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Residential Refuse Collection Technologies

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TECHNICAL bulletin

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RESIDENTIAL REFUSE COLLECTION TECHNOLOGIES

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Many Tennessee cities collect refuse today in much the same way they did 60 years ago. Yet, advances in technology now offer alternatives to older, conventional collection methods. New methods combined with the older technology can also be very successful. Cities now can choose from several refuse collection systems that are highly cost effective.

TYPES OF REFUSE COLLECTION SYSTEM

Automated and semi-automated refuse collection technologies are based on the curbside collection of standardized, wheel-type, refuse containers. Curbside collection not only promotes more economical refuse collection but also provides the opportunity for automation. Standardized containers, or carts, are necessary as the lifting devices on automated and semi-automated collection vehicles are engineered to handle only specially designed containers.

With automated pick up, residents are provided with the standardized container into which they place their wastes. The specially shaped cart is parked at the curb, and the collection vehicle operator picks up the cart with a hoist and dumps it into the vehicle.

In semi-automated collection, the carts are rolled to the back or side of the truck where specially designed hydraulic lifts known as "flippers" empty waste into the vehicle. Semi-automated pick up reduces worker injuries and can reduce worker fatigue, but it is, except for back door collection, the slowest of the collection methods.

As a general rule of thumb, with curbside collection a one-person crew with an automated side-loading vehicle should be able to service 950 homes per day. A three-person crew with a rear-loading vehicle can provide curbside service to 800 homes per day.

Automated and semi-automated systems are easy to use, are less labor intensive, and reduce on-the-job injuries. They can be adapted to operate efficiently in almost any climate, terrain, or street configuration. Reduction of on-the-job injuries is an important consideration; solid waste collection workers have the highest rates of on-the-job injury of any class of municipal employees, including fire and police.

Automated rear-loader packer trucks generally have two or more operators.

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Refuse is placed in the rear of the vehicle, then compacted by a ram mechanism. Truck capacities of 20 to 32 cubic yards are common; payloads average 20,000 to 32,000 pounds.

Automated side-loading vehicles allow a single operator to drive and load the waste into the vehicles. Some trucks are configured with multiple hoppers so that recyclable materials can be collected at the same time as the refuse.

Front- and top-loading collection vehicles provide lifting mechanisms for picking up large refuse containers and tipping them into the vehicle. These vehicles can be used in conjunction with a small fleet of satellite vehicles. Selmer, Tennessee, has converted to this system.

BENEFITS FROM AUTOMATION: SELMER, TENNESSEE

Selmer, Tennessee has converted to a system using a front-loading compactor truck and four Cushman dump bed satellite vehicles. Using the compactor truck and the Cushman satellite vehicles, weekly residential collection is completed in three days, using 112 employee hours. In contrast, the former conventional method took five days and 120 employee hours. The compactor truck is used 24 hours versus 40 hours previously; thus freeing additional truck time for commercial collection. This maximizes the efficient use of equipment resources and avoids the possible necessity of purchasing an additional truck and the expense of additional employee hours. There is a collateral benefit of not having a large collection truck using the edge of a light-duty pavement system in residential neighborhoods.

AUTOMATION ALSO WORKS FOR RECYCLING

Recyclables often are collected in trucks specially designed to handle lighter weight, bulky materials. Where recyclables are mixed together, bagged, and set out at the curb, all the recyclables are hauled together in one chamber of the vehicle. Where residents separate their recyclables into different categories such as glass, plastic, and metal, the pick-up vehicle has multiple compartments into which the different materials are directed.

ISSUES TO CONSIDER

When a private firm is able to undercut a municipality's cost of collection and still earn enough profit to make the contract desirable, it is because the firm has paid attention to the following:

- Proper routing;
- Proper equipment selection;
- Proper staffing;
- Proper training; and
- Economy of scale.

These are all items that a municipality can address if the policy decision is made to do so.

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Appropriate planning, especially on collection routing, is critical to the municipality's competitiveness. The collection environment should be studied carefully, and suitable vehicles with the correct staffing selected to meet the need. Higher equipment prices and automation, for instance, are not necessarily the answer.

One of the most common problems with competitive residential collection is the over-manning of municipal collection vehicles. Having too many employees lowers individual productivity and increases cost of service.

Preventative maintenance is an area where municipalities must guard against falling short. Solid waste collection equipment is a major capital investment. Successful private sector enterprises recognize this. They also recognize that preventative maintenance programs have proven to more than pay for themselves. Equipment will last longer, allow crews to perform at peak efficiency, and not be subject to costly and annoying down time.

Private firms also recognize the value of accurate record keeping for making sound management decisions. Having complete records aids in route planning, staffing, and equipment selection.

Thorough employee and management training is another key area where cities need to take a note of private firm operations.

Once again, policy decisions come into play, but curbside collection allows the municipality to provide service at the lowest cost to the public. A curbside collection route with bagged garbage can be served by a one-person crew in a dual controlled side loader. Bagged trash in a side loader can cut the collector's steps in half compared to city rollouts or customer containers.

Figure 1 provides cost and productivity estimates for seven different refuse collection technologies, each serving 4,000 customers per week. The fully automated side-loading system serving 950 customers per day per vehicle is the most cost effective at an estimated $52,858 per year or $1.10 per customer per month. This figure does not include a number of costs common to the various methods, nor does it reflect what a customer's monthly rate should be. It is merely a convenient method for comparing the relative efficiency of these refuse collection technologies.

