



National Solid Waste Benchmarking Study

2014 Canadian Office and Retail Waste Performance Report

March 2015





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About RCO

Recycling Council of Ontario (RCO) is a member-based not-for-profit organization established in 1978 with a sole focus on solid waste reduction and diversion. RCO is involved in policy advocacy, research, education, and program delivery around the issues of consumption, waste generation, and minimization. As a multi-stakeholder organization focused on solving solid waste issues, RCO provides a collective and effective voice on reduction and diversion opportunities.

To learn more visit rco.on.ca.

Acknowledgements

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RCO would like to extend a special thank you to Julia St. Michael of REALpac, Bala Gnanam of BOMA Toronto, and Hazel Sutton of BOMA Canada for their industry outreach efforts; Yuchi Zhang for project design and co-ordination assistance; and Caitlin Perry for administrative and analysis support.



¹ **Data and Advisory Contribution:** The logos above represent a portion of organizations that have contributed expertise, data and/or outreach assistance.



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Disclaimer

The National Solid Waste Benchmarking Study is the collection and analysis undertaken by RCO using data provided by participants in a 2014-administered survey based on 2013 information. The information has been provided in good faith and is believed by RCO to be truthful. While time and care has been taken to review the quality of the data, none of the information has been verified. RCO, therefore, does not warrant the accuracy of the data, nor are any of its staff, directors, or members responsible for the use of the study's information contained herein. All recommendations made in this study are reserved as the opinion of RCO exclusively and does not reflect on any of the study's participants.

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Executive Summary

Solid waste diversion is a key environmental and operational performance indicator tracked by a growing number of real estate management companies at both corporate and property levels. The amount of waste generated, recycled, and disposed of has implications to operational costs, and is a tangible indicator of stakeholder engagement. A successful waste diversion program includes participation from employees, occupants, shoppers, and/or visitors, depending on type of business. An impediment to increased diversion and reduced waste generation among Canadian organizations stems in part from an absence of quality data to help inform comparable performance on a national scale. Specifically, there is no national resource to reference waste generation and diversion rates by organization type. In addition, there is a lack of standard quality for measurement and tracking to enable informed analysis of how organizations in the Industrial, Commercial, and Institutional (IC&I) sector manage waste.

In response, RCO initiated a first-in-Canada study on solid waste data collection to meet a growing need for industry-specific benchmarking that provides relevant, comparable information about this Key Performance Indicator (KPI). Specifically, RCO sought to address the ongoing issue of waste data reporting by two broad categories: residential and non-residential (or IC&I). Statistics Canada reports that non-residential (or IC&I) sectors had a 19 per cent diversion rate in 2010² – performance rate that is attributed to diverse organization types or subsectors: office buildings, schools, hospitals, restaurants, and manufacturing facilities. Consequently, the 19 per cent diversion rate may not reflect subsector performance, making it difficult for organizations to benchmark their own performance against peers. RCO embarked on the benchmarking study in part to demonstrate the need to analyze waste data by subsector.

Leveraging established relationships with office and retail properties via membership and program participation, such as 3RCertified, RCO Awards, and Take Back the Light, RCO chose to focus on three building types: Office, Retail Centre, and Retail Store.³ In doing so, a voluntary survey was developed to collect waste generation and diversion performance among office and retail buildings across Canada to arrive at an average performance rate. The survey contained mandatory and elective questions that include basic information about the participating buildings, followed by questions specific to waste management operations and on-site or corporate waste diversion programs.

Data from 1,012 office and retail properties representing 17 organizations⁴ was analyzed. Waste generation and diversion data for the 2013 calendar year was gathered between April and August 2014 based on bills, diversion reports, and audits. About .5 per cent of submissions represent twelve-month performance from mid-2012 to mid-2013. Participation was restricted to institutional and commercial office buildings; open air and enclosed retail centres; and standalone retail stores.

² Canadian Council of Ministers of the Environment (CCME). *State of Waste Management in Canada*. 2014. Retrieved from ccme.ca/files/Resources/waste/State_Waste_Mgmt_in_Canada.pdf

³ Office category includes commercial and institutional buildings; data was collected for the entire building not by tenant/floor. Retail Centre category includes enclosed and open-air shopping centres and retail plazas; data was collected for the entire building not by tenant (store). Retail Store category includes standalone stores with the primary function of selling goods (merchandise), excluding gas stations and restaurants.

⁴ One of the 17 organizations conducted audits on behalf of an unknown number of companies. Therefore, data likely represents the performance of more than 17 private and public organizations.



HIGHLIGHTS

- ❖ 1,012 office and retail buildings generated approximately 402,000 metric tonnes (MT) of waste in 2013, of which 220,000 MT of materials were recycled and reused.
- ❖ 1,012 buildings achieved a diversion rate of 54.75 per cent:
 - 282 office buildings achieved a diversion rate of 66.33 per cent
 - 150 retail centres achieved a diversion rate of 48.66 per cent
 - 570 retail stores achieved a diversion rate of 53.78 per cent
- ❖ Provinces with highest diversion rates:⁵
 - British Columbia at 58 per cent
 - Nova Scotia at 57.37 per cent
 - Ontario at 55.74 per cent
- ❖ The highest recycled material by percentage of responses (number of material diversion programs in place) for office buildings is paper (fibre) at 86 per cent, followed by cardboard at 83 per cent.⁶ Ninety-five per cent of retail properties have a cardboard recycling program, while 39 per cent divert plastics, and 35 per cent recycle paper (fibre).⁷

Top challenges for property managers, and potential areas for industry-wide improvements:

- ❖ There is an overall lack of consistency in how waste management services are contracted and audited. To meet this challenge, there needs to be greater transparency in how materials are managed and the costing implications to companies.
- ❖ The large variance of waste measurement and tracking makes it difficult to compare performance against competitors.
- ❖ When asked about the greatest challenge related to their waste management program, respondents rated *recycling program participation* as the highest among listed options.

Although the focus of this study is waste performance analysis, the results reflect a need to mobilize standardization of data collection and reporting, and increase dialogue about the importance of transparency in waste management across Canada. The study seeks to provide a platform for discussion on challenges and opportunities related to standardizing data collection and managing solid waste information.

⁵ Participation per province varies. Diversion calculated from different sized datasets. British Columbia total of 143 buildings; Nova Scotia total of 25 buildings; and Ontario total of 517 buildings.

⁶ Percentage determined from a total of 264 office buildings that submitted amounts recycled per waste stream.

⁷ Percentage determined from a total of 313 retail centres and stores that submitted amounts recycled per waste stream.



Recommendations

Based on survey results, which include performance-based information and qualitative input, RCO suggests the following considerations for future iterations of a solid waste benchmarking study:

1. Data sources should continue to include audits, monthly bills, and diversion reports to ensure wide spectrum of participation by office and retail properties.
2. Include a set of mandatory data fields required by all participants to enable comprehensive data analysis such as performance by location and size, as well as material specific performance:
 - a. Location (village / town / city);
 - b. Size of building by Gross Leasable Area (GLA);
 - c. List of all divertible waste streams;
 - d. Diverted materials by weight per material type.
3. Require per building waste generation, diversion, and disposal information. Exclude submissions of groups of buildings (aggregated) to ensure data can be analyzed to determine average diversion rate.
4. Set thresholds for year-over-year change in waste generation rate to identify anomalies. Once an anomaly is flagged, the study can follow up with a request for additional information to establish context for high rates of waste reduction or increase from one year to the next.
5. Maintain a multi-phase study where additional building types from the IC&I sector can participate. This can inform potential improvements in data collection and help set standardized reporting.

Additional recommendations beyond the scope of this study are important to consider in a larger context for the commercial building industry, including office and retail, as well as the waste management performance of Canada's IC&I sector:

1. Standardize waste terminology to create a common language by which materials, waste diversion performance, and tracking is consistent.
2. Standardize waste auditing methods to easily compare audited results of this or similar studies.
3. Update and nationalize volume-to-weight conversion factors to standardize measurement for wider utilization.
4. Facilitate national dialogue about issues concerning material diversion, marketplace availability, and reduction opportunities for the IC&I sector to identify solutions for industry and policymakers.



Study Overview

In fall 2013 RCO sought to engage retail and commercial building industry associations and experts to determine interest and feasibility of a national study on waste performance benchmarking. Benchmarking is a tool for comparing performance across a group or set of organizations to determine how a sector or industry achieves one or more measurable indicators. For building managers, it enables comparison of performance against peers and within a portfolio of assets. Although waste benchmarking is valuable to other organization types within the IC&I sector, this study focuses on retail and office buildings. Its results, however, identify issues that are prevalent throughout the entire IC&I sector across Canada.

RCO's decision to focus on office and retail buildings was because of existing relationships with national property management firms through its waste reduction programs such as RCO Awards, 3RCertified, and Take Back the Light (see page 40). In addition, industry participation in national and international benchmarking studies such as *Real Property Association of Canada (REALpac) Energy Benchmarking Study*⁸ and *Green Real Estate Sustainability Benchmark (GRESB)*⁹ indicated interest and willingness to participate.

Moreover, there is limited waste generation and diversion statistics currently available to office and retail buildings that would help determine industry performance average. Two major publications that report on buildings' waste performance are *Waste Management Industry Survey: Business and Government Sectors*¹⁰ by Statistics Canada and *BOMA BESt Energy and Environment Report*¹¹ by Building Owners and Managers Association of Canada (BOMA Canada). Statistics Canada reports on data every two years for the entire IC&I sector and is based on information received by waste collectors. The BOMA Canada report only includes BOMA BESt certified buildings in a given year and does not detail performance per material type. Both reports are valuable in that they provide supplementary information that can support a future baseline for office and retail properties; however, a focused solid waste study is necessary to fill current knowledge gaps.

To address this, RCO assembled stakeholders for a series of consultations to develop a waste performance benchmarking study that engages waste generators in the office and retail buildings subsector: industry associations, waste and property management companies, academia, and subject-matter experts. From the study outset in October 2013 to the survey launch in April 2014, a committee helped set the scope of study, develop the survey, and outreach to potential participants.¹² Additional organizations participating in the study provided input on the draft survey before it was published and reviewed a draft of the final report.

STUDY TIMELINE



⁸ Real Property Association of Canada (REALpac). *Energy Benchmarking Project*. 2015. Retrieved from realpac.ca/?page=RPEBP1Intro

⁹ Global Real Estate Sustainability Benchmark (GRESB). *Global Real Estate Sustainability Benchmark*. 2015. Retrieved from gresb.com

¹⁰ Statistics Canada. *Waste Management Industry Survey: Business and Government Sectors 2010*. 2013. Retrieved from statcan.gc.ca/pub/16f0023x/16f0023x2013001-eng.htm

¹¹ Building Owners and Managers Association of Canada (BOMA Canada). *BOMA BESt Energy and Environment Report (BBEER)*. 2014. Retrieved from bomabest.com/wp-content/uploads/BBEER-2014-Full-Report.pdf

¹² Project committee members: Bala Gnanam, Kirk Johnson, Julia St. Michael, Jo-Anne St. Godard, Hazel Sutton, and Jessica Wilkinson.



Purpose + Objectives

The purpose of the National Solid Waste Benchmarking Study is to create a baseline of non-hazardous solid waste generation, disposal, and diversion performance for buildings across the entire IC&I sector implemented over several phases. In its first phase, the purpose is to create performance benchmarks per building type for Office, Retail Centre, and Retail Store categories.

Objectives:

- A. Create a national and regional baseline of solid waste generation, diversion, and reduction performance and engage office and retail properties.
- B. Enable organizations to benchmark their own performance against industry peers.
- C. Identify and promote best practices in waste reduction and diversion to office and retail building industry and the public.

To meet objective A, the study requires one or two additional cycles in order to arrive at a baseline that can be determined by industry participants as representative. The current average diversion rate is based on unverified data and, therefore, useful to reference but not as an industry benchmark.

Meeting objective B relates to how each company incorporates study results into its own knowledge base and potentially, operations. A number of respondents indicated study results will help them benchmark their own buildings' performance in each region against average diversion rates. For its part, RCO will continue to promote best practices in waste reduction and diversion through this study and other outreach activities.

Data Collection

Participants responded to one of two online surveys composed of mandatory and elective questions about a building's or portfolio of buildings' waste performance and management.

Survey components:

1. Building information (type; city; province/territory; size)
2. Waste management information (collection services; billing type; policies; diversion programs; communications)
3. Performance data (total generated in 2012 and 2013; total reused, recycled, and disposed of in 2013)¹³
4. Waste and recycling program (challenges; on-site/corporate programs)

Participants responded on behalf of a single office / retail property or a group of buildings.

