

# Two Measured Parameters Correlated to Participation Rates in Curbside Recycling Schemes in the UK

**MARIE K. HARDER\***

**RYAN WOODARD**

**MATTHEW L. BENCH**

Waste & Energy Research Group (WERG)

University of Brighton

Brighton, BN2 4GJ, UK

**ABSTRACT** / Local authorities in the United Kingdom are currently changing their approach towards recycling as they attempt to meet legislative targets. An important part of this drive is the provision of an effective curbside recycling service and it is vital to understand the parameters that influence the performance of the system offered.

In this article, three primary datasets, collected from over 1400 households each, are examined for parameters correlated to participation rates. Two measured parameters were found that are not commonly identified in previous studies of curbside recycling schemes, and they are shown to merit further investigation as useful tools for planning purposes. One is the number of types of material collected; participation rates are greater for schemes collecting more materials. The second is the number of households situated on the same road; the lower the number, the higher the participation rate. In both cases, evidence of the measured correlation is presented, justifying their usefulness for planning. The multiple underlying factors causing the correlations are not identified here, but suggestions are made for further studies.

In 2001–2002, the United Kingdom generated 25.6 million tons of household waste (DEFRA 2003). This is defined in the United Kingdom and in this article as material from household collection rounds and from services such as street sweeping, bulky waste collection, hazardous household waste collection, litter collections, household clinical waste collection, separate yard waste collection, civic amenity sites, and those collected for recycling or composting through bring/drop-off schemes, and curbside schemes (Great Britain 1990).

The majority of UK household waste is sent to landfill, with only 12% being recycled or composted in 2002 (DEFRA 2003). This is despite a UK government target for recycling 25% of household waste by 2000 (DOE 1995) and the new Landfill Tax of 1996, intended to make landfill a more expensive form of disposal thereby increasing the viability of alternatives (Turner and other 1998).

The recycling target of 25% was not met, and the deadline was extended to the firm date of 2005, with step increases in interim years. This time, the responsibility for meeting the targets was placed directly on individual local authorities with new, statutory, recycling

targets allocated based on their previous recycling achievements (DETR 2001). The penalties for failing to meet these targets could include fines or forfeit of duties (i.e., the enforced handing over of waste responsibilities to another body). Local authorities are also bound by The Household Waste Recycling Act, which requires them to provide, in most cases, curbside collections for all households for a minimum of two materials by 2010 (Great Britain 2003).

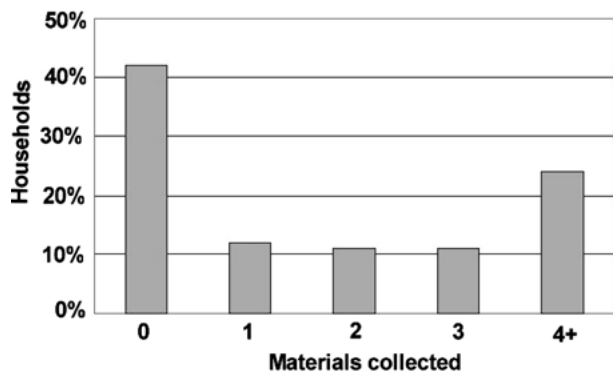
Local authorities throughout the United Kingdom are thus under great pressure to increase their recycling rates. They are revising their existing waste management structure, implementing recycling schemes where previously absent, and improving existing ones, to increase their recycling rates.

Curbside recycling schemes are seen as the main tool to do this, but they are complex systems with different parameters, each of which can influence overall performance. Quality data to assist such decision-making is now becoming more widely published. For example, Folz (1999) identified mandatory recycling schemes as having higher levels of recycling and participation. Noehammer and Byer (1997) showed that economic incentives and a weekly collection were other variables found in high-performing schemes. Gilitz (1989), Schmerling (1990), and Everett and Peirce (1993) found that recycling programs that supplied residents with curbside containers captured more materials. Further examples of variables that influence

**KEY WORDS:** Waste planning; Household waste; Recycling targets; Curbside recycling; Participation rates

Published online February 6, 2006.

\*Author to whom correspondence should be addressed; email: m.k.harder@brighton.ac.uk.



**Figure 1.** Number of materials collected in curbside recycling schemes in England.

performance include the frequency of collection (Tucker and others 2000), type of collection vehicle (Jones and Read 2001), public education, and promotion of the schemes (Read 1999).

