

## Summary report

# Analysis of kerbside dry recycling performance in the UK 2008/09



This report provides an analysis of kerbside dry recycling performance for local authorities in the United Kingdom for 2008/09. It explores how the nature of the collection systems and local area characteristics influence recycling performance, and provides benchmarks against which authorities can compare themselves.

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**Front cover photography:** Materials commonly collected at kerbside

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# Foreword

WRAP has commissioned this report for two main reasons.

The first is to provide local authorities with a simple way to judge how their recycling services are performing compared to the performance of other authorities of a similar type, to their nearest (statistical) neighbours and to national performance.

These comparisons are not intended to create performance league tables but to encourage authorities to ask themselves tough questions about the performance of their schemes. The different bases of comparison are provided so that factors outside of the control of the authority, which are known to affect performance, can be ruled out.

The benchmarks offered are based on the weight of individual materials commonly collected at the kerbside. There clearly are other benchmarks which could be developed: costs of systems or resident satisfaction with the service they receive would be desirable comparisons, for example, but the data necessary are not currently available. The comparisons offered are only for those factors currently known to affect performance and necessarily cannot reflect factors which have not yet been identified or for which reliable data are not yet available. Spending on local communications or a broader measure of the level of engagement with residents would be examples.

The second reason for commissioning this analysis was to see how far the variation in the performance of different local authority schemes could be explained – in the statistical sense - by factors which are measurable and available for all schemes. Within the limitations of such analysis, the conclusions are set out in the report by Resource Futures, our contractors.

Care should be taken in using the results. They offer an insight not a blueprint. As with all WRAP's research, local authorities should use this evidence as an aid to decision making, but should reach their own conclusions taking account of local needs and circumstances including the views of their residents.

Phillip Ward  
Director for Local Government Services  
WRAP

# Executive summary

## Introduction

The purpose of this study is twofold: to demonstrate which factors affect the success of the kerbside dry recycling services provided by local authorities to householders and to assist local authorities in evaluating the performance of their kerbside dry recycling schemes against various national performance benchmarks.

This report provides benchmark data for kerbside dry recycling performance in the United Kingdom during 2008/09. It is an update of a previous WRAP (Waste & Resources Action Programme) study, *Analysis of kerbside dry recycling performance in England 2007/08*. The main differences with the previous study are:

- The 2007/08 study covered all local authorities in England, whereas this study relates to 2008/09 data and is extended to cover all local authorities in the United Kingdom; and
- This study includes 2008/09 benchmark data for textiles collected for recycling at the kerbside; these data were not included in the 2007/08 study.

These benchmarks are provided for different dimensions:

- Material-specific performance (Section 3);
- Local authority characteristics (Section 4); and
- Collection system characteristics (Section 5).

This report presents the full continuum of kerbside dry recycling performance, from the minimum through to the maximum. Tables and charts are provided which categorise local authorities into four tiers of performance:

- *Low performance* – local authorities with recycling yields per household that place them in the lower quartile (i.e. the bottom 25% of all local authorities);
- *Below average performance* – local authorities with recycling yields per household that are greater than the lower quartile, but less than the median;
- *Above average performance* – local authorities with recycling yields per household that are greater than the median, but less than the upper quartile; and
- *High performance* – local authorities with recycling yields per household that place them in the “upper quartile” (i.e. the top 25% of all local authorities).

## Key findings

Material-specific kerbside dry recycling yields across local authorities in the UK during 2008/09 are summarised in Table E1. These data relate to all unitary and collection authorities. Less than a quarter of these authorities target *Paper without card* at the kerbside, with the median yield achieved being 74.8 kilogrammes per household per year (kg/hh/yr). By contrast, slightly over three quarters of local authorities target *Paper and card*, with the median yield being the highest for any material stream, 111.6 kg/hh/yr.

**Table A:** Kerbside material specific dry recycling performance, UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)	
Minimum	11.4	20.7	0.0	0.0	0.2	32.7	0.0	59.9	
Lower Quartile	59.5	86.1	6.0	29.0	9.2	137.0	0.6	135.4	
Median	74.8	111.6	8.4	41.3	13.5	170.6	1.4	162.5	
Upper Quartile	83.2	138.6	11.5	53.4	19.1	206.0	2.5	188.9	
Maximum	131.0	197.7	20.2	79.3	28.8	299.9	6.0	303.4	
Count	102 (23.5%)	329 (75.8%)	418 (96.3%)	330 (76%)	346 (79.7%)	206 (47.5%)	131 (30.2%)	74 (17.1%)	Total no. LAs: 434

The vast majority of local authorities (over 96%) collect metal cans at the kerbside, though the median yield is relatively low, at 8.4 kg/hh/yr.

Over three-quarters of local authorities collect glass at the kerbside, with a median yield of 41.3 kg/hh/yr.

Nearly four-fifths of local authorities collect plastic at the kerbside, with a median yield of 13.5 kg/hh/yr.

It was found that 206 local authorities (nearly half of UK local authorities) target all five materials out of: *paper, card, cans, glass, plastics*, with a median yield (for these five materials combined) of 170.6 kg/hh/yr.

131 local authorities collect textiles at the kerbside for recycling, with a median yield of 1.4 kg/hh/yr. Of these local authorities, 74 also target the five 'main materials': *paper, card, cans, glass, plastics*. The median yield achieved by these authorities across these materials *plus* textiles is 162.5 kg/hh/yr. This median yield is lower than that for local authorities targeting the five 'main materials' but not textiles (achieving a median yield of 170.6 kg/hh/yr). The local authorities collecting the five 'main materials' plus textiles are a small subset of those local authorities that target the five 'main materials'. The lower yields achieved by the subset local authorities also targeting textiles are not due to the additional targeting of textiles but due to other factors, including those identified in the regression model (see below).

## Changes in kerbside dry recycling yields for England between 2007/08 and 2008/09

There have not been any highly significant changes in recycling yields per household for the various materials. This can be seen by comparing the 2007/08 and 2008/09 median yields across the materials (for England, as the 2007/08 only covered England), as shown in Table E2. The main difference is the *number of local authorities* in England targeting various materials, with a significant increase in local authorities targeting card (and a corresponding decrease in authorities targeting paper only) and slight increases in the number of local authorities targeting cans, glass and plastic. There is a substantial increase in the number of local authorities targeting all 5 materials, with 173 England authorities collecting all of these materials during 2008/09 (nearly half of all England local authorities).

**Table B:** Comparison of kerbside material specific dry recycling performance in England during 2007/08 and 2008/09

		Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)
Minimum	2007/08	18	46	0	0	0	72
	<b>2008/09</b>	<b>35</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>33</b>
Lower Quartile	2007/08	63	95	5	29	5	140
	<b>2008/09</b>	<b>60</b>	<b>91</b>	<b>6</b>	<b>31</b>	<b>9</b>	<b>144</b>
Median	2007/08	73	129	9	43	10	182
	<b>2008/09</b>	<b>75</b>	<b>116</b>	<b>9</b>	<b>41</b>	<b>14</b>	<b>177</b>
Upper Quartile	2007/08	88	155	11	53	11	216
	<b>2008/09</b>	<b>83</b>	<b>144</b>	<b>12</b>	<b>54</b>	<b>19</b>	<b>213</b>
Maximum	2007/08	125	207	18	78	20	305
	<b>2008/09</b>	<b>131</b>	<b>198</b>	<b>20</b>	<b>79</b>	<b>29</b>	<b>300</b>
Count	2007/08	140	213	341	276	261	126
	<b>2008/09</b>	<b>93</b>	<b>260</b>	<b>344</b>	<b>282</b>	<b>278</b>	<b>173</b>

## Factors affecting kerbside dry recycling performance

Kerbside dry recycling performance data for the UK during 2008/09 were analysed to investigate which factors are most influential in affecting kerbside dry recycling performance. These data were analysed alongside a wide

range of contextual data using regression analyses. The model presented here has a very high degree of explanatory power, significantly greater than for any previously developed regression models relating to kerbside dry recycling.

The 'best fit' model for the UK explains 42% of the variation in kerbside performance (kg/hh/yr) using a combination of variables that relate to the socio-economic, regional and kerbside operational characteristics of local authorities.

These factors fall in to four main groups:

- **Socio-economic**, with lower yields associated with areas with higher levels of deprivation;
- **Range of materials targeted**, with those local authorities targeting a wider range of materials for dry recycling achieving higher kerbside dry recycling yields;
- **Kerbside collection system characteristics**, with those areas with less containment volumes for residual waste (most commonly through providing fortnightly residual collections) and greater capacity provided to householders for presenting their dry recycling at the kerbside (sufficient dry recycling containment capacity and collection frequency) achieving higher dry recycling yields at the kerbside; and
- **Regional**, with some regional variations in kerbside recycling performance that cannot be explained by the other factors in the model, or by any other factors tested during this study.

Of these factors, those found to be most influential were levels of deprivation (with lower yields associated with higher levels of deprivation), the range of materials targeted (with wider ranges of materials targeted achieving higher dry recycling yields) and fortnightly refuse collections (being associated with higher dry recycling yields in comparison to weekly refuse collections).

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## 1.0 Aims and methodology

This section outlines the scope of this study: to benchmark kerbside dry recycling performance in the UK during 2008/09 and use performance data to increase our understanding of which factors affect kerbside dry recycling performance. It also describes the methodology applied during this study.

A key aim of this study is to demonstrate which factors affect the success of the kerbside dry recycling service provided by local authorities to householders. The outputs from the study also are intended to assist local authorities in evaluating the performance of their kerbside dry recycling schemes against various national performance benchmarks.

This report provides benchmark data for kerbside dry recycling performance in the United Kingdom during 2008/09. It is an update of a previous WRAP study, *Analysis of kerbside dry recycling performance in England 2007/08*. The main differences with the previous study are:

- The 2007/08 study covered all local authorities in England, whereas this study relates to 2008/09 data and is extended to cover all local authorities in the United Kingdom; and
- This study includes 2008/09 benchmark data for textiles collected for recycling at the kerbside; these data were not included in the 2007/08 study.

### 1.1 Scope of this study

This report provides benchmarking data for kerbside dry recycling performance for local authorities (LAs) in the United Kingdom during 2008/09. These benchmarks are provided for different dimensions:

- Material-specific performance (Section 3);
- Local authority characteristics (Section 4); and
- Collection system characteristics (Section 5).

The kerbside dry recycling performance data has also been analysed to investigate which factors are influential in affecting kerbside dry recycling performance (Section 2).

#### 1.1.1 Data presentation

This report contains a series of tailored benchmarks according to a range of factors such as: the materials that local authorities target for kerbside recycling; the configuration of their kerbside collection system; and the type of local authority (in terms of the Office for National Statistics classifications of area types). It is hoped that these benchmarks will assist local authorities in understanding how their performance compares to other local authorities in similar circumstances or operating similar collection systems, and that it will assist them in setting suitable operational targets for improving kerbside dry recycling performance.

This report presents the full continuum of kerbside dry recycling performance, from the minimum through to the maximum. The report uses a series of graphs and tables to outline performance (defined by the weight of material collected per household in the authority, not per household served, in 2008/09), with local authorities categorised into four tiers of performance:

- *Low performance* – local authorities with recycling yields per household that place them in the lower quartile (i.e. the bottom 25% of all local authorities);
- *Below average performance* – local authorities with recycling yields per household that are greater than the lower quartile, but less than the median;
- *Above average performance* – local authorities with recycling yields per household that are greater than the median, but less than the upper quartile; and
- *High performance* – local authorities with recycling yields per household that place them in the “upper quartile” (i.e. the top 25% of all local authorities).

In line with these categories, the benchmark tables include the following data:

- **Minimum** – indicates the lowest recorded recycling yield;
- **Lower quartile** – indicates the recycling yield below which the bottom 25% of all local authorities performed (performance is referred to as “*low*”);
- **Median** – indicates the recycling yield which is the mid performance i.e., 50% of local authorities performed lower than this figure and 50% performed higher. Performance below this mid point but above the lower quartile is referred to here as “*below average*”. In contrast, performance above the median but below the upper quartile is referred to here as “*above average*”;

- **Upper quartile** – signifies the recycling yield above which the top 25% of all local authorities performed (performance is referred to as “*high*”);
- **Maximum** – indicates the highest recorded recycling yield; and
- **Count** – the total number of local authorities.

In the benchmarking tables, yields per household per year are reported to one decimal place. Where the value “0.0” appears, this refers to a small collection yield (<0.05 kg/hh/yr) which is reported as “0.0 kg/hh/yr” due to rounding. For example, in Section 3, Table 2, the minimum recycling yield for cans is reported as “0.0 kg/hh/yr”; this refers to the fact that at least one authority targets cans but achieved very low yields (<0.05 kg/hh/yr). Data for local authorities which do not target a particular material for kerbside dry recycling have not been included in the calculation of benchmark recycling yields.

Where a material or combination of materials has not been targeted by any authorities for a particular benchmark measure, this is indicated by blanks in the table. For example, Table 5 in Section 3.1 provides benchmark data for different combinations of targeted materials. As no local authorities in the UK targeted the combination “paper, cans, plastic & textiles” during 2008/09 this is indicated by the blank cells for Minimum, Lower Quartile, Median, Upper Quartile and Maximum values, and by the Count of zero for the number of local authorities targeting this combination of materials.

Lower and upper quartiles are only listed in tables where five or more authorities are collecting a specific material. Where between five and 10 authorities are collecting a material lower and upper quartiles are included, but these should be treated with caution as the sample size is small, and these data values are marked in grey type. In these cases the better measures are minimum, maximum and median.

### *1.1.2 Comparison of 2007/08 and 2008/09 performance*

It is only possible to compare kerbside dry recycling performance during 2007/08 and 2008/09 for local authorities in England, since the 2007/08 study focussed only on England authorities. A comparison of material specific yields for England authorities during 2007/08 and 2008/09 is presented in Table 3 in Section 3. Further comparison tables are provided in Appendix 2, which includes benchmark tables for various groups of England local authorities. For each table in Appendix 2 that provides benchmark data for 2008/09 that corresponds to 2007/08 data in the 2007/08 report, the corresponding table in the 2007/08 report<sup>1</sup> is indicated, to help readers compare how the particular benchmarks that interest them have changed between 2007/08 and 2008/09.

## 1.2 Methodology

This project has involved producing benchmark data for kerbside dry recycling performance in the UK for 2008/09 and carrying out statistical analyses to investigate which factors are influential in affecting kerbside dry recycling performance. The data sources used for these purposes are detailed below.

### *1.2.1 Recycling yields*

Overall and material-specific kerbside recycling figures were calculated for 434 local authorities in the United Kingdom (collection and unitary authorities). Calculations were based on local authority WasteDataFlow returns for 2008/09, with annual yields per household (i.e. total number of households in the relevant local authority) using dwelling stock figures for the last quarter of 2008/09.

In a number of cases local authorities reported a single co-mingled tonnage for all the materials collected for recycling via kerbside schemes rather than reporting tonnages for the individual materials. In such cases estimates of the co-mingled material composition (i.e. split of collected materials in to paper, cans, glass, etc) were made on the basis of reference data from waste audits of kerbside dry co-mingled collections. This represents an improvement on the apportionment of co-mingled recycling tonnages used in WasteDataFlow and is based on more up to date data which are relevant to the containment methods now commonly employed in kerbside dry recycling services<sup>2</sup>. Further details on how co-mingled recycling tonnages have been apportioned to individual materials are provided in Appendix 3.

<sup>1</sup> Downloadable at: [http://www.wrap.org.uk/local\\_authorities/research\\_guidance/collections\\_recycling/benchmarking.html](http://www.wrap.org.uk/local_authorities/research_guidance/collections_recycling/benchmarking.html)

<sup>2</sup> The reference data for arriving at a more accurate apportionment of co-mingled tonnages has been derived from Resource Futures on behalf of Defra, *Municipal Waste Composition: a Review of Municipal Waste Component Analyses, 2010*, <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=15133>

Yields are based on the amount of material collected and therefore exclude collection rejects. However, rejects that occur further down the line at the Material Recovery Facility (MRF) or at the gate of the reprocessor are not excluded. Some allowance has been made for material rejected at MRFs, and where this occurs it has been clearly stated in the report. For the purposes of this analysis this rate is assumed to be 10%, based on the typical average reject rate of 10.8% currently quoted by the Environment Agency. The 10% applied here may underestimate rejects for single stream co-mingled schemes and overestimate for two stream comingled schemes as not all material from two stream schemes may go to a MRF. However, for the purposes of this analysis a standard rate has been applied to both scheme types.