DATASET – STUDY PARTICIPATION

A total of 1,012 office and retail use buildings are included in this study. The dataset represents submissions from 17 organizations.¹⁴

¹³ Applicants were required to provide waste disposal information that separated landfill from Energy from Waste (EFW) method. In addition, applicants were asked how they define diversion with a choice of *on-site separation*; *off-site separation* and *both*.

¹⁴ One of the 17 organizations conducted audits on behalf of an unknown number of companies. Therefore, data likely represents the performance of more than 17 private and public organizations.



EXTERNAL VERIFICATION

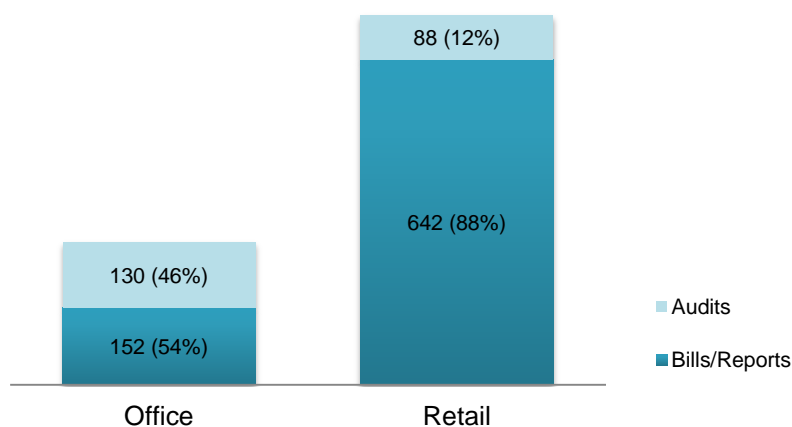
RCO's intention was to verify data of 20 per cent of submissions through random selection, which were to provide copies of data sources, such as bills and/or audit reports. However, due to higher than expected response rates, the percentage of verified submissions would have required additional resources unavailable within the established study timeline.

As an alternative, RCO reviewed all data multiple times for anomalies. Participants were contacted to provide clarification of specific submissions where required.

Data Sources

In order to collect waste generation and diversion data from as many sources as possible, RCO provided the option of submitting performance information, such as waste generated and diverted in 2013 calendar year, from audit reports, monthly bills, or diversion reports. Approximately .5 per cent of submitted data represent twelve consecutive months from mid-2012 to mid-2013. Figure 1 provides a breakdown of audits and bills/reports.

Figure 1: Data Source - All Buildings



Quality and Variability of Data

Information obtained for the study is based on a variety of sources: monthly bills; internal tracking systems (based on monthly bills); and audit report information. Waste can be a difficult indicator to track due to the various ways in which it is managed and reported: there are inconsistencies in waste terminology; methods for calculating the quantity of diverted materials; on-site handling differences (e.g., separated, commingled); and method of disposal (e.g., landfill, incineration, Energy from Waste (EFW) facilities).¹⁵

¹⁵ Energy-from-waste is also referred to as waste-to-energy.



The majority of submissions were clear, fulsome, and detailed. Three portfolio submissions, however, had data quality issues that affected a portion of the overall dataset of building information:

- ❖ Missing information indicating zero materials disposed (see *Exclusions*).
- ❖ New auditing requirements by a company resulted in missing information as some properties were still due for a full material composition analysis.
- ❖ Averaged diversion rate was provided for groups of buildings.

DATA REPORTING: WEIGHT VS. VOLUME

Although the majority of buildings track waste by weight in kilograms or metric tonnes a number of submissions included volume measurements. Volume can be helpful in tracking lightweight, high-volume (bulk) materials, such as polyethylene terephthalate (PET) commonly used in the production of single-use food and beverage containers. While tracking and reporting materials by volume is effective, for the purpose of consistency, all data analyzed in this study was converted from volume to weight. To do so, RCO consulted several resources of conversion benchmarks for non-municipal collection of materials. Appendix I includes a table listing the conversion factor for each material. In the absence of a Canadian reference, RCO consulted documents from U.S. sources.

EXCLUSIONS

RCO received data from 1,046 buildings in total, and 34 submissions were disqualified for analysis. Thirty-three buildings were excluded because they reported zero waste disposal. One submission from a restaurant was excluded because it is outside the scope of this study.

Zero Waste Disposal vs. Zero Waste Diversion

- ❖ Zero waste disposal refers to no material sent to landfill or EFW facilities, which assumes 100 per cent recycling and reuse program in place.
- ❖ Zero waste diversion refers to no material sent for recycling and reuse, which assumes 100 per cent disposal rate.

Although submissions that indicate zero waste disposal were excluded, 23 submissions that reported zero waste diversion were included. The basis for including data from one and not the other is that zero waste diversion is plausible: in remote areas, distance to end-markets makes recycling difficult or cost-prohibitive. Zero waste disposal, however, is unlikely, particularly for a large group of buildings.

Exclusion from Analysis

Four hundred and one retail stores are excluded from specific performance analysis, such as average diversion rate calculation. They provided total weight generated and diverted per region, each representing a specific number of stores.



STUDY PARTICIPATION

- ✓ *Participation by Building Type*
- ✓ *Participation by Location*
- ✓ *Participation by Size*

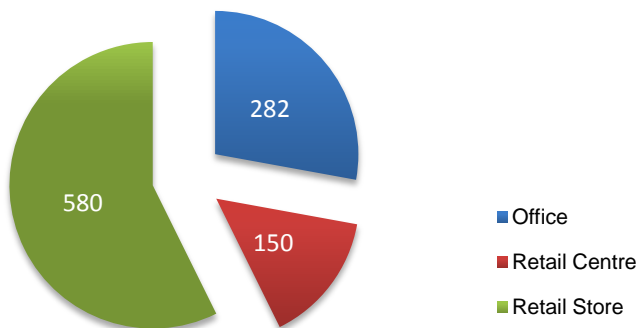


Study Participation

By Building Type

A total of 1,012 buildings were included in the final dataset, of which the largest group is in the Retail Store category with a total of 580 buildings, followed by 282 Office (commercial and institutional), and 150 Retail Centre (enclosed shopping centres and open air retail plazas).

Figure 2: Participation by Building Type



By Province / Territory

The complete dataset of 1,012 buildings are located throughout Canada with all provinces and territories represented with the exception of Nunavut. The largest group of buildings is located in Ontario, followed by Alberta and British Columbia. Figure 3 shows the regional participation for all buildings. A breakdown by building type per region is shown in Figures 4, 5, and 6.

Figure 3: Participation by Province/Territory

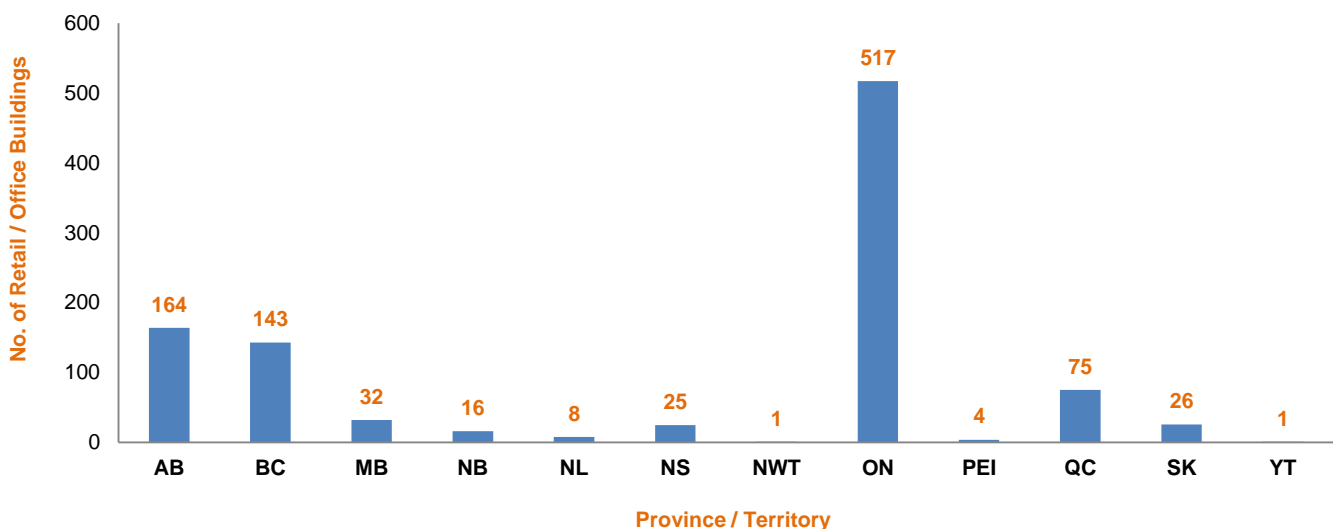




Figure 4: Participation by Region - Office

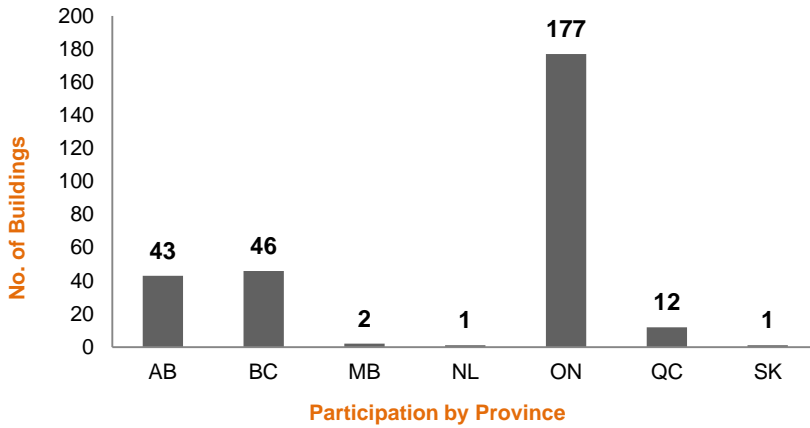


Figure 5: Participation by Region - Retail Store

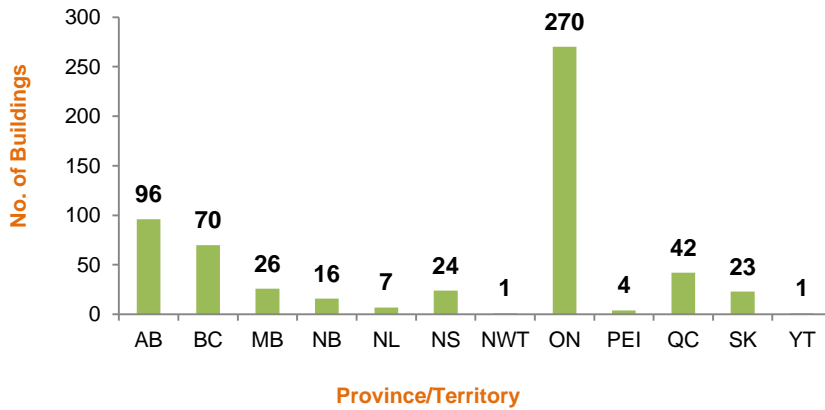
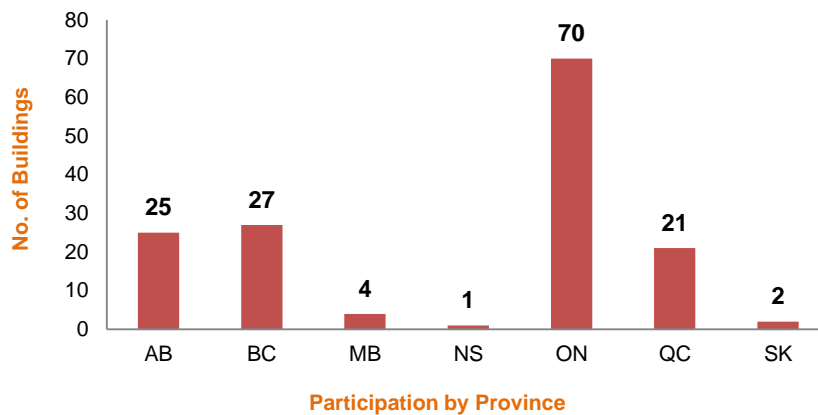