In this article, we re-examine existing datasets for the express purpose of uncovering correlated parameters with participation rates. In particular, three large primary datasets of over 1400 households each were examined, and two parameters were found to be correlated to participation rates. They clearly merit further specific investigation as potential tools to improve recycling rates. One parameter is the number of materials collected in a scheme; a higher participation rate is found for those collecting more materials. The second parameter is the number of households situated on the same road; a negative correlation is found between it and the participation rate. Evidence for the correlations is provided to justify their use in planning. The multiple factors that together cause the correlations are not investigated here, as the emphasis is on providing useful planning tools rather than identifying complex contributory facets like education and in-

fortnightly. The types of material collected vary (see Figure 1): in some areas, only paper is collected; in others, a wide range of materials from glass to aluminum is collected. In the United Kingdom, participation by residents is voluntary.

The set-out rate is defined as “the number of households placing recyclable materials out for collection on a given day” (DETR 1999). This metric is a quick and useful indicator of the number of households taking part in recycling, but is often wrongly interpreted as the participation rate.

The participation rate (PR) is a quantity used to record levels of participation in a recycling scheme. In the United Kingdom, it is “the number of households that actively take part in recycling over a four week period” (DETR 1999). Collections are typically weekly or every 2 weeks, but some households might not place recyclable materials out at each opportunity, as they might not generate enough or they might forget. The definition presumes that if the household actively recycles, materials will be set out at least once in a 4-week period, which is why this period is used as a standard. Although the PR is not a perfect standard for comparisons across different schemes (e.g., which have different collection frequencies), it is the most standardized quantity currently used. Set-out rates have been related to the PR, but with different factors. Everett and Peirce (1992) and Waite (1995) proposed conversions of 1.2–3.0 and 2.5, respectively, for weekly collections. Tucker and others (1997) and Perrin (2002) suggested a value of 1.4 for fortnightly collections, compared to the range given by Everett and Peirce (1992) of 1.7–2.0. It should be noted that a high PR does not necessarily reflect a high overall recycling rate, as the measurement of participation does not take into account the quantity of material placed out by an individual (Wang and others 1997).

Participation rate

$$= \frac{(\text{No. of households setting materials out for collection at least once in a 4-week period})}{(\text{Total no. of households})} \times 100\%$$

come, whose complex interactions are more difficult to model for planning uses.

### Curbside Recycling Schemes

Curbside schemes are those where recyclable materials are collected directly from households for recycling. Local authorities usually provide residents with appropriate containers, such as boxes, wheelie bins, sacks, or bags, and they collect materials weekly or

The preferred form of measuring PRs is by directly surveying how many households set materials out for collection. However, many local authorities have used questionnaires or “focus groups” to estimate participation, as they cost less. These approaches are not according to government guidelines (DETR 1999) and result in unreliable data, as the claims of residents often do not reflect their actions (Perrin and Barton 2001). Participation rates of 90–100% are thus sometimes reported, which are very unlikely to reflect

Table 1. Reported participation rates in the United Kingdom

Case study	Participation rate	Data collection method	Detail	No. of materials collected
Bradford (Perrin and Barton 2001)	92%	Measured	Mixed multimaterial collection	6
Unknown (Moloney 2002)	90%	Measured	Alternate collection of yard waste and refuse and dry recyclables	Unknown
Bath and NE Somerset (FoE 2001)	76%	Measured	Comingled dry recyclables collected weekly in boxes	4
Bournemouth (FoE 2001)	75%	Unknown	Co mingled dry 3 recyclables collected weekly in returnable blue bags	3
Havering, London (Lyas and others 2002)	71%	Measured	Survival bags	Unknown
Milton Keynes (Thomas 2001)	71%	Self-reported	Dry recyclables collected weekly	5
Luton (Coggins 1994)	63%	Measured	Dry recyclables	Unknown
Milton Keynes (Coggins 1994)	58%	Measured	Comingled recyclables; pilot scheme data	Unknown
Bristol (FoE 2001)	52%	Measured	Comingled dry recyclables collected weekly in boxes	4
Fylde (Tucker and others 1997)	51%	Measured	Newspaper collection only	1
Sheffield (Coggins 1994)	40%	Measured	Pilot	Unknown
Wyre (Tucker and others 1997)	35%	Measured	Newspaper collection only	1
Glasgow (Tucker and others 1997)	33%	Measured	Newspaper collection only	1
East Dumbartonshire/N. Lanark (Tucker and others 1997)	28%	Measured	Newspaper collection only	1

reality, as UK schemes are not mandatory. Indeed, these rates are not reflected in the tonnage of material collected. Moloney (2002) conducted a survey of participation rates in 21 curbside recycling schemes operating in United Kingdom, and the highest participation rates reported were based on reported participation rather than by measured participation. Everett and Peirce (1992) conducted a survey of curbside recycling schemes operating in the United States. Of the 357 respondents, only 34% actually appeared to directly measure participation.

