



Key	Material	EWG code	Negligible quantities greyed out	
	Oils	13 01 13*	Glass	17 02 02
	Cardboard packaging	15 01 01	Plastics	17 02 03
	Plastic packaging	15 01 02	Vinyl floor coverings	17 03
	Mixed packaging	15 01 06	Mixed metals	17 04 07
	Liquids	16 10 02	Contaminated soils	17 05 03*
	Concrete	17 01 01	Soils and stones	17 05 04
	Bricks and blocks	17 01 02	Fines	17 05 04
	Tiles and ceramics	17 01 03	Insulation	17 06 04
	Mixed inert/hardcore	17 01 07	Gypsum	17 08 02
	Timber	17 02 01	Other plaster/cement	17 08 02
			Mixed hazardous	17 09 03*
			Mixed C+D/roof waste	17 09 04
			Paper/cardboard	20 01 01
			Soft floor coverings	20 01 11
			Paint	20 01 28
			Electrical (MSW)	20 01 36
			Vegetation	20 02 01
			Canteen/mixed MSW	20 03 01
			Bulky/furniture	20 03 07
			Non recyclable	

Figure S1: Waste stream breakdowns for case study projects, as reported by waste management companies. Waste categories and names are used inconsistently by different companies; the colours shown are based on the EWG codes they used, translated into our key, and the labels are as stated in their reports. Charts (a) and (b) relate to waste from two contractors doing the same type of refurbishment work, aggregated over several months. One would expect the breakdowns to look similar. The data in (a) come from an estimate based on the overall WTS figures; in (b), from an estimate carried out visually on a skip-by-skip basis. Therefore (a) is modelled on the waste from a far larger sample size – it should represent a more generalised profile of C&D waste streams in London – whereas (b) should be a more accurate model of the project in question.

Table S1. Summary of interviewees.¹

Company type	Role	No. of interviewees	Background/expertise
Contractor	Project director	1	Construction management, business development
Contractor	Contracts manager	4	Contracts management, building trades
Contractor	Senior site manager	1	Construction management, building trades
Contractor	Sustainability manager	3	Sustainability, consultancy
Contractor	Health, safety and environment manager	3	Health and safety, administration, sustainability
Waste management	Operations manager	3	Waste logistics, haulage
Waste management	Sales manager	1	Waste logistics, sales, public relations
Client	Project director	5	Construction management, project management

¹ Limitations: interviews with individuals unavoidably contain a degree of subjectivity and a risk of biased viewpoints or inaccurate reporting of events. These limitations were mitigated by carrying out interviews with several people from each case study project. Across different projects and with interviewees occupying different construction industry roles, the same topics were covered, increasing confidence in the testimony.

Table S2. Total proportions of each waste stream and treatment method for all case study projects.

Treatment	Waste stream	Percentage	Total percentage
Reuse	n/a	0.0%	0.0%
Recycling	Mixed packaging	2.7%	94.5%
	Concrete	19.3%	
	Mixed brick, tiles, hardcore	41.9%	
	Timber	5.8%	
	Glass	0.7%	
	Plastics	1.2%	
	Metals	2.3%	
	Soil and stones	18.8%	
	Insulation	0.7%	
	Gypsum	0.9%	
	Mixed C&D	0.4%	
Recovery	Timber	0.2%	1.7%
	Mixed C&D	0.8%	
	Undefined	0.7%	
Landfill	Mixed C&D	2.7%	3.8%
	Undefined	1.1%	
Total			100%

Table S3: Summary of findings from interviews with contractors, waste management companies and client organisations