Figure 6: Participation by Region - Retail Centre





Participation by City and Location Characteristic

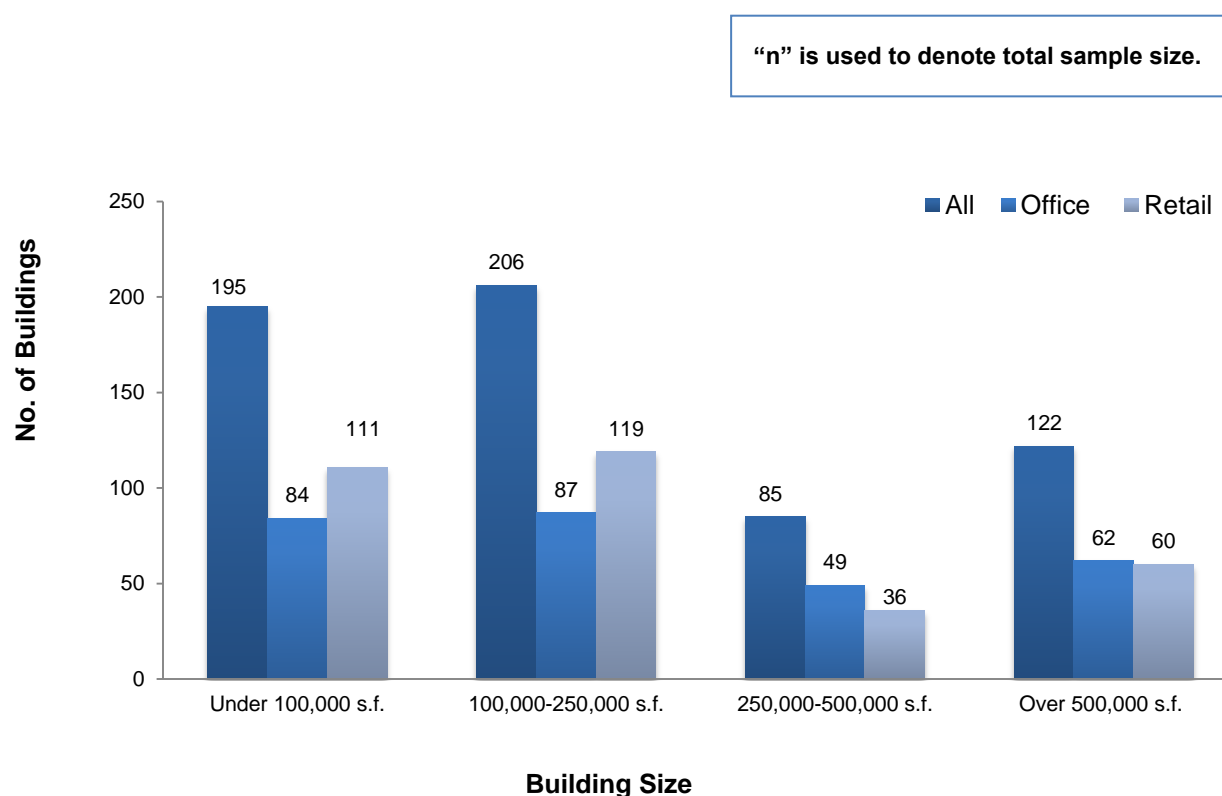
Three hundred ninety respondents, or 38.5 per cent, provided building locales even though they were not obligated to indicate town or city for each building. Respondents were also asked about each building's location characteristic, choosing from *urban*, *suburban*, and *rural*; only 80 out of 1,012 submissions provided this information. In future studies, RCO may consider incorporating municipal location information as a mandatory identifier to cross-reference economic differences and regional recycling market availability. In addition, data analysis by urban, suburban, and rural locations may lend additional insight into waste collection and disposal differences.

Participation by Size – Gross Leasable Area

In Figure 7, dataset representation by building size is limited to 608 submissions that include total GLA information. Excluded buildings that did not provide GLA data are all in the Retail Store category.

Size breakdown for all building types demonstrates the majority of submissions are from buildings in the 100,000-250,000 square foot (s.f.) category, followed by Under 100,000 s.f. category. The same distribution is similar when looking at each category separately. The Retail category charted in Figure 7 includes Retail Centre and Retail Store.

Figure 7: Participation by GLA (All n=608; Office n=282; Retail n=326)





PERFORMANCE

- ✓ *Waste Generation*
- ✓ *Waste Diversion*
- ✓ *Waste Stream Information*



Performance: All Buildings

Performance metrics used to evaluate buildings include *waste generation rate*, *diversion rate*, and *capture rate* (see Appendix II for Glossary of Terms).

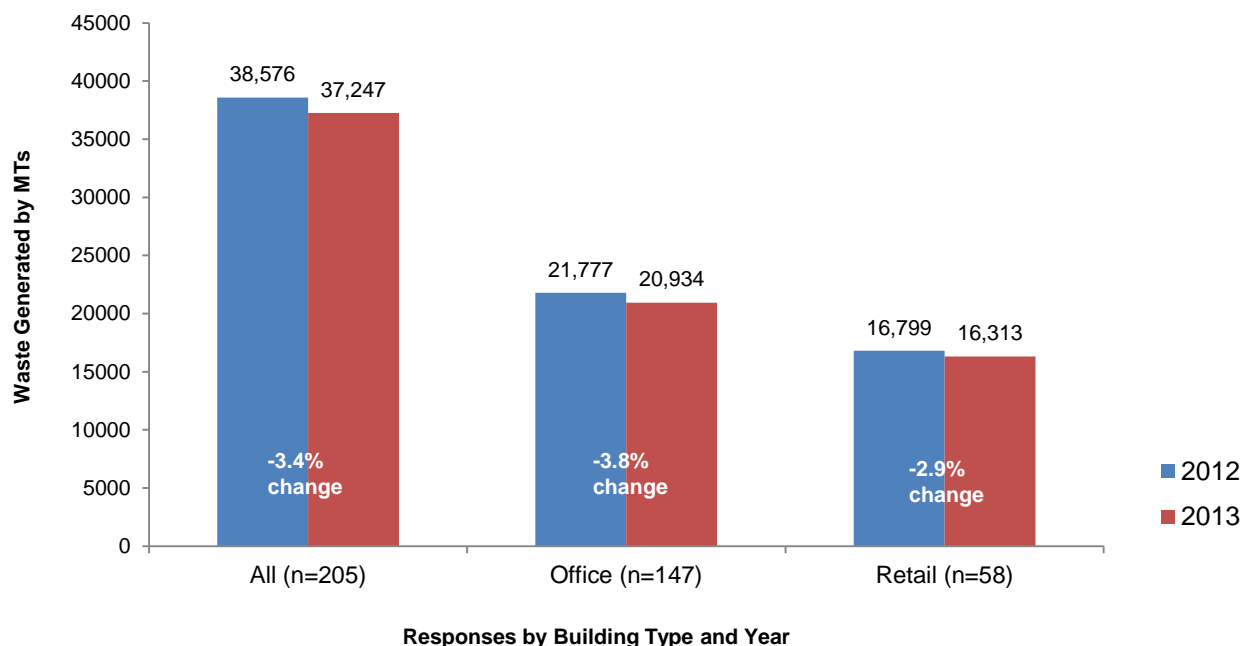
Waste Generation

Generation rate is an important KPI because it measures how much waste is created on-site. In following the 3Rs hierarchy, waste reduction is the preferred action because less waste generated results in less that needs managing. Generation rate is also essential to understand the context in which diversion performance is reported for a given year. For example, if a building's diversion rate decreases but tenancy remains the same, it could indicate a reduction in overall waste generated on-site. However, if a building experiences a high vacancy rate and the amount of waste generated has not decreased, it may suggest a reporting anomaly or an increase due to specific actions that may not necessarily be flagged by reviewing waste diversion rate alone.

Waste Generation – All Buildings

Participants were required to provide total waste generated and diverted for the 2013 calendar year, allowing some variance to include mid-2012 to mid-2013 twelve-month consecutive data range, to accommodate internal tracking systems and waste audits.¹⁶ Participants had the option to submit the total waste generated in 2012 and 2013 in order to compare year-over-year change (increase or decrease).

Figure 8: Waste Generation by Year by Type



Two hundred and five retail and office buildings provided annual waste generated for both years expressed in Figure 8 for All Buildings, Office (147 buildings), and Retail (58 buildings). All three categories demonstrate a decrease in waste generation from 2012.

¹⁶ These allowances represent approximately .5 per cent of total submitted data.



Waste Diversion

The fundamental challenge of reporting waste diversion is that there is no agreement on the mechanisms that are included in diversion claims. In the absence of common criteria it is then difficult to develop a standardized method for calculating diversion performance (e.g., some organizations claim EFW as diversion, while others claim it as disposal).

New technologies provide alternatives to manage waste, which requires constant re-evaluation on what can be claimed as diversion or disposal, as well as the entity that can claim it: generator or material processor. Additionally, interest and research on diversion claims – how much of a given material that is collected for recycling actually gets processed and reutilized – further necessitates standardization of waste performance tracking and reporting.

With increased expectation of corporate environmental performance reporting, quality of published diversion rates is an issue worth exploring in more detail outside the context of this study.

Diversion Rate – All Buildings

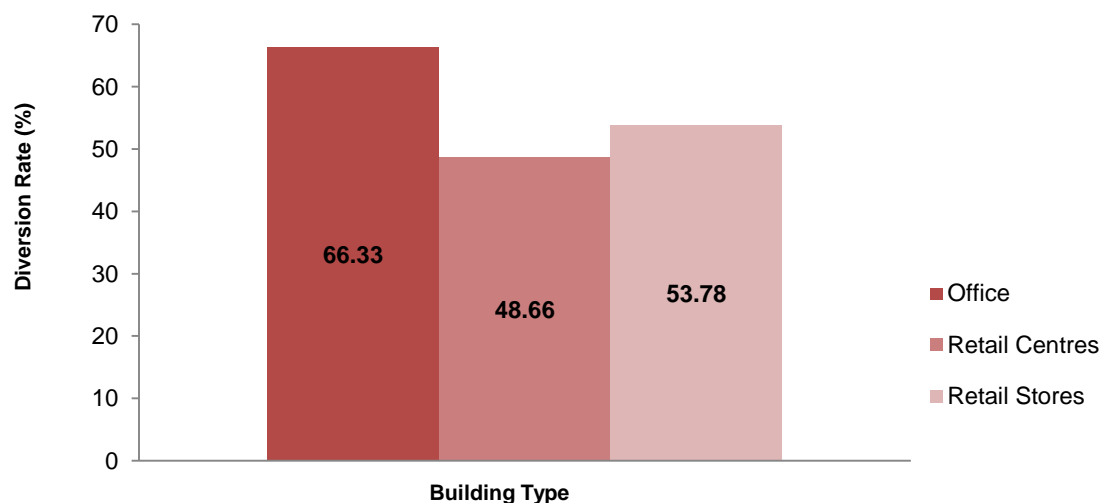
Total waste diverted by weight was calculated to determine the diversion rate for All Buildings; Office; Retail Store; and Retail Centre, as shown in Figure 9. Diversion rate refers to the total sum of diverted waste by weight divided by total sum of waste generated by weight expressed as a percentage. For the purpose of this study, diversion includes materials reused and recycled. It excludes waste sent to landfill and EFW facilities. The entire dataset of 1,012 buildings across Canada produced a diversion rate of 54.75 per cent.

Diversion rate calculation:

$$D = \frac{\text{(total weight of all materials diverted to reuse and/or recycling per year)}}{\text{(total weight of all materials generated per year)}} \times 100\%$$

See Appendix II for the definition used for *diversion*.

Figure 9: Diversion Rate by Building Type





WHAT'S BEHIND THE STUDY'S DIVERSION CLAIMS?

In order to minimize variability in what is defined and claimed as diversion, participants submitted specific materials of diverted and disposed or listed commonly diverted material types. While this information does not mitigate the issue of data inconsistency, it increases control of what materials are claimed under diversion for the purposes of this study.

In keeping with definitions by the Government of Ontario, the U.S. Environmental Protection Agency, and the United Nations Environmental Programme (UNEP), EFW is not included in diversion rate calculations. RCO requested that submissions include landfill and EFW waste to be reported separately. A total of 17,302.25 MT was reported as sent to EFW facilities in B.C., Ontario, Prince Edward Island, and Quebec. Of the total disposed materials reported, the energy recovery proportion is approximately 10 per cent

Table 1 includes materials streams reported as diverted in 2013 for all buildings. Please note this is not a comprehensive list.