A review of various published participation rates from the United Kingdom is presented in Table 1. Some clearly state that their rates have been measured by counting boxes set out, but for others it is unclear how they were obtained. It is interesting to note a trend in the data in Table 1 that schemes reporting participation of less than 50% appear only appear to collect paper whilst schemes reporting higher levels of participation collect a range of materials. This trend will be discussed further below. Although the data suggests a correlation, the studies were carried out with different methodologies, different household types and used different reporting methods, making it difficult to draw clear conclusions. In the section below, more appropriate data sets are used to investigate the trend further.

### Recent WERG Studies

The Waste & Energy Research Group (WERG) at the University of Brighton has monitored many curbside schemes for research, consultancy and public service (WERG 2000, 2001, 2002; Woodard and others 2001, 2002, 2004, 2005). In some cases, these data sets included detailed information on participation rates, often subdivided into information on each material type and demographic group and with the data collected on a house-by-house basis.

It was therefore decided to re-examine appropriate studies from this databank to investigate whether there were parameters not widely reported that were correlated with higher PRs and that could be used to help plan better schemes. An obvious one to start with, suggested by previous data, was the possible correlation of PRs with number of materials collected. All of these WERG datasets had consistent methodologies, and, in particular, each set had PRs that were *measured* rather than estimated. In this work, three sets were chosen, each of which has a significant number of households (i.e., 1400–2000 each). They cover similar areas of population density averaging 20–40 people per hectare (National Statistics 2004). Their demographics are

Table 2. Summary of characteristics of three datasets used

Case study	A	B	C
No. of households	1473	1957	1921
PR (overall)	38%	49%	65%
Materials collected (parentheses indicate those collected together in one container)	1 (newspapers and magazines)	2 (newspapers and magazines + mixed paper)	3 (newspapers and magazines) (cans + plastic bottles)
Collection frequency (recyclates)	Fortnightly	Fortnightly	Alternate weeks i.e., (news & magazines) one week (cans + plastics) the next
No. of recycle collections every 4 weeks	2	2	4
Container types	Box, baskets bags	Reusable bag	Baskets
Collection frequency (residual waste)	Weekly	Weekly	Weekly
Minimum PR on any given road	15%	1%	0%
Maximum PR on any given road	67%	80%	100%
Overall recycling rate (over period of analysis)	10%	13%	13%
Percentage of high recyclers (participating 2/2, 3/4, or 4/4 opportunities)	21% (2/2)	28% (2/2)	29% (18% + 11%) (3/4 + 4/4)
Percentage of low recyclers (participating 1/2, 1/4, or 2/4 opportunities)	17% (1/2)	21% (1/2)	36% (19% + 17%) (1/4 + 2/4)
Percentage of nonrecyclers (participating in 0 opportunities)	62% (0/2)	51% (0/2)	35% (0/4)
Year of survey	2002	2001	2002

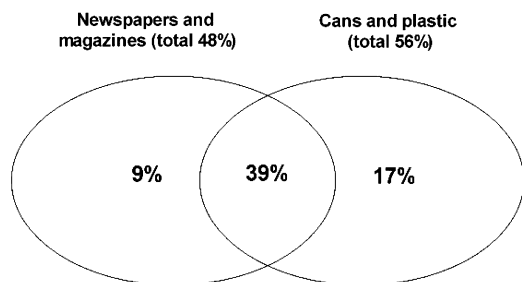
also similar, with considerable overlapping ACORN profiling (CACI 2002). ACORN profiles were designed for marketing purposes, rather than demographics, and care must be taken not to use them as anything other than a general guide rather than a reliable indicator of demographics. However, broadly speaking, ACORN profile A designates typically higher income, higher educated household, through to profile F, which typically denotes a lower income and household education. None of the measurements were taken at anomalous times of year, such as during major holiday periods. All of the sets were taken in similar parts of the country—Sussex—where unemployment rates are generally similar at around 3%, waste production is typically 900–1200 kg/households/yr, and the residents live in towns rather than villages.

