Communities and Local Government

Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005

Construction, Demolition and Excavation Waste

Final Report

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Construction, Demolition and Excavation Waste

Final Report

Report from Capita Symonds Ltd, in association with WRc plc

February 2007

Department for Communities and Local Government : London

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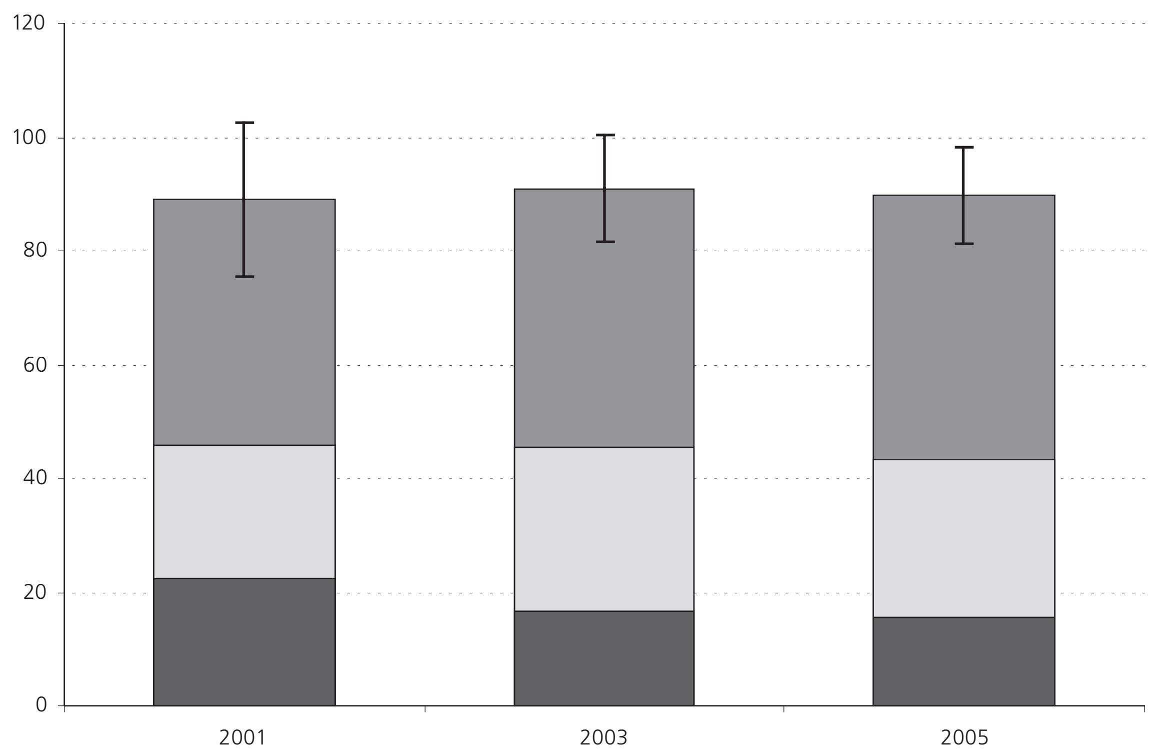
CHAPTER 1
Executive Summary

1.1 Two surveys were carried out during the spring and early summer of 2006, backed up by a programme of other data analysis, to establish estimates for the arisings and use as aggregate of construction and demolition waste (CDEW) in England in 2005. The work was carried out for the Planning Resources and Environment Policy Division of the Communities and Local Government. It was carried out by Capita Symonds Ltd, with the support of WRc plc on issues of statistical design and analysis. Directly comparable surveys were carried out by the same research team two and four years previously.

1.2 The surveys covered operators of crushers and screens, and of licensed landfills. Data on Paragraph 9A&19A registered exempt sites were also analysed. The objective was to generate estimates for recycled aggregate and soil, CDEW used and disposed of at licensed landfills, and CDEW spread on registered exempt sites. The surveys made a clear distinction between 'hard' Construction and Demolition (C&D) waste and excavation waste in order to identify not just the current rate of aggregate recycling, but also the future potential rate. As in the previous surveys, very little evidence was found of hard C&D waste which could be recycled into aggregate being landfilled as waste, and only very modest tonnages were identified being used within landfills in an unprocessed form (and then it was mainly for site engineering).

1.3 The central estimate for total arisings of CDEW for 2005 is 88.63 million tonnes ± 9% at a confidence level of 90%. This is slightly lower than the equivalent estimate for 2003, but the difference between the estimates for the two years is not statistically significant. Figure 1.1 shows the key estimates for 2001, 2003 and 2005.

Figure 1.1: **Changes in estimated total arisings of CDEW, from 2001 to 2005 (million tonnes)**



Notes:

The three bands are as follows: spread on registered exempt sites (lower band), used or disposed of at licensed landfills (middle band) and recycled as aggregate or soil (top band).

The bars show the upper and lower estimates for the total arisings at a confidence interval of 90%.

1.4 The central estimate for production of recycled aggregate has risen from 39.60 million tonnes ± 13% in 2003 to 42.07 million tonnes ± 15% in 2005. However, this change is not statistically significant. Evidence from the surveys suggests that the population of recycling crushers has continued to grow, but that the annual throughput of the average crusher has fallen since 2003, pointing to greater competition between recyclers.

1.5 The survey also confirms a conclusion from a previous survey, namely that the recyclers who are most successful at 'pushing' recycled aggregate up the value chain tend to be those operators who mix working on demolition sites with having access to a fixed recycling site of their own.

1.6 The small apparent falls in the tonnages of CDEW sent to landfills and registered exempt sites are not statistically significant. The estimates for CDEW sent to licensed landfills and registered exempt sites also need to be viewed against a background of regulatory and administrative changes between 2003 and 2005 which mean that the data collection methods had to be changed. Landfills are now classified and authorised in a different way, and operators of registered exempt sites now have to pay a fee as well as going through a much more formal application procedure than was previously the case.

1.7 Although the national estimates appear reasonably robust, this is less true of the regional estimates, and progressively less true the more local the focus becomes, because the response rates are not high enough. Future voluntary surveys are considered unlikely to overcome this challenge. As far as the 2005 sub-regional estimates are concerned the report warns that they should not to be relied on as anything other than a reasonable indication of arisings and recycling of CDEW, and should only be used with caution by Mineral Planning Authorities (and others) to provide contextual background in the undertaking of functions such as development control.

1.8 Looking to the future, the report recommends that Communities and Local Government should look into the practicality of drawing information from other sources. In the case of licensed landfills this means looking to the quarterly site returns which are submitted by all licence holders to the Environment Agency (EA). In the case of operators of recycling crushers and screens the most realistic alternative appears to be to request the necessary information when operators are renewing their Part B authorisations. Running local voluntary surveys of recycling crushers will always run into issues associated with out-of-area working, as well as requiring the organisers to achieve considerably higher response rates than can be obtained from national surveys (as a consequence of the local population of recycling crushers inevitably being so much smaller).

1.9 This recommendation (to find alternative ways of obtaining the data) is given additional force by the adverse impacts (which are more acute at the local level) which changing recycling technologies are having on the reliability of the existing method of grossing up.

1.10 If further voluntary national surveys are to be commissioned in future, the report recommends that they should be initiated at a time that allows survey forms to be circulated soon after the end of the year for which data are being sought.

CHAPTER 2
Background to the Study

INTRODUCTION, AIM AND OBJECTIVES

2.1 This is the draft Final Report from Capita Symonds Ltd in association with WRc plc covering the Construction, Demolition and Excavation Waste (CDEW) element of the project entitled 'Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005'. This report is addressed to the Communities and Local Government. There is a separate report covering other materials used as alternatives to primary aggregates in England, including slags, ashes, mineral wastes and other comparable materials.

2.2 The project covers England only, and in this report any references to regions, organisations, Local Authorities and other structures and entities should be interpreted as referring only to those in England.

2.3 The aim of this element of the project was to survey and report on arisings and use of alternatives to primary aggregates for 2005 (including materials such as concrete, bricks, tiles, soil and rock, but excluding other materials such as wood, metals and plastics which also arise on demolition and construction sites, but have no potential for use as aggregate).

2.4 The specific objectives of the work in respect of CDEW were set out as follows in the research specification (which is reproduced in full in Annex 1):

(i) to review the method and results of the previous national survey and to identify improvements, if any;

(ii) to review data collected by industry (the Quarry Products Association, British Aggregates Association and National Federation of Demolition Contractors) so that, if possible, use can be made of these to avoid duplication and reduce the burden of the survey on respondents;

(iii) to design an appropriate survey method that takes account, as far as is practicable, of consistency with past surveys while improving reliability at regional / local level especially by devising means of improving response rates;

(iv) to undertake the survey;

(v) to analyse, collate and validate the results;

(vi) to prepare a commentary on the results that includes an assessment of reliability and a comparison with results of previous surveys; and

(vii) to identify lessons for future surveys.

2.5 This report sets out the general approach to the various surveys and other data gathering exercises which were carried out, and presents the results from the analyses which were carried out. It also provides a commentary on the results, including lessons for future surveys.

2.6 Whereas data on aggregate recycling and the use and disposal of CDEW at licensed landfills were collected via postal surveys (using approaches very similar to those used by the same project team two and four years before), information on Paragraph 9A and 19A registered exempt sites was extracted from the EA's REGIS database, reflecting the fact that the process of registering certain exemptions, and the information which has to be provided by applicants, changed in July 2005.

THE PROJECT STEERING GROUP AND REPORTING ARRANGEMENTS

2.7 The Communities and Local Government invited representatives of Central and Local Government and of industry to sit on a Steering Group. The members of the steering group are listed in Annex 2.

2.8 The steering group met twice, in May and September 2006. At the first meeting they were briefed about the overall approach, and invited to comment on this and the draft survey forms. Comments were received, and incorporated into the final survey forms. Prior to the second meeting they were provided with a report presenting the emerging results and preliminary conclusions which were then discussed at the meeting. Later drafts of this report were circulated to the steering group by the Department for comment.

MAIN ACTIONS AND MILESTONES

2.9 The main completed actions and project milestones were as follows:

(i) start of project (February 2006);

(ii) completion of survey of Local Authority Environmental Health Officers, to update information on mobile crusher operators authorised by them (in early April 2006);

(iii) completion of survey of Mineral Planning Authorities (MPA's), to draw on information held by them on aggregate recycling (in early May 2006);

(iv) updating of survey database of operators of crushers and screens, drawing on information from various sources, including Local Authorities (see above), the EA and major recycling companies (completed in mid-May 2006);

(v) assembly of survey database of licensed landfills and their operators, based on information from the EA's PAS and REGIS databases (completed in early May 2006);

(vi) preliminary analysis of information on Paragraph 9A&19A registered exempt sites using information from the EA's REGIS database (completed in early May 2006);

(vii) approval of survey forms by Communities and Local Government, following steering group meeting (in mid-May 2006);

(viii) mailing of all survey forms (on 15 and 16 May 2006);

(ix) mailing of follow-up forms to non-respondents (in early July, with closing date of 18 August 2006);

(x) analysis of survey returns and information from registered exempt sites, and presentation of emerging results to Steering Group members (on 18 September 2006);

(xi) submission of draft Final Report to Communities and Local Government and the Steering Group (on 30 October 2006); and

(xii) submission of Final Report to Communities and Local Government (on 28 November 2006).

KEY CONCEPTS AND TERMINOLOGY

2.10 Most of the key concepts and terms used in this report are consistent with those that have been used in earlier reports on the same topic. All of them are defined and/or fully explained in Annex 3. The more important usages are as follows:

(i) 'CDEW' means the sum (or any mixture) of 'C&D waste' and 'excavation waste' as defined below, and does not include materials such as wood, metals and plastics which also arise on demolition and construction sites, but have no potential for use as aggregate;

(ii) 'C&D waste' means waste materials which arise from the construction or demolition of buildings and/or civil engineering infrastructure, including hard C&D waste and excavation waste, whether segregated or mixed;

(iii) 'hard C&D waste' means either segregated or mixed unprocessed / uncrushed materials (particularly concrete, masonry, bricks, tiles, 'blacktop' etc);

(iv) 'excavation waste' means naturally occurring soil, stone, rock and similar materials (whether clean or contaminated), which have been excavated as a result of site preparation activities;

(v) 'mixed hard C&D and excavation waste' (mixed CDEW) means a physical mixture of the two previous categories;

(vi) 'crushing' is a mechanical process of breaking concrete, bricks, blocks, tiles and similar hard materials into a more regular aggregate or similar material with a specified distribution of particle sizes;

(vii) 'screening' is a general term covering all systems (including hand picking) for sorting, separating and sizing mixed materials, but primarily refers to the use of powered screens or riddles which are not attached to a crusher;

(viii) a 'full-time crusher equivalent' is a crusher which is under the control of a survey respondent for a full year (irrespective of how often the crusher is used during that period), or any equivalent combination of crushers and time (e.g. two crushers controlled for six months, or three crushers for four months each);

(ix) 'registered exempt sites' are sites which are notified by the site operator as being exempt from waste management licensing (though not exempt from waste regulation) and where this exemption has been placed on the public register by the EA. This project is concerned in particular with sites exempted under the terms of Paragraphs 9A(1) and/or 19A(2) of Schedule 3 to the Waste Management Licensing Regulations 1994 as amended by the Waste Management Licensing (England and Wales) (Amendment and Related Provisions) (No.3) Regulations 2005 (SI No.2005/1728);

(x) 'Paragraph 9A(1) sites' are registered exempt sites where exemption holders are permitted to spread up to 20,000 m^3/ha of certain specified waste materials including soil, rock, ash, some sludges, dredgings or C&D waste for land reclamation / restoration / improvement purposes or agricultural improvement;

(xi) 'Paragraph 19A(2) sites' are registered exempt sites where exemption holders are permitted to use certain specified waste materials including C&D waste, excavation waste, ash, clinker, rock, wood or gypsum in connection with recreational or infrastructure projects, excluding land reclamation; and

(xii) 'recycling' involves an active processing of the material concerned (such as crushing or screening in the case of recycled aggregates), as opposed to its simple re-use.

ROUNDING ERRORS AND CONFIDENCE INTERVALS

2.11 All of the numbers cited in this report have been calculated using complex formulae to many decimal places, and then rounded. As a consequence, there may appear to be small arithmetical errors in some of the tables. In fact all of the individual numbers, including the totals, are as precise as might reasonably be expected. Nevertheless, mathematical precision should not be confused with absolute accuracy: many of the numbers are, after all, estimates.

2.12 Unless specified to the contrary, all bands around central estimates are given at a confidence interval (CI) of 90%.

CHAPTER 3
The Pre-Survey Preparations

BACKGROUND

3.1 The project seeks to estimate the tonnages of CDEW being processed by crushers and/or screens, the tonnages being used and disposed of at licensed landfills, and the tonnages being used on registered exempt sites. The total of these three estimates is taken to be the level of arisings of CDEW, because there is no other legal route via which CDEW can be managed.

3.2 The first two components (the tonnages processed by crushers and/or screens, and the tonnages used and disposed of at licensed landfills) have been estimated on the basis of returns to postal surveys. This Chapter sets out the key preparatory activities prior to sending out the survey forms.

3.3 First we explain the approach that has been taken to regional and sub-regional reporting, which differs from the approach taken for previous comparable surveys.

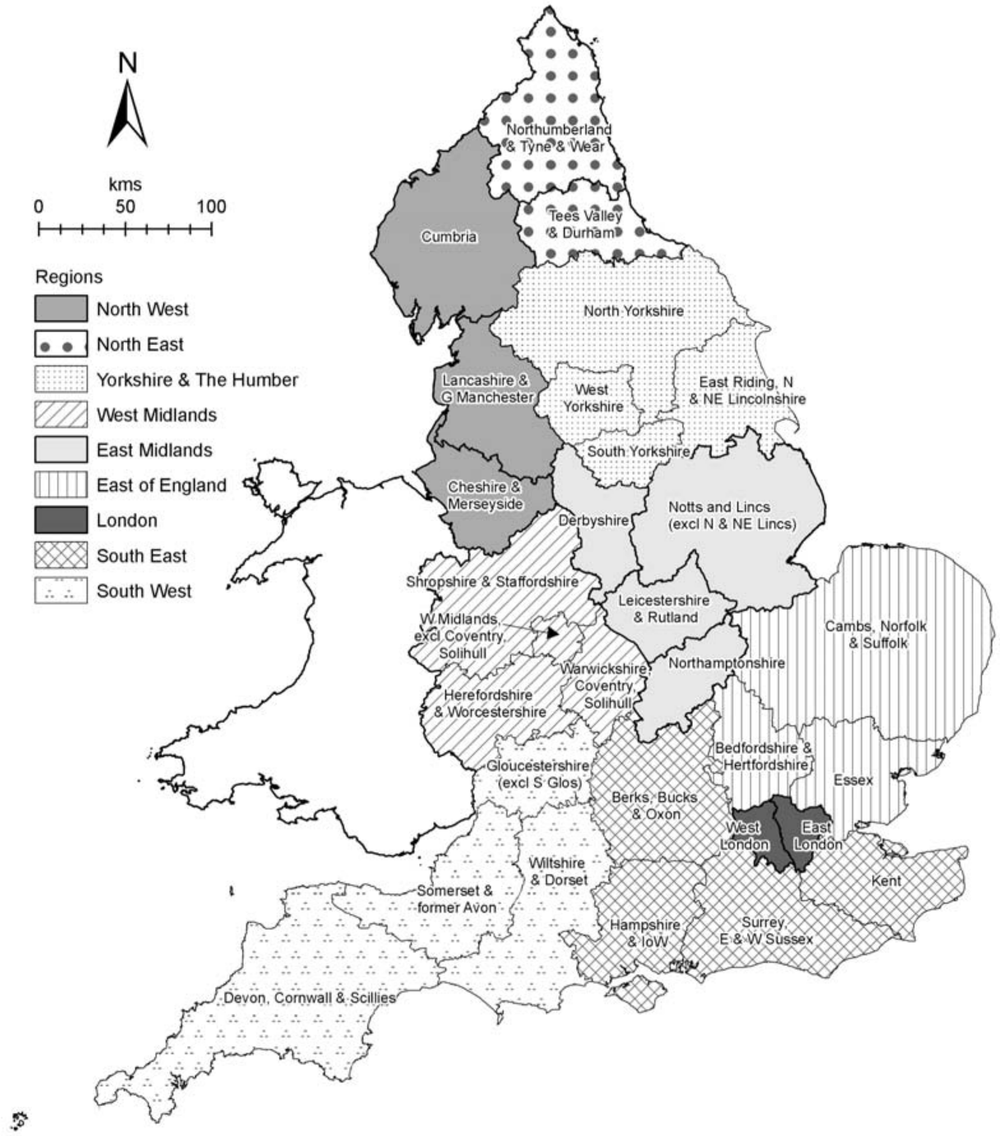
REPORTING THE RESULTS AT SUB-REGIONAL LEVEL

3.4 It was agreed with Communities and Local Government that as well as generating regional estimates for the production of recycled aggregate (and other measures to do with use and disposal), the report should explore the extent to which it is practical to project estimates down to the sub-regional level. This requires a balance to be struck between the demand for detail at the smallest geographical area, the need to avoid over-interpreting imperfect data and estimates, and (in some instances) considerations of commercial confidentiality. The definitions of the sub-regions were discussed with the Communities and Local Government and with the British Geological Survey, which was collecting data on primary aggregate arisings and use over a very similar time period. The agreed sub-regions, which are consistent with those used by the British Geological Survey, are set out in Table 3.1 and illustrated in Figure 3.1.

Table 3.1: **Regions and sub-regions for data collection and reporting**

English Regions	Sub-Regions
North West	Cumbria
	Lancashire and Greater Manchester
	Cheshire and Merseyside
North East	Northumberland and Tyne & Wear
	Tees Valley and Durham
Yorkshire & the Humber	North Yorkshire (excluding south Teesside)
	West Yorkshire
	South Yorkshire
	East Riding, North Lincolnshire and North East Lincolnshire
West Midlands	Shropshire and Staffordshire
	Herefordshire and Worcestershire
	Metropolitan County of West Midlands, other than Coventry and Solihull
	Warwickshire, Coventry and Solihull
East Midlands	Derbyshire
	Nottinghamshire and Lincolnshire (excluding North Lincolnshire and North East Lincolnshire)
	Leicestershire and Rutland
	Northamptonshire
East of England	Cambridgeshire, Norfolk and Suffolk
	Bedfordshire and Hertfordshire
	Essex
London	West London
	East London
South East	Kent
	Surrey, East and West Sussex
	Hampshire and the Isle of Wight
	Berkshire, Buckinghamshire and Oxfordshire
South West	Gloucestershire (excluding South Gloucestershire)
	Wiltshire and Dorset
	Somerset and the four former Avon authorities
	Devon, Cornwall and the Isles of Scilly

Figure 3.1: **Regions and sub-regions for data collection and reporting**



REFINING THE CONTACT DATABASES

3.5 The most important pre-survey activity involved assembling, checking and improving information on the survey populations. This involved:

(i) contacting all Environmental Health Officers (EHOs) in London and Metropolitan Borough Councils, Unitary Authorities and District Councils to check the existing database of operators of mobile concrete crushers last used in 2004, by sending them details of the information already held and asking them to review it for errors and omissions;

(ii) drawing on other sources of information on CDEW recycling (as described below);

(iii) contacting all MPA's outside London, and the nine Regional Aggregate Working Parties (RAWPs) regarding fixed recycling centres, sending them details of the information already held and asking them to review it for errors and omissions; and

(iv) liaising with the EA regarding current operators of licensed landfills.

3.6 By the time the survey forms were sent out in mid-May, information had been received from 297 out of 354 Local Authorities, a response rate of 83.9%. Of these, 226 reported that they have authorised crushers in their areas (and 745 between them), and 71 provided 'nil returns'. Most of these responses confirmed information that we already held, but some also reported changes which had taken place since 2003. The overall impact of the responses has been to confirm that the number of crushers has continued to expand.

3.7 Of the 57 non-respondent Local Authorities, two thirds are thought (based on information collected prior to earlier surveys or drawing on other information sources) to have one or more authorised crushers. Although not quite so satisfactory as a fully up-to-date response, non-respondents' websites were also checked, because some Local Authorities post schedules of Part B processes in their areas. Although only seven websites with full registers were found, this nevertheless confirmed the position regarding a further 22 crushers.

3.8 We also drew on BDS Marketing's commercially published list of fixed recycling sites together with information from Waste Resources Action Programme (WRAP). Both of these sources list many operators who were already on 'our' list, plus sites that hire in crushers rather than owning them. Most of the contacts that were added from these sources were therefore hirers / users of crushers rather than owners.

3.9 The final pre-survey estimate for the size of the recycling crusher population was 876 machines (about 12% higher than two years ago) owned or operated by 596 companies (about 13% more than two years ago). These were split into two groups:

(i) Group 1 operators, whose involvement in recycling was supported by strong evidence from at least one of a range of sources; and

(ii) a much smaller number of Group 2 operators, for whom the evidence of involvement in recycling was rather weaker.

3.10 The mailing list contained a further 680 companies (described as Group 3 operators) who were thought to use hired-in crushers and/or screens to recycle aggregate from time to time. The large majority of these hired-in crushers are authorised by Local Authorities, though from discussions with some Local Authority officers it appears that some crushers are still slipping between the regulatory regimes.

3.11 The largely updated national list was then split into nine regional lists and immediately after Easter was sent to MPAs outside London, the GLA and the RAWP secretaries, inviting them to review the lists and comment if they wished. Responses to this initiative (which was not done for previous surveys) were used in the final updating process. The response was quite mixed, and in several cases the MPAs simply passed our request on to the same EHOs who had previously responded to our earlier mailing, which evidently caused some understandable irritation.

3.12 Information on operators of landfills was drawn from the EA's PAS and REGIS databases. Landfill operators find themselves in the middle of a major process of change from Waste Management Licensing to Pollution Prevention and Control permitting. The PAS database includes all landfills that have been permitted for the first time since about 2004, plus those more significant facilities that have been re-permitted since the same time. Lower priority facilities are now being re-permitted, and PAS holds some information on facilities which are in the process of 'migrating' to the new regulatory regime. In the meantime, details of such facilities remain on REGIS, and are not necessarily removed from REGIS once they appear on PAS. PAS and REGIS use different criteria for classifying landfills.

3.13 Our challenge was to create a 'fit-for-purpose' mailing list from these two largely independent but substantially overlapping databases.

3.14 The final database of landfills (or probable landfills) thought to be worth surveying contained 955 entries: 471 drawn from PAS (some of which were also on REGIS) and a further 484 which were only on REGIS. Each of these 955 sites was then placed into one of 11 distinct categories, based on objective criteria. These 11 categories, and the numbers of sites in each, are summarised in Table 3.2 below. The significance of the shading is explained later.

3.15 The categories in Table 3.2 can be thought of as a series of filters which were applied in sequence, working from the top row downwards.

Table 3.2: **11 categories of landfills (and probable landfills)**

Database of origin	Description	Comment	Number of Facilities
Either PAS or REGIS	Landfills associated with power stations, steel mills, sugar factories, the water industry and waterways.	Known from previous surveys to take little or no CDEW.	48
REGIS only	Other factory curtilage landfills and lagoons (REGIS codes A08 and A09) not included in the previous category.	Known from previous surveys to take little or no CDEW.	52
PAS only	Facilities where the waste type has not yet been specified in PAS (and which may include some non-landfills).	May not be open yet, and may not all be landfills.	25
REGIS only	Inert landfills (REGIS codes A05 and A06) which are owned/operated by an individual not a company.	Likely to be smaller on average than company-owned sites.	69
PAS only	Inert landfills (PAS classification) only on PAS.	May not be open yet (known not to be transferring from REGIS).	16
PAS only	Non-hazardous landfills (PAS classification) only on PAS, including sites with hazardous waste cells.	May not be open yet (known not to be transferring from REGIS).	25
REGIS only	Co-disposal, special, and household, commercial & industrial waste sites (REGIS codes A01, A02 and A04).	Sites not yet transferred to PAS, and therefore likely to be small. Some may have closed during 2005.	128
PAS & REGIS	Sites that have transferred or are in the process of transferring from REGIS to PAS (and are classified in PAS as non-hazardous, but may have hazardous waste cells).	May well take CDEW for engineering, capping etc, but not as waste.	252
PAS & REGIS	Sites that have transferred or are in the process of transferring from REGIS to PAS (and where the waste classification in PAS is unknown).	May well take CDEW for engineering, capping etc, but not as waste.	53
REGIS only	Inert landfills (A05 and A06) which are owned/operated by a company.	Not being on PAS yet, likely to be smaller than those in the next category.	203
PAS & REGIS	Inert landfills (PAS classification).	Transferred to PAS, so known to be established and of some consequence.	84

3.16 Because of the transition from REGIS to PAS it was necessary to approach stratification differently from previous surveys. It is well established that large facilities use and/or dispose of most of the CDEW that enters landfills, but whereas REGIS provided charge codes from which a landfill's size could be inferred, PAS does not, because the EA now levies charges that are risk-based rather than volume-based.

3.17 Prior to the survey we had some idea which of the categories in Table 3.2 we expected to return the largest average tonnages of CDEW, because some categories are by definition more or less likely to take CDEW in the first place, and some categories are likely to have a higher proportion of closed (or not-yet-open) sites. However, we knew that provided we maintained the objective basis for allocating sites to categories, we could take advantage of the evidence provided by actual returns to group those 11 categories into three, four or five groups with comparable characteristics in order to achieve greater precision in the final grossing-up stage.

3.18 The four groups that were eventually used in the grossing-up process are indicated by the shading in Table 3.2.

DESIGNING THE SURVEY FORMS

3.19 Survey forms were drafted for operators of crushers/screens and landfills. These drafts took into account the recommendations made in Annex 12 to the report on the previous survey ('Survey of Arisings and Use of Construction, Demolition and Excavation Waste as Aggregate in England in 2003' ODPM October 2004, ISBN 1 85112 745 3, and downloadable from the Communities and Local Government website). The drafts were discussed at the first meeting of the steering group on 5 May 2006, and amended to take into account issues raised at that meeting. Copies of the forms as issued on 15 and 16 May 2006 are included as Annex 4 to this report.

3.20 Because the project also involved the collection of data on secondary materials used as an alternative to primary aggregates, the CDEW survey forms were fine-tuned so that data on other materials which are processed in a very similar manner to CDEW (such as spent railway ballast and 'blacktop') could be explicitly collected in a format that would complement the approach being taken to the collection of data on secondary materials.

SENDING OUT THE SURVEY FORMS

3.21 The survey forms were sent out to operators of recycling crushers and landfills on 15 and 16 May 2006, with an initial closing date of 16 June 2006. This gave us time to send follow-up forms to non-respondents at the beginning of July, with a revised closing date of 18 August. The only group to whom follow-up forms were not sent comprised potential operators of recycling crushers and screens who were thought not actually to own a crusher (i.e. the Group 3 operators as defined above).

3.22 The follow-up survey forms only differed from the originals in the wording on the first page, which explained that the recipients would have seen the original forms, and that we remained very keen to receive a return from them, even though the original closing date had passed.

CHAPTER 4
The Results of the Survey of Operators of Recycling Crushers and Screens

CHARACTERISTICS OF THE SURVEY POPULATION AND RESPONSE RATE

4.1 The characteristics of the survey population of operators and potential operators of recycling crushers and screens, and their survey returns, are set out in Table 4.1 below. These data use all returns received by 1 October 2006, six weeks after the 'official' closing date of 18 August. By the middle of September the returns had almost completely dried up.

Table 4.1: **Response rate: survey of operators of recycling crushers and screens**

	Group 1 (Operator probably owns a recycling crusher)	**Group 2** (Operator may own a recycling crusher)	**Group 3** (Operator probably hires in any recycling crusher)	**Total**
Forms mailed	513	83	680	1,276
Useful returns:				
Forms returned with information on recycling activity (incl. nil returns)	147	31	96	274
Forms returned reporting no recycling activity (nil returns)	14	11	27	52
Useful response rate	28.7%	37.3%	14.1%	21.5%
Unuseable returns:				
Post Office unable to deliver form	11	4	44	59
Form returned by addressee, but with no useful information provided	2	1	1	4
All unuseable returns	13	5	45	63
Unuseable response rate	2.5%	6.0%	6.6%	4.9%
Crusher numbers:				
Pre-survey estimate of total population of recycling crushers	781	95	0	876
Number of crushers on pre-survey estimate associated with respondents who provided useful information	211	34	0	245
Response rate by pre-survey estimate of crusher population	27.0%	35.8%	n/a	28.0%

4.2 As can be seen from Table 4.1 a relatively small number of Group 1 respondents reported that they were not in fact involved in recycling. The same was true, albeit on a larger scale, for Group 2 operators. Furthermore, the numbers of crushers reported by those operators who were involved in recycling differed in many instances from our pre-survey expectations[1].

1 Nevertheless, there was a strong correlation between our pre-survey expectations regarding crusher ownership and reported ownership.

These differences are reported in Table 4.2, below. On the assumption that the ratios between pre-survey expectations and actual crusher populations also apply to non-respondents, it can be concluded that the true count of recycling crushers owned and operated by Group 1&2 operators as a whole is likely to be lower than the original pre-survey estimate. On the other hand, the 96 Group 3 operators who responded to the survey reported that they actually owned almost 22 recycling crushers active in England between them. Assuming that the rate of Group 3 operator ownership (0.23 crushers per respondent) is equally true of non-respondents, the resultant adjustment is large enough not just to offset the reduction in the other two groups, but actually to raise the estimated total. The original estimate for the total number of recycling crushers was 876, whereas the adjusted estimate based on the factors described above is 893 when rounded to the nearest whole number: an increase of just under 2.0%. These adjustment factors are set out in Table 4.2.