Table 1: List of Materials Included in Participants' Diversion Claims

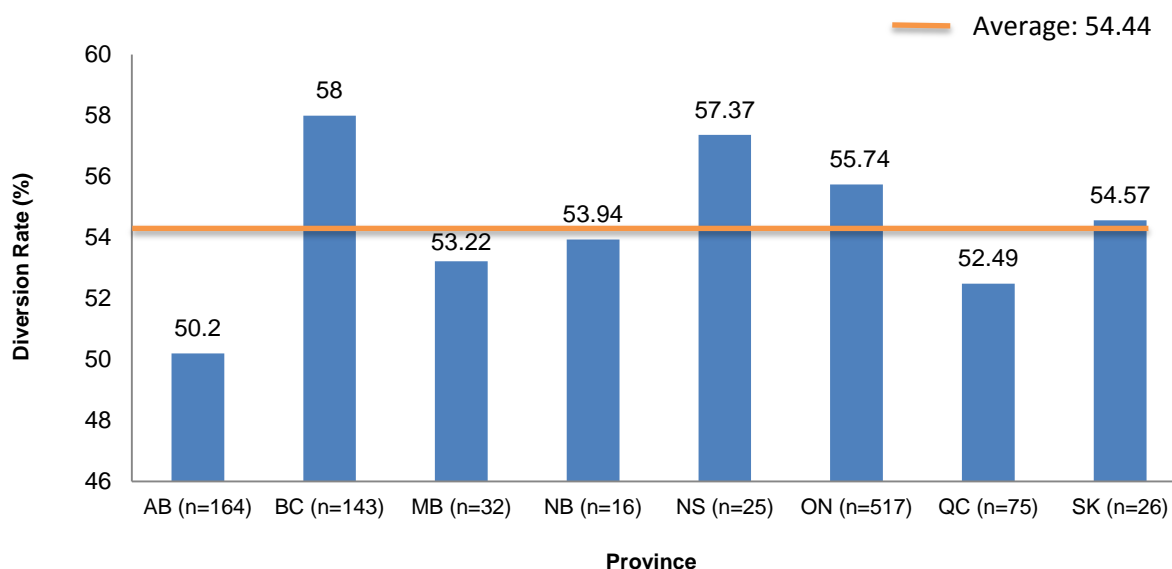
Diverted Waste Streams (alphabetized)		
Aluminum Food & Beverage	HDPE #2	Rigid Plastics
Batteries	Ink Cartridges	Scrap (Metal & Steel)
Bottles & Jars	LDPE #4	Shredded Paper
Cardboard	Light Bulbs, Tubes	Steel Food & Beverage
Cartridges	Mixed Construction & Demolition	Styrofoam
Coat Hangers	Mixed Paper	Textiles
Commingled Recyclables	Mixed Plastic	Wood (Untreated)
Contaminated Wood	Newsprint	Wood Skids
Drywall	Non-Beverage Plastics	Writing Instruments
E-Waste	Non-Fine Paper	
Electronics	PET #1	
Fine Paper	Plastic Bags & Shrink Wrap	
Food/Organics	Plastic Baler	
Furniture	Plastic Food & Beverage	
Grass, Weeds, Trimmings	Plastics #1-5	
Grease & Cooking Oil	Polystyrene #6	



DIVERSION RATE BY PROVINCE

Figure 10 shows the diversion rate of office and retail buildings by province (provinces and territories with less than ten buildings are not included). The overall average for all provinces is 54.44 per cent diversion rate.

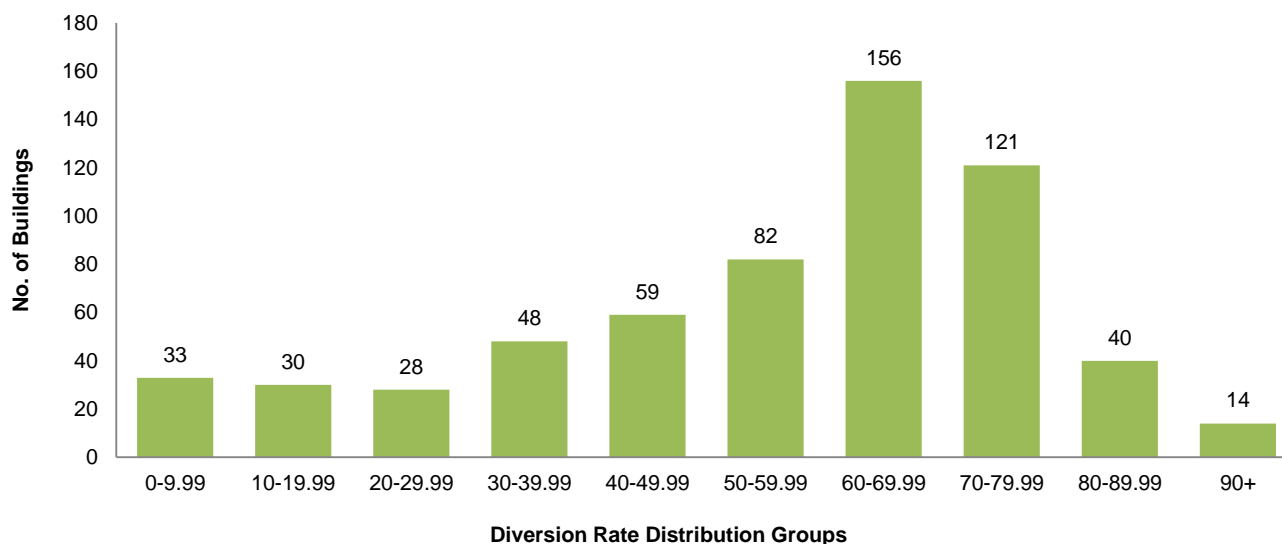
Figure 10: Diversion Rate by Province - All Buildings



DIVERSION RATE DISTRIBUTION

Figure 11 shows performance rate distribution to provide a visual representation of a performance curve for 611 retail and office buildings, with its peak (highest number of buildings) in the 60-69.99 per cent diversion rate category. The second and third clusters are in the 70-79.99 and 50-59.99 per cent diversion rates. The total number of buildings analyzed is 611, as 401 Retail Store submissions were excluded due to data quality (see *Exclusions*).

Figure 11: Diversion Rate Distribution - All Buildings (n=611)

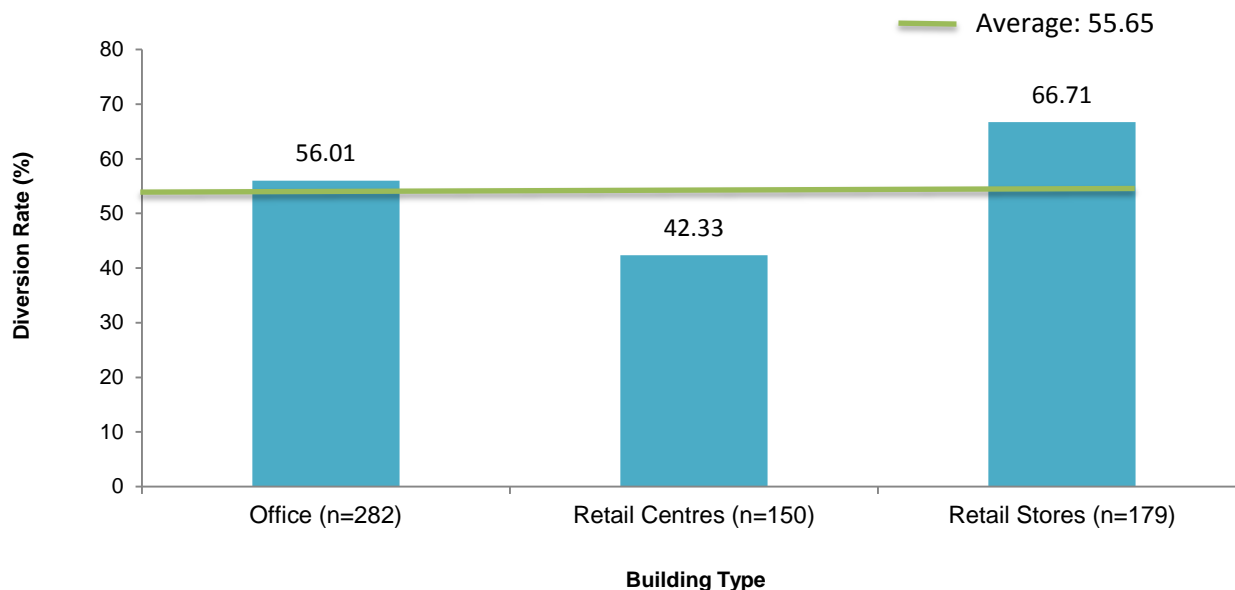




AVERAGE DIVERSION RATE

To calculate diversion rate mean per category, each building entry had its diversion rate calculated and the total group sample averaged. The average diversion rate for all buildings totalling 611 (excluding 401 Retail Store submissions) is 55.65 per cent.

Figure 12: Average Diversion Rate by Building Type



Capture Rate

Capture Rate can be generated from waste audits¹⁷ is a performance indicator expressed as a percentage. It measures success of a waste diversion program by calculating the total weight of diverted materials in a given year by the total divertible materials generated in that same period.

Capture rate calculation:

$$C = \frac{\text{(total weight of all divertible materials that were actually diverted to reuse and/or recycling per year)}}{\text{(total weight of all divertible materials generated per year)}} \times 100\%$$

Definition of *capture rate* can be found in Appendix II.

Capture rate, like diversion rate, relies on weight as measurement and is subject to discrepancy if a given year's divertible material tonnage is unusually heavy. It allows multiple like-properties, with some variance in material type composition, to compare performance regardless of market availability. For example, two office buildings located in different regions can compare their rate of success for capturing fine paper regardless of the total amount recycled. It is a KPI that complements other assessment tools in determining a diversion program's success.

¹⁷ Capture Rate is dependent on the quality of audit conducted including but not limited to sampling choices and conducting a material composition analysis.



Capture Rate – All Buildings

Out of 130 audited submissions from the Office category, 42 included material specific information – total weight diverted and disposed per material type. Forty-three Retail Centre submissions provided audited results that include diversion and disposal amounts per material type.

The capture rate performance of a combined 85 retail and office buildings is 77.59 per cent, as shown in Table 2. That means the group of 85 office and retail buildings were able to capture (recycle and reuse) 77.59 per cent of the total amount of divertible materials generated on-site.¹⁸ Furthermore, approximately 22 per cent of divertible materials ended up in the disposal stream.

Table 2: Capture Rate in Detail: Office and Retail (n=85)

Divertible Materials	By Weight (MT)	Percentage (%)
Generated	60,542.13	100
Recycled (captured)	46,972.86	77.59
Disposed	13,569.27	22.41

¹⁸ Divertible materials refer to waste streams that can be reused and recycled (can be diverted from disposal).

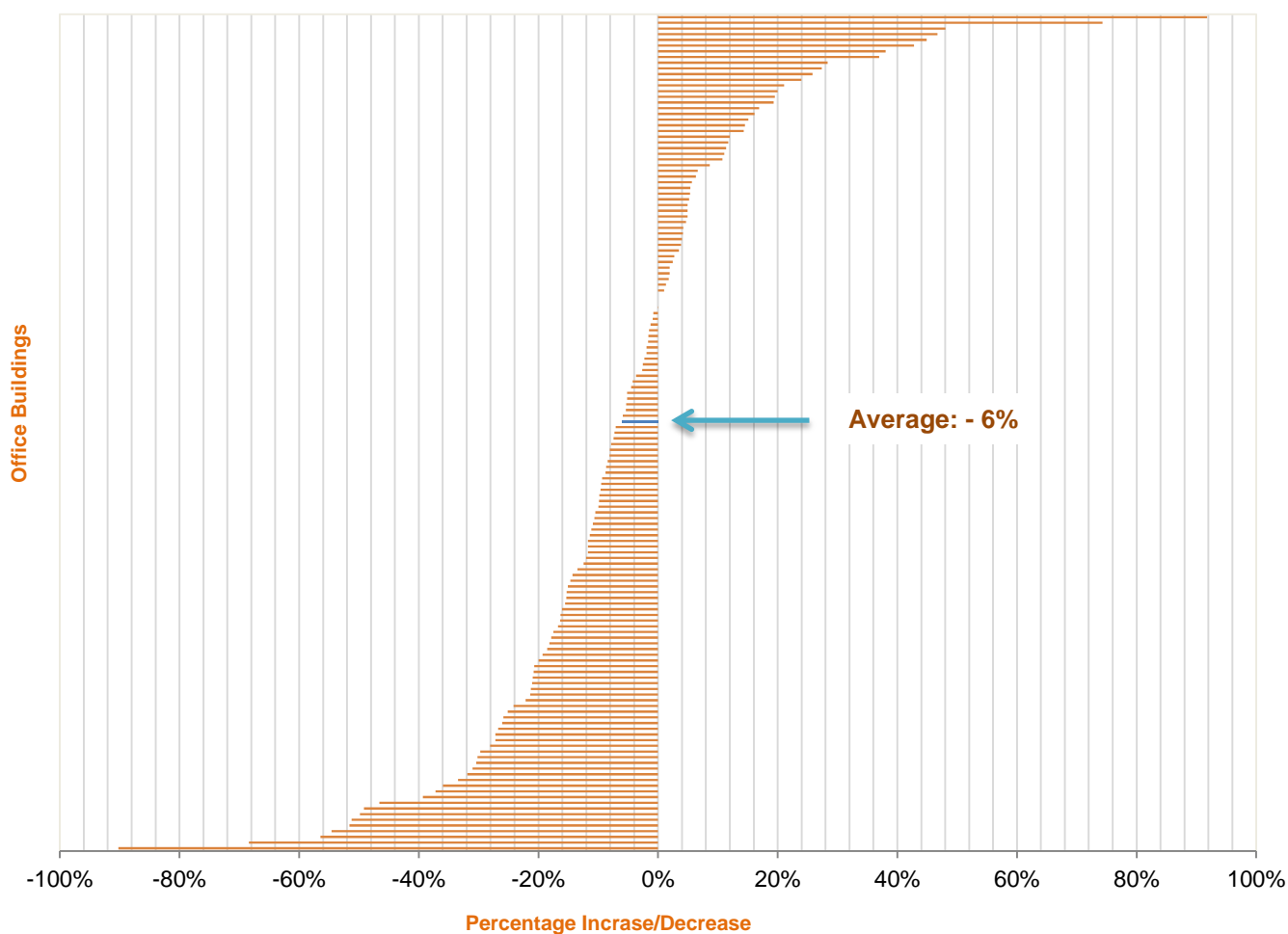


Performance – Office Building

Waste Generation

Participants provided the total weight of waste generated for 2012 and 2013 in order to calculate year-over-year waste reduction or increase (data from 2012 was not mandatory). A total of 147 submissions (52 per cent) included waste generation data for 2012 and 2013 and reported year-over-year increase or decrease no larger than 100 per cent.¹⁹ The result is an average six per cent decrease in waste generation from 2012 to 2013.