In each case, data were collected on a house-by-house basis for each recyclable material group for each collection date, allowing not only the participation rate to be calculated (i.e., summing over 4 weeks) but also for the classification of individual households as high, low, and nonrecyclers. High recyclers set out materials at every opportunity; nonrecyclers were those that did not participate at all in the 4 week period. This earmarking of house residents in terms of their measured commitment to recycling proved to be a very useful tool, yielding the information discussed below. The data were also able to be analyzed on a road-by-road basis, which brought out interesting trends. Table 2 summarizes general information about the three sets, labeled A, B, and C.

Ideally, it would have been desirable to have all of the datasets collected at the same time and to vary only the parameters being investigated, but it is rare that such an opportunity to collect such data occurs. To arrange the necessary trials would imply great costs unless carried out on only a few households, which would then make the dataset weak in terms of sample number. The reasonable size of the datasets used and the fact that the same research group had carried out all three studies using consistent methodologies made them suitable for exploratory work looking for correlations. The first parameter investigated was the number of materials collected.

#### Variation of Participation Rates with Number of Material Types Collected

Whereas most of the earliest systems only collected newspapers, 24% of households in England are now provided with a service that collects four or more materials (DEFRA 2003). Moreover, the inclusion of yard waste in curbside collections is also becoming common (15% of households in England). Yard waste



**Figure 2.** Participation rates for different material groups in Scheme C; the overall participation rate was 65%.

can contribute up to 32% of the household waste stream (Woodard and others 2002) and has proved to be a material that householders are willing to recycle through curbside schemes. Further information on yard waste collection schemes has been reported in the works of Woodard and others (2001), Jones and others (2001), and Williams and Kelly (2003).

Schemes A, B, and C summarized in Table 2 are used here to investigate a possible correlation of PR with the number of materials collected. Scheme A collected only one material type (newspapers and magazines) and reported the lowest PR of 38%. Scheme B collected two material types and reported a PR of 49%, and Scheme C collected three material types and reported PR of 65%. The trend of increased PR with increasing number of collected materials holds. Moreover, Scheme C had the largest proportion of high recyclers at 29% (those who participate at every opportunity) and the least number of nonrecyclers at 35% (those who did not participate). So, what is the best explanation of this apparent correlation, and how robust is the suggestion that one way to increase an authority's participation rate is to collect more types of material?

To answer these questions, it is necessary to further unravel the different parameters involved. The data from Scheme C can be used to do this, as it contains more detail on which household set out which material types. Figure 2 indicates how the overall participation rate of 65% is made up of some households that set out newspapers and magazines only (9% contributions), some which set out cans and plastics only (17% contributing), and 39% setting out both, all within a given period of 4 weeks.

The percentage of households setting out newspapers and magazines (48%) in Scheme C corresponds well with the number participating in Scheme A, where this is the only material type collected and 38% participated. Newspapers have the longest tradition of being recycled, are clean and easy to handle, and are

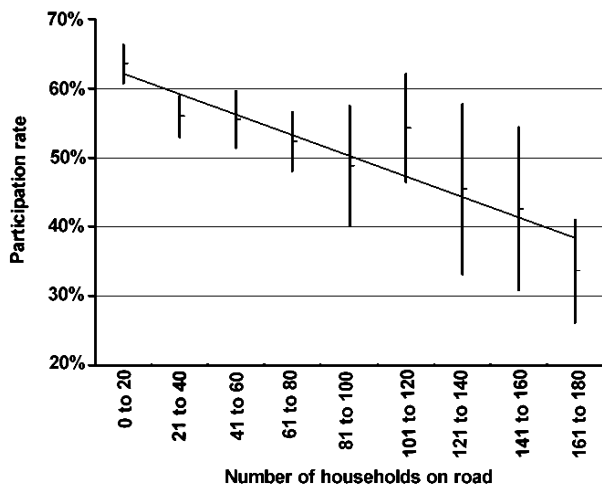
usually kept segregated from other waste in households. For example, Sudol and Zach (1991) reported on a scheme in Newark after glass was collected as well as paper, and they found more recycled paper alone (47%) compared to those recycling both paper and glass (30%).

Of those in Scheme C setting out newspapers and magazines, most set out cans and plastics (39 out of 48). Of course, not all households might use enough cans and plastics for them to feel it is worthwhile to sort and store them for recycling, but most of these households are doing so.

