

Report No. VTRC 88-R14	Report Date February 1988	No. Pages 5	Type Report: State Period Covered: August 26, 1985 to March 20, 1987	Project No. : None Contract No.:
Title and Subtitle Evaluation of the Caravelle Litter Retrieval System			Key Words Litter retrieval equipment Litter Demonstrations Highways Ramps Guardrails Ditches	
Author(s) David C. Mahone and John E. McEwen				
Performing Organization Name and Address Virginia Transportation Research Council Box 3817, University Station Charlottesville, Virginia 22903-0817				
Sponsoring Agencies' Names and Addresses Va. Dept. of Transportation 1221 E. Broad Street Richmond, Virginia 23219			University of Virginia Charlottesville Virginia 22903	
Supplementary Notes				
Abstract Based on observations, the Caravelle Litter Technologies, Inc's., demonstration of its litter retrieval equipment it was concluded that use of the equipment on highways open to traffic would require extensive and expensive traffic control. The machine cannot traverse the areas where the majority of highway litter is located, and in those areas it does traverse, it does not do a thorough job. It picks up grass and other biodegradable materials that need not be picked up, and picks up stabilizing stone and throws it onto the travel way. Therefore it was recommended that the Department neither rent nor purchase the equipment.				

FINAL REPORT

EVALUATION OF THE CARAVELLE LITTER RETRIEVAL SYSTEM

by

David C. Mahone
Senior Research Scientist

and

John E. McEwen
Assistance Maintenance Engineer

(The opinions, findings, and conclusions expressed in this report
are those of the authors and not necessarily those of the
sponsoring agencies.)

Virginia Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia
Department of Transportation and the University of Virginia)

Charlottesville, Virginia

February 1988
VTRC 88-R14

MAINTENANCE RESEARCH ADVISORY COMMITTEE

J. K. MCEWEN, Chairman, Assistant Maintenance Engineer, VDOT
R. E. BLANKENSHIP, Engineering Programs Supervisor, VDOT
J. G. BROWDER, JR., Assistant District Engineer, VDOT
S. L. BUTTS, Management Services Division, VDOT
C. M. CLARKE, Assistant District Engineer - Maintenance, VDOT
R. H. CONNOCK, JR., Assistant District Engineer, VDOT
J. A. COPP, Residency Maintenance Supervisor, VDOT
EDGARDO CORDERO, Area Engineer, FHWA
T. F. FARLEY, Assistant District Engineer, VDOT
C. F. GEE, Assistant Construction Engineer, VDOT
C. O. LEIGH, Maintenance Engineer, VDOT
D. C. MAHONE, Highway Research Senior Scientist, VTRC
D. H. MARSTON, Assistant District Engineer - Maintenance, VDOT
J. E. MELONE, Equipment Engineer, VDOT
R. L. MOORE, Assistant District Engineer, VDOT
D. S. ROOSEVELT, Resident Engineer, VDOT
B. W. SUMPTER, District Engineer, VDOT
C. S. TAYLOR, Program/Systems Development Supervisor, VDOT
W. E. WINFREY, Materials Engineer, VDOT

FINAL REPORT

EVALUATION OF THE CARAVELLE LITTER RETRIEVAL SYSTEM

by

David C. Mahone
Senior Research Scientist

and

John E. McEwen
Assistance Maintenance Engineer

INTRODUCTION

On two occasions, August 26, 1985, in Albemarle County and on March 20, 1987, in Henrico County, personnel of the Virginia Department of Transportation observed the operation of litter retrieval equipment manufactured and demonstrated by Caravelle Litter Technologies, Inc. The two demonstrations are discussed below.