Figure 13: 2012 to 2013 Waste Generation Increase/Decrease, Office (n=147)



Each coloured bar represents a single office building response: specifically, the percentage of waste generation increase or decrease from 2012 to 2013. The data range includes anomalies, such as waste reduced by 90 per cent from one year to the next, or increased by 92 per cent from 2012 to 2013.

¹⁹ A small number of responses reported more than 100 per cent increase or decrease of waste from one year to the next. Those entries were removed from this analysis.



While there is no available benchmark for year-over-year waste reduction, some of the data indicates more than 50 per cent reduction or increase in waste generated, which requires additional explanation (e.g., significant increase in tenancy from one year to the next). Further analysis into the cause of high fluctuation is essential to understand a common variation in waste generation among buildings with advanced, mid-level, and new waste diversion programs.

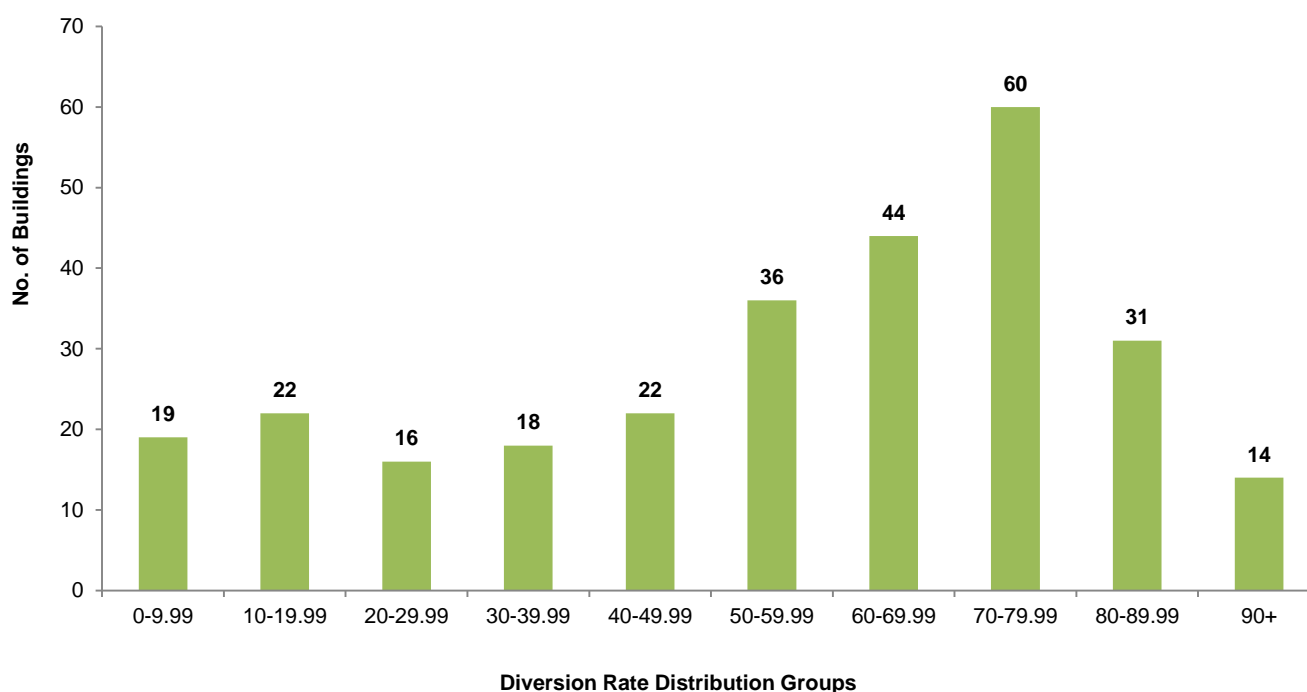
A method to counter such variations is to use an intensity factor such as *per unit reduction rate*, so long as the measurement unit (e.g., occupants) remains the same. As a result, tenancy increase or decrease does not skew annual reduction rate results.

Waste Diversion

The Office category has the highest diversion rate performance overall, and includes the largest proportion of audited information.

Figure 14 shows diversion rate distribution for all 282 Office submissions, however, 12 entries reported zero diversion. The majority of participants rank in the third highest diversion rate group of 70-79.99 per cent with 60 buildings, followed by 44 buildings in the 60-69.99 per cent grouping.

Figure 14: Diversion Rate by Distribution - Office Building





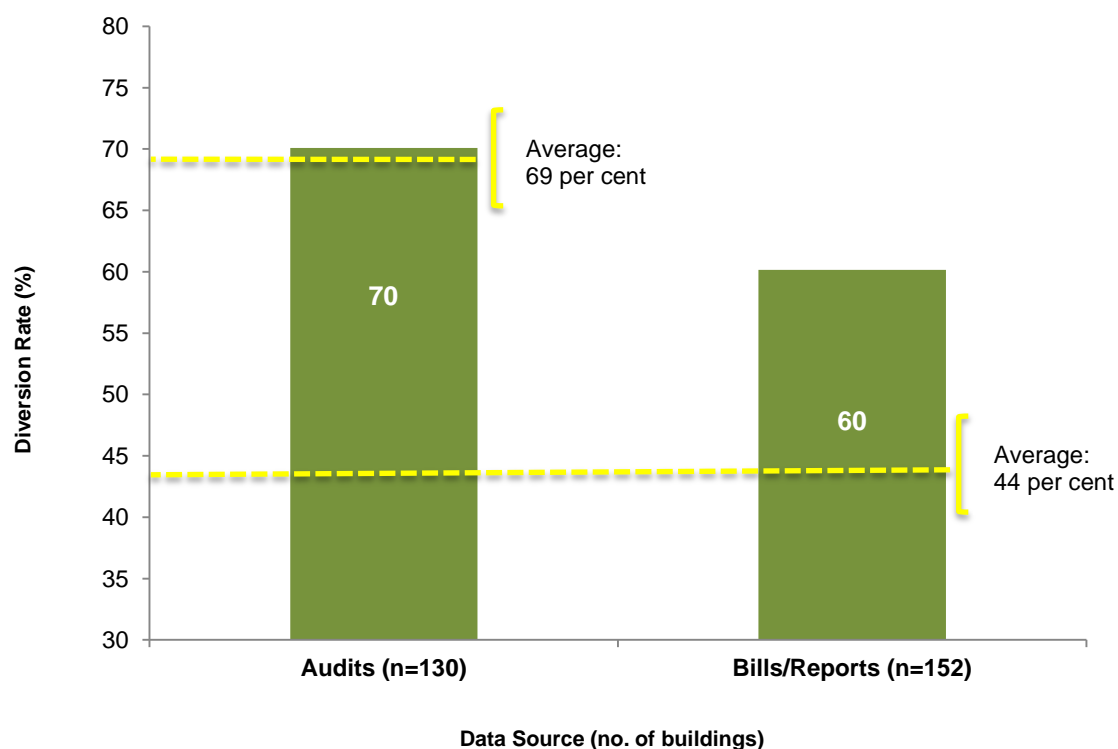
DIVERSION RATE BY DATA SOURCE

From 282 Office entries, 46 per cent (130 buildings) submitted waste audit results, and 54 per cent (152 buildings) submitted data through diversion reports and bills. To compare diversion rate performance between waste audit and billing data the two groups were split as shown in Figure 15. Audited buildings achieved a diversion rate of 70 per cent, while the non-audited group achieved a diversion rate of 60 per cent. Although audited data is highly valued for national studies, due to the variation in the methods of conducting waste audits, no correlation or causation can be attributed to the higher diversion rate of audited properties.

Average Diversion Rate

The average diversion rate of the sampled group of buildings was calculated to help inform how wide or narrow the performance distribution is. The average diversion rate for the audited buildings is 69 per cent, close to the overall diversion rate for that group of buildings; whereas the average rate for the billing group is 44 per cent, indicating high variability of performance among the group. Specifically, the billings group shows considerable variation in diversion rates per building, based on the difference between the average of 44 per cent and overall group performance of 60 per cent.

Figure 15: Diversion Rate and Average (Mean) by Source - Office





PERFORMANCE BY WASTE STREAM

Divertible Materials Captured for Recycling

Of the 282 Office submissions, 194 included material type information. The data is based on waste audits, bills, and diversion reports. Table 3 provides the total weight of materials recycled in 2013. Some materials had to be combined into a larger category to ensure no material was exclusively represented by a single company or building. For example, Paper (Fibre) is a combination of newsprint, fine, mixed, and shredded paper.

Table 3: Divertible Material Types, Recycled – Office (n=194)

Divertible Materials Recycled	Total by Weight (MT)	Percent (%)
Paper (Fibre)	7,366	36.4
Cardboard	3,570.64	17.64
Organic	5,563.89	27.49
Batteries	17.24	0.08
Light Tubes/Bulbs	94.89	0.47
Wood Skids	473.19	2.34
E-Waste	94.88	0.47
Aluminum/Steel Food & Beverage	185.18	0.91
Scrap Metal/Steel	77.12	0.38
Styrofoam	12.29	0.06
Plastic Bags & Shrink Wrap	55.90	0.27
Mixed Plastics	103.72	0.51
Glass Bottles/Jars	316.31	1.56
Commingled²⁰	2,201.73	10.88
Misc./Other²¹	104.99	0.52

²⁰ **Commingled materials include:** mixed recycling typically consisting of all or some of the following: cans (aluminum, steel); bottles (plastic, glass); and paper (mixed, non-fine).

²¹ **Misc./Other materials include:** used to describe trace amounts for various materials recycled, which vary by property. Those include clothing/textiles; writing instruments; cell phones; e-waste; scrap metal; condiment packs; ink cartridges; kegs; and coat hangers.



Divertible Material Types Disposed (Sent to Landfill or EFW Facilities)

Table 4 lists total amounts disposed for the same material types included in Table 3. Paper (Fibre) and Organics lead with the greatest weight of disposed recyclables/compostables. Cardboard, the third largest group of recycled materials in Table 3, is one of the lowest disposed of in Table 4, which demonstrates it is successfully managed by office buildings in this dataset. One of the reasons may be that cardboard tends to be source separated from other recyclable materials due to its value in the recycling markets. Old corrugated cardboard is sold as a single material type, which necessitates its careful management to reduce contamination.

Based on total weight of recyclable materials reported as disposed, Organics make up 40 per cent, followed by Paper (Fibre) at 37 per cent, which indicates these material types are disposed of as waste instead of being composted or recycled.

Table 4: Divertible Material Types, Disposed - Office (n=194)

Divertible Materials Disposed	Total by Weight (MT)	Percent (%)
Paper (Fibre)	1,290.79	37.12
Cardboard	69.63	2.00
Organic	1,398.36	40.22
Batteries	0.10	0.00
Light Tubes/Bulbs	0.00	0.00
Wood Skids	0.10	0.00
E-Waste	2.17	0.06
Aluminum/Steel Food & Beverage	101.23	2.91
Scrap Metal/Steel	56.78	1.63
Styrofoam	82.04	2.36
Plastic Bags & Shrink Wrap	43.79	1.26
Mixed Plastics	136.03	3.91
Glass Bottles/Jars	135.61	3.90
Commingled	3.63	0.10
Misc./Other	156.90	4.51

It is important to consider weight may skew how results are typically reported. Specifically, Organics, which is primarily food waste, is heavy and influences diversion or disposal weights; it makes up a high percentage because it is proportionately heavier than other materials.