Conversely, as many as 17 of the 56% who recycle cans and plastics never seem to set out newspapers and magazines. One possible explanation is that many households do not take regular newspapers or do not acquire enough to bother setting out; Tucker (1999) has shown that householders believe that curbside recycling schemes are of little use to low users of newspaper. On the other hand, McDonald and Oates (2003) have shown that 62% of those residents not participating in a curbside scheme might recycle through other mechanisms such as bring banks or civic amenity sites. Two reasons for this type of behavior are possible. First, such households might have committed recyclers who segregate other materials (e.g., glass) not commonly collected at curbside that they transport regularly to bring banks, and they prefer to take the newspapers there. Second, newspapers and magazine can be heavy and it is possible that the household relies on a particular person to be available to remove them; this person might find bring banks more convenient, as they can be accessed at most times of the week. All of these hypotheses could be feasibly tested and will be the subject of future surveys by this research group.

It is interesting that in Scheme B, mixed paper is collected. Households that do not subscribe to newspapers but that acquire paper (e.g., from computer printouts) will be able to make use of this curbside collection service, which might contribute toward the higher participation rate of 49% (compared to 38% for Scheme A, newspapers and magazines). In other words, mixed-paper collections might widen the net and allow a wider spread of households to participate compared to newspaper-only collections.

The above data and analysis strongly indicate that PRs are increased when a larger number of key material types are collected. However, there is another aspect that might be contributing, which we call the Stepwise Rise. When only one or two materials are diverted by householders from their waste for recycling, the emphasis is still on waste collection. When more



**Figure 3.** Relationship between number of households on a road and participation rate.

significant amounts of the householders' waste are regularly segregated for recycling (e.g., four to six materials), the householders might shift their perception of the process to one of overall recycling, with minimal actual "residual waste." Their waste systems could become dominated by recyclates. If that were the case, then schemes that facilitate this could benefit from a significant stepwise increase in both PRs and the amounts of recyclates collected from each household. Scheme C, which collects three key materials comprising a large fraction of the waste, could have a Stepwise Rise effect contributing to its PR of 65%.

Some authorities are moving towards this kind of recycling-dominated system by reducing the frequency of collection of residual waste to fortnightly only and increasing the frequency and range of recyclates collected. For example, in the first week, residual waste is taken, and in the following week, dry recyclable materials and yard waste might be collected. This approach is becoming increasingly popular throughout the United Kingdom, and the two authorities recording the highest recycling rates in the United Kingdom in 2002–2003 used this system (Letsrecycle.com. 2004).

It would appear worthwhile and timely for further research to investigate the correlation of PRs with number of material types further and to see whether stepwise increases in recycling rates do occur in the United Kingdom when a comprehensive curbside recycling collection service is brought in. It certainly seems that in order for the recycling rate in the United Kingdom to increase significantly, emphasis needs to be placed on changing the public and local authorities' perception from a *garbage collection* to a *recycling collection*.

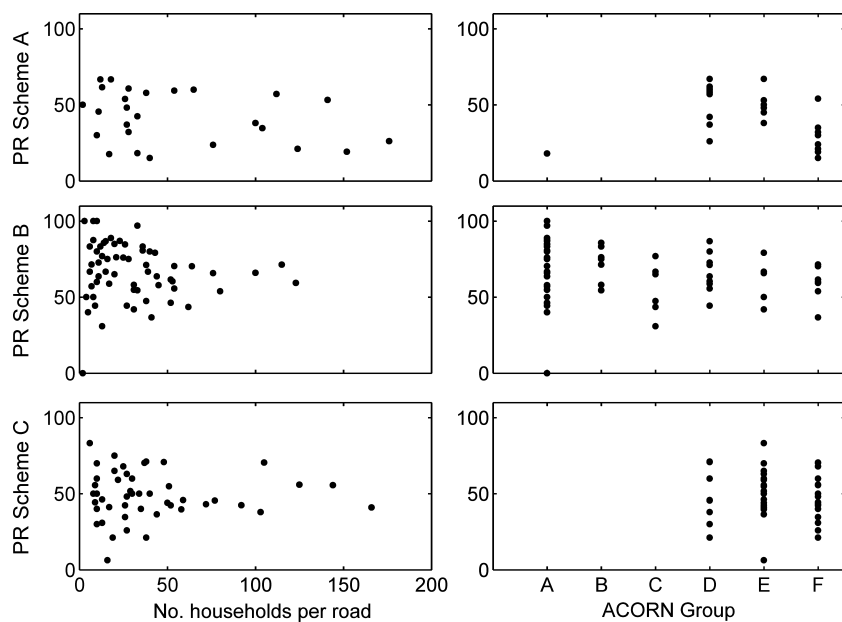
#### Variation of Participation Rates with Number of Houses on a Given Road

