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Expanding the Use of Roll-On, Roll-Off Trash Compactor Technology to Reduce Rodent Infestations in New York City: NYC Private Multiple-Dwelling Deployment Assessment

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I. Introduction

The New York City Department of Health and Mental Hygiene (DOHMH) is increasing its efforts to prevent rodent infestations in the five boroughs by enhancing proactive inspection programs, increasing public education, and promoting the use of best practices and technologies that are more effective and safe for human health and the environment.

One of the primary conditions promoting rodent infestations is the improper handling and storage of garbage, specifically putrescible (organic-based) waste. Putrescible waste that is not adequately contained is a reliable and consistent source of food that will sustain rodent populations as long as it is available. Preventing rodents from reaching this food source is paramount in the fight against rat and mice infestations. Large private apartment buildings and residential complexes generate a large amount of waste. In many neighborhoods in New York City, improperly managed waste contributes to the presence of rodents within, and around buildings.
Large apartment complexes may be able to better contain building waste and reduce rodent infestations by adopting the use of roll-on, roll-off trash compactors as their standard means of waste management.

This report assesses the feasibility and identifies the criteria needed to deploy roll-on roll-off trash compactors in New York City's large apartment complexes to bring about a reduction of rodent infestations in and around apartment complex properties.

Included in this report is a description of the roll-on, roll-off compactor technology, the benefits of its deployment, and the physical and operational requirements for adoption of the technology on apartment complex properties. Site visits to a sample of five residential complexes were conducted. The results of those site visits are summarized in this report, along with a series of recommendations for developers and managers to consider when examining the feasibility of deploying this technology on their properties. This report is intended to serve as a guide for assessing the feasibility of large private apartment complexes that are considering adopting this technology for waste management.

I. Background

New York City is one of the most densely populated in the United States. More than a third of all of our residential space resides in the 5,000 or so apartment buildings with 10 or more floors. As such, a sizeable portion of our residentially generated waste is managed in a highly centralized way. Most large apartment complexes move trash from residential units to central compactor or storage rooms, from which the trash is moved out of the buildings in one of two ways. Some large apartment complexes place trash in heavy duty trash bags curbside, where it is picked up by regular DSNY trucks during normal routes. Many apartment complexes place trash bags in 2 to 8 cubic yard containers (see Appendix B) until they are serviced by front-end loading Department of Sanitation trucks that lift the containers and empty their contents into a compacting truck.

Most open containers, or dumpsters, fail to prevent access by people and by vermin because they are open to the elements. Rats are adept at vertical climbing and will easily scale the sides of these waste containers. If a rat gains entry to a container, it can chew through heavy duty trash bags in as little as 15 seconds. If, as Figure 1 (below) shows, these containers are left open to receive more trash than they are designed to hold, it makes access by rats even easier. Even if closed, rats require just a half inch gap to gain entryAdditionally, trash stored inside a building contributes to the presence, and severity of mice, which can chew though heavy duty trash bags as readily as a rat.

Figure 1. Trash stored in standard containers (dumpsters).

Roll-on roll-off trash compactors are already in use in many large residential buildings in New York City. The New York City Housing Authority (NYCHA) uses over 320 compactors in the buildings they manage. And, a number of private residential building complexes, such as Battery Park City, have adopted this technology. In the case of NYCHA one compactor is used to service about 500 apartment buildings, and each apartment is expected to produce approximately 5 pounds of garbage per day. These figures may be different for other residential areas and depend on estimates of the expected number of persons living in each apartment and the amount of waste produced. Both NYCHA and the Department of Sanitation report sizeable reductions in rodent infestations since deploying roll-on, roll-off trash compactors.

Description of the Roll-on, Roll-off Trash Compactor Technology

A roll-on roll-off trash compactor is a mechanized waste volume reduction and storage device. It is a self-contained unit that uses a hydraulic pressure system to significantly reduce waste volume. The container portion, where the trash is compacted and stored, remains completely sealed when not in use. These compactors occupy the space of about three 8-cubic yard containers. They use a rolling bin that is lifted by hydraulic arms to feed the trash into the compactor. After each load of trash, an operator will activate the compactor. Each unit requires an accompanying smaller structure that houses the power mechanisms.

When the compactors reach a certain capacity level, which is usually 80%, a light is turned on and the waste manager responsible for the unit calls for the compactor to be serviced. This requires a specialized DSNY truck to arrive at the facility to pick up the entire compactor unit and take it to a waste transfer station where the compactor is emptied. The compactor is then returned to the site, usually within the same day. The amount of time needed to empty the compactor and return it to its facility depends on its location relative to a waste transfer station, traffic, and other factors.