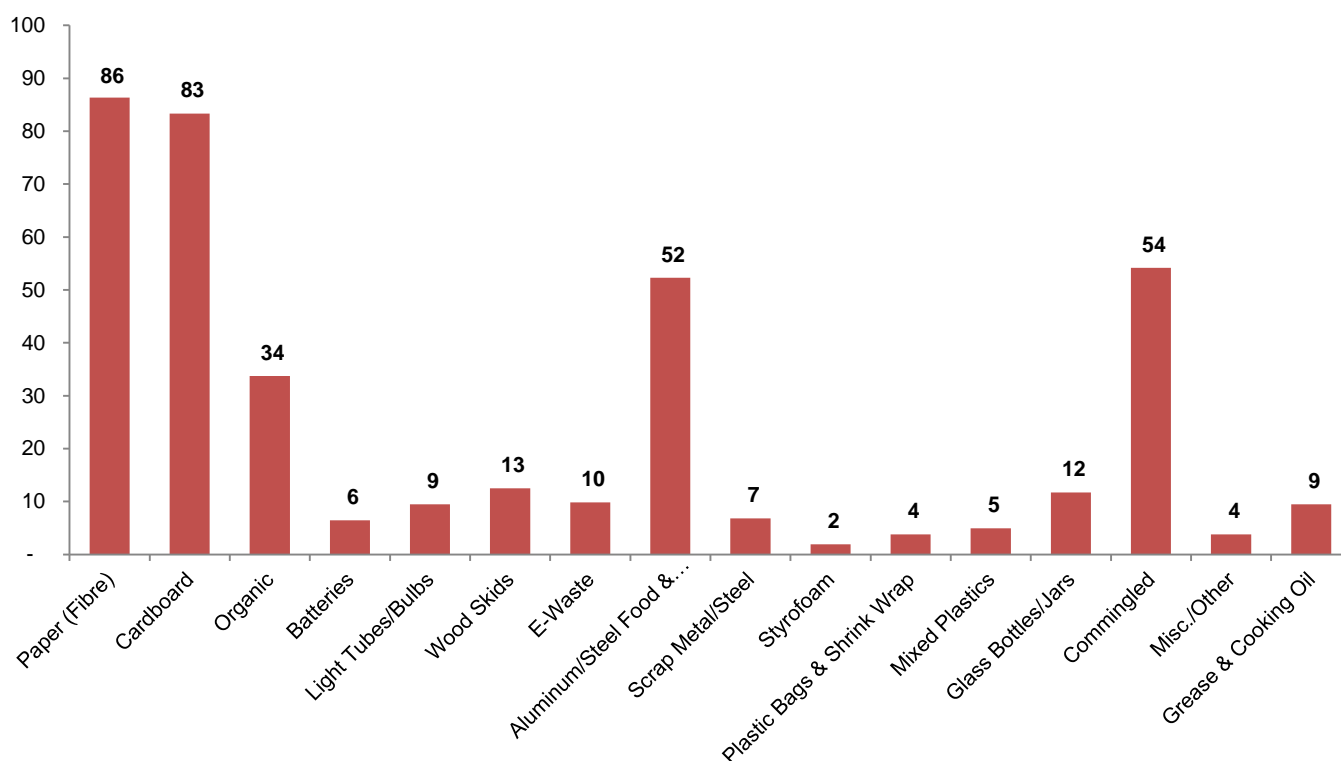


Recycling Plans per Material Type

An alternative method to determine the scope of material diversion among a national group of office buildings is the reported reuse and recycling of specific materials. By analyzing the percentage of recycling programs available for specific material types across Canada accessibility of markets can be distinguished. Unlike the use of weight as a metric to analyze how much materials are being diverted, this output demonstrates the number of recycling plans in place. For example, Table 3 lists Organics as the second most diverted material. However, only 34 per cent of the buildings surveyed have an organic diversion program in place. Although the use of weight is important, it cannot be used as the primary indicator of the prevalence of recycling programs.

A total of 264 office buildings reported information about their recycling plans. Figure 16 shows each of the materials expressed as a percentage of participation. The majority of participants have a paper and cardboard recycling program: 86 per cent of buildings recycle paper and 83 per cent recycle cardboard. Fifty-two per cent of the 264 office buildings in this group recycle aluminum/steel beverage cans, which is also included in the commingled category with 54 per cent participation.

Figure 16: Recycling Plans in Place (% Per Waste Stream) - Office (n=264)



The listed materials represent the majority of total materials identified by office buildings as recycled. Each bar represents a specific material type and the percentage of office buildings that have a program in place to recycle it.

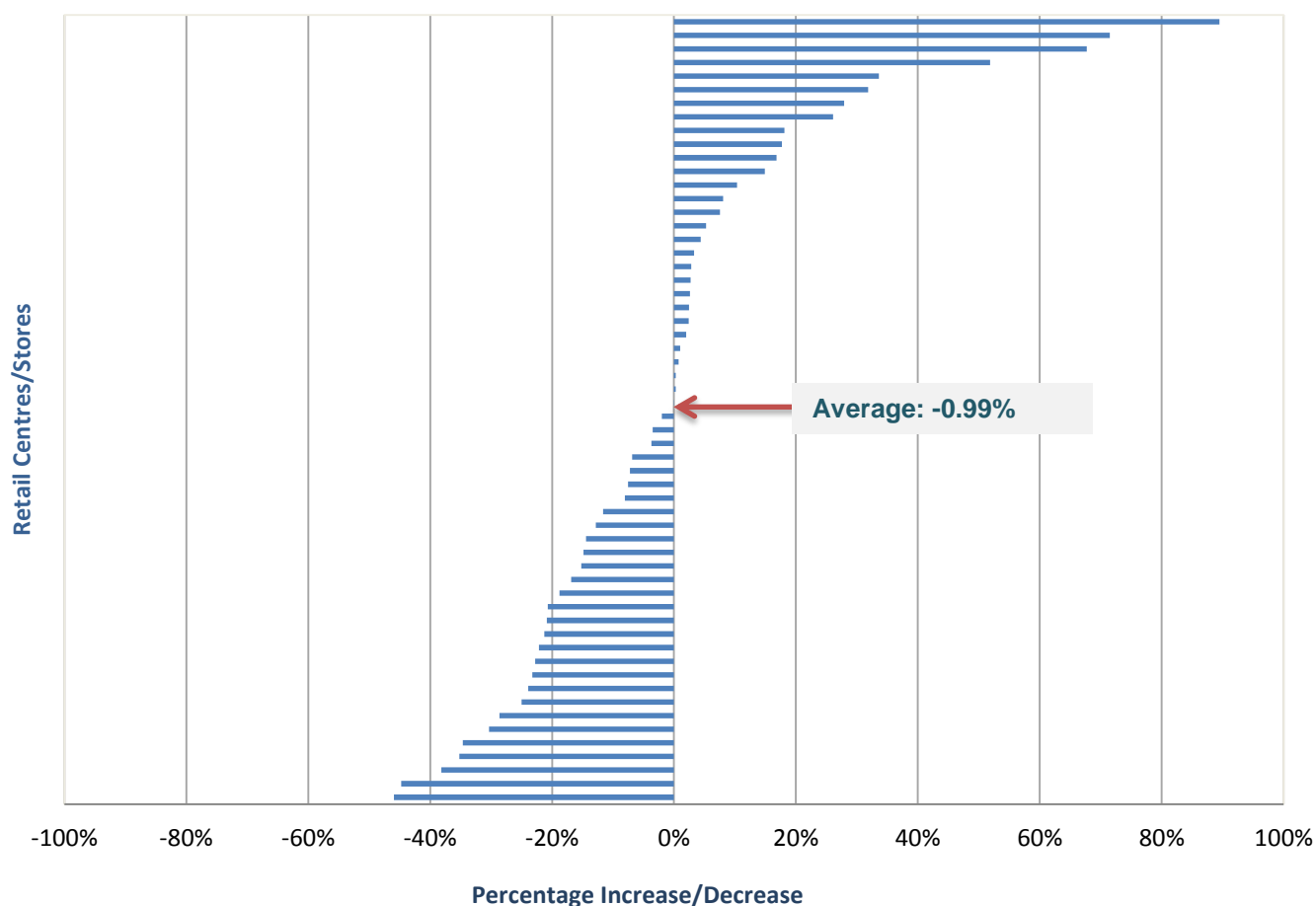


Performance – Retail Store and Retail Centre

Waste Generation

In Figure 17 buildings are plotted according to their percentage increase and decrease in waste generation from the previous year. The average performance for this group is a two per cent decrease in waste generation from 2012 to 2013. Similar to Office, the data range of reported increase and decrease of waste generated from one year to the next indicates anomalies: a number of retail properties reported more than 50 per cent increase, while others experienced more than 40 per cent reduction. In the absence of a benchmark for common year-over-year waste generation rate, further analysis is required to determine parameters by which anomalies can be identified and causes recorded where applicable. (See pages 17 and 23 for additional discussion.)

Figure 17: 2012 to 2013 Waste Generation Percent Change per Building (n=58)



Each blue bar represents a single retail property response; specifically, the percentage of waste generation increase or decrease for the years 2012 to 2013.



Diversion Rate

The collective diversion rate for 150 Retail Centre properties is 48.66 per cent. When charting the results by grouped performance, the highest number is concentrated in the 40-49.99 per cent diversion rate category with 36 centres. The second and third highest results are almost identical at 28 and 29 properties for the 50-59.99 and 30-39.99 per cent groupings respectively.

Figure 18: Diversion Rate Distribution - Retail Centres (n=150)

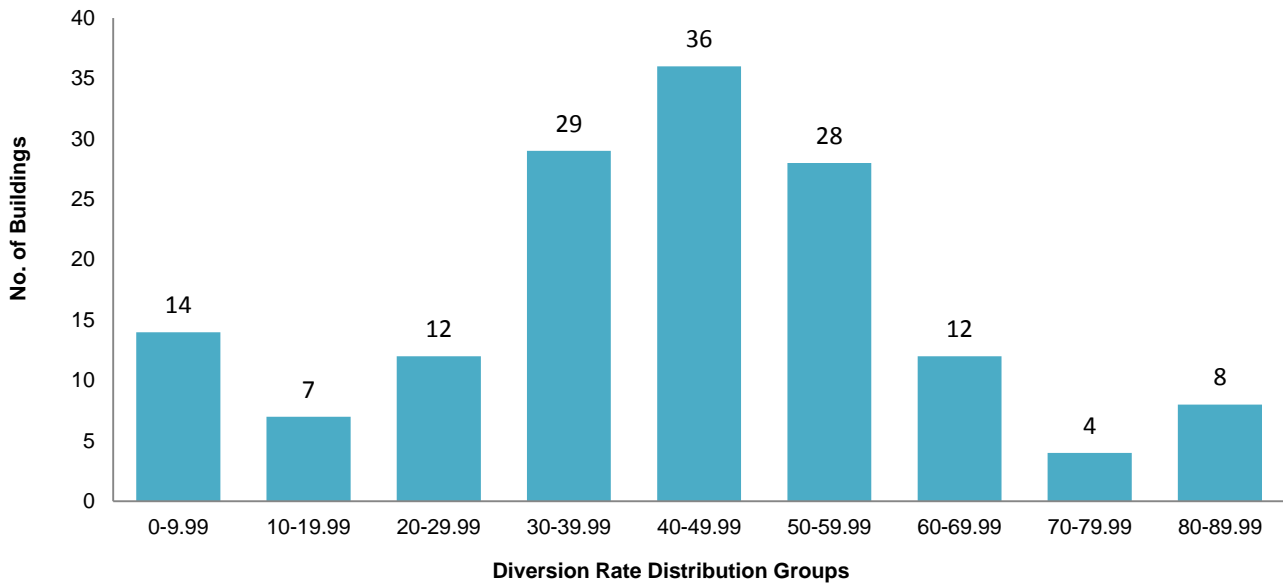
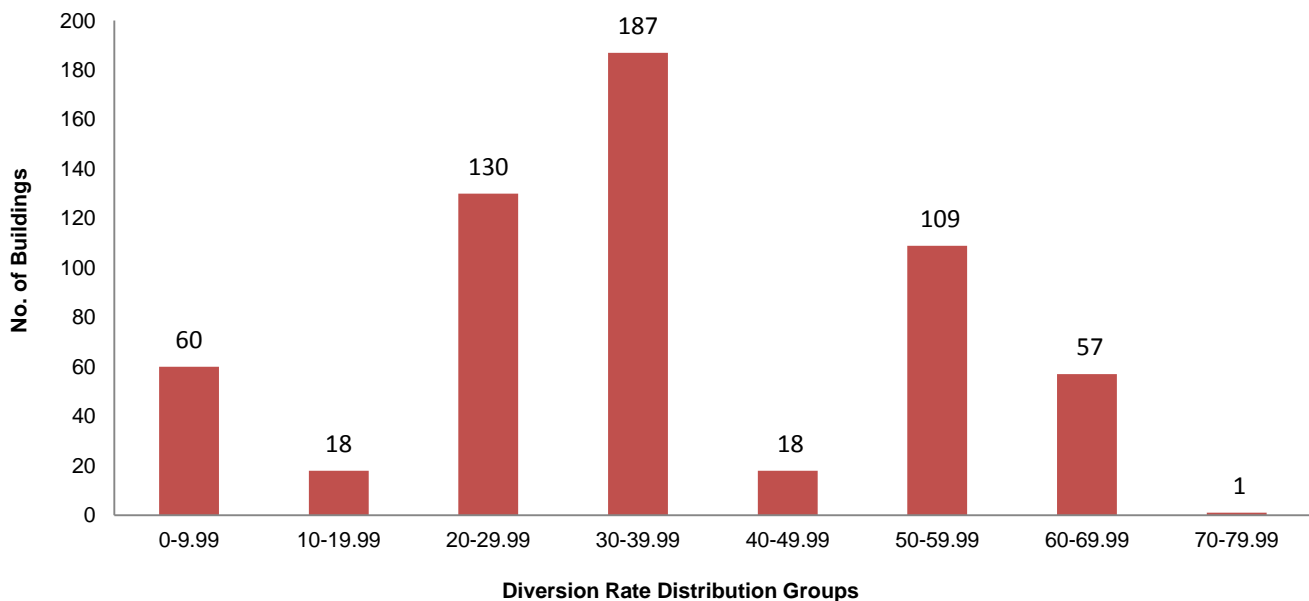