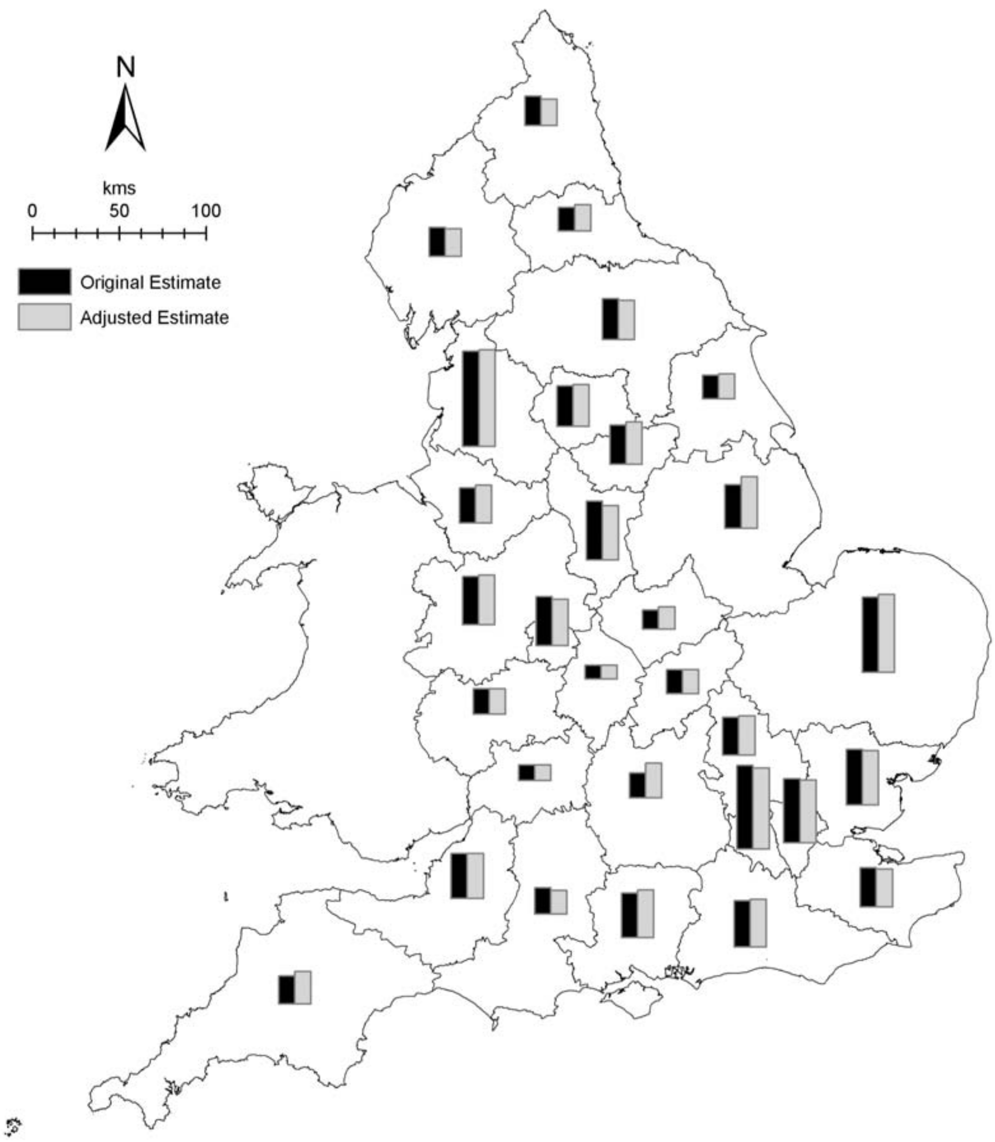
Table 4.2: **Adjustments to the estimated population of recycling crushers**

	Group 1 (Operator probably owns a recycling crusher)	**Group 2** (Operator may own a recycling crusher)	**Group 3** (Operator probably hires in any recycling crusher)
Pre-survey estimate of total population of recycling crushers	781	95	0
Number of crushers on pre-survey estimate associated with respondents who provided useful information	211	34	0
Number of recycling crushers reported by respondents as being owned by them and used in England	186.67	17.00	21.85 (from 96 respondents)
Adjustment factors for Group 1&2 operators	(211 – 186.67) / 211 = - 11.53 %	(34 – 17.00) / 34 = - 50.00 %	n/a
Adjustment factor for Group 3 operators	n/a	n/a	+ 0.23 per operator
Adjustment process, and adjusted estimate of English recycling crusher population	781 – 11.53 % = 690.84	95 – 50.00 % = 47.50	680 x 0.23 = 154.77

4.3 This is very similar to the adjustment process that was carried out for the previous survey (covering 2003 recycling activity). However, on that occasion, because fewer Group 3 operators reported owning recycling crushers, the adjustment was smaller, and resulted in a small reduction compared to the original estimate, whereas this time the adjustment is upwards.

4.4 Table A7.1 (which can be found in Annex 7) gives both the original (pre-survey) estimate of crusher numbers, and the adjusted estimate for each of the 30 reporting sub-regions, rounded to the nearest whole number. These data are illustrated in Figure 4.1, and the equivalent regional and national estimates are given in Table 4.3.

Figure 4.1: **Original and adjusted estimates of numbers of recycling crushers in 2005**



Notes:

The first bar in each sub-region indicates the original estimate for the number of recycling crushers; the second indicates the adjusted estimate. As can be seen, in most cases the two estimates are very similar.

The source data for this figure can be found in Table A7.1.

Table 4.3: Original and adjusted regional and national estimates of recycling crusher populations

Regions	Original estimate	Adjusted estimate
North West	114	117
North East	38	37
Yorkshire & the Humber	103	106
West Midlands	97	96
East Midlands	104	108
East of England	121	123
London	106	103
South East	111	120
South West	82	83
England	**876**	**893**

4.5 Previous surveys have confirmed that most recycling crushers serve a relatively small geographical area, with very little CDEW travelling more than 20 miles to be processed. This arises from a whole series of considerations, and in turn has implications and consequences which can be summarised as follows:

(i) the commercial viability of recycling CDEW is largely determined by the balance between the cost of waste disposal and the cost of primary aggregate, both of which are strongly influenced by haulage costs, which in turn are largely determined by travel distances, which tend to be higher (for both disposal and aggregate) in conurbations, where landfills and quarries have been squeezed out by rising land values;

(ii) operators of recycling crushers in rural areas can find suitable working sites more easily, but are often further from both raw materials (demolition waste) and markets (development sites in predominantly urban areas);

(iii) by contrast, operators in the most densely populated urban areas have plenty of raw materials and the recovered product can compete with primary aggregate, but the operators often have difficulty identifying permanent (fixed) recycling sites; and

(iv) operators on the urban fringe are more likely to be able to combine proximity to both raw materials and market demand with workable and accessible fixed recycling sites.

4.6 Local population density is a reasonable proxy for several of these variables, and therefore all of the crushers on the mailing list have also been allocated to a human population density band, based on the individual Local Authority in which they are authorised or based. This was also done for the 2003 survey.

4.7 The difference this time (2005, compared to 2003) is that three population density bands have been used instead of two. This has been done because a re-working of the 2003 data showed that some small gains in precision could be obtained by making this change, and with the pressure to provide estimates for smaller geographical units, any additional precision is valuable. The population data used to calculate densities were again taken from the 2001 Census returns.

4.8 On this occasion the three population density bands are as follows:

(i) areas with 1,000 or fewer persons per square kilometre (km) (referred to as low density areas);

(ii) areas with more than 1,000 and up to 2,000 persons per square km (referred to as medium density areas); and

(iii) areas with more than 2,000 persons per square km (referred to as high density areas).

4.9 The lowest density band remains unchanged from two years ago, whereas the two higher density bands represent a splitting of the upper band as used on that occasion.

4.10 Table 4.4 lists those Local Authorities that fall into the two higher population density bands, arranged by sub-region. The 45 Local Authorities in medium density areas account for 16.2% of the population of England and 4.3% of the surface area, while the 87 high density areas account for 35.6% of the population and 3.8% of the area. Between them, therefore, these two bands hold 51.8% of the population of England on just 8.2% of the land area.

Table 4.4: **Local Authority areas with medium and high population densities**

Sub-region	Local Authority areas with 1,001-2,000 pesons/km²	Local Authority areas with 2,001 or more persons/km²
Cumbria		
Lancashire and G Manchester	Blackburn with Darwen, Bolton, Bury, Hyndburn, Oldham, Rochdale, Trafford, Wigan	Blackpool, Manchester, Salford, Stockport, Tameside
Cheshire and Merseyside	Halton, Knowsley, Sefton, St Helens, Warrington, Wirral	Liverpool
Northumberland and Tyne & Wear	Blyth Valley, Gateshead	Newcastle-upon-Tyne, North Tyneside, South Tyneside, Sunderland
Tees Valley and Durham		Middlesbrough
North Yorkshire		
West Yorkshire	Bradford, Leeds	
South Yorkshire	Sheffield	
East Riding, N&NE Lincolnshire		Kingston-upon-Hull
Shropshire and Staffordshire	Cannock Chase	Stoke-on-Trent, Tamworth
Herefordshire and Worcestershire	Redditch	Worcester
W Midlands, excl Coventry, Solihull		Birmingham, Dudley, Sandwell, Walsall, Wolverhampton
Warwickshire, Coventry, Solihull	Nuneaton & Bedworth, Solihull	Coventry
Derbyshire	Chesterfield, Erewash	Derby
Notts and Lincs (excl N&NE Lincs)	Ashfield, Broxtowe, Mansfield	Lincoln, Nottingham
Leicestershire and Rutland		Leicester, Oadby & Wigston
Northamptonshire		Northampton
Cambs, Norfolk and Suffolk		Cambridge, Ipswich, Norwich
Bedfordshire and Hertfordshire	Broxbourne	Luton, Stevenage, Watford
Essex	Basildon, Castle Point	Harlow, Southend-on-Sea
West London		All 17 Boroughs
East London	Bromley, Havering	All 14 other Boroughs
Kent	Dartford, Medway, Thanet	
Surrey, E&W Sussex	Adur, Elmbridge, Epsom & Ewell, Spelthorne, Woking	Brighton & Hove, Crawley, Eastbourne, Hastings, Rushmoor, Worthing
Hampshire and IoW	Eastleigh, Fareham	Gosport, Havant, Portsmouth, Southampton
Berks, Bucks and Oxon	Bracknell Forest	Oxford, Reading, Slough
Gloucestershire (excl S Glos)		Cheltenham, Gloucester
Wiltshire and Dorset	Weymouth & Portland	Bournemouth, Poole
Somerset and former Avon		Bristol,
Devon, Cornwall and Scillies		Exeter, Plymouth, Torbay

KEY SURVEY RESULTS

4.11 The survey results confirm that the average output of recycled aggregate per crusher in 2005 did indeed vary by population density band, as shown in Table 4.5 below, encouraging us to put forward the hypothesis that the differences are not just apparent but real (in a statistical sense). The statistical test to see whether the means of two groups of data are genuinely different (the 't' test) takes account of the size and variability of each data set as well as the actual average values. Two 't' tests were carried out, and the results suggest that the differences between crushers in low density and medium density areas are significant at a confidence level of 85%, while the differences between crushers in medium and high density areas are significant at a confidence level of 66%. While this could not be regarded as a ringing endorsement for the approach that is being taken, it certainly does not undermine it in any way. Further information on the various statistical tests and procedures can be found in Annexes 5 and 6.

Table 4.5: **Differences between recycling crushers in different population density bands in 2005**

Population density band	Average tonnes of recycled aggregate per crusher	Ratio between graded and ungraded recycled aggregate
Low density areas	44,869	51:49
Medium density areas	66,271	74:26
High density areas	41,658	57:43
All areas taken together	46,968	57:43

4.12 The different ratios between graded and un-graded recycled aggregate reported in Table 4.5 are consistent with a specific finding of the 2001 survey[2], that the highest quality output is achieved by recyclers who can mix on-site work (i.e. on the demolition/redevelopment site) with access to a fixed recycling centre (where they can deal with materials which might be wasted altogether or at best turned into relatively low-grade fill if dealt with at the point of arising). Further 't' tests were carried out to test the differences between the ratios between graded and un-graded aggregate in low, medium and high density areas. These suggest that the differences between crushers in low density and medium density areas are significant at a confidence level of 90%, while the differences between crushers in medium and high density areas are significant at a confidence level of 85%. Further information on this can be found in Annex 6.

4.13 All operators were asked how many crushers and screens they owned, how many they hired in, and how many full-time machines their actual utilisation was equivalent to (with the guidance that the time to be used when calculating availability should include idle time if the machine was under their control when it was idle). This approach was exactly the same as was taken for the 2003 survey, and is central to the grossing up procedure.

4.14 Operators were also asked where their machines had been active during 2005, enabling any machines that had been working outside England, together with their output, to be taken out of the calculation.

2 This point was not investigated in 2003.

4.15 The grossing up procedure as it applies to England as a whole is illustrated in Table 4.6. The same procedure has then been repeated for each of the 30 sub-regions individually, using the numbers of crushers per sub-region and the national mean values for aggregate and soil per crusher[3]. The key results of that process (but not the individual workings) are reported in Table A7.2, which can be found in Annex 7. The equivalent regional results are given in Table 4.7.

4.16 Tables 4.6 and A7.2 both include estimates for the tonnage of recycled soil (excluding topsoil). This is expressed per recycling crusher, though in reality, of course, this material is almost entirely recovered using screens rather than crushers.

4.17 As previously noted, all of the reported numbers (including the numbers of full-time crusher equivalents) have been rounded individually, with the consequence that the workings cannot be reproduced precisely using the numbers given.

Table 4.6: **National estimate of the production of recycled aggregate and soil in England in 2005, by population density band**

	Low density	Medium density	High density	Total
Adjusted population of crushers	542	127	224	893
Number of crushers (i.e. reported full-time crusher equivalents) providing data (England only)	156	33	57	246
Million tonnes of recycled aggregate reported by respondents (England only)	6.99	2.17	2.38	11.54
Mean tonnes of recycled aggregate per crusher	44,869	66,271	41,658	46,968
Mean tonnes of recycled soil (excl topsoil) per crusher	3,856	9,519	4,755	4,819
Grossed-up production of recycled aggregate (million tonnes)	24.33	8.41	9.34	42.07 ± 15 %
Grossed-up production of recycled soil (million tonnes)	2.09	1.21	1.07	4.36 ± 36 %
Total estimate of recycled aggregate and soil in England in 2005 (million tonnes)	**26.4**	**29.62**	**10.40**	**46.44 ± 14 %**

Notes:

The bands around the central estimates are at a confidence interval of 90 %.

3 National rather than regional means for recycled aggregate per recycling crusher are used on the grounds that it is the setting (population density) in which a crusher is operated that influences its throughput rather than its specific geographical location.

Table 4.7: Regional estimates of the production of recycled aggregate and soil in England in 2005 (tonnes)

	Graded recycled aggregate	Ungraded recycled aggregate	Recycled soil (other than topsoil)	Total recycled aggregate and soil
North West	3,758,097	2,259,397	703,320	6,720,814
North East	953,127	754,691	173,123	1,880,941
Yorkshire & the Humber	3,071,057	2,184,463	549,951	5,805,470
West Midlands	2,551,655	1,895,768	470,201	4,917,625
East Midlands	2,845,598	2,240,550	504,968	5,591,117
East of England	2,884,291	2,654,663	492,199	6,031,153
London	2,514,616	1,830,899	500,821	4,846,336
South East	3,525,843	2,451,493	637,508	6,614,844
South West	1,928,015	1,769,873	332,652	4,030,541
England	**24,032,301**	**18,041,797**	**4,364,743**	**46,438,841**

4.18 The 30 sub-regions (which were not chosen simply for the purposes of this project) are really quite varied in terms of their populations, population densities and economic characteristics, though not nearly as varied as the 354 Local Authority areas from which they are assembled. Their variability provides an opportunity to check the extent to which the chosen method for grossing up appears credible.

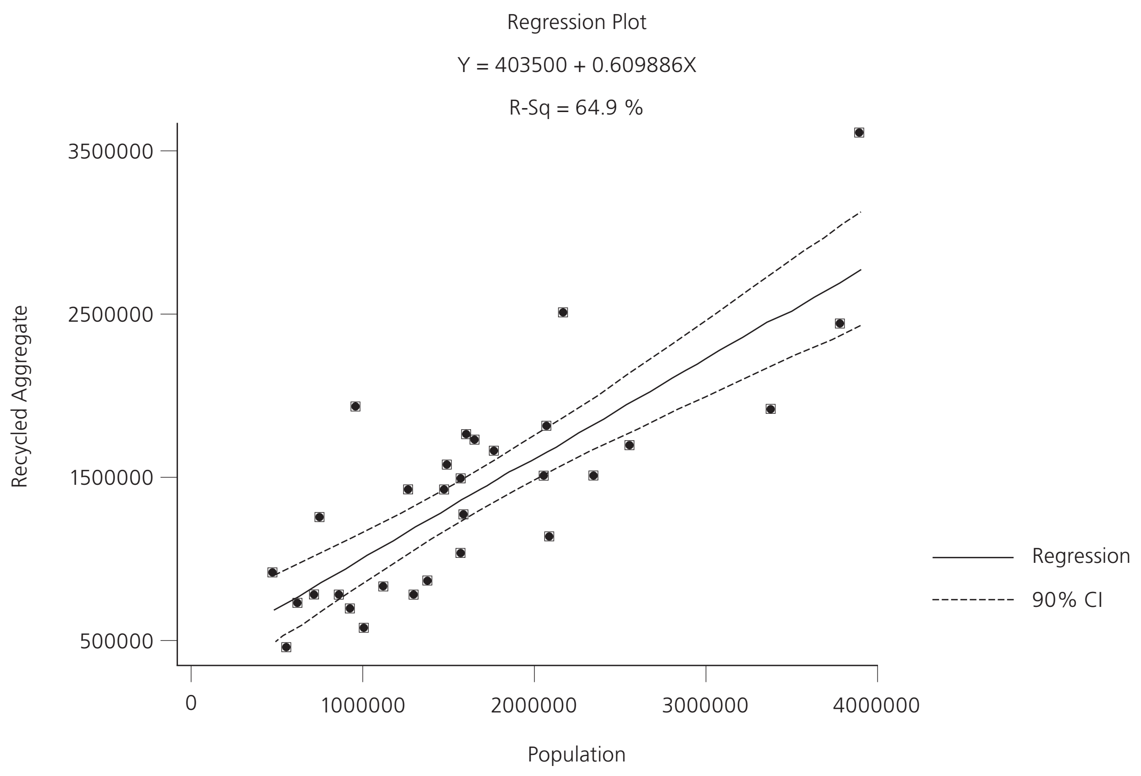
4.19 The regional estimates generated from the 2003 survey were checked for the degree to which they were correlated with both population levels and regional gross value added (GVA). GVA is a good measure of overall economic activity, because it measures the value which is being added to raw materials and basic services. The link to population turned out to be appreciably stronger. This time the same thing has been done for the 2005 sub-regional estimates.

4.20 Table A7.3 (which can be found in Annex 7) shows the population and the population density for each sub-region, together with the estimated tonnage of recycled aggregate (the sum of the graded and un-graded tonnages from Table A7.2) and the same tonnage expressed as tonnes per person. We have then calculated the correlation coefficient for the number of tonnes of recycled aggregate and the human population for all 30 sub-regions.

4.21 This shows that there is a reasonably strong correlation between human population and the estimated production of recycled aggregate. The correlation coefficient (R) is 0.805 (meaning that 64.9% (R^2) of the variation in recycled aggregate production is explained by the variation in the populations in the different sub-regions).

4.22 We also tested the hypothesis that the correlation is different in relatively rural and relatively urban areas, and we did this by calculating a series of pairs of correlation coefficients for sub-regions with lower and higher population densities (above and below the national average, and above and below a selection of other 'break points'). However, this process did not explain the relationships any better. The regression line which best fits the relationship between population and recycled aggregate production is illustrated graphically in Figure 4.2.

Figure 4.2: **Regression between population and recycled aggregate production using 30 grossed up sub-regional estimates**



4.23 A cursory examination of the penultimate column of Table A7.3 (in Annex 7) will confirm that the three sub-regions with the highest per capita output of recycled aggregate are Cumbria, North Yorkshire and Derbyshire. All three of these sub-regions have below average population densities. Specific comments about these sub-regions are as follows:

(i) Cumbria and North Yorkshire have the lowest population densities of all 30 of the sub-regions, and are the only sub-regions which are entirely made up of low population density areas. However, a simple calculation shows that the average throughput of recycling crushers in Cumbria and North Yorkshire taken together is only slightly lower than the average for low density areas as a whole; and

(ii) Derbyshire is a county with a long history of primary aggregate supply, with rural areas which sit directly between Greater Manchester, Sheffield, Derby and Stoke-on-Trent.

4.24 Table A7.3 also shows the sub-regional data for GVA, taken from the website of the Office for National Statistics (ONS). In the case of London these data are approximate, because the ONS uses different sub-regions which do not precisely match the west-east split used for this study. Our GVA figure for West London is probably very slightly overstated as a consequence. The relationship between GVA and recycled aggregate production is appreciably weaker than that between recycling and population, with a correlation coefficient of 0.631 and a value for R^2 of 39.8%.

MISCELLANEOUS RESULTS

4.25 Some information was collected which is not necessarily suitable for grossing up, but provides helpful insights into the recycling market. For example, Q4.1 on the survey form asked about the sorts of locations in which respondents had worked during 2005.

4.26 Eighty seven respondents (out of 222 active recyclers and 274 respondents) reported that their machines had worked on demolition sites during 2005, of whom 51 also used their machines on other types of sites (such as fixed recycling sites, waste transfer stations, landfills or quarries). One hundred and sixty five respondents reported that they had worked at a fixed site of some sort, of which 114 only worked at fixed sites.

4.27 There was very little difference in the average throughput per crusher over the different site types, but (as when this aspect was surveyed four years ago) a very considerable difference was revealed in the balance between graded and un-graded recycled aggregate. The key figures are reported below in Table 4.8. It must be emphasised that these are the respondents' actual returns, and are not necessarily fully representative of the population of recyclers as a whole.

Table 4.8: **Differences between results reported by operators using different types and combinations of sites**

Site types / combinations	Recycled aggregate reported	% of total (ignoring blank forms)	Graded: ungraded ratio
Demolition sites only	2,261,546	19.8%	38:62
Demolition sites and fixed sites	4,140,838	36.3%	67:33
Demolition sites and other site types	37,000	0.3%	14:86
Fixed sites only	4,602,342	40.3%	59:41
Other site types only	372,600	3.3%	27:73
Question left blank	125,861	(omitted)	57:43
All sites	**11,544,998**	**n/a**	**57:43**
All sites for which answers were given	***11,419,137***	***100%***	***57:43***
Combinations of lines above:			
Demolition with/without other sites	6,439,384	56.4%	57:43
Fixed/other sites with/without demolition	9,152,780	80.2%	63:37

4.28 The middle column of figures in Table 4.8 removes from the calculation the tonnage reported by the seven operators who did not specify the type or combination of sites on which they had worked.

4.29 The principal conclusion is that the 'best' results (in terms of pushing recycled aggregate up the value chain) are achieved by operators who mix working on demolition sites with having access to a fixed recycling site of their own.

4.30 These data also provide an opportunity to check our estimates against results reported by others who have looked at different segments of the aggregate recycling industry.

4.31 For example, BDS Marketing and WRAP both collect data from operators of fixed recycling sites (but covering those operators' full recycling operations wherever they took place). The data reported in Table 4.8 suggest that this sub-group of operators is responsible for 80.2% of all aggregate recycling, so a tonnage estimate based on them alone would have to be increased by marginally under 25% in order to obtain an overall estimate of aggregate recycling. (This factor would be enough to raise the 80.2% share attributed to operators of fixed sites in the final row of Table 4.8 to 100%).

4.32 BDS Marketing asked respondents to put their annual tonnage of recycled output into one of six bands (the bands being nil to 50,000 tonnes, 50,000 to 100,000 tonnes, 100,000 to 150,000 tonnes, 150,000 to 200,000 tonnes, 200,000 to 300,000 tonnes and 300,000 to 400,000 tonnes). By assigning a tonnage representing the mid-point of each band (e.g. 25,000 tonnes, 75,000 tonnes, 125,000 tonnes, 175,000 tonnes, 250,000 tonnes or 350,000 tonnes) to all sites in that band, a crude estimate of the total tonnage can be made. After non-English sites had been removed and a few multiple bandings had been resolved (by averaging the estimates where a site had been assigned to more than one band), the final few sites which were not banded were allocated to the lowest tonnage band. Having done this, the tonnage was estimated at 37.28 million tonnes. If this figure is increased by 25% it provides a national estimate of 46.60 million tonnes, which is 10% higher than our estimate of 42.07 million tonnes (see Table 4.8), and comfortably within the stated confidence interval of ± 15%. This gives general support to the contention that our national estimate is broadly credible.

4.33 We have also used data from the National Federation of Demolition Contractors (NFDC) to see how well it matches our estimate. Although not all demolition contractors are NFDC members, most of the major ones are. Data collected by the NFDC suggests that in 2005 those in England generated about 17 million tonnes of hardcore / recycled aggregate (the figure is approximate, because Welsh returns are included with those from the Midlands, and cannot be as easily stripped out as those from Scotland). If 56.4% of all recycled aggregate is accounted for by operators who carry out at least part of their work on demolition sites (see the penultimate row of Table 4.8) then the factor by which any estimate based on this sub-group of operators would need to be increased in order to give an overall estimate for all recycled aggregate would be 78%. Applying this factor to the NFDC's returns of 17 million tonnes produces an estimate of 30.26 million tonnes, which is 72% of our estimate of 42.07 million tonnes. If the factors used in these calculations are all correct, then NFDC members would be responsible for 72% of all demolition and excavation waste recycling, by weight. This does not seem unreasonable.

4.34 One other point that has been checked concerns the sub-population of recycling centres that reported that they accept utility trench arisings (alongside other types of CDEW). A total of 54 respondents with 67 full-time crusher equivalents reported accepting trench arisings, and their total tonnage output amounted to 1.98 million tonnes of graded aggregate and 1.61 million tonnes of ungraded aggregate (a ratio of 55:45). These 54 operators represent 24% of all respondents involved in recycling, and their crushers represent 27% of the full-time crusher equivalents reported. If these proportions are projected onto the national population of recycling centres, it suggests that there are 225 such centres in England, equivalent to one for every 220,000 persons[4].

4 It does not imply that a quarter of CDEW arisings come from utility trench works: the questions that were asked in the survey were not sufficiently detailed to allow that proportion to be estimated.

4.35 The second part of Question 2.2 on the survey form (which is reproduced in Annex 4) asked what proportion of recycled materials were left on the site where they arose and were processed. Unfortunately, many respondents did not answer this question at all, and many others gave answers which were clearly unreliable. In several instances the respondents gave percentages, as requested, but the ones that they gave added up to 100%, and corresponded precisely to the tonnages reported for the four types of material, strongly suggesting that they had not understood the question actually being asked. In several other instances, operators who work at fixed recycling centres and transfer stations rather than demolition sites reported that they were leaving materials on the original sites for use there. We have therefore concluded that it would be very unwise to use the answers given to this question to make any calculations.

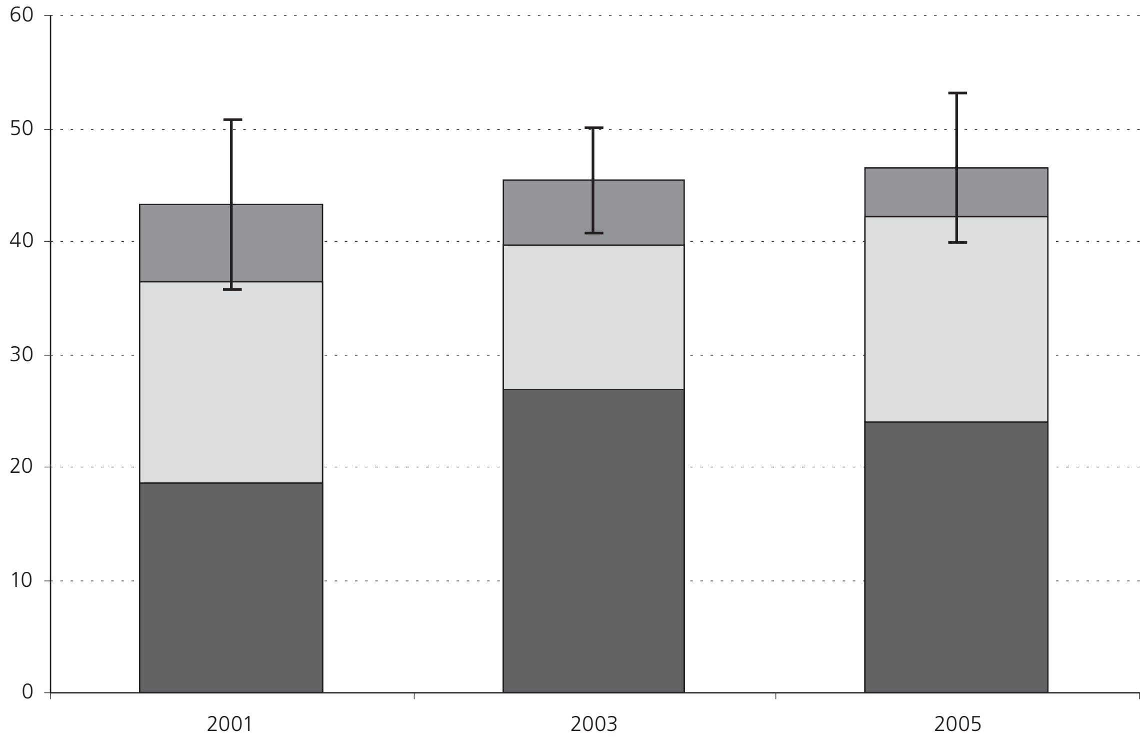
4.36 Finally, Question 7 on the survey form asked for respondents' impressions of changes in the supply of recycled aggregate over the past two years. Roughly 10% of respondents did not answer this question, but of those who did 103 reckoned supply had grown, 79 thought it had not changed appreciably and 20 reckoned it had fallen. Most of those who thought supply had grown thought the growth had been modest (20% or less).

4.37 In fact we have been able to compare 111 actual returns given by respondents who returned forms covering both 2003 and 2005 and expressed an opinion on the direction of change. The data collected from this group collectively showed a decline of 9% in aggregate recycling. However, of these 111 respondents 58 reported that they felt the supply had grown, 42 felt it had remained steady and 11 felt it had fallen. In fact returns provided by two out of these three groups showed actual declines in tonnage terms, by 17% in the case of those who felt it had grown, and by 9% in the case of those who felt it had fallen. The returns from the group who reported no change bore out their views. This leads to the conclusion that respondents' medium-term memories are no substitute for actual returns, and that some recyclers are apparently relatively optimistic in their view of the market.

DISCUSSION OF MAIN FINDINGS

4.38 The 'headline' results from the survey of operators of recycling crushers and screens suggest that the rise in tonnage of recycled aggregate that has been observed in previous surveys has continued. In 2001 the estimate was 36.47 million tonnes, and in 2003 it was 39.60 million tonnes. The estimate for 2005 of 42.07 million tonnes suggests that production has risen by around 3.1% a year over the two years since the previous survey (or just under 3.7% a year over the four years since the 2001 survey). This trend is illustrated in Figure 4.3, together with the uncertainties around the central estimates.

Figure 4.3: **Changes in the estimates of recycled aggregate and soil production, 2001 to 2005 (million tonnes)**



Notes:

The three bands are as follows: graded aggregate (lower band), ungraded aggregate (middle band) and recycled soil (top band).

The bars show the upper and lower estimates around the total central estimate at a confidence interval of 90 %.

