

# Sorting out recycling rates

By Ted Siegler and Natalie Starr



## C alculating actual and potential recycling rates can be essential to improving municipal recovery programs.

A recent two-year effort in Boston indicates the importance of obtaining real information on potential recycling rates. The data gauge not only the success of a recycling program, but also yield details that can help refine program efforts.

Since Boston is Massachusetts' largest city, its reported recycling rate of about 12 percent significantly affects the state's recycling goal of 46 percent. As a consequence, state officials have advocated that Boston do more to increase recycling. Boston has countered that it is doing a reasonable job of recycling: the recycling rate results from the unique spectrum of wastes collected by the city's Department of Public Works, and differences between Boston and other municipalities in Massachusetts.

DSM Environmental Services (Ascutney, Vermont) became involved in these discussions while working on a project for the Massachusetts Department of Environmental Protection (Boston). Boston's statements about differences between urban areas and other

areas of Massachusetts appeared to be consistent with data that were collected by the Washington-based American Plastics Council during the Model Cities Project (see "Collecting Plastic Bottles More Efficiently" in the September 1994 issue). Total household discards of plastic bottles measured in San Francisco were approximately half of measured discards in suburban areas in other states with container deposit laws.

Equally interesting were data collected from suburban West Linn, Oregon by Waste Matters Consulting (Portland, Oregon), which appeared to show that non-recycling households generate only approximately one-half the total quantity of bottles and cans as do recycling households.

To test this apparent urban/suburban disparity, APC agreed to fund a study of recovery rates in East Boston, as part of a larger promotional campaign and study jointly car-

ried out by Boston and the state. DSM conducted the recovery rate study in July and November 1997. The results raised enough questions about feasible recycling rates in East Boston that the City of Boston contracted with DSM to conduct similar studies in the Roslindale and West Roxbury neighborhoods of Boston in the summer and fall of 1998. This article reports on the results of both recovery rate studies.

### Definition of terms

In the absence of universally agreed upon definitions, terminology used in this study was defined as follows:

- "Capture rate" is the percentage of potentially recyclable material set out for recycling by *participating households*, where a participating household is defined as a household that sets out recyclables at least once during the month.

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- “Recovery rate” is the percentage of potentially recyclable material set out for recycling in a neighborhood of *both participating and non-participating households*.
- “Recycling rate” is then defined as the percentage of recyclables set out for recycling in a neighborhood compared to the total amount of garbage and recyclables set out by that neighborhood over the same time period.
- “Set-out” is defined as garbage and recyclables, just garbage or just recyclables.

## Study methodology

Streets judged by the city to be representative of the three collection districts were selected for the recovery rate study. The garbage and recycling collection contractors serving the study areas agreed to keep their trucks off these streets until the latter part of the collection day, allowing the sampling crew to collect and sort garbage and recyclables from every second or third (varying by collection district) household on the selected streets.

At each set-out, sorters recorded the address as well as the number of units in the building. All garbage set out for disposal in front of the designated building was weighed on a portable scale, dumped into the hopper of a packer truck, and sorted. Any material in the garbage that could be recovered in Boston’s recycling program (Table 1) was pulled out and weighed as “paper” or “containers.” If material was set out for recycling at the same building, then this material also was weighed as “paper” or “containers.” Paper and containers pulled from the garbage then were stored separately from paper and containers set out for recycling, for subsequent sorting by material type. The same addresses were sampled again during the second phase of the analysis.

Table 2 illustrates the number of households and the total weight of garbage and recyclables sorted on each day of sampling. The sample size was limited each day by the amount of time available to the sorters before the garbage trucks had finished the remainder of their routes and physical limitations of the sorters with respect to sorting through garbage.

It should be noted that the number of households sampled is small in comparison to the number of households in each of these three districts. There are approximately 14,000 households in East Boston, with 20,000 households in the Roslindale and West Roxbury districts combined. Therefore, no representation is made that the sample size is statistically significant or representative of the city.

Monthly participation rates for the sampled neighborhoods were recorded throughout the study peri-

**Table 1** Materials accepted in Boston’s residential recycling program

### Paper

- Newspaper (with inserts)
- Magazines/catalogs
- Junk mail
- White and colored paper/brown bags
- Phone books/paperback books
- Boxboard (e.g., cereal boxes)
- Flattened corrugated boxes (3’x3’ or less)

### Containers

- Glass bottles/jars.
- Metal food cans, non-deposit and deposit aluminum cans, aluminum foil and empty aerosol cans.
- Milk and juice cartons or drink boxes
- All plastic food and beverage containers

Source: City of Boston, 1999.

