

Multifamily Property Collection Area Survey

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Material Management

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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.



State of Oregon
**Department of
Environmental
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Executive Summary

In response to changes in Oregon's recycling laws, the opportunity to recycle is being extended to all residential and commercial tenants of multi-tenant properties. The change will require cities and counties to ensure properties with tenants that share garbage collection service also receive recycling collection by July 2022. This requirement is for cities with 4,000 or more residents, cities within the Metro Service District and counties which manage programs within those cities' urban growth boundaries. In order to support implementation of this statutory change, Oregon Department of Environmental Quality staff surveyed multifamily property collection areas and analyzed service-level data to establish a baseline understanding of common practices at multifamily housing properties statewide. This report offers a snapshot of the current practices and range of provision of recycling collection service.

Findings from this research have been organized into two main sections: behavioral characteristics and collection characteristics.

There are a number of behavioral characteristics revealed through this research. Visual cues, both in writing and images, that could help residents to correctly choose receptacles, were lacking in the majority of properties surveyed. Signage, as well as decals or labels on receptacles with information about what belonged in receptacles, were rarely found. When those signs were present, they rarely included images or second and third languages that could help users to cross language and literacy barriers.

Likewise, receptacle colors were not used consistently to help differentiate material types. Blue was used most frequently for all material types.

Improperly sorted materials were observed at most properties surveyed. Mixed recycling was very commonly found in garbage receptacles while other non-acceptable materials were commonly found in recycling receptacles. The rate of whole bags of garbage found in recycling receptacles was relatively low.

Tenants could moderately access and use the vast majority of receptacles surveyed, and receptacles did not have excessive blocking materials — though blocking materials were certainly present.

Although full receptacles were rarely encountered by the DEQ team, the majority of properties surveyed revealed uncontained materials, most often garbage or larger bulky items.

Collection area characteristics were also studied. Although collection area designs varied — likely related to when properties were constructed — most material collection areas were located outdoors and very few had any sort of roof.

Finally, the opportunity to recycle was offered inconsistently statewide, and often even within individual cities. Sixty-seven percent of properties had some level of recycling such as cardboard collection. Only 37 percent of properties had mixed recycling and glass recycling, including properties that collected glass with the mixed recycling.

Because the sample size for this study was small, especially in certain cities studied, findings are revealing but might not be representative of the whole population.

1. Introduction

This report is prepared for the benefit of stakeholders in order to determine solutions that could be helpful to cities and counties that need to implement multi-tenant recycling by 2022. Stakeholders could include but not limited to garbage and recycling collection companies and associations, developers and builders, local and regional governments, materials management programs, multi-tenant property owners, property managers, planners, recycling processors, tenant and tenant associations, and others.

The Recycling Opportunity Act was passed in 1983, with the intent that everybody in Oregon should be provided with an opportunity to recycle. In cities of 4,000 or more populations and within the Metro area, that opportunity meant regular on-route collection of recyclable materials from all collection service customers, or an equivalently-effective program. However, as the law was interpreted and implemented, many residential and commercial tenants ended up being denied an opportunity to recycle because it was the landlord, rather than the tenants, who were considered to be the collection service customers. If the landlord decided not to use a recycling service, then the tenant did not have an opportunity to recycle. In 2015, the legislature corrected this with the passage of Senate Bill 265. One provision of this law is that by July 1, 2022, tenants will also be considered to be collection service customers, and so must directly be provided with the opportunity to recycle by their landlords and collection service providers.

By July 1, 2022, local governments will need to ensure that the opportunity to recycle is extended to residential and commercial tenants of multi-tenant properties. Local jurisdictions affected include cities with 4,000 or more residents, cities within the Metro Service District and counties which manage programs within those cities' urban growth boundaries.

In order to help guide implementation of the updated recycling law, the Oregon Department of Environmental Quality collected and analyzed information about garbage and recycling collection conditions at residential multi-tenant (multifamily) properties in Oregon. From May through October 2017, DEQ randomly selected 255 multifamily housing complexes in 14 Oregon cities and conducted property collection area surveys. DEQ researchers conducted in-person visual surveys and analyzed service level data. This report offers a snapshot of the current practices and range of provision of garbage and recycling collection services provided to tenants.

Findings from this research have been organized into two sections: behavioral characteristics and collection characteristics.

2. Methods

2.1 Overview

DEQ hired four temporary research analysts to conduct the research in 2017 — two out of the Eugene DEQ office and two out of the Portland office. Two analysts started in May and two started in August and were trained on protocols in Portland. Training was conducted in the respective office and at a sample property. One follow-up field visit was conducted by a supervisor for the Eugene team. Weekly conference calls served as check-ins for the entire team.

DEQ research analysts selected 255 multifamily properties to conduct collection area surveys. Research analysts collected 63 data points along with photographs — see Appendix A for the data sheet. The data collected included information about both material collection area characteristics and behavioral factors. Behavioral data included considerations about safety and security, accessibility, convenience, signage and other communication. Collection area data included the types and sizes of collection areas and receptacles, the types of material collected, the quality of materials and information about the collection area. Researchers also took a series of photographs to

help clarify data points, illustrating the arrangement and context of collection areas, receptacle type and color, condition of collected materials and any uncontained materials.

Additionally, collection providers were asked to share the surveyed properties’ garbage and recycling collection service-level data — volume of receptacles by stream and collection frequency. DEQ included service-level data from the Metro Multifamily Recycling 2017 Report as well.

2.2 Sample selection

2.2.1 City selection

In order to ensure representation from around the state, DEQ selected 15 cities to sample using census data from the 2011-2015 five-year American Community Survey and Portland State University’s Population Research Center’s 2016 estimates. The ACS estimates the number of units of multifamily housing for each city. PSU provides an annual list of cities and their projected populations. Cities over 4,000, but not within the MSD, were selected from the 2016 PSU list and combined with the ACS estimates and then ordered by the number multifamily units. Unit-counts for less than five units, mobile homes, boats, recreational vehicles and vans were excluded as it is not guaranteed they share collection services. Cities in the Metro area were excluded from the sample due to the fact that Metro regional governments conducted similar research in 2016 and 2017. Due to their larger size, two cities were selected more than once — Eugene was selected three times and Salem twice. In order to also reflect rural areas of the state, two rural cities were added: Pendleton and Tillamook. In total, there were 14 individual cities selected — see Table 1.

Table 1: Cities selected for multitenant research

City	Sample size	Estimated 2016 population	Estimated 2015 multifamily units (five or more)
Albany	15	52,540	2,943
Bend	15	83,500	4,428
Corvallis	15	58,240	7,768
Eugene (sample 3x)	45	165,885	17,770
Keizer	15	37,505	2,579
Lebanon	15	16,435	1,109
Medford	15	78,500	4,882
Pendleton	15	16,880	982
Redmond	15	27,595	964
Salem (sample 2x)	30	162,060	12,757
Sheridan	15	6,115	351
Springfield	15	60,140	4,542
Tillamook	15	4,920	693
Woodburn	15	24,795	1,459
Total	255		

2.2.2 Property selection and profiles

For each city selected, DEQ planned to sample 15 multifamily properties using city, county and collection providers’ records for a total of 225 samples. After adding two additional rural cities, the property sample increased to 255. To qualify for participation, properties needed to meet the following criteria:

- They contained five or more dwelling units — DEQ’s definition of multifamily
- Collection was not shared with commercial tenants
- Multiple units shared material collection receptacles in common collection areas (garbage, recycling or both)

Properties with less than five units, mobile home parks, recreational vehicle parks, marinas with houseboats and similar properties were not included since the census data did not specify which of these were in multifamily configurations.

Properties were randomly selected within each city, proportional to the size distribution for each city. In most cases, the 2015 American Community Survey provided unit-size distributions for each city. These were used to create a list of the types and proportions of multifamily properties to choose. Overall, 27 percent of multifamily properties in Oregon were 5-9 units in size, 22 percent were 10-19 units and 50 percent consisted of 20 or more units — see Table 2 and Appendix A. Properties were selected to match, as closely as possible, to this unit-size distribution. In some cases, properties were selected by records provided by the city that included unit counts or from customer lists provided by the local collection companies that included garbage service levels. In all cases, the properties were intended to be representative of the city. DEQ staff then used web searches and Google Maps’ aerial and street views to verify the eligibility and size of the property.

Table 2: 2015-2016 American Community Survey unit-size distribution for Oregon

Unit-sizes	Percent
5 to 9	27%
10 to 19	22%
20 or more	50%
Total	100%

2.3 Protocol for contacting property managers

DEQ searched for property contact information on the web. In cases where contact information was not available on the web, researchers attempted to get customer information from their garbage and recycling collection service provider. A majority of collection service providers contacted were able to provide customer contact information. In some cases, where ownership was obtained from assessment records, DEQ conducted a web search for the property owner.

Researchers called each property and attempted to talk to property managers or staff responsible for maintaining the garbage and recycling collection areas at least two times. They were assumed to have the most knowledge of their community’s garbage and recycling collection practices.

When no contact was made on the first call, a voicemail message was left. If email addresses were available, an email was sent to the property manager. Another follow-up call was made three business days later. If no returned call was received after four business days, a replacement property was selected.

Alternate properties within the same unit-size class were chosen by using a random number generator from the preliminary list of properties following the protocol above.

2.4 Property survey methods

Research analysts obtained permission from property managers before performing property surveys. Researchers visited each property to gather data about collection and behavioral characteristics using visual observations, measurements taken with tape measures, walking times estimated using stopwatch apps on cell phones or a combination of these methods. Researchers used a rubric to define each of the characteristics recorded to ensure data were collected consistently. See Appendix B for the data sheet and rubric. When multiple collection areas were present on a survey property, analysts assigned numbers to each collection area and used a random number generator to choose the collection area to be surveyed.

2.4.1 Behavioral characteristics

The behavioral characteristics studied included measurements and observations of how residents used collection areas along with design decisions that may have impacted user access, comfort, convenience and real and perceived safety.

The table below provides an overview of the data collected and collection methods used. More detailed descriptions of data collection methods can be found in Table 3.

Table 3: Behavioral characteristics surveyed and methods

Data collected	Collection method
Average walking time between units and closest collection area	Timed walk
Change in floors	Visual observation
Walking time between garbage and recycling areas — if not colocated	Timed walk
Access to receptacles	Measured with a tape measure
Uncontained materials — bulky materials, garbage, mixed recycling, glass, cardboard, hazardous waste, e-cycles and other	Visual observation
Signage — presence of directional signs, decals on receptacles, material collection area signage, contamination messaging and illegal dumping signage	Visual observation
Number of languages on signage	Visual observation
Images on decals or signs	Visual observation
Receptacle and lid colors — garbage, mixed recycling, glass and cardboard	Visual observation
Presence of security cameras	Visual observation
Collection area lighting — direct, indirect or none	Visual observation

2.4.1.1 Average walking time between units and closest collection area

Researchers defined a group of units that served a collection area as the units that were closest to the studied collection area compared to a more distant collection area. In order to determine the average time needed to take out materials from one of these units, DEQ recorded the time required to walk from the furthest and the closest unit to the collection area, including the time required to use stairs or elevators, when applicable. An average time was calculated for each property.

