SUSTAINABLE CONSTRUCTION FOR THE FUTURE

Refereed Paper

BENCHMARKS FOR RECYCLING PRACTICES IN COMMERCIAL OFFICE BUILDING REFURBISHMENTS: DATA COLLECTION CHALLENGES

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ABSTRACT

In recent years considerable effort has gone into quantifying the reuse and recycling potential of waste generated by residential construction. Unfortunately less information is available for the commercial refurbishment sector. It is hypothesised that significant economic and environmental benefit can be derived from closer monitoring of the commercial construction waste stream. With the aim of assessing these benefits, the authors are involved in ongoing case studies to record both current standard practice and the most effective means of improving the eco-efficiency of materials use in office building refurbishments. This paper focuses on the issues involved in developing methods for obtaining the necessary information on better waste management practices and establishing benchmark indicators. The need to create databases to establish benchmarks of waste minimisation best practice in commercial construction is stressed. Further research will monitor the delivery of case study projects and the levels of reuse and recycling achieved in directly quantifiable ways.

Keywords: **Waste management, waste minimisation, refurbishment, reuse, recycling, commercial construction**

BENCHMARKS FOR REUSE AND RECYCLING PRACTICES IN COMMERCIAL OFFICE BUILDING REFURBISHMENTS: A LOOK AT VARIOUS SOURCES OF INFORMATION

1.0 INTRODUCTION

It is estimated that the construction and demolition industry in Australia generates up to 40% of all waste going to landfill (Bell, 1998). This is at the upper level of international rates (Bossink and Brouwers, 1996) and represents an ongoing cost to the community, to industry and to the environment. Commercial refurbishment, in particular, is a large volume generator of waste. Some authorities have suggested that as much as 90% of this waste stream is potentially reusable or recyclable if due consideration is given to the potential benefits (BRE, 2003; Building Designers Association of Victoria, 1998). Meanwhile, government sponsored programs such as the WasteWise Construction Program have demonstrated the effectiveness of waste minimisation programs for several of Australia's largest construction companies (Andrews, 1998; ABS, 2003; Environment Australia and Bell, 2000). These facts point to an opportunity for the construction industry generally, and the refurbishment sector specifically, to improve its performance in relation to environmental sustainability without loss of profitability. It remains for the industry and its researchers to develop methodologies and practices which will spread sustainable waste management systems throughout construction companies of all sizes and sectors.

Currently there is little consistency in the collection of data about waste minimisation or material salvage. There are no established benchmarks, few cross project comparisons and, as a result, little identification of under-performance. Furthermore, the issues that affect rates of reuse and recycling have not been determined other than in a case by case situation. From a life cycle approach to waste minimisation, the distinction between reuse and recycling of waste is significant. For the purposes of this study, 'reuse' is defined as involving an extended life for building materials or components without the need for significant alteration or transformation. 'Recycling' refers to the use of salvaged material as feedstock for new material which could involve significant transformation and reprocessing.

With this in mind the researchers involved in this study have developed an approach that utilises a number of techniques to determine the state of current practice in recycling and waste management for commercial office building refurbishments. These have included a review of current construction waste minimisation and recycling information resources available via the internet; a Delphi study involving experts in construction management; case studies of ongoing refurbishment projects and engaging a 'focus group' of experts on waste management in construction. This paper deals with issues relating to methodology and reports on progress towards developing a method for collecting data that is robust and directly comparable across a range of projects. Such a method is required in order to integrate the range of information currently available from various sources in differing formats. It is intended that the end result of this ongoing research will be a Best Practice Guideline for waste minimisation in refurbishment projects which will be of value to the industry as a whole.

2.0 WEB-BASED RESOURCES

The first phase of the research was a review of the existing web-based resources dealing with recycling and waste management in construction. This was undertaken in order to analyse trends in the collection and reporting of data on waste and the methods that are used. While there is a plethora of useful recycling information, the main conclusion drawn

from this review, is that there is no consistently recognised method for collecting and quantifying data on waste generated by construction refurbishments or by construction and demolition generally.

A search of website information on recycling and construction waste minimisation revealed a diverse range of approaches and methods. Two significant approaches invite discussion about their relevance to commercial refurbishment projects. These are the waste auditing approach represented by the SMARTWaste system in the UK and the market driven recycling-based approach adopted in the USA and fostered by organisations such as the Environmental Protection Agency and the California Integrated Waste Management Board.

