Survey of arisings and use of construction and demolition waste: main document

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Summary

This study responds to the need for information which can be used to monitor and review aggregates policy documents: Minerals Planning Guidance Note 6: Guidelines for aggregates provision in England (MPG6) in the case of England, and the Aggregates Technical Advisory Note in the case of Wales. The results will also be used to monitor certain effects of the aggregates levy.

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Note: The above publication was issued by our former department, the Office of the Deputy Prime Minister (ODPM). ODPM became Communities and Local Government **on 5 May 2006** - all references in the text to ODPM now refer to Communities and Local Government.

The findings and recommendations in this report are those of the consultant authors and do not necessarily represent the views or proposed policies of Communities and Local Government.

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Preface

This study was commissioned in November 2001 by the Minerals and Waste Planning Division of the Department for Transport, Local Government and the Regions (DTLR) with the support of the Welsh Assembly Government. The Research Specification is included as Annex 1 to this report. In May 2002 the DTLR was restructured, and the Minerals and Waste Planning Division became part of the Office of the Deputy Prime Minister (ODPM).

The DTLR/ODPM invited representatives of Central Government and its agencies and local government to sit on a Steering Group, together with representatives of industry. The members of the Steering Group are listed in Annex 2.

The work was carried out by a study team comprising David Knapman and Andrew Herbert of Symonds Group and Julian Ellis of WRc. The members of the study team would like to acknowledge the cooperation and support of the Steering Group members, and of all those companies and individuals who completed and returned the various survey forms.

The findings, conclusions and recommendations reported here take into account the contributions of a wide range of parties, but are the responsibility of the study team, and do not necessarily represent the views of those parties, nor of the ODPM.

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Chapter 1: Executive Summary

Introduction and Background

1.1 Three related surveys were carried out during the first six months of 2002 to establish estimates for the arisings and use of construction and demolition waste (C&D waste) in 2001 in England and Wales, and in each of the regions covered by Regional Aggregate Working Parties. The work was commissioned by the Minerals and Waste Planning Division (now part of the Office of the Deputy Prime Minister - ODPM - formerly part of the Department for Transport, Local Government and the Regions - DTLR) with the support of the Welsh Assembly Government. It was carried out by Symonds Group Ltd, with the support of WRc plc on issues of statistical design and analysis.

1.2 The three surveys covered operators of crushers and screens, licensed landfills and Paragraph 9 & 19 registered exempt sites. Between them, these surveys were designed to generate estimates for recycled aggregate and soil, C&D waste used and disposed of at licensed landfills, and C&D waste spread on registered exempt sites. The surveys made a clear distinction between hard C&D waste and excavation waste in order to identify not just the current rate of aggregate recycling, but also the further potential.

1.3 The information generated will feed into the revision of MPG6 (in England) and the Aggregates Technical Advisory Note (in Wales), and into other policy documents which deal with recycled aggregate.

1.4 The expectation is that comparable surveys will be run in future, to coincide with the fouryearly collection of data on primary aggregate production.

Summary of Main Findings

1.5 As can be seen from Figure 1, the estimate for production of recycled aggregate and soil has risen steeply, from 25.13 million tonnes in 1999 to 45.07 million tonnes in 2001. This growth accounts for almost all of the increase in overall C&D waste production in England and Wales between 1999 and 2001. The total for 2001 is estimated at 93.91 million tonnes ± 15% at a confidence level of 90%. Although this is almost 30% higher than the equivalent estimate for 1999 (72.5 million tonnes ± 35%), the difference between the central estimates for the two years is not statistically significant.

1.6 The 1999 estimate comes from a similar survey carried out in 2000 by Symonds for the Environment Agency and the DTLR.

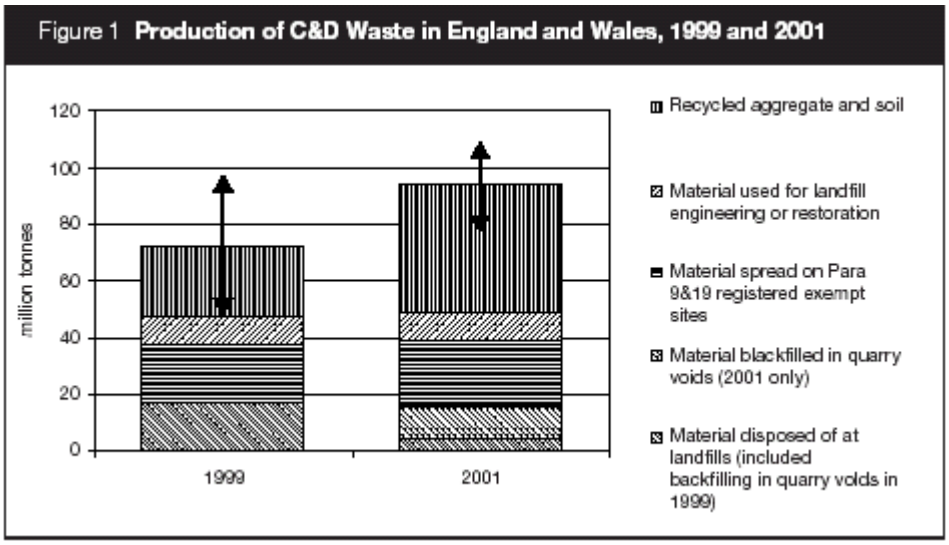
1.7 An estimated 38.02 million tonnes (± 18%) was crushed and/or screened prior to being recycled as aggregate: more than five times the tonnage of recycled soil. Some of the apparent rise in recycling activity can be attributed to a better 'detection rate' of crushers and screens used for processing hard C&D waste into recycled aggregate and soil, though the population of

such machines is widely thought to be rising.

1.8 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 in an unprocessed form (and then it was mainly for landfill engineering).

1.9 The greatest source of uncertainty, as in 1999, surrounds the true population of Paragraph 9 & 19 registered exempt sites, and the extent to which any unreliability within the national database of such sites is regionally biased. The study team concludes that such bias may well exist, and that as a consequence the regional estimate for the South West of England may well be disproportionately higher than those for other regions.

Figure 1: Production of C&D Waste in England and Wales, 1999 and 2001



1.10 Taking this uncertainty over registered exempt sites into account, the report states that there is a good case for saying that the true figure for C&D waste arisings in England and Wales as a whole may lie below the mid-point of the estimated band.

1.11 Table 1 summarises the key findings. Compared to the confidence interval surrounding the national estimate (± 15% at a confidence level of 90%), those applicable to the estimated regional totals are typically three or four times wider.

1.12 Of the estimated 38.02 million tonnes (± 18%) recycled as aggregate, about half was graded aggregate, primarily derived from clean concrete and brick waste. Estimates were also calculated for each Regional Aggregates Working Party region (see Table 1, first column).

The Survey Process

1.13 The estimates given above all derive from the three surveys carried out between March and June 2002 by Symonds. Survey forms were sent to:

i. 632 operators of crushers and screens, including a sub-set of 89 in a structured sample;
ii. the operators of 1,149 licensed landfills, including a sub-set of 94 in a structured sample;

and
iii. the operators of 539 Paragraph 9&19 registered exempt sites, including 110 comprising a structured sample selected from a much larger number of small sites.

1.14 The response rate varied from group to group, with 124 forms (20%) returned by operators of crushers and screens, 219 (19%) returned by operators of licensed landfills, and forms returned giving data on 131 registered exempt sites (24%). The response rate for the structured sample groups was notably higher (38% overall), reflecting the greater effort which was put into following up non-respondents from these groups.

Table 1: Estimated re-use, recycling and disposal of hard C&D and excavation waste by region in 2001 (million tonnes)

1.15 By defining a series of structured samples from within the overall populations of operators, it was possible to test the extent to which the respondents (who inevitably comprised a selfselecting group) were atypical of the wider pool from which they were drawn. No statistically significant differences between sample and non-sample groups were found, enabling much larger numbers of responses to be used in the grossing-up process, with the benefit of higher precision in the resultant estimates.

Future Surveys

1.16 The survey forms were simpler than their equivalents two years earlier, but the response rates were not noticeably different, suggesting that improved design alone will not raise response rates in future. Higher response rates are crucial to narrowing the confidence intervals surrounding the national and regional estimates.

1.17 The report concludes that a 'step change' in response rates can probably only be achieved by making the surveys mandatory, or at least by linking them to events (such as the re-licensing of crushers or the statutory returns required of landfill operators) that demand the full attention of the potential respondent.

1.18 The report calls for the arrangements under which crushers and screens are authorised, licensed and exempted from licensing to be reviewed. It also acknowledges that the arrangements for the classification of landfills will change over the next one to two years in response to the landfill Directive.

1.19 Registered exempt sites between them use a significant proportion of C&D waste, and particularly excavation waste. The report endorses the recommendations made in 1999 for a thorough overhaul of the procedures for registering and monitoring exemptions in a way that automatically collects the information which is required.

1.20 Some specific proposals for future survey forms, drawing on the experience of the 2001 survey, are also put forward to assist the next such survey.

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Chapter 2: Introduction and Background to the Study

The Policy Context

2.1 This study was commissioned in November 2001 by the Minerals and Waste Planning Division of the Department for Transport, Local Government and the Regions (DTLR) with the support of the Welsh Assembly Government. In May 2002 the DTLR was restructured, and the Minerals and Waste Planning Division became part of the Office of the Deputy Prime Minister (ODPM).

2.2 This study responds to the need for information which can be used to monitor and review aggregates policy documents: Minerals Planning Guidance Note 6 (MPG6) in the case of England, and the Aggregates Technical Advisory Note in the case of Wales. The results will also be used to monitor certain effects of the aggregates levy.

2.3 This study follows directly on from a similar research and development project carried out by Symonds Group in 1999/2000 for the Environment Agency and the Department of the Environment, Transport and the Regions (DETR) covering construction and demolitionrelated activity in 1999. The number of that project was P1-366, and the report was entitled 'Construction and Demolition Waste Survey', Research and Development Technical Report P402. The report is referred to throughout this document as 'EA R&D TR P402'.

2.4 The present survey was commissioned to build on that work, and specifically to provide the basis for time series data with 2001 as the base year. It is proposed that future surveys will be carried out to coincide with surveys of primary aggregate production.

2.5 This study (for which the full Research Specification is included as Annex 1 to this report) differs in three main respects from the 1999/2000 project, in that:

i. it places greater emphasis on aggregate recycling and the potential for further aggregate recycling and use;
ii. it requires better regional estimates than were obtained last time; and
iii. it is required to establish an approach which can be followed without excessive difficulty on future occasions.

2.6 The present study uses the Regional Aggregate Working Party boundaries. In England these coincide with those of the Planning Regions used in 1999/2000. However, there are two Regional Aggregate Working Parties in Wales (for North and South respectively), whereas in 1999/2000 results were reported for Wales as a whole.

The Project Steering Group and Reporting Arrangements

2.7 The DTLR/ODPM 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 three times:

i. on 4 December 2001, to be briefed about the overall approach, and to comment on the first draft of the survey forms and the proposed statistical method;
ii. on 15 May 2002, to consider the preliminary results and an Interim Report;
iii. on 17 July 2002, to discuss the main results and a first draft of the Final Report.

2.9 Symonds issued Progress Reports at approximately monthly intervals, and these were circulated by the ODPM (and before them the DTLR) to the members of the Steering Group.

2.10 Ad hoc meetings were held with the DTLR/ODPM to discuss progress, and with the Environment Agency to discuss data sources.

Main Actions and Milestones

2.11 The main actions and project milestones were as follows:

i. completion of survey of Local Authorities, to update information held on mobile crushers authorised by them (by early January 2002);
ii. updating of survey database of operators of crushers and screens, drawing on information from various sources, including Local Authorities (see above), the Environment Agency and major recycling companies (by early February 2002);
iii. assembly of survey database of licensed landfills, based on information from HM Customs & Excise, the Environment Agency and major landfill operators (by early February 2002);
iv. mailing of survey forms to operators of crushers and screens (on/about 1 March 2002);
v. mailing of survey forms to operators of licensed landfills (on/about 6 March 2002);
vi. assembly of survey database of Paragraph 9 & 19 registered exempt sites, based on information from the Environment Agency and local Planning Officers (by late March);
vii. selection of structured sample of operators of crushers and screens, and mailing of chase-up letter to those in the sample who had not responded (on 3 April 2002);
viii. selection of structured sample of operators of licensed landfills, and mailing of chaseup letter to those in the sample who had not responded (on 15 April 2002);
ix. selection of structured sample of operators of Paragraph 9&19 registered exempt sites, and mailing of survey forms (on 22 April 2002);
x. presentation of emerging results to Steering Group members (on 15 May 2002);
xi. mailing of final chase-up letters to non-respondents from the structured samples of (1) operators of crushers and screens and (2) licensed landfills, accompanied by simplified survey forms (on 22 May 2002);
xii. cut-off for receipt of survey returns to allow for analysis of findings (on 1 July 2002);
xiii. presentation of main results to Steering Group members (on 17 July 2002);
xiv. submission of draft Final Report to ODPM and Steering Group members (on 31 July 2002);
xv. submission of Final Report to ODPM (on 4 September 2002).

Key Concepts and Terminology

2.12 The key terms and concepts used in this report are consistent with (though not identical to) those that were used in EA R&D TR P402. All of them are defined and/or fully explained in Annex 3 to this report. The more important usages are as follows:

i. '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;
ii. 'hard C&D waste' means either segregated or mixed unprocessed/uncrushed materials (particularly concrete, masonry, bricks, tiles, 'blacktop' etc: see Figure 2.1A);
iii. '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 (see Figure 2.1B);
iv. 'mixed hard C&D and excavation waste' (mixed CDEW) means a physical mixture of categories (ii) and (iii) above (see Figure 2.1C);
v. '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;
vi. '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;
vii. '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) Introduction and Background to the Study and where this exemption has been placed on the public register by the Environment Agency. This project is concerned in particular with sites exempted under the terms of Paragraphs 9 and/or 19 of Schedule 3 to the Waste Management Licensing Regulations 1994 (SI No 1994/1056);
viii. 'Paragraph 9 sites' are registered exempt sites where exemption holders are pemitted to spread up to 20,000 m3/ha of soil, rock, ash, sludge, dredgings or C&D waste for land reclamation purposes or agricultural improvement;
ix. 'Paragraph 19 sites' are registered exempt sites where exemption holders are permitted to store or use C&D waste, excavation waste, ash, clinker, rock, wood or gypsum in connection with recreational or infrastructure projects, excluding land reclamation;
x. '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.

Figure 2.1: Different categories of C&D waste illustrated

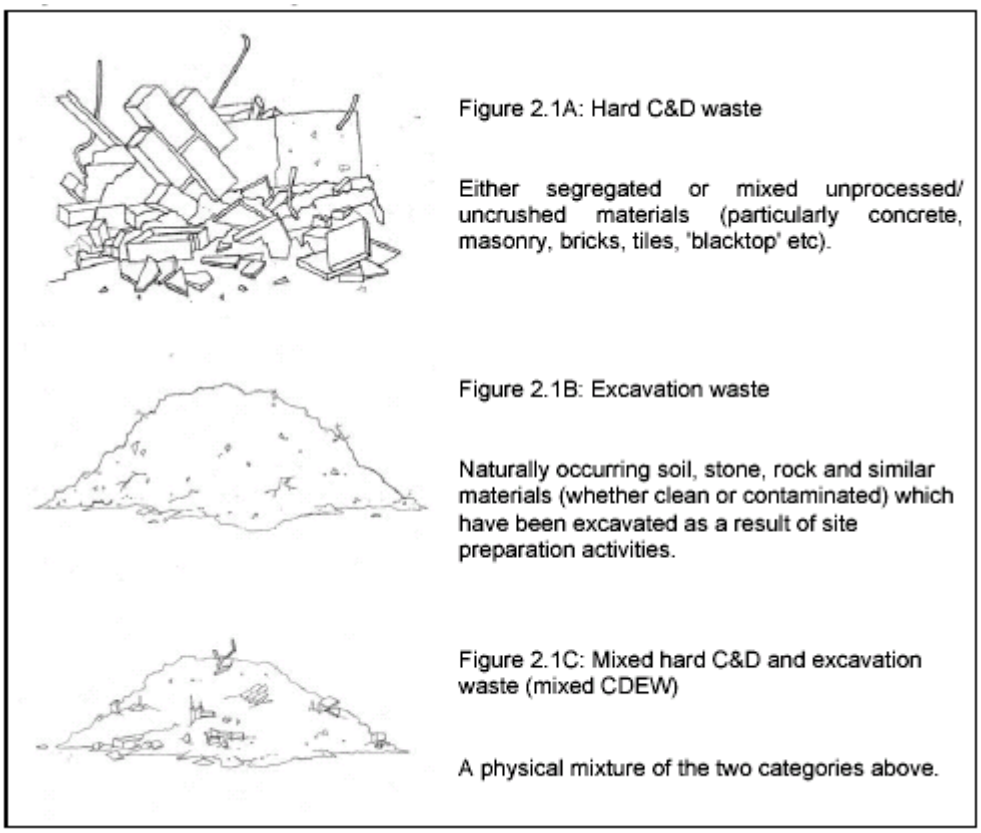

Figure 2.1A: Hard C&D waste

Either segregated or mixed unprocessed/ uncrushed materials (particularly concrete, masonry, bricks, tiles, 'blacktop' etc).

Figure 2.1B: Excavation waste

Naturally occurring soil, stone, rock and similar materials (whether clean or contaminated) which have been excavated as a result of site preparation activities.

Figure 2.1C: Mixed hard C&D and excavation waste (mixed CDEW)

A physical mixture of the two categories above.

2.13 As was noted in EA R&D TR P402, there is scope for, and evidence of, confusion being caused to (and by) landfill managers due to the use of the term 'exempt'. In this report, and as set out above, it refers to sites registered by the Environment Agency as exempt from waste management licensing, whereas it is increasingly being used by landfill operators in relation to areas within sites, and materials which have been agreed with HM Customs & Excise to be exempt from landfill tax.