2.4.1.2 Change in floors

DEQ analysts recorded when tenants needed to change floors to reach the selected collection area from their dwelling units and, if so, whether stairs or elevators would be used.

2.4.1.3 Accessing garbage and recycling together

When garbage and recycling areas were not located in the same collection area, DEQ researchers timed how long it took to walk between garbage and recycling receptacles. When garbage and recycling areas were colocated in the same collection area, “0” was recorded and the receptacles were considered colocated.

2.4.1.4 Access to receptacles

Access to receptacles is defined as the percent of the front of the receptacle that was open and unblocked by materials, other receptacles or walls. It was measured by linear distance accessible across the front opening of receptacles that was unobstructed. The opening was considered unobstructed if at least a 32-inch space was free of objects. Thirty-two inches is the distance required under the Americans with Disabilities Act for walkways. DEQ analysts used a tape measure to determine the total accessible inches, as well as total inches for each receptacle and types of materials collected, to create a ratio of total accessible inches to total inches.

2.4.1.5 Uncontained materials

DEQ researchers observed whether any uncontained materials were present in or within the vicinity of the collection areas surveyed. Uncontained materials are materials littering or blocking access to the collection area. Staff recorded the presence of following types of materials:

- Bulky materials — couches, mattresses and items that do not fit in receptacles due to size
- Garbage — bags or boxes of materials and loose items
- Mixed recycling — bags, boxes or loose mixed recyclables
- Glass — bags, boxes or loose bottles and jars
- Cardboard — whole or broken down boxes
- Hazardous waste — household chemicals, oil, needles, sharps, bio-wastes, etc.
- E-cycles program electronics — monitors, TVs, printers, computers, keyboards and computer mice

2.4.1.6 Signage

DEQ researchers used visual observation to determine whether the following types of signage were present or absent at each property surveyed:

- Directional signage — signs beyond the collection area that give directions for tenants to locate the collection area — did not include signs on the outside of the collection area doors or walls
- Signs or decals on receptacles — signage, decals or stamps on receptacles that indicate what types of materials are collected
- Material collection area signage — signs above or behind receptacles that indicate which materials belong in each receptacle
- Contamination messaging — decals or signs that indicate unacceptable materials — such as, “no plastic bags”
- Illegal dumping warnings — signs that indicate that dumping is illegal or discourage illegal dumping

Researchers estimated the number of receptacles and collection areas with signs by calculating a weighted analysis of the total number of units for each property.

2.4.1.7 Number of languages present on signage

DEQ researchers observed the number of languages, including English, present on signage.

2.4.1.8 Images on decals or signs

Analysts visually observed the presence or absence of images or illustrations on decals or signs showing examples of acceptable materials.

2.4.1.9 Receptacle and lid colors

Researchers observed and listed colors of garbage and recycling receptacles and lids, rather than quantifying the number of receptacles with each color. “Metal” was indicated in the case of unpainted chutes. DEQ calculated the number of sites where each color was found. Percentages for mixed recycling, glass and cardboard are based on the total number of sites where those materials are collected, rather than all properties surveyed.

2.4.1.10 Presence of security cameras

DEQ research analysts performed a visual scan of collection areas and their surroundings to determine the presence or absence of cameras visible from the collection area.

2.4.1.11 Collection area lighting

Researchers performed a visual scan to determine the presence and quality of lighting at collection areas. “Direct lighting” was recorded if lighting was located over the collection area. “Indirect lighting” was recorded if a light source was nearby and would likely cast light in the collection area but not located directly overhead. “None” was recorded if no lighting was visible in the area. All surveys were conducted during the day when lights were off, with the exception of indoor collection areas. It is assumed that all lights observed were in working order.

2.4.2 Collection characteristics

DEQ research analysts gathered data about the materials collected and the design and layout of the collection areas at all properties surveyed. The table below provides an overview of the data collected and collection methods employed. Detailed descriptions of data collection methods can be found in Table 4.

Table 4: Collection area characteristics surveyed and methods

Data collected	Collection method
Material collection area design — enclosed, covered, open, garage, basement, utility room, hallway or other	Visual observation
Collection area size and extra space	Measured by measuring tape and visual observation
Visibility from the street	Visual observation
Receptacle types — container, roll cart, compactor, roll-off dumpster, chute or other	Visual observation
Materials collected — garbage, mixed or commingled recycling, glass, cardboard, organics or other	Visual observation
Distance from floor to opening of receptacle	Measured vertically by measuring tape
Collection service levels — volumes and frequency	Data shared by collection providers
Number of units served by collection area	Visual observation and counting
Full receptacles	Visual observation

Data collected	Collection method
Contamination — bags of garbage in recycling, other contamination in recycling or mixed recycling in garbage	Visual observation

2.4.2.1 Material collection area design

Using visual observation, DEQ recorded the following characteristics and types of material collection areas:

- Enclosed — outdoors, with two to three walls or fencing — some have a gate or door that shields receptacles — minimizing the visual impact of a collection area and providing a visual boundary for users
- Covered — outdoors and have a roof that provides protection from weather
- Open — outdoors and have no protection or screening and are open to the sky
- Garage — indoors and are associated with a parking area
- Basement — indoors on sub-floor without associated parking
- Utility room — interior rooms with collection receptacles or chutes that stand alone or are contained with other utilities
- Hallway — located inside a building but not in designated rooms — includes hallways with receptacles and garbage chutes embedded in walls

2.4.2.2 Collection area size and extra space

Using a tape measure, researchers measured the square footage of material collection areas and unused space available for additional receptacles. When receptacles were lined up in a row in an open area, analysts measured depth from the back of the receptacles to 32 inches in front of the receptacle. Extra space was recorded if there was space adjacent to receptacles for additional receptacles without requiring additional construction or removal of a parking space or an accessible walkway.

2.4.2.3 Visibility from the street

DEQ researchers used visual observation to determine whether a collection area could be seen from the street. Researchers walked around the collection area to account for views from adjacent streets and visual obstructions such as foliage, buildings and other structures.

2.4.2.4 Receptacles types

DEQ visually observed the types of receptacles found on each site surveyed. Receptacle types were defined as:

- Containers — square metal boxes with four wheels — typically with lids and can be lifted and tipped into the front or back of a truck
- Cages — containers that have at least one grated side you can see into and a slot to slide items like cardboard in from the front
- Roll carts — smaller, typically made of plastic with two wheels and a lid
- Compactors — large metal boxes with two sets of wheels and are connected to a compactor
- Roll-off dumpsters — large metal boxes with at least one set of wheels and are open from the top with no lid — are meant to be transported on a flatbed truck and cannot be lifted and emptied by a standard truck
- Others — include round, plastic or metal cans or other receptacles

2.4.2.5 Materials collected

Visual cues such as decals and signage on receptacles, types of receptacles used, and conditions inside receptacles helped analysts identify the types of materials intended to be collected on each property. They recorded the following material types:

- Garbage
- Commingled without glass

- Commingled with glass
- Glass on the side
- Cardboard
- Organics (wasted food, yard debris or both)
- Other (including yard waste, e-waste, etc.)

2.4.2.6 Distance from floor to opening of receptacle

Researchers used a tape measure to measure the distance from the ground to the opening of receptacles. When there was a handle that must be operated to open the receptacle, such as a chute door, the higher of the two was recorded.

2.4.2.7 Collection service levels

DEQ requested weekly volumes of garbage and recycling from collection service providers for each property. Mean service levels for each property were calculated. To determine statewide service levels for garbage, mixed recycling and glass, researchers incorporated data gathered by researchers at Metro. All service levels were normalized to gallons per unit per week, based on total volume on site, number of units for the property and frequency of collection. Researchers calculated the statewide mean service levels by using the proportions of multifamily units for non-Metro cities and Metro cities following the 2015 American Community Survey using the following equation:

$$\text{State median SL} = (\text{median SL non-Metro} \times 0.408) + (\text{media SL Metro} \times 0.592).$$

Median service levels for cardboard and single-stream recycling were determined using only data collected by DEQ because data for the MSD was unavailable.

2.4.2.8 Number of units served by each collection area

On properties with more than one collection area, DEQ performed a visual scan to estimate the number of units a given collection area was likely to service. Researchers started halfway between collection areas and counted while moving towards the selected sample collection area. For properties with only one collection area, researchers assumed that all units were served by that collection area.

2.4.2.9 Full receptacles

DEQ recorded instances of receptacles with lids that could not be closed, if materials were overflowing onto the ground or both. To survey garbage chutes, staffers visited the receptacle to which each chute led.

2.4.2.10 Contamination

Researchers viewed inside the tops of garbage and recycling receptacles to record materials that were not on the acceptable recyclable list for that program and were considered contamination. Staff recorded only what could be observed from the top layer of waste and did not sort through materials. Staff confirmed whether the visible materials were acceptable with local guidelines, including those posted on-site. Data points included the following:

- Mixed recycling in garbage — presence or absence of acceptable recyclables in the garbage
- Bags of garbage in recycling — presence or absence of bags of garbage in the recycling
- Other contamination in recycling — presence or absence of loose items not acceptable such as plastic bags, plastic hose, cables, clamshells or single-use plastic cups

3. Findings

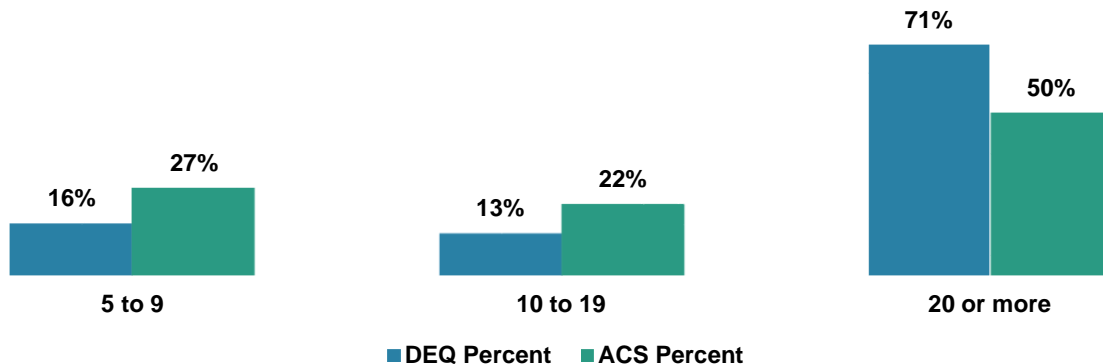
3.1 Properties surveyed

DEQ completed 235 of the selected 255 multifamily property surveys that were planned. Properties were difficult to identify and contact. In some cases, properties would not respond to calls and alternate properties had to be selected. In several of the smaller cities, researchers could not find enough properties to select — see Appendix C.

3.1.1 Property profiles

Multifamily property designs range widely from small clusters of cottages or courtyard designs with only five units to multi-story complexes with multiple buildings and hundreds of units. The properties selected included rental apartments, townhouses, condominiums, transitional and rehabilitative housing and assisted-living facilities. Sites surveyed contained as few as five units and as many as 600 units. On average, properties had 66 units and a median of 32 units. Unit-size distributions for properties selected for property surveys varied from those identified in the 2015 ACS. Of the surveyed properties, 14 percent had five to nine units, 19 percent had 10 to 19 units and 67 percent had 20 or more units, as illustrated by Figure 1 and Appendix A.