Throughout the report, dry recycling yields are presented separately for five main materials – paper without card, paper & card, cans, glass and plastic – and, for those local authorities who collect them, all the five main materials together. Additionally, yields are presented for kerbside collected textiles; and, for those local authorities who collect all the five main materials *and* textiles, total yields for these six materials are reported. These yields do not necessarily relate to total kerbside recycling as some local authorities may collect additional materials (e.g. batteries).

Bring site collection yields were also considered in the regression analyses (see Appendix 1). These data were obtained from WasteDataFlow tonnages for 2008/09.

### *1.2.2 Local authority socio-demographic data*

Various socio-demographic data were considered in the analyses carried out for this study. Benchmarking of kerbside dry recycling performance was carried out according to the Office for National Statistics (ONS) Local Authority Area Classification 2001 (see Section 4.2). This classification system groups areas together into clusters according to key characteristics common to the population. Based on Census Data on population demographics, socio-economic variables, housing, employment and industry sector, eight “supergroups” are identified (which can be further broken down into 13 “groups”) for the UK.

Government Office Region was also considered in the regression analyses, and it was in fact found that there were some significant regional variations (see Section 2).

Levels of deprivation have been considered primarily in the regression analyses (see Section 2 and Appendix 1), although some comments are made in relation to deprivation levels and benchmarking kerbside dry recycling performance in Section 4.1. Indices of Multiple Deprivation are standard measures of deprivation, with deprivation levels measured across a range of domains, such as income, employment, health and disability, education skills and training, barriers to housing and services, living environment, and crime.

Different methods are used for calculating Indices of Multiple Deprivation in England and each of the Devolved Nations. As a consequence, there are separate Indices of Multiple Deprivation for England, Wales, Scotland and Northern Ireland and they are not mutually comparable. Therefore Indices of Multiple Deprivation for England (2007) have been applied in analyses which relate only to the England local authorities; (the most powerful regression model developed for this study relates only to England data and uses the England Indices of Multiple Deprivation; see Appendix 1).

In order to develop a common measure of deprivation across all local authorities in the UK, 2001 census data on the proportion of people in Social Grades D or E was calculated for all 434 local authorities. For England and each of the Devolved Nations, this measure is highly correlated with the respective Indices of Multiple Deprivation for each country, indicating that it is a reliable indicator of deprivation levels, at least at the local authority level. The proportion of population of Social Grades D or E is an important feature of the regression model presented in Section 2.

Population and dwelling stock estimates for 2008 were analysed to ascertain average household sizes for each local authority. These data were also used to produce kerbside recycling yields per capita (rather than per household) in order to investigate whether average household size has a significant effect on kerbside dry recycling performance; (see Appendix 1).

Other socio-demographic data were analysed to produce common measures across all UK authorities and were included in the regression analyses discussed in Appendix 1. These measures included:

- Population density (inhabitants per hectare, based on mid-2008 population estimates);
- Proportion of housing stock consisting of multi-occupancy dwellings (from 2001 census data); and
- Proportion of housing stock consisting of detached or semi-detached dwellings (from 2001 census data).

### *1.2.3 Recycling service profiles*

A dry recycling service profile is defined here as the combination of the dry recycling scheme and the associated residual waste scheme provided to households. Information on dry recycling services operated by local authorities in 2008/09 was obtained through a survey carried out by WRAP.

For the purposes of benchmarking, local authorities were assigned a recycling service classification if a single kerbside service profile served 90% or more of households receiving a recycling service in the authority area. This criterion was necessary as local authorities report recycling tonnage data via WasteDataFlow as single figures for each material category, irrespective of how many different schemes may have contributed to that tonnage.

For the purposes of the regression analyses (Section 2 and Appendix 1), less restrictive criteria were applied in order to describe aspects of collection systems for each local authority (collection frequency, containment method, etc), essentially by characterising each local authority on the basis of the most common collection system in that authority (i.e. the greatest number of households in that authority receiving a particular type of service).

The aspects of collection service considered for both benchmarking and the regression analyses were:

- Dry recycling collection frequency;
- Dry recycling scheme type (kerbside sort, single stream co-mingled, two stream co-mingled);
- Dry recycling scheme containment type; and
- Residual waste collection frequency.

## 2.0 Factors affecting kerbside dry recycling performance

This section describes a model derived from kerbside recycling performance data for UK local authorities. It is the most powerful explanatory model describing kerbside dry recycling to be produced to date. The model provides insights into which factors are influential in affecting kerbside dry recycling performance.

Kerbside dry recycling performance data for the UK during 2008/09 were analysed to investigate which factors are most influential in affecting kerbside dry recycling performance. These data were analysed alongside a wide range of contextual data using multiple regression analyses. Models built from regression analyses attempt to explain the separate effects of various factors on a variable (in this instance, kerbside dry recycling performance). Various models were tested and those which were most statistically robust were selected for inclusion in this study.

The best UK model developed for this project is presented in this section, describing which factors influence kerbside dry recycling yields for all targeted materials across local authorities in the UK<sup>3</sup>. Other models are discussed in Appendix 1. The model presented here has a very high degree of explanatory power<sup>4</sup>, significantly greater than for any previously developed regression models relating to kerbside dry recycling. The success in developing a powerful model is due to improved tonnage data and consistency in reporting (particularly through WasteDataFlow returns) and improved knowledge of contextual factors (such as collection system configurations in individual local authorities).

The 'best fit' model for the UK explains 42% of the variation in kerbside performance (kg/hh/yr) using a combination of variables that relate to the socio-economic, regional and kerbside operational characteristics of local authorities.

A scatter plot illustrating the regression model is shown in Figure 1 below, which plots actual kerbside dry recycling yields (for all targeted materials) against those yields which are predicted by the model for each local authority. The degree to which data points deviate from the line indicates the degree to which the actual performance differs from the predicted performance.

The factors which were found to be significant in affecting kerbside dry recycling performance are summarised in Table 1, along with an indication of the relative significance of the factors and a brief explanation of how the factors affect recycling performance.

These factors fall in to four main groups:

- **Socio-economic**, with lower yields associated with areas with higher levels of deprivation;
- **Range of materials targeted**, with those local authorities targeting a wider range of materials for dry recycling achieving higher kerbside dry recycling yields;
- **Kerbside collection system characteristics**, with those areas with less containment volumes for residual waste (most commonly through providing fortnightly residual collections) and greater capacity provided to householders for presenting their dry recycling at the kerbside (sufficient dry recycling containment capacity and collection frequency) achieving higher dry recycling yields at the kerbside; and
- **Regional**, with some regional variations in kerbside recycling performance that cannot be explained by the other factors in the model, or by any other factors tested during this study. Therefore the reasons for these variations are not clear from the available data, but they appear to be genuine variations that significantly affect kerbside dry recycling yields. For further comments, refer to Appendix 1.

Of these factors, those found to be most influential were levels of deprivation (with lower yields associated with higher levels of deprivation), the range of materials targeted (with wider ranges of materials targeted achieving higher dry recycling yields) and fortnightly refuse collections (being associated with higher dry recycling yields in comparison to weekly refuse collections).

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<sup>3</sup> This relates to yields for the materials collected at kerbside which are considered in this report, namely the five 'main materials' (paper, card, glass, cans, plastic) plus textiles in some cases. Therefore the model presented here is derived from dry recycling performance based on collection yields for these materials – other materials targeted at the kerbside (such as batteries, etc) are not accounted for in the model.

<sup>4</sup> Adjusted  $R^2 = 0.423$ . Crudely speaking this indicates that the model can account for 42.3% of the variability in kerbside dry recycling performance. A model relating to only England local authorities has an even higher adjusted  $R^2$  value of 0.501; this model is presented in Appendix 1.

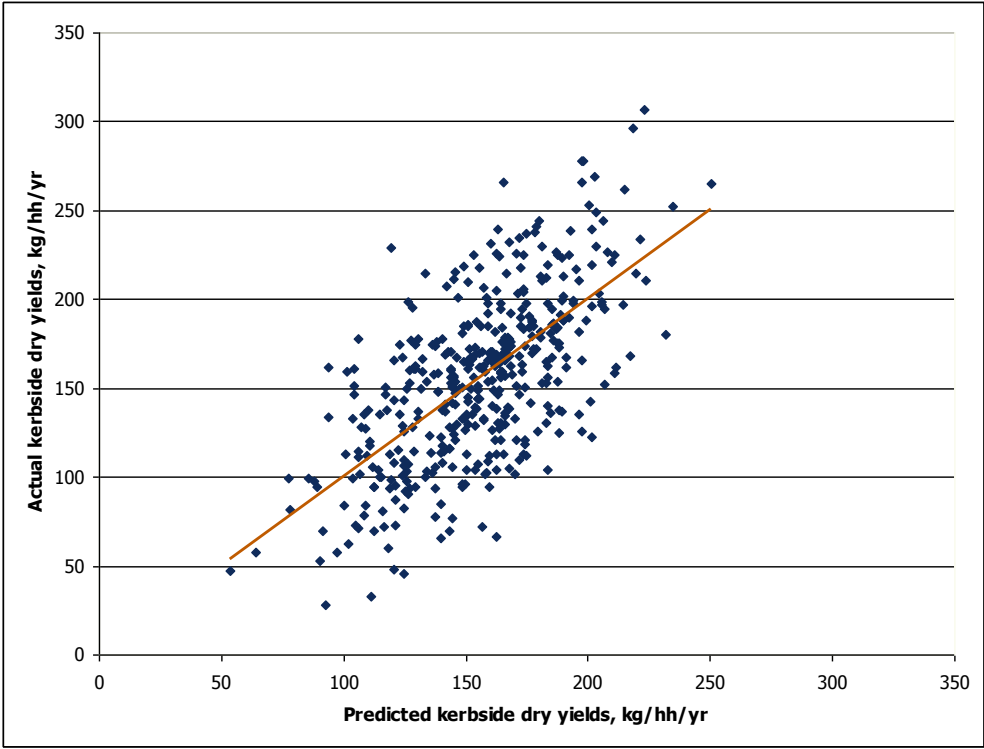
The latter point fundamentally relates to the balance of residual and recycling capacities offered to householders at the kerbside. The findings of the model are consistent with the supposition that local authorities which provide the most appropriate balance of capacities (with sufficient recycling capacity in relation to residual capacity, whilst restricting capacity for residual waste) generally achieve higher kerbside dry recycling yields. However, beyond a certain point (depending on housing type and local circumstances), successively increasing recycling containment capacity through providing more or larger recycling bins will provide only diminishing returns in terms of improving recycling performance.

Whereas the benchmark tables (in Sections 3, 4 and 5) attempt to account for some materials being rejected at Materials Recycling Facilities (MRFs) – with a 10% reject rate assumed for all commingled collections – no MRF rejection rates have been assumed for the regression modelling<sup>5</sup>. Furthermore, there is some uncertainty as to the proportion of co-mingled materials which are rejected at MRFs; see Section 1.2.1 for further comments.

A range of other factors (such as quantities of materials collected at bring sites<sup>6</sup>) were investigated during the development of the regression models, as discussed in Appendix 1. However these factors did not feature in the models that were most statistically robust. Therefore whilst some of the other factors investigated may have a bearing on kerbside dry recycling performance in individual cases, our investigation has found that there is not a significant and consistent effect arising from the factors in relation to kerbside dry recycling performance.

Furthermore, it should be borne in mind that kerbside performance is likely to be subject to a significant degree of random variation; or – at the very least – variation which cannot be accounted for systematically. A case in point would be the influence of poorly calibrated weighbridges, co-weighing of material from bring sites or data entry errors. Additionally overarching descriptors for local authorities (such as an average level of deprivation for each local authority) have been used to attempt to explain behaviours that are linked to many characteristics of the local authority and the individual household. This could also lead to unexplained variation in recycling performance (basically because the descriptors are too general in nature to fully represent the characteristics of different local authorities).


**Figure 1:** Actual kerbside dry recycling yields (kg /household/year) plotted against predicted yields for LAs in the UK, 2008/09



<sup>5</sup> This is because it was considered that applying a 'universal' MRF reject rate for all commingled collections would reduce the explanatory power of the model, since in reality reject rates are likely to vary significantly between different local authorities.

<sup>6</sup> HWRC collection tonnages were not considered for any authority types in the analyses carried out for this project.

**Table 1:** Factors that provided significant coefficients in model explaining variation in kerbside dry recycling performance

Factor	Relative explanatory power within model	Explanation
Level of deprivation	<b>Highest</b>  <b>Lowest</b>	Areas with higher levels of deprivation are associated with lower kerbside dry recycling performance. This is often due to more impoverished households being less able to prioritise participating in recycling activities. It may also reflect local authorities in more deprived areas having fewer resources to develop comprehensive kerbside recycling services.
Number of materials targeted for kerbside dry recycling		Fairly obviously, those authorities targeting a wider range of materials achieve higher kerbside dry recycling yields.
Refuse collection frequency		Areas with fortnightly refuse collections generally achieve significantly higher kerbside dry recycling yields. The restriction of residual waste capacity encourages householders to recycle more, especially when provided in combination with weekly recycling services.
Regional variations		There are some regional variations in kerbside recycling performance that cannot be explained by the other factors in the model, or by any other factors tested during this study. Therefore the reasons for these variations are not clear from the available data, but they appear to be genuine variations that significantly affect kerbside dry recycling yields.
Dry recycling weekly equivalent containment capacity		Local authorities which provide greater weekly equivalent containment capacity to householders for their dry recycling achieve higher dry recycling yields. Containment capacity is a combination of container volumes and collection frequency <sup>7</sup> .

It is important to note that all the factors listed in Table 1 are significant in affecting kerbside dry recycling performance. Those factors which are described as having a “Lower” relative explanatory power are still significant factors, but their explanatory power within the model is less in relation to the other factors. The actual effects of the various factors, expressed as standardised coefficients, are presented in Appendix 1, Table A1.6.

The regression model was successful in separately identifying those factors relating to collection systems that are most influential in affecting kerbside dry recycling performance. Since these are the factors which, in principle, are in the power of local authorities to change (in contrast to the socio-demographic and regional factors described in Section 2), they are of particular interest. It is therefore worth concluding with the collection system factors which have been found to have the greatest positive effects on kerbside dry recycling performance:

- Reduced refuse collection frequency is the most important collection system factor, having a significant beneficial effect on recycling performance; and
- Dry recycling containment capacity (meaning weekly equivalent capacity, so taking dry recycling containment volumes and collection frequency in to account) is less significant, but still important, with greater weekly equivalent containment capacity being associated with better kerbside dry recycling performance. In particular, this means that for a given volume of dry recycling kerbside collection containment, weekly dry recycling collections perform better than where dry recycling is collected less frequently.

<sup>7</sup> For example, if a local authority provides 100 litres of containment capacity to each householder for dry recycling, but dry recycling is collected fortnightly, the weekly equivalent containment capacity would be  $100/2 = 50$  litres.

### 3.0 Material-specific performance

This section provides material-specific benchmark data for kerbside dry recycling performance achieved by local authorities in the UK during 2008/09. The performance for various combinations of materials targeted for recycling at the kerbside is also benchmarked.

Material-specific kerbside dry recycling yields across local authorities in the UK during 2008/09 are summarised in Table 2.

**Table 2:** Kerbside material specific dry recycling performance, UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)	
Minimum	11.4	20.7	0.0	0.0	0.2	32.7	0.0	59.9	
Lower Quartile	59.5	86.1	6.0	29.0	9.2	137.0	0.6	135.4	
Median	74.8	111.6	8.4	41.3	13.5	170.6	1.4	162.5	
Upper Quartile	83.2	138.6	11.5	53.4	19.1	206.0	2.5	188.9	
Maximum	131.0	197.7	20.2	79.3	28.8	299.9	6.0	303.4	
Count	102 (23.5%)	329 (75.8%)	418 (96.3%)	330 (76%)	346 (79.7%)	206 (47.5%)	131 (30.2%)	74 (17.1%)	Total no. LAs: 434

**Paper without card** - around 24% of local authorities across the UK reported a kerbside recycling collection of paper without card during 2008/09. The average performance was 75 kg per household per year (kg/hh/yr), with 'high performance' (i.e. the top 25%) 83 kg/hh/yr or more, and 'low performance' (i.e. the bottom 25%) less than 60 kg/hh/yr.