Figures 2 and 3, below show shows compactors at a public housing development. Figure 3 (right) shows how the compactor lifts the bins and empties the trash into the compactor. This also demonstrates the one-person operation required of this technology.

Figure 2

Figure 3

Compactors are normally used only for non-recyclable waste. Once compressed, recyclables are difficult to separate.

Capital Costs

There are a number of factors that make the total cost of installation vary from one site to another and these factors relate to the site characteristics and expenses related to preparing

the site for the installation of a compactor. The preparation costs include plumbing running water to the area to be used for cleaning, creating a concrete pad where one may not already exist, and electrifying the site.

The cost of acquiring a trash compactor is approximately $40,000 - $50,000, with installation and site preparation costs of as much as $80,000-$100,000, depending on the site characteristics. The cost of installing an additional compactor at a site generally decreases after the first one is installed. Some general estimates by NYCHA from 2006 for residential building sites are $150,000 for the installation of one compactor; $225,000 for two compactors; $300,000 for three compactors; and $375,000 for four compactors. Electricity is a variable component of the costs involved in the installation of a compactor. The cost depends on where the electricity is brought in from. Longer distances between electrical trunks and the compactors usually involve higher costs. In general, the cost of the electrical installation is considered very small relative to the cost of the compactor. The installation cost also depends on the nature of construction that might have to be done for the electric connections. Construction underground and through walls is likely to be more expensive. The need to remove concrete will add to the expense.

Compactors can be expected to have a lifetime of about 10-15 years. However, some have lasted abut 20 years. The lifetime of a compactor depends on its proper operation and maintenance.

Potential benefits of using this technology

Roll-on roll-off trash compactor technology is a viable waste management tool that would allow operators of large apartment complexes to better manage their waste while preventing rodent infestations in and around properties. Specific benefits of this technology include:

- ◊ Roll-on, roll-off compactors are able to hold much more garbage per unit of space than the more commonly used traditional garbage containers because the waste is compacted
- ◊ Properly managed, it will improve the aesthetics and cleanliness of a an apartment complex's waste management area. Since garbage bags are compacted and stored inside the sealed container, there will be no exposed trash piled about.
- ◊ Many units employ an odor neutralizer, which eliminate unpleasant odors traditional waste management containers produce due to organic/food wastes. Odor neutralizer units work by producing ozone which is injected into the compactor to displace oxygen and reduce and retard bacterial growth.
- ◊ The sealed container cuts rats off from their food source. Rodent populations decline when food sources are eliminated.
- ◊ No intermittent storage of trash is required: trash can be compacted throughout the day.
- ◊ Because the self-contained compactor is closed and sealed when not in use, there is less potential of trash dumping by unauthorized third parties. Users must have a key and access to the power house to activate the system. Vandalism is difficult. In addition, if

the compactor is placed in an area that is fenced off or isolated, as recommended, the potential for vandalism and garbage dumping by third-parties will be reduced to an even greater extent.

◊ Compactors require fewer pickups/service by DSNY trucks. While regular trash containers are generally picked up three times per week a compactor is serviced only when it reaches 80% capacity which depending on the waste volume of an institution such as an apartment complex, could be much less. Less frequent pickups for compactors may also translate to less noise pollution for the neighborhood.

While there is an initial capital cost associated with the launch of this technology at a site, the overall costs associated a site's waste disposal may be reduced with a wider adoption of this technology. The use of compactors for facilities that produce large amounts of waste is more efficient in terms of transporting waste per unit of weight. For example, the trucks that handle regular waste use two DSNY employees and move 8-12 tons of waste per day. However, a truck used to service compactors only requires one employee and may service three compactors per day, which translates to over 20 tons of waste per day. (Note: Manhattan compactors now need to be taken to waste transfer stations in New Jersey. However, when the marine transfer stations are operational the trips to and from waste transfer stations in Manhattan will be significantly shortened).

II. Requirements for Deployment

Criteria for adopting roll-on roll-off compactors

Not all apartment complexes would be able to deploy roll-on, roll-off trash compactors. There are specific site characteristics and conditions that must be present to accommodate deployment of the units.