No.	Interview topic	Sample of interviewees' testimonies	Authors' observations and interpretation	Suggested driver/barrier mechanism	Suggested systemic factors
1	Waste transfer notes (WTN) and the waste hierarchy	'Compliance with waste hierarchy' tick box on WTN at point of waste transfer is too late to be effective; already discarded to skip, potential demand not reached/heard; better if built in as something the sustainability manager actively governs (RC, NBL).	'Prepare for reuse' stage of hierarchy unlikely to be taken unless there is confidence that it will beneficially lead to reuse. Site workers have the potential to identify opportunities for on-site reuse; sustainability manager may see opportunities elsewhere in company; but off-site reuse by others cannot reliably be anticipated from contractor's vantage point.	WTNs tick box showing adherence to waste hierarchy not supported by system to enable compliance; uncertain value/demand	Weak regulatory legislative drivers; lack of systems thinking
2	Deconstruction – cost and programme	Taking building down by hand not specified by client, more expensive because it takes far more time and has health and safety issues (NBS). Required time for deconstruction will not fit with programme (PH), and is unlikely to result in anything that can be reused (PH).	There are sometimes instances of buildings made vacant but projects on hold, which could allow at least soft-strip to commence. Not clear that time invested will be paid back in sale of components unless demand is established first. Assumption that there would be no demand remains untested.	Deconstruction not considered in advance; high cost relative to demolition; uncertain value/demand	Item 3; lack of client leadership/enabling; buildings not designed for deconstruction
3	Cost of new versus reused	Very cheap these days to get new materials (PH).	Client expectation that reused should be cheaper than new; difficult to achieve in practice without mature supply chain, given lack of economies of scale and probable labour intensity of reuse.	Low cost of new materials relative to labour	Lack of economic legislative drivers; lack of mature supply chain
4	Offering materials for reuse – arranged	Useful materials end up in the skip (NBS, RC, THH); much good quality timber and plywood arrives at WTS (WM1, WM3).	Those managing construction often started as trades-people, working with materials; they do not like to see good materials go in the	Lack of outlets for unwanted materials;	Separation between supply and

	end-user	Old timber, doors etc. previously given to carpentry apprentices for practice (RB, RX); but no consistency of demand and no time to identify other users (RB). Space and time constraints at WTS prevent setting aside for reuse (WM1, WM3).	skip. But personal moral/emotional reasoning is overridden by company/project demands. However, companies are very aware of their public reputation; if inconvenience is minor, willing to offer materials to local community groups.	contractor uncertain of usefulness of materials <i>Driver: Corporate social responsibility</i>	demand; uncertain value
5	Offering materials on reused materials marketplaces (RMMs)	Some have used RMMs (NBL, RC); some have heard of but not used (NBS, WM2); some are not aware (RX). Off-putting associated costs in temporary storage and managing site during collection (NBL). Takes time to post items on websites, with no guarantee that anyone will want, or taker may fail to collect (NBS).	Individual on site has bounded knowledge of what is useful elsewhere; he may waste time offering things that are not wanted, and dispose of things that are wanted. Trust between person offering material and person taking material on RMM could be established through member profiles.	Contractor uncertain of usefulness of their unwanted materials	Separation between supply and demand; uncertain value
6	Reusing materials – RMMs as supply	No recognition of where to find reused general building components – only specialist architectural salvage (RC). Those familiar with RMMs sceptical about achieving spec compliance (NBL, RC); lack of warranties (NBL); quantities needed not available at right time from single source (WM2). Extensive certification of new products deters use of reclaimed (RX).	Designers not familiar with specifying from RMMs. Mainstream industry requires materials to be certified to ensure consistent quality. Recertification not common practice. No known examples of value-adding reuse enterprises. If RMMs paired with existing infrastructure of builders' merchants they could sell recertified materials alongside new to normalise the idea of reuse.	Infancy of supply networks (except architectural salvage); lack of reliability in quantities and consistency of reused materials	Lack of client leadership/enabling; high cost of land relative to materials; uncertain value
7	Reusing materials – time to use	Inadequate stocks and lack of consistency in reused components makes finding and working with them more time consuming, and often a more skilled task (WM2).	Contractors almost always struggling to keep up with construction programme; consolidation needed to ensure reasonable lead-in times and stocks as consistent as new.	Lack of reliability in quantities and consistency of reused materials	Items 3 and 6
8	Reusing materials –	Reclaimed materials lack information about any toxicity, previous stress for structural	Reclaimed materials are considered something of an unknown; e.g., there may	Lack of evidence of fitness for purpose;	Items 6 and 9; reporting