SMARTWaste is a tool developed by the Building Research Establishment (BRE) in the UK (BRE, 2005) for recording and managing construction waste. The system is available for use by builders and project managers. It collects data on waste generated, then divides this waste into two categories: 'sent to landfill' and 'segregated'. It analyses trends and highlights the areas most in need of attention. Regulatory incentive for the use of such tools is provided by the UK Landfill Tax established in 1996 with the intention of diverting significant percentage of overall waste generation away from landfill sites (Coventry et al. 2001). SMARTWaste does not address the issue of what becomes of the segregated waste, and does not distinguish between reuse and recycling. This presents a particular problem when dealing with refurbishment projects. An example of the way that this system differs from an ultimate destination approach can be illustrated by the manner that asbestos fibre waste removal from a refurbished building is recorded. Under SMARTWaste this would be considered 100% segregated but from a life cycle point of view it would have to be 0% reused or recycled. The SMARTWaste software is not intended specifically for refurbishment projects therefore the distinction is not important for their purposes. The project has, nevertheless, been successful in lifting the profile of waste diversion on UK construction sites as well as in quantifying the benefits of on-site segregation of waste materials.

In the United States the emphasis is generally on encouraging the widespread use of products with recycled content and thereby creating a market which gives economic value to waste products and in turn encourages recycling. The California Integrated Waste Management Board (CIWMB) website provides extensive lists of building product suppliers with the percentage of Post-consumer Content (PC) and Total Recycled Content (TRC). The TRC includes the PC plus recycled material from within the manufacturing process itself, in other words, process efficiency gains. The PC percentage is an indirect measure of how much material has been diverted from landfill (CIWMB, 2005). Case studies of successful 'green building' projects are also provided as exemplar projects.

Both the auditing of the waste stream and the preferential treatment for recycled content can improve waste management in construction refurbishment. A combination of the two strategies is likely to be more effective than either strategy employed in isolation. However, the type of data yielded by the two approaches is not very useful for the purposes of our study. This study requires that a clear distinction is made between reuse and recycling and that the ultimate destination of the waste is taken into account. This renders the SMARTWaste data incompatible. Data listed on the CIWMB website, meanwhile, does not specify whether the percentages are listed by weight or by volume and the breadth of materials and components listed suggest that they are likely to be either depending on the particular case. The utility of CIWMB data, is therefore also limited.

In terms of waste stream monitoring, Waste Management Plans are now a common requirement for all kinds of construction projects both in Australia and overseas. Typically these plans prepared as a DA (development application) approval requirement for construction approvals in Australia require estimates to be made of the volume and weight of

certain categories of material (City of Sydney, 2005). The proposed destination of any waste, plus any reuse on or off site, should also be stated. An example of this is given in Appendix 1.

Good practice indicates that it is also necessary to record the destination of all waste after it leaves the site. This avoids the possibility of waste which has been separated but which finds no suitable end user being counted as recycled when it in fact ends up in landfill. Because of the variable value in second-hand materials and components refurbishment projects are particularly likely to be subject to problems of this nature.

There are however, many different formats under which waste data is recorded and frequently the recorded data is not verified or audited to any significant degree. It can be said however, that current good practice appears to include recording waste leaving a construction or demolition site by both weight and volume. If only volume or number of skips is recorded, the variability in the "bulking factor" of the scrap material is likely to mean that results are not comparable across different projects or across different time periods. A study by Seydel et al. (2002) presents a methodology for quantifying these factors and this may have some application to data collection from refurbishment projects.

One of the main difficulties affecting the rigour of research into waste minimisation specifically relating to refurbishment projects is that the 'initial conditions' are not fully known. Although 'as built' drawings and even specifications may be available for an existing building of twenty or more years in age, experience shows that in the vast majority of cases, it is unlikely that these documents will accurately represent the current state of the built form. They are often incomplete and the building may have had renovations and maintenance work done that is not recorded. Consequently, although it is possible to accurately quantify the materials and components that are reused or recycled there is usually some remaining undifferentiated waste whose makeup is unknown because quantities in the original building are not accurately known. Quantities and nature of waste generated by refurbishment projects is difficult for construction managers to predict precisely because of these variable initial conditions.

To summarise, although the review of internet based resources highlighted several difficulties in accounting for waste in refurbishment projects it also indicated that potential gains can be made by establishing methodologies that lead to a lifting of rates of reuse and recycling generally. As the opportunity for doing this is largely within the purview of the construction manager, it was decided to gather information on priorities in refurbishment projects from construction managers with expertise in the area.