2.14 A key assumption used for this project (which is only concerned with those materials which are managed as waste) is that, for both hard C&D and excavation waste, all arisings are recycled (by crushing or screening), or used at landfills, or spread on registered exempt sites, or disposed of to landfill.

2.15 The linkages between hard C&D and excavation waste arisings and their uses or destinations are illustrated in Figure 2.2. This Figure differs in some aspects from the equivalent Figure in EA R&D TR P402. Some of the changes reflect minor differences in the survey forms compared to those used in 2000, while others reflect a better understanding of the various processes and site types. The use, mainly of clean excavation waste, to backfill former quarry workings is more explicitly recognised.

Figure 2.2: The specific component parts of hard C&D and excavation waste when recycled, re-used or disposed of at licensed landfills

Arisings	*Uses/destinations*		*Specific component parts*	*See Note*
Production of hard C&D and excavation waste	Recycled	Used as aggregate	Hard C&D / excavation waste crushed and/or screened for use as aggregate	● ⊛ ◆
		Used as soil	Excavation waste / mixed CDEW screened for use as soil	⊛ ◆
	Re-used	Used for engineering or restoration at licensed landfills (using clean and/or contaminated materials)	Hard C&D waste	●
			Excavation waste	⊛
			Mixed CDEW (or unspecified material)	◆
		Used to backfill quarry voids (using mainly clean materials)	Hard C&D waste	●
			Excavation waste	⊛
			Mixed CDEW (or unspecified material)	◆
		Spread on Para 9&19 registered exempt sites	Hard C&D waste (excluding road planings)	●
			Clean, unmixed excavation waste	⊛
			Mixed CDEW	◆
	Disposed of at licensed landfills		Clean, unmixed hard C&D waste	●
			Mixed and/or contaminated hard C&D waste	●
			Clean excavation waste	⊛
			Mixed and/or contaminated excavation waste	⊛
			Mixed CDEW and unspecified materials	◆

Note: Based on arisings as follows: ● = Hard C&D waste ⊛ = Excavation waste ◆ = Mixed CDEW

2.16 This project therefore sought to measure arisings/production by surveying the three component parts (crushers and screens, licensed landfills and Paragraph 9 & 19 registered exempt sites), both for hard C&D waste and for excavation waste. By its nature it will have identified some materials which are beneficially re-used on the (exempt) sites where they first arose. It will not, however, have identified those clean materials which are simply (and legitimately) moved around on construction sites for which no exemption has been registered, and which are not, therefore, being managed as waste.

2.17 The survey of crushers and screens was designed to record all recycled aggregate, since materials are only crushed if they are going to be recycled, and can generally only become recycled aggregate if they are crushed or screened. The other two surveys (of landfills and registered exempt sites) were designed to record the remaining materials. The survey of landfills was designed to distinguish between materials used for landfill engineering or restoration, materials used to backfill quarries, and any other materials disposed of as waste.

2.18 Although the surveys conducted for this study did not deal directly with demolition or nonexempt construction sites, most C&D waste generated at such sites would have been recorded via mobile crushers and fixed recycling sites, or at the point of final use or disposal. This is less true for excavation waste.

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Chapter 3: Preparing the Survey Lists and Forms

Objectives

3.1 This Chapter reports on how we dealt with two separate key issues which had been identified when our proposal for this study was first put together:

> i. assembling the necessary details on good and reliable survey populations; and then
> ii. carrying out the surveys in such a way that the data obtained were equally good and reliable, and capable of yielding estimates to achieve the desired degree of precision and confidence.

3.2 How we dealt with the first issue is described below under three separate headings, each one starting with the words 'Preparing the Mailing List of ...'.

3.3 Having assembled and structured the necessary databases of potential respondents, the second key challenge was to create suitable sets of questions to be sent to them. The questions all had to be ones to which answers could reasonably be expected.

3.4 This is dealt with below under three separate headings, each one starting with the words 'Preparing the Survey Forms for Operators of ...'.

Preparing the Mailing List of Operators of Crushers and Screens

3.5 As one of the very first tasks, the database listing all those crusher operators to whom forms were sent by Symonds for the Environment Agency survey in 2000 was amended to show which of them had responded (and which of those had provided nil returns), and to identify those understood to have moved away from the addresses shown. Further fields were added to record the Local Authority responsible for the mobile crushers' authorisation (where this was known) and the number of crushers and screens believed to be owned by each operator.

3.6 The database was then broken into regional print-outs, and a copy of the relevant print-out was sent to each Local Authority in England and Wales on 22 November 2001 with a covering letter asking them to review the information, and either to confirm or amend it by Christmas. One additional Local Authority (the Council of the Isles of Scilly) was surveyed this time that had not been contacted in 1999.

3.7 Three slightly different covering letters were sent to Local Authorities: one to those that had reported mobile crushers in 1999, a second to those that had actively reported that there were no mobile crushers in their areas, and a third to those that had not responded at all. Each letter was addressed to a named contact, asking for the following information for each authorised operator of mobile crushers and/or screens:

> i. the name of a contact person;
> ii. the name of the company/operator;

iii. the postal address and telephone number of the company/operator;
iv. guidance as to whether or not C&D waste was processed by the operator during 2001;
v. the total number of crushers operated;
vi. the total number of screens operated (if known).

3.8 Many of the Local Authorities reported no change since 1999, though a significant number of new authorisations were added, and some revocations were noted. A chaser letter to nonrespondents was sent on 7 January, and the eventual response rate by the end of February (when the survey forms were sent to operators) was 83.5%. Only one Local Authority actively declined to provide information (due to "restrictions of Data Protection"). The results of the survey of Local Authorities are given in Table 3.1.

Table 3.1: Response to Local Authority consultation about authorised mobile crushers, by region

Region	Number of Local Authorities	Local Authorities reporting authorised crushers	Local Authorities reporting no authorised crushers	No reply received (of which no reply in 1999 either)	% non-response rate in 2002 (no response in 1999 either)
North West	43	31	6	6 (0)	14.0 (0.0)
North East	23	12	5	6 (1)	26.1 (4.3)
Yorkshire & the Humber	21	17	1	3 (3)	14.3 (14.3)
West Midlands	34	21	7	6 (0)	17.6 (0.0)
East Midlands	40	22	12	6 (2)	15.0 (5.0)
East of England	48	27	13	8 (0)	16.7 (0.0)
London	33	14	10	9 (1)	27.3 (3.0)
South East	67	38	21	8 (0)	11.9 (0.0)
South West	45	25	15	5 (2)	11.1 (4.4)
England	354	207	90	57 (9)	16.1 (2.5)
North Wales	6	3	1	2 (0)	33.3 (0.0)
South Wales	16	7	6	3 (2)	18.8 (12.5)
Wales	22	10	7	5 (2)	22.7 (9.1)
England & Wales	376	217	97	62 (11)	16.5 (2.9)

3.9 Just 11 Local Authorities fell into a sub-group of those which failed (or declined) to respond in 2001/2002, having not responded in 1999 either. However, a number of operators from those 11 Local Authorities' areas were included on the database, the information identifying them having come from other sources.

3.10 Given the good general match between the crusher operators reported in 2001/2002 and those reported in 1999/2000, it appears unlikely that the total number of omissions due to some Local Authorities not responding to the survey was significant (being estimated at less than 5% of the total number of crushers identified).

3.11 In addition to seeking information from Local Authorities, use was made of national data from the Environment Agency on both licensed transfer stations (from the REGIS database), and registered exempt sites (including current Paragraph 13&24 exempt sites, because some of these process C&D waste and/or soil).

3.12 The REGIS list of transfer stations contains almost 3,000 entries, many of which have nothing to do with C&D waste. By means of a judicious mix of manual and electronic searches, companies/sites common to both REGIS and the emerging database of operators of crushers and screens assembled from Local Authority returns were coded in the database to record this information. Although the matches were not always perfect (in that, for example, the addresses might not match completely), using established knowledge of the companies concerned, 180 companies/sites were identified and coded in this way.

3.13 A single consolidated dataset containing one name and address for each company with an exemption under paragraphs 13 and/or 24 was prepared. There were slightly under 600 entries on this list. As with the list of transfer stations, using a judicious mix of manual and electronic searches, companies/sites common to both the Paragraph 13 & 24 dataset and the emerging database of operators of crushers and screens were coded to record this information within the database of operators of crushers and screens. One hundred and thirty four companies/sites were identified and coded in this way (of which 47 were also licensed transfer stations). Although many of the other sites appeared to be locations where mobile crushers have been working, the operators of the mobile crushers concerned should already be on the database from the survey of Local Authorities.

3.14 These files were then sent back to the Environment Agency to give their local offices a final opportunity to comment. This process did not result in any further changes being made.

3.15 It was agreed with the DTLR that nothing further would be done with those names and addresses from the lists of transfer stations and Paragraph 13 & 24 exemptions which were not on the main database of operators of crushers and screens. Apart from including locations where known operators work from time to time, both lists include operators and operations unrelated to C&D and/or excavation waste.

3.16 A similar process was carried out using the National Federation of Demolition Contractors (NFDC) website and members list. Seventy two NFDC members on the database were identified and coded appropriately.

3.17 Based on the processes described above, the database was significantly enhanced from the version generated in 1999/2000. This allowed each entry finally to be allocated to one of the following four categories:

i. Group 1: definitely or almost certainly involved in recycling C&D waste, with a distinction made between those involved in crushing, and those involved in screening (of soil and/or rubble), but not in crushing;
ii. Group 2: probably involved in recycling C&D waste;
iii. Group 3: probably not involved in recycling C&D waste;
iv. Group 4: involved in crushing or screening, but not (or almost certainly not) C&D waste.

3.18 Put another way, our expectation was that 90% of the operators in Group 1 would have crushed and/or screened some hard C&D or excavation waste during 2001, compared to 60% in Group 2 and 30% in Group 3. The remaining 10% of Group 1 operators were expected to be largely accounted for by owners of machines that had been sold, or that had been used solely for non-C&D materials, or that were not in operation by the end of 2001 or that were otherwise inactive. All of these would have been placed into Group 1 on the basis of faulty intelligence. The 'nil returns' rates for Groups 2 and 3 were therefore expected to be 40% and 70% respectively. Consequently, the overall mean and standard deviations of the tonnages processed by operators from Groups 2 and 3 were expected to be smaller than the equivalent figures for Group 1 operators.

3.19 For each entry, the database recorded the expected number of crushers (and in several cases the expected number of stand-alone screens).

3.20 Final checks were made with a small number of major national operators to confirm that the information held about them was correct. This was because some companies organize all of their Local Authority licences centrally, even though the machines concerned are distributed around the country. It was felt to be worth checking the geographical distribution in advance of the survey to make the eventual grossing up process more accurate.

3.21 The survey forms were mailed on or around 1 March, with responses requested four weeks later (by Easter weekend). After the original mailing had been sent out, two operators contacted us to request forms, which were then sent. Taking these two operators into account, the final structure of the mailing list was as set out in Table 3.2.

Table 3.2: Structure of final mailing list of operators of crushers and screens, by region

Region	Number of operators	Crushers of Group 1 operators	Crushers of Group 2 operators	Crushers of Group 3 operators	Total crushers
North West	82	59	10	19	88
North East	30	50	6	11	67
Yorkshire & the Humber	70	63	5	9	77
West Midlands	65	54	15	12	81
East Midlands	56	61	2	19	82
East of England	96	86	8	8	102
London	51	53	3	16	72
South East	98	82	12	8	102
South West	59	49	6	11	66
England	607	557	67	113	737
North Wales	7	8	1	1	10
South Wales	20	12	0	10	22
Wales	27	20	1	11	32
England & Wales	634	577	68	124	769

3.22 When one of the Group 1 operators with a West Midlands address - who was believed to own and operate one crusher - responded to the survey, it emerged that the company

concerned had actually moved to the East Midlands. The operator and crusher are recorded above as being in the West Midlands, where the final mailing list showed them to be.

Preparing the Survey Form for Operators of Crushers and Screens

3.23 A first draft of the survey form was drawn up prior to the first Steering Group meeting. This draft was based on an adapted version of the 1999/2000 form, but incorporating all of the recommendations made in EA R&D TR P402 relating to subsequent surveys. A single form was therefore designed to cover all of an operator's crushing and screening activity.

3.24 Following the discussion at the first Steering Group meeting, and written comments submitted over the following two weeks, the content of the form was finalised by early January 2002. A copy of the form sent out to all operators as an A3-folded sheet is included in Annex 4, together with the covering letter. The same form was also made available in a format which could be sent out and returned by Email.

Preparing the Mailing List of Operators of Licensed Landfills

3.25 The basis for the landfill mailing list was the HM Customs & Excise (HMC&E) list of landfills subject to landfill tax, which is downloadable from their website (www.hmce.gov.uk). This list was supplemented with codes (for the size of facility and type of waste) taken from the Environment Agency's REGIS database, which was updated and re-issued in December 2001.

3.26 Landfills are currently classified by the Environment Agency under the following types:

i. A01 co-disposal sites;
ii. A02 other special waste sites;
iii. A03 boreholes;
iv. A04 household, commercial and industrial waste sites;
v. A05 non-biodegradable waste sites (not construction);
vi. A06 other waste sites (including construction, demolition and dredgings);
vii. A07 industrial waste sites;
viii. A08 lagoons; and
ix. other undefined landfills (of which there are relatively few)

3.27 All of these, with the exception of boreholes, might accept C&D and/or excavation waste. Lagoons, for example, can use C&D and/or excavation waste for the construction of bunds, site roads or drainage, or for capping at closure.

3.28 Landfills are also classified by the Environment Agency as large (ie receiving more than 75,000 tonnes/year), medium (25-75,000 tonnes/year) or small (less than 25,000 tonnes/year).

3.29 There were originally 1,228 landfills on the HMC&E database, of which a small number appeared to be duplicates of other entries, or closed, and were therefore discounted. By reference to the websites of major operators and the on-line database of the Environmental Services Association, a small number of other apparently significant landfills were identified.

3.30 As a consequence of this process a revised list of 1,250 landfills was assembled, and

coded for size and waste type (using the codes from REGIS). Some codes could not be identified, and the Environment Agency gave further help in cross-referencing the remaining landfills to their REGIS entries where possible.

3.31 With the rapid pace of consolidation within the waste management industry, it was decided to send letters to 15 major landfill operators with over 400 sites between them (of which around 300 were understood to be large) asking them to check details of the entries attributed to them prior to sending out the survey forms. This was done under cover of a letter dated 18 January 2002. The resultant feedback from those operators who responded led to some further amendments to the database. After the survey forms had been sent out, one operator who had not received a form telephoned to request one, which has also been included in the figures given.

3.32 The final mailing list comprised 1,165 landfills, which we then divided into five groups of comparable type/size combinations, as set out in Figure 3.1. We did this to reduce the number of categories to a more manageable number. These groups were assembled using those criteria which, in 1999/2000, had proved to be good indicators of the amount of hard C&D and/or excavation waste likely to be accepted (with landfill Groups A and C2 the most significant destinations). The regional breakdown of each group is then given in Table 3.3.

Figure 3.1: Structure of final mailing list of landfills, by type and size

<table>
<tr><th></th><th>Large</th><th>Medium, Small or Unknown</th></tr>
<tr><td>Type A06 (or possibly A06)</td><td>Group A (83 sites)</td><td>Group B (130 sites)</td></tr>
<tr><td>Type A03, A07 or A08</td><td>Group C1 (45 sites)</td><td rowspan="2">Group D1 (423 sites)</td></tr>
<tr><td>Type A01, A02, A04 or A05</td><td rowspan="2">Group C2[1] (432 sites)</td></tr>
<tr><td>Type not known</td><td>Group D2 (52 sites)</td></tr>
</table>

Note [1] Only one landfill was known to be large, but of an unknown type.

Table 3.3: Structure of final mailing list of landfills, by region

Region	Group A	Group B	Group C1	Group C2	Group D1	Group D2	Total
North West	3	15	5	49	58	5	135
North East	4	8	2	35	15	1	65
Yorkshire & the Humber	9	12	9	46	84	10	170
West Midlands	5	6	5	52	30	3	101
East Midlands	8	4	9	53	45	1	120
East of England	7	15	4	53	50	5	134
London	5	0	0	2	0	0	7
South East	19	16	4	75	35	12	161
South West	12	41	3	38	59	8	161
England	72	117	41	403	376	45	1,054
North Wales	5	1	0	9	9	1	25
South Wales	6	12	4	20	38	6	86
Wales	11	13	4	29	47	7	111
England & Wales	83	130	45	432	423	52	1,165

Preparing the Survey Form for Operators of Licensed Landfills

3.33 A first draft of the survey form was drawn up prior to the first Steering Group meeting. This draft was based on an adapted version of the 1999/2000 form, but incorporating all of the recommendations made in EA R&D TR P402 relating to subsequent surveys. As in 1999/2000, it was decided to use one survey form per landfill.

3.34 Following the discussion at the first Steering Group meeting, and written comments submitted over the following two weeks, the content of the form was finalised by early January 2002. A copy of the form sent out to all operators as an A3-folded sheet is included in Annex 4, together with the covering letter. The same form was also made available in a format which could be sent out and returned by Email.

Preparing the Mailing List of Operators of Paragraph 9&19 Registered Exempt Sites

3.35 Our intended method was to identify all Paragraph 9 & 19 registered exempt sites, and with the help of the local Environment Agency offices with whom the exemptions had been registered, to distinguish between the relatively small number of sites thought to be large (ie those thought to have accepted more than 10,000 tonnes of material in 2001) and those thought not to be large. We had proposed to survey all of the first group, plus a sample selected from the second (much larger) group.

3.36 However, feedback on the identity of large sites (both from local Environment Agency offices, and from local planners approached by the DTLR through the Planning Officers Society) was too patchy for this approach to be as reliable as we had hoped. We had good quality feed-back from some areas, but not from the majority.

3.37 As a further complication, some of the feedback on sites thought to be large identified sites which were not already on the database of sites which had been provided to us by the

Environment Agency in December 2001, so we had a slightly extended site list with a total of 1,795 entries.