The data collected in Schemes A, B, and C also include house-by-house detail, which is not commonly collected. This allows a powerful matrix of data to be built up that can be interrogated in a variety of ways. It was due to this level of detail that a correlation could be found existing between the PR achieved and the number of houses on a given road. In other words, residents on short roads tend to participate in recycling more than those on longer roads. Although there are likely to be shifts in the sizes of properties and the wealth and nature of the households going from short roads to longer ones in a UK town, all such effects appear to be contained within the envelope of this simple parameter. It is important to note that all houses considered were in similar urban areas; the effect might not be present for rural or metropolitan communities. The data from all three of the datasets A, B, and C were used, totaling 5351 households sited on 140 roads, and are shown in Figure 3.

The data were analyzed with respect to the PRs of residents depending on the number of houses on each road. For example, roads with 1–20 households on them averaged a PR of 64%, disregarding the type of scheme or town. Households on roads with 161–180 households averaged a significantly lower participation rate of only 34%. The general trend indicates that as the number of houses on a road increases, the PR gradually decreases. Standard deviations are shown in Figure 3, as is the best fit. The number of houses on a road is correlated to the PR with a Pearson's correlation coefficient of  $r = 0.30$ , which for  $n = 138$  is highly significant, giving  $P < 0.01$ .

Clearly, changes in PRs are not caused by the number of houses on the road—the relationship is not directly causal. The number of houses on a road does not in itself change the PR. However, there are linked factors that might be more directly related. The effect might be related to an individual's attachment to their neighbourhood (Folz 1999; Lyas and others 2002). On shorter roads, there might be more of a community spirit and peer pressure to recycle. It is interesting that Noehammer and Byer (1997) also found that the lowest performing (mandatory) schemes were mainly in areas of large population density.

It is natural to expect that education and income might affect PRs, and that these are significant contributors to the trends seen. Whether they are or not, the correlation shown here is valid over the three towns studied in England, suggesting that this parameter of



**Figure 4.** Participation rates of Schemes A, B, and C versus the number of households on the respective road and versus the ACORN groups A–F (roughly corresponding to decreasing income and education).

road type or length could be directly useful for planning waste services in England.

However, in an effort to determine approximately the extent of the contribution of education and income on the PRs, the data were checked for each of Scheme A, B, and C separately for correlations of PR to ACORN groups. No clear pattern emerged, as shown in Figure 4. The correlations to road length were also examined for each individual Scheme A, B, and C. The trend is significant in Scheme A, but there are insufficient data in the individual data sets of the others to make a judgement.

The overall correlation seen for all three schemes combined, providing a larger sample and as shown in Figure 3, is exciting, and further studies are planned to explore how significant it is and to unravel its cause. One possibility is that the PR is linked to the size of the dwelling. A review of recycling worldwide has indirectly shown a general trend of higher recycling rates in larger dwellings (Resource Recovery Forum 2004) and also viewed by density of population. It is also true that roads with only 0–10 houses along them tend to be cul-de-sacs in Schemes A, B, and C, but this trend does not easily extend to the higher end. (Cul-de-sacs are small groups of houses on dead-end road spurs off from a through road.) Further investigation on this topic will be interesting.

Regardless of its cause, the influence of road size on participation could have several implications for planning of curbside schemes, UK local authorities sometimes have standard education programs that are applied throughout their respective municipalities. In

many instances, these authorities have a shortfall of funding and resources for such schemes. This analysis suggests that resources could be better focused on different areas. For example, curbside schemes could be expanded and supported for residents in cul-de-sacs and crescents, who are more likely to participate at higher rates. On the other hand, residents living on main roads with more traffic might be better served not by curbside schemes requiring collection vehicles that would cause more traffic congestion, but street-based minirecycling centers of communal recycling bins that are emptied less often. Moreover, residents on these roads might benefit from a more intensive waste education and awareness program.