**Paper and card** - around 76% of local authorities reported a kerbside recycling collection of paper and card. The average performance was 112 kg/hh/yr, with 'high performance' more than 139 kg/hh and 'low performance' less than 86 kg/hh/yr.

**Cans** - almost all (96%) local authorities reported a kerbside recycling collection of cans. The average performance was 8 kg/hh/yr, with 'high performance' more than 11 kg/hh/yr and 'low performance' less than 6 kg/hh/yr.

**Glass** - over three quarters (76%) of local authorities reported a kerbside recycling collection of glass. The average performance was 41 kg/hh/yr, with 'high performance' more than 53 kg/hh/yr and 'low performance' less than 29 kg/hh/yr.

**Plastic** - four fifths (80%) of local authorities reported a kerbside recycling collection of plastic (i.e. plastic bottles and/or mixed plastic). The average performance was 14 kg/hh/yr, with 'high performance' more than 19 kg/hh/yr and 'low performance' less than 9 kg/hh/yr.

**All 5 materials** - nearly half (47.5%) of local authorities targeted all five of the above mentioned materials for kerbside recycling. The average performance across all these materials for these authorities was 171 kg/hh/yr, with 'high performance' greater than 206 kg/hh/yr and 'low performance' less than 137 kg/hh/yr.

**Textiles** - 30% of local authorities reported a kerbside recycling collection of textiles. The average performance was 1.4 kg/hh/yr, with 'high performance' of more than 2.5 kg/hh/yr and 'low performance' of less than 0.6 kg/hh/yr.

**All 5 materials + textiles** - 17% of local authorities targeted all five of the 'main material' plus textiles. The average performance across all these six materials for these authorities was 163 kg/hh/yr, with 'high performance' of 189 kg/hh/yr and 'low performance' of less than 135 kg/hh/yr.

Further benchmarks of different combinations of targeted materials are provided in Section 3.1.

A comparison of kerbside dry recycling performance for England authorities between 2007/08 and 2008/09 is provided in Table 3 below. The figures in bold relate to 2008/09 data, whilst the other figures relate to 2007/08 data.

**Table 3:** Comparison of kerbside material specific dry recycling performance in England during 2007/08 and 2008/09

		Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)
Minimum	2007/08	18	46	0	0	0	72
	<b>2008/09</b>	<b>35</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>33</b>
Lower Quartile	2007/08	63	95	5	29	5	140
	<b>2008/09</b>	<b>60</b>	<b>91</b>	<b>6</b>	<b>31</b>	<b>9</b>	<b>144</b>
Median	2007/08	73	129	9	43	10	182
	<b>2008/09</b>	<b>75</b>	<b>116</b>	<b>9</b>	<b>41</b>	<b>14</b>	<b>177</b>
Upper Quartile	2007/08	88	155	11	53	11	216
	<b>2008/09</b>	<b>83</b>	<b>144</b>	<b>12</b>	<b>54</b>	<b>19</b>	<b>213</b>
Maximum	2007/08	125	207	18	78	20	305
	<b>2008/09</b>	<b>131</b>	<b>198</b>	<b>20</b>	<b>79</b>	<b>29</b>	<b>300</b>
Count	2007/08	140	213	341	276	261	126
	<b>2008/09</b>	<b>93</b>	<b>260</b>	<b>344</b>	<b>282</b>	<b>278</b>	<b>173</b>

There have not been any highly significant changes in recycling yields per household for the various materials. This can be seen by comparing the 2007/08 and 2008/09 median yields across the materials. The main difference is the *number of local authorities* in England targeting more materials, with a significant increase in local authorities targeting card (and a corresponding decrease in authorities targeting paper only) and slight increases in the number of local authorities targeting cans, glass and plastic. There is a substantial increase in the number of local authorities targeting all 5 materials, with 173 England authorities collecting all of these materials during 2008/09 (nearly half of all England local authorities).

Median values for yields collected are generally similar for both periods. Where they are lower during 2008/09 compared to 2007/08, as is the case for *paper and card* and *all five materials*, this is most likely due to some local authorities that did not collect those materials during 2007/08 commencing collections during 2008/09. It may be the case that the lower median yields for 2008/09 for *paper and card* and *all five materials* are due to these authorities rolling out the collection of new materials partway through 2008/09, resulting in lower annual yields. It is also possible that lower yields are associated with other factors, such as the effects of the economic recession (i.e. lower consumption of paper and other materials commonly targeted for recycling) or light-weighting of packaging. However insufficient data was available to this study to test whether this was the case.

Separate material-specific benchmarks for England, Wales, Scotland and Northern Ireland is provided in Appendix 2, Tables A2.1 to A2.4.

### 3.1 Performance for various material collection combinations

The recycling yields for local authorities targeting different combinations of materials (excluding textiles) are presented in Table 4.

**Table 4:** Material collection combinations, excluding textiles - UK 2008/09

	paper, card, cans, glass & plastic	paper, card, cans & glass	paper, card, cans & plastic	paper, cans, glass & plastic	paper, cans & glass	paper, cans & plastic
Minimum	32.7	69.2	27.6	30.7	62.6	57.7
Lower Quartile	137.0	104.2	133.2	113.3	106.9	76.8
Median	170.6	127.3	162.6	148.1	128.7	95.2
Upper Quartile	206.0	162.2	179.6	167.6	149.1	100.3
Maximum	299.9	214.7	229.8	204.5	191.0	112.8
Count	206	28	88	45	42	6

The recycling yields for local authorities targeting different combinations of materials (excluding textiles) are illustrated in Figure 2. The upper ranges for each quartile are included in Figure 2, with minimum values indicated by the brown numbers.

**Figure 2:** Kerbside material-specific dry recycling performance (kg/hh/yr), excluding textiles – UK 2008/09

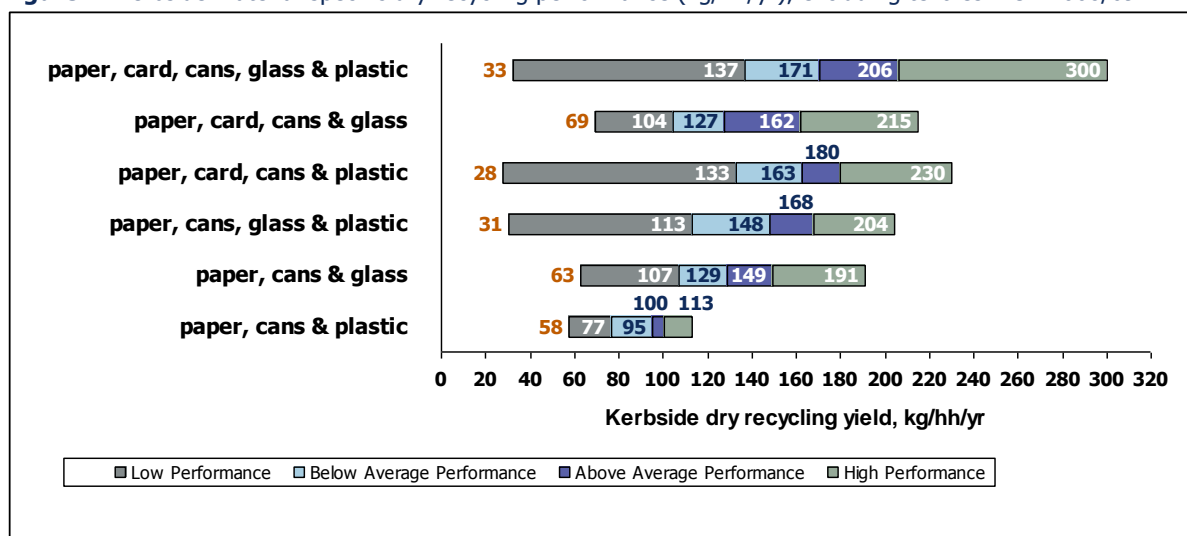


Table 4 and Figure 2 demonstrate that the highest performing authorities are those that target all 5 materials (paper, card, cans, glass & plastic), though there is a wide range in performance amongst these authorities.

The recycling yields for local authorities targeting different combinations of materials *including textiles* are benchmarked in Table 5 and illustrated in Figure 3. The upper ranges for each quartile are included in Figure 3, with minimum values indicated by the brown numbers.

**Table 5:** Material collection combinations, including textiles - UK 2008/09

	paper, card, cans, glass, plastic & textiles	paper, card, cans, glass & textiles	paper, card, cans, plastic & textiles	paper, cans, glass, plastic & textiles	paper, cans, glass & textiles	paper, cans, plastic & textiles
Minimum	59.9	69.5	134.1	83.8	81.0	
Lower Quartile	135.4	89.5		114.7	113.4	
Median	162.5	120.2	160.8	147.4	131.2	
Upper Quartile	188.9	134.3		168.7	157.1	
Maximum	303.4	167.1	206.7	197.3	177.5	
Count	74	8	4	22	20	0

**Figure 3:** Kerbside material-specific dry recycling performance (kg/hh/yr), including textiles – UK 2008/09

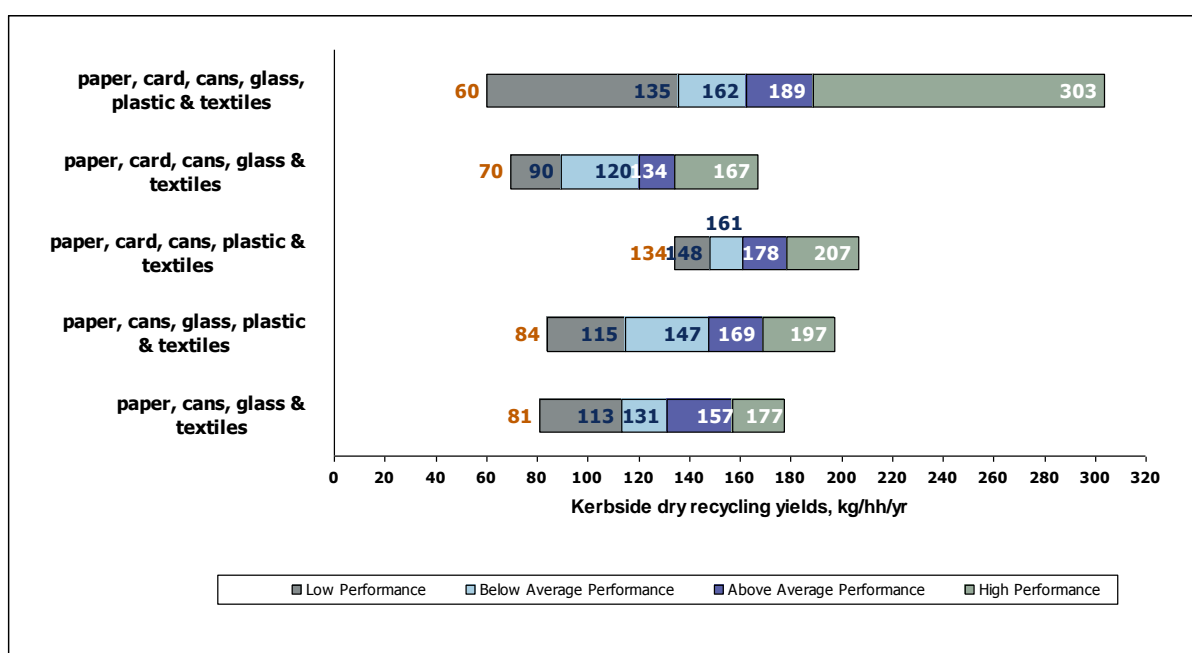


Table 5 and Figure 3 demonstrate that the highest performing authorities are those that target all 6 materials (paper, card, cans, glass, plastic and textiles), though there is a wide range in performance amongst these authorities.

## 4.0 Local authority characteristics

This section discusses kerbside dry recycling performance during 2008/09 according to socio-demographic characteristics (including levels of deprivation and population density) and provides benchmark data for each ONS Local Authority Area Type.

### 4.1 Socio-demographic characteristics

This study has confirmed the findings (of several previous studies) that levels of deprivation are an influential factor affecting kerbside dry recycling performance, with areas with higher levels of deprivation generally achieving lower performance (once all other factors considered in this study are taken into account).

However, rather than looking at the relationship between deprivation levels and recycling performance in isolation, it is more useful to view deprivation in the context of other factors that have been found to be significant in affecting kerbside dry recycling performance (such as collection system characteristics), as presented in the regression modelling outputs in Section 2. If deprivation levels are considered in isolation from other factors, much weaker correlations are found with recycling performance.

This is also the case for other socio-demographic factors, such as housing type or population density. Average household sizes can also be expected to be a significant factor when measuring performance on the basis of kilogrammes per household per year. However whilst we can expect this to be the case for some local authorities (i.e. those with particularly large or small average household sizes), it is not a generally significant factor amongst local authorities in the UK as a whole. These issues are further discussed in Appendix 1.

### 4.2 ONS Local Authority Area Classification 2001

Material-specific kerbside recycling yields were calculated for each of the local authority groups identified in the Office of National Statistics Local Authority Area Classification 2001. This classification defines local authorities on the basis of key socio-demographic and geographic characteristics common to the population (i.e. demographic profile, household composition, housing type, socio-economic and employment profile). For further information regarding the ONS classifications, visit:

[http://www.statistics.gov.uk/about/methodology\\_by\\_theme/area\\_classification/](http://www.statistics.gov.uk/about/methodology_by_theme/area_classification/)

The ONS classifications have been adapted for this study and 10 types of authority are described (with the number of local authorities in each classification indicated in brackets):

- Regional Centres (24);
- Centres with Industry (20);
- Prospering Small Towns (118);
- New & Growing Towns (21);
- Prospering Southern England (45);
- Coastal and Countryside (77);
- Industrial Hinterlands (46);
- Manufacturing Towns (44);
- Inner London (14); and
- Outer London & Thriving London periphery (25).

Benchmark data are presented for each of these area types in Tables 6 to 15.