3.0 DELPHI STUDY

Phase two of the research utilised findings from a Delphi study conducted by the 'Re-Life' Project for the Australian Cooperative Research Centre for Construction Innovation to determine the significant issues involved in the project management of a commercial office building refurbishment. The study covered several areas including: sustainability and building efficiency; construction management; performance of existing building; recycling and waste management; and floor space optimisation. The overall results of the survey will be reported in detail elsewhere as part of reporting on the Re-Life project. For this project, with specific regard to waste minimisation in commercial building refurbishments, the significant factors determined by the Delphi expert consultation were that the disposal of hazardous waste is a significant issue and that the impact of incorporating Ecologically Sustainable Development principles in the project was likely to be an important driver of waste minimisation.

Hazardous wastes are taken to include such things as asbestos fibres, PCBs, heavy metals, biological contaminants and some paints. The deleterious effect of the discovery of hazardous waste on a project site has been reported on in the literature (Cole, 2000; Ihlanfeldt and Taylor, 2004; Sterner, 2001). Environmental issues were also confirmed as important construction management drivers from the review of the construction literature on the subject (Cole, 2000; Nystrom and Kehr, 2000; Perry, 2003; Poon et al., 2004).

Significantly, the issue of the cost of sending waste to landfill was not rated as significant by the Delphi experts despite studies in the UK finding this to be an important driver for waste minimisation (Lawson et al., 2001). Perhaps this issue may become more important for Australia in the future as the availability of landfill sites becomes more restricted or if landfill charges are increased.

In summary, the Delphi process revealed that waste minimisation is a consideration in office refurbishment projects but it was not a high order priority for the expert group consulted. This could be at least partly explained by the level at which the participants normally interacted with refurbishment and waste management issues. The list of participants mainly comprised of either academics in construction management or high level construction managers. As such they represented a group concerned more with the 'big picture' management of a refurbishment project rather than the day to day issues concerning the efficient utilisation of personnel and materials management on site. Consequently it was considered necessary to look elsewhere for more detailed information on the benefits and the costs of increasing the rate of reuse/recycling on commercial construction projects.

4.0 CASE STUDIES

A third approach at gathering useable data involves the authors participating in the planning and design phase of two large office building refurbishment projects in Sydney and Melbourne. It is envisaged that the output data collected from these case studies will be measured against that collected from other sources. In the case of the Melbourne project a 3D CAD model of the existing building is being produced, in which all the 'objects' or components in the building will be captured and described. The objects will then be tagged for replacement, reuse in place, reuse elsewhere, recycling or disposal in the new design. Actual measurements of waste generated and waste diverted by the refurbishment project will be made. This elaborate and comprehensive procedure will provide a basis for making comparisons between the predicted and actual reuse and recycling rates. It is hoped that data collected about actual waste quantities will either confirm or disprove the validity of the waste generation predictions. This will indeed serve as one of the rare cases of investigating/ identifying the possible occurrence of underperformance in waste minimisations and verifying the validity of waste minimisation forecasts. The costs associated with the procedure may well be justified by the fact that it is meant to serve as an exemplar 'green building' project.

The Sydney case study is an extensive refurbishment of a 1970s twenty two storey office building. In this case 3D CAD drawings are not being produced, however, detailed existing drawings are available which will be supplemented by visits to each floor prior to strip out to record finishes and fixtures. This information will be used to predict waste generation rates which will then be compared to the measured rates achieved. In addition, since some floors will have major replanning and refurbishment and some will just have finishes upgraded, comparisons will be able to be made between the waste generated by a major and a minor refurbishment covering the same floor area.

This promises to be a comprehensive approach and the information collected will be compatible to the needs of our study. However, this is inevitably a long drawn out process.

With shorter timelines to meet research outputs, sole reliance on the case-study approach will generally not be a feasible option. On top of that, such projects are prone to be subjected to commencement delays as has been the experience with both our case studies. The researchers have, therefore, adopted a fourth strategy to quantify waste generation in construction refurbishments. This involves the use of expert focus groups to determine existing practice and broad ranges of reuse and recycling rates that are currently being achieved and the possibilities for the future.

