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CONTENTS

Trends in Solid Waste Collection —What's the Future, Part III

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Last issue, we discussed a recent trend in solid waste collection involving the implementation of hybrid vehicle technology and enhanced electronics. This issue we will discuss the use of software to help optimize routing of solid waste collection fleets and provide an overview of current trends in purchasing of solid waste fleets by local solid waste agencies.

ROUTING SOFTWARE

Is it feasible? The short answer is "Yes." Routing software is used throughout the United States by both private and municipal operations to optimize collections and assist managers in monitoring the performance of their fleets and personnel (Exhibit 1). The decision to purchase or use a routing software application must be considered carefully. Because equipment costs, labor, and fuel are significant operating expenses for waste collection operations, reducing the number of routes, labor hours, and mileage through route optimization is a critical and straight forward approach to increasing efficiency and reducing costs. Typical complaints heard from many of our clients include the following: that the software is too complicated to be adopted into daily operations, that the software is too expensive to purchase outright or to procure through a monthly service fee, and that the system maintenance requirements are too extensive.

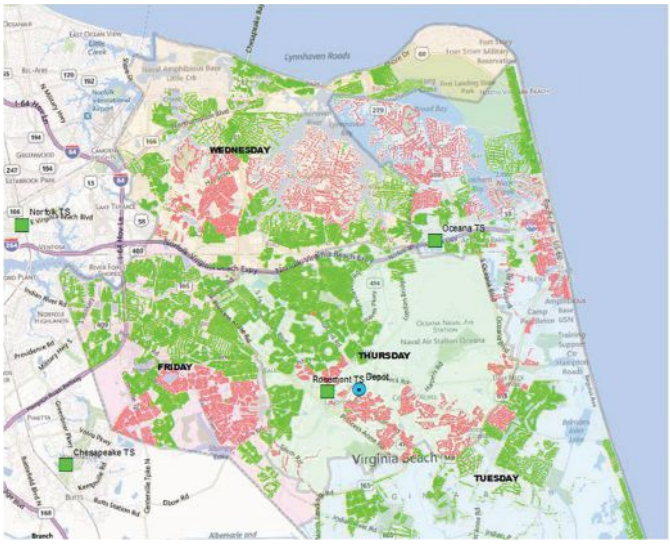

Exhibit 1. Routing software was used by SCS to help reduce routes for the City of Virginia Beach, Virginia, from 143 to 129 (9% reduction) with an initial 10% labor hour savings.

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Reaching an optimal solution requires many types of algorithms, including:

- High density for residential curbside collection
- Point-to-point routing for commercial collection or residential bulky items collection
- Paired routing for rolloff box collection and delivery

SCS's experience shows that no single application on the market handles all types of waste routing effectively. Some of the more widely used routing software applications for typical residential solid

waste collection fleets include Fleet Smart™, Route Smart™, WM Design™ and WM Logistics™. Several software vendors have developed point-to-point routing software applications. Point-to-point routing is used when the daily delivery locations, or, in the case of solid waste, daily collection of bulky waste might vary. However, the number of applications that can solve the problem properly drops to fewer than 10 worldwide when routes have more than 50 stops. Two examples of point-to-point routing software include Roadnet™ and Route Solutions™.

Each program uses various routing techniques and algorithms, graphical information system (GIS) applications, automatic vehicle location technologies, and on-route mapping and monitoring. Multiple applications sometimes need to be implemented to service all types of waste collection routing required: To assess whether a solid waste agency is a good candidate for implementing waste route optimization software, the following questions should be answered.

- Do the crews have assigned route boundaries?
- Do the crews have maps to use?
- Was the last re-route more than five years ago?
- Do you know how many stops and containers are included in each individual route?
- Are the current routes developed based on all of the factors of time, weight, number of dump trips, and the number of stops?
- Do you have current route statistics (e.g., time on route, time to first dump, time to second dump, travel time to dump site (landfill or transfer station), break time, check in and check out time, and breakdown time?
- Are total route times within an hour of the normal workday hours?

If the answer is "no" to any of these questions, it is highly likely that the agency's operation is not efficient and would benefit from route optimization.

CHALLENGES OF ROUTE PLANNING SOFTWARE IMPLEMENTATIONS FOR WASTE COLLECTIONS

For residential waste collection, thousands of customers typically must be plotted and routed. Further, you will have varying productivity rates amongst different types of vehicles, in different types of streets and neighborhoods, and with different types of customers. Oftentimes, maneuver restrictions exist on certain roads and time constraints around schools or heavy traffic areas.

The complexity can seem insurmountable, but route optimization software applications do the initial hard work of developing an initial routing solution based on pre-defined priorities (e.g., right turns are preferred). After the initial routing is completed, the solution must be reviewed

carefully to address and resolve anomalies that generally occur. The software does make it easier to create new routes, change routes and generate maps and report outputs. These programs typically can integrate directly with on-vehicle hardware to allow truck drivers and their supervisors to track the route progress in real time. For larger systems, the upfront investment of time to configure the system and set up the routing solution can be worth the effort; however, these systems require dedication of resources to maintain and keep the data up-to-date.