**Table 6:** Kerbside material specific dry recycling performance – “Regional Centres” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	47.0	43.1	0.0	7.7	1.9	52.8	0.4	114.0
Lower Quartile		82.0	5.4	22.3	10.2	140.5	1.2	
Median	64.2	102.3	7.1	35.8	12.9	162.8	1.6	151.3
Upper Quartile		134.5	8.5	42.0	15.1	202.3	2.5	
Maximum	72.7	168.9	11.7	56.1	19.8	237.6	2.8	209.6
Count	3	21	23	16	20	12	5	3

**Table 7:** Kerbside material specific dry recycling performance – “Centres with Industry” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	38.1	22.1	0.8	2.1	0.4	32.7	0.0	59.9
Lower Quartile		56.1	3.7	22.2	4.4	83.6	0.2	91.6
Median	44.8	78.2	7.2	27.8	9.9	126.8	0.5	146.5
Upper Quartile		84.0	11.3	45.6	13.1	155.7	1.2	160.4
Maximum	51.4	162.3	15.1	70.6	15.4	228.7	3.3	162.4
Count	2	19	20	21	20	18	8	6

**Table 8:** Kerbside material specific dry recycling performance – “Prospering Smaller Towns” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	34.6	42.0	2.3	0.0	2.3	64.8	0.0	65.5
Lower Quartile	66.3	99.1	7.3	39.7	9.8	163.9	1.0	170.9
Median	78.4	129.6	10.6	49.3	15.4	189.2	1.8	194.3
Upper Quartile	83.0	154.6	12.3	58.5	21.9	218.2	2.9	225.3
Maximum	111.1	194.7	19.3	79.2	28.5	299.9	6.0	303.4
Count	38	80	116	93	89	50	45	24

**Table 9:** Kerbside material specific dry recycling performance – “New and Growing Towns” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	61.3	53.3	4.3	3.0	3.8	142.7	1.5	
Lower Quartile		121.6	6.9	32.6	11.5	170.8		
Median	65.3	132.3	8.3	36.7	16.6	185.9	2.5	225.2
Upper Quartile		142.2	10.6	42.7	19.9	223.6		
Maximum	83.6	166.8	20.2	54.5	22.5	234.7	3.2	225.2
Count	3	20	23	16	21	13	3	1

**Table 10:** Kerbside material specific dry recycling performance – “Prospering Southern England” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	46.9	86.1	1.4	23.7	3.6	164.9	0.2	165.1
Lower Quartile	76.2	125.1	7.6	47.5	11.8	213.2	1.0	
Median	86.4	150.2	9.9	54.1	16.3	239.1	1.9	198.2
Upper Quartile	98.0	163.5	12.0	63.2	20.5	252.9	3.0	
Maximum	109.4	197.7	17.6	75.1	27.4	278.2	4.8	225.0
Count	15	30	43	31	33	18	7	3

*The above table corresponds to Table 14 in the 2007/08 report*

**Table 11:** Kerbside material specific dry recycling performance – “Coastal and Countryside” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	11.4	20.7	0.3	0.6	0.9	45.6	0.0	102.1
Lower Quartile	49.7	76.6	6.3	27.0	6.7	108.6	0.4	136.7
Median	74.8	98.6	8.2	38.4	11.6	142.7	1.0	161.3
Upper Quartile	77.0	118.6	11.0	52.5	17.0	170.3	2.1	175.2
Maximum	104.7	161.5	14.6	65.2	23.6	185.2	3.5	182.8
Count	13	48	58	43	45	22	15	9

**Table 12:** Kerbside material specific dry recycling performance – “Industrial Hinterlands” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	43.8	48.4	2.2	6.8	0.2	84.7	0.0	94.6
Lower Quartile	51.1	75.6	5.6	25.3	7.6	110.7	0.4	111.4
Median	58.9	90.9	8.5	31.8	13.8	150.8	1.1	151.8
Upper Quartile	64.9	122.8	10.7	41.6	17.9	165.9	2.0	165.5
Maximum	83.1	159.3	16.7	63.0	24.6	224.1	4.6	211.1
Count	11	35	44	40	37	24	21	11

**Table 13:** Kerbside material specific dry recycling performance – “Manufacturing Towns” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	42.4	59.3	1.3	6.2	1.3	101.2	0.1	122.9
Lower Quartile	58.9	96.2	6.0	37.3	10.1	148.7	0.3	144.7
Median	62.9	115.3	9.0	42.3	13.5	188.5	1.4	165.5
Upper Quartile	75.4	136.9	12.2	50.7	18.2	209.0	2.0	178.0
Maximum	131.0	160.5	17.0	79.3	23.2	240.8	2.5	212.4
Count	13	31	42	34	33	18	15	7

**Table 14:** Kerbside material specific dry recycling performance – “Inner London Boroughs” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		22.5	1.4	17.7	3.7	94.0	0.1	110.8
Lower Quartile		72.1	3.7	21.2	6.9	110.2		
Median		99.7	5.4	28.8	10.1	152.2	0.4	120.7
Upper Quartile		127.2	6.5	34.0	11.8	180.7		
Maximum		139.3	8.0	36.8	12.9	196.0	0.6	130.5
Count	0	14	14	13	14	13	2	2

*The above table corresponds to Table 18 in the 2007/08 report*

**Table 15:** Kerbside material specific dry recycling performance – “Outer London & Thriving London Periphery” - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	55.1	47.8	0.4	13.5	2.5	73.0	0.0	112.9
Lower Quartile		89.2	4.5	27.1	8.1	136.0	0.8	129.0
Median	62.4	104.6	5.9	35.0	11.6	173.6	1.1	141.4
Upper Quartile		133.1	7.7	41.9	14.3	190.7	1.8	154.3
Maximum	74.9	160.1	20.2	71.9	21.2	229.6	3.5	169.9
Count	4	21	25	23	24	18	8	6

*The above table corresponds to Table 19 in the 2007/08 report*

The range of kerbside dry recycling performance for each area type is illustrated in Figure 4. The upper ranges for each quartile are included in Figure 4, with minimum values indicated by the brown numbers.

**Figure 4:** Kerbside dry recycling performance, all materials excluding textiles (kg/hh/yr), according to ONS Area Classifications, UK 2008/09

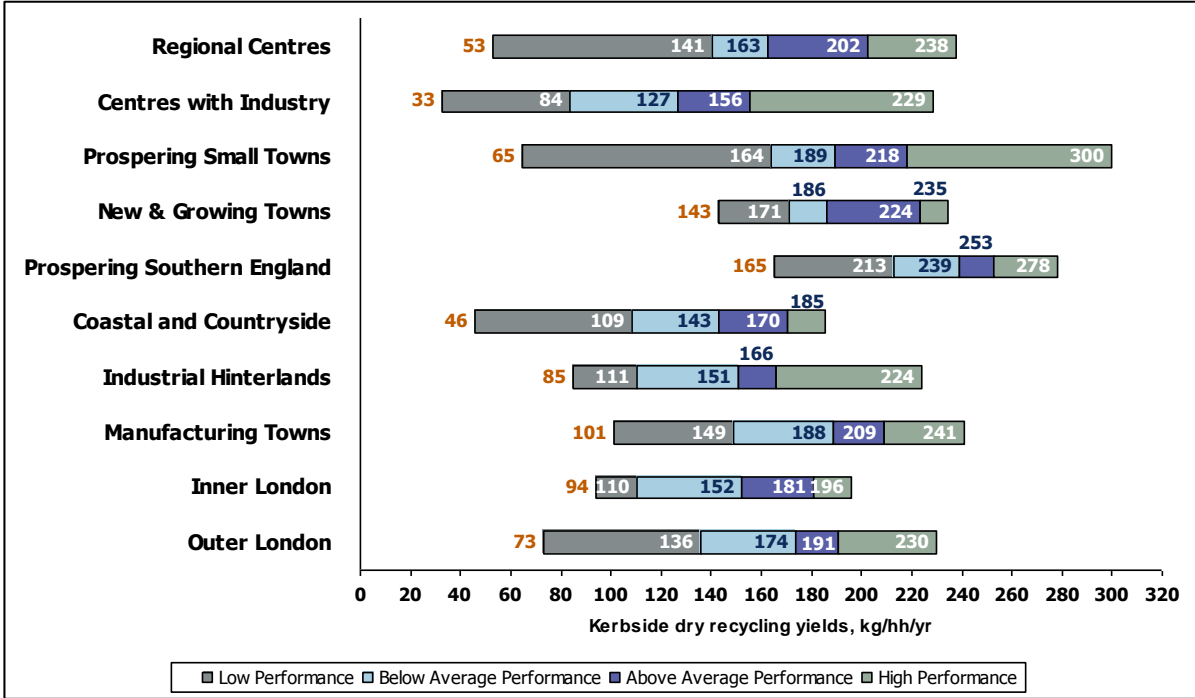


Figure 4 shows that “Prospering Small Towns” and “Prospering Southern England” authorities generally perform relatively well compared to other authority types, this is likely to be due to these areas having deprivation levels which are, on average below those of other area types; (higher levels of deprivation are associated with lower recycling performance – see Section 2). However, there is a very wide range of performance for “Prospering Small Towns”, which is perhaps a result of these area types containing a mix of more and less affluent areas.

The Inner London authorities have attained relatively low recycling performance in comparison to other area types, which may partly be reflected in the challenges of recycling in densely populated areas with a high proportion of multi-occupancy properties, and with deprivation levels and cultural diversity also presenting challenges to achieving higher recycling performance. However, it is too simplistic to equate densely populated areas with lower recycling performance. For example, the poorest performing area type is “Coastal and Countryside”, which includes many rural areas, and perhaps reflects the different challenges associated with achieving high recycling performance in rural contexts.

For the best available description of the effects of various factors on kerbside dry recycling performance, it is necessary to refer back to the regression model presented in Section 2.

## 5.0 Kerbside recycling service characteristics

In this section, benchmark data is provided for different kerbside dry recycling service profiles. A dry recycling service profile is defined here as the combination of the dry recycling scheme and the associated residual waste scheme provided to households. Local authorities were included for analysis if a single kerbside dry recycling service served 90% or more of households receiving a kerbside recycling service in the authority; (see Section 1.2.3).

Dry recycling service profiles were classified on the basis of the following:

- Dry recycling scheme type (kerbside sort, single stream co-mingled, two stream co-mingled); (see Table 16 below);
- Dry recycling collection frequency;
- Dry recycling scheme containment type; and
- Residual waste collection frequency.

**Table 16:** Definitions of kerbside dry recycling scheme types adopted for this study

Scheme type	Description
Kerbside Sort	The materials are separated at kerbside into a multi-compartment vehicle to such an extent that they can be sold directly to a reprocessor and require minimal sorting. The material streams sold can include paper and card together, and cans and plastic mixed together.
Single Stream Co-mingled	All the material collected goes into a single compartment vehicle (e.g. RCV) and requires sorting at a Materials Recycling Facility (MRF).
Two Stream Co-mingled	One fraction of the material collected is mixed sufficiently that it requires sorting at a MRF. The other fraction does not require sorting (and can be sold directly to a reprocessor) and is collected either on a split compartment vehicle or on a separate vehicle.

A classification of collection systems is presented in Table 17 below, taking into account scheme type, dry recycling collection frequency, dry recycling containment method and residual waste collection frequency. The numbers of local authorities in the UK found to conform to the different classifications of collection system during 2008/09 are also illustrated in Table 17. A collection system was included in these classifications if it was found that 10 or more local authorities across the UK were operating that system. Therefore the *Other schemes* category contains collection scheme variations based on collection frequency or containment type that are shared by fewer than 10 local authorities in the UK.

In Table 17 we can see that a total of 333 local authorities have been classified according to kerbside dry collection system. Since there are a total of 434 local authorities in the United Kingdom being considered in this study, this means that it has not been possible to classify schemes for 101 authorities. This is due to these authorities not meeting the criteria that 90% of households offered a kerbside recycling service in that authority are served by one definable kerbside dry recycling system, because several recycling systems are in place. This fairly restrictive criteria has been applied in order that consistent benchmark data can be produced. For example, the benchmark data for *kerbside sort, weekly dry, box/sack, weekly residual* authorities in Table 18 below can be viewed in the confidence that they refer to only authorities where this collection system is offered to at least 90% of residents. (More flexible criteria were applied to the definitions of collection systems for the purposes of the regression analyses carried out for this study; see Appendix 1.)

The data on collection system types was obtained from WRAP's annual survey of local authorities.

**Table 17** Kerbside dry recycling service classifications, UK 2008/09

<b>Scheme type</b>	<b>Collection frequency</b>	<b>Collection container</b>	<b>Residual waste frequency</b>	<b>No. of LAs</b>	<b>% of LAs</b>
kerbside sort	weekly	box/sack	weekly	22	6.6%
kerbside sort	weekly	box/sack	fortnightly	18	5.4%
kerbside sort	fortnightly	box/sack	weekly	59	17.7%
kerbside sort	fortnightly	box/sack	fortnightly	53	15.9%
single stream co-mingled	weekly	box/sack	weekly	11	3.3%
single stream co-mingled	fortnightly	wheeled bin	weekly	12	3.6%
single stream co-mingled	fortnightly	wheeled bin	fortnightly	63	18.9%
two stream co-mingled	fortnightly	box/sack	weekly	11	3.3%
two stream co-mingled	fortnightly	box/sack	fortnightly	12	3.6%
two stream co-mingled	fortnightly	wheeled bin / box/sack	fortnightly	12	3.6%
other scheme types				60	18.0%
<b>TOTAL</b>				<b>333</b>	<b>100%</b>

Benchmark data for kerbside sort systems are provided in Section 5.1, for single stream co-mingled in Section 5.2, for two stream co-mingled in Section 5.3.

## 5.1 Kerbside sort services

Benchmark data for the kerbside sort systems defined in Table 17 are presented in Tables 18 to 21 below. For a definition of kerbside dry recycling scheme types, refer to Table 16, Section 5.0.

**Table 18:** Kerbside sort, weekly dry, box/sack, weekly residual, UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	38.1	82.1	1.4	18.0	3.8	136.4	0.1	137.6
Lower Quartile	60.7	89.7	5.2	38.5	8.1	162.5	0.9	163.8
Median	73.9	102.1	7.6	50.8	10.9	168.7	1.1	171.4
Upper Quartile	82.2	112.1	9.5	54.6	15.4	182.0	1.8	203.6
Maximum	95.0	147.8	15.8	76.1	24.6	224.7	2.9	225.0
Count	10	12	20	21	14	9	14	6

**Table 19:** Kerbside sort, weekly dry, box/sack, fortnightly residual, UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	69.4	62.2	4.7	21.2	5.2	94.1	0.6	122.9
Lower Quartile	77.3	68.0	8.5	46.3	10.5	129.4	1.6	142.8
Median	87.5	94.4	10.9	58.4	12.3	173.2	2.0	170.4
Upper Quartile	92.2	118.4	13.8	65.1	14.6	212.0	3.9	198.5
Maximum	111.1	137.4	18.1	68.7	23.4	233.6	6.0	234.3
Count	6	12	18	18	16	11	10	6

**Table 20:** Kerbside sort, fortnightly dry, box/sack, weekly residual - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	34.6	20.7	1.7	17.3	1.2	102.0	0.0	103.8
Lower Quartile	56.6	71.5	5.7	29.1	7.2	158.3	0.5	160.5
Median	71.3	93.5	7.4	37.8	10.5	161.7	1.1	170.0
Upper Quartile	76.0	109.5	9.7	48.2	16.4	195.3	1.9	181.7
Maximum	105.1	127.1	15.6	63.4	25.9	218.4	3.5	198.2
Count	27	31	53	58	25	17	20	6

**Table 21:** Kerbside sort, fortnightly dry, box/sack, fortnightly residual - UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	52.0	46.2	3.3	25.8	3.6	130.2	0.0	136.4
Lower Quartile	65.4	78.2	8.6	41.4	8.8	154.8	0.3	156.7
Median	79.3	87.9	11.1	50.3	11.8	165.6	1.2	162.5
Upper Quartile	89.2	101.0	12.9	58.2	15.5	184.8	2.5	186.2
Maximum	109.4	136.4	19.3	75.1	21.7	209.9	4.8	212.4
Count	29	24	52	52	27	17	30	13

## 5.2 Single stream co-mingled services

Benchmark data for the single stream co-mingled systems defined in Table 17 are presented in Tables 22 to 24 below. For a definition of kerbside dry recycling scheme types, refer to Table 16, Section 5.0. The benchmark data presented allow for a 10% MRF reject rate (see Section 1.2.1).

**Table 22:** Single stream co-mingled, weekly dry, box/sack, weekly residual (brackets indicate an assumed 10% MRF reject rate) UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		22.5 (20.2)	1.4 (1.3)	23.8 (21.4)	3.7 (3.4)	126.8 (114.1)	2.5 (2.2)	209.6 (188.7)
Lower Quartile		100.2 (90.1)	5.3 (4.8)		9.9 (8.9)			
Median		130.0 (117.0)	8.8 (7.9)	38.7 (34.8)	19.0 (17.1)	189.6 (170.7)	2.8 (2.5)	236.4 (212.7)
Upper Quartile		137.9 (124.1)	10.6 (9.5)		19.9 (17.9)			
Maximum		168.8 (151.9)	11.5 (10.3)	56.5 (50.8)	24.1 (21.7)	260.0 (234.0)	3.1 (2.8)	263.1 (236.8)
Count	0	11	11	4	11	4	2	2

**Table 23:** Single stream co-mingled, fortnightly dry, wheeled bin, weekly residual (brackets indicate an assumed 10% MRF reject rate) UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		89.7 (80.7)	4.5 (4.1)	0.0 (0.0)	8.2 (7.4)	162.3 (146.1)		
Lower Quartile		123.8 (111.4)	7.6 (6.9)	39.7 (35.7)	14.1 (12.7)	211.1 (190.0)		
Median		140.8 (126.7)	8.1 (7.3)	41.7 (37.6)	15.2 (13.6)	221.4 (199.3)		
Upper Quartile		154.4 (138.9)	9.4 (8.4)	46.1 (41.5)	17.0 (15.3)	228.3 (205.5)		
Maximum		162.3 (146.0)	10.6 (9.5)	52.7 (47.4)	19.4 (17.4)	232.2 (208.9)		
Count	0	12	12	6	12	6	0	0

**Table 24:** Single stream co-mingled, fortnightly dry, wheeled bin, fortnightly residual (brackets indicate an assumed 10% MRF reject rate) UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		81.7 (73.5)	3.6 (3.2)	6.5 (5.8)	9.2 (8.3)	170.8 (153.7)	3.0 (2.7)	
Lower Quartile		123.9 (111.5)	8.0 (7.2)	37.1 (33.3)	15.2 (13.7)	223.9 (201.5)		
Median	131.0 (117.9)	138.7 (124.9)	10.8 (9.7)	42.4 (38.1)	20.1 (18.0)	225.8 (203.2)	3.2 (2.9)	292.9 (263.6)
Upper Quartile		158.5 (142.7)	12.1 (10.9)	46.1 (41.5)	22.4 (20.2)	256.3 (230.7)		
Maximum	131.0 (117.9)	197.7 (177.9)	15.5 (13.9)	62.9 (56.6)	28.8 (25.9)	289.5 (260.5)	3.4 (3.1)	292.9 (263.6)
Count	1	62	63	12	63	11	2	1

### 5.3 Two stream co-mingled services

Benchmark data for the two stream co-mingled systems defined in Table 17 are presented in Tables 25 to 27 below. For a definition of kerbside dry recycling scheme types, refer to Table 16, Section 5.0. The benchmark data presented allow for a 10% MRF reject rate (see Section 1.2.1).