5.0 FOCUS GROUPS

Although some records are currently being kept on rates of reuse and recycling in refurbishment projects, targeting data collection at the most effective level in construction management structures has been a problematic process. The construction management experts enlisted for the 'Re-Life' Delphi study reported above did not have access to this detailed information as it is not readily available. Senior management does not necessarily have a "hands on" acquaintance with this level of information. 'Commercial in confidence' concerns can also impinge on the willingness to share data at this level.

Consequently, a 'focus group' of experts with specific knowledge and experience in waste minimisation for refurbishment projects was established. This group included experts from industry, government and research/ training sectors. Information was collected to quantify the experience level of the expert participant. Personal interviews were conducted that included questions aimed at determining the current state of waste management practice in the refurbishment of commercial buildings in Australia. Both open-ended and directed questions were asked. (Interview questions are included in Appendix 2). The experts were also asked to provide information via charts (see Appendix 3). This information relates to the rates of reuse, recycling and disposal they had experienced for materials and components commonly encountered in commercial refurbishment projects.

At the time of writing, a pilot survey has been completed and the larger focus group interviews are still in progress. Preliminary results confirm the difficulty in collecting data on rates with several respondents initially reporting that it was impossible to put figures on expected rates of reuse and recycling because of project variability and commercial confidentiality issues. Persistent questioning did, however, reveal that some generalised answers could be presented. Having tried various forms of questionnaire, we are finally making progress in collecting data which is being collated and will form the basis of future reports.

The initial response indicates numerous difficulties with the current waste management systems. Respondents confirmed that the presence of certain building material in the building, for example asbestos was likely to severely limit the possibility of any material salvage in a refurbishment project. In addition, considerable cynicism was expressed by the industry representatives interviewed regarding the application of certain regulatory mechanisms such as written Waste Management Plans (WMP). Some respondents complained that policy decisions made by government declaring waste management to be a priority and economic decisions made by private enterprise are, in practice, far apart.

Such cynicism tends to relate to the general approach a particular respondent takes to waste minimisation which in turn tends to relate to the level at which the respondent deals with refurbishment and waste management. In general, respondents who were commercial contractors tended to be sceptical about the value of reuse and recycling. Several insisted that the issue was entirely cash-driven and if money could be saved, reuse and recycling at enhanced rates, would automatically be incorporated. Environmental consultants, on the

other hand, were equally insistent that financial gains could be made from increased reuse and recycling.

The absence of readily comparable cross project data makes it difficult for either side to persuade the other of the validity of their position. If indeed waste minimisation leads to financial savings, this fact is either not common knowledge and/ or is strongly debated by practitioners.

Difficulties were also encountered with the terminology relating to waste management. Some respondents felt that 'waste avoidance', 'waste recovery' or 'material salvage' were more appropriate terms than 'waste minimisation' in the construction site situation - the minimisation concept being more relevant to the planning and design phases of a project. In addition, the survey questionnaire distinguished between 'strip out' and 'fit out' phases of a refurbishment and respondents felt that this distinction was not always clear or that the two phases could sometimes overlap or partially merge. However, it was pointed out that the two stages differed in the nature of waste products generated and the time available for carrying out certain procedures such as waste sorting.

6.0 TOWARDS A METHODOLOGY FOR RESEARCH ON WASTE MINIMISATION

The ongoing research reported in this paper aims at 'plugging the gaps' in the currently available information on waste management approaches and practices. These gaps centre around the absence of consistent data collection and cross project comparisons which can be used to establish benchmarks and identify under-performance Reference to benchmarks helps reassure that the overall performance of the industry is progressing in a positive direction. With increased reuse and recycling we can reduce raw material consumption, mitigate resource depletion and reduce the need for landfill sites - benefits to the community at large. On the other hand, these benchmarks are also an essential prerequisite for targeting the areas where waste needs to be reduced by more efficient management practices as well as through reuse and recycling of materials and components.

There are definite public relations benefits for a construction contractor who can deliver a cleaner and 'greener' mode of operation. This aspect is likely to become increasingly important as the various 'eco-rating' schemes for buildings gain greater public recognition and feed into property marketing strategies and eventually rentals (Bon and Hutchinson, 2000). Some public authorities in Australia are considering requiring certain 'recycled content' levels in their procurement strategies for buildings as has already happened in the USA. Increased recycling rates will then become an imperative for Australian refurbishment contractors. This will make the availability of valid statistical data on recycling rates in refurbishment all the more important.