Figure 19 charts diversion rate for 580 properties in the Retail Store category. The highest number of stores – 187 – is in the 40-49.99 per cent diversion rate group, followed by 30-39.99 per cent in second, and the 60-69.99 per cent cluster in third.

Figure 19: Diversion Rate Distribution - Retail Stores (n=580)



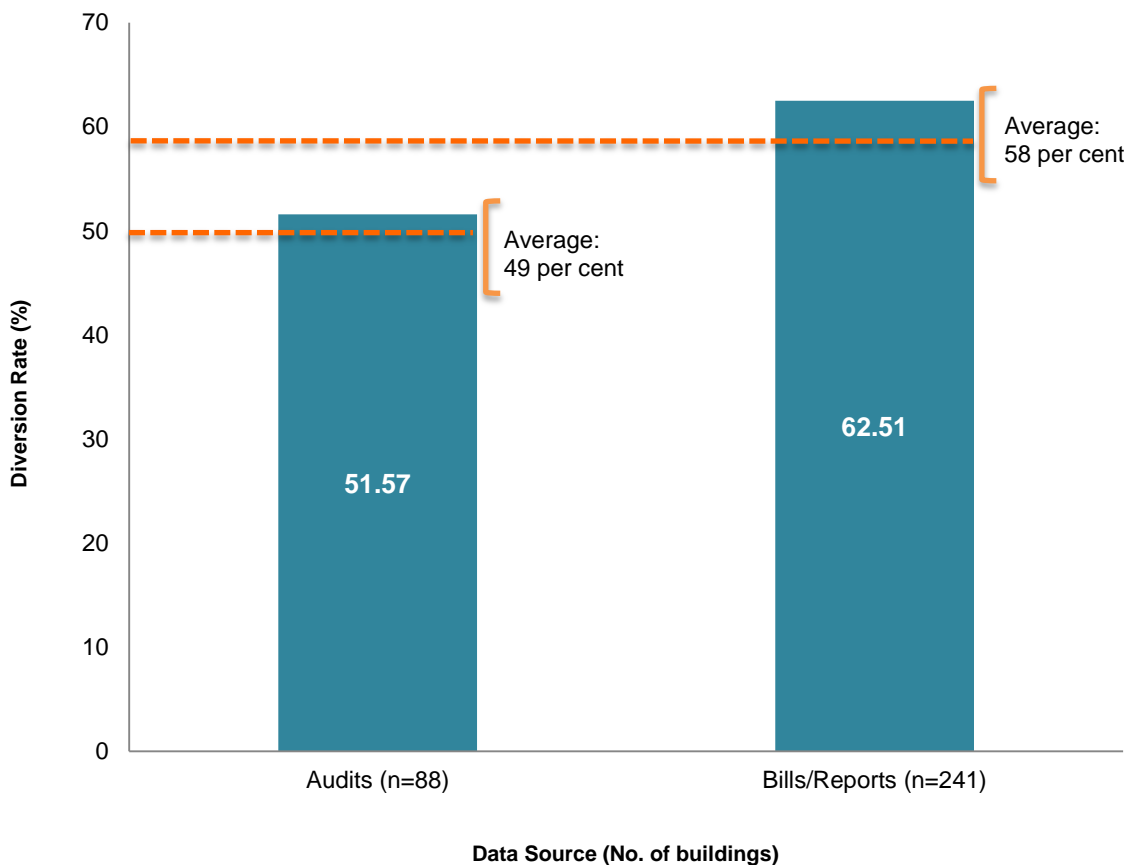


DIVERSION RATE BY DATA SOURCE

A total of 88 retail centres provided audited data, and 241 centres and stores submitted data using monthly bills or diversion reports. To compare diversion rate performance between waste audit and billing data the two groups were split as shown in Figure 20. The audited group shows a diversion rate of 51.57 per cent with a mean (or average) of 49 per cent. Conversely, the monthly reports/bills-sourced data group has a diversion rate of 62.51 per cent with average (mean) performance of 58 per cent.

Unlike the Office category, the non-audited responses have a higher diversion rate. The unaudited retail group also represents a mix of centres and stores, whereas the audited group represents centres exclusively.

Figure 20: Diversion Rate and Average (Mean) by Source - Retail





PERFORMANCE WITH WASTE STREAM INFORMATION

Divertible Material Types Captured for Recycling

For the combined Retail category representing stores and centres, 272 submissions contained per material type information – specifically divertible materials. Certain material types were excluded from Tables 5 and 6 where the majority of weight can be attributed to take-back programs offered by specific brands.

Table 5 provides information about the kind of materials recycled, how much is being recycled, and the percentage each represents of the total. Cardboard, for example, is the largest material recycled by weight, followed by Organics in second, and Paper (Fibre) in third place.

Table 5: Divertible Material Types, Recycled – Retail (n=272)

Divertible Materials Disposed	Total by Weight (MT)	Percent (%)
Paper (Fibre)	3,365.90	8.12
Cardboard	26,868.64	64.80
Organics	5,864.97	14.14
Furniture	133.20	0.32
Wood Skids	1,182.80	2.85
Aluminum/Steel Food and Beverage	683.51	1.65
Scrap Metal and Steel	4.55	0.01
Styrofoam	69.17	0.17
Plastic Bags and Shrink Wrap	681.16	1.64
Mixed Plastic, Glass, and Metal	1,914.49	4.62
Glass Bottles and Jars	414.64	1.00
Misc./Other	280.29	0.68



Divertible Material Types Disposed (Sent to Landfill or EFW Facilities)

Table 6 shows that Organics is the largest material by weight that is disposed, followed by Paper (Fibre) and Wood. There is more than 300 MT of declared scrap metal and steel disposed of despite having high commodity market value.

Table 6: Divertible Material Types, Disposed – Retail (n=272)

Divertible Materials Disposed	Total by Weight (MT)	Percent (%)
Paper (Fibre)	2,513.64	21.59
Cardboard	509.75	4.38
Organics	4,483.59	38.51
Furniture	18.60	0.16
Wood Skids	42.55	0.37
Aluminum/Steel Food and Beverage	222.84	1.91
Scrap Metal and Steel	328.17	2.82
Styrofoam	424.46	3.65
Plastic Bags and Shrink Wrap	298.38	2.56
Mixed Plastic, Glass, and Metal	408.27	3.51
Glass Bottles and Jars	152.06	1.31
Wood ²²	2,240.98	19.25

The information in Tables 5 and 6 relies on weight of materials diverted or disposed of, which offers valuable but incomplete information as it relates to what materials are widely recycled across the country by retail properties. Figure 21 shows the percentage of participants per material recycled out of a total of 313 centres and stores.

²² Material changed to “Wood” as last material category listed from “Misc./Other”.

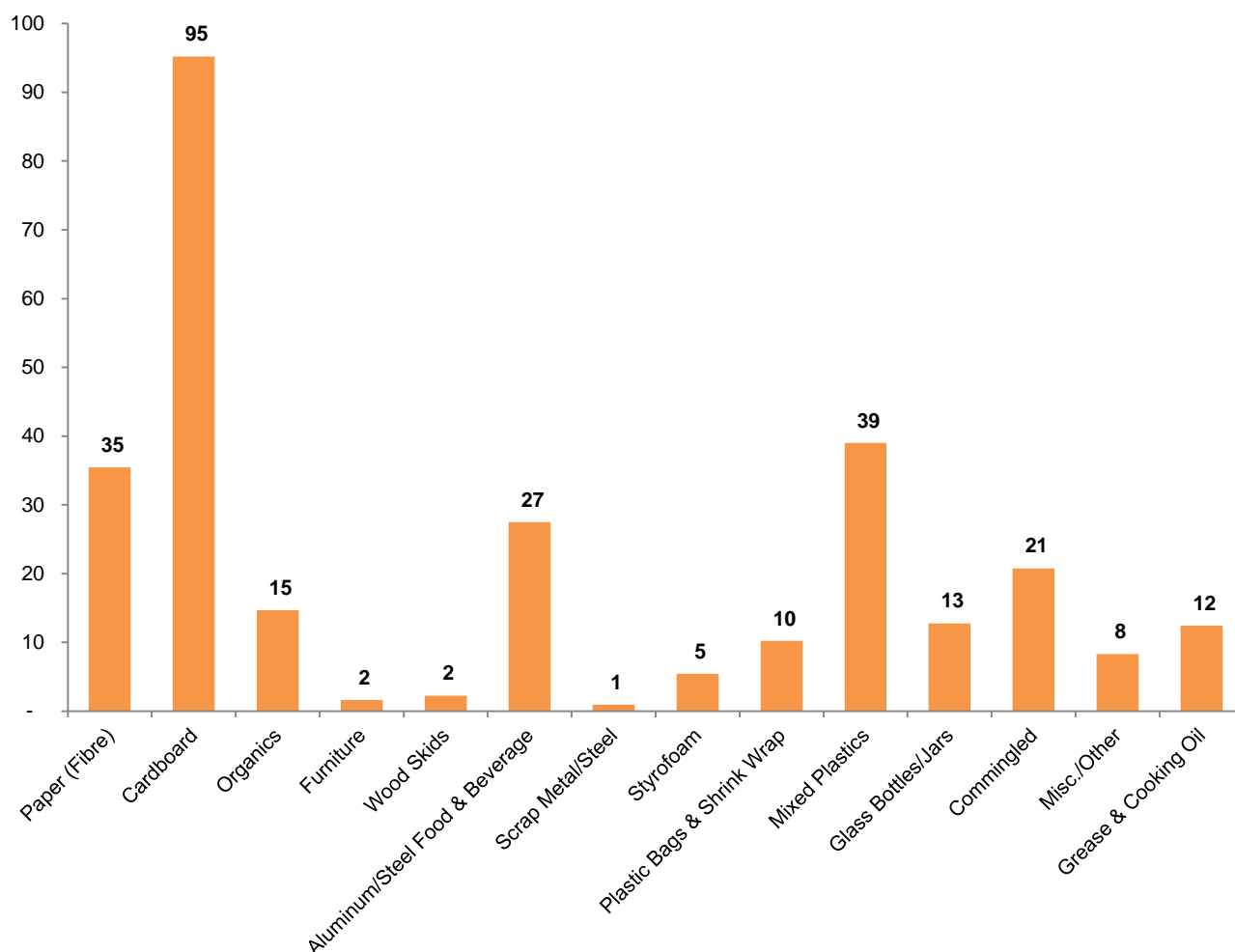


Recycling Plans per Material Type

Figure 21 charts the percentage of recycling programs in place for each of the listed material categories. For 313 retail properties, 95 per cent have a cardboard recycling program, followed by 39 per cent for Mixed Plastics, and 35 per cent Paper (Fibre). A number of categories overlap in terms of materials, such as Commingled, Aluminum/Steel Food & Beverage, and Mixed Plastics.