Data in Figure 1 are based on the following assumptions:

- Labor cost is $505 per week for salary and benefits per crew member.
- Equipment cost is based on a six-year life cycle, and all costs are prorated to actual equipment use.
- Other costs not addressed, but common to all operations, include supervision, equipment insurance and storage, vehicle

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operation and maintenance based on vehicle usage, vehicle financing, other debt service, and overhead.

- Productivity rates (or customers served per day) are average figures that most cities should be able to achieve, the key words in that sentence being "average" and "most." Circumstances vary among cities, and one size does not fit all. These rates assume that each crew works 40 hours per week, spends 30 hours on the route, and collects only refuse placed in containers or plastic bags. Data from a variety of jurisdictions around the country show that with proper management, equipment, and incentives, these or higher productivity rates can be met.

Figure 1.

Collection Method	Crew	Vehicles	Equipment Cost	Labor Cost	Total Cost/Year	Customer Cost/Month
Manual, rear-loader, back door ~350 customers/day/vehicle	3	3	$37,240	$179,618	$216,858	$4.52
Manual, rear-loader, curb side ~650 customers/day/vehicle	3	2	$21,889	$ 96,742	$118,641	$2.47
Semi-auto, rear-loader, curb side w/cans ~700 customers/day/vehicle	3	2	$22,040	$ 89,809	$111,849	$2.33
Manual, rear-loader, curb side bagged trash (no cans) ~800 customers/day/vehicle	3	1	$18,333	$ 78,780	$ 97,113	$2.02
Semi-auto, side-loader, curb side w/cans ~500 customers/day/vehicle	1	2	$56,000	$ 42,016	$ 98,016	$2.04
Semi-automated, side-loader, curb side bagged trash ~950 customers/day/vehicle	2	1	$28,560	$ 44,117	$ 72,677	$1.51
Automated, side-loader, curb side w/cans ~950 customers/day/vehicle	1	1	$30,800	$ 22,058	$ 52,858	$1.10

Note: This table does not account for equipment redundancy. Back-up equipment is essential in refuse collection.

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The most critical difference among the systems presented in Figure 1 are labor costs, not equipment costs. It is largely this labor difference—more than $150,000 per year between the most efficient and least efficient collection methods—that produces the overall system cost differences. The least efficient, of course, reflects rear door collection, which involves a policy decision. The same crews with the same equipment can provide curbside service at about one-half the cost per customer compared to back door collection. Figure 1 does not reflect what a customer's monthly rate should be, nor does it consider other common overhead factors. Figure 1 also does not reflect equipment redundancy. Equipment redundancy does not always necessitate a purchase. Interlocal agreements and vendor contracts are alternatives to purchasing back-up equipment.

Some cities in Tennessee collect refuse twice per week. Using standard containers and automated or semi-automated systems, cities can save up to 40 percent on fuel costs by converting to collection once per week. The standard containers are adequate to handle a week's refuse for the average family and are virtually waterproof and spill proof. In addition, over the life of the containers they actually cost less to the homeowner than two garbage cans and a plastic bag per week. Automated and semi-automated technologies represent reliable, cost-effective methods of refuse collection, and they should be given serious consideration by almost every city that provides refuse collection service.

Data from cities as diverse as McMinnville, Tennessee, (pop. ~13,000) and Memphis, Tennessee, (pop. ~650,000) show that automated and semi-automated refuse collection can work well.

Public reaction to converting to curbside automated or semi-automated refuse collection can be critical to system success. Officials must anticipate the genuine concerns of citizens, answer those concerns honestly, and show citizens that the new systems will save taxpayer dollars while maintaining or improving refuse collection service. Also, cities should implement special programs for people such as the elderly and the handicapped whose physical limitations prevent them from wheeling refuse containers to curbside for collection.

In order to achieve significant savings, local communities must ensure that their new automated or semi-automated systems work effectively. Factors such as how to finance the system, how to deal with personnel displaced by automation, efficient route design, and proper maintenance of automated equipment must be taken into consideration well in advance of system implementation. These same criteria are relevant to cities that elect not to automate. Proper planning, training, staffing, maintenance, and methodology are key to the success of all residential refuse collection technologies.

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Note: This publication was prepared with assistance from Eddie Anderson of Stringfellow, Inc., Nashville, Tennessee, who provided equipment quotations, and with reference to the MTAS Salary Survey, and advice from Richard Stokes, MTAS personnel consultant, on estimating benefits.

EQUIPMENT QUOTATION (LISTED IN THE ORDER OF APPEARANCE FROM FIGURE 1)

Projected budget figures to match the units in Figure 1:

Manual rear loader, back door (HEIL 4000-16 CY on 2008 Ford F750)	$ 98,000
Manual rear loader, curbside (HEIL 4000-20 CY on 2008 Ford F750)	$107,000
Semi-automated rear-loader, curbside (HEIL PT1000-20 on 2008 Sterling Acterra)	$116,000
Manual rear-loader, curbside (HEIL PT1000-20 on 2008 Sterling Acterra)	$110,000
Semi-automated side-loader, curbside (HEIL Multi-Task-28 on 2008 Mack LE)	$210,000
Semi-automated side-loader, curbside (HEIL Multi-Task-28 on 2008 Mack LE)	$204,000
Automated side-loader, curbside (HEIL Python-28 on 2008 Mack LE)	$220,000

(Cart prices will probably be in the $60 to $65 range.)

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