3.38 As a consequence, our intended method could not be used, and a revised approach was required.

3.39 Our first step was to look more carefully at the data which we had. As reported above, we had a database with 1,795 entries (one entry per site), which we were then able to divide between three non-overlapping categories, as follows:

i. 33 where we had positive reason (from feedback from local Environment Agency offices, local planners or operators themselves) to believe that the sites were large (and might well have received over 10,000 tonnes each in 2001);
ii. 400 where the sites might well be large, but were more probably medium (ie receiving between 100 and 10,000 tonnes each in 2001);
iii. 1,362 where the sites were thought most likely to be small (and in most cases to have received less than 100 tonnes each in 2001).

3.40 The second group (of 400 sites) was made up of Paragraph 19 sites where the exemption holder could be identified as falling into one of the following categories:

i. operators of golf courses and other leisure facilities;
ii. contractors (demolition, haulage, waste management, construction etc);
iii. developers and house builders;
iv. consultants (presumably acting as agents for the owners or contractors concerned);
v. quarry and/or landfill operators;
vi. operators of ports, airports and canals.

3.41 The third group (of 1,362 sites) was made up of other Paragraph 19 sites (primarily farms and individual householders) and all Paragraph 9 sites (most of which, based on the limited evidence from the 1999/2000 survey, do not take over 10,000 tonnes of most materials).

3.42 These three groups of sites were distributed between the regions as shown in Table 3.4.

Table 3.4: Structure of final list of registered exempt sites, by region

Region	Sites thought to be large	Sites that might be large	Sites thought to be small	Total
North West	15	76	135	226
North East	0	22	80	102
Yorkshire & the Humber	3	31	107	141
West Midlands	1	36	89	126
East Midlands	7	40	125	172
East of England	1	16	32	49
London	0	10	13	23
South East	4	47	167	218
South West	1	101	510	612
England	32	379	1,258	1,669
North Wales	0	7	24	31
South Wales	1	14	80	95
Wales	1	21	104	126
England & Wales	33	400	1,362	1,795

3.43 There are considerable differences in both the absolute numbers of sites in different regions, and in the balance between the three groups. This can be observed by comparing, for example, the North West (which has 45% of the sites thought to be large), the East of England (which has just 4% of the sites that might be large and 2.3% of the sites thought to be small) and the South West (which has 34% of all sites). Comparable regional imbalances had been observed in 1999/2000.

3.44 This revised approach was put to the Steering Group in March 2002 via one of the monthly Progress Reports with an invitation to comment. No objections to the revised approach were received, and it was therefore agreed with the DTLR in April 2002 that this was the approach to be taken, with survey forms to be sent out in late April for return by the end of May 2002.

3.45 The main consequence of the change in approach was an unavoidable loss of precision, because instead of working from a reasonably reliable 'closed' database (in which all sites have an entry, and enough is known about each site to say whether it is large or not) we had an 'open' database which included many sites, but may well not have included all of them, and in which very little was known about the relative size of the many different sites.

Preparing the Survey Form for Operators of Paragraph 9&19 Registered Exempt Sites

3.46 A first draft of the survey form had been drawn up prior to the first Steering Group meeting. This draft was based on an adapted version of the 1999/2000 form, but incorporating all of the recommendations made in EA R&D TR P402 relating to subsequent surveys. As in 1999/2000, it was decided to use one survey form per operator of registered exempt sites.

3.47 Following the discussion at the first Steering Group meeting, and written comments submitted over the following two weeks, the content of the form was substantially finalised by early January 2002. By this point, however, it was clear that we would need to adapt our

approach (as described above).

3.48 As agreed with the DTLR (see above), a 'merge' letter was created to allow us to write individually with a survey form to each of the 26 operators responsible for the 33 sites in the first group to ensure that it was clear which site(s) we were asking about, where a site name was indeed known. It soon became evident that the same approach (of an individualised letter) could without undue difficulty be employed for the other two groups as well. One effect of this was to place more information in the covering letter and less on the form, which was thereby cut down from a double-sided A3 folded form to a double-sided A4 form.

3.49 A copy of the form sent out to all operators is included in Annex 4, together with the covering letter.

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Chapter 4: The Approach to Statistical Method

Whole Population vs Sampling: The Original Proposal

4.1 Symonds' original proposal for the 2001 survey was to carry out some full population surveys and some stratified samples. The intention was to carry out full population surveys of:

i. all operators of crushers and screens;
ii. all operators of large landfills; and
iii. all operators of Paragraph 9&19 registered exempt sites thought to be large (ie those accepting more than 10,000 tonnes per year).

4.2 Stratified sampling was proposed for:

i. operators of medium and small landfills; and
ii. operators of Paragraph 9 & 19 registered exempt sites thought to be medium or small (ie those accepting less than 10,000 tonnes per year).

4.3 This proposal was based on the results reported in EA R&D TR P402, with a view to devoting the maximum attention to those sites likely to account for the large majority of C&D and excavation waste.

4.4 In the 1999/2000 survey, response rates to full population surveys were around 30-40%, such that follow-up sample surveys were required in order to test the hypothesis that those who had not responded were sufficiently similar to those who had to allow the survey results to be used in 'grossing up'. After these follow-up surveys had been completed, the conclusion was that the two groups were sufficiently similar, but the confidence limits achieved were wider than would have been liked, and could not be applied to the regional estimates.

4.5 When this was discussed with the DTLR and at the first Steering Group meeting in December 2001, there was a feeling that operators, particularly of landfills, would prefer to be treated the same, irrespective of the size of their landfills. It was suggested that an operator with one large, one medium and one small landfill might find it confusing if he received forms for the large landfill and one of the others (because it was part of a stratified sample), but not the third.

Whole Population vs Sampling: The Actual Approach Used

4.6 In response to the soundings described above, the following approach was agreed. All operators of both crushers and landfills would be sent survey forms, but within each population (or sub-population, such as large landfills specialising in C&D waste) some of the forms would have been selected as a regionally representative sample to be followed up if they did not respond. In this way, each recipient of a survey form would eventually fall into one of four sub-sets:

i. Sub-set A: members of the sample group who had responded;
ii. Sub-set B: members of the sample group who had not responded;
iii. Sub-set C: members of the non-sample group who had responded; and
iv. Sub-set D: members of the non-sample group who had not responded.

4.7 One of the main advantages of this approach was that it encouraged every effort to be made to improve the survey databases right up to the point of mailing out the forms, without having to re-calculate and re-allocate the sampling frame with every change in the overall population.

4.8 More than this, in the case of the landfill survey, it allowed the early returns to be used to refine the balance within the final sample selection by, for example, providing preliminary estimates of the means and standard deviations for each sub-population. This flexibility was actually exploited in practice.

4.9 Once the samples had been selected, all follow-up effort could then be devoted to shifting as many operators as possible out of Sub-set B and into Sub-set A, while using the results from Sub-set C to check the proposition that those operators outside the sample groups were similar in all important respects to those within it.

Dealing with Regional Differences

4.10 The Study Brief required regional estimates for all key measures to be made for nine English and two Welsh regions. The first choice to be made was between selecting samples in proportion to the number of crushers, landfills etc in each region, or taking equal sized samples from each region.

4.11 A detailed discussion on this topic using the specific case of crushers can be found in Annex 5. The principles illustrated there apply equally to other populations, such as landfills. It can be drawn from that discussion that although the approach of taking an equal number of samples from each region has the effect of worsening the precision of the overall national estimate, this effect is surprisingly slight. It was agreed with the DTLR and the Steering Group that the presentational advantages of taking equal numbers of samples from each region outweighed any loss of overall precision.

4.12 The second choice concerned the poorer precision achievable for regions as compared with the national totals. This is because the regional samples (of crushers, landfills etc) are inevitably much smaller than the national samples to which they contribute, making it certain that the returns received will generate estimates with either:

i. wider bands at the same level of confidence as the national estimates; or
ii. lower confidence in similar bands; or
iii. a combination of the above.

4.13 Put simply, if the national estimate for a particular measure is 1,000 tonnes ±10% at a confidence level of 90%, the regional estimates (based on perhaps one tenth the number of returns) are likely to be either 1,000 tonnes ±30% at the same confidence level of 90%, or

1,000 tonnes ±10% (the same band width) at a reduced confidence level of 40%, or 1,000 tonnes ±20% at a confidence level of 70%. While the figures used in this illustration are purely notional, they illuminate the dilemma that is faced.

4.14 Based on the approach described in Annex 5, the sample sizes as set out in Tables 4.1 and 4.2 were selected, and samples selected at random.

Operators of Crushers and Screens: The Samples Selected

4.15 In the case of operators of crushers and screens, the objective was to generate estimates of the average (mean) throughput of C&D waste per crusher, and the production of recycled aggregate, which could then be projected onto the regional populations of crushers which had already been estimated (see Chapter 3). Approximately 100 samples were to be selected, based on:

i. an equal number of samples per region; and
ii. the same balance within each region between crushers operated by operators who fell into Groups 1, 2 and 3 (as defined in paragraph 3.17).

4.16 Given that several operators have multiple crushers, the sampling frame was the expected population of crushers within each region, not just the operators. In this way operators with, say, three crushers were three times as likely to be selected at random as those with just one.

Table 4.1: Sample sizes for operators of crushers and screens, by region

	Group 1		Group 2		Group 3	
Region	Popul'n	Samples	Popul'n	Samples	Popul'n	Samples
North West	59	7	10	1	19	1
North East	50	7	6	1	11	1
Yorkshire & the Humber	63	7	5	1	9	1
West Midlands	54	7	15	1	12	1
East Midlands	61	7	2	1	19	1
East of England	86	7	8	1	8	1
London	53	7	3	1	16	1
South East	82	7	12	1	8	1
South West	49	7	6	1	11	1
England	557	63	67	9	113	9
North Wales	8	7	1	1	1	1
South Wales	12	7	0	0	10	1
Wales	20	14	1	1	11	2
England & Wales	577	77	68	10	124	11

4.17 The total number of samples of crushers selected was therefore 98. As a consequence of some multiple crusher operators being selected more than once, the number of operators

responsible for these crushers was 90.

4.18 By Easter (the deadline originally set for survey forms to be returned), 11 of these operators had responded, so follow-up letters were sent out on 3 April to the other 79. Further information on follow-up procedures and their effectiveness is given at the end of this Chapter.

Operators of Licensed Landfills: The Samples Selected

4.19 The original intention as far as landfills were concerned had been to concentrate efforts and resources on large landfills, and particularly on large landfills which specialise in C&D and excavation waste (ie Groups A, C1 and C2 as described above in paragraph 3.32 and Figure 3.1).

4.20 As the initial results were received, it was possible to obtain preliminary estimates of the amount of hard C&D and excavation waste being accepted by the various groups of landfills, and the standard deviations of those data sets. The purpose of the subsequent sampling was to improve the precision of those estimates, and the objective in allocating the samples between the various groups was to improve the overall precision of the total estimate. This could only be achieved by concentrating efforts and resources on those groups with a combination of a large average value (mean) and a more varied population (standard deviation).

4.21 The initial results showed a very large difference between Groups A and C2 on the one hand, and the other groups on the other. Once 130 returns had been analysed, it was clear that the ten largest landfills (four from Group A and six from Group C2) accounted for over two thirds of the total tonnage of hard C&D and/or excavation waste entering landfills, and that the mean tonnages of hard C&D and/or excavation waste entering these two groups of landfills were just over 50,000 tonnes and almost 24,000 tonnes respectively. By comparison, the mean tonnages for the other groups were approximately 1,000 tonnes (Group B), 50 tonnes (Group C2), 1,600 tonnes (Group D1) and 1,400 tonnes (Group D2).

4.22 On the basis of the approach described in Annex 5, it was decided to allocate two samples in each region to Group A landfills, six to Group C2 and one to Group D1 as the best way to achieve overall precision in the total estimate. These were allocated as set out in Table 4.2.

Table 4.2: Sample sizes for landfills, by region

	Group A		Group C2		Group D1	
Region	Popul'n	Samples	Popul'n	Samples	Popul'n	Samples
North West	3	2	49	6	58	1
North East	4	2	35	6	15	1
Yorkshire & the Humber	9	2	46	6	84	1
West Midlands	5	2	52	6	30	1
East Midlands	8	2	53	6	45	1
East of England	7	2	53	6	50	1
London	5	2	2	2	0	0
South East	19	3	75	6	35	1
South West	12	3	38	6	59	1
England	72	20	403	50	376	8
North Wales	5	2	9	6	9	1
South Wales	6	2	20	6	38	1
Wales	11	4	29	12	47	2
England & Wales	83	24	432	62	423	10

4.23 The total number of samples was therefore 96, of which 12 had already responded before the follow-up letters were sent out on 15 April. Further information on follow-up procedures and their effectiveness are given at the end of this Chapter.

Operators of Paragraph 9&19 Registered Exempt Sites: The Samples Selected

4.24 Due to the uncertainties surrounding the overall completeness and accuracy of the list of operators of registered exempt sites, and the fact that (with the exception of some of those sites thought to be large) the sites themselves were generally not identified by name, it was not feasible to take an approach to sampling comparable to those described above (for crushers and landfills).

4.25 Survey forms were sent to all identifiable operators of sites thought to be large and sites that might be large, and to the operators of 10 sites thought to be small in each Regional Aggregate Working Party region. The 10 small sites per region were selected at random, and after duplicates (ie single operators with multiple sites) had been eliminated, 26 letters and forms were sent to operators of the 33 sites thought to be large, 312 to operators of the 400 sites that might be large, and 100 to operators of 110 sites thought to be small.

Boosting the Survey Response Rates

4.26 By mid-May, the response rates from the various sample groups were disappointing, and at the second meeting of the project Steering Group it was agreed that further chase-up letters should be sent to non-respondents from the structured samples of operators of crushers and screens and licensed landfills. It was also agreed that simplified survey forms concentrating solely on the most important data should be sent with these letters.

4.27 It was agreed that prompting non-respondents by telephone would be very labour intensive, without necessarily being particularly successful (based on experience in

1999/2000). It was also acknowledged that the Research Specification (see Annex 1) called for a methodology which would be reproducible in future years without undue effort.

4.28 The closing date for responses from operators of Paragraph 9 & 19 registered exempt sites had not been reached by that point, and with responses still arriving daily, it was agreed that any follow-up action aimed at operators of such sites would be inappropriate at that time.

4.29 Chase-up letters were drafted and sent (on 22 May) to operators of crushers and screens and of licensed landfills, stressing the importance of the survey in the context of the revision of MPG6, and urging recipients to respond by the end of June at the very latest. These letters and the simplified one-page forms are included in Annex 6.

4.30 By 1 July, the response rates from the key sample groups to whom final chase-up letters and simplified survey forms had been sent had risen noticeably, as reported in Table 4.3.

Table 4.3: Effect of final chase-up letters and forms

Sample group	Sample size	Response rate mid-May	Response rate 1 July
Group 1 operators of crushers and screens	77	19.5%	32.5%
Group 2 operators of crushers and screens	10	30.0%	40.0%
Group 3 operators of crushers and screens	11	9.1%	18.2%
Operators of Group A landfills	24	25.0%	33.3%
Operators of Group C2 landfills	62	29.0%	46.8%
Operators of Group D1 landfills	10	50.0%	50.0%

4.31 Taken together, there were 194 samples in the six categories listed in Table 4.3, of which 73 (37.6%) responded by 1 July. For the purposes of comparison, the response rates for nonsample groups (none of whom received any chase-up letters) were as shown in Table 4.4.

Table 4.4: Response rates for non-sample groups

Non-sample group	Number	Response rate 1 July
Group 1 operators of crushers and screens	386	18.7%
Group 2 operators of crushers and screens	63	17.5%
Group 3 operators of crushers and screens	87	12.6%
Operators of Group A landfills	59	18.6%
Operators of Group C2 landfills	370	13.0%
Operators of Group D1 landfills	413	16.9%

4.32 Just one survey form, (a 'nil return' from an operator of a Group C2 licensed landfill), was received after 1 July. It was agreed at the third meeting of the project Steering Group that this form should be disregarded, on the grounds that the very small gains in precision from its inclusion would be heavily outweighed by the extensive re-calculation of results that would be

required.

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Chapter 5: The Responses to the Surveys and the Results Reported

Introductory Comments

5.1 The objective of carrying out the surveys was to 'populate' each individual line in Figure 2.2 with estimated tonnages. Each estimate, or group of estimates, was to be provided with bands around a central estimate, and confidence limits associated with those bands. For the national estimates (ie those covering England and Wales) the confidence limits were set at 90%. This means that if we estimate that a particular figure is 10 million tonnes ± 20%, there is a nine-in-ten chance that the true figure lies between 8 million and 12 million tonnes.

5.2 From this point in the report on, the numbers that are reported may exhibit small 'rounding errors'. All tables are filled with values taken from external spreadsheets which use data correct to several decimal places. Multiplying a mean value of 56,178.4714285714 by a population of 575 (as is the case in Table 5.3, for example) yields a total that is 271 tonnes higher than is obtained using the rounded whole number of 56,178.

The Response Rate to the Survey of Operators of Crushers and Screens

5.3 As reported in Table 3.2, survey forms were sent to 634 operators of crushers and screens, who between them were thought to have 769 crushers. Two of these forms were returned unopened, one by the Post Office marked as 'undeliverable', and the other by the new occupant of the address used marked 'gone away'. Relevant details of these two intended recipients were as follows:

i. the first was a Group 1 operator from the West Midlands who was thought to have a single crusher;
ii. the second was a Group 1 operator from the East of England who was thought to have a single crusher, and who had been selected as a member of the structured sample.

5.4 After removing these, the effective survey database was 632 operators and 767 crushers, including 97 crushers in a structured sample (see Table 4.1 for details), operated by 89 different operators. By 1 July, 124 forms had been received, made up as set out in Table 5.1.