**Table 25:** Two stream co-mingled, fortnightly dry, box/sack, weekly residual (brackets indicate an assumed 10% MRF reject rate) UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		64.4 (58.0)	4.0 (3.6)	8.9 (8.0)	3.4 (3.0)	107.0 (96.3)	0.0 (0.0)	112.9 (101.6)
Lower Quartile		77.7 (70.0)	6.1 (5.5)	26.7 (24.0)	8.0 (7.2)	112.1 (100.9)	2.0 (1.8)	
Median	66.3 (59.7)	79.6 (71.6)	7.8 (7.0)	32.9 (29.6)	12.2 (11.0)	125.4 (112.8)	2.1 (1.9)	120.3 (108.2)
Upper Quartile		106.7 (96.0)	9.2 (8.3)	39.1 (35.1)	16.7 (15.0)	173.2 (155.9)	2.8 (2.5)	
Maximum	66.3 (59.7)	150.5 (135.5)	12.0 (10.8)	60.1 (54.1)	22.0 (19.8)	244.6 (220.2)	2.8 (2.6)	176.0 (158.4)
Count	1	10	11	9	11	9	5	4

**Table 26:** Two stream co-mingled, fortnightly dry, box/sack, fortnightly residual (brackets indicate an assumed 10% MRF reject rate) UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	74.2 (66.8)	72.0 (64.8)	4.8 (4.4)	29.0 (26.1)	6.9 (6.2)	153.3 (138.0)	0.1 (0.1)	153.4 (138.1)
Lower Quartile		107.8 (97.0)	7.7 (6.9)	38.2 (34.4)	9.4 (8.4)	180.7 (162.7)		
Median	77.0 (69.3)	119.6 (107.6)	11.3 (10.2)	55.8 (50.2)	14.7 (13.2)	221.6 (199.5)	0.6 (0.5)	190.2 (171.2)
Upper Quartile		138.3 (124.4)	13.2 (11.9)	59.8 (53.8)	20.0 (18.0)	252.9 (227.6)		
Maximum	88.6 (79.7)	168.6 (151.7)	14.7 (13.2)	68.5 (61.6)	24.6 (22.1)	265.9 (239.3)	1.1 (1.0)	226.9 (204.2)
Count	3	9	12	8	10	6	2	2

**Table 27:** Two stream co-mingled, fortnightly dry, wheeled bin and sack/box, fortnightly residual (brackets indicate an assumed 10% reject rate) UK 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	61.8 (55.6)	83.9 (75.5)	7.0 (6.3)	3.0 (2.7)	8.0 (7.2)	139.2 (125.2)		
Lower Quartile		93.4 (84.1)	10.4 (9.3)	34.1 (30.7)	15.2 (13.7)	150.7 (135.7)		
Median	65.5 (59.0)	129.1 (116.2)	12.3 (11.1)	47.0 (42.3)	17.0 (15.3)	201.6 (181.4)	1.3 (1.2)	
Upper Quartile		155.9 (140.3)	12.8 (11.5)	61.8 (55.6)	21.8 (19.6)	233.8 (210.4)		
Maximum	69.3 (62.4)	158.7 (142.8)	17.0 (15.3)	79.3 (71.4)	23.2 (20.8)	244.4 (220.0)	1.3 (1.2)	
Count	2	10	11	12	11	10	1	0

### 5.3.1 Discussion of results from benchmarking data by collection scheme type

The range of performance data for each kerbside collection system (defined in Table 17, Section 5.0) is presented in Figure 5 for authorities in the UK targeting all 5 main materials (paper, card, glass, cans and plastic). This shows a fairly complex picture in terms of the yields achieved by different systems and it is important to bear in mind that the benchmark yields for different collection configurations are likely to be affected by the different area types associated with different collection systems.

This point is borne out by comparing Figure 5 (benchmark data by collection system for UK local authorities) with Figure 6 (benchmark data by collection system for England local authorities). We can see that for the first two collection system types in Figures 5 and 6 – kerbside sort with weekly dry recycling collections – there are much wider ranges in yields for the UK authorities in Figure 5 in comparison with Figure 6, which shows a narrower range of performance towards higher yields for England local authorities. The local authorities outside England with kerbside sort and weekly recycling generally have deprivation levels which are significantly above the average for the UK. From the regression model in Section 2, we know that deprivation is a strongly significant factor affecting kerbside dry recycling yields, with higher levels of deprivation being associated with lower yields. Therefore the wider range of yields for the United Kingdom local authorities (in comparison to England local authorities) is probably largely due to the inclusion of relatively deprived local authorities outside England.

In relation to kerbside sort systems, those schemes with fortnightly recycling collections generally do not perform as well as those with weekly recycling collections. This is particularly apparent when looking at data for England authorities (Figure 6), where the deprivation levels for the various kerbside schemes are broadly comparable. This suggests that the capacity provided to householders for recycling is insufficient for some kerbside sort systems which collect recycling fortnightly or less frequently. For these schemes, increased capacity would be required in order to improve performance, either by providing a great volume of capacity (an extra recycling box, for instance) or increasing recycling collection frequency to weekly.

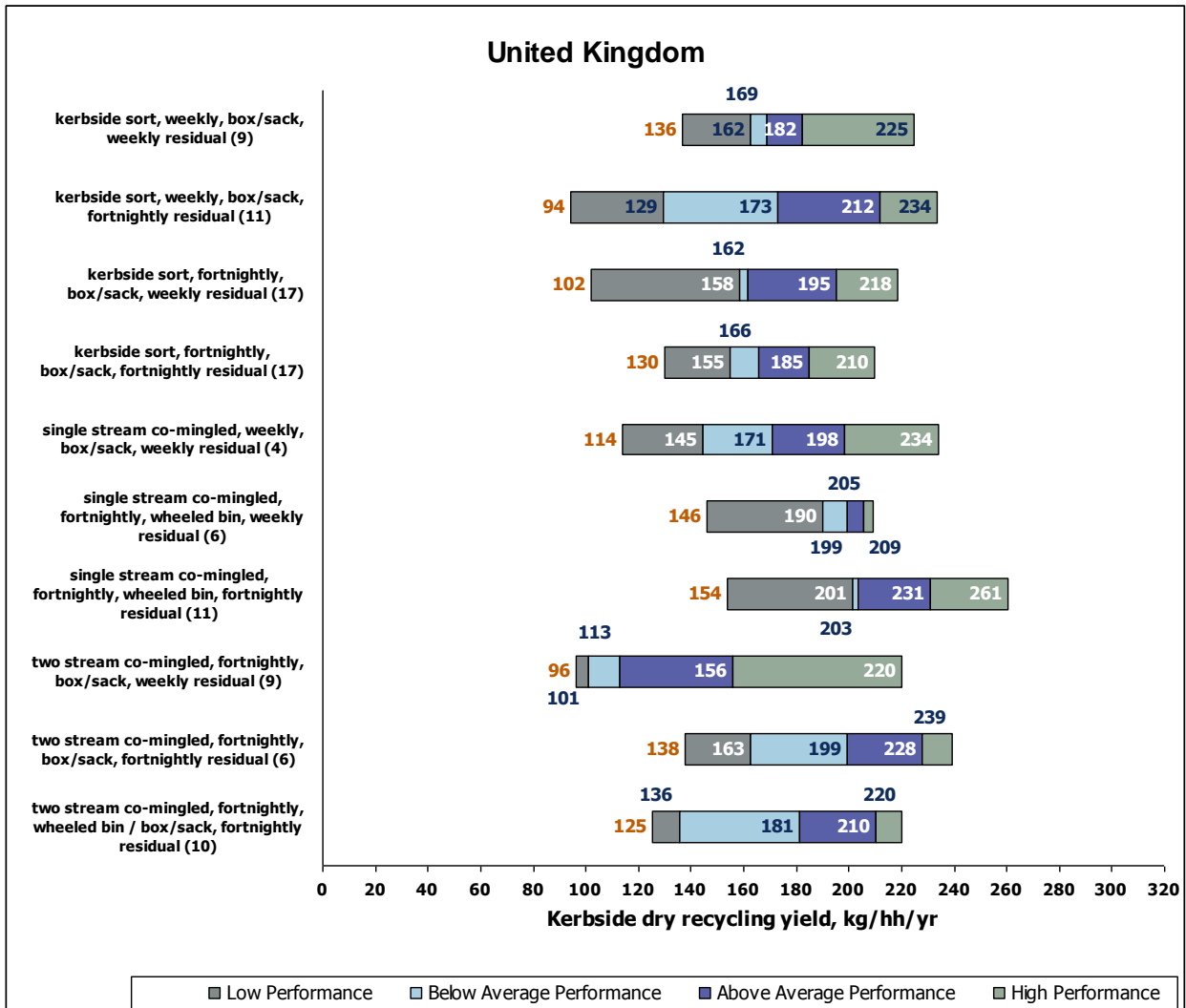
It is interesting that there is a fair degree of variation in performance for both the kerbside sort and co-mingled systems. In respect of co-mingled systems, single stream co-mingled with fortnightly refuse collections are generally performing well, though it should be taken into account that we have applied a 10% reject rates at MRFs for co-mingled systems and that the true reject rate will be quite different for particular local authorities, and could be quite different for various types of co-mingled collection systems.

However, for the best available description of the effects of collection system configurations on kerbside dry recycling performance, it is necessary to refer to the regression model presented in Section 2. The regression model was successful in separately identifying those factors relating to collection systems that are most influential in affecting kerbside dry recycling performance. Since these are the factors which, in principle, are in the power of local authorities to change (in contrast to the socio-demographic and regional factors described in Section 2), they are of particular interest. It is therefore worth concluding with the collection system factors which have been found to have the greatest positive effects on kerbside dry recycling performance:

- The range of materials targeted is clearly vitally important in terms of kerbside dry recycling performance; and
- Refuse collection frequency is an important collection system factor, having a significant beneficial effect on recycling performance; and

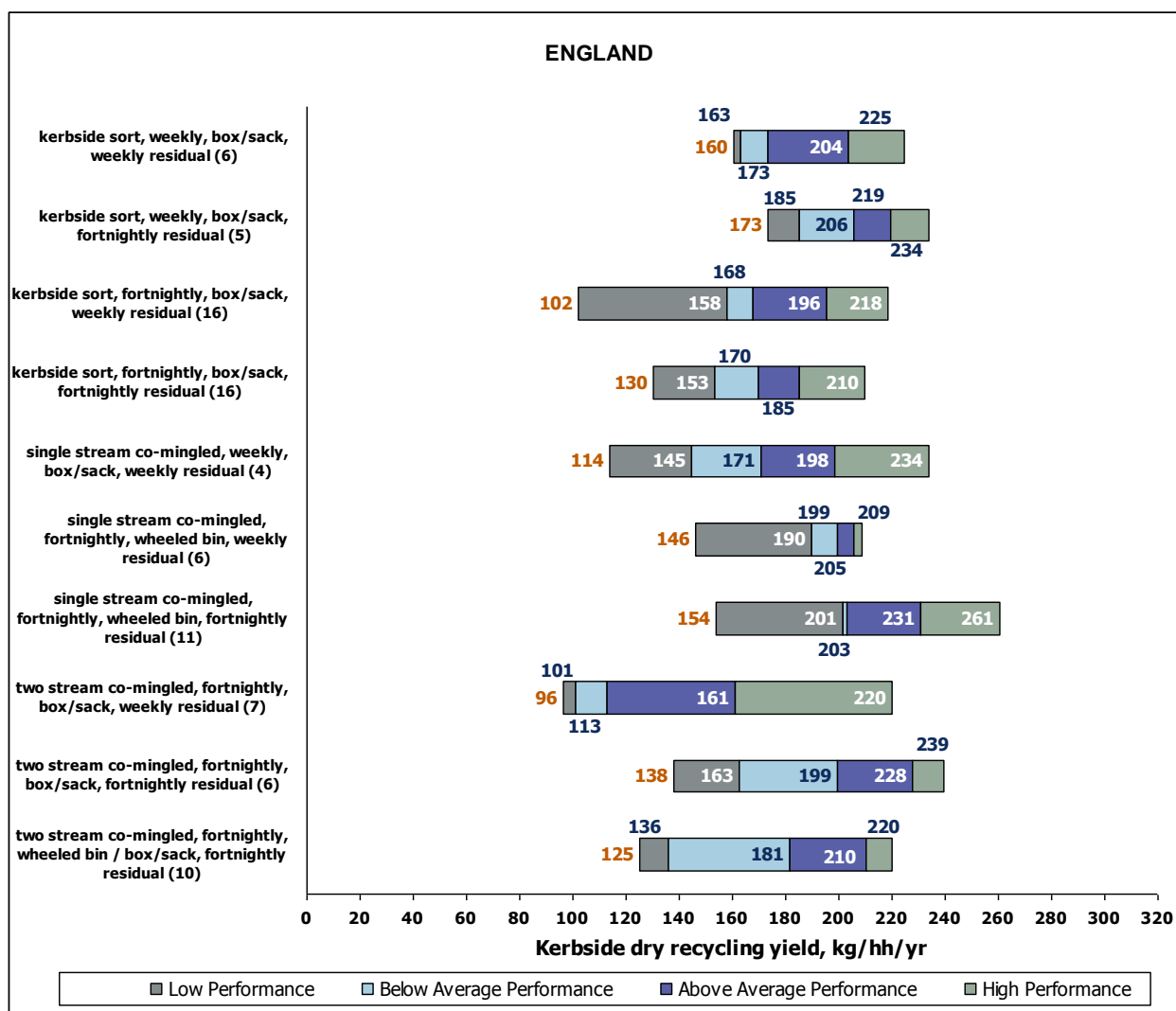
Dry recycling containment capacity (meaning weekly equivalent capacity, so taking dry recycling containment volumes and collection frequencies in to account) is less significant, but still important, with greater weekly equivalent containment capacity being associated with better kerbside dry recycling performance. In particular, this means that for a given volume of dry recycling kerbside collection containment, weekly dry recycling collections perform better than where dry recycling is collected less frequently.

**Figure 5:** Kerbside recycling performance – local authorities collecting all 5 materials, according to kerbside collection system classification (assuming a 10% MRF rejection rate for co-mingled schemes), UK 2008/09\*.



\* Please note that the data for some collection scheme types encompass a small number of authorities (given in brackets after scheme type). This should be considered when interpreting the data.

**Figure 6:** Kerbside recycling performance – local authorities collecting all 5 materials, according to kerbside collection system classification (assuming a 10% MRF rejection rate for co-mingled schemes), England 2008/09\*.



\* Please note that the data for some collection scheme types encompass a small number of authorities (given in brackets after scheme type). This should be considered when interpreting the data.

## 6.0 Conclusions

This report has benchmarked kerbside dry recycling performance for local authorities in the UK during 2008/09. It is an update of a previous WRAP study, *Analysis of kerbside dry recycling performance in England 2007/08*. The main differences with the previous study are:

- The 2007/08 study covered all local authorities in England, whereas this study relates to 2008/09 data and is extended to cover all local authorities in the United Kingdom; and
- This study includes 2008/09 benchmark data for textiles collected for recycling at the kerbside; these data were not included in the 2007/08 study.

When comparing the performance of England local authorities during 2007/08 and 2008/09, it was found that there have not been any highly significant changes in recycling yields per household for the various materials. The main difference is the *number of local authorities* in England targeting various materials, with a significant increase in local authorities targeting card (and a corresponding decrease in authorities targeting paper only) and slight increases in the number of local authorities targeting cans, glass and plastic. There is a substantial increase in the number of local authorities targeting all 5 materials, with 173 England authorities collecting all of these materials during 2008/09 (nearly half of all England local authorities).