Figure 1: Properties selected by DEQ by size compared to the distribution of Oregon properties according to the 2015 American Community Survey



On average, properties had three collection areas for garbage or garbage and recycling (not counting properties that had separate recycling areas). The median number was one.

3.2 Behavioral characteristics

3.2.1 Average walking time from units to collection areas

The average walking time between the furthest unit and the closest unit to the collection area was 38 seconds — see Appendix E. The average walking speed is 4.6 feet per second, so the average distance traveled is approximately 173 feet. Compared to what could be a typical two-car single-family driveway, that is over three times as long. Taking out garbage and recycling in a multifamily setting is less convenient than single-family.

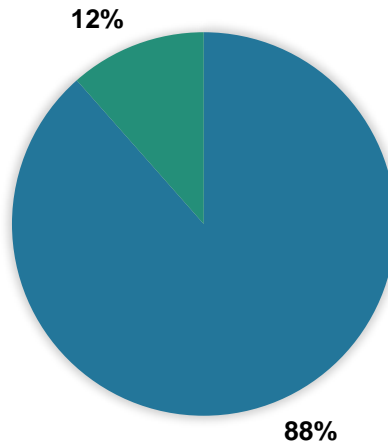
3.2.2 Change in floors

In 77 percent of properties, stairs were necessary to access the collection area. No level change was present at 14 percent of properties. Elevators were available at nine percent of properties to access collection areas — see Appendix F.

3.2.3 Accessing garbage and recycling together

Eighty-eight percent of properties appeared to have colocated garbage and recycling receptacles in collection areas — see Figure 2 and Appendix G. When they were not colocated, the average (mean) walking time between garbage and recycling areas was 17 seconds.

Figure 2: Colocation of garbage and recycling



3.2.4 Access to receptacles

The average garbage receptacle was 91 percent accessible — percent of opening free of blocking materials and having an adequate walkway — see Figure 3 and 4. Mixed recycling receptacles were 87 percent accessible. For glass, the average receptacle was 97 percent accessible. Lastly, cardboard receptacles were 92 percent accessible — see Figure 5 and Appendix H.

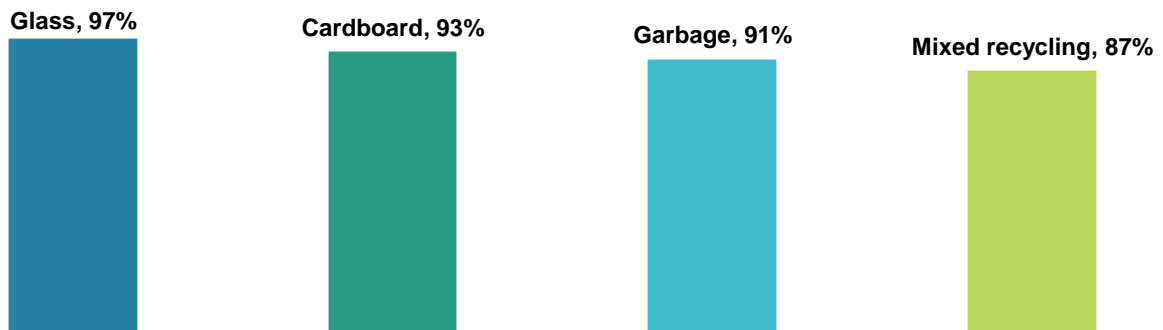
Figure 3: Receptacle with walkway less than 32 in. and access blocked by uncontained cardboard



Figure 4: Receptacle access blocked by a variety of uncontained materials

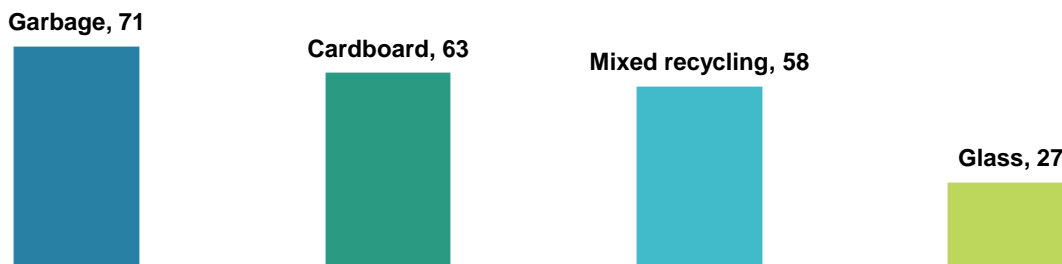


Figure 5: Average percent of receptacles not blocked by materials and with at least a 32-inch walkway



The average (mean) accessible space across the front of garbage receptacles was 73 inches. For mixed recycling receptacles, the average was 59 inches across the front. The average (mean) accessible space across the front of glass receptacles was 27 inches as these receptacles tended to be the smallest of the group. Cardboard receptacles had an average of 63 inches across the front of receptacles and were accessible — see Figure 6.

Figure 6: Average distance of receptacles in inches not blocked by materials and with at least a 32-inch walkway



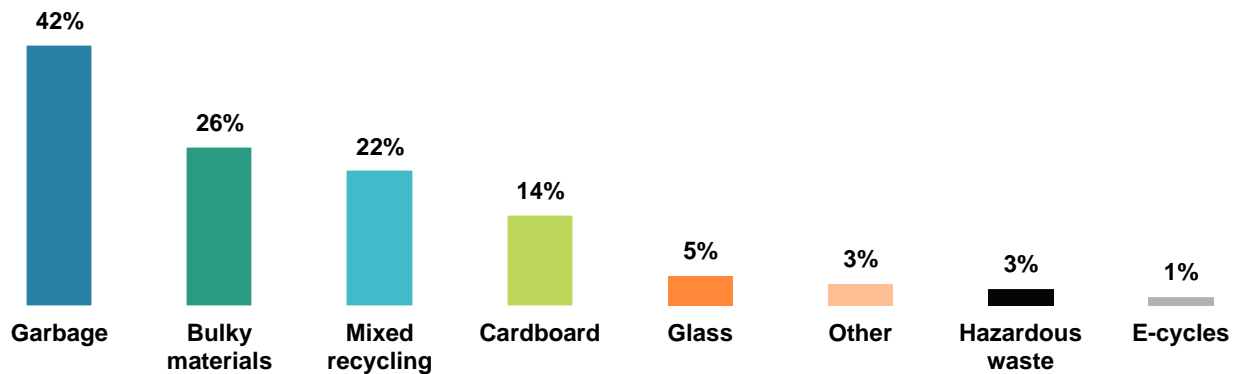
3.2.5 Uncontained materials

Uncontained materials in collection areas were present at 60 percent of the properties surveyed — see Figure 7. The most common uncontained materials were garbage (42 percent), bulky materials (26 percent) and mixed recycling (22 percent) — see Figure 8 and Appendix I.

Figure 7: Uncontained bulky materials placed next to an enclosure



Figure 8: Percent of uncontained materials in collection areas by type

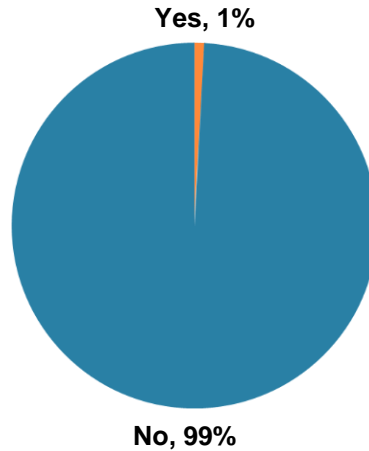


3.2.6 Signage

3.2.6.1 Directional signage

Virtually none of the properties had signage indicating where collection areas were located. Directional signage was only present at less than one percent of properties surveyed — see Figure 9 and Appendix J.

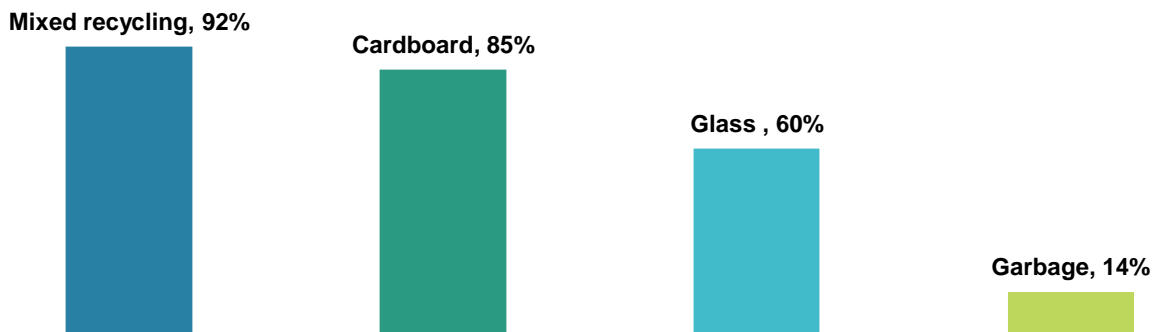
Figure 9: Percent of properties with directional signage



3.2.6.2 Decals or labels on receptacles

Decals or labels were present on mixed recycling and glass receptacles far more frequently than on garbage receptacles. Fourteen percent of garbage receptacles had a decal or in-mold label on the receptacle indicating accepted materials. Mixed recycling receptacles were labeled 92 percent of the time. Sixty percent of glass receptacles were labeled accordingly — see Figure 10 and Appendix K.

Figure 10: Percent of receptacles with decals or labels indicating proper usage, weighted by total units for properties surveyed



3.2.6.3 Material collection area signage

Collection areas rarely had signs within the collection areas and around receptacles, reinforcing what goes into the receptacles. Collection area signs indicating garbage collection were only present at 17 percent of properties surveyed. Recycling collection area signs were only present at 17 percent of properties with recycling — see Figure 11 and 12 and Appendix L.

Figure 11: Percent of collection areas with signs for recycling and garbage — weighted by total number of units for properties surveyed

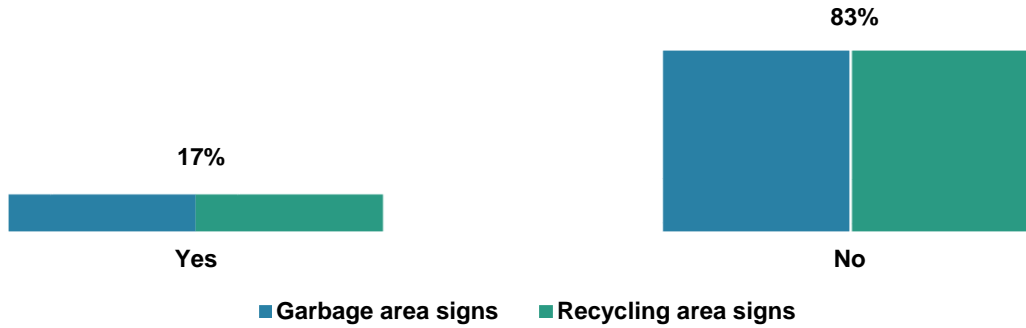


Figure 12: Collection area signage



3.2.6.4 Contamination messaging

Contamination messaging was present at 63 percent of properties surveyed. Messages were shared on signs posted on doors, walls and fences as well as decals on receptacles — see Figure 13 and Appendix M.