To identify the physical and operational requirements for deployment of this technology, we reviewed vendor information and specifications for the purchase of this technology, outlined in a DSNY document titled *Specification for the Purchase of Roll-On Roll-Off Self Compacting Container.* The main criteria that should be considered when analyzing the feasibility of a compactor for an apartment complex are included in Appendix A, which is a tool that can be used to assess the feasibility of deployment of this compactor technology at a specific apartment complex. Following are general siting requirements.

Space and site characteristics

The minimum space requirement is 20 feet by 30 feet. The dimensions of the compactors serviced by DSNY should be 8 feet wide by 8 feet high by 23 feet long. The space requirements of a compactor are similar to the space that is normally used by three 8 cubic yard containers. As a rule of thumb, if a complex uses at least three 8-cubic yard containers (or the area equivalent) that are placed adjacent to each other, it is likely to meet the space requirements of a trash compactor. Figure 4 shows the diagram included in the New York

City Department of Sanitation specifications document to show the space requirements for a compactor.

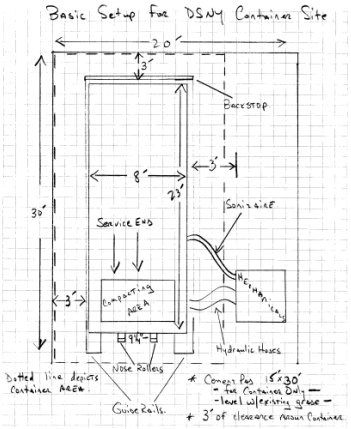


Figure 4: Diagram of space requirements for deployment of a compactor

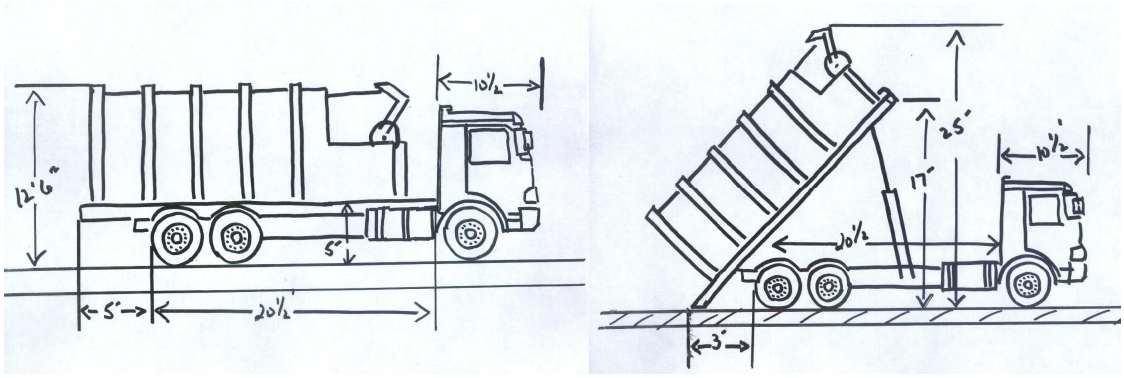
In addition to having sufficient area space, the compactor must be on a surface that can withstand 3,000 pounds per square inch (psi) of pressure. Areas with substructures beneath them may not be able to withstand that pressure.

Truck requirements

The compactor is positioned on top of two rails that allow it to be picked up by a truck and placed in the bed of truck so it can be taken away to be emptied and returned to the site: DSNY trucks must have access to the compactor. The DSNY trucks that service compactors are 36 feet long and 12.6 feet high. When a truck picks up and delivers a compactor it needs to raise the compactor as it is being put into the bed of the truck and as it is being put back in the rails at the site. This requires a total overhead clearance of approximately 25 feet and this requirement must be considered when assessing a site for a compactor, especially if it may be placed indoors.

The DSNY trucks are 10 feet wide, need about 45 feet of access length, and have a 40-feet turning radius. Figure 5 (below) shows the truck dimensions provided in the DSNY specifications document.

Figure 5. Truck dimensions



Source: New York City Department of Sanitation, Specification for the Purchase of Roll-On Roll-Off Self Compacting Container.

These trucks are similar in size to those used to service the commonly deployed 8-cubic yard containers, which are picked up by a front loader truck from the front to empty their contents on the truck. Therefore, if a site already uses 8-cubic yard containers, and especially if it uses 3 or more 8 cubic yard containers, then the truck requirements for a compactor are very likely to be met.