Benchmark data has been produced in respect of ranges of materials targeted for kerbside dry recycling (Section 3), local authority area types (Section 4) and collection scheme types (Section 5). These data are a useful resource for local authorities wishing to benchmark their kerbside dry recycling performance against similar local authorities in the UK. Some patterns in kerbside dry recycling performance are discernable from the benchmark tables. However kerbside dry recycling performance is influenced by several factors and can be best understood through referring to the regression model presented in Section 2.

The regression model produced for this report is by far the most powerful explanatory model describing how kerbside dry recycling performance is influenced by various factors. The factors found to be influential in affecting kerbside dry recycling performance are:

- **Socio-economic**, with higher deprivation being associated with lower recycling performance;
- **Range of materials targeted**, with those local authorities targeting a wider range of materials for dry recycling achieving higher kerbside dry recycling yields;
- **Kerbside collection system characteristics**, with those areas with less containment volumes for residual waste (most commonly through providing fortnightly residual collections) and greater capacity provided to householders for presenting their dry recycling at the kerbside (sufficient dry recycling containment capacity and collection frequency) achieving higher dry recycling yields at the kerbside; and
- **Regional**, with some regional variations in kerbside recycling performance that cannot be explained by the other factors in the model, or by any other factors tested during this study.

Of these factors, those found to be most influential were levels of deprivation (with lower yields associated with higher levels of deprivation), the range of materials targeted (with wider ranges of materials targeted achieving higher dry recycling yields) and fortnightly refuse collections (being associated with higher dry recycling yields in comparison to weekly refuse collections).

# Appendix 1: Regression models

## Regression model for local authorities in the UK

In Section 2 we describe a regression model which identifies how different factors affect kerbside dry recycling performance. The model has a high degree of explanatory power (adjusted  $R^2 = 0.423$ ), particularly in the context of waste data and investigations of how kerbside recycling systems work. In fact, the regression modelling presented in this report is – to the best of our knowledge – of a far higher degree of explanatory power in comparison to any previous modelling in this field. The model presented in Section 2 represents the most important finding of this report, as it identifies the separate effects of those factors which are most influential in affecting kerbside dry recycling performance. Given the importance of this model, we provide full details of the model here, including colinearity diagnostics, (which confirm that the model does not rely on intercorrelations between the factors included in the model to achieve an artificially high degree of explanatory).

Although it is easy to build models that explain more of the variation, these are not as statistically robust as they are generally 'over-determined'. This problem is caused when too many inter-correlated variables (variables that are not strictly independent of one another) are introduced into a model, the proportion of variance explained increases. This is a particular problem with datasets that describe recycling performance: housing type and collection system characteristics are related to one another to some degree. This is an aspect of modelling that needs careful scrutiny and a series of diagnostic tests are required to monitor the extent to which variables are independent of one another - the problem of multicollinearity. These diagnostic tests showed that multicollinearity is not a problem for the models presented in this report.

The dependent variable in this model is:

- **allmaterials\_kerb** – kerbside recycling yield for all targeted materials (out of paper, card, glass, cans, plastic and textiles) in kilogrammes per household per year.

The independent variables (in this case, those variables found to be influential in affecting the dependent variable, i.e. recycling yield) are:

- **SocialGradeDE** – proportion of population (16 years of age and older) found to be of Social Grade D or E in 2001 census;
- **EastAnglia\_EastMidlands** – whether the local authority is located in the Government Office Regions of East Anglia or East Midlands; see comments below;
- **KSdry\_no\_materials** – number of materials targeted for kerbside dry recycling (out of the six materials considered in this study, i.e. paper, card, glass, cans, plastic and textiles);
- **AWC** – whether the local authority operates a fortnightly residual waste collection; and
- **Dry\_capacity\_wkly** – weekly equivalent containment capacity provided to householders for kerbside dry recycling, expressed in litres, taking in to account collection frequency<sup>8</sup>.

It is important to note that kerbside yields for co-mingled collections in the regression models presented here have not accounted for the rejection of any materials at MRFs (in contrast to the benchmark tables in Sections 5.2 and 5.3, where benchmarks which assume a 10% MRF reject rate are included).

The only factor for which there is not an immediate and reasonably obvious explanation relates to the better performance found in East Anglia and East Midlands compared with all other areas. This better performance must be due to factors other than those listed in the above table (deprivation levels, collection system configurations, etc), since these factors are accounted for elsewhere in the model. Likely explanations could include there being generally better communications, recycling roll-out strategies and/or partnership working arrangements in these regions. However there are no data sources from which additional variables can be constructed to represent such factors to test this hypothesis. It is worth noting that the relatively high recycling performance in these regions (both in relation to dry recycling and garden waste – the latter due to the preponderance of free garden waste collections in these areas) has been detected in previous reviews of kerbside recycling performance carried out by Dr Julian Parfitt in the development of WRAP's home composting diversion models. It is recommended that the better performance of East Anglia and East Midlands should be investigated in future reviews. This would require the collection of data on other variables which are considered likely to account for this better performance (such as those discussed above; i.e. data on communications and roll-out strategies, etc); though these variables could only be tested if they were available for all local authorities in the UK.

<sup>8</sup> For example, if a local authority provides 100 litres of capacity but collects dry recycling fortnightly, the equivalent weekly capacity would be  $100/2 = 50$  litres.

Statistical data in relation to this regression model are presented in Tables A1.1 to A1.2 below. Table A1.3 describes the predicted effect of the various factors on kerbside dry recycling performance.

**Table A1.1** Kerbside dry recycling performance regression model for the UK – summary statistics

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.656 <sup>a</sup>	.430	.423	36.09469

a. Predictors: (Constant), Dry\_capacity\_wkly, EastAnglia\_EastMidlands, SocialGradeDE, AWC, KSdry\_no.\_materials

**Table A1.2** Coefficients for kerbside dry recycling performance regression model for the UK

Coefficients <sup>a</sup>								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	119.970	12.516		9.586	.000		
	SocialGradeDE	-255.355	27.683	-.342	-9.224	.000	.985	1.015
	EastAnglia_EastMidlands	25.624	4.396	.218	5.829	.000	.965	1.036
	KSdry_no._materials	16.813	1.909	.340	8.808	.000	.909	1.100
	AWC	27.754	3.569	.292	7.776	.000	.958	1.044
	Dry_capacity_wkly	.224	.041	.209	5.487	.000	.932	1.073

a. Dependent Variable: allmaterials\_kerb

In Table A1.2 above, the Standardized Coefficients indicate the relative significance of each factor within the model. For example, Social Grade has a greater (negative) effect (-.342) in comparison to whether the (positive) effect of the local authority being located in the East Midlands or East Anglia (.218). The actual predicted effects of the various factors on kerbside dry recycling performance are shown in Table A1.3 below (and are derived from the Unstandardized Coefficients in Table A1.2). It is important to note that the model predicts total kerbside dry recycling yields for the materials that are the subject of this benchmarking study, namely *paper, card, glass, cans, plastic* and *textiles*.

**Table A1.3** Kerbside dry recycling performance regression model for the UK – predicted effects on recycling rates

Factor	Effect
Constant	120.0 kg/hh/yr. This value has no operational meaning (i.e. it does <u>not</u> represent an average performance value) and is only the first expression in an equation derived from the multiple regression model.
Deprivation, measured as proportion of population (16 years of age or older) belonging to Social Grades D or E	For each 1% of population consisting of persons Social Grade D or E, yields reduce by 2.6 kg/hh/yr.
Whether local authority is located in East Anglia or the East Midlands	If local authority is located in East Anglia or the East Midlands, add 25.6 kg/hh/yr to the yield.
Number of materials targeted for collection at	For each material targeted for collection, add 16.8 kg/hh/yr

kerbside, out of these six materials: paper, card, glass, cans, plastic, textiles	to the yield.
Refuse collection frequency	If refuse is collected fortnightly, add 27.8 kg/hh/yr to the yield.
Dry recycling containment for householders: equivalent weekly capacity, taking in to account container volumes and collection frequency.	For each litre of equivalent weekly containment capacity, add 0.22 kg/hh/yr to the yield.

### Worked example for predicting kerbside dry recycling yields:

A local authority has the following characteristics, along with the following predicted kerbside dry recycling yields:

Regardless of the characteristics of the local authority, we start off with the "Constant" value of 123.8 kg/hh/yr	"Start" figure: 120.0 kg/hh/yr
<b>30%</b> of the local authority's population (amongst persons of 16 year of age or over) are classified as Social Grade D or E	<i>subtract</i> $(30 \times 2.6) = 78.0 \rightarrow 123.8 \text{ minus } 78.0 = 45.8$
The local authority is located <b>in the East Midlands</b>	<i>Add</i> $25.6 \rightarrow 45.8 \text{ plus } 25.6 = 71.4$
Out of the six materials (paper, card, glass, cans, plastic and textiles), <b>five</b> are targeted.	<i>Add</i> $(5 \times 16.8) = 84.0 \rightarrow 71.4 + 84.0 = 155.4$
<b>Refuse</b> is collected <b>fortnightly</b>	<i>Add</i> $27.8 \rightarrow 155.4 + 27.8 = 183.2$
The local authority provides two 55 litre kerbside boxes for dry recycling and collects recycling weekly. The <b>equivalent weekly dry recycling capacity</b> is $55 \times 2 = \mathbf{110}$ litres	<i>Add</i> $(110 \times 0.22) = 24.2 \rightarrow 183.2 + 24.2 = \mathbf{207.4}$ <b>kg/hh/yr</b>

### Regression model based only on England data

An even more powerful model than the one presented in Section 2 and described above was produced using only England data (with adjusted  $R^2 = 0.501$ ). It should again be emphasised that this is an extremely impressive degree of explanatory power for a model attempting to describe the behaviour of kerbside recycling systems. This model was more powerful than the UK-wide model, despite there being less data available to the model (i.e. performance data and all other data for all authorities outside England were excluded). This is possibly because the 2007 Indices of Multiple Deprivation for England were used (whereas it was necessary to use a measure derived from Social Grades identified in the 2001 census when considering deprivation across England and the Devolved Administrations). It is possible that these Indices provide a more sensitive measure of deprivation levels, insofar as they pertain to kerbside recycling performance, in comparison to the Social Grade measure used in the UK-wide model. It is also possible that data reporting in England is, in general (though obviously not in all cases) slightly more robust, which may be due to the reporting of recycling tonnages being historically better established in England.

The variables included in the England model are the same as for the UK-wide model described above, though with the difference that Indices of Multiple Deprivation 2007 are used as a measure of deprivation for England local authorities (as opposed to the Social Grade measure used in the UK model)

Statistical data in relation to this regression model are presented in Tables A1.4 and A1.5 below.

**Table A1.4** Kerbside dry recycling performance regression model for England – summary statistics

Model Summary				
Model	R			
	England = 1.00 (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	.713 <sup>a</sup>	.508	.501	34.00053

a. Predictors: (Constant), Dry\_capacity\_wkly, EastAnglia\_EastMidlands, IMD\_2007, AWC, KSdry\_no.\_materials

**Table A1.5** Coefficients for kerbside dry recycling performance regression model for England

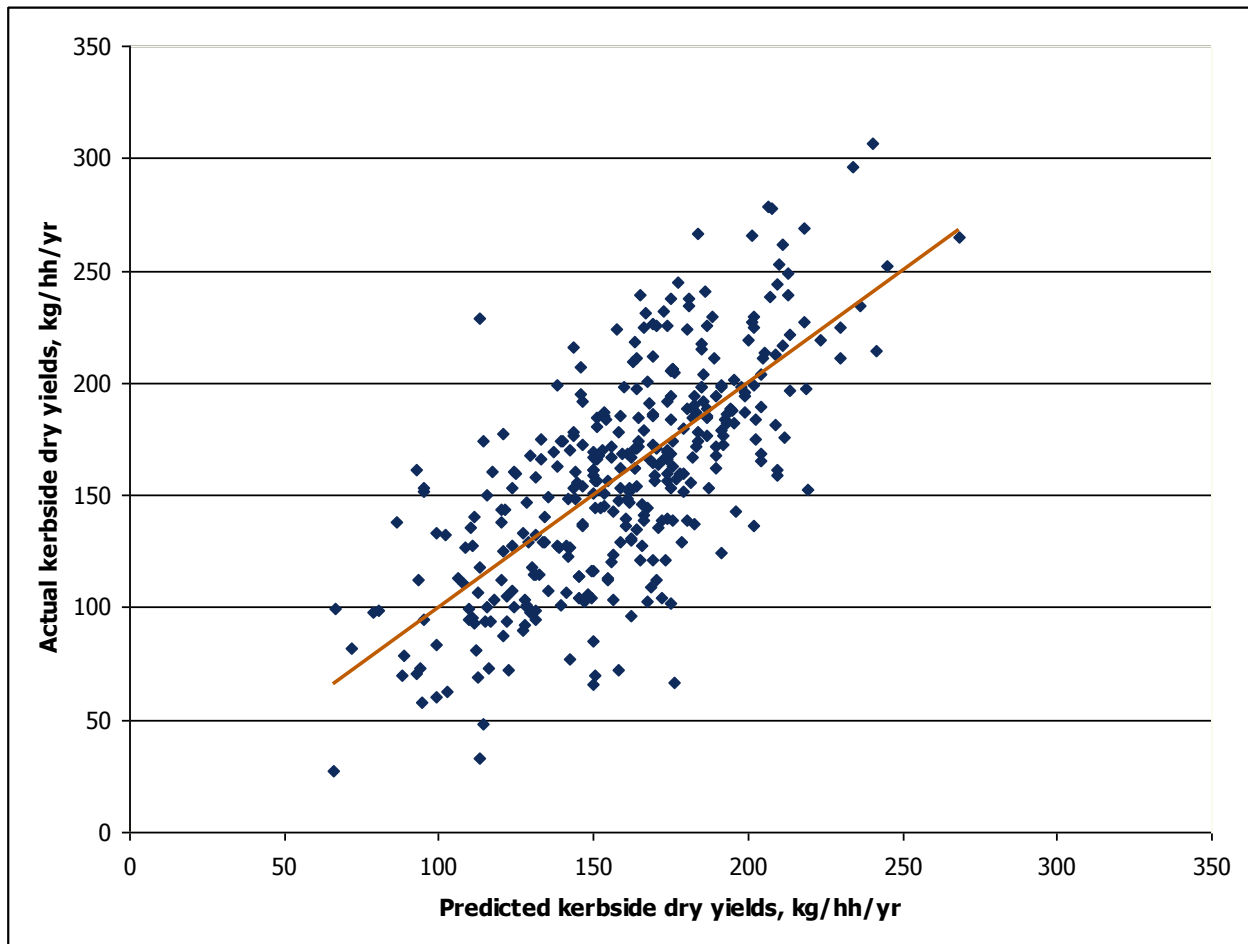
Coefficients <sup>a,b</sup>								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	70.004	10.186		6.873	.000		
	IMD_2007	-2.391	.216	-.439	-11.048	.000	.904	1.106
	EastAnglia_EastMidlands	14.117	4.352	.127	3.244	.001	.926	1.080
	KSdry_no._materials	19.762	2.069	.384	9.553	.000	.884	1.131
	AWC	26.147	3.774	.272	6.929	.000	.926	1.079
	Dry_capacity_wkly	.289	.042	.273	6.952	.000	.924	1.082

a. Dependent Variable: allmaterials\_kerb

b. Selecting only cases for which England = 1.00

A scatter plot illustrating the England regression model is shown in Figure A1.1, which plots actual kerbside dry recycling yields (for all targeted materials) against those yields which are predicted by the model for each local authority. The degree to which data points deviate from the line indicates the degree to which the actual performance differs from the predicted performance.

