and likely will increase VDOT’s emphasis on carcass removal and management (i.e., landfill disposal or composting).


This second study evaluated two different “in-vessel” composting systems – a rotary drum and a forced-aeration (or forced-air) bin – to determine the effectiveness of each as a carcass-management option for VDOT.

The research team analyzed the utility of each system, based on these two factors:

• Whether the compost each generated met a set of established composting criteria, including regulatory standards, and
• Whether the system performed well from an operational standpoint.

A rotary-drum composting system was installed at the Hanging Rock area headquarters in Roanoke County in VDOT’s Salem District and monitored for 163 days. The compost it generated met established criteria for pathogen destruction, but results were inconsistent in meeting temperature and moisture criteria.

This particular rotary-drum system also performed inconsistently. While the problems encountered with this equipment may be preventable in future installations, the system requires further evaluation to determine its usefulness for animal carcass management for VDOT. The study team recommended that VDOT install a smaller rotary-drum system at another maintenance facility and evaluate its performance when the lessons learned from this project are applied.

A forced-air system was installed at VDOT’s Bethel area headquarters in Halifax County in the Lynchburg District and monitored for 274 days. The generated compost met all established criteria for temperature, compost maturity and pathogen destruction. The system also performed well from an operational standpoint. Based on these results, this system proved a useful means of animal carcass management for VDOT.

In its report, the research team recommended that VDOT install forced-air system units at several other maintenance facilities interested in this method of composting. VDOT and VCTIR also will prepare a “composting guidance document” to support agency implementation of animal carcass composting at maintenance facilities. The guidance will include detailed procedures for both windrow and vessel composting and recommended end-use options for the finished compost material.

Finally, VCTIR is studying in more detail the economics and logistics of composting for VDOT, based on another of the report’s recommendations. The new project will develop a decision table so VDOT maintenance facilities can determine the economic value of implementing a composting program at each site.