**Table 2** Boston recovery rate analysis, summary of sample data

District	Number of stops	Number of households	MSW sorted (lbs.)	Recyclables sorted (lbs.)	Total (lbs.)
<b>East Boston</b>					
July 1997	90	244	7,080	1,598	8,678
November 1997	87 (1)	235	4,221	1,611	5,832
<b>West Roxbury</b>					
October 1998	72	81	5,031	1,315	6,346
November 1998	72	81	3,516	1,429	4,945
<b>Roslindale</b>					
October 1998	57	81	3,355	1,205	4,560
November 1998	57	81	4,076	1,407	5,483

MSW = Municipal solid waste.

(1) There were no set-outs in November at three addresses sampled in July, 1997.

Source: DSM Environmental Services, Inc., 1999.

ods by Clear View Consulting (Boston). As part of the participation rate study, an enumerator kept track of weekly set-outs at each address sampled for the recovery rate study. Therefore, participating and non-participating households could be separated to compare waste and recyclables set-out rates.

## Results

**Participation rates.** Measured monthly participation rates were low for East Boston, ranging from 11.5 to 14.5 percent on the two routes there. They were relatively high for Roslindale and West Roxbury, at 64 percent and 75 percent, respectively.

It is unclear why participation rates are so

low in East Boston. Possible explanations include small living areas, and a large percentage of rental versus owner-occupied households. Or, as discussed below, East Boston residents may not feel a great need to recycle because they generate less material to begin with.

**Recovery rates.** Measured recovery rates for paper and containers from the households sampled in the three districts are summarized in Table 3. Recovery rates for paper are significantly higher than for containers, especially in East Boston.

Boston accepts a wide range of materials for recycling. Recovery rates for each material were calculated to determine which mate-

**Table 3** Measured recovery rates from sampled households

District	Paper			Containers			Total recovery (%)
	Set out for recycling (1)	In MSW (1)	Recovery rate (%)	Set out for recycling (1)	In MSW (1)	Recovery rate (%)	
East Boston	878	1,036	46	206	1,089	16	34
Roslindale	1,154	819	58	274	366	43	54
West Roxbury	1,228	933	57	262	321	45	54

MSW = Municipal solid waste.

(1) In pounds.

Source: DSM Environmental Services, Inc., 1999.

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The reader service card is located between pages 18 and 19. Also, refer to the Index of Advertisers to locate additional information about some of these firms.

rials are being set out for recycling and which materials are going in the garbage. Table 4 illustrates that, in general, recovery rates for newspaper are high, while recovery rates for mixed paper and corrugated containers are low. Similarly, recovery rates for plastic milk jugs are high in Roslindale and West Roxbury, while recovery rates for PET bottles are low.

This type of material-by-material analysis can be used to target future promotional and educational campaigns. For example, a promotional campaign targeting all plastic bottles might stimulate additional recovery of plastic bottles other than milk jugs. Similarly, many people may not be aware that corrugated containers can be recycled in the residential program. In some cases, however, there may be limitations to increasing recovery. Much of the mixed paper pulled out of the garbage in Roslindale and West Roxbury had been ripped up, apparently to conceal addresses and account numbers. It is unlikely that a promotional campaign would be effective in persuading people to recycle this material.

**Capture rates.** Capture rates for paper and containers from participating households also were measured (see Table 5). If a 70 percent capture rate is considered a reasonable goal, then Boston is achieving reasonable capture rates for paper, but could increase promotion and educational efforts to improve recovery of containers.

**Recycling rate.** The recycling rate for the sampled households can be calculated by dividing the quantity set out for recycling by the total quantity of waste and recyclables set out for recycling and disposal. Potentially achievable recycling rates also can be estimated based on the total amount of recyclables pulled from the garbage and recycling bins combined.

To calculate potentially achievable recycling rates, it is necessary to make assumptions about sustainable participation and capture rates. Data on measured participation rates are available in the literature. Monthly participation rates as high as 90 percent have been reported. However, it is probably reasonable to assume that an 80 percent participation rate would be considered a maximum sustainable rate in many urban communities.