Many municipal operations will assign the logical candidate to learn and use the software, commonly the route supervisor that manually created routes in the past. In our experience, this is a common point of failure. In many cases, the supervisor does not have the technical background, experience in implementing a complex software application or the time to master the program. Another common mistake is using the GIS staffer that has limited time and limited knowledge of solid waste operations. Thus, the supervisor should be trained to use the software product.

Another pitfall is the expectation that the routing software will do everything that the salesman says that it does. For example, the travel paths generated by high-density routing applications typically are not as efficient as what can be manually generated by a highly experienced routing expert. The benefit of the software is not in making perfect routes, but in providing the ability to quickly generate many routes with accurate completion times and other parameters.

Although no studies exist that quantify the failure rate for solid waste routing software implementations, our observations show that more than half of the residential curbside waste routing projects end up with the customer not continuing to use the waste routing software on an ongoing basis. The project provides an initial set of routes that are implemented, and then the software is hardly used again. For this reason, many municipalities hire a consultant or bid the work to a routing software company that is highly experienced with the various routing applications to develop the optimized routes for them, and repeat this process when the routes become imbalanced.

COLLECTION FLEET PURCHASE PROGRAMS

With the increasing costs of vehicles and equipment for solid waste management, many communities are evaluating their budgets and how they approach their overall vehicle and equipment replacement programs. Historically, local governments have reduced fleet sizes and deferred replacements during economic downturns or times of budget shortfalls to provide a balance against the need to increase user fees or rates to meet operating expenses. While one can argue that the decision to reduce fleet replacement spending is a valuable corrective action, it could result in increasing expenses for these agencies if they tip the balance of fleet replacement spending too far.

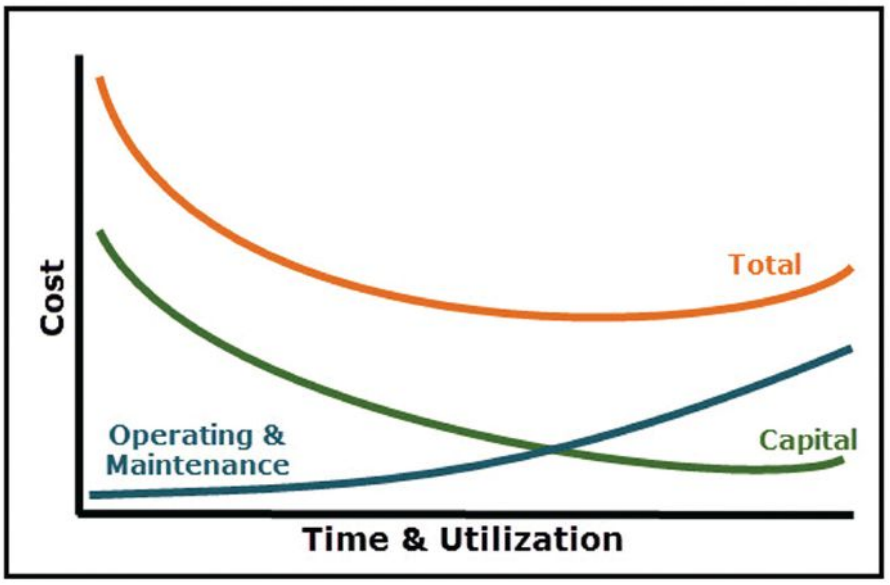

Exhibit 2. Capital Cost Curves. *Source:* American Public Works Association, *Vehicle Replacement Guide*, 2001.

All vehicles and equipment used in public works eventually wear out and become more expensive to maintain and operate. That is, unplanned maintenance and repairs due to component failures tend to rise with increasing age of the vehicles or equipment. These unpredictable incidents result in such events as increasing shop time, delays in securing major parts for repair and delays in getting the vehicle or equipment back into operation.

Capital costs tend to decline over time, while operating and maintenance costs increase. The combination of these two basic curve functions results in a "U-Shaped" cost curve, often called "total costs" (Exhibit 2). The economic theory of vehicle and equipment replacement predicts that vehicles and equipment should ideally be replaced during the flat portion of the curve; that is, at the time annual operating costs begin to outweigh capital costs. Deferring replacement purchases to accommodate short-term budget shortfalls can result in future increased replacement costs and often unmanageable fleet replacement backlogs.

Commonly, public sector organizations attempt to purchase solid waste vehicles and equipment using cash generated from their annual operating income. This is akin to an individual paying for a personal vehicle in cash from his or her annual salary—a daunting task for most people. Similarly, many agencies historically have used cash as the primary means of funding their replacement program. Involving no interest or debt financing costs, cash purchases are viewed by many finance and solid waste managers as a prudent method for funding fleet replacement. Unfortunately, the use of cash to primarily fund vehicle and equipment replacements results in volatile funding requirements with high annual peaks and valleys.