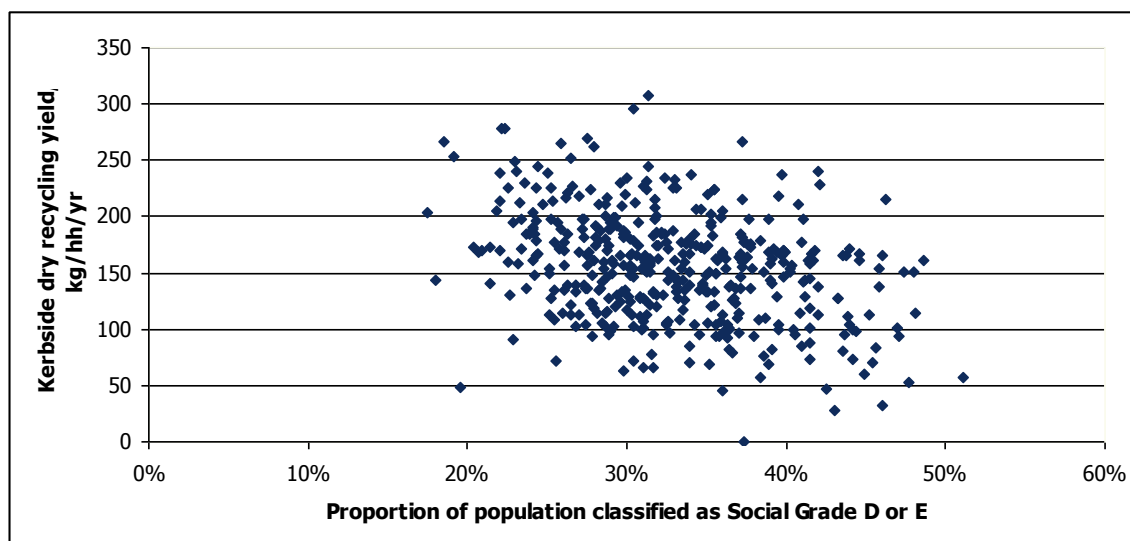
**Figure A1.1** Actual kerbside dry recycling yields plotted against predicted yields for local authorities in England, 2008/09; (the trend line indicates performance predicted by the model)



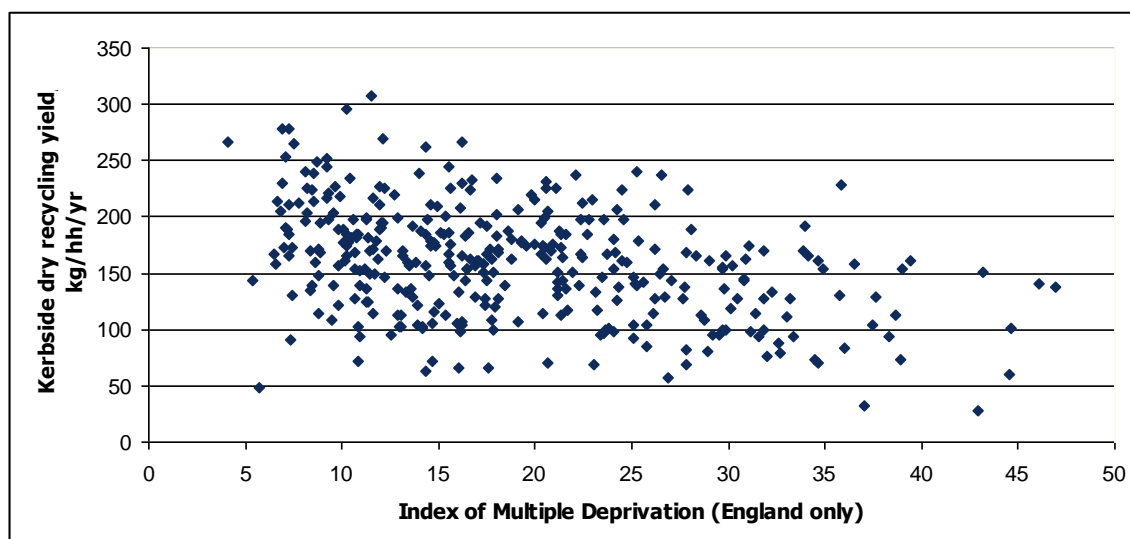
### Deprivation levels and recycling yields

In Section 4.1 it is pointed out that whilst a relationship between deprivation levels and recycling performance can be detected in the data, it is a much weaker analysis than if other factors (known to influence recycling performance) are also accounted for, as regression models attempts to do. This can be illustrated by plotting recycling yields against deprivation measures, as shown in Figures A1.2 (UK data with the Social Grade deprivation measure) and A1.3 (England data using 2007 Indices of Multiple Deprivation).

**Figure A1.2** Kerbside dry recycling yield (kg/hh/yr) plotted against proportion of population (16 years or over) found in the 2001 census to be Social Grade D or E – UK 2008/09



**Figure A1.3** Kerbside dry recycling yield (kg/hh/yr) plotted against Index of Multiple Deprivation – England 2007/08



Whilst it can be seen that higher levels of deprivation are generally associated with lower recycling yields, the data is very scattered. Only weak correlations were found. This underlines the value of considering all the factors found to be significant in affecting kerbside dry recycling performance in tandem with one another; deprivation is indeed a significant factor, but its effect can only really be accounted for once regional and collection system factors are also taken into account.

### Other factors tested in regression modelling

The models presented above were developed through testing a range of models, in which a wider range of variables than those included in the above models were tested. The variables tested but not included in the final regression models are listed in Table A1.9, along with a brief explanation of why they were excluded from the final models.

**Table A1.9** Factors tested but not included in the final regression models

<b>Factor</b>	<b>Reason for exclusion</b>
Authority type: Unitary or District	Highly inter-correlated with deprivation levels. Lower explanatory power than deprivation levels.
Targeting of glass at kerbside	Highly significant in affecting kerbside yields, but does not explain much beyond the obvious fact that glass arises in large tonnages where it is targeted. The "number of materials targeted at the kerbside" was used instead, as a more useful (if equally obvious) variable, that also produced models with higher R <sup>2</sup> values.
Bring bank yields	Bring bank yields did not appear as influential factors in affecting kerbside dry recycling yields. Including bring bank yields in the independent variable did not produce better models. It is thought that whilst bring bank yields might be important when considering the kerbside dry recycling performance of some individual authorities, it is generally not a significant factor (and certainly less significant than it has been historically), mainly due to the relative magnitude of bring bank and kerbside dry recycling tonnages.
Scheme type: kerbside sort or co-mingled	Highly inter-correlated with kerbside dry recycling containment type, with wheeled bins never being associated with kerbside sort systems, but often being associated with co-mingled systems. The difference in performance between kerbside sort and co-mingled systems is thought to be due to the larger kerbside dry containment capacity often provided with co-mingled systems.
ONS Local Authority Area Classification	Not found to be a significant factor affecting kerbside dry recycling yields.
Degree to which kerbside recycling is embedded <sup>9</sup>	Higher inter-correlated with levels of deprivation. Lower explanatory power than deprivation levels.
Average household size	Not found to be a significant factor affecting kerbside dry recycling yields. Average household size will obviously be significant for individual authorities with particularly large or small household sizes, where recycling performance is measured in terms of kg/hh/yr. However regression modelling suggests that it is not generally significant across UK or England authorities as a whole.
Kerbside recycling yields per capita	Models produced using as a dependent variable recycling yields per capita were statistically less robust and had lower explanatory power in comparison to models using yields per household. Similar considerations as for Average household size (above) apply.
Population density	Higher inter-correlated with levels of deprivation. Lower explanatory power than deprivation levels.
Proportion of dwelling stock consisting of detached and semi-detached housing	Higher inter-correlated with levels of deprivation. Lower explanatory power than deprivation levels.
Proportion of dwelling stock consisting of multi-occupancy residences	Higher inter-correlated with levels of deprivation. Lower explanatory power than deprivation levels.

<sup>9</sup> Number years since 2001 during which recycling yields > 100 kg/hh/yr (data could only be produced for England).

## Appendix 2: Additional benchmark tables

This appendix provides benchmark tables additional to those presented in the main part of the report. Most of the tables in the main report refer to local authorities across the United Kingdom. The tables presented here mostly relate to England, in many cases providing data which can be compared to tables included in the 2007/08 report (*Analysis of kerbside dry recycling performance in England 2007/08*). Where this is the case, the relevant table in the 2007/08 report is referred to. There are also some tables included for the Devolved Nations, where it is considered that this data is likely to be of interest.

Tables A2.1 to A2.4 provide material-specific benchmark data for England and the Devolved Nations.

**Table A2.1:** Kerbside material specific dry recycling performance, England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)	
Minimum	34.6	22.1	0.4	0.0	0.2	32.7	0.0	59.9	
Lower Quartile	59.7	90.8	6.4	30.6	9.1	144.2	0.6	146.8	
Median	74.9	116.3	8.7	41.5	13.8	176.6	1.3	169.9	
Upper Quartile	83.4	143.6	11.7	53.8	19.4	212.8	2.4	207.1	
Maximum	131.0	197.7	20.2	79.3	28.5	299.9	6.0	303.4	
Count	93 (26.3%)	260 (73.4%)	344 (97.2%)	282 (79.7%)	278 (78.5%)	173 (48.9%)	107 (30.2%)	57 (16.1%)	Total no. LAs: 354

*The above table corresponds to Table 1 in the 2007/08 report*

**Table A2.2:** Kerbside material specific dry recycling performance, Wales 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)	
Minimum	60.5	57.9	3.9	0.6	2.3	100.0	0.1	102.1	
Lower Quartile	62.9	66.7	6.3	28.5	10.1	112.7	0.9	115.0	
Median	69.4	78.6	8.0	39.2	13.2	131.0	1.2	129.2	
Upper Quartile	75.4	90.9	10.6	48.3	15.0	160.6	2.1	156.3	
Maximum	83.1	142.6	15.8	65.8	24.6	200.7	4.6	177.8	
Count	5 (22.7%)	17 (77.3%)	21 (95.5%)	20 (90.9%)	19 (86.4%)	12 (54.5%)	10 (45.5%)	6 (27.3%)	Total no. LAs: 22

**Table A2.3:** Kerbside material specific dry recycling performance, Scotland 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	11.4	20.7	0.0	1.1	0.9	45.6	0.0	94.6
Lower Quartile	38.1	65.4	3.0	18.2	4.2	94.5	0.9	123.2
Median	47.2	96.0	7.3	29.2	8.6	149.2	2.8	151.8
Upper Quartile	58.5	122.9	9.8	46.0	16.8	166.8	3.7	158.4
Maximum	91.9	146.8	13.7	63.0	19.7	218.2	4.1	164.9
Count	4 (12.5%)	26 (81.3%)	27 (84.4%)	20 (62.5%)	23 (71.9%)	13 (40.6%)	6 (18.8%)	3 Total no. LAs: (9.4%) 32

**Table A2.4:** Kerbside material specific dry recycling performance, Northern Ireland 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		62.2	3.6	6.8	8.9	109.5	0.4	109.8
Lower Quartile		96.3	4.3	27.4	11.0	123.2	1.1	125.2
Median		108.9	6.4	40.7	13.7	141.7	1.7	142.9
Upper Quartile		120.5	8.7	44.5	20.2	161.3	2.0	162.6
Maximum		153.9	15.5	49.5	28.8	178.0	2.5	180.5
Count	0 (0%)	26 (100%)	26 (100%)	8 (30.8%)	26 (100%)	8 (30.8%)	8 (30.8%)	8 Total no. LAs: (30.8%) 26

Tables A2.5 and A2.6 provide benchmark data for England for different material collection combinations, excluding textiles in Table A2.5 and including textiles in Table A2.6.

**Table A2.5:** Material collection combinations, excluding textiles - England 2008/09

	paper, card, cans, glass & plastic	paper, card, cans & glass	paper, card, cans & plastic	paper, cans, glass & plastic	paper, cans & glass	paper, cans & plastic
Minimum	32.7	69.2	27.6	57.5	62.6	72.3
Lower Quartile	144.2	108.2	151.4	109.6	106.9	90.3
Median	176.6	130.2	168.6	145.1	128.7	100.1
Upper Quartile	212.8	165.3	188.3	166.8	149.1	100.3
Maximum	299.9	174.8	229.8	204.5	191.0	112.8
Count	173	22	61	38	42	5

**Table A2.6:** Material collection combinations, including textiles - England 2008/09

	paper, card, cans, glass, plastic & textiles	paper, card, cans, glass & textiles	paper, card, cans, plastic & textiles	paper, cans, glass, plastic & textiles	paper, cans, glass & textiles	paper, cans, plastic & textiles
Minimum	59.9	69.5	134.1	83.8	81.0	
Lower Quartile	146.8	105.5		104.2	113.4	
Median	169.9	122.7	152.9	136.6	131.2	
Upper Quartile	207.1	140.7		164.1	157.1	
Maximum	303.4	167.1	206.7	197.3	177.5	
Count	57	7	3	18	20	0

Tables A2.7 to A2.13 provide benchmark data for the various ONS Local Authority Area Type classifications, for local authorities in England.

**Table A2.7:** Kerbside material specific dry recycling performance – “Regional Centres” - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	64.2	75.2	4.6	8.6	2.8	112.4	1.2	114.0
Lower Quartile		92.3	6.8	25.4	11.0	143.2		
Median	68.4	104.3	7.9	38.3	13.5	162.8	2.0	151.3
Upper Quartile		134.5	8.6	44.7	15.7	203.4		
Maximum	72.7	168.9	11.7	56.1	19.8	237.6	2.8	209.6
Count	2	17	18	12	17	10	4	3

*The above table corresponds to Table 10 in the 2007/08 report*

**Table A2.8:** Kerbside material specific dry recycling performance – “Centres with Industry” - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	38.1	22.1	0.8	2.1	0.4	32.7	0.0	59.9
Lower Quartile		56.1	3.7	22.2	4.4	83.6	0.2	91.6
Median	44.8	78.2	7.2	27.8	9.9	126.8	0.5	146.5
Upper Quartile		84.0	11.3	45.6	13.1	155.7	1.2	160.4
Maximum	51.4	162.3	15.1	70.6	15.4	228.7	3.3	162.4
Count	2	19	20	21	20	18	8	6

*The above table corresponds to Table 11 in the 2007/08 report*

**Table A2.9:** Kerbside material specific dry recycling performance – “Prospering Smaller Towns” - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	34.6	42.0	2.3	0.0	2.6	64.8	0.0	65.5
Lower Quartile	65.4	103.3	7.6	39.5	11.3	174.0	0.9	177.3
Median	78.0	134.7	10.8	50.2	16.2	197.1	1.8	202.7
Upper Quartile	82.2	156.4	12.3	58.6	21.9	222.4	2.9	226.4
Maximum	111.1	194.7	19.3	79.2	28.5	299.9	6.0	303.4
Count	37	74	109	87	82	45	42	22

*The above table corresponds to Table 12 in the 2007/08 report*

**Table A2.10:** Kerbside material specific dry recycling performance – “New and Growing Towns” - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	61.3	53.3	4.3	3.0	3.8	142.7	1.5	
Lower Quartile		121.6	6.9	32.6	11.5	170.8		
Median	65.3	132.3	8.3	36.7	16.6	185.9	2.5	225.2
Upper Quartile		142.2	10.6	42.7	19.9	223.6		
Maximum	83.6	166.8	20.2	54.5	22.5	234.7	3.2	225.2
Count	3	20	23	16	21	13	3	1

*The above table corresponds to Table 13 in the 2007/08 report*

**Table A2.11:** Kerbside material specific dry recycling performance – “Coastal and Countryside” - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	43.0	47.1	1.7	6.5	1.2	102.8	0.0	103.8
Lower Quartile	72.9	91.2	7.1	32.5	8.3	136.6	0.3	148.5
Median	75.2	108.5	8.6	39.9	14.5	158.3	1.0	161.3
Upper Quartile	80.4	132.8	11.1	53.9	18.8	176.5	2.0	177.0
Maximum	104.7	161.5	14.6	61.3	23.6	185.2	3.5	182.8
Count	11	33	43	32	32	15	13	7

*The above table corresponds to Table 15 in the 2007/08 report*

**Table A2.12:** Kerbside material specific dry recycling performance – “Industrial Hinterlands” - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	43.8	48.4	2.2	11.9	0.2	84.7	0.1	95.7
Lower Quartile	49.4	60.0	5.4	26.2	4.2	96.5	0.4	
Median	53.2	87.0	7.8	31.4	7.6	153.3	1.0	159.7
Upper Quartile	59.1	107.0	10.4	38.9	15.6	163.7	1.2	
Maximum	77.8	159.3	16.7	50.8	21.8	224.1	1.6	211.1
Count	8	15	22	22	17	11	10	4

*The above table corresponds to Table 16 in the 2007/08 report*

**Table A2.13:** Kerbside material specific dry recycling performance – “Manufacturing Towns” - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	42.4	59.3	1.3	6.2	1.3	101.2	0.1	163.4
Lower Quartile	57.0	99.7	7.4	35.7	9.4	165.4	0.3	
Median	61.8	123.9	11.1	42.4	15.4	203.6	1.0	175.4
Upper Quartile	78.0	143.9	12.6	52.8	20.3	216.9	1.6	
Maximum	131.0	160.5	17.0	79.3	23.2	240.8	2.5	212.4
Count	11	20	30	27	21	14	10	3

*The above table corresponds to Table 17 in the 2007/08 report*

Tables A2.14 to A2.17 indicate the frequency of different types of kerbside collection system in England and the Devolved Nations.