Figure 13: Contamination messaging



3.2.6.5 Illegal dumping signage

Seventeen percent of properties surveyed had illegal dumping warning signage. Signs, with messaging such as warnings against dumping by non-residents, were posted on doors, walls and fences — see Figure 14 and Appendix N.

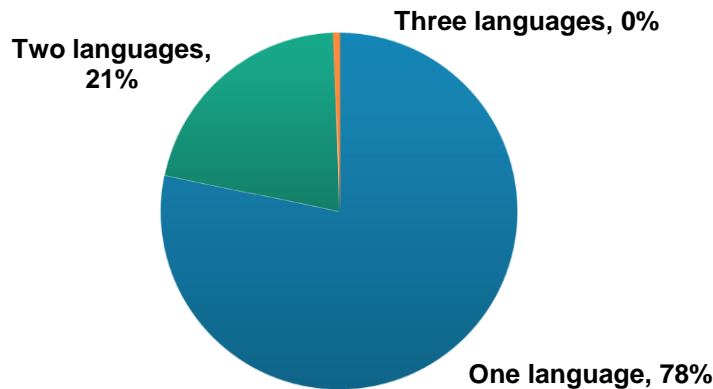
Figure 14: Illegal dumping signage



3.2.6.6 Number of languages present on signage

Of all properties surveyed with signage, single-language signage was most common (78 percent), followed by two languages (21 percent) and three languages (less than one percent). However, when non-English languages were present, they were unlikely to appear on all signs — see Figure 15 and Appendix O.

Figure 15: Percent of properties with signage in one or more languages



3.2.6.7 Images on decals or signs

Only 33 percent of the properties surveyed had signage or decals displaying images of materials that belong in receptacles — see Figure 16. Sixty-seven percent of properties did not — see Appendix P.

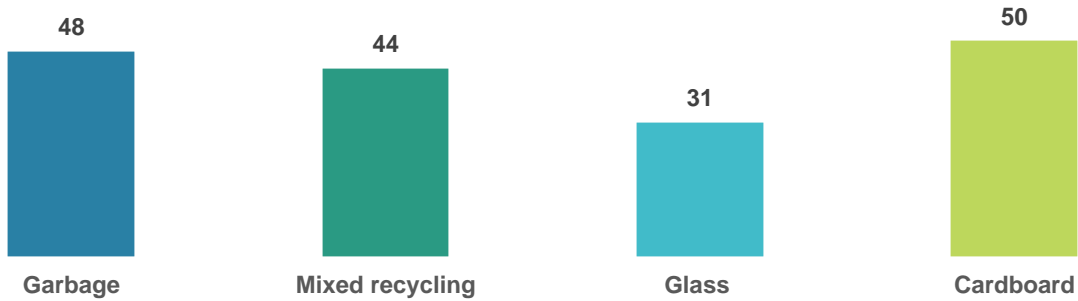
Figure 16: Decal with images displaying materials that belong in a receptacle



3.2.6.8 Receptacle size

Receptacle size was assessed at each property by measuring the distance from the floor to the opening of the receptacle — see in Figure 17 and Appendix Q. For garbage receptacles, the average distance, as well as the median distance, from floor to opening was 48 inches. The average distance for mixed recycling receptacles was 44 inches and the median was 42 inches. For glass receptacles, the average distance was 31 inches and the median distance was 36 inches. The average and median distance from floor to opening for cardboard receptacles was 50 inches.

Figure 17: Average distance from floor to opening of receptacles (inches)



3.2.6.9 Receptacle and lid colors

Properties had widely varied receptacle and lid colors by material stream — see Figure 18 and 19 and Appendix R. Properties had receptacles or lids with more than one color resulting in totals not adding up to 100 percent.

Forty-two percent of properties had blue garbage receptacles, 18 percent had brown and 13 percent had grey receptacles. Most properties had black garbage receptacle lids (90 percent), while three percent had grey lids. Ninety-five percent of properties surveyed had lids on their garbage receptacles.

A majority of properties had blue mixed recycling receptacles (54 percent), followed by green (18 percent) and tan or beige receptacles (13 percent). Thirty-eight percent of properties had blue mixed recycling receptacle lids, 31 percent had black, and 11 percent had tan or beige. Ninety-nine percent of properties with recycling had mixed recycling receptacles lids.

Forty-six percent of surveyed properties had blue glass receptacles. Twenty percent of properties had green glass receptacles and another 20 percent had or grey glass receptacles. Glass receptacle lid colors at surveyed properties were relatively evenly split, with 23 percent of receptacles with green lids, 18 percent blue and 15 percent grey. Properties with glass recycling had receptacles with lids 61 percent of the time.

Thirty percent of properties had green cardboard receptacles, followed by 20 percent tan or beige, and 18 percent red. Properties with cardboard collection had black cardboard receptacle lids 63 percent of time, green 10 percent and tan or beige three percent of the time. Seventy-five percent of properties with cardboard recycling had lidded receptacles.

Figure 18: Receptacle colors by material — some properties had more than one color, resulting in totals not adding up to 100 percent

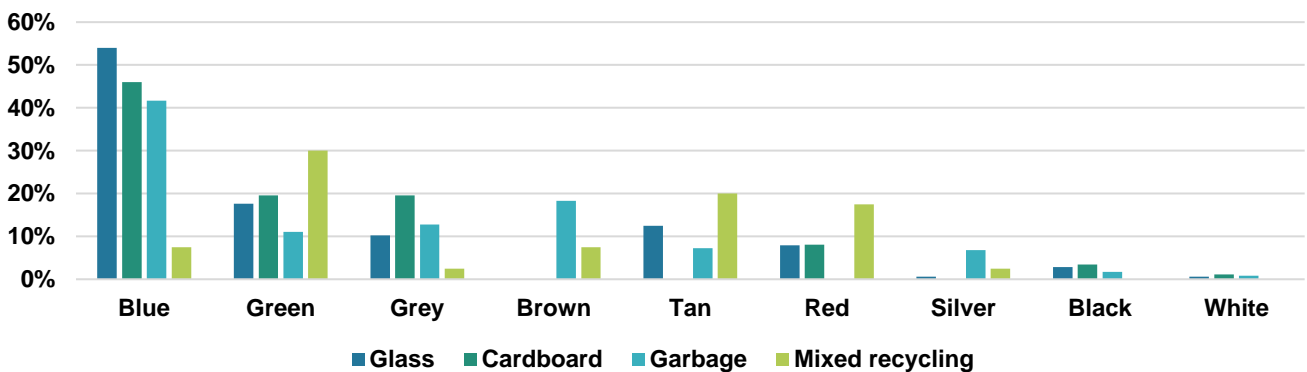


Figure 19: Receptacle lid colors by material — some properties had more than one color, resulting in totals not adding up to 100 percent

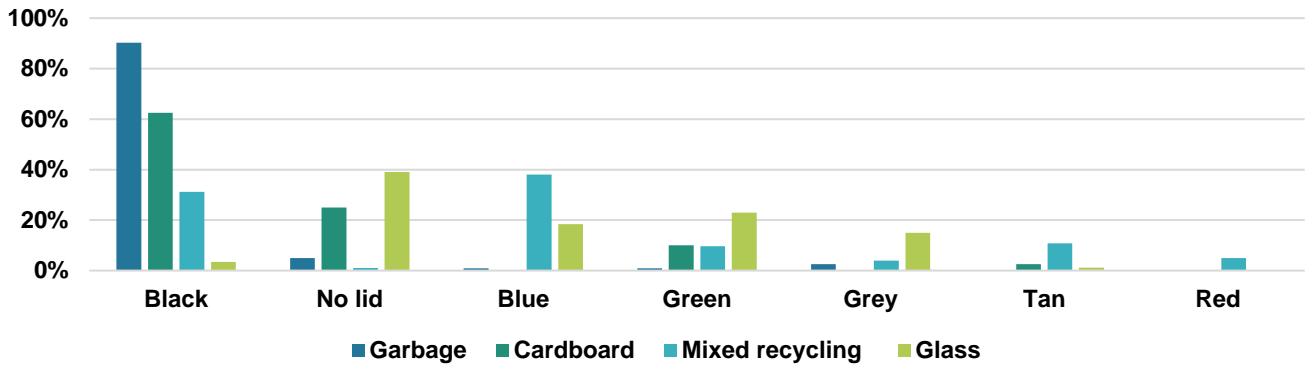


Figure 20: Percent mixed recycling and garbage receptacles and lids that are different colors



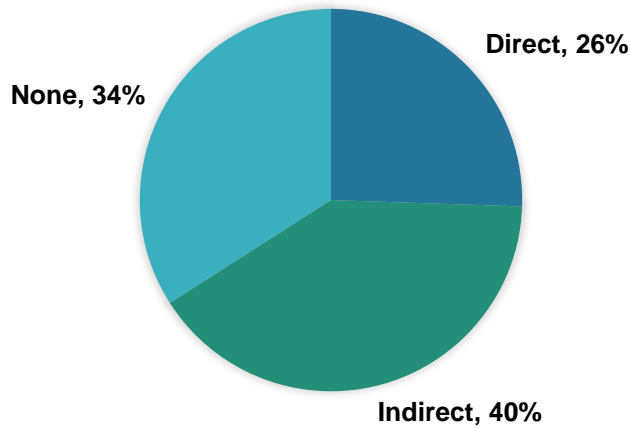
3.2.6.10 Presence of security cameras

Most properties do not have security cameras. Researchers observed security cameras at 10 percent of properties surveyed — see Appendix S.

3.2.6.11 Collection area lighting

Indirect lighting was present at 40 percent of material collection areas. Thirty-four percent of collection areas had no lighting, and 26 percent had direct lighting — see Figure 20 and Appendix T.

Figure 20: Quality of collection area lighting



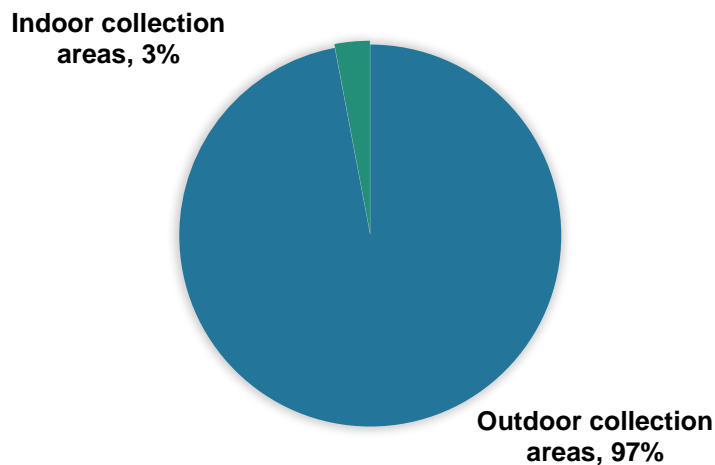
3.3 Collection characteristics

3.3.1 Material collection area design

3.3.1.1 Indoors vs. outdoors

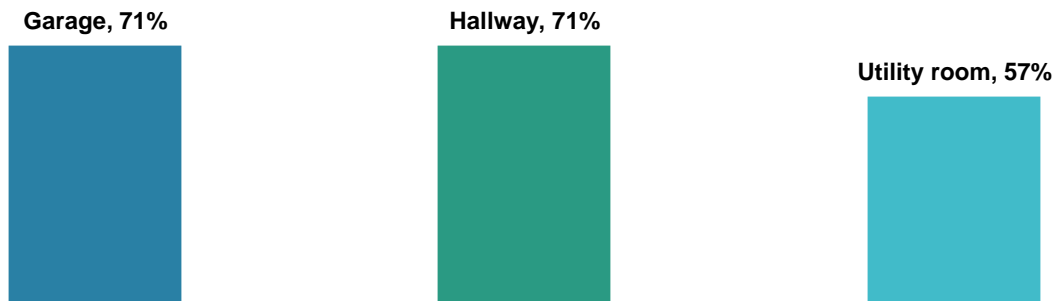
Ninety-seven percent of properties surveyed for this study had collection areas located outdoors, while only three percent of properties had material collection areas located indoors. See Figure 21 and Appendix U.