Electric power needs

The electrical system specifications for the compactors used by DSNY are 10 hp for the motor and a 208/230/480 VAC 60 Hz three phase voltage requirement. The full load current for the 208 volt configuration is 28 amps. The mechanical control components are housed in a small structure generally not farther than 10 feet from the compactor..

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Training

Vendors typically provide training for the personnel operating the compactors. Training includes safety and operational issues, and the training time needed is considered minimal. One vendor indicates that this training takes about 30 minutes. Part of the safety training may include aspects such as shutting off all sources of energy before entering any part of compactor, eliminating all potential hazards and ensuring that the compactor is locked-out and tagged-out in accordance with OSHA and ANSI requirements.

Operation and Maintenance

To ensure proper function and maximum life of a compactor, vendors advise:

- All the units moving parts and fittings should be greased weekly to keep joints free from rust;
- The hoist oil should be changed periodically;
- Paint to prevent rusting when breaks in the metal appear; and Power lines must be disconnected before the compactor is emptied to reduce damage and avoid frequent replacement of power lines.

A comparison of the life cycle of compactors and containers is difficult as it depends on the care and maintenance provided by operators. However, compactors do have several advantages that help to sustain longer operational life:

- Compactors rarely receive heavy, bulky materials (such as construction debris) that can cause structural damage;
- Compactors are closed to the elements, reducing rust and decay;
- Compactors are difficult to overload.
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Summary of Findings and Recommendations

Residential properties that already use multiple waste containers are likely to have the space required to deploy at least one roll-on, roll-off trash compactor on the property.

Recap of technology benefits

Roll-on, roll-off trash compactors are a technology that can help improve waste management practices at large apartment complexes:

- Better contain waste
- More efficient use of space, personnel and other resources
- Eliminate access to putrescible waste food sources for rodents and pigeons
- Improve the aesthetics of a complex's waste handling area
- Reduce unauthorized dumping in complex containers
- Reduce odors associated with uncontained waste
- Reduce the frequency of DSNY trucks trips and associated noise and emissions.

General recommendations

- Apartment building/complexes with significant volume of waste should conduct a site assessment to determine if a roll-on, roll-off trash compactor can be deployed on the site
    - NYCHA uses a ratio of 1 compactor per every 500 apartments, assuming about 5 pounds of waste per apartment per day. This could be used by large residential buildings when considering adoption of this technology.
- If assessment demonstrates a feasibility of deployment, sites should consider purchasing compactors
- Developers of new or substantially renovated housing developments should incorporate roll-on, roll-off trash compactors and site resources in their designs
- Developers and managers can work with DSNY to come up with a plan to deploy compactors on existing properties

Criteria for Assessment of Residential Buildings

Condition or Problem to Address	Parameter	Guidelines	Comments	References
Feasibility				
Identify shared facility arrangements that might alter compactor characteristics	Existence and feasibility of shared waste agreements, including facilities	Yes/no and description of multiple-building arrangements and ownership of multiple properties	Evaluate residential properties with shared agreements separately	
Separate estimates of the waste stream suitable for compaction (putrescibles) from wastes for recycling	Estimated percentage of recyclables (metal, glasses, paper) and putrescible waste		Percentage of recycling will affect the effectiveness of the compactor. If buildings are already separating their waste stream well for recycling this may be a criteria for prioritizing residential buildings	
Building Capacity				
Trash generation rate: Ensure sufficient capacity to warrant the use of ROTCs	Population and # of households Number of children	To be determined		
Capacity of ROTC				
Maximize the efficiency of the process, i.e., by minimizing pickups	Percent full	80% full	If heavier, trucks can't pick up the container; if lighter, it is not efficient (too many pickups)	DSNY, 11/7/08 and 11/12/08
Ensure efficiency of compaction	Compaction strength / level	Max. 700 lbs/cu yd		DSNY, 11/7/08 and 11/12/08; Specs p. 15 (Containerization Service Guide-lines)
Reduce odors, but do not violate federal Clean Air Act (CAA) standards with treatment	Odor control process specification	Describe treatment; Use treatment that avoids CAA problems		DSNY, 11/7/08 and 11/12/08
Installation and Site Requirements				
Concrete pad for	Size and location	At least 10' wider		Marathon