For example, for many agencies to replace a "big ticket" vehicle or piece of equipment, it might be necessary to freeze a significant portion of other fleet replacements and cut other operational programs (i.e., training, safety and professional development, etc.) within the agency's overall budget authority. This almost always results in a deferral of some replacement purchases. Typically, where agencies use cash as the primary means to fund vehicle and equipment purchases, one often finds older fleets, higher maintenance costs, and backlogs in purchases.

A number of alternative vehicle/equipment purchasing programs are being used by solid waste agencies to preserve cash. Each of the financing methods described has its own particular advantages and disadvantages, which can be influenced by local municipal circumstances. Clearly, no single best approach exists for financing fleet replacement costs. With the financial challenges facing local governments today in providing cost-effective and timely solid waste management services, evaluation of these various approaches should be made focusing on ways to minimize costs and providing value-added services to the public.

GUARANTEED BUY-BACK PROGRAMS

Buy-back programs are an alternative to an outright cash purchase of fleet equipment. A buy-back program allows gives an agency the right to sell, lease, trade or otherwise dispose of the vehicle. However, in the bid for equipment, the bidder guarantees that it will repurchase the machine from the agency at the end of a specified hourly or annual term from the date of delivery. Typically, many agencies use these provisions to keep maintenance costs to a minimum and to enable them to procure new equipment at a frequent rate.

SINKING FUND

To fund fleet replacements, many solid waste agencies have used a sinking or revolving fund to spread the costs of funding new vehicles or equipment over a longer period of time. Essentially, this type of financing approach requires that an agency make periodic payments into a fleet replacement fund, thereby ensuring that adequate funds will be available for the replacement vehicle or unit when the time comes.

For example, if the initial purchase price for a vehicle is $120,000 and the replacement cycle is determined to be six years, then $20,000 is budgeted every year to pay for the replacement of the vehicle. In comparison to the cash method, a sinking fund helps even out the annual volatility of the agency's replacement funding needs. Critical to its success is the ability of the agency to account properly for the inflationary increases in purchase prices for the replacement vehicles or equipment, interest earning on the funds placed in reserve and salvage values of the vehicles or equipment, if any.

A basic advantage to this approach is that it enables the agency to predict its annual funding needs over a long planning horizon. A major disadvantage is that it often is prohibitively expensive for most agencies to establish if a large backlog of fleet replacement needs exists. A large amount of cash must be deposited initially to create the working capital necessary to start replacing vehicles or equipment. It is tempting for municipal officials to raid such funds during lean budget years, undermining a well-designed fleet replacement program in a single year.

DEBT FINANCING

In comparison to cash or sinking fund financing programs, debt financing typically allows solid waste agencies an option to spread out the costs of fleet replacement. Rather than trying to accumulate cash reserves in a sinking fund, an agency can borrow funds from financial institutions, either as lines of credit, fixed-term, bank loans or bonds, repaying the outstanding principal and interest on a periodic basis once the vehicles or equipment are placed in service. Similar to the sinking fund method of financing fleet replacement, debt financing enables the agency to eliminate the peaks and valleys in replacement funding requirements. Also, in some respects the predictable natures of the annual expenditures have tended to make replacement funding less subject to controversial budget decision making. Historically, many solid waste agencies have shied away from debt financing to fund their fleet replacements. Often, much of this is due to local or managerial preferences to avoid high interest charges for vehicles and equipment that have a short lifespan. In other cases, state or local laws prohibit the use of debt financing without voter approval.

LEASING

Leasing or lease-purchase options are other commonly used methods by solid waste agencies for financing fleet replacements. Usually, these financing programs are offered directly from the manufacturer or third-party distributor. In comparison to the other financing methods discussed previously, leasing enables the agency to pay a fee ("installment purchases") for a vehicle or equipment and then essentially 'walk away" from it after a specified period.

New municipal lease programs now being offered allow agencies to have new trucks every two years with full factory warranties on the vehicle chassis and body. A variant of leasing is a lease-purchase, where an agency can own the equipment. Overall, there is no hard and fast rule in lease financing since the terms may differ from manufacturer to manufacturer. In most cases, the obligation terminates if the department fails to appropriate funds to make the renewal year's lease payments. Because of this provision, neither the lease nor the lease payments are considered debt. Payments can be structured monthly, quarterly, semi-annually, or annually based on the cash flow of the agency.

What makes municipal leasing financially desirable is its treatment of interest under Section 103 of the Federal Internal Revenue Code. The interest earnings under a properly structured and documented lease are exempt from federal income tax under the same tax laws that enable a municipal bond to carry a tax-exempt rate. Because the lessor does not pay federal tax on the interest earned, the tax-exempt lease often carries a much lower interest rate than other kinds of leases and installment loans, thus significantly lowering the cost of financing for the borrower. This enables the agency to replace vehicles or equipment more frequently without having to acquire significant cash reserves before purchases the replacements.

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THE AUTHORS

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