Figure 21: Percent of indoor and outdoor collection areas



Some properties with indoor collection areas had more than one type of collection area. Of the properties surveyed with indoor collection areas, 71 percent had collection in hallways, 71 percent had collection in utility rooms and 57 percent had collection areas in a garage. See Figure 22 and Appendix U, Table 26.

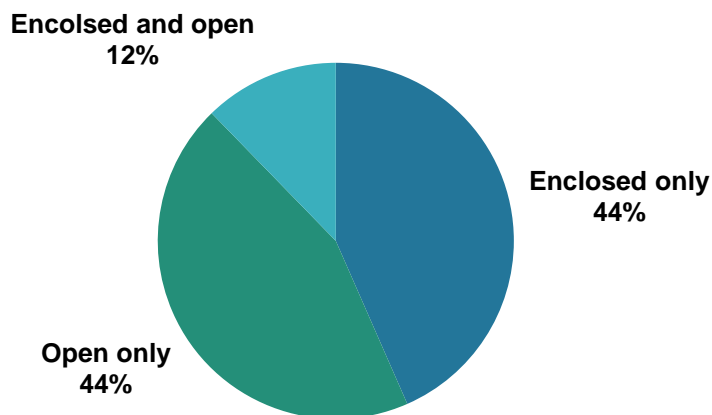
Figure 22: Types of indoor collection areas — some properties had more than one type, resulting in totals not adding up to 100 percent



3.3.1.2 Enclosures and roof coverings

Of all outdoor collection areas surveyed, 44 percent had no walls and were open, 44 percent were enclosed and 12 percent had both enclosures and receptacles located outside of the enclosures — see Figure 23 and Appendix V. Collection areas with roofs were uncommon — found at only five percent of collection areas.

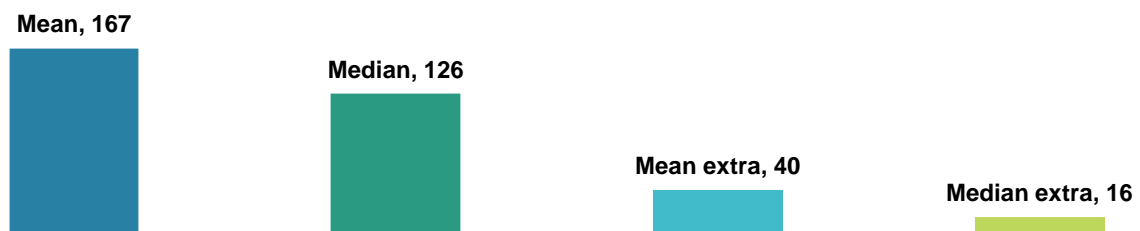
Figure 23: Types of outdoor collection areas



3.3.1.3 Collection area size and extra space

The average (mean) collection area size for surveyed properties was 167 square feet and the median size was 126 square feet. The average (mean) size of extra space was 40 square feet and 16 square feet median extra space — see Figure 24 and Appendix W.

Figure 24: Average (mean) and median collection area and extra space in square feet



3.3.1.4 Visible from the street

Seventy-three percent of collection areas surveyed were visible from adjacent streets — see Appendix X

3.3.2 Receptacle types

The types of receptacles found on properties surveyed varied widely. Garbage and cardboard were often collected in containers. Roll carts were most likely to be used for collecting mixed recycling and glass. However, as seen in Figure 25 and Appendix Y, a variety of receptacle types were used statewide.

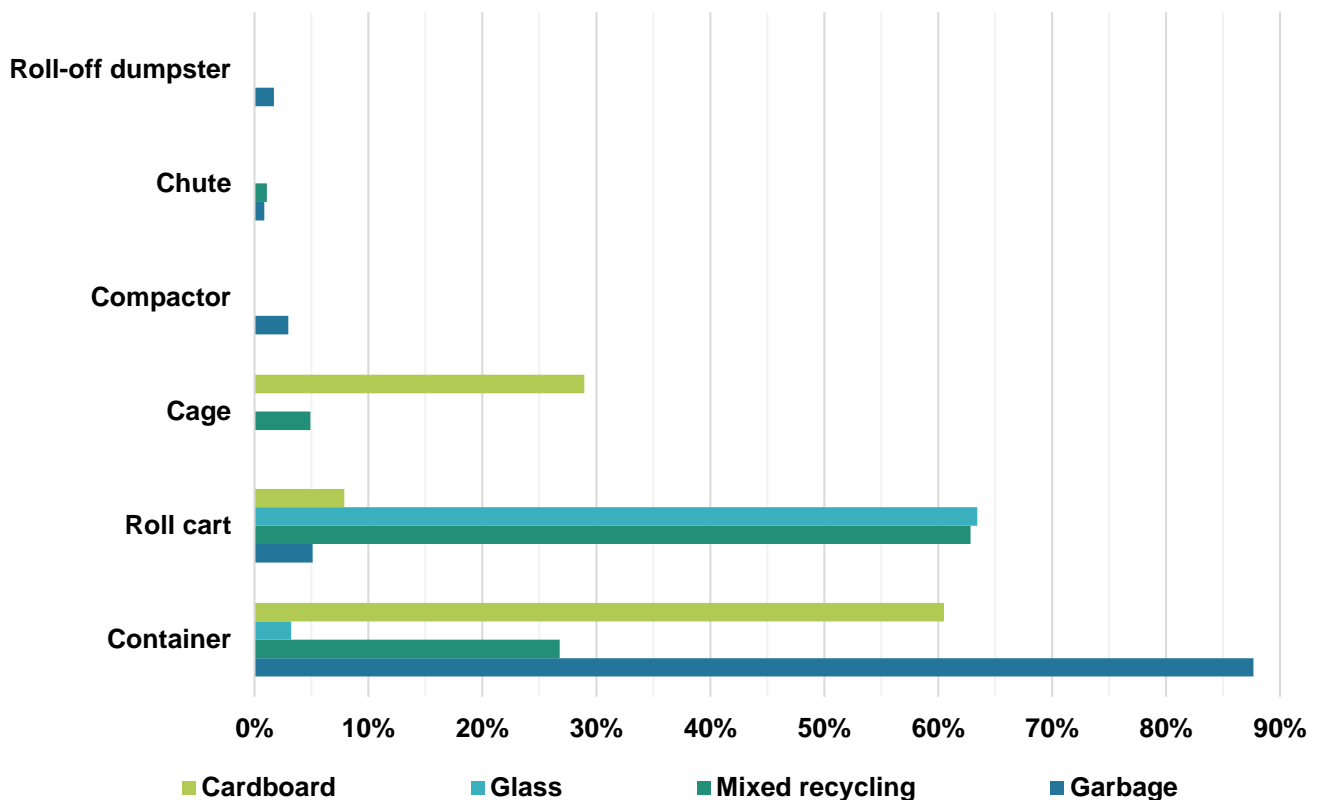
Containers were the most common type of garbage receptacle at 88 percent, followed by five percent garbage roll carts and three percent garbage compactors.

Sixty-three percent of properties collected mixed recycling in roll carts, followed by 27 percent collected in containers and five percent in cages.

Properties collecting glass in roll carts were the most common at 63 percent, followed by 33 percent in some other type of receptacle and three percent collecting in containers. Of the properties with “other” glass collection receptacles, 71 percent used three to five-gallon, square, rigid plastic bins. The remaining properties with “other” receptacles appeared to be using improvised receptacles provided either by residents or property managers, such as storage totes, milk crates, cardboard boxes, garbage cans or by simply placing glass recyclables on the ground in a designated part of the material collection area.

For cardboard collection, most properties used containers (61 percent), followed by cages (29 percent) and roll carts (eight percent).

Figure 25: Types of receptacles by material



3.3.3 Materials collected

All properties surveyed provided garbage collection service. A majority of properties did have some sort of recycling opportunity — though sometimes limited. Overall, 67 percent of properties had some sort of recycling collection service whether it was mixed recycling with glass or just cardboard — see Appendix Z. Thirty-three percent did not have any kind of recycling opportunity.

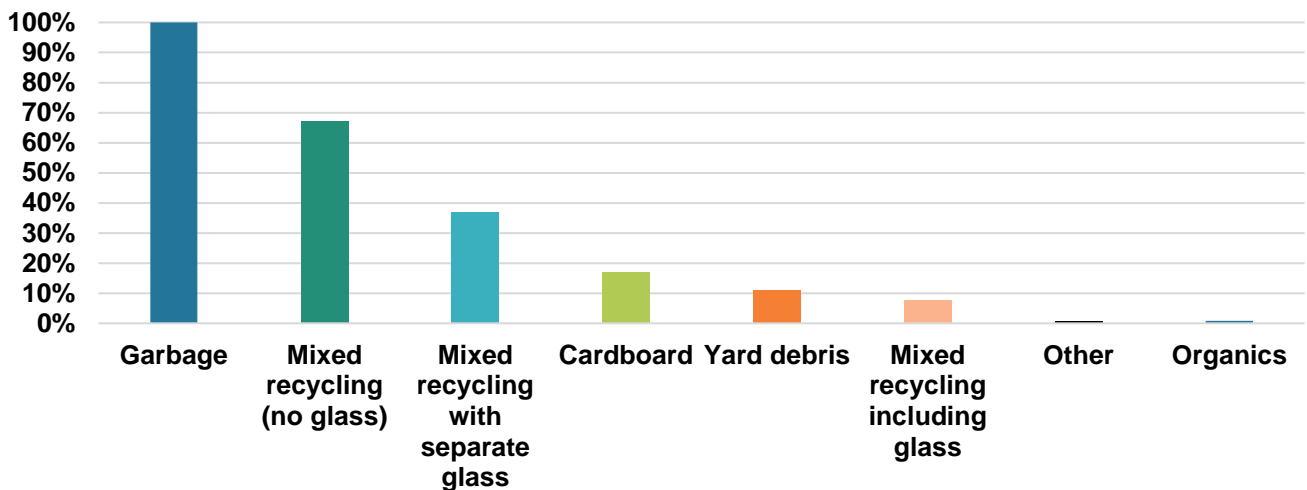
Recycling collection service varied. Sixty-seven percent of properties provided mixed recycling collection, but no glass collection. Thirty-seven percent of properties provided mixed recycling and separate glass recycling collection. Seventeen percent of properties provided cardboard recycling collection and 11 percent collected yard debris. Eight percent of properties provided single-stream recycling, including glass, in one container — see Figure 26 and Appendix Z, Table 33.