Several industry participants consulted for this paper reported that inconsistency in regulatory regimes was a big problem. Waste levies vary greatly from state to state and waste management rules vary from one Council area to another. This needs to be addressed by establishing industry best practice criteria which will grow out of the data and information collection for benchmarking.

7.0 CONCLUSION

The authors have identified significant deficiencies in available data relating to waste minimisation in commercial building projects and considerable obstacles to collecting reliable data. This paper provides the basis for an extensive study on methodology for pertinent research on waste minimisation and management. Rather than presenting an esoteric

theoretical discourse on methodology, it reports on practical problems faced while trying to acquire useful information from a range of potential sources. It deals with a number of approaches and means that researchers may employ to acquire the required information and discusses the strengths and weaknesses of each approach. Currently, data is collected by manufacturers on the recycled content of their products and much of this is published. Individual contractors and waste consultants, on the other hand, often withhold data for commercial reasons on reuse and recycling rates on individual projects and they tend not to collate this information over similar projects. There is no mechanism for independent verification or for cross-industry comparisons. The main conclusion that can be drawn from the focus groups held so far in this area is to identify the need for data sharing to establish performance benchmarks for recycling in refurbishment projects.

Environmental consultants in the industry are convinced that reuse and recycling of materials and components has the potential to produce environmental as well as economic efficiencies in commercial refurbishment projects. As yet, however, they have failed to convince commercial contractors of their arguments. Because there is little consistency in the way waste estimates are arrived at and because there is often little or no verification of the actual rates achieved the argument is at present inconclusive. The immediate need is for accurate waste measurement studies including waste outcomes which can be used to establish benchmarks. The case study projects mentioned earlier will go some way towards meeting this need.

The setting of benchmarks for recycling rates remains problematic due to the range of methodologies currently used to define those rates. The establishment of a database through recording case study performance and from the collective experience of experts in the field as well as from case studies will go a long way towards producing the standards for industry best practice guidelines. This will assist in organising and managing data on the 'whole of life' impact of building materials which is currently only available in the form of 'guestimates'.

Waste management in construction is likely to remain largely driven by the interface between policy decisions made at government level and economic decisions made by private enterprise. At the moment these two streams remain far apart. Improvement in the rates of reuse and recycling in construction refurbishment projects will only become widespread when effective merger of the two priorities is achieved. Researchers need to clearly understand the point of view of each industry participant when collecting and evaluating data. Terminology needs to be clarified so that researchers use the same language as the practitioners on construction sites. The ultimate value of this research will be in informing the industry generally of the economic benefits of increased reuse and recycling. Consequently, the ongoing case studies, though difficult, time-consuming and expensive are likely to result in useful benchmarks for the industry as a whole and to lead to the establishing of best practice guidelines for waste minimisation in refurbishment projects.

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Appendix 1 – Typical Details of waste management plans– demolition phase
(Based on EcoRecycle Victoria's Checklist for preparing Waste Minimisation Plans and Council of the City of Sydney's Draft Policy for Waste Minimisation in new developments)

MATERIALS ON-SITE			DESTINATION		
			REUSE AND RECYCLING		DISPOSAL
Type of materials	Est. Vol. (m²)	Est. Wgt. (t)	ON-SITE – specify proposed reuse or on-site recycling methods	OFF-SITE – specify contractor and recycling outlet	- specify contractor and recycling outlet
Excavated Materials					
Garden Organics					
Bricks					
Tiles					
Concrete					
Timber – please specify					
Plasterboard					
Structural Steel					
Steel Reinforcement					
Other Metals					
Asbestos					
Other waste eg. Ceramic tiles, paints, PVC tubing, cardboard, fittings					

Appendix 2 – Focus Group Questionnaire

BACKGROUND

1.	How long have you worked in the Construction Industry?	0-5	6-10	11-20	>20	*Years*		
2.	What is your current position/job title?							
3.	How long have you been in that role?							
4.	How many multi-storey commercial refurbishments would you have worked on?	<10	10-20	>20				
5.	How many commercial refurbishments have you worked on where a consultant was engaged to address waste minimisation?	0	<5	>6				

DESIGN STAGE **%**

6.	As a %, how often do you see Waste Management Plans required for commercial refurbishments?	0	1-24	25-49	50-74	75-99	100	%
7.	How often do you see these monitored?	0	1-24	25-49	50-74	75-99	100	%
8.	How are they monitored or referred to?							
9.	Based on your experience, how often do clients request that waste to landfill be minimised?	0	1-24	25-49	50-74	75-99	100	%