4.39 However, the response rate to this survey was appreciably lower than it was for the 2003 survey, and when measured by reference to the population of recycling crushers is only about half as high as it was in 2003. It is important to consider why this might have happened.

4.40 The survey form is longer and slightly more complicated than in 2003, but very similar in presentational style. In 2003 the form was a double-sided A4 sheet with seven questions. This time it was a double-sided folded A3 sheet with seven questions and three subsidiary ones, and with a less cluttered layout (which can be seen in Annex 4). All of the background explanation was on the front page, and most of the questions were on the inside of the form. Using the numbering of the 2005 questions, comments and comparisons are as follows:

(i) Question 1 was slightly longer, naming more categories of materials to reflect the broader scope of the overall project compared to 2003;

(ii) Question 1.1 was new, but only affected a minority of respondents;

(iii) Questions 2, 3 and 4 were effectively identical to questions asked in 2003;

(iv) Question 2.1 combined a question asked in 2003 with an additional question not previously asked (regarding the proportion of recycled materials used or left on the site where it had arisen, and been processed);

(v) Question 4.1 was not asked in 2003, but had been asked in 2001;

(vi) Question 5 was effectively identical to a question asked in 2003;

(vii) Question 6 was new (and concerned the origins of the materials processed, as opposed to the place where they were processed); and

(viii) Question 7 was a simpler version of a question asked in 2003.

4.41 A lot of respondents ignored the (new) second part of Question 2.1, and it was clear from the answers that were received that a considerable proportion of those who did answer it had evidently misunderstood the question. A large proportion of respondents either did not answer or only partially answered Q7 (as they had with the equivalent question in 2003). However, neither of these questions was in any sense central to the survey, and there is no obvious reason to conclude that the actual format or content of the survey form contributed to the decline in response rate.

4.42 The biggest difference between 2003 and 2005 was the timing of the survey. In 2003 the survey forms were mailed out on 25 February with an initial closing date of 9 April, whereas in 2005 they were not mailed until mid-May, with an initial closing date of 16 June. The gap between the end of the survey year and receipt of the survey form, therefore, rose from about eight weeks to about 19 weeks. We believe this was the main contributor to the reduced response rate. Crusher operators are not obliged to keep records, and certainly not at the level of detail that we ask about, and the longer the gap between the period being asked about and the receipt of a voluntary survey form, the greater the tendency to ignore it must be.

4.43 There is a separate issue which merits consideration, and which relates to changing technology.

4.44 In 2000, when the first survey of this type was carried out (collecting data from 1999), most recycled aggregate was processed through mobile crushers, and most mobile crushers were geared to recycling. Many of these mobile crushers operated at the original demolition site (as opposed to at a fixed recycling centre). Relatively small amounts of soil (as opposed to aggregate) were recovered. Over the intervening period:

(i) mobile crushing technology has continued to improve, and mobile crushers are increasingly being used within quarries as well as for recycling, as an alternative to fixed crushers;

(ii) the number of fixed recycling centres has increased very substantially;

(iii) greater use is made of mobile screens at these fixed sites, with the consequence that more materials are being recovered without the use of mobile crushers; and

(iv) at least partly due to the availability of grant funding, non-crushing processes such as aggregate and soil washing are becoming more widespread.

4.45 As a consequence of these trends, a survey methodology which uses mobile crushers as the basis for its grossing-up calculations is becoming increasingly inappropriate, particularly where the survey is required to produce estimates at an increasing level of geographical detail. Despite this, there were two strong reason for using the method we did on this occasion: it makes direct comparisons with the results of previous surveys more appropriate, and we have in any case been unable to formulate an alternative method of grossing-up which overcomes these particular challenges satisfactorily.

4.46 The pressure for geographical precision also raises the separate issue of 'out of area' working. Because the method used for grossing up utilises the estimated local population of recycling crushers as one of the key determinants, this issue assumes greater significance each time the size of the reporting areas is reduced, because the proportion of crushers based within 15-20 miles of a regional or sub-regional boundary increases disproportionately.

4.47 As part of the survey we asked operators (a) where their crushers worked during 2005 (Question 5), and (b) where the materials that they processed came from (Question 6). Most respondents provided answers to both questions, but inevitably some were more precise than others, and many of the answers provided cannot be converted into a neat 30 by 30 matrix. What we have been able to do is to estimate for all respondents:

(i) what proportion of the waste materials that they processed came from within their 'home' sub-region;

(ii) what proportion came from another sub-region within their 'home' region;

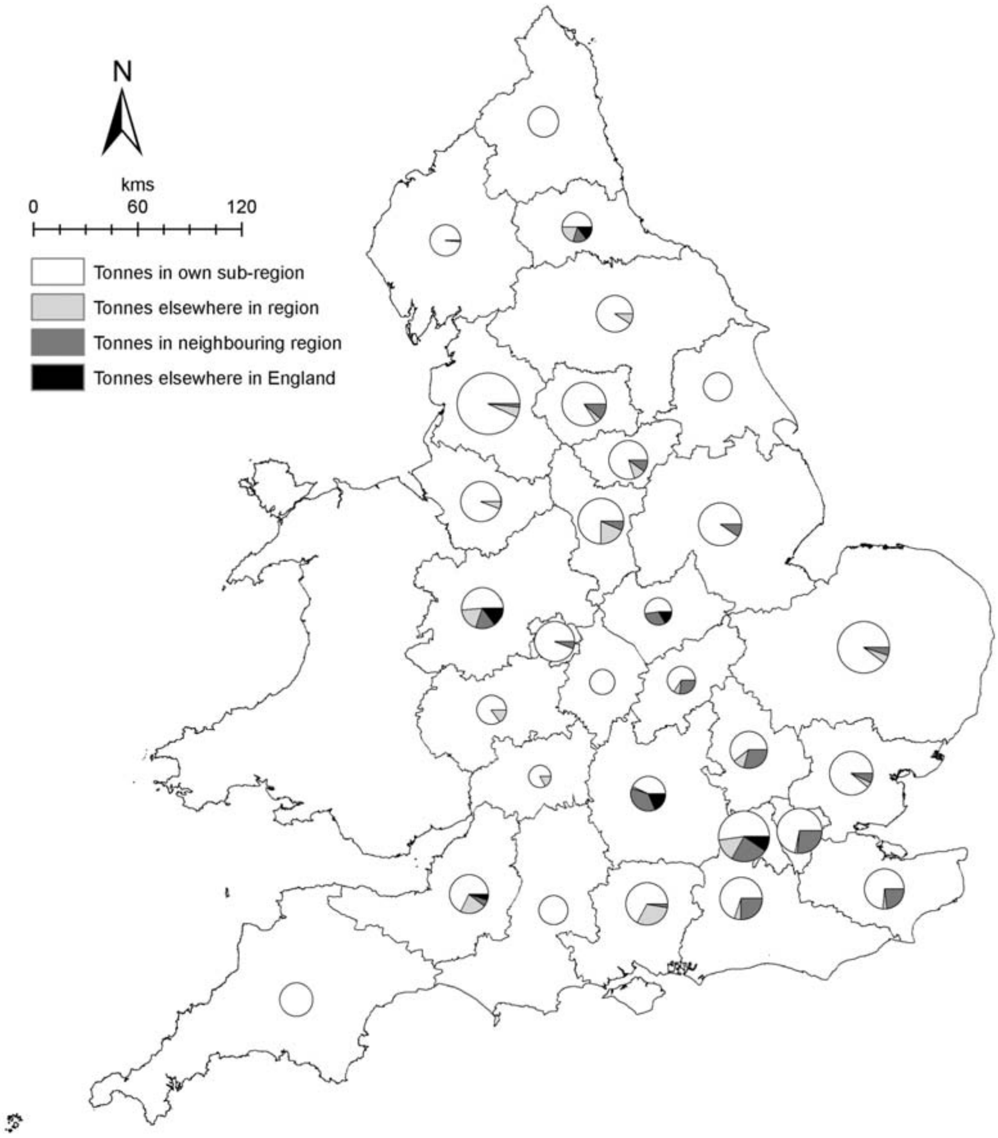
(iii) what proportion came from one of the adjacent regions; and

(iv) what proportion came from further away in England.

4.48 Table A7.4 (which can be found in Annex 7) and Figure 4.4 both show these data for each of the 30 sub-regions. Table A7.4 presents the growing cumulative percentages of materials coming from the 'home' sub-region (second column), the 'home' region (third column), and the 'home' and adjacent regions (fourth column), followed by the percentage coming from regions which are not even adjacent to the operator's 'home' region (fifth column). The shading in columns 2-5 is designed to make the patterns easier to see. Figure 4.4 presents the same data as a series of pie charts, in which an undifferentiated pie means that all material comes from the 'home' sub-region.

4.49 The presence of data in the final column of Table A7.4, or the existence of a fourth slice in a pie chart, indicates the presence of operators with national (or at least more than regional) capabilities.

Figure 4.4: **Sub-regional Differences in the Prevalence of 'Out-of-Area' Working by Recycling Crushers in 2005**



Notes:

In each pie chart the largest slice represents the proportion of CDEW that is processed into recycled aggregate that comes from the 'home' sub-region of the crushers based in that sub-region. In some cases where materials come from elsewhere the waste will have been hauled to the crusher; in others it will have been the crusher which travelled to the waste before recycling it.

The sizes (by area) of the pie charts are in proportion to the total (grossed-up) estimated tonnage of recycled aggregate recovered in each sub-region, not just the actual tonnages reported by respondents.

The source data for this figure can be found in Table A7.4 (percentages) and A6.3 (recycled aggregate per sub-region).

4.50 Table 4.9 presents the same data aggregated to the regional and national levels.

Table 4.9: **Indications of 'out-of-area' working, by region, and nationally**

Sub-Regions	**% from own sub-region**	**% from own Region**	**% from own or adjacent Region**	**% from further away**
North West	95.0%	99.2%	**100.0%**	**0.0%**
North East	68.8%	81.6%	90.8%	9.2%
Yorkshire & the Humber	87.2%	91.9%	**100.0%**	**0.0%**
West Midlands	65.7%	78.2%	90.2%	9.8%
East Midlands	66.8%	71.3%	92.0%	8.0%
East of England	81.6%	87.8%	**100.0%**	**0.0%**
London	64.8%	71.0%	96.6%	3.4%
South East	66.9%	75.0%	97.2%	2.8%
South West	82.4%	94.8%	97.4%	2.6%
England	**74.5%**	**82.3%**	**96.0%**	**4.0%**

4.51 Although there is a reasonable chance that for some cases of 'out-of-area' working there will be an equal and opposite case which cancels it out, it would be unreasonably optimistic to hope that this will be true in all cases. We therefore have to conclude that the sub-regional estimates are not to be relied on as anything other than a reasonable indication of arisings and recycling of CDEW, and should only be used with caution by MPAs (and others) to provide contextual background in the undertaking of functions such as development control.

4.52 However, on the positive side, the data suggest that almost 75% of all materials that are processed actually originate in the sub-regions to which they are assigned, and a further 8% come from other sub-regions within the processor's 'home' region.

4.53 It should also be noted that where the respondent's answer was imprecise, we did not make an unwarrantedly optimistic assumption. For example, a respondent in Blackburn who stated that "100% of the material comes from Lancashire" would be treated as taking 75% of his materials from Blackburn and 25% from elsewhere within the North West region. The 'true' split might be anywhere from 0:100 to 99:1, but some combination has to be selected, and typically under these circumstances 75:25 was chosen. Less precise guidance (such as "50% from the Midlands, 40% from the North and 10% from London") requires more interpretation, and consequently provides greater scope for misinterpretation.

4.54 In fact 108 out of 246 full-time crusher equivalents appear to operate exclusively on materials from their 'home' sub-regions, and 168 exclusively with materials from their 'home' regions. These two groups accounted for 4.9 million tonnes and 6.8 million tonnes of recycled aggregate respectively (out of 11.5 million tonnes reported by respondents).

4.55 There is a further issue concerning the authorisation of mobile crushers. When we were checking the population of crushers with Local Authorities as a pre-survey activity, it was clear that there are some crushers which are falling between regulatory regimes, and that this may be becoming a bigger issue that it was two, four and six years ago.

4.56 The general approach within Government to the collection of waste statistics is increasingly to use statutory returns wherever possible. Unless there is an appetite for requiring operators of recycling crushers, screens and washing plants to provide statutory returns, possibly at the time that they renew their authorisation, and to make those returns available nationally, there is every possibility that the reliability of future survey-based estimates of the level of aggregate and soil recycling will be open to question, if our concerns about changing technology are well founded. A proposal for a form which could be used as the basis for such an exercise is included as Annex 12 to this report.

CHAPTER 5
The Results of the Survey of Licensed Landfills

CHARACTERISTICS OF THE SURVEY POPULATION AND RESPONSE RATE

5.1 By monitoring incoming survey returns and calculating selected key statistics (first and foremost the total tonnage of CDEW reported by operators), the 11 categories of landfills described in Table 3.2 were combined into four logical Groups, as follows:

(i) Group 1 landfills, which accept the lowest average tonnage of CDEW, comprise the first three categories in Table 3.2, namely the 48 landfills associated with power stations, steel mills, sugar factories, the water industry and waterways; 52 other factory curtilage landfills and lagoons that are not yet on PAS (and are not associated with power stations etc); and 25 facilities where the waste type has not yet been specified in PAS (and which may therefore include some non-landfills);

(ii) Group 2 landfills, which take more CDEW than Group 1, but still not very much, comprise the next three categories in Table 3.2, namely the 69 inert landfills which are not yet on PAS and which are owned / operated by an individual rather than a company; the 16 inert landfills which are only recorded on PAS; and the 25 non-hazardous landfills which are only recorded on PAS;

(iii) Group 3 landfills, which take appreciable tonnages of CDEW, comprise the next four categories in Table 3.2, namely the 128 sites that are not yet on PAS and are described as co-disposal, special, or household, commercial and industrial waste sites; the 252 non-hazardous landfills and 53 landfills where the category of waste is unknown, that have transferred (or are in the process of transferring) from REGIS to PAS; and the 203 company-owned / operated inert landfills that have not yet transferred to PAS; and

(iv) Group 4 landfills, which accept the highest average tonnage of CDEW, comprise the final category in Table 3.2, namely the 84 inert landfills that have transferred (or are in the process of transferring) from REGIS to PAS.

5.2 It should be stressed that this process did not involve any ‘retro-fitting’ of individual landfills to the 11 pre-determined categories; simply the allocation of categories to Groups based on their actual tonnage returns supported by logic.

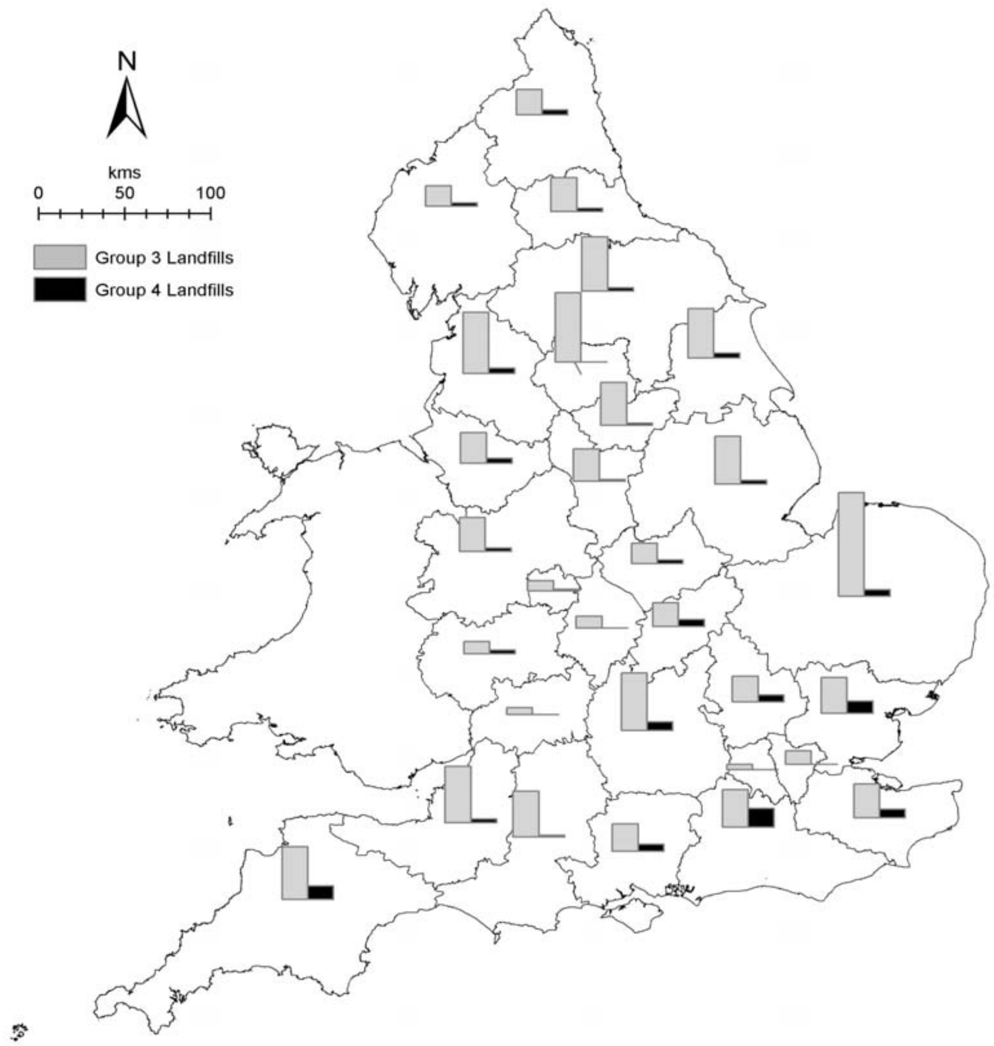
5.3 Table 5.1 sets out the key information on response rates, and the penultimate row illustrates the degree to which the four Groups represent distinct sub-populations of landfills. Carrying out pairs of ‘t’ tests confirms that the difference between any pair of groups of landfills is statistically significant at a confidence level of 95%. Further details of the ‘t’ tests are given in Annex 6.

Table 5.1: Response rate: survey of licensed landfills

	Group 1	Group 2	Group 3	Group 4	Total
Forms mailed	125	110	636	84	955
Useful returns:					
Forms from active sites with information on CDEW and/or aggregate	6	8	120	25	159
Forms from active sites reporting no CDEW or aggregate (nil returns)	27	0	26	3	56
Sites that had not opened by end-2005 (nil returns)	1	3	1	0	5
Sites that had closed prior to 2005 (nil returns)	15	15	50	4	84
Inactive / non-operational sites (nil returns)	5	3	35	4	47
Sites that are not landfills (mostly transfer stations) (nil returns)	6	3	1	0	10
All nil returns (sum of five rows above)	54	24	113	11	202
All useful returns	60	32	233	36	361
Useful response rate	48.0%	29.1%	36.6%	42.9%	37.8%
Unuseable returns:					
Post Office unable to deliver form	14	9	47	4	74
Form returned by addressee, but with no useful information provided	0	0	2	1	3
No longer the site owner	0	1	0	0	1
Returned with form blank, as protest	0	1	2	0	3
Unuseable returns (total of above)	14	11	51	5	81
Unuseable response rate	11.2%	10.0%	8.0%	6.0%	8.5%
Headline tonnage returns (including 'nil return' sites):					
Average total tonnes of CDEW accepted per site	950	10,017	30,934	81,610	n/a
Average total tonnes of aggregates used per site	70	340	1,265	2,969	n/a

5.4 Table A8.1 (which can be found in Annex 8) shows the distribution of the four Groups of landfills by sub-region. Figure 5.1 illustrates the distribution of Groups 3 and 4 (which are much the most important groups in terms of the tonnage of CDEW that they accept), and Table 5.2 gives information on all four groups by region.

Figure 5.1: **Sub-regional distribution of numbers of Group 3&4 Landfills on the 2005 Survey Database**



Notes:

This Figure concentrates on Group 3&4 landfills only, these being the groups which account for by far the highest proportion of CDEW entering landfills in 2005. Some of the landfills on the survey database were shown to have closed prior to 2005.

Table 5.2: **Regional distribution of landfills, by Group**

Regions	Group 1	Group 2	Group 3	Group 4	Total
North West	15	4	66	8	93
North East	6	1	35	5	47
Yorkshire & the Humber	30	25	127	6	188
West Midlands	15	9	40	5	69
East Midlands	16	9	73	9	107
East of England	14	10	97	15	136
London	1	0	11	0	12
South East	10	20	92	25	147
South West	18	32	95	11	156
England	**125**	**110**	**636**	**84**	**955**

KEY SURVEY RESULTS

5.5 The four Groups of landfills can be treated as distinct for the purposes of grossing up. Tables A8.2 to A8.5 in Annex 8 give full sets of average values calculated from all survey returns for each of the four Groups, reported in the same layout as was used on the survey forms, but with the addition of a final column and a final row giving total tonnages.

5.6 The method of grossing up is the same as in 2003. Known as the 'hybrid method' it consists of a four-stage process which must be gone through for each sub-region. The four stages are as follows:

(i) divide the four sub-populations (Groups) of landfills into respondents and non-respondents;

(ii) count the actual tonnage returns provided by all respondents;

(iii) multiply the average tonnages given in Tables A8.2 to A8.5 by the corresponding number of non-respondents; and

(iv) add together the tonnages from all respondents and all non-respondents to arrive at a sub-regional summary table.

5.7 The grossed-up estimate for the use and disposal of CDEW in England is presented in Table 5.3, while Table 5.4 gives the grossed-up estimate for other aggregates and associated materials used, or disposed of, in landfills.

5.8 In the interests of space, the column headings and the text in the final line have been shortened in Tables 5.3 and 5.4. The full headings (and text) should be understood as follows:

(i) 'Engineering' means 'Used in landfill engineering (roads, bunding, drainage, daily cover etc)';

(ii) 'Capping' means 'Used in capping and restoration;

(iii) 'Waste' means 'Disposed of as waste'; and

(iv) in Table 5.3 'Other' means 'Other inert CDEW (or category unknown), which should not include consignments containing significant amounts of timber, metals, plasterboard etc'.

Table 5.3: Total estimate for unprocessed CDEW used or disposed of in licensed landfills in England in 2005 (tonnes)

	Engineering	Capping	Waste	Total
Clean hard C&D waste	850,243	233	442,610	1,293,087 ± 29 %
Contaminated hard C&D waste	7,627	0	71,284	78,910 ± 54 %
Clean excavation waste	2,651,119	5,374,020	12,503,766	20,528,905 ± 20 %
Contaminated excavation waste	81,184	0	980,229	1,061,413 ± 44 %
Clean 'mixed' CDEW	329,554	17,108	2,450,983	2,797,645 ± 36 %
Contaminated 'mixed' CDEW	1,226	0	425,301	426,527 ± 128 %
Other	277,844	23,333	1,261,931	1,563,108 ± 77 %
Total	**4,198,796 ± 48 %**	**5,414,695 ± 33 %**	**18,136,104 ± 19 %**	**27,749,595 ± 16 %**

Notes:

The bands around the central estimates are at a confidence interval of 90 %.

Table 5.4: Total estimate for aggregates and associated materials used or disposed of in licensed landfills in England in 2005 (tonnes)

	Engineering	Capping	Waste	Total
Primary aggregate (purchased)	280,598	16,378	0	296,975
Primary aggregate (dug on site)	104,627	0	0	104,627
Waste from aggregate quarrying	66,259	27,296	333,361	426,916
Other waste-derived aggregates	140,383	0	4,962	145,346
Crushed C&D waste	126,556	0	0	126,556
Total	**718,423**	**43,674**	**338,323**	**1,100,420 ± 30 %**
Total minus crushed C&D waste	591,867	43,674	338,323	973,864 ± 32 %

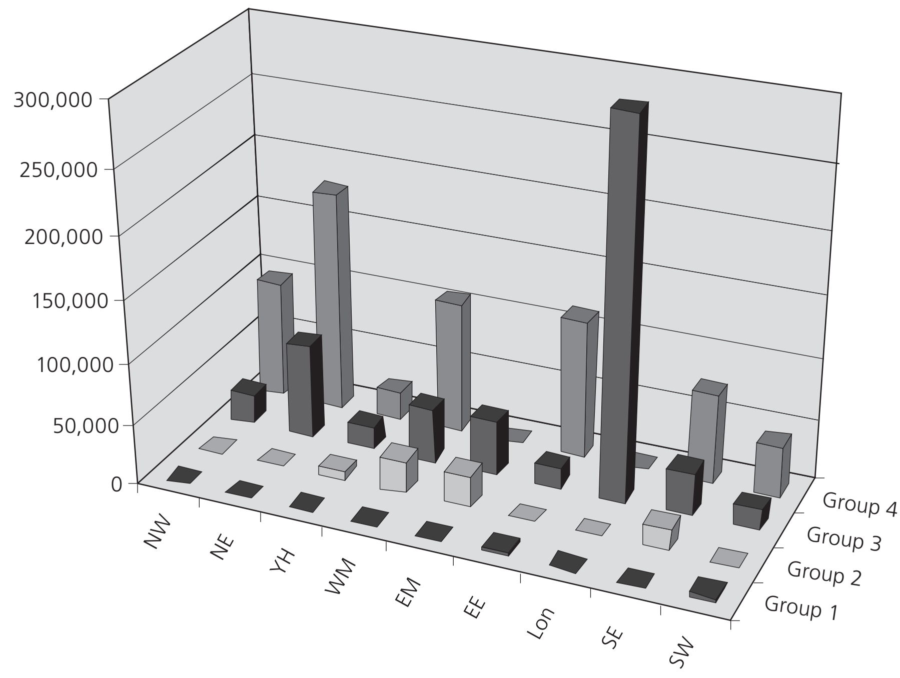
Notes:

The bands around the central estimates are at a confidence interval of 90 %.

5.9 Data equivalent to that shown in Table 5.3 for each of the nine regions and 30 sub-regions can be found within the tables in Annexes 10 and 11 to this report.

5.10 Given that the grossing up procedure uses national average figures, it is important to understand the extent to which landfills differ from region to region. Figure 5.2 shows the regional average tonnages of CDEW entering all four groups of landfills, which emphasises that in reality the respondents are quite varied, with London landfills (all respondents being operators of Group 3 sites) being much larger than elsewhere in terms of the amounts of CDEW that they accepted during 2005. This provides strong pragmatic support for using the 'hybrid method' for grossing up, because using national averages for Group 3 landfills would generate an estimate for London which is substantially lower than the tonnage actually reported by a limited number of respondents. The response rate means that there are too few responses per region to make the use of regional averages at all sensible.

Figure 5.2: **Average tonnage of CDEW accepted at landfills in 2005, by Region and landfill Group**



5.11 Finally, Tables A8.6 (in Annex 8) and 5.5 give the results for the total tonnage of unprocessed CDEW used or disposed of in licensed landfills by sub-region and region respectively.

Table 5.5: **Regional estimates for unprocessed CDEW used or disposed of in licensed landfills in 2005 (tonnes)**

Regions	**Engineering**	**Capping**	**Waste**	**Total**
North West	295,447	580,088	1,790,725	2,666,260
North East	660,711	256,548	1,212,859	2,130,119
Yorkshire & the Humber	641,999	859,067	2,405,416	3,906,482
West Midlands	467,872	358,739	1,184,861	2,011,472
East Midlands	380,866	593,074	2,523,132	3,497,072
East of England	414,787	973,866	2,450,382	3,839,035
London	273,172	417,908	455,624	1,146,703
South East	541,860	775,793	3,799,705	5,117,357
South West	522,083	599,612	2,313,400	3,435,095
England	**4,198,796**	**5,414,695**	**18,136,104**	**27,749,595**

MISCELLANEOUS RESULTS

5.12 The survey form asked (through Question 2) whether the landfill was a former quarry which during 2005 was being backfilled with materials which were exempt from landfill tax.

5.13 By selecting just those landfills which are classified as inert (and specifically, the fourth, fifth, tenth and eleventh categories in Table 3.2), and then using the answers to Question 2 to distinguish between those responses, which involved a former quarry, and those which did not, it is possible to estimate how much CDEW is being used to backfill former quarries with material that is exempt from landfill tax.

5.14 This was done by following exactly the same grossing-up procedure for inert landfills as was used for the full results, and then deflating the resultant estimate by using the ratio between returns from former quarries and returns from non-quarries. The necessary ratios were specific to each of the cells in Table 5.6. Equivalent regional and sub-regional estimates for these values have not been generated.

Table 5.6: **Total estimates for the amounts of unprocessed CDEW being used to backfill former quarry voids which are now inert landfills in 2005 (tonnes)**

	Engineering	Capping	Waste	Total
Clean hard C&D waste	373,822	233	79,497	453,552
Contaminated hard C&D waste	0	0	0	0
Clean excavation waste	1,450,306	297,087	7,260,570	9,007,963
Contaminated excavation waste	0	0	100,333	100,333
Clean 'mixed' CDEW	62,305	280	2,012,542	2,075,127
Contaminated 'mixed' CDEW	0	0	4,667	4,667
Other	0	23,333	779,333	802,667
Total	**1,886,433**	**320,934**	**10,236,942**	**12,444,309**

5.15 The figures in Table 5.6 are based on actual returns. As will be seen, a small tonnage of contaminated material was reported as being used by a handful of respondents. We can only conclude that either the classification of landfills was incorrect, or that the degree of contamination was very small. In this survey the term 'contaminated' was certainly not equivalent to 'hazardous' or even 'non-inert', but referred to the presence of other materials (as 'contraries'), which could have been inert. In any case, the proportions of such materials are very small indeed.

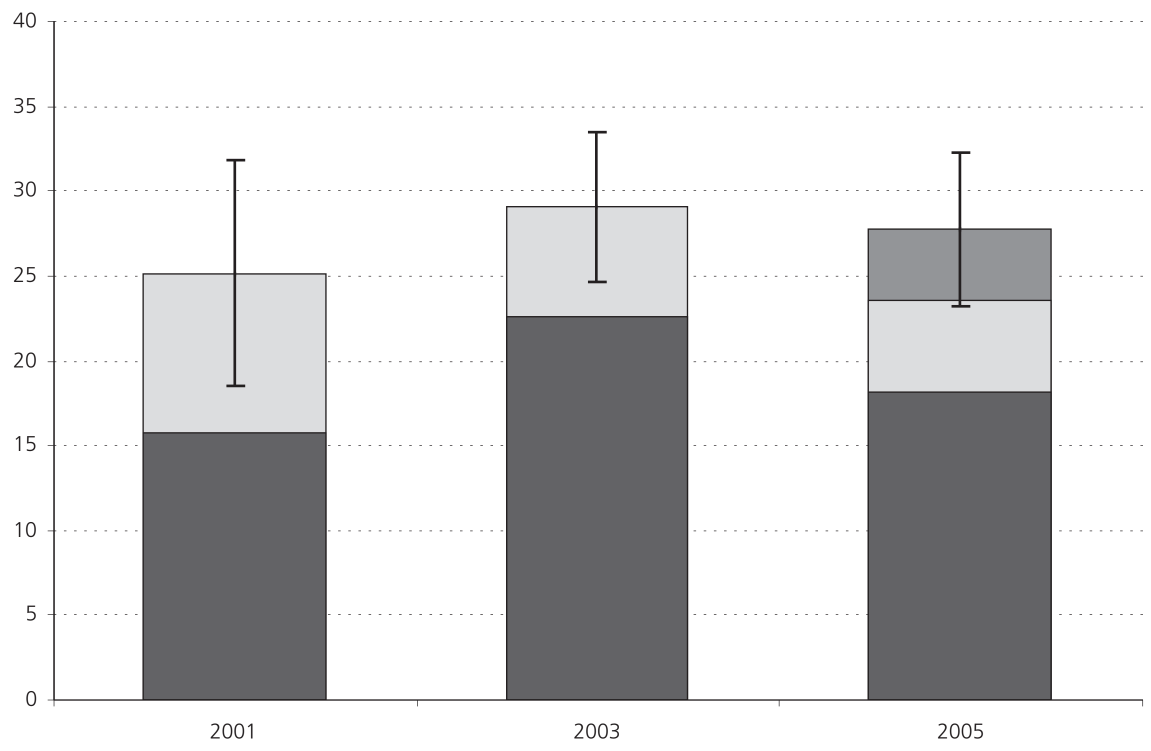
5.16 This suggests that almost 45% of the CDEW which goes to landfill is both inert, and being used to restore former quarries in fulfillment of restoration conditions, even though much of the restoration materials is described as 'waste'. This is entirely consistent with the findings on this point from the 2001 and 2003 surveys. Were these materials to be diverted to recycling for use elsewhere, they would have to be replaced either by other CDEW or by other suitable materials.