Organics were collected at two properties.

Other materials were collected as well at two properties including cooking oil, batteries, light bulbs and separated containers for bottle deposit refunds.

Tenants living on properties that lacked the opportunity for recycling sometimes engaged DEQ researchers, registering complaints about their home’s lack of recycling availability.

Figure 26: Material types collected



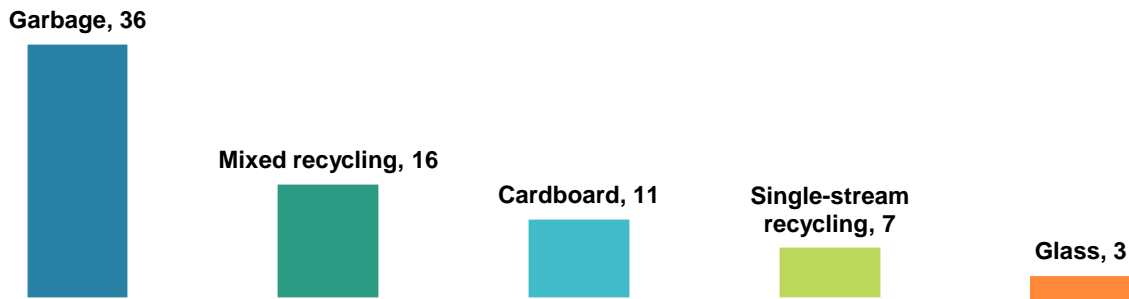
3.3.4 Collection service levels

Collection service providers shared their service levels for 228 of the 235 surveyed properties. Researchers excluded three properties because the collection service providers could not confirm the property from DEQ’s address records. Collection service providers did not respond to queries about the remaining four properties.

The median service level statewide for garbage collection, including properties in the Metro Service District, was 36 gallons per dwelling unit per week. The median mixed recycling service level statewide was 16 gallons per unit per week. The statewide median service level for glass was three gallons per unit per week — see Figure 27 and Appendix AA.

Service levels for single-stream recycling and cardboard collection are based only on the properties surveyed in the DEQ study and do not integrate data from the MSD. Median service levels for single stream recycling were seven gallons per unit per week and median service levels for cardboard recycling were 11 gallons per unit per week.

Figure 27: Median service levels (gallons) by materials type



3.3.5 Number of units served per collection area

The average (mean) number of dwelling units served by one material collection area was 29, and the median was 21 dwelling units per collection area. The average (mean) number of collection areas per property was three and the median was one — see Appendix BB.

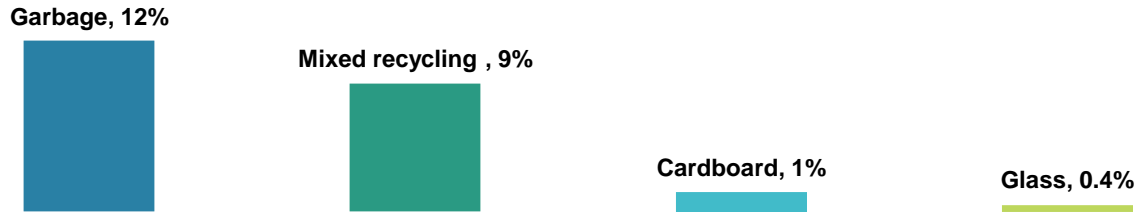
3.3.6 Full receptacles

The majority of properties had space available for more materials in the receptacles provided at the time of the survey. Twelve percent of properties had garbage receptacles that were full — see Figure 28. Nine percent of properties had full mixed recycling receptacles, followed by one percent of properties with cardboard receptacles and less than one percent of properties with glass receptacles — see Figure 29 and Appendix CC.

Figure 28: Full garbage and mixed recycling containers



Figure 29: Properties with full receptacles by material type



3.3.7 Contamination

Researchers discovered the presence of mixed recycling in the garbage at 84 percent of all properties surveyed, other contamination in the recycling at 73 percent of properties with recycling service and bags of garbage in the recycling at 20 percent of properties with recycling service — see Figure 30 through 33 and Appendix DD.

Figure 30: Percent of properties with garbage in the recycling and recycling in the garbage

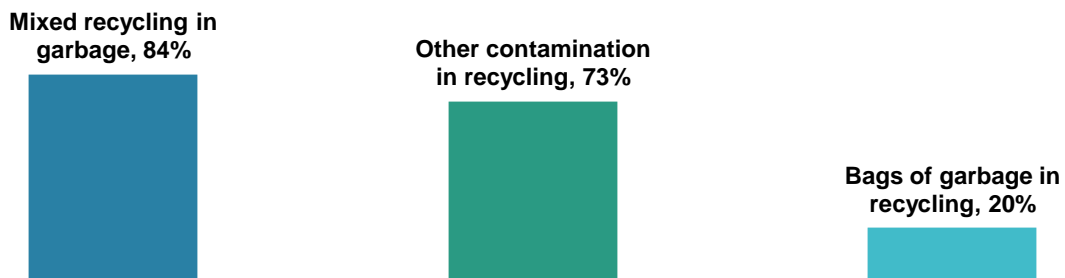


Figure 31: Mixed recycling in garbage



Figure 32: Other contamination in recycling



Figure 33: Bags of garbage in recycling



4. Discussion

4.1 Limitations

This research is meant to help establish a basic understanding of multifamily tenant access to recycling statewide. This study is not meant to provide in-depth comprehensive statistical data representative of conditions statewide or even within the cities surveyed. The project team worked to balance time and budgetary constraints with the need for property-specific data. Several limitations to the site survey methodology were identified by DEQ staff including sample sizes, timing, collection service levels and waste and recycling compositions.

4.1.1 Sample size

Some of the properties selected could not be contacted. For some of the smaller cities, there were not 15 multifamily properties to choose from. Some of these smaller cities did not have 15 properties surveyed. The sample size of 235 multifamily properties may not be large enough for a statistically significant representation of multifamily housing statewide or within communities. There were also not enough samples within cities to be representative of the city. Additionally, some of the smaller cities might not be as proportionally represented.

4.1.2 Timing of samples

The property surveys provide a snapshot in time for each property rather than average conditions. Each property was visited only once at a random point in time and not correlated with collection schedules. Conditions could conceivably be quite different a day before or after the site visit. Because of the large number of property surveys, scheduling visits to consistently coincide with a particular condition — such as the day before collection providers are scheduled to pick up materials — was not possible. However, because a large number of sites were visited, a wide variety of conditions were recorded statewide.

4.1.3 Collection service levels

Researchers did not have the resources to verify the data provided by the collection providers on the volume of collection service. It is assumed there will be some degree of error. Some spot checking revealed that conditions observed on site were different than reported by collection providers.

4.1.4 Material composition

While researchers observed and collected data about the presence of garbage in recycling and recyclable materials in garbage receptacles, they did not sort through collected materials for detailed composition information. Researchers only spotted materials that were on top. It is assumed that some receptacles could have had contamination that was not seen by DEQ researchers. Composition could also be influenced by the time at which it was observed.

4.1.5 Supporting photography

Several photographs needed to provide validation or clarification of data were not taken on properties by DEQ researchers. In follow up conversations, it was revealed that communication regarding the intent behind photographic documentation was not consistently shared or understood during in-person training sessions. In a few instances, viewing photographs could have helped to clarify data that may have been entered incorrectly or in a confusing manner but, those photographs were inconsistently available.

4.2 Conclusion

The purpose of this study was to understand common garbage and recycling collection practices at multifamily properties statewide using a representative sample. Properties surveyed represented a range of conditions, populations served, geographies and types of dwellings. Although the sample size for this study is small and results cannot be assumed to precisely approximate conditions across Oregon, this study does provide useful observations derived from a representative sample of multifamily housing properties. Key takeaways from this research are:

- The vast majority of receptacles could be accessed to some degree.
- Signage, decals and labels that communicate what materials belong in which receptacles was rarely used.
- When signage was present, it was rarely presented in any languages other than English or with imagery.
- Receptacle colors were inconsistently used to differentiate material types collected.
- The overwhelming majority of collection areas were located outdoors and very few had roofs.

- The opportunity to recycle was not consistently offered.
- The majority of properties had uncontained materials either blocking access or littering the floor around receptacles.
- Garbage and bulky materials were the most likely materials to be found outside of receptacles.
- Contamination was a consistent problem in both garbage and recycling receptacles.

5. Evaluation

The findings in this study offer a snapshot of what could be a broader understanding of multifamily recycling and garbage collection conditions in Oregon. If this research is replicated in the future, several steps may be taken to ensure a more detailed, higher quality data set and a more efficient process for data collection and analysis.

A larger sample size would help to provide a more accurate approximation of conditions statewide. This could be accomplished by increasing individual samples to more than 15 properties or by sampling more cities.

The data collection process could be made more efficient by using an online survey platform collected on a digital tablet. It could also be used to capture photographs. This would avoid many hours of data entry and also would help to avoid errors made in two rounds of processing the data.

Choosing a consistent point of time in the collection cycle for performing surveys might help to provide more accurate comparison between properties. Surveying all properties the day before garbage pickup could be performed, for example. Likewise, the end or beginning of a month can present drastically different conditions compared to mid-month surveys because of move-in and move-out times.

In future studies, recording any non-English language signage found on properties would provide a better understanding of which non-English speakers are best served by signage, and it could offer useful comparisons to population data.

For questions regarding the percentages of decals and stamps on receptacles and receptacle color, it is recommended that raw numbers of receptacles be counted rather than calculating percentages on site to ensure a straightforward method for analyzing those data points.

Most collection service providers were unable to provide customer lists specific to multifamily sites because they do not delineate them from either residential or commercial routes. If collectors were given more notice they might have been able to provide better records. Similarly, obtaining data from county assessors required a month's notice to receive relevant data.

