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Donald F. Norris
University of Nebraska at Omaha

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CART-BASED AUTOMATED AND SEMI-AUTOMATED
RESIDENTIAL REFUSE COLLECTION*

Donald F. Norris
Senior Research Associate
Center for Applied Urban Research
University of Nebraska at Omaha

A relatively few years ago, a new technology for residential refuse collection was introduced in urban America. This was the automated collection of residential refuse using standardized roll-out containers, or carts and it occurred in 1969-1970 in Scottsdale, Arizona. In the years since, just over 300 communities in the United States--and I understand some in Canada as well--have implemented automated or semi-automated, cart-based residential refuse collection systems.

An automated refuse collection system in which a single crew member, remaining in the cab of a specially designed side-loading vehicle, operates a mechanical arm or lifting device that automatically extends and grasps or attaches to a standardized refuse container that is left at the curbside. The equipment retracts, dumps the container into the hopper of the collection vehicle, and returns the container to the curbside. All of this is done by a trained operator who manipulates remote controls from the cab of the vehicle.

In a semi-automated system, crew members wheel containers from curbside to either a rear or side-loading collection vehicle and attach the carts to mechanized dumping devices

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(called flippers) that lift and dump them. Crew members then disengage the containers and return them to the curbside.

Semi-automated collection can be adapted to existing fleets of rear or side-loading collection vehicles. Full automation requires specially designed side-loading vehicles. In both cases, a critical ingredient in collection is the standardized container or cart.

The lifting and dumping devices used in automated and semi-automated collection are engineered to handle containers of a standard design. Residential containers come in 82, 84, 85 and 90 gallon sizes and are either cylindrical or have rectangular shaped tops. Recent bid prices range from around \$35 to \$65 depending upon type of construction, whether carts are delivered assembled or disassembled, length and type of warranty, and quantity purchased. The containers typically include built-in wheels, handles, attachable tops, and are made of a sturdy plastic.

Local governments that convert to automated or semi-automated collection should take particular care to ensure that the lifting devices and carts are compatible. If they are not, serious implementation problems can occur. Another sound procedure is to purchase the complete system (vehicle, lifting devices, carts) from a single vendor who is made fully responsible by contract for system performance. In this way, if anything goes wrong one supplier will be responsible for providing corrective action and the community will not be caught in a dispute between vendors.

Most communities that implement cart-based systems appear to do so for reasons of cost. Because labor requirements can be substantially reduced and because collection efficiency is often far better, automated and semi-automated collection can produce considerable cost savings. Memphis, TN (pop. 645,000) implemented semi-automated collection using its existing fleet of rear-loading collection vehicles and 180,000 residential containers in 1980-1981 with an annual savings of over \$9 million. Similarly, the smaller community of Maryville, TN (pop. 17,000) converted to fully automated collection in 1979 with an annual savings are over \$100,000. In both cases, the cities were also able to improve their collection productivity.

In addition to cost savings, the adoption of automated and semi-automated collection technology enables communities to reduce litter, reduce employee injuries, and improve collection efficiency, often with a relatively high level of public support. Yet recent data on cart system adoptions in the United States indicate only a gradual--and in the past three years a decreasing--trend toward implementation of this innovative, effective technology.

In a survey I conducted in 1981-82 and reported in the May 1982 issue of American City and County, I found that only 261 cities and counties and 41 military bases and other entities in the U.S. had converted to cart-based residential refuse collection. This figure represents less than 3 percent of the 9,300 U.S. cities and counties with populations

of 2,500 or more. Of these 302 entities, only 69 (or 23 percent) are fully automated. The remainder (233 or 77 percent) use semi-automated systems. 204 sites are full, permanent installations, 85 are partial installations, 4 are demonstrations, and no information was received on 9. In 205 sites, the local government collected refuse, private haulers made collections in 88 sites, and no information was provided on collection in 19 locations. About 1.9 million carts were in use at the time of the survey of which nearly 403,000 were in use in fully automated installations.

Prior to 1975, 23 cart based systems had been installed in the U.S. From 1975 to 1981, the growth rate of adoptions of this technology was stable although not dramatic. However, beginning in 1980, through 1982, fewer systems were implemented in each successive year. Data are provided in Figures I through VII.

Observation of actual conversions as well as discussion with municipal officials and vendors suggest that three factors have had significant impact on the rate of adoption of automated and semi-automated systems.