10. In your experience on commercial refurbishment projects, do you find waste minimisation addressed in:

Head Contracts? Yes / No / Sometimes					
If yes or sometimes please express as a %	1-24	25-49	50-74	75-99	
Subcontracts ? Yes / No / Sometimes					
If yes or sometimes please express as a %	1-24	25-49	50-74	75-99	
Bill of Quantities? Yes / No / Sometimes					
If yes or sometimes please express as a %	1-24	25-49	50-74	75-99	

11. Do you see evidence of 'design for disassembly' in commercial refurbishments?

Yes / No / Sometimes				
If yes or sometimes please express as a %	1-24	25-49	50-74	75-99

12. In your experience, do waste management practices differ, depending on the age of the building being refurbished? *Discuss* Yes / No

STRIPOUT/FITOUT STAGE

13. What are the factors most likely to **encourage** greater minimisation of waste on a commercial refurbishment at:
Stripout Stage? **Fitout Stage?**

14. What are the factors most likely to **restrict** the minimisation of waste on a refurbishment project during:
Stripout Stage? **Fitout Stage?**

15. What practices create the most waste at the **stripout** stage of a refurbishment?

How could it be improved?

16. What practices create the most waste at the **fitout** stage of a refurbishment?

How could it be improved?

17. To what extent do the following factors affect the costs/feasibility of waste minimisation:
a) safety matters
Discuss

b) occupancy of building
Discuss

c) site location
Discuss

d) other determining factors?

Discuss

18. In practice how is waste measured on commercial refurbishment projects?

GENERAL REFERENCE

19. In your opinion what, (if any), are the real incentives for minimising waste on commercial refurbishment projects?

20. Do you agree / disagree with the following statement?

"Government policy has led to better levels of waste minimisation carried out on commercial refurbishment projects?"

Strongly Agree Agree No Comment Disagree Strongly Disagree

21. What impact do the following groups have in minimising waste on commercial refurbishments?

- The Designers — no impact / little impact / great impact
- The Head Contractor — no impact / little impact / great impact
- The Subcontractors – Demolishers/fitout specialists — no impact / little impact / great impact

22. On an average multi-storey commercial fitout - what % of total project cost might be attributed to waste management (including disposal)?

0-1 1-2.5 2.5-5 >5

23. Do you see any emerging markets for using materials previously wasted on commercial retrofits? *If yes, comment* Yes / No

24. If waste minimisation is a management priority on a commercial refurbishment, how does it usually affect the final cost of a project?

Significantly Higher Higher No Difference Lower Significantly Lower

25. Have the practices in relation to waste generated in a commercial refurbishment changed since you started working in these types of projects? *If so, how?* Yes / No

26. Please provide your best estimate of **what is normal** in regard to the following elements on a commercial refurbishment?

	% Recycled	% Re-used
Concrete		
Timber		
Steel		
Plasterboard		
Glass		

In your opinion, **what is possible** with the same elements?

Appendix 3 – Destination of Waste from Commercial Refurbishments – Fabric, Fittings, Finishes and Services

Material/Component	Reuse Onsite	Reuse Offsite	Recycle Onsite	Recycle Offsite	Disposal
Building Fabric					
Clay bricks, pavers					
Concrete					
Concrete blocks					
Timber - Hardwood					
Timber - Softwood					
Aluminium					
Glass					
Formwork					
Steel – Structural					
Steel - Reinforcing					
Stairs					
Other					
Fittings					
Doors					
Door hardware					
Mirrors					
Suspended Ceilings					
Partition Walls					
Joinery eg. Skirting boards, cupboards					
Workstations					
Glazed partitions					
Electrical fittings eg. lights					
Balustrades					
Other					

Material/Component	Reuse Onsite	Reuse Offsite	Recycle Onsite	Recycle Offsite	Disposal
Finishes					
Carpet and Underlay					
Ceramic tiles (wall or floor)					
Concrete blocks					
Timber – Engineered eg. ply or particleboard					
Plasterboard					
Window fittings and dressings					
Packaging					
Formwork					
Sanitary items eg basins, taps					
Garden organics					
Other					
Services					
Lifts					
Electrical eg. cables					
Mechanical eg. ducts					
Plumbing generally					
Plumbing – copper pipes					
Joinery eg. Skirting boards, cupboards					
Refrigeration components					
Other					