Data on achievable capture rates are much more difficult to find in the literature. Average capture rates in the APC Model Cities Project from six areas

**Table 4** Recovery rate by material, in percent

	<u>East Boston</u>	<u>Roslindale &amp; West Roxbury</u>
<b>Containers (1)</b>		
Plastics		
PET bottles	12	34
HDPE natural bottles	17	59
HDPE pigmented bottles	12	48
PVC bottles	21	4
Rigid plastic containers (all resins)	19	14
Glass	15	44
Aluminum and steel cans	8	39
Polycoated paperboard containers	12	25
<b>Total containers</b>	<b>13</b>	<b>41</b>
<b>Paper</b>		
Newspaper	50	60
Boxboard (2)		41
Corrugated containers	35	35
Magazines	31	49
Mixed paper (2)		22
<b>Total paper</b>	<b>47</b>	<b>51</b>

(1) Deposit containers handled through the redemption system are not included.  
(2) Boxboard and mixed paper were not sampled in East Boston.  
Source: DSM Environmental Services, Inc., 1999.

of the country ranged from a high of 80 percent for glass, to a low of 20 percent for non-HDPE and non-PET plastic bot-

**Table 5**

Capture rates for paper and containers from participating households, in percent

District	Paper	Containers
East Boston	86 (1)	34
Roslindale	64	47
West Roxbury	66	58

(1) Exclusive of mixed paper, which was not analyzed in East Boston.

Source: DSM Environmental Services, Inc., 1999.

tes. Based on these data, an average capture rate of 70 percent would appear to be reasonably achievable over time.

Assuming sustainable participation and capture rates of 80 and 70 percent, respectively, yields a recovery rate of 56 percent. Multiplying the recovery rate by the total amount of recyclables and dividing by the total amount of garbage and recyclables yields a potentially achievable recycling rate for the sampled households (Table 6).

**Comparison of participating and non-participating households.** Per household set-outs of garbage, recyclables and recyclables set out in the garbage were obtained in the three districts in an effort to (1) compare with the West Linn, Oregon data, which suggested that the percentage of total waste that is recyclable is less from non-participating households, and (2) determine if there was a difference in waste and recyclables generation among low- (East Boston), medium- (Roslindale), and high-income (West Roxbury) neighborhoods. As illustrated by Table 7, lower income households set out less garbage and fewer recyclables than higher income households, and non-participating households set out fewer total recyclables than participating households (whether in garbage or separated for recycling).

### Observations and conclusions

The recovery rate analysis conducted in three Boston collection districts was limited to a detailed analysis of 219 set-outs representing approximately 406 households. Therefore, no representation is made that the data are statistically significant or representative of the three collection districts. Instead, conclusions are drawn only about the sampled households' behavior, and are only inferred as being rep-

**Table 6**

Current and potentially achievable recycling rates for the sampled households

District	Recycling set-outs (lbs.)	Recyclables put in MSW (lbs.)	MSW (lbs.)	Current recycling rate	Potentially achievable recycling rate
East Boston	1,084	2,125	11,301	7.5%	12.3%
Roslindale	1,428	1,185	7,431	14.2%	14.6%
West Roxbury	1,490	1,254	8,547	13.2%	13.6%

MSW = Municipal solid waste.

Source: DSM Environmental Services, Inc., 1999.

**Table 7**

Comparison of weekly MSW and recyclables set-outs, participating and non-participating households

District	MSW and recyclables set out (1)	Recyclables set out for recycling and in MSW (1)	Available recyclables (%) (2)
<b>East Boston</b>			
Participating households	40.0	9.6	24.0
Non-participating households	33.1	5.6	16.9
<b>Roslindale</b>			
Participating households	62.0	17.0	27.4
Non-participating households	48.5	9.0	18.6
<b>West Roxbury</b>			
Participating households	70.5	17.5	24.8
Non-participating households	70.5	14.0	19.9

(1) Pounds per household.

(2) Recyclables as a percent of total generation (MSW and recyclables).

Source: DSM Environmental Services, Inc., 1999.

representative of the larger collection districts.

Despite these limitations, analysis of the data raises the following important issues that deserve further research.

- Reasonably achievable recycling rates for Boston residents, exclusive of yard debris and special waste recycling, appear to be less than 15 percent. Meeting recycling goals significantly higher than this will require emphasis on organics and special wastes, and on commercial and industrial generators.
- Higher-income households generate significantly greater quantities of waste and recyclables, but achievable recycling rates remain similar over all three groups of households.
- Less recyclable material appears to be available from non-participants than from participating households. This raises two questions. First, are non-participants finding other outlets for their recyclables, or do they

simply generate fewer recyclables to start with? A second, but related question is whether educational and promotional budgets should be directed at trying to persuade non-participants to recycle, or to convince recycling participants to do a better job.

- Finally, and most important, are high recycling rates necessarily indicative of environmental achievement? Might a better measure of performance be the percentage of *available* recyclables actually set out for recycling? Should neighborhoods such as East Boston be recognized for generating less waste to start with, even though their recycling rate is low compared to neighborhoods that generate significantly more waste?

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