Figure 21 charts the largest reported categories by number of participants and as close to the original categories in respondents' data as possible. For example, a Glass Bottles/Jars category likely indicates glass is separated from other materials such as aluminum and plastics and is maintained as a separate material type.

Figure 21: Recycling Plans in Place (% Per Material Type) - Retail (n=313)



Listed materials represent the majority identified by retailers as recycled. Each bar of the chart represents a material type or group of materials and the percentage of retail properties that have a program in place to recycle it.



Summary of Qualitative Input

Fifteen companies representing 874 office and retail properties responded to qualitative questions. All responses are anonymous, summarized, and not attributable.

- ❖ All respondents have a dedicated corporate position that oversees waste management program nationally.
- ❖ Approximately half of the respondents have national goals and campaigns related to waste diversion, with the majority of companies having a national policy for waste management.
- ❖ Some companies developed national standards for auditing practices and performance tracking across the country. Others have noted their national program development is done in partnership with their waste hauler(s).

Top Challenges

When asked to rate a series of challenges *Low*, *Medium*, and *High*, respondents scored *occupant/visitor participation in the recycling program* highest.

The top five challenges from highest to lowest based on a combined scoring of the fifteen responses:

1. Occupant/visitor participation in waste recycling program
2. Contamination of recyclables
3. Cost of waste management services
4. Lack of material diversion opportunities
5. Cost of waste hauling services

Additional Challenges

- ❖ Variability of waste regulations by province and city can be challenging for national program managers.
- ❖ Variability of recycling market across the country makes it difficult to assess the success of like-properties; a recycling program may be restricted to a few materials based on local collection and recycling facilities.
- ❖ Managers of both office and retail properties with sophisticated recycling programs and streamlined reporting have noted their waste generation rates have increased from previous years. Better tracking and reporting has been indicated as one of the potential reasons for higher generation rates, however the lack of conclusive causation continues to be a challenge.²³

²³ The increase in waste generation is associated with one or more participants and may be associated with 2013 to 2014 data. The 2012 to 2013 reported results in this study show an overall decrease in generated waste (see pages 23 and 29).



Conclusion

As the first study in Canada that gathers material diversion and disposal information directly from generators, RCO is pleased with the amount of data collected and quality of information provided. Canadian office and retail owners and managers demonstrated a willingness to share data to acquire a better understanding of how the industry as a whole performs. For policymakers, results may help shed light on the variations between the IC&I subsectors, and where support and attention is required.

The National Solid Waste Benchmarking Study reveals an urgent need to look at the standardization of data tracking, reporting, and verification for waste streams, especially materials sent for reuse and recycling due to the economic aspect of commodity markets. There is disconnect in how waste is understood and valued: when the monetary worth of recyclables becomes more prevalent, waste will be managed as a resource. This is important because associating value generated from recycling may encourage greater care in how material types are separated and stored. Gathering and sharing complementary datasets will help generators identify where greater efforts are needed and showcase best practices.

The ongoing challenge of data transparency in tracking materials throughout their chain of custody requires co-operation in the entire IC&I sector. RCO received input from a wide range of stakeholders for this study, and hopes it galvanizes interest on best practices in waste management, data collection, and reporting to assess performance with a fair and balanced approach.

Recommendations

Data analysis uncovered a detailed methodical approach by which most respondents track their waste performance data. Due to waste performance reporting variability, future studies – whether for office and retail buildings, or an expanded scope of additional organizations – requires specific information:

- ❖ Data based on waste audits that includes diversion information per material type to calculate capture rate. A large group of waste audit submissions will enable fulsome analysis for per waste stream performance, as well as diversion rate comparison with non-audited submissions.
- ❖ Descriptions of materials diverted for submissions that provide total amount reused and recycled. By providing a list of materials that represent total weight diverted enables expanded analysis of what is being recycled and reused across Canada.
- ❖ Parameters that identify anomalies for year-over-year change in waste generation. Submissions that are outside the norm to provide a brief explanation for increase or decrease in generated waste.
- ❖ Open-ended questions to add context to the reported waste performance metrics to facilitate dialogue within industry.



Appendix I: Volume-to-Weight Conversion

Conversion factors used to calculate submissions received from volume to weight.

Waste Stream	Volume	Weight	Source(s) ²⁴	Comments
Solid Waste	1 cubic yard	300 lbs.	U.S. EPA SWANA	<ul style="list-style-type: none">▪ Labeled <i>Commercial-industrial waste (uncompacted)</i>▪ Range is 300-600 lbs.
Old Corrugated Cardboard	1 cubic yard	100 lbs.	U.S. EPA	<ul style="list-style-type: none">▪ Labeled <i>Old Corrugated Containers, Uncompacted</i>▪ Range is 50-150 (300) lbs.
Plastic	1 cubic yard	38 lbs.	NRC	<ul style="list-style-type: none">▪ Labeled <i>Mixed PET, dairy & other rigid, whole, loose.</i>
Shredded Paper	33 gallons	8 lbs.	U.S. EPA	----
Mixed Paper	1 cubic yard	363.50 lbs.	U.S. EPA	<ul style="list-style-type: none">▪ Labeled <i>Mixed paper, loose (construction, fax, manila, some chipboard)</i>
Newspaper	1 cubic yard	400 lbs.	U.S. EPA	<ul style="list-style-type: none">▪ Labeled <i>Newspapers, loose.</i>
U.S. EPA: United States Environmental Protection Agency NRC: National Recycling Coalition SWANA: Solid Waste Association of North America				

²⁴ **Solid Waste, Old Corrugated Cardboard:** United States Environmental Protection Agency (U.S. EPA). *Standard Volume-to-Weight Conversion Factors, Appendix B*. 1997. Retrieved from epa.gov/osw/conservation/tools/recmeas/docs/guide_b.pdf

Plastic: Washington Department of Ecology. *Coordinated Prevention Grant Conversion Sheet*. 2014. Retrieved from fortress.wa.gov/ecy/publications/publications/1107016.pdf

Shredded Paper, Mixed Paper, Newspaper: U.S. EPA. *Standard Volume-to-Weight Conversion Factors*. 2006. WasteWise. Retrieved from epa.gov/smm/wastewise/pubs/conversions.pdf



Appendix II: Glossary of Terms

Capture Rate: Proportion of divertible waste, expressed as a percentage, which is successfully diverted from disposal.²⁵

Contamination: Addition or presence of material(s) to, or in, another substance to such a degree as to render it unfit for its intended purpose. Also refers to the result(s) of such an addition or presence.²⁶

Disposal: Final stage in the management of waste, which includes:

- ❖ treatment of waste prior to disposal
- ❖ incineration of waste, with or without energy recovery
- ❖ deposit of waste to land or water
- ❖ discharge of liquid waste to sewer
- ❖ permanent, indefinite or long term storage of waste²⁷

Diversion: Actions to prevent waste materials from being generated, actions to reduce material generation, reuse (internal or external,) source separated recycling, composting (on-site or off-site.)²⁸

Diversion Rate: Proportion by weight of all material diverted from disposal (e.g., landfill or incineration) to the total mass of all waste material generated, expressed as a percentage.²⁹

Energy-from-Waste (EFW)/Waste-to-Energy (WTE): A facility that uses solid waste materials (processed or raw) to produce energy. WTE plants include incinerators that produce steam for district heating or industrial use, or that generates electricity; they also include facilities that convert landfill gas to electricity.³⁰

Energy Recovery: The process of extracting useful energy from waste, typically from the heat produced by incineration or via methane gas from landfills.³³

Generation: Total amount of [solid waste] arising from a generator. Includes both waste presented for waste collection and waste sold or presented for recycling.³⁴

Generator: Any person whose activity produces wastes or, if that person is not known, the person who is in possession and/or control of those wastes.³⁵

Landfill: Solid waste disposal site where waste is deposited below, at, or above ground level. The term is limited to engineered sites with cover materials, controlled placement of waste and management of liquids and gases. It excludes uncontrolled waste disposal.³⁶

Recycling: Any recovery operation by which waste materials are reprocessed into products, materials, or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and reprocessing into materials that are to be used as fuels or for backfilling operations.³⁷

Reduce/Reduction: The first priority within the waste management hierarchy is to reduce by as much as possible the amount of material that enters the recycling or the solid waste stream and the associated impact on the environment.³⁸

Reuse: Using a waste product again for the same or a different purpose without further manufacture (i.e., use of second-hand boxes for packing goods or for storage of household goods).³⁹

²⁵ Recycling Council of Ontario (RCO). *Standard Waste Audit Method (SWAM)*. 2014. RCO.

²⁶ International Solid Waste Association (ISWA). *1000 Terms in Solid Waste Management*. 1992. Ed. John Skitt. Retrieved from ecentre.org/Modules/DWMG/docs/8/ISWA_1000_Terms.pdf

²⁷ U.S. Environmental Protection Agency (EPA). *Decision Maker's Guide to Solid Waste Management—Vol. II*. 1995. Retrieved from epa.gov/osw/nonhaz/municipal/dmg2/preface.pdf

²⁸ Recycling Council of Ontario (RCO). *Standard Waste Audit Method (SWAM)*. 2014. RCO.

²⁹ Recycling Council of Ontario (RCO). *Standard Waste Audit Method (SWAM)*. 2014. RCO.

³⁰ United Nations Environment Programme (UNEP)/United Nations Institute for Training and Research (UNITAR): *Guidelines for National Waste Management Strategies*. 2013. Retrieved from unep.org/ietc/Portals/136/Publications/Waste%20Management/UNEP%20NWMS%20English.pdf



Waste: Any substance or object that the holder discards or intends or is required to discard.³¹

Waste Audit: A study relating to solid non-hazardous wastes generated by the auditee site through regular, day-to-day operations. The audit must address the amount, nature and composition of the waste; the manner by which the waste is generated, including management decisions and policies that relate to the generation of waste; and the way in which the waste is managed.³²

³³ UNEP/UNITAR: *Guidelines for National Waste Management Strategies*. 2013. Retrieved from unep.org/ietc/Portals/136/Publications/Waste%20Management/UNEP%20NWMS%20English.pdf

³⁴ World Bank. *Urban Solid Waste Management Glossary*. 2000. Retrieved from worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/EXTUSWM/0,,print:Y-isCURL:Y~contentMDK%3A20241717~pagePK%3A148956~piPK%3A216618~theSitePK%3A463841,00.html

³⁵ International Solid Waste Association (ISWA). *1000 Terms in Solid Waste Management*. 1992. Ed. John Skitt. Retrieved from ecentre.org/Modules/DWMG/docs/8/ISWA_1000_Terms.pdf

³⁶ UNEP/UNITAR: *Guidelines for National Waste Management Strategies*. 2013. Retrieved from unep.org/ietc/Portals/136/Publications/Waste%20Management/UNEP%20NWMS%20English.pdf

³⁷ European Commission, Directorate-General Environment. *Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste*. 2008. Retrieved from ec.europa.eu/environment/waste/framework/pdf/guidance_doc.pdf

³⁸ Canadian Council of Ministers of the Environment (CCME). *State of Waste Management in Canada*. 2014. Retrieved from ccme.ca/files/Resources/waste/State_Waste_Mgmt_in_Canada.pdf

³⁹ U.S. Environmental Protection Agency (EPA). *EPA 842/09, Waste Guidelines (Waste Definitions)*. 2009. Retrieved from epa.sa.gov.au/xstd_files/Waste/Guideline/guide_waste_definitions.pdf

³¹ World Bank. *Urban Solid Waste Management Glossary*. 2000. Retrieved from worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/EXTUSWM/0,,print:Y-isCURL:Y~contentMDK%3A20241717~pagePK%3A148956~piPK%3A216618~theSitePK%3A463841,00.html

³² Recycling Council of Ontario (RCO). *Standard Waste Audit Method (SWAM)*. 2014. RCO.



Appendix III: RCO Programs



3RCertified

Third-party verified waste reduction and diversion program for the Industrial, Commercial, and Institutional sectors recognizing leadership in waste management. 3rcertified.ca



RCO Awards

The RCO Awards (formerly the Ontario Waste Minimization Awards) is a legacy program of Recycling Council of Ontario that recognizes outstanding results in recycling and waste diversion across. rcoawards.ca



TAKE BACK THE LIGHT

Take Back The Light

Take Back the Light is Canada's leading light recycling program for businesses and institutions, and provides a simple low-cost opportunity to have fluorescent lamps and light fixtures to be recycled responsibly. takebackthelight.ca



Waste Free Lunch Challenge

Waste-Free Lunch Challenge is an elementary school program designed to challenge students across Ontario to go waste-free for a whole week as part of Waste Reduction Week in Canada. wastefreelunch.com