Table 5.1: Forms sent to, and returned by, operators of crushers and screens

	Sample	Non-sample	Total
Survey forms sent out	89	543	632
to Group 1 operators	68	393	461
to Group 2 operators	10	63	73
to Group 3 operators	11	87	98
Crushers covered by survey forms	97	670	767
thought to belong to Group 1 operators	76	499	575
thought to belong to Group 2 operators	10	58	68
thought to belong to Group 3 operators	11	113	124
Survey forms received back	30	94	124
sent by Group 1 operators	24	72	96
sent by Group 2 operators	4	11	15
sent by Group 3 operators	2	11	13
'Nil returns' (i.e. 0 tonnes processed)	4	13	17
from Group 1 operators	0	8	8
from Group 2 operators	2	3	5
from Group 3 operators	2	2	4
Crushers covered by survey returns	30	143	173
number reported by Group 1 operators	24	116	140
number reported by Group 2 operators	4	15	19
number reported by Group 3 operators	2	12	14

5.5 A note of explanation should be added at this point concerning the way that crusher numbers for grossing up purposes were calculated from actual survey returns. The relevant background facts are set out below.

i. As can be seen from the survey forms (see Annexes 4 and 6), all operators were asked how many crushers and screens they owned and how many they hired in order to produce the tonnages that they were reporting.

ii. As reported in Table 5.1, 17 operators reported that they had not crushed any C&D waste during 2001, despite being on our original mailing list. Of these, three had crushed primary materials, but 14 had neither crushed nor screened any relevant materials during the year. We had originally thought that these operators had 17 crushers between them.

iii. Fourteen respondents who reported owning no crushers had nevertheless recycled C&D and/or excavation waste during 2001 using hired crushers and/or their own screens and/or hired screens. We had originally thought that these particular operators had seven crushers between them.

iv. Sixteen other operators reported supplementing their own crushers (of which they had 27) with hired machines (30 in all). These 16 operators also operated 38 of their own screens and 26 hired screens.

v. The numbers of crushers reported in the final section of Table 5.1 were derived using the number of crushers reported as being owned by each respondent. Where the respondent did not own a crusher, one was allocated. Applying this rule to the 17 companies inactive on C&D waste matches our original expectations. Applying it to the 14 recyclers who owned no crusher overestimates the total number of machines by seven (compared to our expected population). Applying it to the 16 who both owned 32 and

hired crushers underestimates the total number of crushers, though we would expect that most of the hired machines would be hired for part of the year only.

5.6 On balance, we concluded that this rule (of using the higher of the number of crushers owned by respondents, or one) had the merit of simplicity without appearing to introduce undue scope for inaccuracy. To remove the need for an approximation of this nature, the survey form would have had to be more complex than it was, which might have depressed the response rate further.

5.7 A second note of explanation concerns the way in which returns from some larger operators were dealt with, including some who had been chosen for the structured sample.

i. As can be seen from the survey forms (see Annexes 4 and 6), operators were asked not just how many crushers and screens they operated, but where.
ii. The returns from operators who reported working across regional boundaries were allocated to the relevant regions. This affected both tonnages and (in some cases) fractions of crushers. Thus, a Kent-based operator who reported producing 160,000 tonnes of recycled aggregate from two crushers, and working half of his time in Kent (South East) and a quarter each in London and Essex (East of England) would have one crusher and 80,000 tonnes of recycled aggregate allocated to the South East, and 0.5 crushers and 40,000 tonnes each allocated to London and the East of England.
iii. Where the means and standard deviations of various populations and sub-populations were calculated, this was done by weighting the relevant tonnages according to the proportion(s) of the crusher(s) concerned.
iv. Operators who had been selected as part of the structured samples, and who reported owning more than one crusher, contributed one crusher (and its production) to the sample group, and the rest to the non-sample group.
v. Where such an operator had been selected for the structured sample, his sample crusher would (as far as possible) be active in his 'home' area. Thus, taking the example given above, the sample crusher would be deemed to be wholly active in Kent, with one other (non-sample) crusher split 50/50 between London and the East of England.

The Results Reported by Operators of Crushers and Screens: National Level

5.8 Once the survey data had been entered into a results spreadsheet, it was clear that the number of responses from Group 2 and 3 operators, and particularly those selected for the structured sample, was small. As can be seen from Table 5.1, their 'nil returns' rates (5 out of 15 for Group 2 operators and 4 out of 13 for Group 3 operators) were very similar to each other, and very different from the equivalent rate for Group 1 operators (8 out of 96). Two statistical tests were therefore carried out:

i. one test to see whether there were any statistically significant differences between the results from the sample groups and their non-sample counterparts; and The Responses to the Surveys and the Results Reported
ii. a second test to see whether the responses from Group 2 and 3 operators could prudently be amalgamated for the purposes of analysis and grossing up.

5.9 Both tests were carried out using the tonnages reported for the output of recycled aggregate and recycled soil, and the total of these two measures (the total for useful recycled materials produced). The relevant calculated means and standard deviations are reported in Table 5.2.

Table 5.2: Responses from sample and non-sample operators compared (tonnes)

	Recycled aggregate	Recycled soil	Useful materials
24 Group 1 sample crushers: mean	77,408	5,328	82,736
24 Group 1 sample crushers: standard deviation	104,570	8,099	105,932
116 Group 1 non-sample crushers: mean	51,786	12,167	63,953
116 Group 1 non-sample crushers: st dev	72,603	26,059	81,568
4 Group 2 sample crushers: mean	62,750	0	62,750
4 Group 2 sample crushers: st dev	124,834	0	124,834
15 Group 2 non-sample crushers: mean	23,369	1,821	25,190
15 Group 2 non-sample crushers: st dev	23,466	2,942	23,351
2 Group 3 sample crushers: mean	0	0	0
2 Group 3 sample crushers: st dev	0	0	0
12 Group 3 non-sample crushers: mean	31,698	8,183	39,881
12 Group 3 non-sample crushers: st dev	44,437	25,191	54,586

5.10 From the first test, the conclusion is that, as far as recycled aggregate production is concerned, pooling the sample and non-sample groups can be justified: there are no statistically significant differences between the comparison pairs. The differences for soil recycling are less surprising, and of slightly less concern. As far as the second test is concerned, pooling Groups 2 and 3 does not raise any particular concerns from a statistical point of view. Further details of both of these statistical tests can be found in Annex 7.

5.11 The pooled means and standard deviations for Group 1 crushers are as follows:

i. a mean production of 56,178 tonnes of recycled aggregate per crusher, with a standard deviation of 79,148 tonnes; and
ii. a mean production of 10,995 tonnes of recycled soil per crusher, with a standard deviation of 24,070 tonnes.

5.12 The pooled means and standard deviations for Group 2&3 crushers are as follows:

i. a mean production of 29,755 tonnes of recycled aggregate per crusher, with a standard deviation of 50,918 tonnes; and
ii. a mean production of 3,803 tonnes of recycled soil per crusher, with a standard deviation of 15,286 tonnes.

5.13 The consequences for the estimated production of recycled aggregate and soil in England and Wales in 2001 are worked through in Table 5.3.

Table 5.3: Estimates for production of recycled aggregate and soil in England and Wales in 2001 (tonnes)

	Group 1	Groups 2&3	Total
Number of crushers in overall population	575	192	767
Number of crushers providing data	140	33	173
Recycled aggregate reported by respondents	7,864,987	981,925	8,846,892
Mean recycled aggregate per crusher	56,178	29,755	n/a
Recycled soil reported by respondents	1,539,270	125,515	1,664,785
Mean recycled soil per crusher	10,995	3,803	n/a
Grossed-up production of recycled aggregate	32,302,621	5,712,902	38,015,523
Bands at 90% confidence level	± 20%	± 50%	± 18%
Grossed-up production of recycled soil	6,322,002	730,269	7,052,271
Bands at 90% confidence level	± 31%	± 118%	± 30%
Total recycled aggregate and soil	38,624,623	6,443,171	45,067,794
Band at 90% confidence level	± 18%	± 48%	± 17%

The Response Rate to the Survey of Operators of Licensed Landfills

5.14 As reported above in Table 3.3, survey forms were sent to 1,165 operators of licensed landfills. Sixteen of these forms were returned unopened by the Post Office marked as 'undeliverable'. Relevant details of these 16 intended recipients were as follows:

i. two were Group A landfills, one in the East of England and one in the South East;
ii. three were Group B landfills, one in Yorkshire & the Humber, one in the East Midlands and one in the East of England;
iii. six were Group C2 landfills, and of these two were in the structured sample (one each in the East Midlands and South East). The other four were in the North West, West Midlands (2) and South Wales;
iv. five were Group D1 landfills, in the North West, West Midlands (2), East Midlands and South West.

5.15 Taking these facts into account, the effective survey database was 1,149 landfills, including 94 in a structured sample (see Table 4.2 for details, bearing in mind that this includes the two 'undeliverable' Group C2 samples). By 1 July, 219 forms had been received, as set out in Table 5.4.

Table 5.4: Forms sent to, and returned by, operators of licensed landfills

	Sample	Non-sample	Total
Survey forms sent out	94	1,055	1,149
to operators of Group A landfills	24	57	81
to operators of Group B landfills	n/a	127	127
to operators of Group C1 landfills	n/a	45	45
to operators of Group C2 landfills	60	366	426
to operators of Group D1 landfills	10	408	418
to operators of Group D2 landfills	n/a	52	52
Forms sent back	41	178	219
covering Group A landfills	8	11	19
covering Group B landfills	n/a	17	17
covering Group C1 landfills	n/a	16	16
covering Group C2 landfills	28	48	76
covering Group D1 landfills	5	80	85
covering Group D2 landfills	n/a	6	6
'Nil returns' (i.e. 0 tonnes of C&D waste)	16	86	102
from Group A landfills	1	4	5
from Group B landfills	n/a	8	8
from Group C1 landfills	n/a	12	12
from Group C2 landfills	12	9	21
from Group D1 landfills	3	49	52
from Group D2 landfills	n/a	4	4

5.16 Of the 102 landfills which received no hard C&D or excavation waste during 2001, 22 were reported to be closed, with a further 54 inactive. Some of these 54 will have been temporarily closed, and some might well have been finally closed, but the person who completed the form did not specifically confirm this. The other 26 were open and actively receiving waste, but did not report receiving any hard C&D or excavation waste during 2001. Of these 26, 19 were Group D1 landfills (mainly medium and small non-inert landfills).

The Results Reported by Operators of Licensed Landfills: National Level

5.17 Before carrying out a detailed analysis, a similar statistical test to the first of the two described above in the context of operators of crushers and screens was run. The objective was to see whether the landfills from the structured sample (which only included landfills from Groups A, C2 and D1) showed any statistically significant differences from their nonsample counterparts. The measure used for this comparison was the total hard C&D and excavation waste entering each landfill, whether for use or for disposal. The relevant calculated means and standard deviations are reported in Table 5.5.

Table 5.5: Responses from sample and non-sample operators compared (tonnes)

	C&D / excavation waste received
8 Group A sample landfills: mean	74,302
8 Group A sample landfills: standard deviation	118,715
11 Group A non-sample landfills: mean	57,998
11 Group A non-sample landfills: st dev	69,705
28 Group C2 sample landfills: mean	38,353
28 Group C2 sample landfills: st dev	72,490
48 Group C2 non-sample landfills: mean	39,858
48 Group C2 non-sample landfills: st dev	60,506
5 Group D1 sample landfills: mean	633
5 Group D1 sample landfills: st dev	960
80 Group D1 non-sample landfills: mean	2,430
80 Group D1 non-sample landfill: st dev	6,553

5.18 In all three cases, the differences between sample and non-sample returns are not statistically significant, which allows them to be amalgamated for grossing-up purposes. Further details of the tests and results can be found in Annex 7.

5.19 The consequences for the estimated use and disposal of hard C&D and excavation waste at licensed landfills in England and Wales in 2001 are worked through in Table 5.6 and Table 5.7.

Table 5.6: Estimates for the receipt of hard C&D and excavation waste at licensed landfills in England and Wales in 2001 (tonnes)

Table 5.7: Estimates for the use and disposal of hard C&D and excavation waste at licensed landfills in England and Wales in 2001 (tonnes)

The Response Rate to the Survey of Operators of Paragraph 9 & 19 Registered Exempt Sites

5.20 As reported above in Table 3.4, survey forms were sent out to the operators of:

i. 33 sites thought to be large (ie receiving more than 10,000 tonnes in 2001);
ii. 400 sites that might be large; and
iii. a sample of 110 out of the 1,362 sites thought to be small.

5.21 Four of these forms were returned unopened by the Post Office marked as 'undeliverable'. All were from the second group (of those sites that might be large), which reduced the sample database for that group to 396.

5.22 By 1 July, responses had been received from operators responsible for:

i. 14 sites thought to be large (of which one was a 'nil return');
ii. 82 sites that might be large (of which 26 were 'nil returns'); and
iii. 35 sites thought to be small (of which nine were 'nil returns').

The Results Reported by Operators of Paragraph 9 & 19 Registered Exempt Sites: National Level

5.23 When the responses were collated and checked, those for the 14 sites thought to be large proved not to have received the largest tonnages reported. In fact only two of the 10 largest reported sites (in tonnage terms), and none of the five largest sites, were drawn from this group. Even so, most of the sites thought to be large were indeed large (using the definition of receiving more than 10,000 tonnes during 2001).

5.24 On investigation, no statistically significant difference was found between the mean total tonnages spread on these two categories of larger sites (see Annex 7 for details). There was, however, a highly significant difference in mean tonnages between sites that might be large and those thought to be small.

5.25 In light of the above, it was decided to amalgamate the first two categories for analytical purposes, resulting in one group of 429 'potentially large sites' and 1,362 'probably small sites' (from which latter group a sample of 110, or 8.1%, had been drawn). Information was therefore received on 96 out of the 429 potentially large sites, and 35 out of the 110 probably small sites. These data are summarised in Table 5.8 below, together with the results of the grossing-up process.

Table 5.8: Forms sent to, and returned by, operators of Paragraph 9 & 19 registered exempt sites

	Potentially large sites	Probably small sites	Total
Number of sites in overall population	429	1,362	1,791
Sites covered by survey forms	429	110	539
Sites for which responses were received	96	35	131
'Nil returns'	27	9	36
Total tonnage reported	5,698,869	228,512	5,927,381
Mean of sites reported	59,363	6,529	n/a
Standard deviation of sites reported	185,369	15,662	n/a
Grossed up estimate of total hard C&D waste spread on sites	273,876	444,012	717,888
Grossed-up estimate of total clean, unmixed excavation waste spread on sites	15,944,790	5,708,531	21,653,322
Grossed-up estimate of total mixed CDEW spread on sites	653,050	657,924	1,310,974
Grossed-up estimate of total road planings spread on sites	317,058	1,945,714	2,262,772
Grossed-up estimate of processed / crushed aggregate used on sites	4,750,371	0	4,750,371
Grossed-up estimate of ash, slag, clinker, dredged and other materials spread on sites	3,527,676	136,200	3,663,876
Grossed-up total tonnage of all materials spread on sites	25,466,821	8,892,381	34,359,202
Bands at 90% confidence level	± 53%	± 69%	± 43%
Grossed-up tonnage of hard C&D and excavation waste spread on all sites	16,871,716	6,810,467	23,682,183
Bands at 90% confidence level	± 51%	± 79%	± 43%

5.26 The middle section of Table 5.8 gives grossed-up estimates for the full range of materials spread on Paragraph 9 & 19 registered exempt sites. Some of these materials are not hard C&D or excavation waste, and some are not even waste materials. This is because many mainstream construction sites are now registered by owners and/or contractors as exempt sites, which greatly increases the tonnage of excavated materials recorded by respondents, even compared to 1999/2000. It also introduces some confusion over the nature of 'aggregate', some of which appears to be being used for the exempt activities, and some of which appears to be being used as part of the follow-on construction projects.

5.27 In our view, the first three of the six categories identified in Table 5.8 above (ie hard C&D waste, clean unmixed excavation waste and mixed CDEW) are genuine hard C&D and/or excavation waste, unlike the final three categories (road planings, aggregate and other materials).

5.28 Any recycled aggregate reported in Table 5.8 (within the category 'grossed-up estimate of processed/crushed aggregate used on sites') should represent double counting of material already picked up through the survey of operators of crushers and screens.

Overall National Results

5.29 Pulling together the results reported above into a table based directly on the categories

established in Figure 2.2 gives us Table 5.9. From there it can be seen that the total amount of **C&D waste arising** in England and Wales in 2001 is estimated to have been 93.91 million tonnes ± 15% at a confidence level of 90%. Hard C&D and excavation waste crushed and/or screened for **use as aggregate** accounted for 38.02 million tonnes (ie 40.5% of the total).

5.30 It should be noted that the **confidence intervals** reported in Table 5.9 for the second, third and fifth sub-totals are taken from the overall confidence intervals for materials received at landfills, as reported in Tables 5.6 and 5.7. To calculate the confidence intervals for the three sub-totals separately would be very time-consuming for a small marginal gain.

5.31 Compared to the 1999 survey reported in EA R&D TR P402, it can be seen that by 2001:

i. the tonnage of recycled aggregate and soil had risen by almost 80% (from just over 25 million tonnes to just over 45 million tonnes);
ii. the tonnage of hard C&D waste, excavation waste and mixed CDEW used for landfill engineering or restoration remained almost static at between 9 and 10 million tonnes (the 1999 survey did not separately identify the use of these materials for backfilling quarry voids);
iii. the tonnage of hard C&D waste, excavation waste and mixed CDEW spread on Paragraph 9&19 registered exempt sites rose by around 15% (from over 20 million tonnes to over 23 million tonnes);
iv. the tonnage of waste materials disposed of at landfills fell from 17.5 million tonnes in 1999 to 15.5 million tonnes (if backfilling of quarry voids is included with mainstream landfilling, which it was in 1999).