Further unraveling of this effect would be useful. For example, it would be of interest to see the relative contributions to this effect of factors such as property size, value, and demographics. Another important factor that should be investigated is the correlated link to capture rates (i.e., the percentage of material captured for recycling compared to that discarded). It does not follow that the areas with higher PRs necessarily correspond to those recycling the most materials, although the maximization of this quantity is the ultimate aim of the local authorities. It would also be interesting to determine whether the main contributions to the effect due to road length are from high recyclers or not. High recyclers are targeted differently than low or nonrecyclers by local authorities wishing to increase recycling, as the barriers to their further involvement are different. For example, nonrecyclers need to be “triggered” to begin, whereas lowrecyclers

might need reminding and encouragement. Further research will test these trends.

## Conclusions

In this article, various datasets that contain house-by-house detail on recycling activity are examined and two parameters that are not commonly identified in other studies of curbside schemes are discussed; the number of types of materials collected and the number of households on a given road.

By considering three large datasets that use consistent methodologies in directly measuring participation, it is seen that the number of households participating in curbside schemes increases as the number of key materials collected increases. For example, 38% participate monthly in recycling newspapers and magazines when that is the only material collected. However, participation was higher (49%) for a scheme in which mixed paper is also collected and 65% for a scheme in which cans and plastic are also collected. Further analysis detail showed that the number of high recyclers observed was 21% in the basic scheme, but as high as 29% in the scheme that had the additional collection of cans and plastics. Even the number of low recyclers were correlated, with 17% in Scheme A collecting one material but as high as 36% in Scheme C collecting four materials, implying that far fewer residents were still in the nonrecycler category. It thus appears that one way to increase general participation is to increase the number of types of material collected. The detailed reason for this is not determined here, but a review of published PRs also indicates that rates are seldom above 40% when only one material is collected and are generally higher (e.g., 65%) when schemes collect more than four materials.

Second, data indicate a decrease of PR with an increase in the number of households situated on the same road. The underlying direct factors are not determined here. What is noted is that this correlation is useful from a practical point of view because it links PRs and a measurable quantity—the number of houses on a road. Such information is useful for planning purposes and is readily available to local authorities. It might, for example, be better to focus curbside schemes on residential areas with small neighborhoods and cul-de-sacs. On long roads, which are often main traffic roads, it might be best to use permanent banks of bins to capture recyclable materials or to implement a more intensive education and promotion campaign.

## Acknowledgments

The authors acknowledge Viridor Waste Management Ltd, for funding part of this research through the Landfill Tax Credit Scheme, and the assistance of the respective local authorities.

## Literature Cited

- CACI. 2002. ACORN the complete consumer classification. CACI, London.
- Coggins, C. 1994. Who is the recycler? *Journal of Waste Management & Resource Recovery* 1(2):69–75.
- DOE (Department of the Environment). 1995. Making waste work — A strategy for sustainable waste management in England & Wales. HMSO, London.
- DEFRA (Department for the Environment, Food and Rural Affairs). 2003. Municipal waste management survey 2001/2. HMSO, London.
- DETR (Department of the Environment, Transport and the Regions). 1999. Monitoring and evaluating recycling, composting and recovery programs. HMSO, London.
- DETR (Department of the Environment, Transport and the Regions). 2001. Guidance on municipal waste strategies. HMSO, London.
- Everett, J. W., and J. J. Peirce. 1992. Measuring the success of recycling programs. *Resources, Conservation and Recycling* 6:355–370.
- Everett, J. W. and J. J. Peirce. 1993. Curbside recycling in the USA: Convenience and mandatory recycling. *Waste Management & Research*. 11:49–61.
- FOE (Friends of the Earth). 2001. Recycling in action. FoE, London.
- Folz, D. H. 1999. Municipal recycling performance: A public sector environmental success story. *Public Administration Review* 59(4):336–345.
- Gilitz, J. 1989. Curbside collection containers, a comparative evaluation. *Resources Recycling* 7(7):20–22,51.
- Great Britain. 1990. Environment Protection Act. HMSO, London.
- Great Britain. 2003. Household Waste Recycling Act. HMSO, London.
- Jones S. R., and A. D. Read. 2001. Green fingered – green minded: Waste management and the organic waste stream. *in: Proceedings of towards the future: Waste in the 21st century*. University of Northampton, UK. pages 30–40.
- Jones, S. R., A. D. Read, and G. M. Robinson 2001. Effective local authority recycling campaigns: Marketing recycling services to the public. University of Kingston, London.
- Letsrecycle.com. 2004. Local authority recycling — English league table (2002–03). Available from [www.letsrecycle.com/info/localauth/league/ranked](http://www.letsrecycle.com/info/localauth/league/ranked).
- Lyas, J., P. Shaw, and M. Van-Vugt. 2002. Survival bag behaviour in a London borough: Householder behaviour, motivations and barriers. *In: Chartered Institute of Waste Management Proceedings*.