5.17 If the estimated 10.24 million tonnes of waste from Table 5.6 is taken away from the 18.14 million tonnes reported in Table 5.3, this leaves 7.90 million tonnes of waste CDEW going to licensed landfills, which is not contributing value of some sort, most of it being clean excavation waste.

DISCUSSION OF MAIN FINDINGS

5.18 The results from the survey of operators of licensed landfills suggest that the tonnage of CDEW accepted at landfills in 2005 has fallen by about 4.5% since 2003, from 29.06 million tonnes to 27.75 million tonnes. This difference is certainly not statistically significant. The estimates for 2001, 2003 and 2005 are illustrated in Figure 5.3, together with indications of the uncertainties around the central estimates.

Figure 5.3: **Changes in the estimates of CDEW entering licensed landfills, 2001 to 2005 (million tonnes)**



Notes:

The three bands in 2005 are as follows: disposed of as waste (lower band), used for capping (middle band) and used for engineering (top band). In 2001 and 2003 the middle and upper bands are combined.

The bars show the upper and lower estimates at a confidence interval of 90 %.

5.19 The overall response rate is lower (at 37.8%) than it was for the previous survey (when it was 45.2%). The questions were marginally simpler this time than they had been in 2003, because on this occasion the table in which respondents were asked to enter tonnages did not distinguish between landfills which are also quarries being restored by backfilling, capping, planting etc and 'other' landfills. This was a distinction which clearly caused some confusion in 2003, and was covered by a separate and simpler question in 2005.

5.20 The survey form was, like the form for operators of recycling crushers and screens, a double-sided folded A3 sheet (instead of the double-sided A4 sheet used in 2003). In all other respects, the form was very similar, and the main difference between the two surveys was (again, as with the crusher survey) one of timing.

5.21 As with previous surveys some operators (arguably more than in 2003, but this cannot be quantified) objected that the information requested was all available through their quarterly returns to the EA, and stated that they would not provide it again. Serious thought should, in our view, be devoted to seeing how the necessary information might in future be extracted from data held by the Agency.

CHAPTER 6
The Results of Analysing Data from Registered Exempt Sites

THE APPROACH TAKEN TO REGISTERED EXEMPT SITES

6.1 It was established early in the project that better information on Paragraph 9A and 19A registered exempt sites, than was previously available, can now be extracted from the Environment Agency's REGIS database. Since 1 July 2005, all applicants for a Paragraph 9A or 19A exemption have had to complete an application form and pay a fee. The application forms require applicants to identify (among other things):

(i) the location of the site where the waste is to be deposited;

(ii) how many tonnes of the different qualifying materials they expect to use; and

(iii) when they propose to use it.

6.2 It was agreed with Communities and Local Government that actual data covering the year starting in July 2005 would provide a better estimate of waste use in 2005 than a postal survey covering calendar 2005 (and, necessarily, spanning the period of change-over from one regulatory regime to another).

6.3 Key elements of this information are recorded in REGIS, though not a material-by-material breakdown. The two key figures (from the point of view of this study) are values for tonnes per annum (TPA) and total tonnes (TTot). For sites that will be used and completed within a year, these figures would be the same, and only one value is recorded in some instances.

6.4 Registrations remain valid for a year, and although they can be renewed for a further year, an additional fee becomes payable, meaning that 'just in case' applications are much less likely to be submitted than before.

6.5 The revised definitions of activities to be carried out under exemptions are set out in The Waste Management Licensing (England and Wales) (Amendment and Related Provisions) (No.3) Regulations 2005 (SI 2005/1728).

6.6 Paragraph 9A(1) allows the spreading of selected wastes on land. There is one general list of qualifying waste materials, and a more restricted list, if the activity is intended to result in agricultural or ecological improvement. Inert 'hard' C&D waste appears on the general list, but the only type of CDEW allowable, where agricultural or ecological improvements are intended, is unmixed excavation waste (i.e. soil and stones, but without any concrete or other non-natural construction materials). These materials are to be "… spread for the purpose of reclamation, restoration or improvement of land which has been subject to industrial or other man-made development, and the use to which that land could be put would be improved by the spreading". The spreading is to be done under the terms of a planning permission "… to a depth not exceeding the lesser of 2 metres or the final cross-sections shown on a plan" which has been submitted in support of the application for the exemption. There is an overall cap of 20,000 cubic metres of waste per hectare under this exemption.

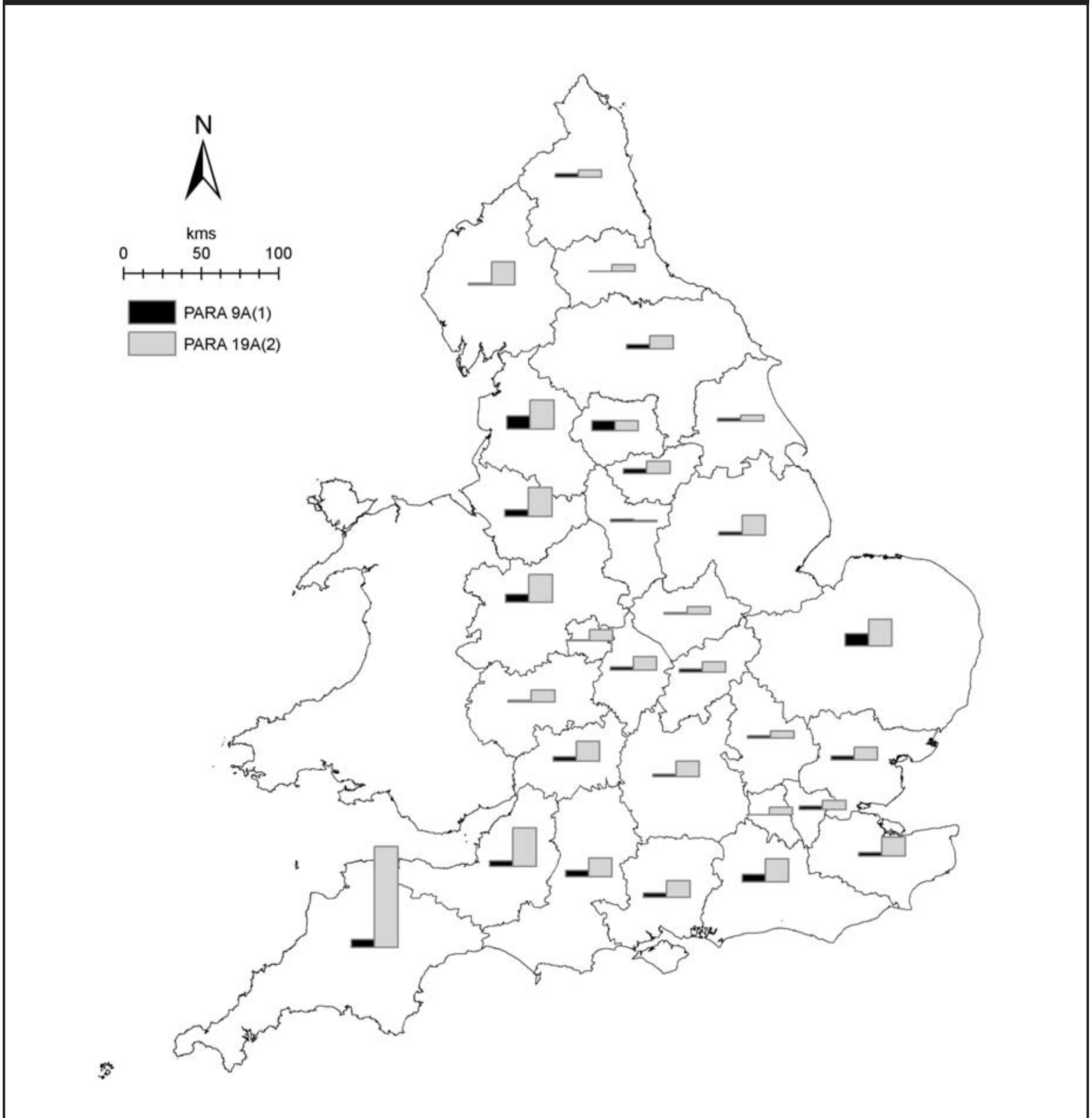
6.7 Paragraph 19A(2) allows the use of selected wastes on land, including all of the main inert fractions of CDEW. These materials are to be used "… for the purposes of relevant work if the waste is suitable …" and the work is carried out in accordance with a planning permission, and "… to a depth that does not exceed the dimensions of the final cross-sections shown on a plan" submitted in support of an application for exemption. 'Relevant work' as used above means "… work for the construction, maintenance or improvement of a building, highway, railway, airport, dock or other transport facility, recreational facilities or drainage, but does not include work involving land reclamation".

6.8 Because the change which created the revised exemptions came into force in the middle of 2005, it does mean that data extracted from the new registration system only covers part of 2005. National consolidations of information held in REGIS are carried out four times a year, and the data that were analysed for the purposes of this study were the returns for Paragraph 9A(1) and 19A(2) exemptions from the August 2006 consolidation.

6.9 The data provided by the Agency following the August consolidation included 218 Paragraph 9A(1) exemptions and 897 Paragraph 19A(2) exemptions in England which had been registered by the Agency in the 12 months ending 21 July 2006. It included a further 60 Paragraph 9A(1) exemptions and 125 Paragraph 19A(2) exemptions in England, which had been submitted to the Agency over the same period, but for which a formal registration date was not recorded. (This second group of sites is referred to below as 'blank date sites', while sites for which a registration date was recorded are referred to as 'non-blank date sites').

6.10 The geographical distribution of these sites is recorded in Table A9.1, which can be found in Annex 9, and in Figure 6.1, which illustrates just how uneven the geographical distribution of such sites is. This unevenness has been observed on previous occasions, with certain counties particularly in the western half of the country having many more exemptions than would be expected if exemptions were evenly distributed.

Figure 6.1: **Distribution of Paragraph 9A(1) and 19A(2) registered exempt sites in 2005**



Notes:

The source of data for this figure is Table A9.1.

6.11 When applying to register an exemption, applicants are required to state whether or not they propose to use more than 2,500 m^3. If they do, they are asked to specify how many tonnes they expect to use.

6.12 The following rules were used to obtain a count of sites and a tonnage value for each site:

(i) only count (and, therefore, only take data from) 'non-blank date sites' (of which there were 1,115);

(ii) for sites that have a TPA value, use that value (there were 383 such sites);

(iii) for sites that are due to be completed within a year and which have a TTot value, use that value (there were 20 such sites);

(iv) for sites that are due to remain operational for more than one year and which have a TTot value, work out the average annual rate of useage, and use that value (this rule had to be applied to 14 sites);

(v) for sites with no TPA value and no TTot value, use the agreed 'de minimis' value (this term is explained below) (there were 637 such sites);

(vi) for sites with a closing date which is within a year of the registration date, but no start date, use the TTot value (there was only one such site); and

(vii) for all remaining sites, divide the TTot value by three (representing an arbitrarily assumed operational life of three years), and use the higher of that calculated value and the 'de minimis' value (there were 60 such sites, some of which had high TTot values, and may, therefore, be operational for several years).

SMALL SITES

6.13 478 of the 1,115 records of applications for 'non-blank date sites' in REGIS included either a TPA or a TTot tonnage value, ranging from one tonne to 900,000 tonnes. The applicants responsible for the remaining 637 sites did not specify a tonnage, and having discussed this point with the Agency, it was concluded that it is fair to assign a 'de minimis' value to all of these sites, on the grounds that the applicant will have ticked the 'less than 2,500 m^3' box. Had they left this part of the form blank, their application should have been rejected. These are referred to here as either small sites, or 'de minimis' sites.

6.14 At a density of 2.0 tonnes per m^3 the maximum 2,500 m^3 would represent 5,000 tonnes. In practice the average value for the volume of materials across all 637 sites for which a 'de minimis' value is required will be well below the maximum, and the average density of materials to be spread is also likely to be less than 2.0.

6.15 The assumptions which were used to calculate the tonnage from the 'de minimis' sites were as follows:

(i) assume that the distribution of the density of materials used on exempt sites is normal (in the statistical sense);

(ii) assume that only 10% of materials have a density when being transported of less than 1.5 tonnes/m^3 and only 10% have a density when compacted of greater than 2.2 tonnes/m^3;

(iii) assume that the minimum value for the volume of materials to be spread on a site is 250 m^3, and that the most common value is 1,000 m^3; and

(iv) assume that a 'de minimis' site is four times as likely to take 1,000 m^3 as it is to take 2,500 m^3.

6.16 The above assumptions would imply an average density of materials on exempt sites of 1.85 tonnes/m^3 and an average volume of 1,357 m^3 (equivalent to 2,511 tonnes per site). It also implies a relative standard deviation (RSD) of 41.3%. When this uncertainty is spread over 637 sites, it suggests a relative standard error (RSE) of ± 1.64%.

6.17 Using the rules and assumptions set out above produces an estimate for the 'de minimis' sites of 1.60 million tonnes ± 1.64%, and an estimate for all sites taken together of 15.44 million tonnes. It should be borne in mind at all times that the materials spread on Paragraph 9A(1) and 19A(2) sites include more than just CDEW, though evidence from previous surveys showed very clearly that CDEW, and particularly clean excavation waste, accounts for a very high proportion of all materials used on what were then Paragraph 9&19 sites.

6.18 A series of other combinations of assumptions have been worked through for the 'de minimis' sites, with consequences which are set out in Table 6.2 for the two most extreme scenarios (one unfeasibly low, the other unfeasibly high). As can be seen, the net outcome differs by up to a maximum of 1.18 million tonnes. However, the implications of varying the assumptions that affect the 'de minimis' sites are very modest in the context of the total tonnage spread on all Paragraph 9A(1) and 19A(2) sites.

Table 6.2: **Regional distribution of materials used on Paragraph 9A(1) and 19A(2) registered exempt sites (million tonnes, on 'non-blank date sites')**

	Base case assumptions	Low assumptions	High assumptions
Low waste density	1.5	1.4	1.7
% of sites with density below value above	10%	15%	5%
High waste density	2.2	2.0	2.5
% of sites with density above value above	10%	5%	10%
Minimum volume spread (m^3)	250	100	500
Most frequently encountered volume spread (m^3)	1,000	500	2,000
Frequency of 2,500m^3 as % of peak frequency	25%	10%	50%
Outcome (million tonnes from 'de minimis' sites)	1.60	1.14	2.78

6.19 Given that it is unrealistic to pretend that the central estimate of 1.60 million tonnes of CDEW used on 'de minimis' sites is completely reliable, and drawing on the foregoing discussion of sensitivities, it was concluded that a more reasonable way to present the estimate of CDEW used on 'de minimis' sites is 1.60 million tonnes ± 10% at a confidence interval of 90%. Because this estimate is not derived from a conventional survey, this estimate relies on expert judgement rather than statistical method.

LARGER SITES

6.20 The term 'larger sites' is potentially misleading, because some applicants provided estimates of the tonnage of CDEW which they expected to use which was lower than the 'de minimis' level. Nevertheless, most of the 487 non-'de minimis' registered exempt sites involve significantly greater tonnages of CDEW.

6.21 Although the rules set out earlier in this Chapter result in an apparently precise value of 13.84 million tonnes of waste being spread on these larger registered exempt sites, the rules themselves incorporate some assumptions which may not be justified. The most potentially significant of these is the assumption that whenever a site has a TPA value, that value is right, even when it is the same as the TTot value and the site is expected to be active for several years. The other assumption which may be hard to justify is that in cases where there is a TTot value for a site with an unknown working life, then it should be assumed that the working life of that site is three years. We have, therefore, tested what would happen if we varied these two assumptions.

6.22 If every TPA value given for sites with a working period of more than a year is disbelieved, and it is assumed instead that the tonnages given were really TTot values which should have been spread over the declared working period[5], the impact would be to reduce the average tonnage per site from 103,555 tonnes to 42,356 tonnes, and to reduce the total tonnage on the 40 affected sites by 2.45 million tonnes (from 4.14 million tonnes to 1.69 million tonnes). This would be equivalent to 17.7% of the tonnage thought to be being used on all of the non-'de minimis' sites in a 12-month period. To put this in further context, half of the total adjustment is accounted for by just two sites, and 90% comes from 12 sites (which confirms that the 'problem' to the extent that there is one is not systemic to the whole data set).

6.23 The second sensitivity test involves changing the assumed working life of those sites where it is unknown. Reducing it from three years to two has the effect of raising the total tonnage used at larger sites from 13.84 million tonnes to 14.16 million tonnes (i.e. by 2.3%). Increasing it from three to four years reduces the tonnage to 13.69 million tonnes (i.e. by 1.1%). Relatively speaking, the impact of this potential error is very small.

6.24 As with the small sites, it is unrealistic to pretend that the central estimate of 13.84 million tonnes of CDEW used on larger sites is completely reliable. Drawing on the foregoing discussion of sensitivities, it was concluded that a more reasonable way to present the estimate of CDEW used on larger sites is 13.84 million tonnes ± 20% at a confidence interval of 90%. As before, this estimate relies on expert judgement rather than statistical method.

KEY RESULTS AND DISCUSSION

6.25 It was concluded above that 'fair' estimates for the tonnage of CDEW used on registered exempt sites in 2005 are 1.60 million tonnes ± 10% for the small ('de minimis') sites, and 13.84 million tonnes ± 20% (both at a confidence interval of 90%). This translates into an overall band of ± 18% around the central estimate of 15.44 million tonnes, at a confidence interval of 90%. The reason why such an expression of uncertainty is needed is to enable the overall confidence interval around the estimated total arisings of CDEW to be calculated. Were the estimates from registered exempt sites to be accepted at face value, the overall estimate would appear more reliable than it really is.

6.26 The sub-regional and regional breakdowns of this estimate are given in Table A9.2 (in Annex 9) and Table 6.3 respectively, including the break-down between Paragraph 9A(1) and 19A(2) sites.

5 For the benefit of anyone wishing to perform the same adjustment on a future data set, the steps taken were as follows: (1) isolate in a new file those 'non-blank date sites' where TPA > 0 and TPA ≥ TTot; (2) where the 'Notif Intend Start' field is blank, insert the value from the 'Date Regd' field instead; (3) delete those sites where the 'Notif Intend Finish' date is 365 days or less after the 'Notif Intend Start' date; (4) calculate an 'Adjusted TPA' value by dividing the original TPA value by the number of working days multiplied by 365; and (5) to show the impact of these adjustments, compare the total of the original TPA values with the total of the 'Adjusted TPA' values. It is assumed that a field will already have been created to count the number of working days on each site (i.e. the difference between 'Notif Intend Finish' and 'Notif Intend Start'), since this value is required for other calculations.

Table 6.3: **Regional distribution of materials used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes, on 'non-blank date sites')**

Regions	9A(1)	19A(2)	Total
North West	978,665	979,483	1,958,148
North East	327,521	476,122	803,643
Yorkshire & the Humber	301,947	483,000	784,947
West Midlands	855,564	2,055,029	2,910,592
East Midlands	138,968	594,199	733,166
East of England	409,971	1,273,140	1,683,111
London	22,755	2,017,836	2,040,590
South East	1,489,736	1,023,230	2,512,966
South West	230,649	1,786,140	2,016,789
England	**4,755,777**	**10,688,178**	**15,443,954 ± 18 %**

Notes:

The bands around the central estimates are at a confidence interval of 90 %.

6.27 The estimates reported above suggest that the tonnage of materials used on registered exempt sites (15.44 million tonnes) is 1 million tonnes lower than the equivalent estimate put forward in 2003 (16.43 million tonnes). However, this is what would be expected where a more demanding written application procedure is being enforced, and a fee of over £500 has been introduced. For several years the evidence gathered via the forerunners to this survey has shown very clearly that small sites (i.e. those that only took a few hundred tonnes of waste materials) comprised the dominant category of registered exempt sites in numerical terms, but only accounted for a small proportion of the total tonnage of waste materials used. Developers or landowners, needing only a few hundred tonnes of fill-type material in order to level a site, or repair a track, now find it appreciably cheaper to purchase primary aggregate or recycled aggregate, that has been fully recovered under the terms of the WRAP Protocol (and is, therefore, no longer regulated as waste), than to register and pay for an exemption and provide the supporting information that is required in order to take advantage of waste materials, even if those materials are entirely suitable for the use to which they are to be put, and delivered to site without charge.

6.28 What is very striking is the size of the regional differences, which are very different indeed from 2003.

CHAPTER 7
Overall Findings

7.1 When the results from the three previous chapters are brought together, they can be summarised as follows, in Table 7.1. Equivalent regional and sub-regional summary tables (without confidence intervals) are included in Annexes 10 and 11 respectively.

Table 7.1: National estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in England in 2005 (million tonnes)

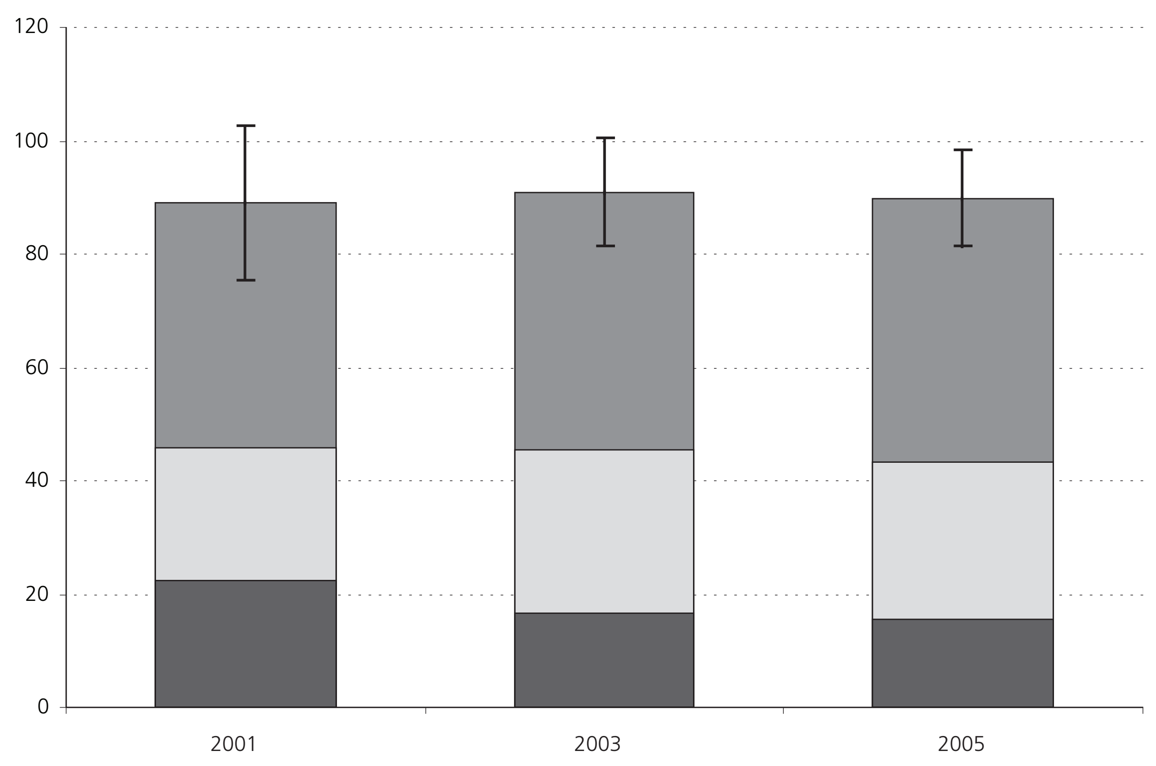
Adjusted estimate of population of recycling crushers				893
Estimated production of recycled aggregate (million tonnes)				42.07 ± 15%
Ratio between graded and ungraded recycled aggregate				57:43
Estimated production of recycled soil (excluding topsoil) (million tonnes)				4.36 ± 36%
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	0.85	0.02	0.44	1.29 ± 29%
Contaminated hard C&D waste	0.01	0.00	0.07	0.08 ± 54%
Clean excavation waste	2.65	5.37	12.50	20.53 ± 20%
Contaminated excavation waste	0.08	0.00	0.98	1.06 ± 44%
Clean 'mixed' CDEW	0.33	0.02	2.45	2.80 ± 36%
Contaminated 'mixed' CDEW	0.00	0.00	0.43	0.43 ± 128%
Other	0.28	0.02	1.26	1.56 ± 77%
Total	**4.20 ± 48%**	**5.41 ± 33%**	**18.14 ± 19%**	**27.75 ± 16%**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (million tonnes)				15.44 ± 18%
Total estimated arisings of CDEW in 2005 (million tonnes)				89.63 million ± 9%

Note:

The bands around the central estimates are at a confidence interval of 90%.

7.2 Figure 7.1 shows the total estimated tonnage for 2005 alongside equivalent estimates for 2003 and 2001.

Figure 7.1: **Changes in estimated total arisings of CDEW, from 2001 to 2005 (million tonnes)**



Notes:

The three bands are as follows: spread on registered exempt sites (lower band), used or disposed of at licensed landfills (middle band) and recycled as aggregate or soil (top band).

The bars show the upper and lower estimates at a confidence interval of 90%.

The methods of data collection and estimation have had to change over the years. The differences are explained in the main text of this report.

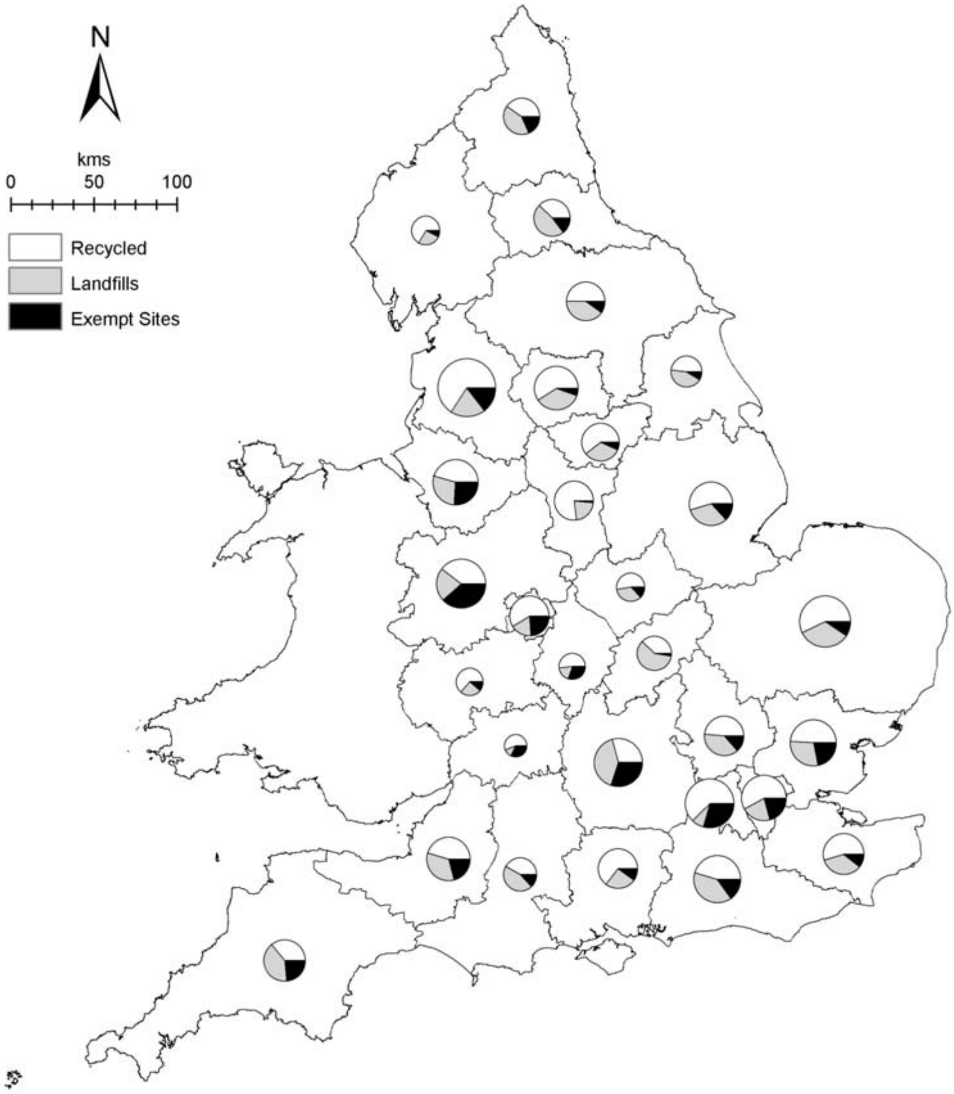
7.3 Table 7.2 provides a sub-regional summary of the overall results. The data from Table 7.2 are then illustrated in Figure 7.2, while Figure 7.3 presents the same tonnages, but adjusted for differences in sub-regional populations.

7.4 Table 7.3 is the regional equivalent to Table 7.2, and can be compared with the equivalent results from 2003, which are presented in Table 7.4.