**Table A2.14:** Kerbside dry recycling service classifications, England 2008/09

<b>Scheme type</b>	<b>Collection frequency</b>	<b>Collection container</b>	<b>Residual waste frequency</b>	<b>No. of LAs</b>	<b>% of LAs</b>
kerbside sort	weekly	box/sack	weekly	18	6.5%
kerbside sort	weekly	box/sack	fortnightly	7	2.5%
kerbside sort	fortnightly	box/sack	weekly	55	19.9%
kerbside sort	fortnightly	box/sack	fortnightly	49	17.8%
single stream co-mingled	weekly	box/sack	weekly	9	3.3%
single stream co-mingled	fortnightly	wheeled bin	weekly	11	4.0%
single stream co-mingled	fortnightly	wheeled bin	fortnightly	44	15.9%
two stream co-mingled	fortnightly	box/sack	weekly	9	3.3%
two stream co-mingled	fortnightly	box/sack	fortnightly	11	4.0%
two stream co-mingled	fortnightly	wheeled bin / box/sack	fortnightly	12	4.3%
other scheme types				51	18.5%
<b>Total</b>				<b>276</b>	<b>100%</b>

*The above table corresponds to Table 21 in the 2007/08 report*

**Table A2.15:** Kerbside dry recycling service classifications, Wales 2008/09

<b>Scheme type</b>	<b>Collection frequency</b>	<b>Collection container</b>	<b>Residual waste frequency</b>	<b>No. of LAs</b>	<b>% of LAs</b>
kerbside sort	weekly	box/sack	weekly	3	20.0%
kerbside sort	weekly	box/sack	fortnightly	4	26.7%
kerbside sort	fortnightly	box/sack	weekly	1	6.7%
kerbside sort	fortnightly	box/sack	fortnightly	3	20.0%
single stream co-mingled	weekly	box/sack	weekly	1	6.7%
two stream co-mingled	fortnightly	box/sack	weekly	1	6.7%
two stream co-mingled	fortnightly	box/sack	fortnightly	1	6.7%
other scheme types				1	6.7%
<b>TOTAL</b>				<b>15</b>	<b>100%</b>

**Table A2.16:** Kerbside dry recycling service classifications, Scotland 2008/09

<b>Scheme type</b>	<b>Collection frequency</b>	<b>Collection container</b>	<b>Residual waste frequency</b>	<b>No. of LAs</b>	<b>% of LAs</b>
kerbside sort	weekly	box/sack	weekly	1	5.3%
kerbside sort	weekly	box/sack	fortnightly	4	21.1%
kerbside sort	fortnightly	box/sack	weekly	3	15.8%
kerbside sort	fortnightly	box/sack	fortnightly	1	5.3%
single stream co-mingled	weekly	box/sack	weekly	1	5.3%
single stream co-mingled	fortnightly	wheeled bin	fortnightly	2	10.5%
two stream co-mingled	fortnightly	box/sack	weekly	1	5.3%
other scheme types				6	31.6%
Total				19	100%

**Table A2.17:** Kerbside dry recycling service classifications, Northern Ireland 2008/09

<b>Scheme type</b>	<b>Collection frequency</b>	<b>Collection container</b>	<b>Residual waste frequency</b>	<b>No. of LAs</b>	<b>% of LAs</b>
kerbside sort	weekly	box/sack	fortnightly	3	13.0%
single stream co-mingled	fortnightly	wheeled bin	weekly	1	4.3%
single stream co-mingled	fortnightly	wheeled bin	fortnightly	17	73.9%
other scheme types				2	8.7%
Total				23	100%

Tables A2.18 to A2.27 provide benchmark data for England local authorities for different kerbside dry recycling collection system types.

**Table A2.18:** Kerbside sort, weekly dry, box/sack, weekly residual - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	38.1	82.1	1.4	18.0	3.8	160.4	0.2	163.4
Lower Quartile	61.3	96.8	6.6	41.4	8.1	163.1	0.9	
Median	76.6	105.1	7.6	54.1	10.3	173.5	1.1	188.7
Upper Quartile	83.6	111.6	9.1	54.6	14.4	203.8	1.9	
Maximum	95.0	147.8	11.7	76.1	19.5	224.7	2.9	225.0
Count	9	9	16	17	10	6	11	4

*The above table corresponds to Table 22 in the 2007/08 report*

**Table A2.19:** Kerbside sort, weekly dry, box/sack, fortnightly residual - England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	92.3	91.0	8.3	50.7	10.4	173.2	0.6	175.2
Lower Quartile		108.1	11.1	61.6	10.9	185.2		
Median	101.7	115.7	12.4	68.3	12.8	205.7	1.3	206.3
Upper Quartile		126.7	14.3	68.5	14.4	219.3		
Maximum	111.1	137.4	18.1	68.7	18.2	233.6	6.0	234.3
Count	2	5	7	7	6	5	4	3

*The above table corresponds to Table 23 in the 2007/08 report*

**Table A2.20:** Kerbside sort, fortnightly dry, box/sack, weekly residual - 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	34.6	48.4	1.7	17.3	1.2	102.0	0.0	103.8
Lower Quartile	56.6	78.1	5.7	30.1	7.1	158.2	0.6	160.5
Median	71.3	96.0	7.4	38.4	11.2	167.9	1.2	170.0
Upper Quartile	76.0	111.8	9.8	48.6	16.4	195.6	2.0	181.7
Maximum	105.1	127.1	15.6	63.4	25.9	218.4	3.5	198.2
Count	27	28	51	55	24	16	19	6

*The above table corresponds to Table 24 in the 2007/08 report*

**Table A2.21:** Kerbside sort, fortnightly dry, box/sack, fortnightly residual – England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	52.0	66.0	4.5	25.8	3.6	130.2	0.0	136.4
Lower Quartile	65.4	84.0	8.6	41.6	8.6	153.2	0.3	155.3
Median	79.3	91.5	11.2	50.3	12.3	169.7	1.3	164.2
Upper Quartile	89.2	104.7	13.1	58.2	15.6	184.9	2.5	186.3
Maximum	109.4	136.4	19.3	75.1	21.7	209.9	4.8	212.4
Count	29	20	49	48	26	16	28	12

*The above table corresponds to Table 25 in the 2007/08 report*

**Table A2.22:** Single stream co-mingled, weekly dry, box/sack, weekly residual (brackets indicate an assumed 10% MRF reject rate) England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		22.5 (20.2)	1.4 (1.3)	23.8 (21.4)	3.7 (3.4)	126.8 (114.1)	2.5 (2.2)	209.6 (188.7)
Lower Quartile		90.1 (81.1)	4.5 (4.1)		8.4 (7.5)			
Median		131.1 (118.0)	8.5 (7.6)	38.7 (34.8)	19.1 (17.2)	189.6 (170.7)	2.8 (2.5)	236.4 (212.7)
Upper Quartile		141.3 (127.1)	10.6 (9.6)		20.6 (18.6)			
Maximum		168.8 (151.9)	11.5 (10.3)	56.5 (50.8)	24.1 (21.7)	260.0 (234.0)	3.1 (2.8)	263.1 (236.8)
Count	0	9	9	4	9	4	2	2

*The above table corresponds to Table 26 in the 2007/08 report*

**Table A2.23:** Single stream co-mingled, fortnightly dry, wheeled bin, weekly residual (brackets indicate an assumed 10% MRF reject rate) 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		89.7 (80.7)	4.5 (4.1)	0.0 (0.0)	8.2 (7.4)	162.3 (146.1)		
Lower Quartile		120.0 (108.0)	7.6 (6.8)	39.7 (35.7)	14.0 (12.6)	211.1 (190.0)		
Median		132.8 (119.5)	8.2 (7.4)	41.7 (37.6)	14.9 (13.4)	221.4 (199.3)		
Upper Quartile		154.5 (139.1)	9.6 (8.7)	46.1 (41.5)	17.5 (15.8)	228.3 (205.5)		
Maximum		162.3 (146.0)	10.6 (9.5)	52.7 (47.4)	19.4 (17.4)	232.2 (208.9)		
Count	0	11	11	6	11	6	0	0

*The above table corresponds to Table 27 in the 2007/08 report*

**Table A2.24:** Single stream co-mingled, fortnightly dry, wheeled bin, fortnightly residual (brackets indicate an assumed 10% MRF reject rate) England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		105.1 (94.6)	7.8 (7.0)	6.5 (5.8)	9.4 (8.4)	170.8 (153.7)		
Lower Quartile		137.5 (123.7)	10.0 (9.0)	37.1 (33.3)	18.4 (16.6)	223.9 (201.5)		
Median	131.0 (117.9)	152.7 (137.4)	11.1 (10.0)	42.4 (38.1)	20.3 (18.2)	225.8 (203.2)	3.4 (3.1)	292.9 (263.6)
Upper Quartile		160.1 (144.1)	12.3 (11.0)	46.1 (41.5)	22.4 (20.2)	256.3 (230.7)		
Maximum	131.0 (117.9)	197.7 (177.9)	15.0 (13.5)	62.9 (56.6)	27.4 (24.6)	289.5 (260.5)	3.4 (3.1)	292.9 (263.6)
Count	1	43	44	12	44	11	1	1

*The above table corresponds to Table 28 in the 2007/08 report*

*There is no table in this report which corresponds to Table 29 in the 2007/08 report (referring to Single stream co-mingled, fortnightly collection, wheeled bin or sack/box, fortnightly residual waste for England in 2007/08), since an insufficient number of local authorities in England operated this collection system during 2008/09 for this scheme type to be included as a separate collection system classification. Refer to Section 1.2.3.*

**Table A2.25:** Two stream co-mingled, fortnightly dry, box/sack, weekly residual (brackets indicate an assumed 10% MRF reject rate) England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum		64.4 (58.0)	4.0 (3.6)	21.2 (19.1)	3.4 (3.0)	107.0 (96.3)	0.0 (0.0)	112.9 (101.6)
Lower Quartile		77.6 (69.8)	5.9 (5.3)	26.8 (24.1)	7.4 (6.7)	112.5 (101.2)		
Median	66.3 (59.7)	92.6 (83.4)	6.6 (5.9)	32.9 (29.6)	12.2 (11.0)	125.4 (112.8)	2.4 (2.2)	127.5 (114.7)
Upper Quartile		113.3 (102.0)	8.0 (7.2)	36.9 (33.2)	18.5 (16.7)	179.0 (161.1)		
Maximum	66.3 (59.7)	150.5 (135.5)	12.0 (10.8)	60.1 (54.1)	22.0 (19.8)	244.6 (220.2)	2.8 (2.6)	176.0 (158.4)
Count	1	8	9	7	9	7	4	3

*The above table corresponds to Table 30 in the 2007/08 report*

**Table A2.26:** Two stream co-mingled, fortnightly dry, box/sack, fortnightly residual (brackets indicate an assumed 10% MRF reject rate) England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	74.2 (66.8)	104.3 (93.9)	4.8 (4.4)	29.0 (26.1)	6.9 (6.2)	153.3 (138.0)	0.1 (0.1)	153.4 (138.1)
Lower Quartile		112.4 (101.2)	8.1 (7.3)	48.2 (43.4)	9.4 (8.4)	180.7 (162.7)		
Median	77.0 (69.3)	128.2 (115.4)	11.6 (10.4)	56.4 (50.7)	14.7 (13.2)	221.6 (199.5)	0.6 (0.5)	190.2 (171.2)
Upper Quartile		144.8 (130.3)	13.3 (12.0)	61.3 (55.2)	20.0 (18.0)	252.9 (227.6)		
Maximum	88.6 (79.7)	168.6 (151.7)	14.7 (13.2)	68.5 (61.6)	24.6 (22.1)	265.9 (239.3)	1.1 (1.0)	226.9 (204.2)
Count	3	8	11	7	10	6	2	2

*The above table corresponds to Table 31 in the 2007/08 report*

**Table A2.27:** Two stream co-mingled, fortnightly dry, wheeled bin or sack/box, fortnightly residual (brackets indicate an assumed 10% MRF reject rate) England 2008/09

	Paper without card (kg/hh/yr)	Paper & card (kg/hh/yr)	Cans (kg/hh/yr)	Glass (kg/hh/yr)	Plastic (kg/hh/yr)	All 5 materials (kg/hh/yr)	Textiles (kg/hh/yr)	All 5 materials + textiles (kg/hh/yr)
Minimum	61.8 (55.6)	83.9 (75.5)	7.0 (6.3)	3.0 (2.7)	8.0 (7.2)	139.2 (125.2)		
Lower Quartile		93.4 (84.1)	10.4 (9.3)	34.1 (30.7)	15.2 (13.7)	150.7 (135.7)		
Median	65.5 (59.0)	129.1 (116.2)	12.3 (11.1)	47.0 (42.3)	17.0 (15.3)	201.6 (181.4)	1.3 (1.2)	
Upper Quartile		155.9 (140.3)	12.8 (11.5)	61.8 (55.6)	21.8 (19.6)	233.8 (210.4)		
Maximum	69.3 (62.4)	158.7 (142.8)	17.0 (15.3)	79.3 (71.4)	23.2 (20.8)	244.4 (220.0)	1.3 (1.2)	
Count	2	10	11	12	11	10	1	0

*The above table does not correspond to any data in the 2007/08 report, since an insufficient number of local authorities in England operated this collection system during 2007/08 for this scheme type to be included as a separate collection system classification. Refer to Section 1.2.3.*

# Appendix 3: Apportionment of co-mingled tonnages

The procedure for determining the split of materials within a co-mingled collection reporting total co-mingled tonnage was as follows:

- Total tonnages were ascertained through local authority reported co-mingled tonnages in Question 10 of WasteDataFlow;
- Mix of materials collected for each of these local authorities was ascertained by WRAP through a survey of local authorities for the relevant financial year;
- The co-mingled streams were then classified into 8 types (see Table A3.1), depending on the list of target materials (e.g. for 'Type 5' co-mingled collections 'paper/card', 'cans' and 'glass' are collected);
- Default compositional splits (% weight) were then applied to the reported co-mingled tonnages; and
- Currently the co-mingled collection default splits used within WasteDataFlow date from research conducted in 2002 or earlier. As part of an extensive review of municipal waste composition across the UK, recently completed by Resource Futures<sup>10</sup>, new apportionment of materials within co-mingled collections have been derived from kerbside compositional datasets collated from across the UK. These have provided revised profiles for Types 1, 3, 4 and 6. For the remaining systems, the default values are the same as those used by WasteDataFlow. Table A3.1 profiles the mean values obtained and the number of authorities for which the relevant data were available. So, for 'Type 1' co-mingled collections this would be a 82%:7%:12% split between paper/card, cans and plastic, based on compositional data from 10 authorities.

The apportionments of co-mingled tonnages which have been updated for this study are marked with yellow shading in table A3.1 below, with the remaining apportionments (marked with unshaded cells) corresponding to current default splits used within WasteDataFlow.

**Table A3.1:** Apportionment of co-mingled tonnages by range of materials targeted

	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
<b>Paper/card</b>	82%	0%	71%	78%	70%	64%	0%	70%
<b>Cans</b>	7%	50%	4%	6%	5%	4%	15%	0%
<b>Plastic</b>	12%	50%	7%	14%	0%	9%	15%	0%
<b>Glass</b>	0%	0%	19%	0%	25%	21%	70%	30%
<b>Textiles</b>	0%	0%	0%	2%	0%	1%	0%	0%
<b>Total</b>	100%	100%	100%	100%	100%	100%	100%	100%
<b>Number of compositional studies available</b>	10		9	8		7		

<sup>10</sup> *Municipal Waste Composition: Review of Municipal Waste Component Analyses - WR0119*  
<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=15133>

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