ALBEMARLE COUNTY

On Friday, August 23, 1985, three days before the demonstration on Monday, August 26, the sections of highway over which the system was to be operated were videotaped to record the quantity, types, and location of litter. It was observed that most of the litter consisted of paper products and was located on ramps, under and close to guardrails, and in and behind ditches. These findings provided a focus for the observations to be made during the demonstrations of the retrieval equipment. Prior to the demonstration over the selected sections of highway, Mr. James Roncaglione placed a windrow of debris that, unlike the majority of litter found on the rights-of-way, consisted of metal, rubber, plastic containers, a tire, etc. The retrieval machine was then driven over the windrow at a very low speed, and after repeated coverages was able to mechanically pick up the debris. The machine had the greatest difficulty in picking up the tire.

The planned demonstration was then carried out on the right-hand shoulders of Route 29 north of Charlottesville, the Route 29-250 Bypass, and Interstate 64, and on the encompassed ramps, for a total distance of 12.8 miles. Caravelle's driver, helper, and Mr. Roncaglione rode in the two vehicle during the operation.

To record the demonstration, the Research Council provide a video equipment operator in a van that followed directly behind the retrieval system. The Charlottesville Residency provided two shadow trucks with appropriate traffic control lights to follow the van.

The cameraman videotaped the entire retrieval operation, the dumping of the litter from the retrieval equipment into a dump-truck, the litter after it had been dumped from the truck, and after it had been separated by type. Observers included personnel of the Research Council and Charlottesville Residency maintenance staff, Resident Engineer D. S. Roosevelt, District Maintenance Engineer R. H. Connock, Jr., and representatives of the Maintenance Division.

Mr. Roncaglione informed the group that the benefits offered by the equipment could best be realized through the following uses:

1. To pick up debris such as tires, large pieces of rubber from truck tires, tail pipes, mufflers, etc., from high-speed, highly trafficked roads such as Route 495. In this operation, the equipment would be towed over highways at the prevailing speed of traffic. When the driver would spot debris, he would change lanes, slow down to 3 to 5 mph, pick up the debris, and then resume speed.
2. To pick up bags full of litter placed in easily accessible areas along the shoulders of the roadway.
3. To pick up litter normally discarded along the right-of-way. For this purpose, the equipment should be towed by a four-wheel-drive vehicle or a tractor.

During the demonstration, the engine powering the retrieval unit malfunctioned several times. Mr. Roncaglione indicated that a larger engine might be needed. He also advised that the manufacturer planned to add to the unit an apparatus that would reach out to parapets, curbs, etc., and pull litter and debris to the pickup mechanism.

The equipment operator had a great deal of difficulty in dumping the litter. It is not known whether this was due to the engine problem mentioned above, the design of the leverage system, or a malfunction of the hydraulic system.

The following observations were recorded:

1. Most of the litter consisted of paper products.
2. Most of the litter was located on ramps, under and close to guardrails, and in and behind ditches.
3. The equipment did not pick up litter close to guardrails, posts, etc.

4. The equipment could not traverse the areas where most of the litter was located, and thus could not collect it.
5. The equipment did a poor job of picking up litter in the areas that it did traverse.
6. When the equipment was operating on stabilized shoulders, it threw stabilizing stone onto the traffic lanes, which could lead to windshield breakage.
7. A flagman would be required for traffic control to allow the equipment to safely cross intersecting ramps and routes. Even though lead and trailing vehicles were used, there were serious safety problems at the several ramps and intersections.
8. The efficiency of the pickup apparently was highly sensitive to the travel speed.
9. The efficiency also was apparently sensitive to the amount of downward pressure on the pickup tines.
10. When the litter storage area began to fill, a noticeable amount of litter was kicked out.
11. As the speed of travel increased, the unit picked up less litter and left many smaller pieces in the grassy areas.
12. If the optimum speed and downward pressure were used, the tines would probably undergo a high rate of wear.
13. The equipment picked up a lot of cut grass.
14. The equipment picked up a great amount of stabilizing stone.
15. The equipment picked up quite a few sticks that ordinarily need not be picked up.
16. The pick-up truck pulling the retriever unit became stuck on a very general incline.
17. During dumping operations, debris was blown by the wind. Dumping was difficult, particularly where the dump truck had limited space for maneuvering.