5.32 Table 5.9 summarises the principal factual findings from this study in response to the first two bullet points set out in the Aims section of the Research Specification (covering arisings of C&D waste and the amount crushed or screened for use as aggregate respectively). The third bullet point requires "... estimates of the **scope for further use of C&D waste as aggregate**". This is addressed more fully in Chapter 7, which contains our discussion of the main findings. However, the outcome of that discussion can be summarised as follows:

i. 38.02 million tonnes of hard C&D and excavation waste was recycled as aggregate, and a further 7.05 million tonnes as soil in 2001, accounting between them for 48.0% of the total waste stream;
ii. of the remaining 48.84 million tonnes (52.0% of the total waste stream):

a. 2.68 million tonnes (2.9%), including 1.33 million tonnes of hard C&D waste used for landfill engineering or restoration, was accounted for by uncontaminated (and unrecycled) hard C&D waste and by heavily mixed and/or contaminated hard C&D waste with varying **potential for recycling** as aggregate;

b. 5.51 million tonnes (5.9%) was mixed CDEW (primarily soil, but mixed with some hard C&D waste) with **limited scope for recycling** as aggregate; and

c. 40.65 million tonnes (43.3%) wholly or mainly comprised soil and excavation waste with **little or no scope for recycling** as aggregate

Table 5.9: Estimated re-use, recycling and disposal of hard C&D and excavation waste in England and Wales in 2001

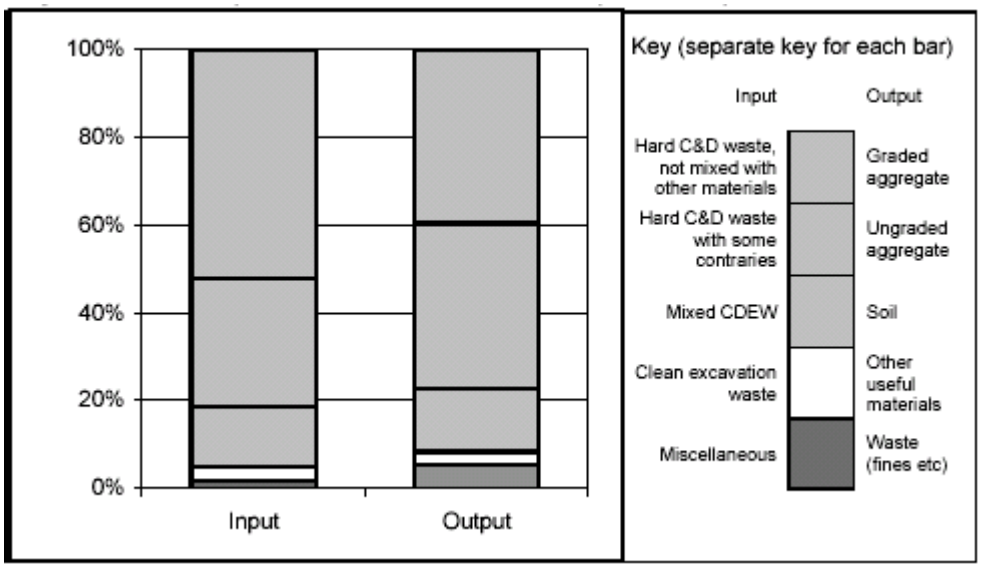
Other Incidental Results

5.33 This penultimate section reports on findings from the surveys which complement the core data reported in Table 5.9. These incidental results help to establish, in a non-statistical way, the extent to which the respondents from whom survey returns were received on this occasion differ from those who responded to the 1999/2000 survey. The final section looks at data from other groups which may be able to validate the survey returns.

5.34 Just over half (51%) of the 8.8 million tonnes of recycled aggregate reported by respondents (and recorded in Table 5.3) was **graded**. Where no breakdown was given, we classified the resultant aggregate as ungraded, so the calculated figure of 51% graded may be an underestimate. This (along with other materials, including 1.7 million tonnes of re-useable soil) was produced from 2.5 million tonnes of clean concrete, 1.3 million tonnes of clean masonry, bricks, tiles and similar, 5.0 million tonnes of mixed (mainly hard) C&D waste, and 2.0 million tonnes of excavation waste (with or without some hard C&D waste mixed in with it).

5.35 This balance between **input and output materials** is broadly similar to the results recorded in 1999/2000, though the different ways that data were collected for the two surveys makes direct comparisons impossible. The 2001 data are illustrated in Figure 5.1.

Figure 5.1: Composition of crusher and screen input and output, 2001



5.36 Figures 5.2 and 5.3 allow more direct comparisons to be made between the two surveys. Figure 5.2 (covering 117 crushers in 2001 and 111 in 1999) shows the **age structure of crushers** from those respondents who provided the necessary level of detail. Figure 5.3 (covering 150 crushers in 2001 and 130 in 1999) shows the numbers of crushers in each of a

range of **tonnage throughput bands**. Even here, the comparison between 1999 and 2001 is not absolute, because the data from 1999 covered the entire throughput of crushers, whereas for 2001 they are for recycled aggregate only.

Figure 5.2: Age structure of crushers, 2001 and 1999

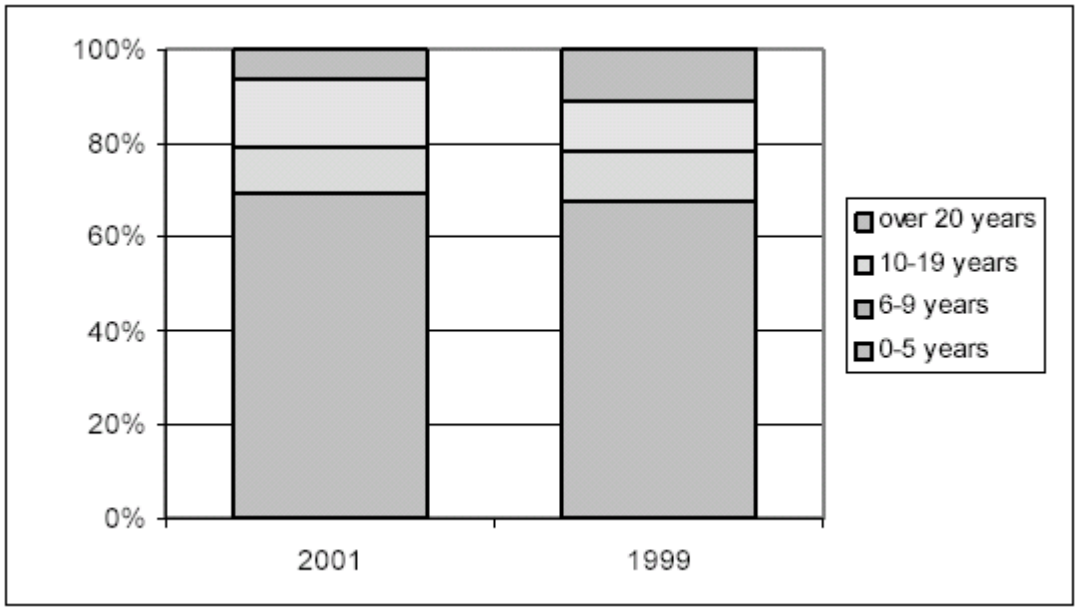
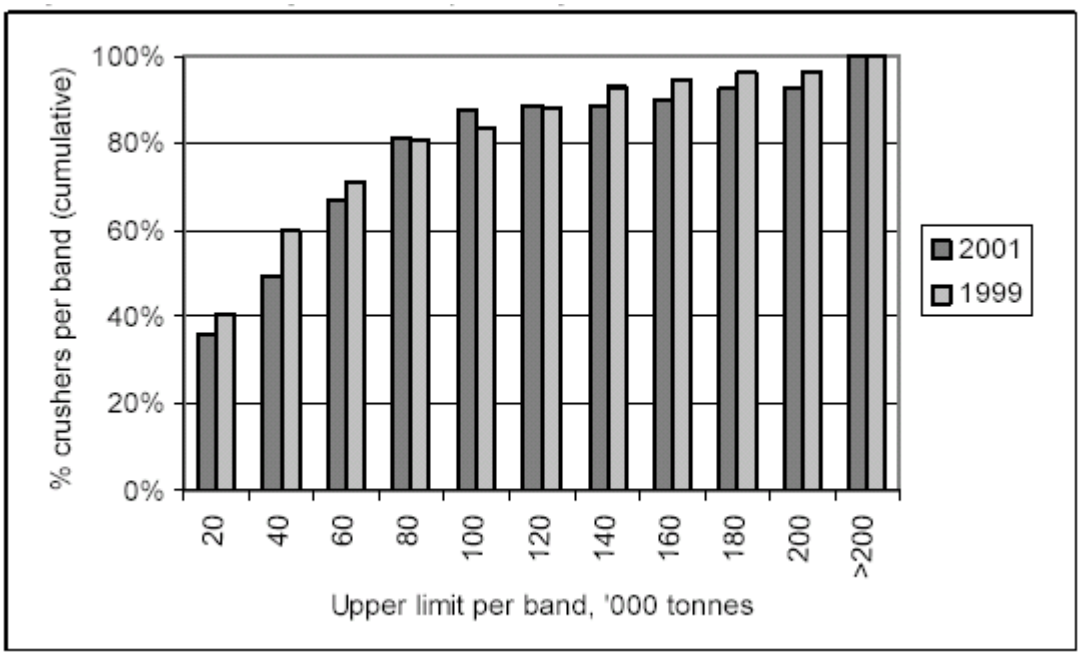


Figure 5.3: Percentage of crushers per tonnage band, 2001 and 1999



5.37 Figures 5.4 and 5.5 provide further information from the surveys of licensed landfills and registered exempt sites respectively on the haul distances over which different types of waste were moved prior to use or disposal.

Figure 5.4: Haul distances to licensed landfills, 2001

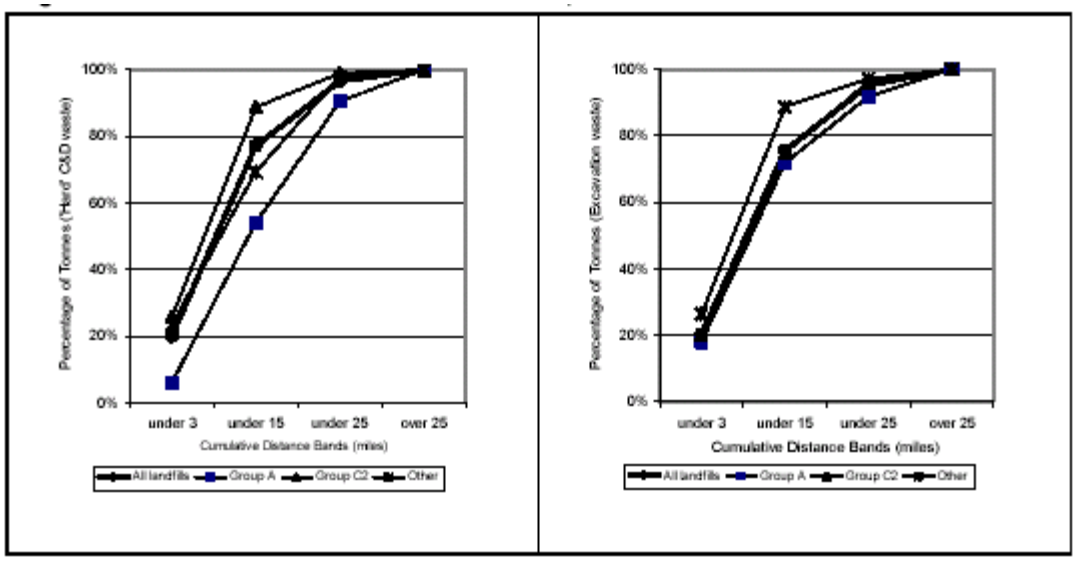
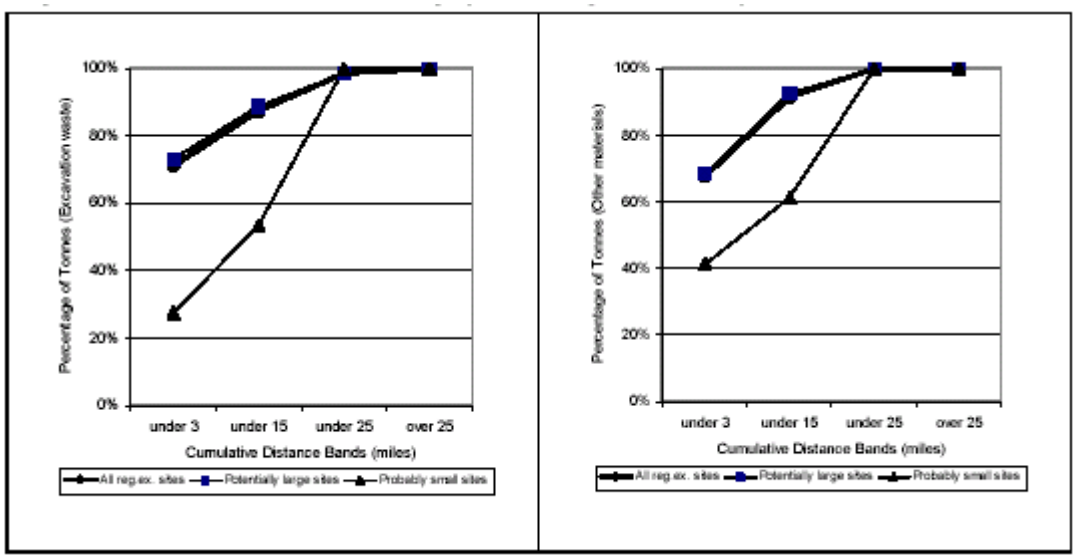


Figure 5.5: Haul distances to Paragraph 9&19 registered exempt sites, 2001



5.38 The data in Figures 5.4 and 5.5 are derived from replies to questions in the survey forms about haul distance. Not all respondents answered these questions, but a large majority did. The data used represent almost 4 million tonnes of hard C&D and excavation waste going to landfills and 5.8 million tonnes of excavation waste and other materials (including some non-C&D wastes) going to Paragraph 9 & 19 registered exempt sites. The findings are largely as would be expected, and the main points are as follows:

i. hard C&D waste going to large inert landfills (Group A, as defined in Chapter 3, Figure 3.1) tends to travel slightly longer distances than comparable material going to other landfills;
ii. hard C&D waste tends to travel slightly further to landfills than excavation waste;
iii. excavation waste going to registered exempt sites, particularly large ones, tends to travel very short distances;

iv. very little hard C&D or excavation waste is hauled more than 25 miles either to licensed landfills or (particularly) to registered exempt sites, and only a small proportion is hauled more than 15 miles.

5.39 Direct comparisons with data from 1999 are not easy, but the patterns are certainly not dissimilar. If anything, typical haul distances to registered exempt sites appear to have fallen. This would be consistent with an increase in the registration of exemptions at 'cut and fill' construction sites in 2001 compared with 1999.

5.40 As can be seen by reference to Annex 4, the survey form also asked respondents on **what sort(s) of site(s)** the crushers and screens under their control had been working in 2001. They were offered five 'tick boxes', as follows:

i. on demolition/construction sites;
ii. on public highway/motorway maintenance sites;
iii. at a waste transfer station/recycling centre;
iv. at a landfill site;
v. at another sort of site.

5.41 Responses to this question were received from 97 operators, who between them owned 126 crushers and 133 stand-alone screens, and hired in a further 45 crushers and 34 screens. These respondents were responsible for 88% of the recycled materials reported in the survey, namely 7.82 million tonnes of recycled aggregate and 1.62 million tonnes of recycled soil. Of the 97 operators, 57 ticked one of the five boxes, while the rest ticked two or more. Only eight operators did not report working on either a demolition/construction site or at a waste transfer station/recycling centre at all during the year.

5.42 The locations (or combination of locations) reported by the other 89 operators, were as follows:

i. 19 operators worked solely on demolition/construction sites (producing 1.41 million tonnes of recycled aggregate);
ii. 31 operators worked solely at waste transfer stations/recycling centres (producing 1.53 million tonnes of recycled aggregate);
iii. 21 operators worked at a mixture of just the first two categories above (producing 2.74 million tonnes of recycled aggregate);
iv. 11 operators worked at both of the first two categories above plus some other site type(s) (producing 1.61 million tonnes of recycled aggregate); and
v. 7 operators worked at one of the first two categories of site (but not the other), plus some other site type(s) (producing 0.38 million tonnes of recycled aggregate).

5.43 As reported in paragraph 5.34 above, over the entire group of survey respondents, the ratio between graded and ungraded aggregate was 51:49. As Table 5.10 shows, the ratio for those 97 operators who responded to the question about site type was reversed (ie 49:51 graded:ungraded), and also varied considerably according to the site type. The highest proportion of graded aggregate was produced by those who operate on a combination of site

types, including (but not limited to) a fixed recycling centre. Of the top 20 producers of graded aggregate (each of whom reported producing over 60,000 tonnes of graded materials), only one did not have access to a fixed site, but many spent part of their time working on demolition sites. By contrast, but not surprisingly, most of the operators who reported producing no graded aggregate at all operated exclusively on demolition/construction sites.

Table 5.10: Comparison of results reported by companies according to where they worked in 2001

Comparisons with Other Data Sources

5.44 The only other check data set available for **crushed materials** comes from the members' survey carried out by the National Federation of Demolition Contractors (NFDC). The NFDC survey asks members how much material they crushed over the previous year for use on and off site. The latest available data (collected in 2001 for a 12-month period ending in 2001) sets out the findings from 98 member companies in England and Wales, who between them reported crushing just under 5 million tonnes, two thirds of it for use on the original site. There are also results for NFDC members based in Scotland, but these have been discounted for the purposes of the following comparison.

5.45 NFDC members reported crushing an average of 50,625 tonnes each, with a standard deviation of 71,000 tonnes. This compares with an average of 70,213 tonnes with a standard deviation of 120,126 tonnes from the companies who responded to this survey (with the average given in this paragraph being per company, not per crusher, which was the measure reported elsewhere in this Chapter).

5.46 Individual company returns were spread over a wide range. At the lower end of the scale there were 17 NFDC members (17.3%) that reported no crushing activity at all, and a further 25 (25.5%) that reported crushing less than 20,000 tonnes each. Table 5.11 compares the NFDC results with the results reported by respondents to this survey for aggregate production. The results are reported as percentages to make it easier to compare the two data sets. This is done twice, with the non-crushing companies included for one comparison and excluded for the other. As can be seen, the patterns are very similar, with the NFDC members including a slightly smaller proportion of companies with very low levels of activity (less than 20,000 tonnes), and a slightly smaller proportion at the upper end of the scale (over 200,000 tonnes) as well.