Table 7.2: **Sub-regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)**

Sub-regions	Recycled by crushers / screens	Used / disposed of at landfills	Spread on registered exempt sites	Total
Cumbria	985,525	388,875	108,918	1,483,318
Lancashire and G Manchester	4,029,118	1,212,931	880,447	6,122,496
Cheshire and Merseyside	1,706,171	1,064,454	968,783	3,739,408
Northumberland and Tyne & Wear	971,315	976,285	448,843	2,396,443
Tees Valley and Durham	909,625	1,153,835	354,800	2,418,260
North Yorkshire	1,353,341	1,081,613	267,928	2,702,882
West Yorkshire	2,041,866	1,231,508	189,824	3,463,198
South Yorkshire	1,564,693	835,814	175,578	2,576,085
East Riding, N&NE Lincolnshire	845,570	757,547	151,618	1,754,735
Shropshire and Staffordshire	1,729,084	950,815	1,684,841	4,364,740
Herefordshire and Worcestershire	848,934	335,602	155,157	1,339,693
W Midlands, excl Coventry, Solihull	1,689,375	497,328	692,305	2,879,008
Warwickshire, Coventry, Solihull	650,231	227,727	378,290	1,256,248
Derbyshire	2,128,493	587,280	45,921	2,761,694
Notts and Lincs (excl N&NE Lincs)	1,904,285	1,129,561	449,224	3,483,070
Leicestershire and Rutland	757,446	506,371	182,796	1,446,613
Northamptonshire	800,893	1,273,859	55,225	2,129,977
Cambs, Norfolk and Suffolk	2,723,755	1,604,832	451,890	4,780,477
Bedfordshire and Hertfordshire	1,388,698	1,093,344	385,687	2,867,729
Essex	1,918,701	1,140,859	845,534	3,905,094
West London	2,706,641	361,207	1,276,032	4,343,880
East London	2,139,695	785,496	764,558	3,689,749
Kent	1,670,864	1,046,262	329,312	3,046,438
Surrey, E&W Sussex	1,860,873	1,611,313	620,758	4,092,944
Hampshire and IoW	1,848,850	736,736	286,768	2,872,354
Berks, Bucks and Oxon	1,234,258	1,723,046	1,276,128	4,233,432
Gloucestershire (excl S Glos)	509,172	108,808	297,187	915,167
Wiltshire and Dorset	846,898	896,729	268,100	2,011,727
Somerset and former Avon	1,551,327	1,154,531	715,933	3,421,791
Devon, Cornwall and Scillies	1,123,142	1,275,027	735,569	3,133,738

Figure 7.2: **Sub-regional distribution of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)**

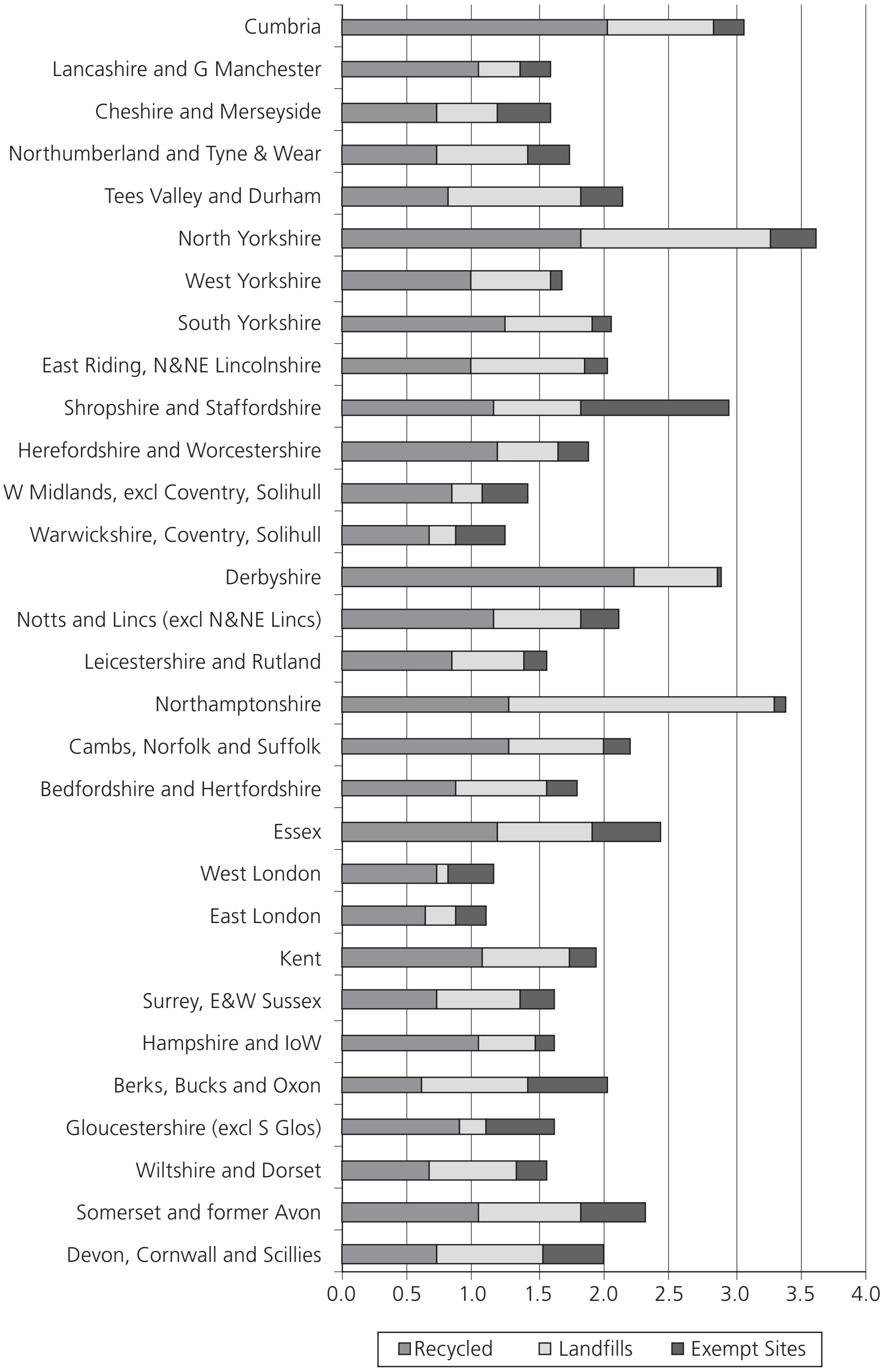


Notes:

The sizes (by area) of the pie charts are in proportion to the tonnages of CDEW managed in each sub-region.

The source data for this figure can be found in Table 7.2.).

Figure 7.3: Sub-regional distribution of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes per capita)



Notes:

The source data for this figure can be found in a combination of Table 7.2 (tonnes) and Table A7.3 (population).

Table 7.3: **Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (million tonnes)**

Regions	Recycled by crushers / screens	Used / disposed of at landfills	Spread on registered exempt sites	Total
North West	6.72	2.67	1.96	11.35
North East	1.88	2.13	0.80	4.81
Yorkshire & the Humber	5.81	3.91	0.78	10.50
West Midlands	4.92	2.01	2.91	9.84
East Midlands	5.59	3.50	0.73	9.82
East of England	6.03	3.84	1.68	11.55
London	4.85	1.15	2.04	8.03
South East	6.61	5.12	2.51	14.25
South West	4.03	3.44	2.02	9.48
England	**46.44 ± 14%**	**27.75 ± 16%**	**15.44 ± 18%**	**88.63 ± 9%**

Table 7.4: **Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills and spread on Paragraph 9 and 19 registered exempt sites in 2003 (million tonnes)**

Regions	Recycled by crushers / screens	Used / disposed of at landfills	Spread on registered exempt sites	Total
North West	5.21	3.01	2.89	11.11
North East	2.61	1.43	0.84	4.88
Yorkshire & the Humber	5.08	4.01	2.75	11.84
West Midlands	4.94	2.42	0.78	8.14
East Midlands	4.88	3.90	1.10	9.88
East of England	5.96	4.47	2.18	12.61
London	6.15	0.52	0.58	7.25
South East	5.52	6.80	2.91	15.23
South West	5.09	2.51	2.41	10.01
England	**45.45 ± 10%**	**29.06 ± c17%**	**16.43 ± 38%**	**90.94 ± 10%**

7.5 Any patterns would be expected to be more clearly evident at the regional rather than sub-regional level because there are so many sub-regions, and wherever there are locally significant distorting factors they show up more clearly at that level.

7.6 We tested the level of correlation between human population numbers (as reported in Table A7.3 In Annex 7) and the tonnages of the component elements of CDEW at the sub-regional level (as reported in Table 7.2). We then did the same thing at the regional level both with and without London (in recognition of its very different characteristics). The values of the various correlation coefficients (including the equivalent regional figures for 2003) are shown in Table 7.5.

Table 7.5: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills and spread on Paragraph 9 and 19 registered exempt sites in 2003 (million tonnes)

Data set to be compared with human population (using 2005 data unless specified to the contrary)	Correlation coefficient (R)	R-squared
Sub-regional estimate of CDEW recycled by crushers and/or screens	0.813	66.1%
Sub-regional estimate of CDEW sent to licensed landfills	0.289	8.3%
Sub-regional estimate of CDEW spread on registered exempt sites	0.606	36.8%
Sub-regional estimate of total CDEW	0.818	66.9%
Regional estimate of CDEW recycled by crushers and/or screens (all regions)	0.729	53.1%
Regional estimate of CDEW sent to licensed landfills (all regions)	0.127	3.9%
Regional estimate of CDEW spread on registered exempt sites (all regions)	0.662	43.8%
Regional estimate of total CDEW (all regions)	0.718	51.5%
Regional estimate of CDEW recycled by crushers and/or screens (excluding London)	0.826	68.2%
Regional estimate of CDEW sent to licensed landfills (excluding London)	0.585	34.2%
Regional estimate of CDEW spread on registered exempt sites (excluding London)	0.661	43.7%
Regional estimate of total CDEW (excluding London)	0.933	87.1%
Regional estimate of total CDEW (all regions, 2003)	0.600	36.0%
Regional estimate of total CDEW (excluding London, 2003)	0.850	72.3%

Notes:

The correlation coefficient (R) indicates the strength and direction of a linear relationship between two random variables. Correlation does not imply causality.

In statistics, the coefficient of determination (R-squared) is the proportion of a sample variance of a response variable (CDEW in this case) that is 'explained' by the predictor variable (human population in this case). A value of 60% for R-squared suggests that 60% of the variation in CDEW is explained by the variability in the human population; the remaining 40% being explained by other factors.

7.7 The results which are reported in Table 7.5 are consistent with the following series of statements:

(i) there is a reasonably constant level of per capita arisings of CDEW around the country, particularly outside London;

(ii) the pattern of utilisation of landfills to use or dispose of CDEW more closely matches that of the human population at the regional level than it does at the sub-regional level (implying that some CDEW crosses sub-regional boundaries prior to entering a landfill); and

(iii) some of the unevenness in the sub-regional provision of landfill capacity is reflected in the use of registered exempt sites.

CHAPTER 8
Lessons for Future Surveys

8.1 This results from this survey, taken in combination with previous ones, suggests that levels of CDEW arisings are quite consistent from year to year, and that the level of recycling is growing perceptibly, but not dramatically. However, none of the national estimates differ significantly from the equivalent 2003 estimates, at a confidence level of 90%.

8.2 Great caution should, therefore, be exercised in drawing conclusions regarding changes in the management of CDEW since 2003, particularly as regards the tonnages going to landfills and registered exempt sites (not least because of the regulatory and recording changes since 2003 which mean that the survey methods could not be directly repeated).

8.3 Despite these caveats, the national estimates appear reasonably robust. However, this is less true of the regional estimates, and progressively less true the more local the focus becomes. Future voluntary surveys of this type are extremely unlikely to overcome this challenge, because there is no realistic prospect of achieving high enough response rates. If reliable information is needed on CDEW arisings and management at the level of individual mineral and waste planning authorities (i.e. at county and unitary authority level), then it would be sensible to explore other methods of collecting the necessary data.

8.4 The present study has made use of data from the EA on Paragraph 9A(1) and 19A(2) registered exempt sites. By making some small adjustments to the form which applicants are required to complete (both before first starting work and annually thereafter if the work lasts longer than 12 months) it would be possible to eliminate the confusion between the total tonnage of materials to be used over the life of the exemption, and any lesser amount to be used over the next 12 months. This could be achieved by explicitly asking applicants to give details about the waste that they propose to use 'over the 12 months covered by this application / renewal'.

8.5 There is an equivalent challenge to find alternative sources of information on the tonnage of CDEW entering licensed landfills and being processed by recycling crushers and screens.

8.6 In the case of licensed landfills there is an obvious alternative source of information: the quarterly site returns which are submitted by all licence holders to the EA. We, therefore, recommend that well before any future survey of CDEW is commissioned, Communities and Local Government (possibly in association with Defra and the EA) should consider sponsoring a modest research project to investigate the true feasibility of extracting useful data on the tonnage of CDEW entering licensed landfills for use and disposal. Although there would almost certainly need to be some degree of compromise between the information that can in practice be extracted and the level of detail that would be wanted in an ideal world, the benefits of having access to real data might well justify such a change.

8.7 In parallel with any such feasibility study it would be necessary for Government and the EA to consider the legal and administrative implications of utilising such data, and any restrictions which these might impose.

8.8 In the case of operators of recycling crushers and screens the only realistic alternative to the present voluntary survey approach[6] is to request the necessary information at a time when the operator is more motivated to respond. The obvious administrative process, through which all operators have to pass once a year, is the Part B authorisation application and renewal.

8.9 To this end, it is recommended that Communities and Local Government and Defra should jointly look into the possibility of using the Part B authorisation process as it applies to mobile crushers to collect the necessary data, which would still need to be assembled into regional and national totals. Some specific proposals (for collecting but not collating the data) are set out in Annex 12.

8.10 Although any such change would impose a burden on industry, it would be no greater than the burden of responding (or considering and then not responding) to a voluntary survey. There is also a certain symmetry in the fact that in areas with single-tier local Government, the same Local Authorities that consider that they need the data for planning purposes have it directly within their powers (albeit in a different department) to collect the data.

8.11 Any move to link Part B authorisations to the operational base of crushers rather than their point of ownership would also be beneficial to the process of data collection. The relatively small number of national operators seem to find it particularly difficult to provide data at the level of geographical detail which local planners say they require.

8.12 If, despite the suggestions above, further voluntary surveys are to be commissioned in future, it is strongly recommended that they should be initiated at a time that allows survey forms to be circulated soon after the end of the year for which data are being sought. In the case of a survey covering arisings and use in, say, 2007, this would imply tenders being called in July or August 2007 to permit the preparatory phase to be carried out in late 2007, and forms to be sent out in January or February 2008. This is particularly relevant in the case of recycling crushers and screens, whose operators are not obliged to keep records of throughput, and who are likely to provide better quality information when their memories are still fresh.

8.13 If there is no appetite for collecting the information locally, planners will need to base their work on the basis of reasonable projections rather than locally validated data. There is no reason to believe that this need necessarily compromise the quality and effectiveness of the planning process.

6 The desirability of identifying an alternative method of data collection is highlighted in Chapter 4. What is concluded there is that the grossing-up method used for this and earlier surveys is becoming less appropriate over time due to technical changes in recycling practice. It is worth stressing that the problem lies with the grossing-up method as it applies to regions and local areas, not to the basic approach to data collection or the national estimate of CDEW recycling, both of which are considered by the project team to be sound.

ANNEX 1
Research Specification

The following research specification covers the full project, which extends beyond this study of arisings and use of CDEW as aggregate. Those parts of the specification which relate wholly or partly to this study have been emphasised through the use of bold text. When the specification was issued, it was issued by the Office of the Deputy Prime Minister (ODPM) (as was).

SURVEY OF ARISINGS AND USE OF ALTERNATIVES TO PRIMARY AGGREGATES IN ENGLAND, 2005

Introduction

1.1 **It is Government policy to encourage the use of alternative materials instead of quarrying and dredging for primary aggregates. Construction, demolition and excavation wastes (CDEW) are the main alternatives and, therefore, ODPM requires up-to-date information on arisings and use of these as aggregate. Previous surveys of CDEW were undertaken for 1999, 2001 and 2003. A survey for 2005 is now required.**

1.2 **The surveys have been improved progressively and, while still subject to statistical uncertainties, are now reasonably reliable at the national level and useful, but less reliable, at the regional level. There is strong pressure to improve regional data for use in Regional Spatial Strategies, and to secure sound information by Mineral Planning Authority area as an input into the preparation of local development documents.**

1.3 A variety of other alternatives are used as aggregates including industrial by products, mineral wastes and other recycled wastes. Information is also needed on arisings and use of these for 2005.

Aim

2.1 **The aim of the work is to survey and report on arisings and use of alternatives to primary aggregates for 2005.**

Objectives

3.1 **The objectives of the work in respect of CDEW are:**

- **to review the method and results of the previous national survey and to identify improvements, if any;**
- **to review data collected by industry (the Quarry Products Association, British Aggregates Association and National Federation of Demolition Contractors) so that, if possible, use can be made of these to avoid duplication and reduce the burden of the survey on respondents;**

- **to design an appropriate survey method that takes account, as far as is practicable, of consistency with past surveys, while improving reliability at regional / local level especially by devising means of improving response rates;**

- **to undertake the survey;**

- **to analyse, collate and validate the results;**

- **to prepare a commentary on the results that includes an assessment of reliability and a comparison with results of previous surveys; and**

- **to identify lessons for future surveys.**

3.2 The objectives, with respect to other alternatives to primary aggregates, are:

- to devise a method or methods for securing reasonably reliable information on arisings and use;

- to collect and collate data; and

- to prepare a commentary on the results that includes an assessment of reliability and a comparison with results of a survey undertaken for 2001.

3.3 **It is expected that most of the effort in this work will be allocated to the CDEW survey.** The survey of other alternatives will rely on reasonable estimates.

Deliverables

4.1 **The required deliverables are:**

a) an interim report setting out the proposed approaches to the surveys for discussion by a steering group;

b) a digital database containing information on participating organisations and results of the CDEW survey;

c) a draft final report of the CDEW survey for amendment following discussion with the steering group;

d) a draft final report of the survey of other alternatives for amendment following discussion with the steering group;

e) 20 copies of the two final reports in the versions agreed for publication; and

f) publication-ready digital copy of the final reports suitable for placing on a website and also for reproduction as paper copy.

Management

5.1 Day to day management of the work will be undertaken by the contract managers for the ODPM and for the contractor only. However, the ODPM contract manager will be advised by a steering group consisting of representatives drawn from about eight key interested organisations.

Quality Plan

6.1 The proposal should include a quality plan setting out quality assurance procedures for all activities and outputs. The plan will indicate who has responsibility for each element of the work and who has overall management control and who has editorial control of the final reports.

Criteria for Tender Evaluation

7.1 Tenderers are asked to identify an appropriate programme to deliver the outputs described in section 4, within the objectives stated in section 3, above.

7.2 Tender evaluation will be based on performance against the following:

a) understanding of the policies and practical issues, and knowledge of related studies;

b) how well the research objectives are addressed;

c) the quality of ideas that are presented;

d) the relevance of skills and the experienced of the proposed research team;

e) the robustness and suitability of the proposed approach in meeting the requirements of the specification;

f) the adequacy of the proposed project management, programme of work, and quality assurance procedures;

g) evidence of the track record of the tenderer in delivering high quality, succinct reports and other outputs to schedule;

h) the extent to which the tender meets the requirements of ODPM; and

j) overall value for money.

Duration and Timetable

8.1 ODPM expects the length of the contract to be about 12 months. The work should be completed by the end of February 2007. The proposed timetable of work should make due allowance for consideration of drafts by, and meetings of, the steering group at appropriate points during the work programme. The contractor will be responsible for preparing and distributing papers for, and preparing a note of the proceedings at, each meeting.

ANNEX 2
Members of The Project Steering Group

ACKNOWLEDGEMENT

The members of the Project Steering Group, and their alternates where relevant, are listed below. Their advice, guidance and contributions are gratefully acknowledged. Information and comments put forward by members of the steering group were taken into account in the preparation for, and analysis of, the surveys. However, the findings and commentary are those of the study team, as is the responsibility for any errors or omissions.

Communities and Local Government:

Peter Bide (Chairman), Planning: Resources and Environment Policy Division
William Mackenzie (Contract Manager), Planning: Resources and Environment Policy Division
Andrew Lipiński (Secretary), Planning: Resources and Environment Policy Division

Department for Environment, Food and Rural Affairs:

Alex Comber, Rural Affairs Division
Jane Hinton, Environmental Protection, Statistics & Information Management
Steven Melbourne, Environmental Protection, Statistics & Information Management

Department for Trade and Industry:

David Hughes, Construction Industry Directorate

Environment Agency:

Terry Coleman, Strategic Waste and Resource Manager
Brian Jones

HM Revenue and Customs:

David Fitzgerald, Environmental Tax Policy
Steve Robinson, Analysis Division (Environmental Taxes)
Lee Johnson, Environmental Tax Policy

British Aggregates Association:

Peter Huxtable
Paul Allison (Sherburn Stone Co Ltd)

Quarry Products Association:

Jerry McLaughlin

National Federation of Demolition Contractors:

Howard Button, Acting Secretary

Regional Aggregates Working Parties:

Ian Thomas, Secretary to the East Midlands RAWP and National Stone Centre
Phil Hale, Secretary to the South West RAWP

Waste and Resources Action Programme:

John Barritt, Aggregates Programme

Contractor:

Richard Smith, Project Manager, Capita Symonds
David Knapman, CDEW survey, Capita Symonds
Andrew Herbert, Other materials study, Capita Symonds
Douglas Myall, Capita Symonds
Julian Ellis, Principal Statistician, WRc

ANNEX 3
Definitions

Working (non-legal) definitions and explanations of key terms used in this study are arranged below in a logical sequence rather than in alphabetical order. The key terms are as follows:

1. Waste
2. Construction and demolition waste
3. Hard C&D waste
4. Excavation waste
5. Mixed hard C&D and excavation waste
6. Production (arisings)
7. Aggregate
8. Graded aggregate
9. Recycling (and re-use)
10. Crushing
11. Screening
12. Full-time crusher equivalents
13. Landfills
14. Registered exempt sites
15. Permitting Administration System (PAS)
16. Regulatory Information System (REGIS)

1. Waste

'Waste' is any substance or object which the holder discards or intends, or is required, to discard. For the purposes of this study, materials arising from construction or demolition works which are beneficially used in an unprocessed form on the site on which they arise are not regarded as waste.

2. Construction and demolition waste

For the purposes of this study, 'construction and demolition waste' (C&D waste) includes hard C&D and excavation waste materials as separately defined below, primarily by reference to Chapter 17 of the European Waste Catalogue. These waste materials arise as a direct result of:

- the total or partial demolition of buildings and/or civil engineering infrastructure; or
- the construction of buildings and/or civil engineering infrastructure.

3. Hard C&D waste

'Hard C&D waste' includes both segregated and mixed unprocessed/uncrushed materials listed in Sections 17.01, 17.03 and 17.05 of the European Commission Decision of 3 May 2000 (replacing the European Waste Catalogue), plus the same materials when contaminated (with, for example, asbestos, mercury or PCB).

Category	Description
17.01.01	Concrete.
17.01.02	Bricks.
17.01.03	Tiles and ceramics.
17.01.06	Mixtures of, or separate fractions of, concrete, bricks, tiles and ceramics containing dangerous substances.
17.01.07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17.01.06.
17.03.01	Bituminous mixtures containing coal tar.
17.03.02	Bituminous mixtures other than those mentioned in 17.03.01.
17.03.03	Coal tar and tarred products.
17.05.07	Track ballast containing dangerous substances.
17.05.08	Track ballast other than those mentioned in 17.05.07.

Efforts have been made to omit unmixed materials from Section 17.03 (recognising that some 'mixed hard C&D and excavation waste' will include elements of bituminous and tarred materials).

4. Excavation waste

'Excavation waste' includes both clean and contaminated waste soil, stone and rocks arising from land levelling, civil works and/or general foundations. Such materials are defined in two categories of European Commission Decision of 3 May 2000 (replacing the European Waste Catalogue): 17.05.03 (soil and stones containing dangerous substances) and 17.05.04 (soil and stones other than those mentioned in 17.05.03).

For the avoidance of doubt, excavation waste generally excludes those excavated materials arising from construction or demolition works which are beneficially used in an unprocessed form on a site, which is not a registered exempt site (see below), since such materials are not generally regulated as waste.

5. Mixed hard C&D and excavation waste

'Mixed hard C&D and excavation waste' (mixed CDEW) means any mixture of the two previous categories where the proportion of soil and similar materials within the mix is greater than about 10%. Typically it is more likely to exceed 75%.

6. Production (arisings)

For the purposes of this study 'production' (or 'arisings') of hard C&D waste is defined as the sum of the following:

- hard C&D waste which is processed by crushing and/or screening for subsequent use, whether sold to a third party or not;
- hard C&D waste which is used without being crushed or screened, either in landfills (for restoration or engineering) or to backfill quarry voids or on sites which are 'registered exempt' (see below);

- unprocessed hard C&D waste which is disposed of as waste in licensed landfills; and
- process waste from the crushing and/or screening of hard C&D waste (i.e. crusher fines and similar) which is disposed of as waste in licensed landfills.

For the purposes of this study 'production' (or 'arisings') of excavation waste is defined as the sum of the following:

- excavation waste which is processed by screening (or possibly by crushing) for subsequent use, whether sold to a third party or not;
- excavation waste which is used without being screened or crushed, either in landfills (for restoration or engineering) or to backfill quarry voids, or on sites which are 'registered exempt' (see below);
- unprocessed excavation waste which is disposed of as waste in licensed landfills; and
- excavation waste soil materials arising from soil and/or mixed C&D waste screening which are disposed of as waste in licensed landfills.

Hard C&D and excavation waste which is used in an unprocessed form (generally at its point of arising) and which is neither spread on 'registered exempt' sites nor disposed of in licensed landfills is therefore excluded from 'production' (or 'arisings').

7. Aggregate

'Aggregate' is any hard, granular, non-plastic, mainly inert, construction material, including bulk fill. It may be derived from primary sources (e.g. quarries and sand pits), secondary sources (e.g. slags and other industrial and mining by-products), or from the recycling of C&D waste through a process of crushing and/or screening (as defined below).

8. Graded aggregate

'Graded aggregate' is aggregate which has been sorted, selected or mixed (or any combination of these processes) in such a way that it meets an agreed specification covering characteristics such as size distribution and hardness.

9. Recycling (and re-use)

'Recycling' involves the processing of waste material so that it can be used as a raw material, or used without further processing, and ceases to be a waste. 'Re-use' does not involve any processing.

10. Crushing

'Crushing' is a mechanical process of breaking irregular over-sized blocks of hard materials into a more regular aggregate or similar material with a predictable distribution of particle sizes. Crushing is used for preparing primary and secondary aggregates, as well as for recycled aggregates, derived from waste concrete, bricks, blocks, tiles and similar hard C&D waste.

Crushers may be fixed or mobile, though many mobile crushers are in practice permanently located in one place. Many crushers have a built-in screening capability (see below).

11. Screening

'Screening' is a general term covering all systems (including hand picking) for sorting, separating and sizing mixed materials, but primarily refers to the use of powered mechanical screens or riddles which are not attached to a crusher.

12. Full-time crusher equivalents

A 'full-time crusher equivalent' is a crusher which is under the control of a survey respondent for a full year (irrespective of how often the crusher is used during that period), or any equivalent combination of crushers and time (e.g. two crushers controlled for six months, or three crushers for four months each).

13. Landfills

'Landfills' are sites licensed by the EA to receive waste materials for final disposal (including site restoration and engineering) under the provisions of the Landfill (England and Wales) Regulations 2002 (SI No.2002/1559). A landfill is defined there as "… a waste disposal site for the deposit of waste onto or into land …" which may include "… any site which is used for more than a year for the temporary storage of waste; and any internal waste disposal site that is to serve a site where a producer of waste is carrying out its own waste disposal at the place of production". There are various exclusions which allow for registered exemptions and specified temporary activities to fall outside this definition.

14. Registered exempt sites

'Registered exempt sites' are sites which are notified to the EA by the site owner or operator as being exempt from waste management licensing by the provisions contained in Schedule 3 to the Waste Management Licensing Regulations 1994 (SI No.1994/1056). Such exemptions are placed on the public record by the Agency. The exemptions only apply if the operation complies with the terms and conditions of the exemption, and does not harm the environment or human health.

For the purposes of this study, the most relevant paragraph numbers are 9A(1) and 19A(2), which allow for the spreading or use on land of specified (mainly inert) materials. The details of these exemptions were changed in 2005, and the current provisions can be found in The Waste Management Licensing (England and Wales) (Amendment and Related Provisions) (No.3) Regulations 2005 (SI No.2005/1728).

15. Permitting Administration System (PAS)

The Permitting Administration System (PAS) is the EA's strategic system for processing Pollution Prevention and Control (PPC) Permits from application to issue and any subsequent variation. It is also used to manage former Waste Management Licensing (WML) Landfill Permits, now subject to PPC regulation.

16. Regulation Information System for Waste Management (REGIS)

The REGIS (Regulation Information System for Waste Management) License module is used to process WML Permits from application to issue and any subsequent modification, transfer or surrender. Linked tools are used to record monitoring and compliance – site inspections and waste tonnage returns. An exempt module is used to record and process notification of exemptions from WML.

ANNEX 4
Survey Forms

Department for Communities and Local Government

Construction, Demolition and Excavation Waste Survey, 2005

Name
Organization
Address1
Address2
Address3
Address4 County
PostCode

(If your contact details or address as given to the left are wrong, please correct them by hand before returning the form. Thank you)

Confidential Survey of Crushing & Screening Activity in England in 2005

May 2006

This survey is being carried out by Capita Symonds Ltd for the Department for Communities and Local Government (formerly the Office of the Deputy Prime Minister). Copies of this form have been sent to a carefully selected group of companies including most of the leading demolition contractors in England, selected waste management companies and everybody (including quarry operators) who has an authorised mobile crusher which is suitable for processing demolition waste into recycled aggregate. Different survey forms are being sent to operators of landfills asking about the use and final disposal of construction, demolition and excavations waste (CDEW), and information is being collated on materials used on 'registered exempt' sites.

We will treat any information that you give us as confidential, and will not pass it on to anyone else in a format that would enable them to link you to the information that you provide.

The information will be used to generate current estimates of the arisings of CDEW and the uses to which it is put. These estimates will be used to influence and monitor policy and strategy on the management of CDEW at a national, regional and local level.

We would be very grateful if you would use this form to give details of **all materials that your company (or you as an individual) crush and/or screen** using equipment that you own and/or operate, **even if you process no construction, demolition or excavation waste at present**. If there are other parts of your company that operate separately and which process CDEW, please check to see that they too have received a survey form. We do not mind whether we receive information site-by-site, machine-by-machine or company-by-company, but we are keen to achieve as good an overall coverage as possible.

If you would prefer to complete the form electronically, or if it would make it easier for you to distribute it internally within your company, please send an Email to david.knapman@capita.co.uk, but please make sure that your company is clearly identifiable from your Email address, or in the text of your message.

Please pass this form to the most appropriate person within your company, asking them to complete it and return it to Capita Symonds at their FreePost address (which is given on the back page of this form) **by Friday 16 June 2006**.

If you need any help in completing this form, or if you would like extra copies of this (or the other) survey forms, please ring 01342 327161 and ask for the 'CDEW Survey Help Desk'.

Thank you in advance for your cooperation.

Survey organised for Communities and Local Government by:

Capita Symonds Ltd, Capita Symonds House, Wood Street, East Grinstead, West Sussex. RH19 1UU Registered in England No.2018542

Q5	**Where were the machines** that you used active during 2005? Please give your best estimate of the percentages of the total tonnage reported overleaf in each District/City (e.g. "50% in Walsall, 25% in Birmingham City centre, 20% in Stoke-on-Trent and 5% in Wales").

Q6	Where did the **materials** that you processed in 2005 come from? If the answer to this is exactly the same as the answer to Q5 please put "Same as above". If the materials that you processed were taken off-site to be processed elsewhere, please describe briefly how (e.g. "90% of the material processed in Walsall came from Birmingham and the other 10% was from Walsall. When working in Birmingham, Stoke and Wales the machines worked entirely on the actual demolition sites").

Q7	How do you think the **supply of recycled aggregate** changed between 2003 and 2005?
Please delete as appropriate:	No real change / The supply grew / The supply fell
If you think it changed, by how much?	%

Thank you for your cooperation. It would be very helpful if you would give your name and contact details so that if we have any need to follow up on any of your answers, we know who to contact.	
Name:	
Tel No or Email:	

Capita Symonds (CDEW in England)
FREEPOST
ND6717
24 Holborn
LONDON
EC1B 1DQ

You should be able to fold this form so that the address to the left appears in the window of a standard office window envelope. Alternatively, you can write or type it onto any other envelope.

No stamp is required.

If you would find it easier to complete different forms for different machines (or combinations of machines), please feel free to make additional copies so that you can do so.

Q1	Which of these products did **you produce in 2005**?	
		(Please tick **all** boxes that apply)
A	**Primary** (quarried) aggregate	
B	Recycled aggregate / soil (made from **crushed concrete, brick,** general development site **excavation waste** etc)	(*)
C	Recycled aggregate made from used **asphalt** (including asphalt planings)	(*)
D	Recycled aggregate / soil made from utility **trench arisings**	(*)
E	Recycled aggregate made from spent **railway track ballast**	(*)
F	Crushed **glass** for use as aggregate / sand	
G	**Aggregate made from other materials** (e.g. from ash, slag, foundry sand etc)	
H	**None** of the above	
(*)	If you have ticked **any** boxes with (*) please include the tonnages in your answers to Questions 1.1 (if relevant) and 2. If you have **not** ticked any boxes with (*), please complete Questions 1.1 (if relevant) and 3 and 4, and return the form.	