- McDonald, S., and C. Oates. 2003. Reasons for non-participation in a curbside recycling scheme. *Resources, Conservation and Recycling* 39:369–385.
- Moloney, D. 2002. Research into householder participation in recycling schemes. *Warmer Bulletin* July, 85 2002:16–19.
- National Statistics. 2004. Census 2001. Available from [www.statistics.gov.uk/census2001/](http://www.statistics.gov.uk/census2001/).
- Noehammer, H. C., and P. H. Byer. 1997. Effect of design variables on participation in residential curbside recycling programs. *Waste Management & Research* 15:407–427.
- Perrin D., 2002. The importance of determining factors affecting household recycling participation and efficiency levels. PhD thesis, University of Leeds.
- Perrin, D., and J. Barton. 2001. Issues associated with transforming household attitudes and opinions into materials recycling: a review of two recycling schemes. *Resources, Conservation and Recycling* 33:61–74.
- Read, A. 1999. “A weekly doorstep recycling collection, I had no idea we could!” Overcoming the local barriers to participation. *Resources, Conservation and Recycling* 26:217–249.
- Resource Recovery Forum. 2004. High diversion of municipal waste: Is it achievable? Resource Recovery Forum, Vol. 3.
- Schmerling, E. 1990. Recycling container choices. *Biocycle* 31(3):36–37.
- Sudol, F. J., and A. L. Zach. 1991. Newark’s curbside recycling Program: A participation rate study. *Resources, Conservation and Recycling* 5(1):35–45.
- Thomas, C. 2001. Public understanding and its effect on recycling performance in Hampshire and Milton Keynes. *Resources Conservation and Recycling* 32:259–274.
- Tucker, P. 1999. A survey of attitudes and barriers to curbside recycling. *Environmental and Waste Management* 2(1):55–63.
- Tucker, P., G. Murney, and J. Lament. 1997. Participation in recycling: A comparative study of four curbside recycling schemes. *Journal of Waste Management & Resource Recovery* 4(1):11–23.
- Tucker, P., J. Grayson, and D. Speirs. 2000. Integrated effects of a reduction in collection frequency for a curbside newspaper recycling scheme. *Resources, Conservation and Recycling* 31:149–170.
- Turner, R. K., R. Slamons, J. Powell, and A. Craighill. 1998. Green taxes, waste management and political economy. *Journal of Environmental Management* 53:121–136.
- Waite, R. 1995. Household waste recycling. Earthscan, London.
- Wang, F. S., A. J. Richardson, and F. A. Roddick. 1997. Relationships between set-out rate, participation rate and set-out quantity in recycling programs. *Resources, Conservation and Recycling* 20:1–17.
- WERG. 2000. The impact of CROWN on the composition of waste generated in Wealden District, a report for Wealden District Council WERG, Brighton, UK.
- WERG. 2001. Monitoring of CHEERS Recycling Programme, a report for Crawley Borough Council. WERG, Brighton, UK.
- WERG. 2002. Monitoring of the Paperchasers Recycling Scheme, a report by WERG on behalf of Brighton & Hove City Council. WERG, Brighton, UK.
- Williams, I. D., and J. Kelly. 2003. Green waste collection and the public’s recycling behaviour in the Borough of Wyre, England. *Resources, Conservation and Recycling* 38(2):139–159.
- Woodard, R., M. Bench, and M. K. Harder. 2005. The development of a UK kerbside scheme using known practice. *Journal of Environmental Management* 75(2):115–127.
- Woodard, R., M. Bench, M. K. Harder, and M. Philip. 2001. Evaluating the performance of a fortnightly collection of household waste separated into compostables, recyclates and refuse in the south of England. *Resources, Conservation and Recycling* 31:265–284.
- Woodard, R., M. Bench, D. W. J. Greenfield, and M. K. Harder. 2002. Achieving recycling targets in the UK—Practical examples from East and West Sussex. Pages 561–568 in *Proceeding of ISWA World Congress*.
- Woodard, R., M. Bench, M. K. Harder, and N. Stantzos. 2004. The optimisation of household waste recycling centres for increased recycling—A case study in Sussex, UK. *Resources, Conservation and Recycling* 43:75–93.