Table 5.11: Comparison of numbers of companies in specified tonnage bands in England and Wales, this survey and NFDC survey

Tonnage band (tonnes of recycled aggregate produced per company)	Cumulative percentages, including non-crushers:		Cumulative percentages, excluding non-crushers:	
	This survey	NFDC	This survey	NFDC
Zero	18.3	17.3	n/a	n/a
1 - 19,999 tonnes	48.4	42.9	36.9	30.9
20,000 - 39,999 tonnes	60.3	65.3	51.5	58.0
40,000 - 59,999 tonnes	65.9	69.4	58.3	63.0
60,000 - 79,999 tonnes	72.2	76.5	66.0	71.6
80,000 - 99,999 tonnes	78.6	80.6	73.8	76.5
100,000 - 119,999 tonnes	83.3	86.7	79.6	84.0
120,000 - 139,999 tonnes	84.1	90.8	80.6	88.9
140,000 - 159,999 tonnes	88.1	93.9	85.4	92.6
160,000 - 179,999 tonnes	88.1	95.9	85.4	95.1
180,000 - 199,999 tonnes	89.7	96.9	87.4	96.3
Over 200,000 tonnes	100.0	100.0	100.0	100.0

5.47 The best check data set for **landfills** comes from the Environment Agency's consolidated Site Returns for 2000/2001. We were provided with data from seven of the 11 RAWP regions by the Agency. Data from the North West, East of England, North Wales and South Wales were not available in time for us to extend the comparison described below to cover all regions.

5.48 Exactly the same procedures that were used to generate Tables 5.6 and 5.7 were re-run after excluding all returns from the four missing regions. The total grossed-up estimate for hard C&D and excavation waste in the seven English regions concerned was 18.25 million tonnes. This can be compared with the figure of 22.32 million tonnes recorded by the Agency as having been deposited in inert/C&D landfills in these same regions. This (Agency) figure for inert/C&D landfills includes all inert industrial waste deposited at such sites, but excludes any hard C&D and excavation waste deposited at other landfills. It also excludes returns from the Agency's Welsh office for some parts of the West Midlands.

5.49 It has to be acknowledged that the match between our six landfill Groups A-D2 and the Agency's consolidated return categories (of inert/C&D; municipal; industrial/commercial; and special waste landfills) is not particularly good, which limits the value of any comparisons.

5.50 The only check data set for Paragraph 9 & 19 **registered exempt sites** of which we are aware is the 1999/2000 survey. Report EA R&D TR P402 drew attention to the extremely skewed nature of the tonnage distribution from site to site, with over 40% of the total tonnage accounted for by sites accepting over 100,000 tonnes, and about 50% accounted for sites in the 10-100,000 tonne band.

5.51 The 2001 data show 54% of the material being spread on sites accepting over 100,000 tonnes, and 36% on sites in the 10-100,000 tonne band: a very similar pattern.

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Chapter 6: The Regional Breakdown of Results

Objective

6.1 A key objective of the Research Specification was to generate regional estimates of the main measures, especially for aggregate recycling, with specified levels of precision.

6.2 The main measures are considered to be the five sub-totals set out in Figure 2.2 and Table 5.9, namely:

i. recycled aggregate and soil;
ii. materials used for landfill engineering or restoration;
iii. materials used to backfill quarry voids;
iv. material spread on Paragraph 9 & 19 registered exempt sites;
v. material disposed of at licensed landfills.

Developing Regional Estimates

6.3 There are at least four approaches which can be taken to developing regional estimates:

i. a 'pure' regional approach;
ii. a 'modified' regional approach;
iii. a national approach; and
iv. a 'hybrid' approach.

6.4 These are discussed in more detail in Annex 8, but the key points about them are as follows.

6.5 In the 'pure' regional approach, each region is treated as having a distinct population with its own characteristics which may be entirely independent of those to be found in other regions. This is essentially the approach which is discussed in Annex 5, and is a 'mini' version of the method used to estimate a mean and confidence intervals at the national level. As discussed in Annex 5, because the number of responses per region is inevitably much lower than at the national level, the level of precision is much poorer. Whereas at the national level we calculate that the average output of recycled aggregate per Group 1 crusher is 56,178 tonnes (± 20% at a confidence level of 90%), the equivalent confidence intervals at regional level are likely to be three-to-three-and-a-half times as wide.

6.6 In the 'modified' regional approach, the central estimate is calculated as in the 'pure' approach (by multiplying the regional population by the regional mean), but the confidence interval is calculated using the pooled standard deviation.

6.7 By contrast, the national approach assumes that a single national population is evenly

distributed across all regions, which allows the national mean, with the national confidence limits, to be attributed to each regional population. This is tantamount to saying that we do not believe that there are any regional differences. Whereas this may be broadly defensible for landfills, and possibly for Paragraph 9 & 19 registered exempt sites, it is not very credible where crushers are concerned. Extensive anecdotal evidence, supported by the returns analysed, even if this support is not rigorously quantifiable, suggests that, for example, crushers in and around London and other major cities work harder on average than those in rural areas. Unfortunately, all of the regions combine urban, suburban and rural areas in varying combinations.

6.8 There is a 'third way' between these extremes, albeit one that lacks a wholly respectable statistical pedigree. This is what we refer to as the 'hybrid' approach. The 'hybrid' approach acknowledges that there are almost certainly genuine regional differences in the throughput of different operators and their individual machines, but distrusts the wide variations in regional means that can be thrown up by the 'pure' regional approach. In effect it says "we cannot ignore the fact that we found some much larger-than-average crushers in Region A and some small ones in Region B, but we do not believe that these are entirely representative of all of the non-respondents from whom no returns were received in all regions. We will therefore assume that the national mean represents them more accurately." This sounds very reasonable, and in practice it 'smooths' the regional differences. Unfortunately, another way of describing the 'hybrid' method is to say that "although we found evidence of regional differences among the respondents to the survey, we have decided to ignore this where nonrespondents are concerned, and treat them as a uniform group with no regional differences."

6.9 Nevertheless, this 'hybrid' approach is used on other surveys, and was used in 1999/2000 (as reported in EA R&D TR P402 Sections 5.5.1 and 5.5.2). Following discussion with the project Steering Group, it has been used for this survey.

6.10 Because it is essentially a compromise that falls between two statistically established stools, it makes the calculated confidence intervals misleadingly narrow, particularly for component parts of the regional totals. However, approximate confidence limits for the overall regional arisings of hard C&D and excavation waste have been estimated using the 'modified' regional approach, and these are presented below. Annex 8 also deals in more detail with these issues.

6.11 Because 'un-rounded' numbers (e.g. 2,435,826) can give an unwarranted impression of precision, the Tables in this Chapter report the regional estimates expressed as million tonnes (eg 2.44 million tonnes). Results shown as <0.01 million tonnes represent a nonzero value of 49,999 tonnes or less, while 0.00 means zero.

Recycled Aggregate and Soil, by Region

6.12 The regional estimates for recycled aggregate and soil come from the survey of operators of crushers and screens. Because crushers are mobile, and because some do genuinely move from area to area, each response has been allocated to the relevant region(s). As a result of this, reference will be found in Table 6.1 to fractions of crushers.

6.13 The 'hybrid' method (described in general terms above) works as follows where crushers

are concerned:

i. the number of responding Group 1 and Groups 2 & 3 crushers and their production are reported; then
ii. the balance for each group (ie the expected population of crushers minus the number reported) is multiplied by the relevant national average output of aggregate and soil per crusher.

6.14 Table 6.1 works through this process for the North West region, and reports the results. Table 6.1 employs an amended version of Table 5.3. Comparable tables have not been individually produced for the other nine English and two Welsh regions, but the 'headline' results are reported at the end of this Chapter in Table 6.5, and the detailed results can be found in Annex 9.

6.15 Because of the significance for policy of the production and use of recycled aggregate, separate estimates have been made for recycled aggregate, and these are discussed in Chapter 7.

Table 6.1: Estimates for production of recycled aggregate and soil in North West England in 2001

	Group 1	Groups 2&3	Total
Number of crushers in overall population	59	29	88
Number of crushers providing data	14.58	3	n/a
Number of non-responding crushers	44.42	26	n/a
Million tonnes of recycled aggregate reported by respondents	1.13	0.04	1.17
National mean recycled aggregate, tonnes per crusher	56,178	29,755	n/a
Million tonnes of recycled aggregate from non-respondents	2.50	0.77	3.27
Million tonnes of recycled soil reported by respondents	0.32	0.0	0.32
National mean recycled soil, tonnes per crusher	10,995	3,803	n/a
Million tonnes of recycled soil from non-respondents	0.49	0.10	0.59
Regional estimate for recycled aggregate (million tonnes)	3.63	0.81	4.44
Regional estimate for recycled soil (million tonnes)	0.81	0.10	0.91
Regional estimate for recycled aggregate and soil (million tonnes)	4.44	0.92	5.35

Use and Disposal of Materials at Licensed Landfills, by Region

6.16 Three of the measures for which regional estimates are required (ie materials used for landfill engineering or restoration, materials used to backfill quarry voids, and material disposed of at licensed landfills) come from the survey of licensed landfill operators. Landfills

are static, so there is no need to allocate individual returns between different areas. However, to reflect the genuine regional differences reported by respondents, the 'hybrid' approach has been used (in which actual returns for all incoming materials are used, together with national average returns applied to each non-respondent).

6.17 However, when it comes to how those materials are allocated within the landfills (between engineering/restoration, backfilling and disposal), we have assumed that within each group of licensed landfills (A, B, C1, C2, D1 and D2), the split is consistent across the country. Table 6.2 gives the relevant percentages for each group of landfills.

Table 6.2: Percentages of C&D waste used for landfill engineering and restoration, backfilling of quarry voids and disposed of at licensed landfills

	A	B	C1	C2	D1	D2
Material used for landfill engineering or restoration	28.3%	3.4%	34.7%	44.4%	41.8%	4.9%
Material used to backfill quarry voids	51.2%	80.8%	0.0%	41.3%	6.8%	94.6%
Material disposed of as waste	20.5%	15.8%	65.3%	14.4%	51.4%	0.6%

6.18 Table 6.3 works through this process for the North West region, and reports the results. Table 6.3 employs the same logic as a consolidated version of Tables 5.6 and 5.7. The populations of C2 and D1 landfills differ slightly from those reported in Table 3.4, because they have been adjusted to take account of the 'undeliverable' forms reported in paragraph 5.14.

Table 6.3: Estimates for receipts, use and disposal of hard C&D and excavation waste at licensed landfills in North West England in 2001

Material Spread on Paragraph 9&19 Registered Exempt Sites, by Region

6.19 The final measure comes from the survey of operators of Paragraph 9 & 19 registered exempt sites. Although registered exempt sites, like landfills, are static, not all of the sites for which we received returns turned out to be located where we expected them to be. For example, one operator based in the East Midlands, and with exemptions granted by the Environment Agency's office in the East Midlands, provided returns for sites in the South East.

6.20 We have dealt with this by assuming that, on balance, such 'cross-border anomalies' cancel each other out. We have therefore kept the number of sites which we regard as the basic population to the figures set down in Tables 3.4 and 5.8. Responses have then been allocated to the region(s) where the sites concerned are actually located. Table 6.4 works through this process for the North West region, and reports the results. Table 6.4 employs a simplified version of Table 5.8.

Table 6.4: Estimates for the amounts of C&D and excavation waste spread on Paragraph 9 & 19 registered exempt sites in North West England in 2001 (tonnes)

	Potentially large sites	Probably small sites	Total
Number of sites in overall population	91	135	226
Number of active sites providing data	29	11	40
Number of non-responding sites	62	124	186
Million tonnes of C&D and excavation waste reported as spread on sites by respondents	0.27	0.04	0.31
National mean tonnes per site	39,328	5,000	n/a
Million tonnes of C&D and excavation waste spread on sites by non-respondents	2.44	0.62	3.06
Regional estimate for C&D and excavation waste spread on sites (million tonnes)	2.71	0.66	3.37

Summary of Regional Results

6.21 The foregoing estimates are drawn together in Table 6.5, together with estimates developed using exactly the same approach for all other regions. Individual figures are given for recycled aggregate and soil because of the particular importance for policy of information on recycled aggregate. A more detailed table with additional information can be found in Annex 9.

Table 6.5: Estimated re-use, recycling and disposal of hard C&D and excavation waste by region in 2001 (million tonnes)

Reliability of the Regional Estimates

6.22 The general issue of reliability is dealt with in Chapter 7, where the accuracy of the estimated population sizes (of crushers, landfills and registered exempt sites) is identified as the main cause for concern. Any such concerns become more serious if there are grounds for believing that unreliability is geographically biased. Unfortunately, there are good grounds for believing this to be the case, particularly for Paragraph 9 & 19 registered exempt sites.

6.23 Table 3.4 in Chapter 3 contains the relevant facts. A cut-down version of Table 3.4 is reproduced here as Table 6.6 for ease of reference.

Table 6.6: Simplified structure of final list of registered exempt sites (based on Table 3.4)

Region	Sites thought to be large	Sites that might be large	Sites thought to be small	Total
North West	15	76	135	226
East of England	1	16	32	49
South West	1	101	510	612
Other English regions	15	186	581	782
Wales	1	21	104	126
England & Wales	33	400	1,362	1,795

6.24 If all 11 regions had equal numbers of registered exempt sites, we would have expected to find three sites thought to be large in each region, 36 sites that might be large, and 124 sites thought to be small (ie 163 sites in total per region). However, as Table 6.6 shows, 45% of the sites thought to be large were identified in the North West region, and 25% of the sites that might be large were in the South West, as were 37% of the sites thought to be small. Quite apart from these absolute differences in numbers from region to region, the ratios between site types differ considerably, even after combining the two categories of large sites into one.

6.25 We have no way of knowing to what extent the regional differences are real, and to what extent they reflect differing approaches to the registration process within local Environment Agency offices. However, we strongly suspect that regional differences in registration processes contribute substantially to the differences reported above.

6.26 The implications of this are not trivial. By reporting such a lot of registered exempt sites, the South West inevitably appears to rely more heavily than other regions on such sites once the national average tonnages per site type are projected onto the estimated populations of large and small sites. Table 6.5 and Annex 9 suggest that the South West sends just over half of its hard C&D and excavation waste to registered exempt sites: twice the national average.

6.27 Were the number of both large and small registered exempt sites in the South West to be one third of the level reported to us (ie 34 potentially large ones and 170 probably small ones), this would still leave the South West with more sites than any region other than the North West and South East. This would cause the estimate for hard C&D and excavation waste spread on registered exempt sites to drop from 6.33 to 1.99 million tonnes. Both the regional and national totals would, of course, drop by the same amount (from 12.62 to 8.28 million tonnes and from 93.91 to 89.58 million tonnes respectively).

6.28 Equally, those regions - like the South West - with an apparent population of registered exempt sites furthest from the mid-point (of 39 potentially large sites and 124 probably small ones) should be treated with greater caution.

6.29 Based on anecdotal evidence, it appears possible that local Environment Agency offices take different approaches to the registration (as exempt) of 'cut and fill' operations. Such operations often involve the digging and placement elsewhere within the same site of very large tonnages of excavated material, and two different persons could quite reasonably disagree over whether or not such material is waste. The consistent registration as exempt of all cut and fill operations in one region but not in another would make them not strictly comparable.

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Chapter 7: Findings and Discussion

The Headline National Figures

7.1 A key objective for this study was to produce reliable estimates for England and Wales and for Regional Aggregate Working Party regions of:

i. the amount of C&D waste arising;
ii. the amount crushed or screened for use as aggregate; and
iii. the scope for further use of C&D waste as aggregate.

7.2 For England and Wales taken together, **arisings** of C&D waste in 2001 are estimated to have been 93.91 million tonnes ± 15% at a confidence level of 90%.

7.3 Of these arisings, 38.02 million tonnes (± 18%), representing 40.5% of total arisings, was recycled as **aggregate** by crushing and/or screening in England and Wales. The figure for England was 36.47 million tonnes.

7.4 The **scope for further recycling** of C&D waste for use outside landfills and registered exempt sites appears to be limited by the fact that much of the C&D waste that was not being recycled as aggregate was not physically capable of forming aggregate, because it was wholly or largely made up of soil. Only 2.68 million tonnes of **non-recycled hard C&D waste** was identified (see lines 3, 6, 9, 12 and 13 in Table 5.9). This figure is made up of:

i. 1.33 million tonnes used for landfill engineering or restoration (which might have to be replaced by primary aggregate if diverted for use elsewhere);
ii. less than 10,000 tonnes used to backfill quarry voids;
iii. 720,000 tonnes spread on Paragraph 9&19 registered exempt sites;
iv. 240,000 tonnes of clean, unmixed hard C&D waste disposed of as waste at licensed landfills; and
v. 390,000 tonnes of contaminated or heavily mixed hard C&D waste disposed of at landfills. We have no way of knowing whether this material was capable of being cleaned sufficiently and economically to allow recycling to take place safely.

7.5 Recycling all of the above material into aggregate, if that were possible, would only raise the recycling rate from 40.5% to 43.3%.

7.6 Leaving on one side the excavation waste (see lines 4, 7, 10, 14 and 15 in Table 5.9), we are left with 5.51 million tonnes of **mixed CDEW** from which it might be physically possible to separate further hard C&D waste (see lines 5, 8, 11 and 16 in Table 5.9). This is made up as follows:

i. 640,000 tonnes used for landfill engineering or restoration;
ii. 1.94 million tonnes used to backfill quarry voids;
iii. 1.31 million tonnes spread on Paragraph 9 & 19 registered exempt sites; and
iv. 1.62 million tonnes disposed of as waste at licensed landfills.