Q1.1	If you recycled any of the more specialist materials covered by lines C-G in Question 1 into aggregate (including asphalt), it would be very helpful if you could describe briefly below what you do and how much of each you processed in 2005.
	Examples of the sort of information that would be very helpful would include: • "We recycled 5,000 tonnes of asphalt planings straight back into asphalt. We incorporated another 10,000 tonnes in the general aggregate/fill that we sell." • "We crushed 3,000 tonnes of glass for use as pipe bedding."
C	
D	
E	
F	
G	

Q2	How many **tonnes** of **recycled aggregate and/or soil** did you produce in 2005? (If you do not keep detailed records, estimated figures or ranges (e.g. 15-20,000 tonnes) would still be very helpful).	
		Tonnes
A	**Crushed** with or without screening	
B	**Screened** without any crushing	
C	**Total** of the above (lines A and B)	

Q2.1	How did the **totals** given in answer to Question 2 **break down** into the following materials? (If you do not keep detailed records, estimated figures or ranges (e.g. 15-20,000 tonnes) would still be very helpful).		
		Tonnes	% (of W-Z) used on site (*)
A	**Graded aggregate**	(W)	%
B	**Ungraded aggregate** (including general fill)	(X)	%
C	Clean **topsoil**	(Y)	%
D	Other **clean / useable soil** (not topsoil)	(Z)	%
(*)	Please include here all materials which never left the original site, i.e. the % which was both generated and recycled on site and was then either used by you on site or left on site for someone else to use there.		

Q3	How many mobile crushers and screens did you **use to recycle aggregate and/or soil in 2005**? (If you replaced a machine during the year, please count this as one machine)		
		Number of machines that you owned	Number of machines that you hired in
A	**Mobile Crushers** (with or without integral screens)		
B	**Stand-alone screens**		

Q4	How many **full-time machines** (including ones that you hired in) is your answer to Q3 equivalent to? Examples: • If you owned (or hired in) a crusher or screen for the full year, and you were the only person / company to use it, please count this as one full-time machine, however much or little you used it. • If you hired in a crusher or screen for a week every month, please count this as a quarter of a machine. • If you hired in a crusher or screen for a five-week period, please count this as one tenth (5/52) of a machine.	
		Number of machines
A	Equivalent number of full-time **mobile crushers**	
B	Equivalent number of full-time **stand-alone screens**	

Q4.1	At **what sort of site(s)** did the machines that you used operate during 2005?	
		(Please tick **all** boxes that apply)
A	On **demolition / construction** sites	
B	On public **highway / motorway** maintenance sites	
C	At a dedicated **recycling centre**	
D	At a **recycling** centre that is also a **waste transfer station**	
E	At a **recycling** centre that is also a **landfill**	
F	At a **recycling** centre that is also a **quarry**	
G	At **another** sort of site	

Thank you for your cooperation. It would be very helpful if you would give your name and contact details so that if we have any need to follow up on any of your answers, we know who to contact.

Name	
Tel No or Email	

Capita Symonds (CDEW in England)
FREEPOST
ND6717
24 Holborn
LONDON
EC1B 1DQ

You should be able to fold this form so that the address to the left appears in the window of a standard office window envelope. Alternatively, you can write or type it onto any other envelope.

No stamp is required.

Department for Communities and Local Government

Construction, Demolition and Excavation Waste Survey, 2005

«Contact_Name»
«Permit_Holder_or_Operator_Company_Name»
«Address1»
«Address2»
«Address3»
«Address4» «Address5»
«Postcode»

(If your contact details or address as given to the left are wrong, please correct them by hand before returning the form. Thank you)

Confidential Survey of Licensed Landfills in England in 2005

May 2006

This survey is being carried out by Capita Symonds Ltd for the Department for Communities and Local Government (formerly the Office of the Deputy Prime Minister). Everyone to whom one of these survey forms has been sent is believed to be the operator of a licensed landfill which was either accepting waste for disposal, being capped and closed, or being constructed during 2005. Other survey forms are being sent to operators of recycling crushers / screens to monitor other activity related to construction, demolition and excavation waste (CDEW), and information is being collated on materials used on 'registered exempt' sites.

We have sent this form to you in connection with **«Facility_Name», «Site_County».**

We will treat any information that you give us as confidential, and will not pass it on to anyone else in a format that would enable them to link you to the information that you provide.

The information will be used to generate current estimates of the arisings of CDEW and the uses to which it is put. These estimates will be used to influence and monitor policy and strategy on the management of CDEW at a national, regional and local level.

We would be very grateful if you would use this form to give details of **all materials that entered the disposal area of your landfill**. If you would prefer to complete the form electronically, please send an Email to david.knapman@capita.co.uk, but please include the site name and/or licence details given above either in the Email subject line or in the text of your message.

Please pass this form to the most appropriate person within your company, asking them to complete it and return it to Capita Symonds at their FreePost address (which is given on the back page of this form) **by Friday 16 June 2006**.

If you need any help in completing this form, or if you would like extra copies of this (or the other) survey forms, please ring 01342 327161 and ask for the 'CDEW Survey Help Desk'.

Thank you in advance for your cooperation.

Survey organised for Communities and Local Government by:

Capita Symonds Ltd, Capita Symonds House, Wood Street, East Grinstead, West Sussex. RH19 1UU Registered in England No.2018542

The following illustrations are provided to clarify what is meant by some of the key terms used in this form:

Hard C&D Waste

Excavation Waste

'Mixed' CDEW

These are the three components which together comprise construction, demolition and excavation waste (CDEW)

Q1	Which of the following statements applied to your landfill **in 2005**?	
		Please tick **all** boxes that applied
A	It was **open** to accept waste(s)	
B	It was **accepting engineering or restoration materials**	
C	Any CDEW that came in was brought in under an **exemption** from waste management licensing (NB This does not refer to Landfill Tax)	
D	It was **non-operational**	(*)
E	It was **closed to all materials** prior to the start of the year	(*)
(*)	If you have **only** ticked boxes marked (*), please ignore Question 2 and the tables, but please return the form to the FreePost address given on the back page. Otherwise please answer Question 2 and complete Tables Q3 and Q4.	

Q2	Is/was the landfill a former quarry which is/was being backfilled with materials which are/were **exempt from landfill tax**? (Please tick relevant box)		
		Yes	
		No	

When completing Tables Q3 and Q4, please note the following:

- You should **not record** any materials that you recycled/reclaimed and then **sent off-site**.
- There should be **no overlap** between the cells in the Tables: any materials which went into the landfill for any purpose should only be recorded once.
- **'Contaminated'** means **mixed with hazardous** materials such as asbestos, oils, chemicals etc
- The total tonnage of CDEW entering the landfill will be the **total of all cells** in Table Q3.
- The total tonnage of aggregate entering the landfill will be the **total of all cells** in Table Q4.

Table Q3:	**Tonnages** of unprocessed **construction, demolition and excavation waste** that entered the landfill in **2005**, and what happened to them		
	Used in landfill engineering (roads, bunding, drainage, daily cover etc)	**Used in capping and restoration**	**Disposed of as waste**
Clean hard C&D waste			
Contaminated hard C&D waste			
Clean excavation waste			
Contaminated excavation waste			
Clean 'mixed' CDEW			
Contaminated 'mixed' CDEW			
Other inert CDEW (or category unknown)			(#)
(#) This should not include consignments containing significant amounts of timber, metals, plasterboard etc.			

Table Q4:	**Tonnages of aggregate** (if any) that entered the landfill in **2005**, and what happened to them		
	Used in landfill engineering (roads, bunding, drainage, daily cover etc)	**Used in capping and restoration**	**Disposed of as waste**
Primary aggregate (purchased)			
Primary aggregate (dug on site)			
Waste from aggregate quarrying / processing			
Other waste-derived aggregate (e.g. slags)			
Crushed C&D waste			

Thank you for your cooperation. The FreePost address to which this form should be returned is on the back page.

ANNEX 5
Confidence Intervals around the Central Estimates

This Annex explains how the confidence intervals around the central tonnage estimates derived from the two main surveys (of operators of recycling crushers and landfills) were calculated.

CRUSHERS

The grossed-up totals seen in the tables in Chapter 4 are derived from what are called 'ratio' estimates of mean weight per crusher, with the summations running over all operators. That is:

$$\text{Wt/Cr} = \sum [\text{weight}] / \sum [\text{No of crushers}]$$

This means that, once a general formula has been derived for calculating the relative standard error (RSE) of a ratio estimate, it is a straightforward matter to calculate all the required confidence intervals for those tables.

Where:

n	=	number of operators in data set,
X_i	=	number of crushers (possibly non-integral) for operator i,
W_i	=	tonnes weight (in any specific category) processed by operator i,
A	=	estimated tonnes weight per crusher,
AvW	=	mean weight produced per operator,
AvX	=	mean number of crushers per operator,
RSE(A)	=	RSE for A,
RSE(AvX)	=	RSE for mean X,
RSE(AvW)	=	RSE for mean W, and
r	=	correlation coefficient between the X's and the W's.

Then:

$$\text{RSE(A)} = \sqrt{[\ \text{RSE(AvX)}^2 + \text{RSE(AvW)}^2 - 2r \times \text{RSE(AvX)} \times \text{RSE(AvW)}]}$$

Note that RSE(AvX) is calculated as [St.dev(X)/√n]/Mean(X), and RSE(AvW) likewise.

It may be helpful to see what happens to the RSE(A) formula in the special case in which all the X values are 1 (i.e. where every operator has a single crusher). In that case, A = $\sum W_i/\sum(1) = \sum W_i/n$ = AvW, the ordinary straightforward average of W.

Furthermore, as the X's have zero variability, RSE(AvX) = 0, and so the RSE(A) formula just boils down to RSE(AvW), as would be expected.

LICENSED LANDFILLS

National Totals

The national grossed up total CDEW either used or disposed of in landfills, which fell into four groups (1 to 4) in England, was calculated using the following logic:

n_i	=	number of landfills (including 'nil' returns) in sample for Group i,
N_i	=	number of landfills in population for Group i,
f_i	=	'sampling fraction' for Group i ($f_i = n_i/N_i$),
A_i	=	mean of total tonnage over the ni landfills for Group i,
s_i	=	standard deviation of total tonnage over the ni landfills for Group i,
SE_i	=	standard error of A_i ,
RSE_i	=	relative standard error of A_i ,
G_i	=	grossed-up tonnage estimate for Group i,
$V(G_i)$	=	variance of G_i,
Gtot	=	estimate of overall grossed-up tonnage, and
RSE(G)	=	relative standard error of Gtot.

Then:

SE_i	=	$(1 - f_i)\ \ s_i/n_i$
RSE_i	=	SE_i/A_i
G_i	=	N_iA_i ,
$V(G_i)$	=	$(1 - f_i)\ \ N_i^2 s_i^2/n_i$,
Gtot	=	$\sum G_i$
RSE(G)	=	$\sum V(G_i)$ / Gtot, the summations running from i = 1 to 4.

The same method can be applied to calculate the grossed up totals and confidence intervals over sub categories of classes of CDEW as presented in Table 7.1 (such as, for example, clean hard C&D waste or clean excavation waste) and by the use or disposal of that sub category of CDEW (such as, for example, used in engineering or disposal). This would be achieved by adding two additional subscripts to each of the above stated dependent variables, representing the sub category of CDEW and its use. The rationale for taking such an approach is now discussed.

National Sub-Totals

The above RSE calculation can be applied to any individual tonnage component of interest (for example, the tonnage of clean 'hard' C&D waste used in landfill engineering).

If the total tonnage is subdivided into N categories of interest, the sum of the N separate grossed-up tonnage estimates will, of course, be identical to the overall grossed-up total obtained directly by analysing the total tonnage data for each landfill. However, there is no easy way of combining the sub-total variances to obtain the grand total variance. In the simplest case (where N = 2 and the sub-totals are W and Z), then:

T	=	W + Z, and
Var(T)	=	Var(W) + Var(Z) + 2r x StD(W) x StD(Z), where

r is the correlation coefficient between W and Z.

More generally, there is a correlation term for all possible pairs of terms on the right-hand side of the T expression. So with seven sub-categories (which there are, as can be seen by reference to the components which make up the three sub-totals applicable to landfills in Table 7.1, i.e. the different forms of CDEW which make up the seven sub categories which in turn correspond to a use or final disposal in a landfill as coded by either engineering, capping or waste in landfills), there are 7x6/2 = 21 correlation terms in addition to the seven main variance terms.

This is a practical argument against going to a very fine level of detail.

ANNEX 6
Significance Tests for Differences between Groups

INVESTIGATING WHETHER CRUSHERS IN AREAS WITH DIFFERENT POPULATION DENSITIES PRODUCE SIGNIFICANTLY DIFFERENT AMOUNTS OF RECYCLED AGGREGATE

To investigate the hypothesis that crushers which operate in areas with differing levels of population density recycle differing levels of aggregate, a series of t-tests were undertaken to determine if there were significant differences between the mean levels of aggregate recycled per full time equivalent crusher in the three population density bands. The three density bands are defined as low (an area with a population density with 1,000 or fewer persons per square km), medium (areas with a population density within the range of 1,001 and 2,000 persons per square km) and high (areas with 2,001 or more persons per square km).

These t-tests used a method which utilises ratio estimates of mean weight per full time equivalent crusher. That is:

Wt_i / $FTEC_i$ = Σ[weight]$_i$ / Σ[number of full time equivalent crushers]$_i$,

With the summations over all operators in population density band i. The method used is summarised below. Let:

n_i	=	number of operators of full time equivalent crushers in population density band i.
$FTEC_i$	=	number of full time equivalent crushers per operator in population density band i;
Wt_i	=	total quantity of recycled aggregate in population density band i;
A_i	=	Estimated tonnes weight per full time equivalent crusher: [weight]$_i$ / [number of full time equivalent crushers]$_i$; across population density band i;
Av $(FTEC)_i$	=	Mean number of full time equivalent crushers per operator in population density i;
Av $(Wt)_i$	=	Mean quantity of recycled aggregate per operator in population density band i;
RSE $(A)_i$	=	Relative standard error for A in population density band i;
RSE (Av $(FTEC)_i$)	=	Relative standard error of full time equivalent crushers in population density band i;
RSE (Av $(Wt)_i$)	=	Relative standard error of recycled aggregate in population density band i;

r_i	=	correlation coefficient between full time equivalent crushers and aggregate recycled in population density band i;
$RSE\ (A)_i$	=	Relative standard error of $A_i = \sqrt{[(RSE\ (Av\ (Wt))^2_i + RSE\ (Av\ (FTEC))^2_i - 2r^*RSE\ (Av\ (Wt))_i{}^*\ RSE\ (Av\ (FTEC)_i)]}$.

Note that $RSE\ (Av\ (Wt)_i)$ is calculated as $[st.\ dev\ (Wt)_i\ /\ \sqrt{n_i}]\ /\ Av\ (Wt)_i$, and $RSE\ (Av\ (FTEC)_i)$ likewise.

The t-statistic assessing the difference between two population density bands (high and medium in this case) is then calculated as $[(A_{high} - A_{med})\ /\ (RSE\ (A)_{high} + RSE\ (A)_{med})^{0.5}]$.

The results can be summarised in Table A6.1 below.

Table A6.1: **Results of t-tests investigating the influence of population density on recycling activity**

Test	t-statistic	Degrees of freedom	Outcome (at a confidence level of 90%)
High vs Medium	0.97	71	It is likely that the difference in the quantities recycled per crusher is not significantly different in areas with high and medium population densities
Medium vs Low	1.48	167	It is likely that the difference in the quantities recycled per crusher is significantly different in areas with medium and low population densities

Only one of the t-tests demonstrated a significant difference between the mean amounts of recycled aggregate processed by crushers located in areas with different levels of population density at the 90% confidence level. This significant difference was between the medium and low population density bands. The test of the mean amounts in high and medium population density areas showed that there was an 83% probability of a difference.

This suggests that although there is limited evidence of there being significant differences in the mean amount of recycled aggregate per crusher between different population density bands, there is some evidence to suggest that the medium population density band generates more recycled aggregate per full time equivalent crusher that the other population density bands, and the difference is more than likely to be real, particularly when compared to the low density population band.

INVESTIGATING WHETHER CRUSHERS IN AREAS WITH DIFFERENT POPULATION DENSITIES PRODUCE RECYCLED AGGREGATE WITH A DIFFERENT BALANCE BETWEEN GRADED AND UNGRADED AGGREGATE

A series of t-tests were undertaken to test for the differences between the estimated ratios of graded and ungraded material recycled across crushers based in each of the three human population density bands.

The t-test assesses whether the means of two different groups are statistically different from one another and is, therefore, appropriate in this case, assuming that the ratios are normally distributed in each population density band. The outcome of the test provides some evidence for believing that certain parts of England produce significantly more graded recycled aggregate as a proportion of the total, and therefore the test provides a greater level of understanding into the recycled aggregate market.

As the means being tested by the t-test are ratio estimates, the following approach was taken. Let:

n_{id}	=	number of i operators who recycled graded and/or ungraded material within regions in population density band d;
g_{id}	=	tonnes of graded material recycled by operator i within regions in population density band d;
$Av\ (g)_d$	=	average tonnes of graded material recycled within regions in population density band d;
u_{id}	=	tonnes of ungraded material recycled by operator i within regions in population density band d;
$Av\ (u)_d$	=	average tonnes of ungraded material recycled within regions in population density band d;
$FTEC_{id}$	=	total number of full time equivalent crushers operated by operator i within regions in population density band d;
$\phi d = \Sigma g_{id} / \Sigma FTEC_{id}$	=	average tonnes of graded material recycled per full time equivalent crusher operated by i operators within regions in population density band d;
$\theta d = \Sigma u_{id} / \Sigma FTEC_{id}$	=	average tonnes of ungraded material recycled per full time equivalent crusher operated by i operators within regions in population density band d;
$\gamma_d = \phi_d / \theta_d$	=	the ratio estimate of the average tonnes of graded material recycled per average tonne of ungraded material recycled within regions in population density band d;
$RSE\ (Av\ g)_d$	=	relative standard error of graded material recycled within regions in population density band d;
$RSE\ (Av\ u)_d$	=	relative standard error of ungraded material recycled within regions in population density band d;
r_i	=	correlation coefficient between the gid and uid across operators i within population density band d;
$RSE\ (\gamma)_d$	=	$\sqrt{[}\ RSE\ (Av\ g)^2 d + RSE\ (Av\ u)^2_d - 2r_i * RSE\ (Av\ g)_d * RSE\ (Av\ u)_d]$;

Note that $RSE\ (Av\ (g)_d)$ is calculated as $[st.\ dev\ (g)_i / \sqrt{n} i_d] / Ave\ (g)_d$, and $RSE\ (Ave\ (u)_d)$ likewise.

Then the t test-statistic is calculated as:

$$t = (\gamma_{high} - \gamma_{medium}) / [(RSE\ (\gamma)_{high}) + (RSE\ (\gamma)_{medium})]^{0.5}$$

The results of the t-tests of the graded to ungraded ratios in each of the three population density bands are presented below in Table A6.2.

Table A6.2: Results of t-tests investigating the influence of population density on the ration between graded and ungraded recycled aggregate

Test	t-statistic	Degrees of freedom	Outcome and level of confidence
High vs Medium	-1.11	81	Ratios might be different (reject null hypothesis of no difference in ratios with 86.5% confidence)
Medium vs Low	1.411	78	Ratios likely to be different (reject null hypothesis of no difference in ratios with 92.0% confidence)

The ratio of graded:ungraded recycled aggregate produced in areas of high population density was estimated to be 57:43, while in areas of medium population density it was estimated to be 74:26, and in areas of low population density it was 51:49.

The test shows that although there is evidence to suggest that the two estimated ratios for high and medium density areas are not statistically the same, this evidence is not conclusive at the 90% confidence level (the relevant confidence level being 86.5%). It is usual practice to treat confidence levels below 90% as providing inconclusive evidence of a real difference.

By contrast, the somewhat more pronounced difference between the ratios of graded:ungraded recycled aggregate in medium and low population density areas is statistically significant at the 90% confidence level, meaning that it is likely that the difference between the two ratios is real.

Given the above analysis, it is suggested that while population density is a reasonably good proxy for determining differences in the ratio between graded and ungraded aggregate, there are other factors of local significance which are probably determining whether there is in fact a difference. These could range from:

- accessibility to quarried primary aggregates;
- local demand for ungraded materials and graded materials – a key determinant as the market is very much demand driven, with the supply responding to local need;
- the nature of the waste arising; and
- the type of crusher and location at which crushing takes place.

These could all be factors which differ significantly across England at the sub-regional level. If this is true, then this would lead to a range in the difference of ratios of graded to ungraded aggregates produced from recycling activity within a population density band and hence make identifying differences between population bands less significant.

INVESTIGATING DIFFERENCES BETWEEN GROUPS OF LICENSED LANDFILLS

Investigating landfills using the t-test

A number of t-tests were undertaken to test for statistical differences between the average amounts of CDEW either used or disposed of in each of the four stratified groups of landfills. This was done to assess whether there was evidence of a statistical difference between the sample means of each of the groups, and thus to provide evidence that each of the four groups contained relatively homogenous landfills, and was sufficiently different to be considered distinct from the other groups, and thus give credence to the approach to banding landfills.

The t-test assesses whether the means of two different groups of landfills are statistically different from one another, and can be utilised when it is believed that the two groups being tested can be approximately modelled with the normal distribution.

The following approach was taken. Let:

A_i = Mean CDEW used or disposed of in a landfill in Group i;
$\sigma 2_i$ = Variance of CDEW used or disposed of in a landfill in Group i;
n_i = number of respondent landfills in Group i;

Then the t-statistic (or test statistic) is, where the subscripts i and j represent two different groups of landfill (say Groups 1 and 2):

$$t = (A_i - A_j) / [(\sigma 2_i / n_i) + (\sigma 2_j / n_j)]^{0.5}$$

The calculated t-statistic is then compared against a critical t-statistic to test whether the null hypothesis of no difference between the two sample means can be rejected or not. If the calculated t-statistic is large then there is a greater probability of there being a statistically significant difference in the means of the two groups. The critical t-statistic is read off a t-table given the degrees of freedom associated with the test and a pre-selected level of significance.

The results were as follows:

- for Group 1 vs Group 2, the t-statistic was 1.94 with 90 degrees of freedom, giving confidence at a level of 97.2% that the means are different;

- for Group 2 vs Group 3, the t-statistic was 3.18 with 263 degrees of freedom, giving confidence at a level of 99.9% that the means are different; and

- for Group 3 vs Group 4, the t-statistic was 2.35 with 267 degrees of freedom, giving confidence at a level of 99.0% that the means are different.

As can be seen, all of the t-tests show that the differences between the mean quantities of CDEW used or disposed of in the pairs of landfills being compared are significant at a confidence level of 95%. Thus is can be concluded that all four groups of landfills are different, and that the approach taken to the banding of landfills is supported.

Investigating landfills using the Mann-Whitney test

It can be argued that using the t-test for landfills is inappropriate, because the distribution is not normal. To check that the results set out above were not misleading, a further non-parametric test (the Mann Whitney test) was used.

The Mann Whitney test is used to see whether two independent samples are from different populations when the samples are not normally distributed. This is relevant in this case, because the tonnages of CDEW used or disposed of at landfills, irrespective of group, is not normally distributed. In fact, it is more likely that the data are log normally distributed, reflecting the high frequency of landfills where low or zero tonnages of CDEW are reported, and the low frequency of landfills accepting high tonnages of CDEW, characterising the distributions with positive skewness.

To tackle the lack of normality in the data, the data relating to the CDEW disposed or used in landfills was transformed by taking the quad root (or ¼ root) to reduce the skewness of the data. This improved the normality of the distribution for landfill groups 3 and 4, although it was less successful for landfill groups 1 and 2 due to the high frequency of zero CDEW being disposed or used in landfills in these groups. (Recalculating the t-test with the transformed data yields the same outcome as before, suggesting that all groups are significantly different at a confidence level greater than 95%).

The Mann Whitney test was used to test whether there were differences in the medians of pairs of groups of landfills. The null hypothesis states that the two medians are the same, and therefore that the two sets of data are drawn from populations with the same distribution, and can, therefore, be said to be from the same population.

The standard approach to undertaking the Mann Whitney test was undertaken, in which data from both groups were pooled and ranked in ascending order. Then all the ranked positions of the data from each of the two groups were summed. The test statistic is then the summation of all the ranks of the first of the two groups, and a significance level is calculated based on the test statistic.

It should be noted that the significance level at which the null hypothesis can be rejected is not sensitive to whether or not the data are transformed, although the calculated medians are.

The results of the Mann-Whitney Test are as follows:

- for Group 1 vs Group 2, based on median tonnages of CDEW of 0 tonnes for both groups, the confidence level that the distributions differ is 95.6%;

- for Group 2 vs Group 3, based on median tonnages of CDEW of 0 tonnes for Group 2 and 100 tonnes for Group 3, the confidence level that the distributions differ is 99.3%; and

- for Group 3 vs Group 4, based on median tonnages of CDEW of 100 tonnes for Group 3 and 35,190 tonnes for Group 4, the confidence level that the distributions differ is 99.8%.

Therefore, the practical outcome of the tests is directly comparable to the outcome of the associated t-tests reported above, allowing the same conclusion to be drawn, namely that each of the groups can be considered distinct from one another and drawn from independent populations.

OTHER STATISTICAL TESTS

Chi-Square Goodness of Fit Test

The Chi-Square Goodness of Fit test is a non-parametric test which (as applied in this context) assesses whether there is a statistically significant difference between the observed frequencies of samples falling into various categories and the frequencies that were expected before the survey. In this particular context it has been used to test a null hypothesis that the relative frequencies of occurrence of observed crusher ownership follow a specified frequency distribution – the expected distribution of crusher ownership. Such a test is, therefore, useful in drawing conclusions on how accurate the prior expected population of crushers in England is, as it compares the number of crushers each respondent confirms they own with the numbers of crushers they were expected to own, before the survey was run. This is especially important as the grossing up of the total amount of recycled aggregate depends upon the pre-survey expectation of the total population of crushers, and if any significant difference is found between the observed ownership of crushers of respondents and the prior expectation of ownership of crushers of these operators, it would provide evidence for the procedure of adjusting the expected distribution of crushers based on the survey returns.

The test is limited in coverage by being only testable against the operators who responded to the survey. There are also a number of requirements which must be complied with before the Chi-Square Goodness of Fit test can be applied to the data, which are all met in this case. These requirements are that: the number of crushers owned by each operator must be randomly drawn from the population; the numbers of crushers owned by each operator must be reported in absolute frequencies; the number of crushers owned by any one operator is independent of the number of crushers owned by any other operator; all independent data fall within the categories and they are mutually exclusive and exhaustive over the full sample; and the expected frequency of crushers owned by each operator in any one category should be at least five.

A simple test was first applied which investigated whether there was a significant difference between the expected number of crushers owned in England by the 222 operators, who responded to the survey, and the observed number of crushers owned by these 222 operators. This test covered respondents from all three Groups of crusher operators.

The Chi Square Goodness of Fitness test is completed in the following way.

A series of categories are assigned to each of the expected and observed frequency distributions, which represent the number of crushers owned by operators. The categories were differentiated from one another based upon the number of crushers owned by an operator, and ranged from zero to six, although one category combined the operators who owned between four and six crushers because there were so few operators in each of the individual categories, which if put into separate categories would have violated the conditions required to allow the Chi-Square Goodness of Fit Test to be applied to this set of data.

The following formula is then applied to each category i and summed across all i categories, where:

X^2	=	Chi-Square test statistic;
O_i	=	Observed value in category i; and
E_i	=	Expected value in category i; so that
X^2	=	$\Sigma (O_i - E_i)^2 / E_i$

If the Chi-square test statistic is non zero, then the expected and observed distributions could still be considered to be the same, as the difference could be due to sampling differences alone. To test this outcome, the Chi-square test statistic is compared against a critical value in a Chi-Square distribution table, for the given degrees of freedom. If the test statistic is greater than the critical value at the desired level of confidence, then the null hypothesis that any difference between the expected and observed distributions cannot be accepted due to sampling differences alone, and therefore the null hypothesis can be rejected.

The test was first applied simply over the full number of operators who responded to the survey which covered 222 operators from all three groups of crusher operators. Five categories of crusher ownership were utilised based on the number owned. The resulting Chi-square test statistic was 3.053 (with 2 degrees of freedom). At the 90% confidence level the critical value is 4.605. This suggests that the null hypothesis cannot be rejected, and that the two distributions of crushers, the expected and observed, are not statistically different and that any difference was due to random sampling. Although there are in fact a number of differences between the expected and observed ownership of crushers by operators, many of these differences cancel out in the Chi-square test due to the frequent occurrence of operators who were thought to own one crusher, but in fact did not own any, and those who were thought to own no crushers, but in fact owned one. This outcome can be better demonstrated with an example, as outlined with the aid of Table A6.3 below.

Table A6.3: **Crushers expected and observed in Groups 1&2**

Number of crushers thought in advance to be owned by operators	Frequency Expected	Frequency Observed
0	0	15
1	112	95
2	29	30
3	7	5
4 or 5 or 6	5	8

The same test cannot be strictly applied to respondents from operator Groups 1 and 2 only, as there are no instances of an operator who is expected not to own a crusher (which, therefore, violates the requirements which the Chi-square test puts on data to make it relevant). However, Table A6.3 demonstrates the distribution of crusher ownership in the expected and observed distributions and clearly shows the divergence between what was expected and what was observed from the survey respondents, and in particular the differences between those operators expected to own zero and one crusher and observed owning one and zero crushers respectively.

The goodness of fit test was further applied at the regional level for three regions (East of England, London and the South West) to see if there were regional differences. There was no evidence that the observed distribution of crusher ownership differed from the expected distribution of crushers for these regions. This is largely due to the small sample sizes at the regional level resulting in very few categories, and the fact that if a crusher operator was expected to own one crusher, it was as often the case that he did in fact own zero crushers as when a crusher operator was expected to own zero crushers and in fact owned one crusher, thus negating the differences in the observed distribution and the expected distribution.

In fact, it is always the case, and largely unavoidable, that when applying the gross up over the full population it will be slightly inaccurate, due to the fact that there is always going to be some difference in the number of crushers observed and the number of crushers expected, although the Chi-square test concludes that there is in fact little difference between the expected and observed distributions of crusher ownership. This can be demonstrated by Figure A6.1 below, which ignores the direction of change between the number of crushers observed being owned by operators and the number of crushers expected to be owned by operators, by taking the modulus of the difference. This removed the cancelling factor which frequently occurred in the Chi-Square Goodness of Fit test as described above.