the container		and 5'longer than container (3000 PSI steel reinforced, 6'' thick), or 15' x 30' >2' between the machine and building		Equipment website Specs
Supporting frame; sufficient to move container easily for pickup and return	Guide rail specifications	Steel guide rails; Install properly on guide strips		Specs p. 10
Weight constraint	Weight-bearing capacity	Variable weight limit depending on the nature of the substructure	Relevant if ROTC is above a structure such as a parking lot or underground facility	
Pad slope requirement	1/8 per foot required by Univ. North Carolina		To allow rainwater and other liquids to drain off without pooling	UNC Facility service guideline
Durability	Surface material	Blacktop and concrete		
Electricity and water requirement		Motor 10HP TEFC 208/230/460, 3Ph, 60HZ Water: hydraulic pump 10.0 GPM Motor 3/60/230-460, 120VAC	Sufficient for operation	Specs p. 6 Solid Waste and Recycling Specifications for New and Remodeled Buildings on the Stanford University Campus (2)
Container Characteristics				
	Size (container only)	15 ft. wide x 30 ft. long or 20 ft x 30 ft including mechanical controls; height can be variable, subject to overhead clearance		Specs 2.0
Sufficient clearance to enable the top of the truck to be raised	Size (overhead clearances)	18 ft; subject to site conditions; truck should not catch in overhead wires when open; when open completely the truck can go to a height of		

		25 ft		
	Tare weight (actual wt of empty container)	4-5 tons (container only) 17.2 tons (?)		
	Leakage control	"Ratchet style latches on both sides of container tailgate" or other type approved by NYCDOS		Specs 3.11
	Misc standard safety features	OSHA standards		Specs p. 6
	Overall safety	ANSI standards	ANSI-Z 345.30; Z245.1	OSHA
Compatibility of container with DOS trucks	Containerization Service Guide-Lines	Containerization Service Guidelines		Specs p. 17
Operations				
Safety; security	Role, number and location of control keys	Key operated start; 2 keys must be available, one with the operator and the other in an office	Required by OSHA	
Safety; security	Location of controls	Within site of container	OSHA requires this to avoid injury	
Minimize traffic and user disruption for truck pickups	Hours of operation	For both pickup and return, avoid sleeping hours and hours of street congestion		
Keep compacted wastes to putrescibles	Waste content specifications	Putrescibles, paper, not other recyclables		
Trucking				
	Street width	25-30 ft opening or driveway to get out on to street (not including any parked cars)	Very important	DSNY, 11/7/08 and 11/12/08; see Specs 712.0, p. 15
	Curb cut and entrance/exit location	Approx. 50 feet, Curb cuts and location as specified in 712.0		
	Turning radius Curb-to-curb (CTC) Wall-to-wall (WTW)	City of Raleigh: CTC > 30' West Sacramento: WTW > 38' Stanford University CTC: 41.5' WTW: 44' Dallas: (247'' wheelbase)	Affected by truck width and driveway width	City of Raleigh Solid Waste Collection Design Manual (1); Solid Waste and Recycling Specifications for New and Remodeled Buildings on the Stanford University

		42’		Campus (2); CWD Trash and Recycling Guidelines (3)
	Operation space	> 45’ in front of container; Consider truck length, turning radius, and angle of the approach		Marathon Equipment website

Condition or Problem to Address	**Parameter**	**Guidelines**	**Comments**	**References**
Safety and Aesthetics				
Wall	Min height	Min height required by many municipalities	6’ by UNC and City of Raleigh	See, e.g., OWRR Design Guidelines (4)
Landscaping		Public screen		
Lighting				
Cost				
	Capital and operations costs	~ $40,000 - $125,000 (this includes ROTC equipment, installation, collection and maintenance)		DSNY; To be confirmed with vendors
	Replacement rate	10-20 years		

Notes:

In the reference column “Specs” refers to the New York City Department of Sanitation *Specifications for the Purchase of Roll-On Roll-Off Self Compacting Container.*

DSNY in the reference column refers to a meeting with George Best and Peter McKeon on November 7 and a follow-up conversation with George Best on November 12 to discuss points of clarification.

(1) City of Raleigh Solid Waste Collection Design Manual, available online: http://www.raleighnc.gov/publications/Solid_Waste_Services/Solid_Waste_Services_Design_Manual_01-14-2005.pdf
(2) Solid Waste and Recycling Specifications for New and Remodeled Buildings on the Stanford University Campus, available online: http://recycling.stanford.edu/acadbuild/Specs%20for%20Compactors.pdf
(3) CWD Trash and Recycling Guidelines, available online: http://www.ci.watauga.tx.us/water/commercial.pdf
(4) OWRR Design Guidelines, available online: http://www.fac.unc.edu/OWRRGuidelines/

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