7.7 We do not know what proportion of this 5.51 million tonnes is contributed by hard C&D waste that is potentially suitable for recycling as aggregate, but it is very unlikely to exceed 1 million tonnes. Nor can we say anything helpful regarding the economic feasibility of separating the hard materials from the soils with which they were mixed.

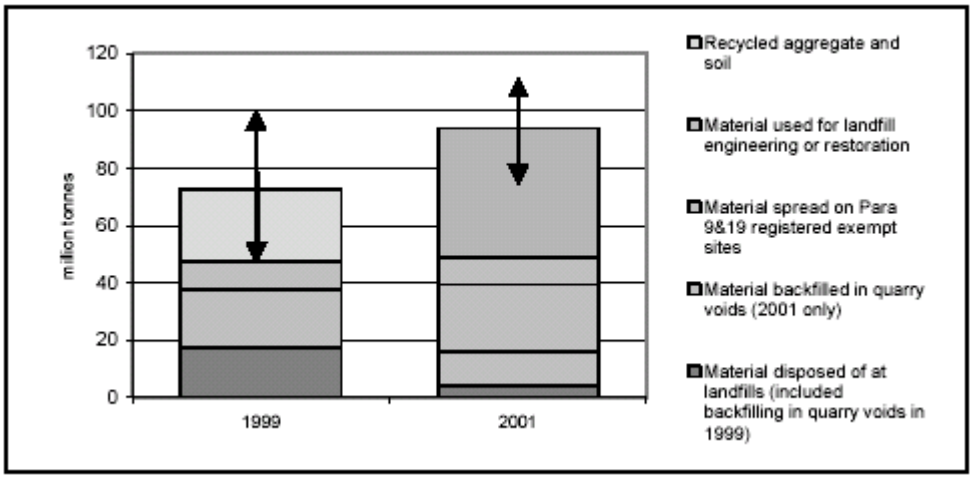
Comparisons with 1999

7.8 The 1999 survey (reported in EA R&D TR P402) included tonnage bands at a confidence level of 95%. The overall estimate for arisings of C&D waste then was 72.5 million tonnes ± 35% (i.e. between 47.2 and 97.9 million tonnes). The equivalent figures for 2001 (at a confidence level of 95%, rather than the 90% level previously quoted) would be 93.9 million tonnes ± 18% (ie between 77.0 million tonnes and 110.8 million tonnes). Despite the size of the difference between the central estimates (of just under 30%), there is nevertheless a 20-million-tonne overlap between the two bands (from 77.0 to 97.9 million tonnes). This overlap suggests that the difference between the two totals may not be statistically significant, and this was confirmed by an appropriate statistical test.

7.9 As can be seen by reference to Figure 7.1, most of the rise between 1999 and 2001 was accounted for by the amount of hard C&D waste which we identified in this survey, which was then recycled into aggregate. In 1999 the estimated tonnage of recycled aggregate (ie excluding soil) was 22.7 million tonnes ± 15% at 95% confidence (ie 19.3 million tonnes to 26.1 million tonnes). In 2001 it was 38.0 million tonnes ± 22% (i.e. 29.7 million tonnes to 46.4 million tonnes). The lack of overlap between the bands shows that the rise in aggregate recycling was statistically significant, and this was confirmed by an appropriate test.

7.10 In Figure 7.1 the order in which the various categories are listed has been amended slightly as compared to Table 5.9 to account for the fact that backfilling of quarry voids was not separately recorded in 1999.

Figure 7.1: Changes from 1999 to 2001



The Reliability of the Estimates

7.11 The confidence bands quoted above are derived from mathematical processes, and they make no allowance for any errors or unreliability which may have been introduced by the use of incorrect or inadequately justified assumptions. Specifically, the reliability of the total populations (of crushers, landfills and particularly of registered exempt sites), is a cause for some concern.

7.12 In 1999 this aspect was identified as "... the most likely, and the most serious, source of error". Although we believe that the populations were better estimated in 2001 than they were in 1999, they will have included some errors.

7.13 By way of illustration, in 1999 the total population of crushers active on C&D waste was estimated prior to the survey to be 493. In 2001, more detailed preparation, aided by information gleaned in 1999, raised the estimated population to 767 machines. This very significant rise - of 55% - reflects both a population which is genuinely rising, and a better 'detection rate'.

7.14 As in 1999, the greatest uncertainty surrounds the true number of Paragraph 9 & 19 registered exempt sites. This issue was discussed in the final section of Chapter 6, which deals with the levels and reliability of the regional estimates, where it was pointed out that, any questions raised by unreliability in the estimated national population size become more serious if there are grounds for believing that such unreliability is geographically biased, and unfortunately, there are good grounds for believing this to be the case, particularly for Paragraph 9 & 19 registered exempt sites.

7.15 For the reasons set out in Chapter 6, we believe that on balance, it may be safer to conclude that the overall (national) tonnage of hard C&D and excavation waste probably lies towards the lower end of the expected band rather than at or above the mid-point.

Urban and Rural Differences

7.16 There is a completely different issue linked to the regional estimates obtained from the survey of operators of crushers and screens which may be felt to be worth exploring in future, particularly if our preferred solution (of introducing some element of compulsion to the survey - see below for details) is not taken up.

7.17 As discussed at the start of Chapter 6 and in Annex 8, the question of how real the regional differences between crushers are is important in estimating the confidence intervals around the central estimates.

7.18 When arisings of C&D waste were first estimated (by Arup, in the early-mid 1990s) there was thought to be a real difference between crushers in London and those elsewhere, with London crushers having a higher average throughput. Evidence from the 1999/2000 survey and from the present one, as well as anecdotal evidence from industry observers, suggests that the difference is more likely to be between urban/urban fringe crushers on the one hand, and rural crushers on the other.

7.19 There is logic behind this: construction, and more particularly the demolition and redevelopment of old structures, is primarily an urban phenomenon. The larger the urban centre, the greater the reliance on a ring of surrounding waste management facilities.

7.20 Whereas this is more extreme in the case of London (with much of the supporting waste management infrastructure lying in adjacent parts of Hertfordshire, Essex, Kent, Surrey, Berkshire and Buckinghamshire), the same can be seen around Birmingham, Manchester, Liverpool, Leeds-Bradford etc. The big difference is that whereas London is defined as a separate statistical region, the other major cities all lie in regions which also include much or all of their hinterland.

7.21 London's hinterland, by contrast, lies in otherwise predominantly rural East of England and the more mixed South East. This means that the regional mean for East of England covers the full range from large London-driven crushers around the M25 to small, local operations in rural East Anglia. Even a substantially better response rate to future surveys will not overcome this structural fault line.

7.22 However, Annex 10 does explore one possible way of addressing this in future surveys.

Issues Raised by Survey Design and Management

7.23 The survey forms were simpler than in 1999/2000, and in general they worked well. Some respondents provided information that needed to be checked, but this was not an undue problem, and certainly no worse than in 1999/2000.

7.24 The chase-up survey forms (sent to operators of crushers and screens and licensed landfills only) were even simpler than the main forms and - particularly in the case of the landfills - apparently very satisfactory in getting the necessary information from respondents. However, it should be noted that the simpler a form becomes, the fewer opportunities there are for picking up inconsistencies: asking the same question in more than one formulation is good survey technique (because it builds in an element of self-checking), but it is also irritating to the respondent.

7.25 Despite the above, the overall response rates were no better than in 1999/2000, and there was some anecdotal evidence (as there had been two years previously) of 'survey fatigue' and a general unwillingness to provide information that was not officially mandated.

7.26 Another difference between the 1999/2000 survey and this one (which might be linked to the previous point) is that the earlier one had the Environment Agency's logo on the covering letter.

7.27 Three specific points which have potential implications for future survey form design emerged during the analysis of the survey returns and/or at the final meeting of the project Steering Group. They were as follows:

i. it would be desirable if any future survey of crushers and screens could deal better with the issue of owned vs. hired-in crushers;
ii. it may be worth including a question in any future survey of licensed landfills to establish the extent to which operators are using primary or secondary aggregate

materials for site engineering and restoration, including primary materials quarried from within the landfill site itself;
iii. it may be worth including a question in any future survey of registered exempt sites to clarify the nature of the work being carried out at the site concerned.

Improving Future Survey Response Rates

7.28 The only ways to get better data from future surveys are:

i. to improve the survey databases further; and/or
ii. to raise the response rates.

7.29 Improving the survey databases means spending more time on the preparatory phase. It also relies on the continuing good will and assistance of local authorities and the Environment Agency in particular.

7.30 The cooperation of operators can be encouraged by not running such surveys too often, and by consulting in advance with industry associations. Nevertheless, we have some doubts that the response rates for the various surveys could be significantly raised without either making them more fully official or linking them more closely to other official data collection mechanisms.

7.31 In the case of crushers and screens this might involve changing the regulatory regime, including the introduction of a requirement for annual reporting linked to the renewal of authorisation.

7.32 A suggested standardised survey form which could be used by the body responsible for overseeing, authorising, licensing and/or exempting the machines concerned is included in Annex 11. It would be possible to go one step further, and to say that it would be desirable if such a standardised form could be used by any organisation carrying out a general survey of recycled aggregate production.

7.33 As far as licensed landfills are concerned, there is a strong case for urging that data on the use and disposal of hard C&D and excavation waste should, if at all possible, be collected at the same time as the Environment Agency's regular waste returns. Not only would this very probably increase the response rate, but it would save landfill operators from having to pull the same information from their files on two separate occasions. A suggested survey form for this purpose is included in Annex 11.

7.34 As far as Paragraph 9 & 19 registered exempt sites are concerned, we would not wish to change the very specific and detailed recommendations which were included in EA R&D TR P402. Although these have not been adopted, they are reproduced (with the kind Findings and Discussion permission of the Environment Agency) in Annex 12. Should the changes set out there not be acceptable, a fall-back suggested survey form is included in Annex 11 to this report.

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Chapter 8 Conclusions and Recommendations

Conclusions from this Survey

C1 Analysis of the survey results yields the conclusion that between 80 and 108 million tonnes of hard C&D and excavation waste were produced in England and Wales in 2001. The central estimate is 93.91 million tonnes, and the confidence level applicable to this estimate and the surrounding band (± 15%) is 90% (see paragraph 7.2). Reliability is discussed in Chapter 7, where it is concluded that the accuracy of the estimated population of Paragraph 9 & 19 registered exempt sites is the most significant single source of potential error. However, the accuracy of the estimates of other elements (eg 38.02 million tonnes ± 18% of recycled aggregate) is unaffected by any uncertainties regarding Paragraph 9 & 19 registered exempt sites.

C2 Out of the total waste stream, 38.02 million tonnes (± 18% at the 90% confidence level) was recycled as aggregate. This compares to 22.70 million tonnes in 1999. (The corresponding figures for England only are 36.47 and 22.05 million tonnes.) The increase is statistically significant (see paragraph 7.9) and reflects a better 'detection rate' of crushers and screens, and a real increase in their numbers (see paragraph 7.13). Regional estimates of the amount of recycled aggregate are given in Table 5.9. These regional estimates are much less precise than the national figure, and no direct comparison can be made with the 1999 regional figures. In addition to recycled aggregate, 7.05 million tonnes of the waste stream was recycled as soil in 2001.

C3 As reported in paragraphs 7.4 to 7.6 and Table 5.9, of the remaining 48.84 million tonnes:

> i. 2.68 million tonnes (2.9% of the total waste stream, including 1.33 million tonnes of hard C&D waste used for landfill engineering or restoration) was accounted for by uncontaminated (and unrecycled) hard C&D waste and by heavily mixed and/or contaminated hard C&D waste with varying potential for recycling as aggregate;
> ii. 5.51 million tonnes (5.9% of the total waste stream) was mixed CDEW (primarily soil, but mixed with some hard C&D waste) with limited scope for recycling as aggregate; and
> iii. 40.65 million tonnes (43.3% of the total waste stream) was wholly or mainly accounted for by waste soil and excavation waste with little or no scope for recycling as aggregate.

As in 1999/2000, there is very little evidence of hard C&D waste which could easily be turned into aggregate being disposed of to landfill. It is again concluded that the key to increasing the proportion of hard C&D waste recycled as aggregate is to improve on-site separation of these materials (concrete, bricks, tiles and suchlike) from soil and other potentially deleterious materials in order to make them more accessible to the recycling industry.

C4 If more C&D waste is diverted from landfills and registered exempt sites, some material which is currently used for landfill engineering or for engineering purposes on registered exempt sites may have to be replaced with low-grade primary aggregates or mineral wastes. It is very possible that up-grading the newly available C&D waste for aggregate use will require considerable effort, and that leaving matters as they are would actually be more efficient from a

resource use standpoint. Some quarries and similar workings would also have problems complying with their planning requirements if a significant proportion of clean materials were to be diverted for recycling.

C5 Simplifying the forms compared to 1999/2000 did not result in a significant change in the survey response rates (reported in Chapter 5). There was again some anecdotal evidence of 'survey fatigue', particularly among operators of crushers and screens (see paragraph 7.25). It is concluded that introducing some form of compulsion may be the only way to ensure a notably higher response rate in future.

C6 Of the three main groups surveyed, landfill operators were able to provide the best and most reliable data, simply because of the record-keeping obligations imposed on them by their licensing conditions. Large landfills account for over two thirds of the hard C&D waste and soil going to landfills (see Table 5.6).

C7 Although the Environment Agency's list of Paragraph 9 & 19 registered exempt sites was definitely better than in 1999/2000, it was nevertheless concluded that a better, nationally consistent registration system for Paragraph 9 & 19 sites is needed (see paragraph 7.34).

C8 Regional estimates for C&D waste arisings were produced, with stated confidence intervals (see Table 6.5), but inevitably the precision of these estimates was lower than for the equivalent national estimates even before taking into account regional differences in the estimated populations of crushers, landfills and Paragraph 9&19 registered exempt sites. No direct comparison between the 1999 and 2001 regional estimates should be made, because the 1999 estimates had no attached confidence limits.

Recommendations for the Future

R1 Consideration should be given to reviewing the arrangements for overseeing, authorising, licensing and exempting from licensing mobile and fixed crushers and screens. It would be particularly desirable if the renewal of any permit, licence or exemption (whether by the local authority or the Environment Agency) were to be accompanied by collection of data on the previous year's activity.

R2 If R1 cannot be implemented, such that future surveys of operators of crushers and screens are required, then the possibility of classifying the underlying population differently from on this occasion should be investigated first. As discussed in Chapter 7 (starting at paragraph 7.16) and in Annex 10, this classification might in future be not just into those 'probably involved' with processing C&D waste (Group 1 on this occasion) and those 'possibly involved' (Groups 2&3 on this occasion), but might also take account of their urban or rural setting. It is recommended that the use of population density as a proxy for the degree of urbanisation should be investigated further.

R3 Future surveys of landfill operators would benefit from a more consistent and complete database of licensed landfills than was available in 2001/2002. It is hoped that the new system of landfill categories required under the landfill Directive will add further value to the classification of landfills.

R4 Anything which could be done to 'capture' the information that is required either direct from

regular landfill site returns, or by collecting it at the same time as site returns, would be desirable (see paragraph 7.33). Serious consideration should be given to collecting data on hard C&D and excavation waste entering landfills in future by distributing a separate annual survey form (using the format suggested in Annex 11) at the same time as regular site returns are being completed by operators of licensed landfills. Special emphasis should be given to surveying large landfills (both large inert and other large sites).

R5 Where registered exempt sites are concerned, the key lies in better record keeping of those sites which are currently active. Greater clarity (or removal of the distinction) between the uses of Paragraph 9 & 19 exemptions would also be highly desirable. The detailed recommendations (made in 2000 and contained in EA R&D TR P402) which set out ways in which these aims could both be achieved are reproduced in this report as Annex 12.

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Annex 1: Research Specification, Survey of Arisings and Use of Construction and Demolition Waste in England and Wales in 2001

Introduction

The Department for Transport, Local Government and the Regions (DTLR) requires information on the use of construction and demolition waste as aggregate. It will be used to monitor and review MPG6, and to monitor the effects of the aggregates levy. The National Assembly for Wales (NAW) will use the information to monitor and review their Aggregates Technical Advice Note.

A survey carried out by the Environment Agency with support from DETR produced estimates of C&DW arisings, use and the scope for further use in England and Wales in 1999. A copy of the report is attached. We now wish to build up a time series of data on a comparable basis for England and Wales, with 2001 as the base date.

Compared to the EA Survey, the future surveys will focus more on aggregate use and the potential for aggregate use, and will each relate to one year (and not for both a single week and one year as in the EA Survey). It is expected that the survey will be based on an inventory of authorised mobile crushers provided by DTLR (and amended by industry) but will also need to cover landfill sites and exempt sites, though not necessarily as a single survey. Careful consideration will be needed of how to get the best possible results from exempt sites.

The criteria against which tenders will be assessed are given in Annex 1.

Aim

The Aim of the survey is:

> *To collect data on the arisings and use of construction and demolition waste (C&DW), including hard materials and soils in 2001.*

This will provide a basis for producing reliable estimates for England and Wales and for RAWP regions of:

- the amount of C&DW arising;
- the amount crushed or screened for use as aggregate;
- and the scope for further use of C&DW as aggregate.

Objectives

The Objectives of the survey are:

a. To review briefly recent relevant surveys with regard to methodology and results.
b. To develop, in consultation with the Steering Group, an agreed methodology that will provide the required estimates. The methodology will cover sampling, questionnaire design, pilot surveys, grossing up procedures, and validation procedures. The following issues will need to be addressed:

1. the need to provide a baseline for future surveys;

2. the need to minimise the burden on respondents and to avoid duplication with other surveys including those of the NFDC, QPA and the EA;

3. the required confidence limits of the estimates at national level, for England and Wales separately, and at regional level;

4. the difficulty of getting information about exempt sites;

5. the DTLR will provide a list of authorised crushers.

c. Following the agreed methodology, to design in detail the questionnaire surveys and associated guidance, in consultation with the Steering Group.
d. To carry out the surveys.
e. If needed, carry out a follow up survey to assess the consequences of non-responses.
f. To analyse the results and produce the required estimates, and estimate the confidence limits of the estimates.
g. To produce a commentary on the reliability of the estimates and on the factual comparison with previous estimates.
h. To prepare a final report to a standard suitable for both hard copy and website publication.
i. To identify any lessons for related future surveys.