Appendix A

Table 5: DEQ selected properties compared to American Community Survey distribution for Oregon

	DEQ		ACS	
	Percent	Number	Percent	Number
5 to 9	16%	12	27%	75,092
10 to 19	13%	10	22%	61,499
20 or more	71%	55	50%	136,981
Total	100%	77	100%	273,572

Appendix B

Property survey data sheet

1. Surveyor
2. Date
3. City
4. Property type (R = residential; C = commercial; M = mix)

5. Property name
6. Address
7. Property manager
8. Phone number

9. Units (number)
10. Materials collection areas (number)
11. Building/floor (number/letter)
12. Total buildings/floors (number)

Materials collected

13. Garbage (Y; N)
14. Mixed recycling — <i>no glass</i> (Y; N)

15. Mixed recycling with glass (Y; N)
16. Glass recycling (Y; N)
17. Cardboard recycling (Y; N)

18. Organics (Y; N)
19. Other (list)

Materials collection area(s)

20. Garbage and recycling receptacles collocated (Y; N)
21. GARBAGE receptacles (C = container; G = cage; R = roll cart; RCD = compactor; ROD = roll-off dumpster; T = chute; O = other)
22. MIXED RECYCLING receptacles (<i>same as above</i>)
23. GLASS RECYCLING receptacles (<i>same as above</i>)
24. CARDBOARD RECYCLING receptacles (<i>same as above</i>)

25. Type of area (E = enclosed; C = covered; O = open; G = garage; B = basement; U = utility room; H = hallway; O = other)
26. Visible from street (Y; N)
27. Number of units served by area(s)
28. Time from furthest unit to closest area (seconds)
29. Time from closest unit to closest area (seconds)
30. Change in floors (E = elevator; S = stairs; N = none)

31. Time between garbage and recycling areas (seconds)
32. Distance floor to opening of GARBAGE receptacles (inches)
33. Distance floor to opening of MIXED RECYCLING receptacles (inches)
34. Distance floor to opening of GLASS RECYCLING receptacles (inches)
35. Distance floor to opening of CARDBOARD RECYCLING receptacles (inches)
36. Access to GARBAGE receptacles (inches accessible/total inches)
37. Access to MIXED RECYCLING receptacles (inches accessible/total inches)

38. Access to GLASS RECYCLING receptacles (inches accessible/total inches)
39. Access to CARDBOARD RECYCLING receptacles (inches accessible/total inches)
40. Uncontained materials (B = bulky materials; G = garbage; R = mixed recycling; S = glass; C = cardboard; H = hazardous waste; X = e-cycles; O = other)
41. Full receptacles (G = garbage; R = mixed recycling; S = glass; C = cardboard)
42. Area dimension (width x depth)
43. Dimensions extra space (width x depth)

Signage

44. Directional signs (Y; N)
45. GARBAGE receptacle signage (percent)
46. MIXED RECYCLING receptacle signage (percent)
47. GLASS RECYCLING receptacle signage (percent)
48. CARDBOARD RECYCLING receptacle decals (percent)
49. Collection area material GARBAGE signage (percent)
50. Collection area material RECYCLING signage (percent)
51. GARBAGE receptacle and lid colors (list)
52. MIXED RECYCLING receptacle and lid colors (list)

53. GLASS RECYCLING receptacle and lid colors (list)
54. CARDBOARD RECYCLING receptacle and lid colors (list)
55. Languages (number)
56. Images on decals or signs (Y; N)
57. Contamination messaging (Y; N)
58. Illegal dumping warning (Y; N)
59. Security cameras (Y; N)
60. Collection area lighting (D = direct; I = indirect; N = none)

Materials in receptacles

61. Other contamination in RECYCLING (Y; N)
62. Bags of garbage in RECYCLING (Y; N)

63. Mixed recycling in GARBAGE (Y; N)

Pictures to take

- | | | |
|---------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------|
| <input type="checkbox"/> Property identification sign | <input type="checkbox"/> Each type of receptacle | <input type="checkbox"/> Examples of each type of sign and decal |
| <input type="checkbox"/> The approach to the collection area | <input type="checkbox"/> Inside the top of each type of receptacle | <input type="checkbox"/> Other illustrative examples |
| <input type="checkbox"/> The entire collection area from 2 or more angles | <input type="checkbox"/> Any uncontained materials | |

Multi-tenant Recycling Opportunity Property Survey Protocols

- | | |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| 1. Surveyor — research analyst’s name. | 4. Property type — residential, commercial or mixed when recycling collection area is shared by both. |
| 2. Date — date survey was conducted. | |
| 3. City — location of survey. | |

5. **Property name**
6. **Address** — street address
7. **Property manager** — (in advance) name
8. **Phone number** — (in advance) phone number if questions when on site
9. **Units** — (in advance) number of units on the property
10. **Materials collection areas** — (in advance) total number of garbage and recycling collection areas for residents on the property
11. **Building/floor** — designation or description of building or floor (*for high-rises*) being sampled
12. **Total buildings/floors** — (in advance) with tenants only — not outbuildings, common areas
13. **Garbage** — presence or absence of collection receptacles
14. **Mixed/commingled recycling** — presence or absence of mix of materials including containers, paper and cardboard collection receptacles. No glass included.
15. **Mixed recycling with glass** — same as above including glass
16. **Glass recycling** — presence or absence of separated bottles and jars collection receptacles
17. **Corrugated cardboard recycling** — presence or absence of cardboard only collection receptacles
18. **Organics** — presence or absence of wasted food collection receptacles
19. **Other** — list of materials with collection receptacles such as yard debris, cooking oil, textiles, electronics, etc. Needs to be contained in marked container not loose.
20. **Location garbage and recycling** — presence or absence of collocated material collection areas — garbage and recycling within 20 feet of each other
21. **Garbage receptacles** — Types of receptacles present. **Containers** are square metal boxes with four wheels, typically have lids and can be lifted and tipped into the top or back of a truck. **Cages** are containers that have grated side you can see into and a slot to slide items like cardboard in from the front. **Roll carts** are smaller, typically made of plastic and have two wheels and a lid. **Compactors** are large metal boxes with two sets of wheels and are connected to a compactor. **Roll-off dumpsters** are large metal boxes with two sets of wheels and are open from the top with no lid. **Others** could include round, plastic or metal cans or other receptacle.
22. **Mixed recycling receptacles** — same as above.
23. **Glass recycling receptacles** — same as above.
24. **Cardboard recycling receptacles** — same as above.
25. **Type of area** — **enclosed** are outdoors, have two to three walls, sometimes with a gate or door, which shield receptacles. **Covered** areas are outdoors, have a roof that protects from weather. **Open** has no protection or screening and open to the sky. **Garage** are indoor. **Basement** is indoor but no parking. **Utility room** is an inside room with collection receptacles by itself or contained with other utilities. **Hallway** is inside a building. **Other** — indicate in notes where it is.
26. **Visible from street** — receptacles or enclosure can be seen from the street — presence or absence?
27. **Number of units served** — units that are closer to the sample collection area than another collection area. Should be able to be estimated in advance by questions 9 and 10. Confirm on site by finding nearby collection areas where present and find middle units and count backwards.
28. **Time from furthest unit to closest area** — (*develop standard gait and stride in advance*) time in seconds it takes to travel from the door of the furthest unit to the collection area including any change in stairs or elevator.

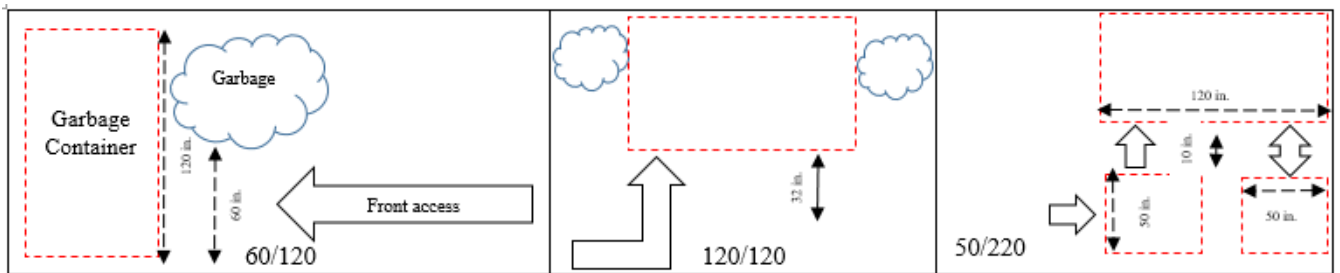
Record in total seconds. Round to closest second.

- 29. **Time from closest unit** — similar to above but from closest unit door including any change in stairs of elevator. Round to closest second.
- 30. **Change in floors** — if elevators or stairs are necessary to get to collection area from any of the units.
- 31. **Time between garbage and recycling areas** — time it takes to walk between garbage and recycling when they are not collocated

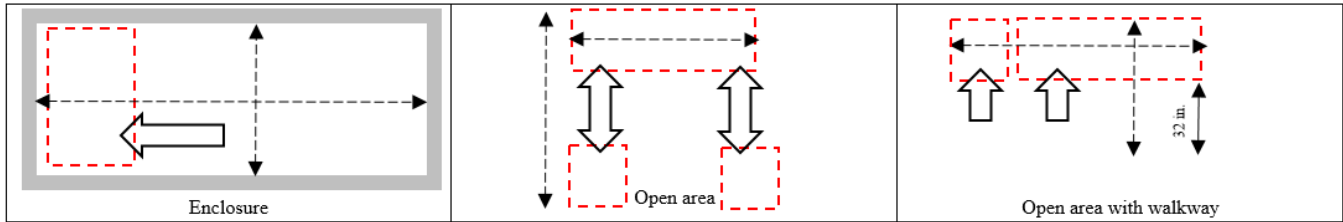
including any change in stairs of elevator. “0” if collocated. Round to closest second.

- 32. **Distance floor/opening garbage** — inches from floor to the opening or lid — whichever is further (*or other opening mechanism*) — of the receptacle where you put garbage.
- 33. **Distance floor/opening mixed recycling** — same as above.
- 34. **Distance floor/opening glass recycling** — same as above.
- 35. **Distance floor/opening cardboard recycling** — same as above.

36. **Access to garbage receptacles** — Inches accessible across the front of opening of receptacles not blocked by other materials or containers, divided by total inches of front of receptacles. Front of container blocked if not at least 32 inches of space for a walkway. See following figure. Take several pictures from multiple angles to illustrate.



- 37. **Access to mixed recycling receptacles** — same as above
- 38. **Access to glass recycling receptacles** — same as above
- 39. **Access to cardboard recycling receptacles** — same as above
- 40. **Uncontained materials** — materials that are littering the collection area or are blocking access.
 - Bulky materials** include couches, mattresses and items that won't fit in receptacles due to size.
 - Garbage** includes bags/boxes of materials and loose items. **Mixed recycling** include bags, boxes or loose mixed recyclables. **Glass** include bags, boxes or loose bottles and jars. **Cardboard** include whole or broken down boxes. **Hazardous waste** includes household chemicals, oil, needles, sharps, bio-wastes, etc. **E-cycles** include monitors, TVs, printers, computers, keyboards and mice.
- 41. **Full receptacles** — which receptacles don't have room for more garbage or recycling without risk of overflowing. If garbage chute, go to receptacle in lower floors to check.
- 42. **Area dimension** — measurement of width and depth of the collection area. For enclosures, measured from wall to wall. For open areas with multiple facing receptacles, measured from back of furthest receptacle to back of opposite receptacle. When single receptacles or receptacles in a row in an open area, measured from back of receptacle to front plus 32 inches (ADA minimum) for walkway access. See figure below.