Figure A6.1: **Frequency of differences between observed and expected values for crusher ownership**

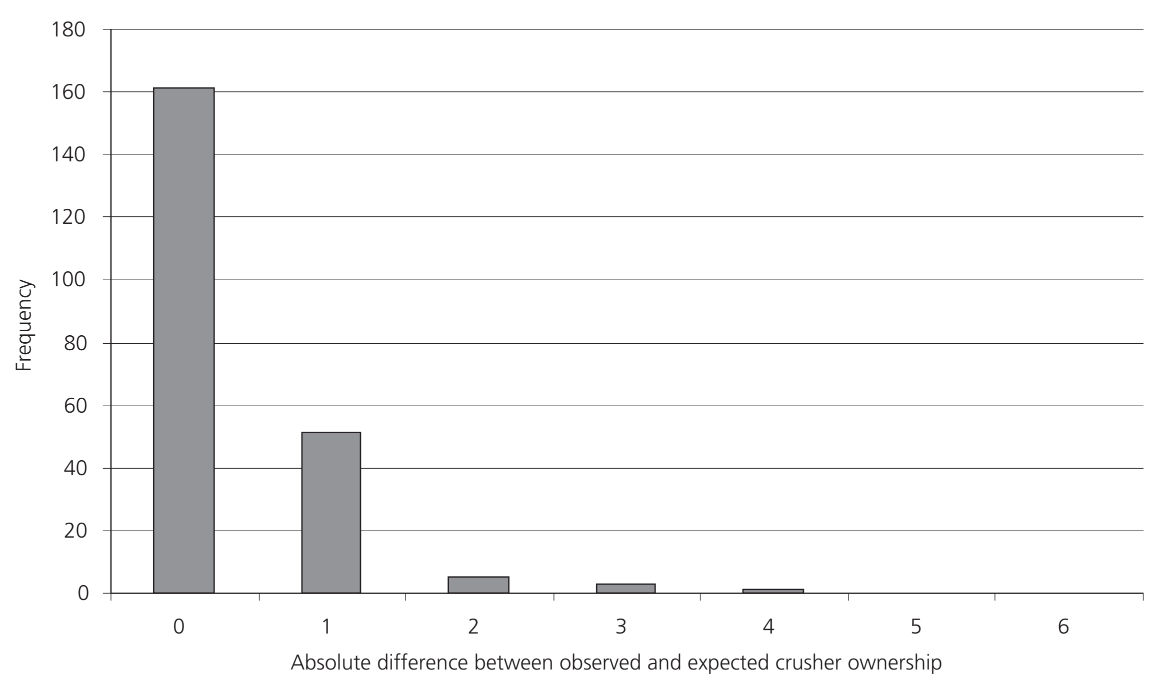


Figure A6.3 is based on the 222 crusher operators who responded to the survey. It can be concluded from the above analysis that there is some statistical evidence to suggest that the expected population of crushers against which the mean output of recycled aggregate per crusher is grossed up needs to be adjusted, particular with reference to group 3 operators (the operators who are thought in advance to hire rather than own a recycling crusher), which needs to be uplifted, whereas the numbers of crushers owned by group 1&2 operators need to be reduced, since the prior expectation of the population of crushers owned is differs marginally from the observed distribution.

Chow Test

The Chow test seeks to establish whether there is a structural difference within a set of data. In this context the Chow test was used to investigate whether there are different relationships between the amount of CDEW recycled in sub-regions with differing levels of human population density. The Chow test works by investigating the data to see if there is a significant divergence in the linearity of a relationship.

The test was applied to investigate whether there was a natural break in the data set (i.e. to check whether sub-regions with an above average population density displayed a different link between population density and recycling, than regions with below average population density. The test was repeated for other break points both below and above the average. In the text below, the two sets of sub-regions divided by the chosen break point are described as 'groups').

It should be stressed that the test was being applied to the average population of whole sub-regions, which may comprise 15 or more individual district council areas. It has been established elsewhere that local population density influences the level of recycling. The objective here was to see whether the characteristics of the wider area (e.g. the sub-region) further qualified that influence.

The model assessed was:

$$Y_i = \alpha + \beta * X_i + \varepsilon_i$$

where

Y_{ni} = recycled aggregate from sub region i from group n;
X_{ni} = population density in sub region i from group n;
α = intercept parameter estimated from the regression;
β = slope parameter estimated from the regression; and
ε_i = stochastic error term (representing the random error in the model).

The model returns fitted values of Y for given values of X.

The data were then split into two groups (n = 1 and n = 2), where the structural break was believed to be, giving:

$$Y_{1i} = \alpha_1 + \beta_1 * X_{1i} + \varepsilon_i$$

and

$$Y_{2i} = \alpha_2 + \beta_2 * X_{2i} + \varepsilon_i$$

The test assesses whether $\alpha_1 = \alpha_2$ and $\beta_1 = \beta_2$. If the estimated parameters are statistically different, then it can be argued that there is a structural break in the data (and, therefore, that two different relationships exists on either side of the break point).

To test for a structural break in the data, the Chow test statistic is calculated using the formula:

$$[(S_c - S_1 + S_2) / k] / [(S_1 + S_2) / (N_1 + N_2 - 2k)]$$

where:

S_c	=	residual sum of squares from the combined model;
S_1	=	residual sum of squares from the first model;
S_2	=	residual sum of squares from the second model;
N_1	=	number of observations in first model;
N_2	=	number of observations in second model; and
k	=	the total number of parameters estimated in the model, which equals two in this instance.

The test statistic follows the F-distribution with k and $N_1 + N_2 - k$ degrees of freedom. If the test statistic is greater than the critical F-statistic found on the F-tables at the desired level of significance (for the 90% confidence level the critical F-statistic is 2.519), then it can be concluded that $\alpha_1 \neq \alpha_2$ and $\beta_1 \neq \beta_2$.

The outcome of a number of investigations into the location of possible structural break points in the data showed little evidence of such a break. Thus there is no strong statistical reason to believe that sub-regions with differing levels of population density recycle CDEW in disproportionate non-linearly quantities.

ANNEX 7
Survey of Operators of Crushers and Screens – Sub-Regional Tables

The following tables are included in this Annex rather than in the main text to avoid breaking up the narrative flow of the main report unnecessarily. In these tables abbreviated names are used for some of the sub-regions. For the full definitions of the sub-regions, readers should refer back to Table 3.2 in the main text. The background shading shows how the sub-regions are grouped together into regions.

Table A7.1: **Original and adjusted sub-regional estimates of recycling crusher populations**

Sub-Regions	Original estimate	Adjusted estimate
Cumbria	21	20
Lancashire and G Manchester	68	69
Cheshire and Merseyside	25	27
Northumberland and Tyne & Wear	21	19
Tees Valley and Durham	17	19
North Yorkshire	29	28
West Yorkshire	29	30
South Yorkshire	28	30
East Riding, N&NE Lincolnshire	17	18
Shropshire and Staffordshire	34	35
Herefordshire and Worcestershire	18	18
W Midlands, excl Coventry, Solihull	35	33
Warwickshire, Coventry, Solihull	10	10
Derbyshire	42	39
Notts and Lincs (excl N&NE Lincs)	31	37
Leicestershire and Rutland	14	16
Northamptonshire	17	17
Cambs, Norfolk and Suffolk	54	56
Bedfordshire and Hertfordshire	27	28
Essex	40	39
West London	60	58
East London	46	45
Kent	28	27
Surrey, E&W Sussex	33	34
Hampshire and IoW	32	34
Berks, Bucks and Oxon	18	25
Gloucestershire (excl S Glos)	11	11
Wiltshire and Dorset	19	17
Somerset and former Avon	32	32
Devon, Cornwall and Scillies	20	23

Table A7.2: **Sub-regional estimates of recycled aggregate and soil in 2005 (tonnes)**

Sub-Regions	Graded	Un-graded	Soil (excl topsoil)	Total
Cumbria	465,483	442,043	77,999	985,525
Lancashire and G Manchester	2,286,289	1,310,180	432,648	4,029,118
Cheshire and Merseyside	1,006,325	507,174	192,672	1,706,171
Northumberland and Tyne & Wear	518,362	353,827	99,126	971,315
Tees Valley and Durham	434,765	400,863	73,997	909,625
North Yorkshire	639,210	607,021	107,110	1,353,341
West Yorkshire	1,235,946	571,512	234,408	2,041,866
South Yorkshire	788,830	638,674	137,189	1,564,693
East Riding, N&NE Lincolnshire	407,072	367,2557	1,243	845,570
Shropshire and Staffordshire	845,493	736,873	146,718	1,729,084
Herefordshire and Worcestershire	404,814	374,770	69,349	848,934
W Midlands, excl Coventry, Solihull	916,748	590,988	181,639	1,689,375
Warwickshire, Coventry, Solihull	384,599	193,137	72,495	650,231
Derbyshire	1,125,445	801,497	201,552	2,128,493
Notts and Lincs (excl N&NE Lincs)	970,000	762,133	172,151	1,904,285
Leicestershire and Rutland	358,195	339,057	60,194	757,446
Northamptonshire	391,958	337,864	71,071	800,893
Cambs, Norfolk and Suffolk	1,292,959	1,211,586	219,209	2,723,755
Bedfordshire and Hertfordshire	682,073	587,186	119,439	1,388,698
Essex	909,259	855,891	153,551	1,918,701
West London	1,390,718	1,038,622	277,302	2,706,641
East London	1,123,899	792,277	223,519	2,139,695
Kent	950,434	544,954	175,476	1,670,864
Surrey, E&W Sussex	982,044	703,644	175,184	1,860,873
Hampshire and IoW	989,369	677,845	181,636	1,848,850
Berks, Bucks and Oxon	603,997	525,050	105,211	1,234,258
Gloucestershire (excl S Glos)	244,777	221,691	42,705	509,172
Wiltshire and Dorset	403,853	373,857	69,188	846,898
Somerset and former Avon	739,538	685,181	126,608	1,551,327
Devon, Cornwall and Scillies	539,848	489,143	94,151	1,123,142

Table A7.3: Sub-regional population, recycled aggregate production and GVA in 2005

Sub-Regions	Population	Density (persons / km²)	Recycled aggregate (tonnes)	Recycled aggregate per person (tonnes)	GVA (£m)
Cumbria	487,607	71	907,526	1.861	5,984
Lancashire and G Manchester	3,897,083	895	3,596,470	0.923	57,465
Cheshire and Merseyside	2,345,110	785	1,513,498	0.645	33,648
Northumberland and Tyne & Wear	1,383,165	248	872,189	0.631	19,171
Tees Valley and Durham	1,132,314	374	835,628	0.738	13,347
North Yorkshire	750,791	90	1,246,231	1.660	11,528
West Yorkshire	2,079,217	1,022	1,807,458	0.869	32,249
South Yorkshire	1,266,337	812	1,427,504	1.127	15,787
East Riding, N&NE Lincolnshire	868,493	247	774,327	0.892	11,988
Shropshire and Staffordshire	1,488,905	240	1,582,367	1.063	19,104
Herefordshire and Worcestershire	716,951	183	779,585	1.087	9,550
W Midlands, excl Coventry, Solihull	2,055,231	3,294	1,507,736	0.734	35,628
Warwickshire, Coventry, Solihull	1,006,250	446	577,736	0.574	13,515
Derbyshire	956,297	364	1,926,941	2.015	14,052
Notts and Lincs (excl N&NE Lincs)	1,662,144	206	1,732,133	1.042	23,144
Leicestershire and Rutland	924,062	362	697,252	0.755	14,419
Northamptonshire	629,676	266	729,822	1.159	10,819
Cambs, Norfolk and Suffolk	2,173,996	173	2,504,546	1.152	32,749
Bedfordshire and Hertfordshire	1,599,938	557	1,269,259	0.793	30,065
Essex	1,614,220	439	1,765,150	1.094	22,215
West London	3,789,048	4,724	2,429,340	0.641	122,557
East London	3,382,988	4,348	1,916,176	0.566	57,115
Kent	1,579,155	423	1,495,388	0.947	20,756
Surrey, E&W Sussex	2,552,771	467	1,685,688	0.660	45,243
Hampshire and IoW	1,776,933	427	1,667,214	0.938	28,600
Berks, Bucks and Oxon	2,091,691	364	1,129,047	0.540	47,863
Gloucestershire (excl S Glos)	564,559	213	466,468	0.826	10,021
Wiltshire and Dorset	1,305,760	213	777,710	0.596	20,158
Somerset and former Avon	1,481,953	310	1,424,720	0.961	26,136
Devon, Cornwall and Scillies	1,576,186	154	1,028,991	0.653	18,770

Table A7.4: **Indications of 'out-of-area' working, by sub-region**

Sub-Regions	% from own sub-region	% from own Region	% from own or adjacent Region	% from further away
Cumbria	98.7%	98.7%	100.0%	0.0%
Lancashire and G Manchester	92.8%	98.3%	100.0%	0.0%
Cheshire and Merseyside	94.4%	100.0%	100.0%	0.0%
Northumberland and Tyne & Wear	99.5%	100.0%	100.0%	0.0%
Tees Valley and Durham	49.9%	70.4%	85.2%	14.8%
North Yorkshire	90.7%	100.0%	100.0%	0.0%
West Yorkshire	84.3%	88.3%	100.0%	0.0%
South Yorkshire	80.0%	90.2%	100.0%	0.0%
East Riding, N&NE Lincolnshire	100.0%	100.0%	100.0%	0.0%
Shropshire and Staffordshire	51.3%	69.6%	85.2%	14.8%
Herefordshire and Worcestershire	84.7%	100.0%	100.0%	0.0%
W Midlands, excl Coventry, Solihull	94.3%	94.3%	100.0%	0.0%
Warwickshire, Coventry, Solihull	100.0%	100.0%	100.0%	0.0%
Derbyshire	74.7%	93.4%	100.0%	0.0%
Notts and Lincs (excl N&NE Lincs)	90.5%	90.5%	100.0%	0.0%
Leicestershire and Rutland	52.4%	52.4%	83.1%	16.9%
Northamptonshire	65.3%	72.6%	100.0%	0.0%
Cambs, Norfolk and Suffolk	89.7%	95.1%	100.0%	0.0%
Bedfordshire and Hertfordshire	60.4%	70.4%	100.0%	0.0%
Essex	88.8%	93.0%	100.0%	0.0%
West London	52.4%	66.9%	90.4%	9.6%
East London	71.7%	73.2%	100.0%	0.0%
Kent	73.8%	76.9%	100.0%	0.0%
Surrey, E&W Sussex	69.8%	74.7%	100.0%	0.0%
Hampshire and IoW	67.3%	97.0%	100.0%	0.0%
Berks, Bucks and Oxon	43.0%	45.0%	81.5%	18.5%
Gloucestershire (excl S Glos)	82.8%	100.0%	100.0%	0.0%
Wiltshire and Dorset	99.4%	100.0%	100.0%	0.0%
Somerset and former Avon	67.5%	89.8%	94.9%	5.1%
Devon, Cornwall and Scillies	100.0%	100.0%	100.0%	0.0%

ANNEX 8
Survey of Operators of Licensed Landfills – Sub-Regional and Other Tables

The following tables are included in this Annex rather than in the main text to avoid breaking up the narrative flow unnecessarily. In these tables abbreviated names are used for some of the sub-regions. For the full definitions of the sub-regions, readers should refer back to Table 3.2 in the main text. The background shading shows how the sub-regions are grouped into regions.

Table A8.1: Sub-regional distribution of landfills, by Group

Sub-Regions	Group 1	Group 2	Group 3	Group 4	Total
Cumbria	3	0	12	2	17
Lancashire and G Manchester	6	2	36	3	47
Cheshire and Merseyside	6	2	18	3	29
Northumberland and Tyne & Wear	1	0	15	3	19
Tees Valley and Durham	5	1	20	2	28
North Yorkshire	6	3	32	2	43
West Yorkshire	10	14	41	0	65
South Yorkshire	10	2	25	1	38
East Riding, N&NE Lincolnshire	4	6	29	3	42
Shropshire and Staffordshire	8	3	20	2	33
Herefordshire and Worcestershire	0	3	7	2	12
W Midlands, excl Coventry, Solihull	2	1	6	1	10
Warwickshire, Coventry, Solihull	5	2	7	0	14
Derbyshire	4	3	19	1	27
Notts and Lincs (excl N&NE Lincs)	6	3	28	2	39
Leicestershire and Rutland	4	0	12	2	18
Northamptonshire	2	3	14	4	23
Cambs, Norfolk and Suffolk	9	4	61	4	78
Bedfordshire and Hertfordshire	1	4	15	4	24
Essex	4	2	21	7	34
West London	0	0	3	0	3
East London	1	0	8	0	9
Kent	2	10	20	5	37
Surrey, E&W Sussex	3	7	22	11	43
Hampshire and IoW	2	1	16	4	23
Berks, Bucks and Oxon	3	2	34	5	44
Gloucestershire (excl S Glos)	2	0	4	0	6
Wiltshire and Dorset	7	3	27	1	38
Somerset and former Avon	8	11	33	2	54
Devon, Cornwall and Scillies	1	18	31	8	58

Table A8.2: Average values for unprocessed CDEW entering Group 1 landfills in 2005 (tonnes)

	Engineering	Capping	Waste	Total
Clean hard C&D waste	0	0	322	322
Contaminated hard C&D waste	0	0	0	0
Clean excavation waste	20	497	57	574
Contaminated excavation waste	0	0	0	0
Clean 'mixed' CDEW	0	0	36	36
Contaminated 'mixed' CDEW	0	0	0	0
Other	18	0	0	18
Total	**38**	**497**	**415**	**950**

Table A8.3: Average values for unprocessed CDEW entering Group 2 landfills in 2005 (tonnes)

	Engineering	Capping	Waste	Total
Clean hard C&D waste	151	0	1	153
Contaminated hard C&D waste	0	0	0	0
Clean excavation waste	642	0	2,344	2,985
Contaminated excavation waste	0	0	761	761
Clean 'mixed' CDEW	50	0	5,765	5,815
Contaminated 'mixed' CDEW	0	0	0	0
Other	304	0	0	304
Total	**1,146**	**0**	**8,871**	**10,017**

Table A8.4: Average values for unprocessed CDEW entering Group 3 landfills in 2005 (tonnes)

	Engineering	Capping	Waste	Total
Clean hard C&D waste	942	0	632	1,574
Contaminated hard C&D waste	12	0	112	124
Clean excavation waste	3,559	7,629	11,713	22,901
Contaminated excavation waste	128	0	1,410	1,537
Clean 'mixed' CDEW	509	26	1,347	1,883
Contaminated 'mixed' CDEW	2	0	669	671
Other	381	0	1,863	2,244
Total	**5,532**	**7,655**	**17,746**	**30,934**

Table A8.5: Average values for unprocessed CDEW entering Group 4 landfills in 2005 (tonnes)

	Engineering	Capping	Waste	Total
Clean hard C&D waste	2,790	3	4	2,797
Contaminated hard C&D waste	0	0	0	0
Clean excavation waste	3,746	5,476	57,014	66,236
Contaminated excavation waste	0	0	0	0
Clean 'mixed' CDEW	5	3	11,374	11,382
Contaminated 'mixed' CDEW	0	0	0	0
Other	0	278	917	1,194
Total	**6,541**	**5,760**	**69,309**	**81,610**

Table A8.6: Sub-regional estimates for unprocessed CDEW used or disposed of in licensed landfills in 2005 (tonnes)

Sub-Regions	Engineering	Capping	Waste	Total
Cumbria	41,249	115,299	232,326	388,875
Lancashire and G Manchester	168,194	350,862	693,875	1,212,931
Cheshire and Merseyside	86,003	113,927	864,524	1,064,454
Northumberland and Tyne & Wear	79,791	83,359	813,135	976,285
Tees Valley and Durham	580,921	173,189	399,724	1,153,835
North Yorkshire	165,285	236,892	679,436	1,081,613
West Yorkshire	282,812	285,353	663,344	1,231,508
South Yorkshire	97,539	204,059	534,217	835,814
East Riding, N&NE Lincolnshire	96,363	132,763	528,420	757,547
Shropshire and Staffordshire	347,234	228,057	375,523	950,815
Herefordshire and Worcestershire	55,785	49,036	230,781	335,602
W Midlands, excl Coventry, Solihull	24,360	34,720	438,247	497,328
Warwickshire, Coventry, Solihull	40,492	46,926	140,309	227,727
Derbyshire	80,904	122,947	383,429	587,280
Notts and Lincs (excl N&NE Lincs)	167,137	201,088	761,337	1,129,561
Leicestershire and Rutland	62,986	81,908	361,477	506,371
Northamptonshire	69,839	187,131	1,016,889	1,273,859
Cambs, Norfolk and Suffolk	196,767	353,648	1,054,417	1,604,832
Bedfordshire and Hertfordshire	77,005	302,541	713,798	1,093,344
Essex	141,015	317,677	682,166	1,140,859
West London	23,164	15,310	322,732	361,207
East London	250,007	402,598	132,891	785,496
Kent	127,038	171,583	747,641	1,046,262
Surrey, E&W Sussex	136,348	206,591	1,268,374	1,611,313
Hampshire and IoW	94,821	98,255	543,659	736,736
Berks, Bucks and Oxon	183,653	299,364	1,240,029	1,723,046
Gloucestershire (excl S Glos)	16,597	38,973	53,238	108,808
Wiltshire and Dorset	150,862	121,415	624,452	896,729
Somerset and former Avon	186,110	268,272	700,150	1,154,531
Devon, Cornwall and Scillies	168,514	170,953	935,560	1,275,027

ANNEX 9

Analysis of Data from the 'REGIS' Database Relating to Paragraph 9A(1) and 19A(2) Registered Exempt Sites

The following tables are included in this Annex rather than in the main text to avoid breaking up the narrative flow unnecessarily. Where the data in these tables form the basis of illustrations, this is indicated. In these tables abbreviated names are used for some of the sub-regions. For the full definitions of the sub-regions, readers should refer back to Table 3.2 in the main text. The background shading shows how the sub-regions are grouped into regions.

Table A9.1: **Sub-regional distribution of Paragraph 9A(1) and 19A(2) registered exempt sites (all sites and 'non-blank date sites')**

Sub-Regions	All sites'		Non-blank date sites'	
	9A(1)	19A(2)	9A(1)	19A(2)
Cumbria	5	39	3	37
Lancashire and G Manchester	24	53	21	47
Cheshire and Merseyside	14	52	11	47
Northumberland and Tyne & Wear	7	14	6	12
Tees Valley and Durham	0	16	0	11
North Yorkshire	15	23	7	21
West Yorkshire	17	18	16	16
South Yorkshire	11	23	8	20
East Riding, N&NE Lincolnshire	5	11	5	10
Shropshire and Staffordshire	14	52	13	45
Herefordshire and Worcestershire	2	22	2	19
W Midlands, excl Coventry, Solihull	6	21	1	18
Warwickshire, Coventry, Solihull	7	24	5	22
Derbyshire	5	3	4	2
Notts and Lincs (excl N&NE Lincs)	8	36	5	32
Leicestershire and Rutland	3	15	2	12
Northamptonshire	6	17	5	17
Cambs, Norfolk and Suffolk	25	48	20	43
Bedfordshire and Hertfordshire	5	16	4	12
Essex	12	28	6	20
West London	1	12	0	12
East London	6	17	6	15
Kent	7	41	6	31
Surrey, E&W Sussex	14	45	12	37
Hampshire and IoW	9	29	7	27
Berks, Bucks and Oxon	6	28	4	25
Gloucestershire (excl S Glos)	8	37	7	32
Wiltshire and Dorset	11	32	10	30
Somerset and former Avon	10	71	9	62
Devon, Cornwall and Scillies	15	179	13	163

Table A9.2: Sub-regional distribution of materials used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes, on 'non-blank date sites')

Sub-Regions	9A(1)	19A(2)	Total
Cumbria	7,532	101,386	108,918
Lancashire and G Manchester	694,777	185,670	880,447
Cheshire and Merseyside	276,356	692,427	968,783
Northumberland and Tyne & Wear	327,521	121,321	448,843
Tees Valley and Durham	0	354,800	354,800
North Yorkshire	205,677	62,251	267,928
West Yorkshire	65,117	124,706	189,824
South Yorkshire	18,599	156,979	175,578
East Riding, N&NE Lincolnshire	12,554	139,064	151,618
Shropshire and Staffordshire	396,548	1,288,293	1,684,841
Herefordshire and Worcestershire	5,021	150,135	155,157
W Midlands, excl Coventry, Solihull	357,000	335,305	692,305
Warwickshire, Coventry, Solihull	96,995	281,295	378,290
Derbyshire	38,021	7,900	45,921
Notts and Lincs (excl N&NE Lincs)	83,371	365,852	449,224
Leicestershire and Rutland	5,021	177,775	182,796
Northamptonshire	12,554	42,671	55,225
Cambs, Norfolk and Suffolk	121,078	330,812	451,890
Bedfordshire and Hertfordshire	177,021	208,666	385,687
Essex	111,871	733,663	845,534
West London	0	1,276,032	1,276,032
East London	22,755	741,804	764,558
Kent	172,634	156,678	329,312
Surrey, E&W Sussex	369,506	251,251	620,758
Hampshire and IoW	17,575	269,193	286,768
Berks, Bucks and Oxon	930,021	346,107	1,276,128
Gloucestershire (excl S Glos)	27,054	270,133	297,187
Wiltshire and Dorset	86,242	181,858	268,100
Somerset and former Avon	84,714	631,219	715,933
Devon, Cornwall and Scillies	32,639	702,930	735,569

ANNEX 10

Regional Results

With the exception of the populations of recycling crushers, all of the numbers in the tables in this Annex are unrounded and in tonnes. The apparent precision of these central estimates should not obscure the very important point that they are just that: estimates with considerable uncertainty attached to them.

Table A10.1: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**North West**
Adjusted estimate of population of recycling crushers				117
Estimated production of recycled graded aggregate (tonnes)				3,758,097
Estimated production of recycled ungraded aggregate (tonnes)				2,259,397
Estimated production of recycled soil (excl. topsoil) (tonnes)				703,320
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	65,631	6	109,180	174,817
Contaminated hard C&D waste	564	0	5,668	6,231
Clean excavation waste	177,340	578,277	1,367,749	2,123,367
Contaminated excavation waste	5,999	0	82,259	88,259
Clean 'mixed' CDEW	26,852	1,250	104,901	133,004
Contaminated 'mixed' CDEW	91	0	31,568	31,659
Other	18,969	556	89,399	108,923
Total	**295,447**	**580,088**	**1,790,725**	**2,666,260**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				1,958,148
Total estimated arisings of CDEW in 2005 (tonnes)				**11,345,222**

Table A10.2: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**North East**
Adjusted estimate of population of recycling crushers				37
Estimated production of recycled graded aggregate (tonnes)				953,127
Estimated production of recycled ungraded aggregate (tonnes)				754,691
Estimated production of recycled soil (excl. topsoil) (tonnes)				173,123
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	34,658	11	15,189	49,859
Contaminated hard C&D waste	1,449	0	5,637	7,086
Clean excavation waste	559,021	254,804	890,571	1,704,396
Contaminated excavation waste	5,321	0	33,182	38,503
Clean 'mixed' CDEW	40,472	622	82,288	123,382
Contaminated 'mixed' CDEW	493	0	15,380	15,874
Other	19,297	1,111	170,613	191,021
Total	**660,711**	**256,548**	**1,212,859**	**2,130,119**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				803,643
Total estimated arisings of CDEW in 2005 (tonnes)				**4,814,703**

Table A10.3: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**Yorkshire & the Humber**
Adjusted estimate of population of recycling crushers				106
Estimated production of recycled graded aggregate (tonnes)				3,071,057
Estimated production of recycled ungraded aggregate (tonnes)				2,184,463
Estimated production of recycled soil (excl. topsoil) (tonnes)				549,951
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	129,941	11	106,231	236,183
Contaminated hard C&D waste	971	0	9,079	10,050
Clean excavation waste	316,979	849,623	1,422,466	2,589,067
Contaminated excavation waste	35,339	0	179,094	214,433
Clean 'mixed' CDEW	42,543	8,322	326,696	377,561
Contaminated 'mixed' CDEW	156	0	206,337	206,493
Other	116,070	1,111	155,515	272,696
Total	**641,999**	**859,067**	**2,405,416**	**3,906,482**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				784,947
Total estimated arisings of CDEW in 2005 (tonnes)				**10,496,900**

Table A10.4: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**West Midlands**
Adjusted estimate of population of recycling crushers				96
Estimated production of recycled graded aggregate (tonnes)				2,551,655
Estimated production of recycled ungraded aggregate (tonnes)				1,895,768
Estimated production of recycled soil (excl. topsoil) (tonnes)				470,201
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	138,710	8	19,979	158,697
Contaminated hard C&D waste	324	0	3,026	3,350
Clean excavation waste	277,420	357,173	586,007	1,220,601
Contaminated excavation waste	3,446	0	42,626	46,072
Clean 'mixed' CDEW	35,654	724	161,114	197,492
Contaminated 'mixed' CDEW	52	0	18,055	18,107
Other	12,265	833	354,054	367,152
Total	**467,872**	**358,739**	**1,184,861**	**2,011,472**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				2,910,592
Total estimated arisings of CDEW in 2005 (tonnes)				**9,839,689**

Table A10.5: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**East Midlands**
Adjusted estimate of population of recycling crushers				108
Estimated production of recycled graded aggregate (tonnes)				2,845,598
Estimated production of recycled ungraded aggregate (tonnes)				2,240,550
Estimated production of recycled soil (excl. topsoil) (tonnes)				504,968
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	73,035	25	41,716	114,776
Contaminated hard C&D waste	564	0	16,338	16,901
Clean excavation waste	215,359	589,276	1,942,534	2,747,168
Contaminated excavation waste	7,793	0	181,220	189,013
Clean 'mixed' CDEW	63,125	1,274	211,511	275,910
Contaminated 'mixed' CDEW	91	0	31,429	31,520
Other	20,900	2,500	98,385	121,784
Total	**380,866**	**593,074**	**2,523,132**	**3,497,072**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				733,166
Total estimated arisings of CDEW in 2005 (tonnes)				**9,821,356**

Table A10.6: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**East of England**
Adjusted estimate of population of recycling crushers				123
Estimated production of recycled graded aggregate (tonnes)				2,884,291
Estimated production of recycled ungraded aggregate (tonnes)				2,654,663
Estimated production of recycled soil (excl. topsoil) (tonnes)				492,199
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	110,428	128	55,931	166,487
Contaminated hard C&D waste	660	0	7,405	8,065
Clean excavation waste	239,980	959,351	1,785,660	2,984,992
Contaminated excavation waste	7,021	0	129,291	136,312
Clean 'mixed' CDEW	33,718	1,609	293,677	329,003
Contaminated 'mixed' CDEW	106	0	36,779	36,885
Other	22,875	12,778	141,637	177,290
Total	**414,787**	**973,866**	**2,450,382**	**3,839,035**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				1,683,111
Total estimated arisings of CDEW in 2005 (tonnes)				**11,553,299**

Table A10.7: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**London**
Adjusted estimate of population of recycling crushers				103
Estimated production of recycled graded aggregate (tonnes)				2,514,616
Estimated production of recycled ungraded aggregate (tonnes)				1,830,899
Estimated production of recycled soil (excl. topsoil) (tonnes)				500,821
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	35,563	0	5,377	40,940
Contaminated hard C&D waste	96	0	897	993
Clean excavation waste	229,340	417,696	381,003	1,028,040
Contaminated excavation waste	1,021	0	37,277	38,298
Clean 'mixed' CDEW	4,071	212	10,816	15,098
Contaminated 'mixed' CDEW	15	0	5,350	5,365
Other	3,065	0	14,905	17,969
Total	**273,172**	**417,908**	**455,624**	**1,146,703**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				2,040,590
Total estimated arisings of CDEW in 2005 (tonnes)				**8,033,630**

Table A10.8: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**South East**
Adjusted estimate of population of recycling crushers				120
Estimated production of recycled graded aggregate (tonnes)				3,525,843
Estimated production of recycled ungraded aggregate (tonnes)				2,451,493
Estimated production of recycled soil (excl. topsoil) (tonnes)				637,508
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	140,736	19	42,118	182,873
Contaminated hard C&D waste	2,376	0	9,906	12,283
Clean excavation waste	304,132	772,138	2,638,557	3,714,827
Contaminated excavation waste	8,605	0	195,974	204,579
Clean 'mixed' CDEW	49,429	1,690	742,358	793,478
Contaminated 'mixed' CDEW	121	0	42,129	42,250
Other	36,461	1,944	128,662	167,067
Total	**541,860**	**775,793**	**3,799,705**	**5,117,357**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				2,512,966
Total estimated arisings of CDEW in 2005 (tonnes)				**14,245,167**

Table A10.9: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region				**South West**
Adjusted estimate of population of recycling crushers				83
Estimated production of recycled graded aggregate (tonnes)				1,928,015
Estimated production of recycled ungraded aggregate (tonnes)				1,769,873
Estimated production of recycled soil (excl. topsoil) (tonnes)				332,652
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	121,542	25	46,889	168,455
Contaminated hard C&D waste	624	0	13,328	13,952
Clean excavation waste	331,547	595,681	1,489,220	2,416,448
Contaminated excavation waste	6,638	0	99,306	105,944
Clean 'mixed' CDEW	33,690	1,406	517,623	552,718
Contaminated 'mixed' CDEW	100	0	38,273	38,373
Other	27,943	2,500	108,762	139,205
Total	**522,083**	**599,612**	**2,313,400**	**3,435,095**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				2,016,789
Total estimated arisings of CDEW in 2005 (tonnes)				**9,482,424**

ANNEX 11
Sub-Regional Results

With the exception of the populations of recycling crushers, all of the numbers in the tables in this Annex are unrounded and in tonnes. The apparent precision of these central estimates should not obscure the very important point that they are just that: estimates with considerable uncertainty attached to them.