These factors appear to be: 1) the relatively high cost of initial investment combined with the current local government revenue crisis and a high degree of fiscal uncertainty; 2) the innovativeness of the technology combined with local governmental resistance to change; and 3) political concerns of local governmental officials.

At a time when local governments, particularly in the U.S., need to improve the efficiency of public service delivery and to reduce operating costs, the relatively high cost of converting to cart-based systems combined with recent municipal revenue shortfalls and a high degree of uncertainty about the fiscal future has caused a slow-down in conversions to automated and semi-automated collection. The initial cost involved in system implementation can be seen in the following example. A municipality of 60,000 will probably require something like 15,000 roll-out containers. At \$50 each, this means an initial cost for containers only of \$750,000. In addition, automated side-loaders cost around \$70,000 each and six vehicles (including one piece of back-up equipment) will cost around \$420,000. For a fully automated system, the total--not including such additional items as public education, operator training, and route redesign--is \$1,170,000. This is a healthy sum for almost any small to medium sized local government.

The irony is that in many cases not only will these systems pay for themselves in a relatively short time (9 months in Memphis) but will also produce actual dollar savings.

A second factor affecting conversions may be the innovativeness of the technology itself combined with the resistance to change so often found in local governments. Automated and semi-automated refuse collection technology has

been commercially available for about twelve years. However, in the U.S. only nine companies manufacture automated side-loading collection vehicles, only six manufacture automated lifting devices, and only twelve supply standardized roll-out containers. See Figure VIII. Further, several of these organizations have only recently entered the market place with components for automated collection. Compared to other recent technological innovations--such as microcomputer technology--in which there are now hundreds of manufacturers, suppliers and retailers, the number of automated refuse system suppliers is quite small.

Local government scholars and those who study the introduction and diffusion of innovation cannot seem to reach agreement on whether local governments are relatively more or less inclined to resist innovation. My own experience providing technical assistance to local governments in three American states, as well as a careful study of the literature, however, leaves me with no doubt that local government resists change and generally is slow to adopt innovative technologies. This conclusion should not be surprising. After all, government itself is considered a conservative social organization. Local governments typically are run by elected officials whose technical knowledge is quite limited and whose tenure is often short. Further, local government must take special care to guard against ventures that will cause either losses to the public treasury or

political damage to the government itself. Hence, conservatism in the adoption of new technologies should not be unexpected.

Further, local officials typically have several quite understandable concerns about the effects of adopting automated and semi-automated refuse collection. These include such things as employee and labor union reaction; the ability of the elderly and the handicapped to use the carts; actual system performance (or the question "Does it really work?"); and whether containers are sturdy enough to withstand 5 to 10 years use in a given climate.

The fact that 69 U.S. communities have implemented fully automated systems and another 225 have implemented semi-automated systems should be enough to answer these concerns. Systems have been installed in large communities (Phoenix, AZ and Memphis, TN both are fully installed and with Detroit, MI and Washington, D.C. are in the process of converting or deciding to convert as this is written), in small cities (Blountstown, FL, pop. 2,500, has a semi-automated system and Kearney, AZ, pop. 2,600, is fully automated), in all regions of the country, all climates, in cities with strong municipal labor unions and places with no unions at all.

Nevertheless, these issues inevitably are raised and must be addressed anew in each new installation. Frequently, this requires a pilot or demonstration program in selected areas

of a community, an intensive public education/public relations campaign by the city government, various incremental measures and political compromises.

In some cities, unions have been promised that displaced sanitation workers will be transferred to other areas of municipal employment. In others, numerous employees have been removed from the payroll. Communities that convert typically provide special help and/or waivers from the cart system for the elderly and handicapped and also purchase all containers for residential use.

Findings from implementations in several cities show reductions in either in streets and alleys and substantial public support during and after demonstration programs. Though it is not known how much these data are attributable to municipally drawn questionnaires or Hawthorne-like effects. In any event, communities have been able to overcome these political concerns and successfully implement systems.

One concern that is probably on the minds of Canadian local officials is the effect of winter weather on containers and mechanical equipment. Actual experience with installed sites shows that containers are able to withstand the deep cold of a great plains winter, they can be rolled through the snow of a midwestern winter and, with a sound maintenance program, hydraulic hoses and lifting arms will also work under these conditions. However, perhaps the best thing I can suggest is that you contact sanitation directors in one

or more cities in Idaho, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, South Dakota, Utah, or Wyoming that have fully automated systems.