43. **Extra space** — dimension(s) of additional room adjacent to receptacles for additional receptacles without requiring additional construction or removing parking or a 32-inch access walkway.
44. **Directional signs** — presence or absence of signs beyond the collection area that give directions for tenants to locate the collection area. Does not include signs on the outside of the collection area doors or walls.
45. **Garbage receptacle messaging** — percent of total garbage receptacles with decals, stickers or other on the receptacle that indicate they are for garbage. Two receptacles with one signed receptacle is 50%.
46. **Mixed recycling receptacle signage** — same as above for mixed recycling.
47. **Glass recycling receptacle signage** — same as above for glass recycling.
48. **Cardboard recycling receptacle signage** — same as above for cardboard recycling.
49. **Collection area garbage signage** — signs above or behind receptacles that indicate which receptacle(s) are for garbage. If receptacles are grouped together, one sign is 100 percent. If garbage receptacles are across from each other, one sign for each area is 100 percent.
50. **Collection area recycling signage** — signs above or behind receptacles that indicate which receptacle(s) are for which type of recycling. If receptacles are grouped together, one sign is 100 percent. If recycling receptacles are across from each other, one sign for each area is 100 percent.
51. **Garbage colors** — list colors of garbage receptacles and lids. "Metal" if unpainted chute.
52. **Mixed recycling colors** — same as above.
53. **Glass recycling colors** — same as above.
54. **Cardboard recycling colors** — same as above.
55. **Languages** — number of languages used on decals or signs including English.
56. **Images** — presence or absence of images or illustrations on decals or signs that show examples of acceptable materials.
57. **Contamination messaging** — presence or absence of decals or signs that indicate unacceptable materials such as no plastic bags.
58. **Illegal dumping warning** — presence or absence of signs indicating it is illegal or discouraging illegal dumping.
59. **Security cameras** — presence or absence of cameras that are visible from collection area.
60. **Lighting** — *direct* lighting over collection area, *indirect* lighting is visible from within collection area but not overhead or *none* can be seen in the area at all.
61. **Other contamination in recycling** — presence or absence of loose items not acceptable such as plastic bags, plastic hose, cables, clamshells, solo cups, etc. Cross check with acceptable materials. No need to sort through — just view from the top.

- 62. **Mixed recycling in garbage** — presence or absence of acceptable recyclables in the garbage. No need to sort through — just view from the top.
- 63. **Bags of garbage in recycling** — presence or absence of bags of garbage in the recycling. Not including minor mistakes or other minor contamination. No need to sort through — just view from the top.

Appendix C

Table 6: Number of properties surveyed compared to number planned to survey

City	Sample size	Number of properties surveyed
Albany	15	15
Bend	15	15
Corvallis	15	15
Eugene	45	45
Keizer	15	15
Lebanon	15	15
Medford	15	15
Pendleton	15	11
Redmond	15	15
Salem	30	30
Sheridan	15	4
Springfield	15	15
Tillamook	15	15
Woodburn	15	10

Appendix D

Table 7: DEQ selected properties compared to American Community Survey distribution for Oregon

	DEQ		ACS	
	Percent	Number	Percent	Number
5 to 9	14%	33	27%	75,092
10 to 19	19%	44	22%	61,499
20 or more	67%	158	50%	136,981
Total sample	100%	235	100%	273,572

Appendix E

Table 8: Average walking time between units and closets collection area

	Average walking time (sec.)
Average time from furthest unit to collection area	58
Average time from closest unit to collection area	19
Average walking time	38

Appendix F

Table 9: Average walking time between units and closets collection area

	Percent	Number
Elevator	9%	22
Stairs	77%	180
None	14%	33
Total sample	100%	235

Appendix G

Table 10: Accessing garbage and recycling together

	Percent	Number
Yes	72%	169
No	9%	22
Not applicable (no recycling service)	19%	44
Total sample		191

Appendix H

Table 11: Access to receptacles

	Percent	Mean accessible (in.)	Mean total (in.)
Garbage	91%	73	80
Mixed Recycling	87%	59	68
Glass	97%	27	29
Cardboard	92%	62	68

Appendix I

Table 12: Uncontained materials — properties can have more than one type of material present

	Percent	Number
Any uncontained materials	60%	141
Garbage	42%	99

	Percent	Number
Bulky materials	26%	61
Mixed recycling	22%	51
Cardboard	15%	34
Glass	5%	12
Other	3%	8
Hazardous waste	3%	7
E-cycles	2%	4
Total sample		235

Appendix J

Table 13: Directional signage

	Percent	Number
Yes	1%	2
No	99%	233
Total sample	100%	235

Appendix K

Table 14: Percent of receptacles with decals or labels indicating proper usage, weighted by total units for properties surveyed

	Percent	Number of properties	Number of units
Mixed recycling	92%	167	12637
Cardboard	85%	36	6655
Glass	60%	61	6233
Garbage	14%	36	2210
Total sample		235	27729

Appendix L

Table 15: Percent of collection areas that have signs for recycling and garbage, weighted by total number of units for properties surveyed

	Percent	Number of properties	Number of units
Garbage signs	17%	29	2358
No garbage signs	83%	206	13116
Recycling signs	17%	21	2191
No recycling signs	83%	206	13283
Total sample		235	15474

Appendix M

Table 16: Contamination messaging

	Percent	Number
Yes	63%	147
No	37%	88
Total sample		235

Appendix N

Table 17: Illegal dumping warnings

	Percent	Number
Yes	17%	39
No	83%	196
Total sample		235

Appendix O

Table 18: Number of language present

	Percent	Number
One	78%	159
Two	21%	43
Three	1%	1
Total sample	100%	202

Appendix P

Table 19: Images on decals or signs

	Percent	Number
Yes	33%	66
No	67%	136
Total sample	100%	202

Appendix Q

Table 20: Average distance from floor to opening of receptacles (inches)

Distance from floor to receptacles	Average (in)	Median (in)
Garbage	48	48
Mixed recycling	44	42
Glass	31	36
Cardboard	50	50

Appendix R

Table 21: Receptacle colors by material — some properties had more than one color, resulting in totals not adding up to 100 percent

	Black		Blue		Brown		Green		Grey		Silver		Tan		White		Red		Total samples
	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	
Garbage	2%	4	42%	98	18%	43	11%	26	13%	30	7%	16	7%	17	1%	2	0%	0	235
Mixed recycling	0%	5	1%	95	0	0	0.18	31	0%	18	0.01	1	0.13	22	0.01	1	0.08	14	176
Glass	3%	3	46%	40	0%	0	20%	17	20%	17	0%	0	0%	0	1%	1	8%	7	87
Cardboard	0%	0	8%	3	0.08	3	0.3	12	3%	1	0.03	1	0.2	8	0	0	0.18	7	40

Table 22: Receptacle lid colors by material — some properties had more than one color, resulting in totals not adding up to 100 percent

	Black		Blue		Green		Grey		Silver		Tan		Red		No lid		Total sample
	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	
Garbage	90%	212	1%	2	1%	2	3%	6	0%	1	0%	0	0%	0	5%	12	235
Mixed recycling	31%	55	38%	67	10%	17	4%	7	0%	0	11%	19	5%	9	1%	1	176
Glass	3%	3	18%	16	23%	20	15%	13	0%	0	1%	1	0%	0	39%	34	87
Cardboard	63%	25	0%	0	10%	4	0%	0	0%	0	3%	1	0%	0	25%	10	40

Table 23: Percent mixed recycling and garbage receptacles and lids that are different colors

	Percent	Number	Total
Lids different colors	67%	122	181
Receptacles different colors	54%	101	187

Appendix S

Table 23: Presence of security cameras

	Percent	Number
No	90%	212
Yes	10%	23
Total sample		235

Appendix T

Table 24: Collection area lighting

	Percent	Number
Indirect	40%	95
Direct	26%	60
None	34%	80
Total sample		235

Appendix U

Table 25: Indoor vs. outdoor collection areas

	Percent	Number
Outdoor	97%	228
Indoor	3%	7
Total samples	100%	235

Table 26: Indoor collection area locations. Some properties had more than one type of indoor collection area.

	Percent	Number
Hallway	71%	5
Utility room	57%	4
Garage	71%	5
Basement	0%	0
Total samples	100%	7

Appendix V

Table 27: Outdoor collection area design. Roof coverings occurred coincidentally with enclosed and open receptacles; total sample is a sum of open, open, enclosed, and open and enclosed collection areas.

	Percent	Number
Open	44.3%	101
Enclosed	43.4%	99
Enclosed and open receptacles	12.3%	28
Roof coverings	5%	12
Total sample	100%	228

Appendix W

Table 28: Collection area size and extra space

	Mean (sq. ft.)	Median (sq. ft.)
Average collection area size	167	126
Average extra space	40	16

Appendix X

Table 29: Visible from street

	Percent	Number
Yes	73%	172
No	27%	63
Total sample	100%	235

Appendix Y

Table 30: Receptacle types

	Container		Cage		Roll cart		Compactor		Roll-off dumpster		Chute		Other		Total sample
	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	
Garbage	88%	206	0%	1	5%	12	3%	7	2%	4	1%	2	1%	3	235
Mixed recycling	27%	49	5%	9	63%	115	0%	0	0%	0	1%	2	4%	8	183
Glass	3%	3	0%	0	63%	59	0%	0	0%	0	0%	0	33%	31	93
Cardboard	61%	23	29%	11	8%	3	0%	0	0%	0	0%	0	3%	1	38

Table 31: Other glass receptacle types

	Percent curbside bin	Number curbside bin	Percent storage tote	Number storage tote	Percent garbage can	Number garbage can	Percent placed on the ground	Number placed on the ground	Percent milk crate	Number milk crate	Percent barrel	Number barrel	Percent cardboard box	Number cardboard box	Total sample
Other glass	71%	22	10%	3	3%	1	3%	1	3%	1	6%	2	3%	1	31

Appendix Z

Table 32: Opportunity to recycle

	Percent	Number
Recycling available (any materials)	67%	158
No recycling available	33%	77
Total sample	100%	235

Table 33: Materials collected

	Yes		No		Total sample
	Percent	Number	Percent	Number	
Garbage	100%	235	0%	0	235
Mixed recycling (no glass)	67%	71	70%	164	235
Mixed recycling with separate glass	37%	87	63%	148	235
Cardboard	17%	40	83%	195	235
Yard debris	11%	26	89%	209	235
Mixed recycling including glass	8%	18	92%	217	235
Other	1%	2	91%	233	235
Organics	1%	2	99%	233	235

Appendix AA

Table 34: Collection service levels

	DEQ MTRO Study Median	Metro study median	State median
Garbage	31 gallons/unit/week	40 gallons/unit/week	36 gallons/unit/week
Mixed recycling	14 gallons/unit/week	17 gallons/unit/week	16 gallons/unit/week
Glass	2 gallons/unit/week	3 gallons/unit/week	3 gallons/unit/week
Cardboard	11 gallons/unit/week	N/A	N/A
Organics	7 gallons/unit/week	N/A	N/A

Appendix BB

Table 35: Number of units served per collection area

	Mean	Median
Units served per collection area	29	21
Collection areas per property	3	1

Appendix CC

Table 36: Full receptacles

	Yes		No		Total sample
	Percent	Number	Percent	Number	
Garbage	12%	28	88%	207	235
Mixed recycling	9%	21	91%	214	235
Glass	0%	1	100%	234	235
Cardboard	1%	3	99%	232	235

Appendix DD

Table 37: Percent of properties with garbage in the recycling and recycling in the garbage

	Yes		No		Not applicable		Total sample
	Percent	Number	Percent	Number	Percent	Number	
Mixed recycling in garbage	84%	198	16%	37	0%	0	235
Other contamination in recycling	73%	133	27%	49	29%	53	235
Bags of garbage in recycling	20%	37	80%	144	30%	54	235