Deliverables

The deliverables are set out below. Twenty copies of all written outputs will be produced and they should be prepared to an adequate standard for review by the Department and Steering Group, eg typescript is acceptable, and should be in a form which allows reproduction.

Output 1

A report on the proposed methodology for discussion by the Steering Group.

Output 2

Draft questionnaires and guidance notes for discussion by the Steering Group.

Output 3

Amended questionnaires and guidance notes.

Output 4

Report on the survey including response rates, the emerging results and any recommendation for a follow-up survey for discussion by the Steering Group.

Output 5

A report on any follow-up survey.

Output 6

A draft final report describing the work carried out, including the conduct of the survey, and presenting and commenting on the results. It will include an Executive Summary which could be published separately to serve as a summary of the work and the main results.

Output 7

A final report to a standard, and in a form suitable for both hard copy and website publication by DTLR.

Output 8

A presentation of the results to the RAWP Secretaries and at least one national conference for interested stakeholders such as the BGS Minerals Industry Forum, as agreed with the DTLR.

Quality Plan

The proposal should include a quality plan setting out quality assurance procedures. This will include measures to ensure the quality and fitness for purpose of the final report, indicating who will be responsible for editorial control.

Project Management

Contact between the contractor and DTLR about the contract should be through the DTLR contract manager. The work will be guided by a Steering Group comprising representatives of the DTLR, DEFRA (Waste Strategy and Construction), NAW, QPA, BAA, NFDC, ESA and EA. The Steering Group will meet about 4 times:

- to consider the proposed methodology
- to agree the details of the methodology and the questionnaires and guidance notes
- to discuss the emerging results and need for any follow-up survey
- to agree the final report.

Duration and Timetable

The Department expects the length of the contract to be about 10 months, and the work should be completed by 30 August 2002. The survey should take place in early 2002 while memory is fresh and therefore the methodology and survey forms and guidance should be agreed by 1 February 2002.

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Annex 2: Members of the Project Steering Group

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 recommendations are those of the study team, as is the responsibility for any errors or omissions.

Public Sector Representatives:

Office of the Deputy Prime Minister (formerly the DTLR):

Brian Marker	Minerals and Waste Planning Division (Chair)
Richard Hilton	Minerals and Waste Planning Division (Contract Manager)
Andrew Lipinski	Minerals and Waste Planning Division (Secretary)

Welsh Assembly Government/National Assembly for Wales

Susan Martin	Welsh Assembly Government
Sarah Downes	Welsh Assembly Government

Department of Environment, Food and Rural Affairs

Gillian Neville	Waste Strategy
Pat Kilbey	Environmental Protection Statistics
Wendy Baillie	Environmental Protection Statistics

Department of Trade and Industry

Julia Mayer	Construction Sector Unit
Christine Jarvis	Construction Sector Unit
John Newman	Construction Sector Unit

Environment Agency

Ralph Crouch	North East Region Waste Strategy Manager
Andy Rees	Environment Agency Wales
Cathy O'Brien	Environment Agency Wales

HM Customs & Excise

Jon Anderson	Excise Policy Group

Local Government Association

Peter Toombs	LGA
John Farrell	Uttlesford District Council

Industry Representatives

British Aggregates Association

Peter Huxtable	BAA
Paul Allison	Sherburn Stone Co

Environmental Services Association

Andrew Ainsworth	ESA

National Federation of Demolition Contractors

David Coleman	Coleman & Co

Quarry Products Association

Richard Griffiths	QPA

Study Team Members

Andrew Herbert	Symonds Group
David Knapman	Symonds Group
Julian Ellis	WRc

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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

'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 Waste Catalogue (see below), 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.

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 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 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;
- process waste from the crushing and/or screening of hard C&D waste (ie 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;
- 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 (eg 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. Landfills

'Landfills' are sites licensed by the Environment Agency to receive waste materials for final disposal (including site restoration and engineering) under the provisions of the Waste Management Licensing Regulations 1994 (SI No 1994/1056).

13. Registered exempt sites

'Registered exempt sites' are sites which are notified to the Environment Agency 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 9, 13, 19 and 24, and particularly Paragraphs 9 and/or 19 which allow for the spreading or use on land or temporary storage of specified (mainly inert) materials.

For the avoidance of doubt, the full wording of Paragraphs 9 and 19 from Schedule 3 (which is entitled 'Activities Exempt from Waste Management Licensing') are reproduced in full below.

Extracts from Schedule 3 of the Waste Management Licensing Regulations 1994 (SI No 1994/1056) ('Activities Exempt from Waste Management Licensing')

Paragraph 9

"9.

> *1. Subject to sub-paragraph (3) below, the spreading of waste consisting of soil, rock, ash or sludge, or of waste from dredging any inland waters or arising from construction or demolition work, on any land in connection with the reclamation or improvement of that land if -*
>
> > *a. by reason of industrial or other development the land is incapable of beneficial use without treatment;*
> >
> > *b. the spreading is carried out in accordance with a planning permission for the reclamation or improvement of the land and results in benefit to agriculture or ecological improvement; and*
> >
> > *c. no more than 20,000 cubic metres per hectare of such waste is spread on the*

land.

2. The storage, at the place where it is to be spread, of any such waste which is intended to be spread in reliance upon the exemption conferred by sub-paragraph (1) above.

3. Sub-paragraph (1) above does not apply to the disposal of waste at a site designed or adapted for the final disposal of waste by landfill."

Paragraph 19

"19.

1. The storage on a site of waste which arises from demolition or construction work or tunnelling or other excavations or which consists of ash, slag, clinker, rock, wood or gypsum, if -

a. the waste in question is suitable for use for the purposes of relevant work which will be carried on at the site; and

b. in the case of waste which is not produced on the site, it is not stored there for longer than three months before relevant work starts.

2. The use of waste of a kind mentioned in sub-paragraph (1) above for the purposes of relevant work if the waste is suitable for use for those purposes.

3. The storage on a site of waste consisting of road planings which are to be used for the purposes of relevant work carried on elsewhere if -

a. no more than 50,000 tonnes of such waste are stored at the site; and

b. the waste is stored there for no longer than 3 months.

4. In this paragraph, "relevant work" means construction work, including the deposit of waste on land in connection with -

a. the provision of recreational facilities on that land; or

b. the construction, maintenance or improvement of a building, highway, railway, airport, dock or other transport facility on that land,

but not including either any deposit of waste in any other circumstances or any work involving land reclamation."

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Annex 4: Main Survey Forms and Covering Letters

(see links to the right to download)

This Annex contains copies of the main survey forms and covering letters as sent to operators of crushers and screens, licensed landfills and Paragraph 9 & 19 registered exempt sites. They appear in the following sequence:

1. 1-page (Annex 4 (1)) covering letter to operators of crushers and screens;
2. 4-page (Annex 4 (2)) survey form sent to operators of crushers and screens (originally printed as a double-sided A3 sheet, with the second and third pages as the 'centre spread');
3. 1-page (Annex 4 (3)) covering letter sent to operators of licensed landfills;
4. 4-page (Annex 4 (4)) survey form sent to operators of licensed landfills (originally printed as a double-sided A3 sheet, with the second and third pages as the 'centre spread');
5. 2-page (Annex 4 (5)) covering letter sent to operators of Paragraph 9 & 19 registered exempt sites (originally printed double-sided); and
6. 2-page (Annex 4 (6)) survey form sent to operators of Paragraph 9 & 19 registered exempt sites (originally printed double-sided).

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Annex 5: Statistical Method for Sampling Crushers

(see link to the right to download)

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Annex 6: Simplified Follow-up Survey Forms and Covering Letters

(see links to the right to download)

This Annex contains copies of the follow-up survey forms and covering letters as sent to non-respondents from the structured samples of operators of crushers and screens and of licensed landfills. They appear in the following sequence:

1. 1-page (Annex 6 (1)) covering letter to operators of crushers and screens;
2. 1-page (Annex 6 (2)) follow-up survey form sent to operators of crushers and screens (originally printed on the back of the covering letter);
3. 1-page (Annex 6 (3)) covering letter sent to operators of licensed landfills;
4. 1-page (Annex 6 (4)) follow-up survey form sent to operators of licensed landfills (originally printed on the back of the covering letter).

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Annex 7: Statistical Method for Comparing Data: Different Groups of Respondents

(see link to the right to download)

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Annex 8: Options and Practice for Regional Grossing-up

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Annex 9: Detailed Regional and National Estimates

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Annex 10: Dealing with Urban-Rural Differences: A Potential Way Forward

(see link to the right to download)

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Annex 11: Format for Suggested Future Survey Forms

(see link to the right to download)

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Annex 12: Proposal for Paragraph 9 & 19 Registered Exempt Sites

The following proposal is made in the context of developing a reporting and/or survey method for use in the future, which was among the most important of the objectives set for this project.

The proposal is framed in the context of work done by Ecotec Research & Consulting for the DETR on the implications of the Landfill Tax on inert waste recovery and disposal, and proposals made to the DETR by the Agency on the subject of exemptions following work by a National Exemptions Working Group. The Agency's proposals are understood to favour making revisions to the exemptions to include the following requirements:

- changes to waste types in the form of an inclusive list rather than relating to activities, and the addition of new waste types;
- a two-tier system of registration depending on the scale of the activity;
- a period of prior notification, and (for larger sites) pre-assessment by the Agency before registration;
- a requirement for the activity to be inspected;
- a prescribed fee to cover the costs of Agency inspections;
- a requirement for the applicant to obtain Planning Permission where appropriate;
- a requirement for applicants to re-register after 12 months;
- clearer definitions of key terms to be provided, to aid interpretation.

It is understood that the Agency intends to give early priority to a short list of exemption types, including those granted under Paragraphs 9 and 19.

In the light of this project, and notwithstanding the first bullet point above, it is suggested that the activities of storage and spreading (or other use) on land should be separated and the following text formed Annex 11 to EA R&D TR P402. As such it contains suggestions which were put to the Environment Agency in 2000 as part of a wider report following the 1999/2000 survey. While the suggestions may be being considered, they have not been adopted by the Agency, and are included here for information only. dealt with via different exemptions. One possibility would be to use Paragraph 9 to deal with exemptions for the temporary storage (but not final use) of mainly inert materials comprising soil, rock, ash, clinker, dredgings, construction and demolition waste (including wood and gypsum) or road planings. This proposal includes no recommendations for introducing reporting obligations for operators of sites for the temporary storage of mainly inert materials. Such sites ought not to account for any production, processing, re-use or disposal as a result simply of their temporary storage exemption.

At the same time, it is suggested that Paragraph 19 should be changed into an exemption for the use by spreading or burial of inert materials. This would involve the removal from current

Paragraph 19 of wood and gypsum (unless present in very small and defined proportions, set on the basis of the need to protect the environment). Such spreading or burial would be for the purposes of the reclamation or improvement of land or permanent tracks or pathways, or for other infrastructure works (including bulk fill, noise bunds or reprofiling) covered by Planning Permission or some equivalent approval.

It is recommended that every such exemption should be granted to a named person or company by a specified local Agency office, and that, to facilitate coordinated reporting, such exemptions would apply only to activities within the geographical area covered by that local office. The Agency's own proposals to the DETR are based on the principles that:

- the granting of exemptions should be dependent on the receipt by the Agency of a minimum level of satisfactory information from the applicant; and that
- every exemption should be dated and time-limited, normally for 12 months, after which it would need to be renewed, or be deemed to have expired.

It must be recognized that applicants will not always know when framing their applications precisely how much material they are likely to receive, and over what period. It is therefore important that any registration and reporting system (which this project strongly suggests should be closely integrated) should be sufficiently flexible to allow for such uncertainty.

In defining the distinction between small- and large-scale activity, the following findings from the main survey are relevant:

- sites accepting over 2,000 tonnes a year accounted for 98.9% of the material spread or otherwise used on registered exempt sites, but only 18.5% of the sites;
- the equivalent figures for sites accepting over 5,000 tonnes were 94.3% (tonnes) and 11.4% (sites);
- the equivalent figures for sites accepting over 10,000 tonnes were 91.9% (tonnes) and 9.1% (sites).

This report proposes that every exemption granted for the spreading or other use of inert waste should fall into one of the following categories:

Type 1 exemption for up to five small sites expected to be active over the life of a single 12-month exemption;

Type 2 exemption for a single large site; Proposal for Paragraph 9 & 19 Registered Exempt Sites

Type 3 exemption for any other site thought at the outset to be likely to remain active for more than 12 months.

Type 1 exemption holders would include most current exemption holders (farmers,

householders, small businesses, Parish Councils and so on). Regular small users (such as hauliers and small builders) would simply need to re-apply each year. Under this system any exemption holder would be allowed to hold more than one exemption in any local Agency area. Type 2 and 3 exemption holders would be required to report to the Agency data on the amounts of different materials used each year.

If registration and reporting are to be dealt with in an integrated manner, which this project suggests is a highly desirable approach, it is impractical to make proposals for reporting without knowing how registration is to be dealt with. Although it goes beyond the strict terms of reference of this project, a proposal has been developed for a combined Application, Approvals and Reporting Form consistent with all of the proposals set out above. This is set out below. This form, if adopted, would be equally applicable to all exemptions for the spreading or other use of inert wastes, thereby addressing the issue of uncertainty over how a site might develop over time.

It is considered very important that a clear distinction should be made between the person completing the form, the owner of the site, and the person capable of answering future questions about the site. This project found that the person who signed the application for an exemption, sometimes a consultant, often had no subsequent responsibility for the site, and no way of reporting on it.

It is suggested that there should be a single system for issuing exemption numbers across the whole country. This could relatively easily be achieved by giving every exemption a numerical code taken from a series specific to the issuing Agency office. It is recommended that the coding system should enable reports to be run by Agency region, by local Agency office, by county (or planning region), or by date. The removal of 'dead' exemptions would be greatly facilitated by such a system.

Were this system to be adopted, monitoring activity on registered exempt sites would be much more straightforward than at present, and any future statistical survey could consist of a structured sample of exemptions. The objective of such a survey would be to confirm whether the information provided at the time of application and approval turned out to be accurate or (in the case of non-reporting exemption holders) whether the exemption was used as originally intended.

Any objection to this proposal on the part of exemption holders and applicants for exemptions should be dealt with in the context that such exemptions as are granted absolve the holder from the need to hold a waste management licence, not from the broader provisions of waste management regulation.

Most applicants, who only operate very small sites (filling potholes in farm tracks, or creating small areas of hard standing) would not be required to report anything once an exemption had been granted and accepted, and the information required in 1-13 appears to be the minimum that the Agency would require in order to discharge its statutory obligations (to report on the operation of the waste management system in its geographical area of responsibility).

No section has been included in the draft form for fee information, but this could be included once the Agency's own proposal to the DETR has been further developed.

DRAFT PROPOSAL FOR AN APPLICATION, APPROVAL & REPORTING FORM FOR REGISTERED EXEMPT SITES ON WHICH INERT MATERIALS ARE TO BE SPREAD OR OTHERWISE USED		
To be completed by the Applicant		
1	Location/identity of all site(s) covered by this application. All sites should be in a single County and in the area covered by a single local Agency office. (attach maps and/or grid references if necessary).	
2	Name, address and telephone number of person (NB not persons) responsible for the site(s), and for dealing with any future questions connected with this exemption.	
3	Name(s), address(es) and telephone number(s) of the owner(s) of the site(s) at the time of the application (if not the same as above).	
4	Name, address and telephone number of the person responsible for completing this application form (if not the same as either of the above).	
5	Date of completing this form.	
6	Date from which the exemption is expected to run.	('From date of Planning Permission, if granted' is an acceptable answer at this stage)
7	Is it intended that all of the activity covered by this exemption will be completed within 12 months of the date from which the exemption is to run (see 6 above)?	Yes / No
8	How much material is expected to be used on the largest of the sites identified in 1?	(tonnes)
9	Which type(s) of materials are expected to be used on the site(s) identified in 1? (Tick all as appropriate)	Soil: Rock: Mixed soil, rock and rubble: Builder's rubble: Road planings: Processed aggregates: Ash, slag and/or clinker: Dredgings:
10	Will the materials identified in 9 come from sources not under the control of one or more of the persons identified in 2-3 above?	Yes / No
11	Is the activity to be carried out at 1 to be added to an existing exemption?	Yes / No
12	If the answer to 11 is 'Yes', give the existing exemption number.	
13	Signature of Applicant (also print name)	

To be completed by the local Agency office after 1-13 above have been completed			
14	Address and telephone number of Agency office.		
15	County to which exemption applies.		
16	Name of person dealing with this application.		
17	Date of granting (or refusing) this exemption.		
18	Exemption type (or refusal).	1 / 2 / 3 / Refused	
19	Exemption number.	New number: Add to existing number:	
To be completed by the Applicant after 14-19 above have been completed, and before any materials are received on site			
20	Exemption acknowledged. Reports (required for sites accepting more than XXX tonnes of materials under exemption types 2 and 3 - see 18 above) will be provided in the following format (see 22-26 below).	Signed: Print name: Dated:	
21	Date from which exemption will actually run (i.e. earliest date for first delivery of materials).		
To be completed by/for the Applicant within 13 months of the date given in 21 above and submitted to the Agency office identified in 14 above, or at the special request of the Agency at any other time			
22	Exemption number (see 19 above).		
23	Type(s) and amount(s) of materials used on the sites covered by this exemption in the 12 months following the date in 6 above or the date in 21 above (if later).	Soil: Rock: Mixed soil, rock and rubble: Builder's rubble: Road planings: Processed aggregates: Ash, slag and/or clinker: Dredgings:	Tonnes
24	Is all of the activity covered by this exemption now complete?	Yes / No	
25	Is any time extension to the exemption required? (If Yes, a new application should be completed).	Yes / No	
26	This report (22-26) prepared by:	Signed: Print name: Dated:	
For Agency use			
27	Site(s) inspected? (When, by whom?) Any other notes.		