Table A11.1: **Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)**

English Region and Sub-Region				**North West: Cumbria**
Adjusted estimate of population of recycling crushers				20
Estimated production of recycled graded aggregate (tonnes)				465,483
Estimated production of recycled ungraded aggregate (tonnes)				442,043
Estimated production of recycled soil (excl. topsoil) (tonnes)				77,999
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	9,043	0	81,961	91,004
Contaminated hard C&D waste	84	0	785	869
Clean excavation waste	24,952	115,114	112,487	252,552
Contaminated excavation waste	894	0	9,867	10,761
Clean 'mixed' CDEW	3,562	185	9,504	13,251
Contaminated 'mixed' CDEW	13	0	4,681	4,694
Other	2,702	0	13,042	15,743
Total	**41,249**	**115,299**	**232,326**	**388,875**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				108,918
Total estimated arisings of CDEW in 2005 (tonnes)				**1,483,318**

Table A11.2: **Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)**

English Region and Sub-Region				**North West: Lancashire and Greater Manchester**
Adjusted estimate of population of recycling crushers				69
Estimated production of recycled graded aggregate (tonnes)				2,286,289
Estimated production of recycled ungraded aggregate (tonnes)				1,310,180
Estimated production of recycled soil (excl. topsoil) (tonnes)				432,648
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	39,885	3	17,723	57,611
Contaminated hard C&D waste	312	0	3,314	3,626
Clean excavation waste	98,138	349,890	495,695	943,723
Contaminated excavation waste	3,319	0	51,819	55,138
Clean 'mixed' CDEW	15,910	691	58,580	75,182
Contaminated 'mixed' CDEW	50	0	17,387	17,437
Other	10,580	278	49,357	60,215
Total	**168,194**	**350,862**	**693,875**	**1,212,931**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				880,447
Total estimated arisings of CDEW in 2005 (tonnes)				**6,122,496**

Table A11.3: **Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)**

English Region and Sub-Region				**North West: Cheshire and Merseyside**
Adjusted estimate of population of recycling crushers				27
Estimated production of recycled graded aggregate (tonnes)				1,006,325
Estimated production of recycled ungraded aggregate (tonnes)				507,174
Estimated production of recycled soil (excl. topsoil) (tonnes)				192,672
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	16,704	3	9,496	26,202
Contaminated hard C&D waste	168	0	1,569	1,737
Clean excavation waste	54,251	113,273	759,568	927,092
Contaminated excavation waste	1,787	0	20,573	22,360
Clean 'mixed' CDEW	7,380	374	36,817	44,570
Contaminated 'mixed' CDEW	27	0	9,501	9,528
Other	5,687	278	27,000	32,965
Total	**86,003**	**113,927**	**864,524**	**1,064,454**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				968,783
Total estimated arisings of CDEW in 2005 (tonnes)				**3,739,408**

Table A11.4: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				North East: Northumberland and Tyne & Wear
Adjusted estimate of population of recycling crushers				19
Estimated production of recycled graded aggregate (tonnes)				518,362
Estimated production of recycled ungraded aggregate (tonnes)				353,827
Estimated production of recycled soil (excl. topsoil) (tonnes)				99,126
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	15,701	6	5,695	21,402
Contaminated hard C&D waste	108	0	1,009	1,117
Clean excavation waste	41,939	82,553	610,155	734,647
Contaminated excavation waste	1,149	0	12,686	13,835
Clean 'mixed' CDEW	8,752	245	34,875	43,872
Contaminated 'mixed' CDEW	17	0	6,018	6,036
Other	12,125	556	142,696	155,376
Total	**79,791**	**83,359**	**813,135**	**976,285**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				448,843
Total estimated arisings of CDEW in 2005 (tonnes)				**2,396,443**

Table A11.5: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				North East: Tees Valley and Durham
Adjusted estimate of population of recycling crushers				19
Estimated production of recycled graded aggregate (tonnes)				434,765
Estimated production of recycled ungraded aggregate (tonnes)				400,863
Estimated production of recycled soil (excl. topsoil) (tonnes)				73,997
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	18,957	6	9,494	28,457
Contaminated hard C&D waste	1,341	0	4,628	5,969
Clean excavation waste	517,083	172,251	280,415	969,749
Contaminated excavation waste	4,172	0	20,495	24,667
Clean 'mixed' CDEW	31,720	377	47,413	79,510
Contaminated 'mixed' CDEW	476	0	9,362	9,838
Other	7,172	556	27,917	35,644
Total	**580,921**	**173,189**	**399,724**	**1,153,835**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				354,800
Total estimated arisings of CDEW in 2005 (tonnes)				**2,418,261**

Table A11.6: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region	Yorkshire & the Humber: North Yorkshire (excluding south Teesside)
Adjusted estimate of population of recycling crushers	28
Estimated production of recycled graded aggregate (tonnes)	639,210
Estimated production of recycled ungraded aggregate (tonnes)	607,021
Estimated production of recycled soil (excl. topsoil) (tonnes)	107,110

Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate

	Engineering	Capping	Waste	Total
Clean hard C&D waste	40,008	6	16,131	56,145
Contaminated hard C&D waste	300	0	2,802	3,102
Clean excavation waste	98,406	229,497	481,469	809,373
Contaminated excavation waste	3,191	0	37,523	40,714
Clean ‘mixed’ CDEW	12,881	6,833	76,382	96,096
Contaminated ‘mixed’ CDEW	48	0	16,718	16,766
Other	10,450	556	48,411	59,416
Total	**165,285**	**236,892**	**679,436**	**1,081,613**

Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)	267,928
Total estimated arisings of CDEW in 2005 (tonnes)	**2,702,882**

Table A11.7: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region	Yorkshire & the Humber: West Yorkshire
Adjusted estimate of population of recycling crushers	30
Estimated production of recycled graded aggregate (tonnes)	1,235,946
Estimated production of recycled ungraded aggregate (tonnes)	571,512
Estimated production of recycled soil (excl. topsoil) (tonnes)	234,408

Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate

	Engineering	Capping	Waste	Total
Clean hard C&D waste	53,386	0	60,714	114,100
Contaminated hard C&D waste	300	0	2,802	3,102
Clean excavation waste	96,087	284,691	327,784	708,562
Contaminated excavation waste	28,191	0	92,545	120,736
Clean ‘mixed’ CDEW	13,271	661	116,204	130,137
Contaminated ‘mixed’ CDEW	48	0	16,718	16,766
Other	91,529	0	46,577	138,106
Total	**282,812**	**285,353**	**663,344**	**1,231,508**

Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)	189,824
Total estimated arisings of CDEW in 2005 (tonnes)	**3,463,198**

Table A11.8: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				Yorkshire & the Humber: South Yorkshire
Adjusted estimate of population of recycling crushers				30
Estimated production of recycled graded aggregate (tonnes)				788,830
Estimated production of recycled ungraded aggregate (tonnes)				638,674
Estimated production of recycled soil (excl. topsoil) (tonnes)				137,189
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	18,167	3	14,216	32,386
Contaminated hard C&D waste	192	0	1,793	1,985
Clean excavation waste	62,070	203,352	252,802	518,224
Contaminated excavation waste	2,042	0	24,076	26,118
Clean 'mixed' CDEW	8,247	427	46,796	55,469
Contaminated 'mixed' CDEW	31	0	162,870	162,901
Other	6,790	278	31,663	38,731
Total	**97,539**	**204,059**	**534,217**	**835,814**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				175,578
Total estimated arisings of CDEW in 2005 (tonnes)				**2,576,084**

Table A11.9: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				Yorkshire & the Humber: East Riding, North Lincolnshire and NE Lincolnshire
Adjusted estimate of population of recycling crushers				18
Estimated production of recycled graded aggregate (tonnes)				407,072
Estimated production of recycled ungraded aggregate (tonnes)				367,255
Estimated production of recycled soil (excl. topsoil) (tonnes)				71,243
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	18,379	3	15,171	33,552
Contaminated hard C&D waste	180	0	1,681	1,861
Clean excavation waste	60,416	132,083	360,410	552,908
Contaminated excavation waste	1,915	0	24,950	26,864
Clean 'mixed' CDEW	8,143	400	87,315	95,858
Contaminated 'mixed' CDEW	29	0	10,031	10,060
Other	7,302	278	28,863	36,443
Total	**96,363**	**132,763**	**528,420**	**757,547**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				151,618
Total estimated arisings of CDEW in 2005 (tonnes)				**1,754,735**

Table A11.10: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				**West Midlands: Shropshire and Staffordshire**
Adjusted estimate of population of recycling crushers				35
Estimated production of recycled graded aggregate (tonnes)				845,493
Estimated production of recycled ungraded aggregate (tonnes)				736,873
Estimated production of recycled soil (excl. topsoil) (tonnes)				146,718
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	109,442	3	9,831	119,276
Contaminated hard C&D waste	156	0	1,457	1,613
Clean excavation waste	203,584	227,430	214,258	645,272
Contaminated excavation waste	1,659	0	19,847	21,506
Clean 'mixed' CDEW	26,720	347	96,299	123,367
Contaminated 'mixed' CDEW	25	0	8,693	8,718
Other	5,647	278	25,137	31,062
Total	**347,234**	**228,057**	**375,523**	**950,815**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				1,684,841
Total estimated arisings of CDEW in 2005 (tonnes)				**4,364,740**

Table A11.11: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				**West Midlands: Herefordshire and Worcestershire**
Adjusted estimate of population of recycling crushers				18
Estimated production of recycled graded aggregate (tonnes)				404,814
Estimated production of recycled ungraded aggregate (tonnes)				374,770
Estimated production of recycled soil (excl. topsoil) (tonnes)				69,349
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	11,619	3	3,166	14,788
Contaminated hard C&D waste	60	0	560	620
Clean excavation waste	36,698	48,619	175,268	260,586
Contaminated excavation waste	638	0	8,570	9,209
Clean 'mixed' CDEW	4,249	136	29,640	34,025
Contaminated 'mixed' CDEW	10	0	3,344	3,353
Other	2,511	278	10,232	13,021
Total	**55,785**	**49,036**	**230,781**	**335,602**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				155,157
Total estimated arisings of CDEW in 2005 (tonnes)				**1,339,693**

Table A11.12: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				West Midlands: Metropolitan County of West Midlands other than Coventry and Solihull
Adjusted estimate of population of recycling crushers				33
Estimated production of recycled graded aggregate (tonnes)				916,748
Estimated production of recycled ungraded aggregate (tonnes)				590,988
Estimated production of recycled soil (excl. topsoil) (tonnes)				181,639
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	5,768	3	2,545	8,316
Contaminated hard C&D waste	36	0	336	372
Clean excavation waste	15,104	34,357	99,611	149,072
Contaminated excavation waste	383	0	4,990	5,373
Clean 'mixed' CDEW	1,582	83	21,253	22,917
Contaminated 'mixed' CDEW	6	0	2,006	2,012
Other	1,482	278	307,506	309,266
Total	**24,360**	**34,720**	**438,247**	**497,328**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				692,305
Total estimated arisings of CDEW in 2005 (tonnes)				**2,879,009**

Table A11.13: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				West Midlands: Warwickshire, Coventry and Solihull
Adjusted estimate of population of recycling crushers				10
Estimated production of recycled graded aggregate (tonnes)				384,599
Estimated production of recycled ungraded aggregate (tonnes)				193,137
Estimated production of recycled soil (excl. topsoil) (tonnes)				72,495
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	11,881	0	4,437	16,318
Contaminated hard C&D waste	72	0	672	744
Clean excavation waste	22,034	46,767	96,869	165,671
Contaminated excavation waste	766	0	9,219	9,985
Clean 'mixed' CDEW	3,103	159	13,921	17,183
Contaminated 'mixed' CDEW	12	0	4,012	4,024
Other	2,624	0	11,179	13,803
Total	**40,492**	**46,926**	**140,309**	**227,727**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				378,290
Total estimated arisings of CDEW in 2005 (tonnes)				**1,256,248**

Table A11.14: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region	East Midlands: Derbyshire
Adjusted estimate of population of recycling crushers	39
Estimated production of recycled graded aggregate (tonnes)	1,125,445
Estimated production of recycled ungraded aggregate (tonnes)	801,497
Estimated production of recycled soil (excl. topsoil) (tonnes)	201,552

Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate

	Engineering	Capping	Waste	Total
Clean hard C&D waste	15,341	3	18,262	33,606
Contaminated hard C&D waste	156	0	1,457	1,613
Clean excavation waste	51,373	122,319	258,296	431,988
Contaminated excavation waste	1,659	0	19,847	21,506
Clean 'mixed' CDEW	6,720	347	49,318	56,385
Contaminated 'mixed' CDEW	25	0	8,693	8,718
Other	5,630	278	27,556	33,463
Total	**80,904**	**122,947**	**383,429**	**587,280**

Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)	45,921
Total estimated arisings of CDEW in 2005 (tonnes)	**2,761,694**

Table A11.15: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region	East Midlands: Nottinghamshire and Lincolnshire (excluding N & NE Lincolnshire)
Adjusted estimate of population of recycling crushers	37
Estimated production of recycled graded aggregate (tonnes)	970,000
Estimated production of recycled ungraded aggregate (tonnes)	762,133
Estimated production of recycled soil (excl. topsoil) (tonnes)	172,151

Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate

	Engineering	Capping	Waste	Total
Clean hard C&D waste	23,935	6	12,662	36,603
Contaminated hard C&D waste	228	0	3,832	4,059
Clean excavation waste	81,843	200,017	596,982	878,842
Contaminated excavation waste	4,219	0	32,059	36,278
Clean 'mixed' CDEW	48,692	509	65,715	114,917
Contaminated 'mixed' CDEW	37	0	12,706	12,742
Other	8,183	556	37,382	46,120
Total	**167,137**	**201,088**	**761,337**	**1,129,561**

Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)	449,224
Total estimated arisings of CDEW in 2005 (tonnes)	**3,483,069**

Table A11.16: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				East Midlands: Leicestershire and Rutland
Adjusted estimate of population of recycling crushers				16
Estimated production of recycled graded aggregate (tonnes)				358,195
Estimated production of recycled ungraded aggregate (tonnes)				339,057
Estimated production of recycled soil (excl. topsoil) (tonnes)				60,194
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	14,060	6	6,661	20,727
Contaminated hard C&D waste	108	0	1,009	1,117
Clean excavation waste	39,581	81,102	281,518	402,202
Contaminated excavation waste	1,149	0	12,686	13,835
Clean 'mixed' CDEW	4,590	245	34,983	39,817
Contaminated 'mixed' CDEW	17	0	6,018	6,036
Other	3,481	556	18,601	22,638
Total	**62,986**	**81,908**	**361,477**	**506,371**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				182,796
Total estimated arisings of CDEW in 2005 (tonnes)				**1,446,614**

Table A11.17: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				East Midlands: Northamptonshire
Adjusted estimate of population of recycling crushers				17
Estimated production of recycled graded aggregate (tonnes)				391,958
Estimated production of recycled ungraded aggregate (tonnes)				337,864
Estimated production of recycled soil (excl. topsoil) (tonnes)				71,071
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	19,698	11	4,131	23,840
Contaminated hard C&D waste	72	0	10,040	10,112
Clean excavation waste	42,562	185,837	805,737	1,034,136
Contaminated excavation waste	766	0	116,628	117,394
Clean 'mixed' CDEW	3,123	172	61,495	64,790
Contaminated 'mixed' CDEW	12	0	4,012	4,024
Other	3,607	1,111	14,845	19,563
Total	**69,839**	**187,131**	**1,016,889**	**1,273,859**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				55,225
Total estimated arisings of CDEW in 2005 (tonnes)				**2,129,977**

Table A11.18: **Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)**

English Region and Sub-Region				**East of England: Cambridgeshire, Norfolk and Suffolk**
Adjusted estimate of population of recycling crushers				56
Estimated production of recycled graded aggregate (tonnes)				1,292,959
Estimated production of recycled ungraded aggregate (tonnes)				1,211,586
Estimated production of recycled soil (excl. topsoil) (tonnes)				219,209
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	43,960	6	19,933	63,898
Contaminated hard C&D waste	360	0	4,603	4,963
Clean excavation waste	115,898	342,286	755,492	1,213,676
Contaminated excavation waste	3,829	0	91,007	94,836
Clean 'mixed' CDEW	20,577	800	75,594	96,972
Contaminated 'mixed' CDEW	58	0	20,061	20,119
Other	12,086	10,556	87,726	110,368
Total	**196,767**	**353,648**	**1,054,417**	**1,604,832**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				451,890
Total estimated arisings of CDEW in 2005 (tonnes)				**4,780,477**

Table A11.19: **Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)**

English Region and Sub-Region				**East of England: Bedfordshire and Hertfordshire**
Adjusted estimate of population of recycling crushers				28
Estimated production of recycled graded aggregate (tonnes)				682,073
Estimated production of recycled ungraded aggregate (tonnes)				587,186
Estimated production of recycled soil (excl. topsoil) (tonnes)				119,439
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	22,413	8	6,024	28,445
Contaminated hard C&D waste	108	0	1,009	1,117
Clean excavation waste	44,570	301,451	539,207	885,228
Contaminated excavation waste	1,149	0	14,209	15,357
Clean 'mixed' CDEW	4,695	248	127,814	132,757
Contaminated 'mixed' CDEW	17	0	6,018	6,036
Other	4,053	833	19,518	24,404
Total	**77,005**	**302,541**	**713,798**	**1,093,344**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				385,687
Total estimated arisings of CDEW in 2005 (tonnes)				**2,867,729**

Table A11.20: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				East of England: Essex
Adjusted estimate of population of recycling crushers				39
Estimated production of recycled graded aggregate (tonnes)				909,259
Estimated production of recycled ungraded aggregate (tonnes)				855,891
Estimated production of recycled soil (excl. topsoil) (tonnes)				153,551
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	44,055	114	29,974	74,143
Contaminated hard C&D waste	192	0	1,793	1,985
Clean excavation waste	79,512	315,614	490,962	886,088
Contaminated excavation waste	2,042	0	24,076	26,118
Clean 'mixed' CDEW	8,447	560	90,268	99,275
Contaminated 'mixed' CDEW	31	0	10,699	10,730
Other	6,736	1,389	34,393	42,518
Total	**141,015**	**317,677**	**682,166**	**1,140,859**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				845,534
Total estimated arisings of CDEW in 2005 (tonnes)				**3,905,094**

Table A11.21: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				London: West London
Adjusted estimate of population of recycling crushers				58
Estimated production of recycled graded aggregate (tonnes)				1,390,718
Estimated production of recycled ungraded aggregate (tonnes)				1,038,622
Estimated production of recycled soil (excl. topsoil) (tonnes)				277,302
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	13,984	0	1,264	15,248
Contaminated hard C&D waste	24	0	224	248
Clean excavation waste	7,118	15,257	310,667	333,042
Contaminated excavation waste	255	0	2,819	3,074
Clean 'mixed' CDEW	1,018	53	2,695	3,766
Contaminated 'mixed' CDEW	4	0	1,337	1,341
Other	762	0	3,726	4,488
Total	**23,164**	**15,310**	**322,732**	**361,207**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				1,276,032
Total estimated arisings of CDEW in 2005 (tonnes)				**4,343,881**

Table A11.22: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				London: East London
Adjusted estimate of population of recycling crushers				45
Estimated production of recycled graded aggregate (tonnes)				1,123,899
Estimated production of recycled ungraded aggregate (tonnes)				792,277
Estimated production of recycled soil (excl. topsoil) (tonnes)				223,519
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	21,579	0	4,113	25,692
Contaminated hard C&D waste	72	0	672	744
Clean excavation waste	222,223	402,439	70,337	694,998
Contaminated excavation waste	766	0	34,458	35,223
Clean 'mixed' CDEW	3,053	159	8,121	11,333
Contaminated 'mixed' CDEW	12	0	4,012	4,024
Other	2,303	0	11,179	13,481
Total	**250,007**	**402,598**	**132,891**	**785,496**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				764,558
Total estimated arisings of CDEW in 2005 (tonnes)				**3,689,749**

Table A11.23: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				South East: Kent
Adjusted estimate of population of recycling crushers				27
Estimated production of recycled graded aggregate (tonnes)				950,434
Estimated production of recycled ungraded aggregate (tonnes)				544,954
Estimated production of recycled soil (excl. topsoil) (tonnes)				175,476
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	39,672	3	10,174	49,849
Contaminated hard C&D waste	180	0	1,681	1,861
Clean excavation waste	61,017	170,902	386,304	618,223
Contaminated excavation waste	1,915	0	50,069	51,984
Clean 'mixed' CDEW	7,938	400	260,520	268,858
Contaminated 'mixed' CDEW	29	0	10,031	10,060
Other	16,287	278	28,863	45,428
Total	**127,038**	**171,583**	**747,641**	**1,046,262**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				329,312
Total estimated arisings of CDEW in 2005 (tonnes)				**3,046,439**

Table A11.24: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				South East: Surrey, East and West Sussex
Adjusted estimate of population of recycling crushers				34
Estimated production of recycled graded aggregate (tonnes)				982,044
Estimated production of recycled ungraded aggregate (tonnes)				703,644
Estimated production of recycled soil (excl. topsoil) (tonnes)				175,184
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	31,988	8	8,216	40,213
Contaminated hard C&D waste	1,765	0	1,345	3,110
Clean excavation waste	71,617	205,421	793,430	1,070,469
Contaminated excavation waste	2,095	0	89,663	91,758
Clean 'mixed' CDEW	23,057	328	337,719	361,103
Contaminated 'mixed' CDEW	23	0	8,025	8,048
Other	5,803	833	29,977	36,613
Total	**136,348**	**206,591**	**1,268,374**	**1,611,313**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				620,758
Total estimated arisings of CDEW in 2005 (tonnes)				**4,092,943**

Table A11.25: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				South East: Hampshire and the Isle of Wight
Adjusted estimate of population of recycling crushers				34
Estimated production of recycled graded aggregate (tonnes)				989,369
Estimated production of recycled ungraded aggregate (tonnes)				677,845
Estimated production of recycled soil (excl. topsoil) (tonnes)				181,636
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	20,443	6	6,959	27,408
Contaminated hard C&D waste	132	0	4,078	4,210
Clean excavation waste	63,024	97,397	438,436	598,856
Contaminated excavation waste	1,404	0	19,480	20,885
Clean 'mixed' CDEW	5,607	298	45,023	50,928
Contaminated 'mixed' CDEW	21	0	7,356	7,377
Other	4,189	556	22,327	27,072
Total	**94,821**	**98,255**	**543,659**	**736,736**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				286,768
Total estimated arisings of CDEW in 2005 (tonnes)				**2,872,353**

Table A11.26: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				**South East: Berkshire, Buckinghamshire and Oxfordshire**
Adjusted estimate of population of recycling crushers				25
Estimated production of recycled graded aggregate (tonnes)				603,997
Estimated production of recycled ungraded aggregate (tonnes)				525,050
Estimated production of recycled soil (excl. topsoil) (tonnes)				105,211
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	48,632	3	16,770	65,404
Contaminated hard C&D waste	300	0	2,802	3,102
Clean excavation waste	108,474	298,419	1,020,387	1,427,280
Contaminated excavation waste	3,191	0	36,762	39,953
Clean 'mixed' CDEW	12,826	665	99,097	112,588
Contaminated 'mixed' CDEW	48	0	16,718	16,766
Other	10,182	278	47,494	57,954
Total	**183,653**	**299,364**	**1,240,029**	**1,723,046**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				1,276,128
Total estimated arisings of CDEW in 2005 (tonnes)				**4,233,432**

Table A11.27: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				**South West: Gloucestershire (excluding South Gloucestershire)**
Adjusted estimate of population of recycling crushers				11
Estimated production of recycled graded aggregate (tonnes)				244,777
Estimated production of recycled ungraded aggregate (tonnes)				221,691
Estimated production of recycled soil (excl. topsoil) (tonnes)				42,705
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	2,826	0	1,896	4,722
Contaminated hard C&D waste	36	0	336	372
Clean excavation waste	10,676	38,893	35,140	84,710
Contaminated excavation waste	383	0	4,229	4,612
Clean 'mixed' CDEW	1,527	79	4,042	5,648
Contaminated 'mixed' CDEW	6	0	2,006	2,012
Other	1,143	0	5,589	6,732
Total	**16,597**	**38,973**	**53,238**	**108,808**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				297,187
Total estimated arisings of CDEW in 2005 (tonnes)				**915,167**

Table A11.28: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				South West: Wiltshire and Dorset
Adjusted estimate of population of recycling crushers				17
Estimated production of recycled graded aggregate (tonnes)				403,853
Estimated production of recycled ungraded aggregate (tonnes)				373,857
Estimated production of recycled soil (excl. topsoil) (tonnes)				69,188
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	39,878	3	12,049	51,930
Contaminated hard C&D waste	168	0	8,069	8,237
Clean excavation waste	94,322	120,760	328,429	543,511
Contaminated excavation waste	1,787	0	28,518	30,305
Clean 'mixed' CDEW	8,313	374	206,394	215,081
Contaminated 'mixed' CDEW	27	0	10,362	10,389
Other	6,368	278	30,631	37,276
Total	**150,862**	**121,415**	**624,452**	**896,729**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				268,100
Total estimated arisings of CDEW in 2005 (tonnes)				**2,011,727**

Table A11.29: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				South West: Somerset and the four former Avon authorities
Adjusted estimate of population of recycling crushers				32
Estimated production of recycled graded aggregate (tonnes)				739,538
Estimated production of recycled ungraded aggregate (tonnes)				685,181
Estimated production of recycled soil (excl. topsoil) (tonnes)				126,608
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	31,623	3	17,409	49,035
Contaminated hard C&D waste	216	0	2,017	2,233
Clean excavation waste	131,724	267,511	458,795	858,030
Contaminated excavation waste	2,298	0	32,223	34,521
Clean 'mixed' CDEW	9,614	480	141,216	151,310
Contaminated 'mixed' CDEW	35	0	14,037	14,072
Other	10,600	278	34,452	45,331
Total	**186,110**	**268,272**	**700,150**	**1,154,531**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				715,933
Total estimated arisings of CDEW in 2005 (tonnes)				**3,421,791**

Table A11.30: Regional estimates of CDEW recycled by crushers and/or screens, used/disposed of at landfills, and spread on Paragraph 9A(1) and 19A(2) registered exempt sites in 2005 (tonnes)

English Region and Sub-Region				**South West: Devon, Cornwall and the Isles of Scilly**
Adjusted estimate of population of recycling crushers				23
Estimated production of recycled graded aggregate (tonnes)				539,848
Estimated production of recycled ungraded aggregate (tonnes)				489,143
Estimated production of recycled soil (excl. topsoil) (tonnes)				94,151
Estimated tonnage of unprocessed CDEW entering licensed landfills, and its use / fate				
	Engineering	**Capping**	**Waste**	**Total**
Clean hard C&D waste	47,214	19	15,535	62,768
Contaminated hard C&D waste	204	0	2,905	3,109
Clean excavation waste	94,825	168,516	666,856	930,197
Contaminated excavation waste	2,170	0	34,336	36,506
Clean 'mixed' CDEW	14,236	473	165,971	180,679
Contaminated 'mixed' CDEW	33	0	11,868	11,901
Other	9,832	1,944	38,089	49,866
Total	**168,514**	**170,953**	**935,560**	**1,275,027**
Estimated weight of waste materials (mainly excavation waste) used on Paragraph 9A(1) and 19A(2) registered exempt sites (tonnes)				735,569
Total estimated arisings of CDEW in 2005 (tonnes)				**3,133,738**

ANNEX 12
Possible Reporting Mechanism for Recycling Crushers

All mobile crushers should be, and in practice most are, authorised by Local Authorities as Part B processes. At the point where an application is being processed for the first time it should be possible to ask the applicant the following questions:

1. What is the make, model and approximate hourly throughput of the crusher (based on the manufacturer's specification)?

2. Which materials are expected to be processed using the crusher and other associated equipment (such as screens and washing plant)?

   As part of the above question it would be sensible to provide applicants with a 'pick list' with tick boxes. A suitable 'pick list' might comprise the following options:

   - primary (quarried) aggregate;
   - recycled aggregate / soil (made from crushed concrete, brick, general development site excavation waste etc);
   - recycled aggregate made from used asphalt (including asphalt planings);
   - recycled aggregate / soil made from utility trench arisings;
   - recycled aggregate made from spent railway track ballast;
   - crushed glass for use as aggregate / sand;
   - aggregate made from other materials (e.g. from ash, slag, foundry sand etc); and
   - none of the above (please specify what materials will be processed).

3. Where will the crusher's 'normal home base' be (i.e. the place where it will normally be kept)?

4. Will the crusher be operated either permanently or from time to time at its 'normal home base'?

5. Will the crusher be used at other locations instead of, or as well as, its 'normal home base'?

6. Will the crusher be hired out without an operator to other persons to enable them to crush materials?

Much of this information is already collected by Local Authorities, and in some cases it is placed on the public register.

At the point where an authorisation is being renewed it should be possible to ask the following two questions, both in relation to the previous 12-month period:

1. which materials were processed using the crusher (whether working under your direct control or when operated by a third party)?

   (The same 'pick list' as is used at the point of initial authorisation should be used here. If no waste materials were processed, no further information would be required.)

2. Please complete the following table for all waste materials processed into aggregate or aggregate-type materials.

   (The figures given in the sample table below are illustrative. The place names used within the table would need to be customised to reflect the number of adjacent authorities and other local factors. It would be important to take a pragmatic view of crusher operators' knowledge of local administrative boundaries, and probably to base the areas on the names of towns rather than local authorities.)

	Demolition waste	Asphalt waste	Utility trench waste	Spent railway track ballast	Waste glass	Ash, slags etc
(A) = 'Input' tonnes processed	25,000	3,000			1,000	
Sources of (A):						
Home District	18,000				1,000	
Neighbouring area 1	7,000	3,000				
Neighbouring area 2						
Neighbouring area 3						
Other named areas						
Area not known						
Processing locations for (A):						
Home District	25,000	3,000			1,000	
Neighbouring area 1						
Neighbouring area 2						
Neighbouring area 3						
Other named areas						
Area not known						
(B) = Tonnes of recycled aggregate produced from (A)	24,000	3,000			1,000	
Expected places of use for (B):						
Home District	5,000					
Neighbouring area 1	9,000				500	
Neighbouring area 2	8,000	3,000			500	
Neighbouring area 3						
Other named areas	2,000					
Area not known						

Some operators would be unable to complete this table, and some might only be able to attempt it using ranges rather than precise numbers. However, this is the level of information that would need to be requested through a voluntary survey, and it is likely that the response rate will be higher if linked explicitly to the authorisation process.

Further consideration would need to be given to how best such data might be collated to produce regional and national estimates.

This report sets out the results of the survey of operators of crushers, licensed landfill sites and registered exemption sites providing estimates for the arisings and use of construction and demolition waste as an alternative to primary aggregates in England, 2005.

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