HENRICO COUNTY

In addition to research, district, residency, and maintenance personnel, Commissioner Pethtel, Chief Engineer Wray, Director of Operations Gehr, and Maintenance Engineer Leigh were present to observe the demonstration in Henrico County. The Maintenance Division had previously mailed Department personnel and Mr. Roncaglione a drawing depicting the routes for the demonstration.

Prior to this planned demonstration, which was conducted on Route 60 and an unopened portion of Interstate 295, the Department distributed along the roadside a great deal of the type of litter formally found there, and video recordings were made of this area, as well as of the remainder of the designated demonstration area. However, again just prior to the expected demonstration, Mr. Roncaglione distributed a windrow of bulky items -- i.e., mufflers, tail pipes, tires, large pieces of rubber from truck tires, etc., -- and, as in Albemarle County, picked up the materials by towing the machine very slowly over the windrow.

The equipment was modified between the Albemarle County and Henrico County demonstration. A heavier duty engine was installed and the dumping mechanism was modified. However, the addition of an apparatus to reach out to parapets, curbs, etc., mentioned during the Albemarle demonstration, was not made.

As in Albemarle County, the demonstration was videotaped. All of the observations made in Albemarle County were also noted for Henrico County.

Although the dumping mechanism had been modified, the operator had great difficulty in dumping the litter into the truck. The hydraulic system did not lift the litter container high enough to effectively dump into the medium-sized dump truck the Department had available.

The heavier-duty engine on the equipment seem to be sufficient.

During the demonstration, litter was distributed close to the parapet on a bridge deck. The machine picked it up much more effectively than it did the litter on grass shoulders, which may indicate that the equipment requires a hard, smooth surface to operate effectively. However, while operating close to the parapet, the machine sheared a safety reflector from the parapet wall.

The Department had distributed much more litter than the equipment could remove in a reasonable time, and it was necessary to pick up the remainder of the litter by hand. This cleanup required ten men working one and one-half hours. They recovered 30 bags of litter, 22 of which were hauled to a landfill prior to the truck driver's being instructed that they were to be kept until video recordings could be made of their contents. The contents of the 8 bags that were examined were different from those picked up by the machine, in that no grass, stabilizing stone, or sticks were included. In regards to volume, if the quantity of litter contained in the 8 bags was multiplied by 3.75 to represent the total 30 bags that were picked up, the quantities of paper, plastic, cans, and bottles would be much greater than those that could be picked up in one and half hour by the machine.

Further, the machine would not be able to traverse some of the area picked up by hand, and where it could traverse that portion it would leave items that would have to be picked up by hand.

SUMMARY

1. To use the Caravelle equipment on highways open to traffic, extensive and expensive traffic control would have to be employed.
2. For safety reasons, the equipment could not be used as suggested by Mr. Roncaglione to pick up debris in traffic lanes by cruising at the prevailing speeds, changing lanes, slowing down for pickup, and then accelerating.
3. The machine throws stabilizing stone onto the roadway, which creates a potential hazard and could result in broken windshields.
4. Because the machine cannot traverse the areas where the majority of highway litter is located, hand pickup would still be required.
5. Because the machine does not pick up all of the litter over the areas it does traverse, again, hand pickup would be required.
6. From shoulders, the machine picks up stone that the Department has gone to the expense of providing for stability. And this adds to the cost of hauling the retrieved litter to a landfill.
7. The machine picks up grass and sticks that are biodegradable and need not be picked up. This also adds to the hauling cost.
8. The contents of the machine cannot be effectively or efficiently dumped into dump trucks.
9. The machine possibly could be used to recover bags of litter, as suggested by Mr. Roncaglione, but this operation probably would be more expensive than loading the bags on trucks by hand.

RECOMMENDATION

Based on the observations from the two demonstrations, it is recommended that the Department neither rent or purchase the Caravelle Litter Retrieval Equipment.