Automated and semi-automated residential refuse collection is a proven technology in operation in an increasing number of communities. It offers a clear cost-effective alternative to conventional methods of refuse collection. Yet adoption is not especially widespread and has apparently slowed in recent years.

Contrary to these data, however, vendors of automated and semi-automated systems believe the slow-down in adoptions is but a temporary aberration caused by current economic conditions. They feel that, if anything, adoptions will increase substantially in coming years. They also cite a growing interest by private haulers.

Finally, and also contrary to reported evidence, at least one observer feels conversion to these systems, if used properly, can provide solid political support for elected officials. (The conventional wisdom on the subject is that conversion is a politically controversial and potentially damaging issue.) Instead, says Charles Levine of the University of Kansas, a mayor in need of an issue that provides visible evidence of his or her activity, is physically attractive, and has the virtue of saving money while improving public service, should look to automated collection. To date Levine's role example is the current

mayorial race in Washington, D.C. Time and the official ballot count will give some indication of whether we may have a new conventional wisdom.

FIGURE I
Types of Sites

<u>Type</u>	<u>Number</u>	<u>%</u>
Municipalities	242	80.1
Military Base	32	10.6
County	17	5.6
Other/No Information	<u>11</u>	<u>3.6</u>
Total	<u>302</u>	<u>99.9</u>

FIGURE II
Semi-Automated or Automated Collection

<u>Type of Collection</u>	<u># Sites</u>	<u>%</u>
Semi-automated	225	74.5
Automated	69	22.8
No Information	<u>8</u>	<u>2.6</u>
Total	<u>302</u>	<u>99.9</u>

FIGURE III
Full or Partial Installation

<u>Type</u>	<u>Number</u>	<u>%</u>
Full	204	67.5
Partial	85	28.2
Demonstration	4	1.3
No Information	<u>9</u>	<u>2.9</u>
Total	<u>302</u>	<u>99.9</u>

FIGURE IV
Collected By

<u>Collecting Entity</u>	<u>Number</u>	<u>%</u>
Municipality	203	67.2
Private Hauler	88	29.1
Other/No Information	19	2.9
Municipal/County	<u>2</u>	<u>0.7</u>
Total	<u>302</u>	<u>99.9</u>

FIGURE V

<u>Total Carts:</u>	1,893,000
<u>Carts in Fully Automated Sites:</u>	402,500 (21.3%)

FIGURE VI

Installation Start-up Dates

<u>Year</u>	<u>Number</u>	<u>%</u>
pre-1975	23	7.6
1975	16	5.3
1976	23	7.6
1977	32	10.6
1978	46	15.2
1979	59	19.5
1980	44	14.6
1981	39	12.9
1982*	2	0.7
No Information	<u>18</u>	<u>5.9</u>
Total	<u>302</u>	<u>99.9</u>

*to March 1982

FIGURE VII
Regional Distribution

<u>Region</u>	<u># States</u>	<u># Sites</u>	<u>%</u>
South-Border	13	185	61.3
Midwest-Plains	11	51	16.9
West-Southwest-Mountain	11	48	15.9
New England-Mid-Atlantic (includes Washington, D.C.)	<u>6</u>	<u>18</u>	<u>5.9</u>
Total	<u>41</u>	<u>302</u>	<u>100.0</u>

FIGURE VIII*

Suppliers of Automated Refuse Collection SystemsA. Automated Side Loaders

Arizona Special Products
Athey Waste Control
Broyhill Manufacturing Co.
EMCO
Government Innovators
Heil Co.
Pak-Mor Manufacturing Co.
Truxmore Industries, Inc.
Wayne Engineering

B. Lifting Devices

Arizona Special Products
EMCO
Government Innovators
Heil Co.
Pak-Mor Manufacturing Co.
Wayne Engineering

C. Standardized Containers

American Refuse Systems, Inc.
EMCO
David A. Garofalo and Associates
Heil Rotomold, Inc.
PPI Industries
Refuse Removal Systems
Reuter, Inc.
Rubbermaid Applied Products, Inc.
Snyder Industries
Turnkey Container Systems, Inc.
Wayne Engineering
Zarn, Inc.

*The lists are intended to include most if not all of the suppliers of devices for automated refuse collection systems. However, the market place is undergoing continual change and their accuracy cannot be guaranteed especially over time.