	product information and quality	elements: do not know what they are working with (NBL). Residents are expecting new, that is what client has paid for; doubts over aesthetic qualities of reclaimed materials (RX).	have been changes in safety standards during lifespan of original use. Need for prototyping during design stages to test aesthetic acceptability (like getting samples of new materials).	client (and societal) expectation of new	oriented to waste; lack of client leadership/enabling
9	Causes of waste – lack of ‘as-built’ building information	Lack of data about what is in buildings leads to waste (RMW): e.g., in refurb strip out, collection of white goods by reuse enterprise needs 72hr notice period and contractor cannot foresee or store (RC).	Reusable resources identified too late in the process to be acted upon.	Lack of as-built building information to identify reusable in advance	Buildings outlive as-built info; waste reporting does not provide substitute
10	Reusing materials – compliance and contractor influence on design	Employer’s Requirements calls for FSC/PEFC (i.e., certified new) timber; considered non-compliant to use reclaimed; no scope to change design (RC). Contractor will not make a tender offer ‘more green’ than it is required to be (RB); may challenge design but ‘must be competitive on the client’s terms’ (NBL).	Contractors often have limited ability to influence design; reuse needs to be built into or explicitly allowed in client’s specification. Perception that ‘green’ always comes at a price premium.	Reuse not considered during design stage, not seen as realistic option	Lack of client leadership/enabling; lowest price tendering
11	Offering materials for reuse – unlicensed carriers	Sometimes people see useful materials in a skip and take, or ask to be put to one side then fail to collect (NBS); employees on site sometimes take away surplus for use on private jobs (RC).	Demonstrates demand for and usefulness of materials. Duty of Care means this type of reuse is a grey area legally; informal agreements with public can inconvenience contractor if abused.	Discarding to skip makes useful materials inaccessible to unlicensed carriers	Item 12; lack of formal connection between supply and demand
12	Offering materials for reuse – storage space	Rarely enough space for segregated waste streams and reuse storage (WM2, NBS, RC). Construction produces things that could be reused, but not immediately by contractor	Blocks of flats sometimes contain unoccupied flats that could be provided as short-term, small-scale storage during works to neighbouring properties; would need	Large spaces rarely available in inner city locations; designated place	Uncertain value; lack of client leadership/

		at time of needing to dispose (NBS, RC); if a dedicated storage space was provided off-site it would help facilitate (NBS, RC).	management regime. Could also bridge gap with collection by reuse enterprises, as items 5 and 9.	for storing non-waste for reuse not prioritised	enabling
13	SWMPs	SWMPs encourage forethought, provide framework for monthly reporting, still using for new projects despite withdrawal (NBL). Forecasting gives contractor an idea of the amount of waste they're likely to generate (WM2).	SWMPs badly maintained as ongoing monitoring tool on refurbishment projects and NBS (doc.): only prepared in fulfilment of tender requirement or used only at pre-construction planning stage.	Outsourcing of reporting to waste management companies	Lack of contractor capacity
14	Sustainability manager	Office-based employee leads on sustainability, overseeing many projects (NBL, RA, RB, RC, RX, RMW).	Lack of site-based sustainability expertise; and lack of site experience on the part of sustainability expert. Usually compliance monitoring role more than driving innovation.	Contractors lack capacity to prioritise active sustainability leadership	Lowest price tendering; lack of systems thinking
15	Cost of disposal	Full 12yd skip costs £200 to remove from site (WM1); most materials continue to attract fee for removal from WTS (WM1, WM3); incineration costs almost as much as landfill (WM1).	Landfill Tax has rendered even recyclable waste (except metals) a liability; this opens up opportunities to find value in resources.	<i>Driver: Opportunities to add value by upcycling and recertifying</i>	<i>Escalation of Landfill Tax</i>
16	Intra-company material exchanges	Material exchanges between projects of different scales – example of stripped out carpet tiles from one project used in site office of another (NBL). Builders' merchants run as part of business (RX) or by sister company (RWM) to re-stock unused surplus.	Potential to cascade uses of materials within company from one project to another at present uncommon and limited to the contractor's own site accommodation. Other leading large contractors beginning to introduce internal RMMs to bring about intra-company reuse practices.	<i>Driver: Desire to avoid disposal costs, reduce carbon footprint and show innovation</i>	<i>Item 15; contractor competition</i>

Abbreviations

RA	contractor for refurbishment Lot A	RMM	reused materials marketplace
RB	contractor for refurbishment Lot B	RMW	contractor for responsive maintenance works
RC	contractor for refurbishment Lot C	SWMP	site waste management plan
RX	contractor for refurbishment Lot X	THH	staff from Tower Hamlets Homes
doc.	finding from documentation	WM1	waste management company 1
PH	staff from Poplar HARCA	WM2	waste management company 2
NBL	contractor for large new build project	WM3	waste management company 3
NBS	contractor for small new build project	WTN	waste transfer note