CASE STUDY

Kier Construction - Mansion House Refurbishment

ZERO WASTE SCOTLAND

Kier Construction Mansion House Refurbishment

Project background

This refurbishment of an existing stone and brick built hotel, the Mansion House, is located within university halls of residence and other mixed use land in the South of Edinburgh. The project cost is just over £400,000, covering 776m² floor space, and is due to complete in 2022.

This site was chosen to trial the use of the new Construction Waste Indicative Cost (CWIC) Calculator. The CWIC Calculator analyses individual skips on construction sites, to estimate the full cost of materials purchased, labour costs, and indirect costs.

The main contractor was tier one framework contractor Kier Construction. All construction work was delivered by subcontractors who were financially responsible for all of the materials that they used. This arrangement motivated sub-contractors to be as efficient as possible regarding materials wastage. The main contractor used the BRE SmartWaste tool to manage waste information and create a Site Waste Management Plan. The contractor's site manager also completed an additional document used internally to estimate approximate volumes of waste types.

Lisa McDade, Kier Construction Environmental Advisor was impressed by the level of detail from the CWIC Calculator, stating that it,

"makes a really useful addition to the other waste data we have to collect for compliance."

She'd like to see it rolled out across all of their sites in the future.

Alex Marshall, Kier Construction Site Manager was delighted that the tool helped to focus the client and designer's attention on reducing waste, stating,

"this is going to reduce waste and save money".

Skip layout

A 12-cubic yard (equating to ~16m³) mixed-waste skip was placed at the front entrance of the building. Waste materials were all carried by hand from the ground and two upper floors. The distance from the mid-point of the main working area was estimated to be 116m, accounting for travel along corridors and staircases.

Figure 1: Skip location

Figure 2: Checking travel distances on a site drawing

Figure 3: Sketched out distances to skip

Figure 4: mixed waste arriving at the skip in a bin

Individual materials were logged as timber off-cuts, plastic packaging, and demolition rubble.
Screws and their packaging were logged separately, demolition and stripping out waste was logged as bulk volumes.

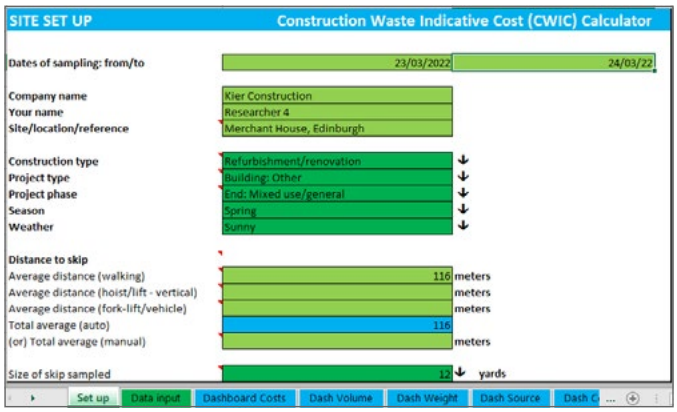

Figure 5: CWIC Calculator Set up page

Seq No.	Type of waste	Waste code (auto fill)	Description of waste	Notes on waste	Source of waste	No. of similar objects (enter 1 if only one)	Length (mm)	Width (mm)	Thickness (mm)	Total volume (auto fill. Aim for 5m3)	Condition	Waste material was installed then removed	New material needed to replace material
	↓Drop-Down List		↓Drop-Down List		↓Drop-Down List					1.055	↓Drop-Down List	↓List Yes/No	↓List Yes/No
1	Mixed_construction_and_demolition_wastes	09-04	Insulation	various sizes	Demolition and stripping out	250	300	150	40	0.450	Mostly recyclable	No	No
2	Wood_untreated	17-02-01	Wood - untreated: hardwood (volume)	various sizes	Cutting waste	140	150	150	30	0.095	Suitable for recycling	No	No
3	Packaging_Paper_and_Card	15-01-01	Packaging: Paper/Card	carboard boxes	Not recovered by supplier (packaging)	1	1000	650	250	0.163	Suitable for recycling	No	No
4	Mixed_metals	17-04-07	Mixed metals		Conversion waste (dimensions)	12	400	20	20	0.002	Suitable for recycling	No	No
5	Mixed_metals	17-04-07	Mixed metals	timber screws	Conversion waste (dimensions)	300	60	10	5	0.001	As good as new	No	No
6	Packaging_Paper_and_Card	15-01-01	Packaging: Paper/Card	screw boxes	Not recovered by supplier (packaging)	40	80	50	5	0.001	Suitable for recycling	No	No
7	Treated_wood_glass_plastic_including_wood_plastic_window_frames	17-02-04	Treated wood/glass/plastic: timber (lengths) - wall or partition members	saw dust	Cutting waste	50	100	100	100	0.050	Landfill	No	No
8	Mixed_construction_and_demolition_wastes	17-09-04	Mixed construction and demolition wastes	rubble	Demolition and stripping out	50	100	100	100	0.050	Landfill	No	No
9	Mixed_construction_and_demolition_wastes	17-09-04	Mixed construction and demolition wastes	wall paper	Demolition and stripping out	100	100	100	100	0.100	Landfill	No	No
10	Other_Each	0	Other [Zero Cost]	domestic waste (food packaging/ rapping)	Canteen and office waste	40	100	100	100	0.040	Landfill	No	No
11	Plastic_excluding_packaging_waste	17-02-03	Plastic - excludes packaging waste: plastic drain pipe	various lengths plastic pipes	Cutting waste	10	300	100	5	0.005	Mostly recyclable	No	No
12	Treated_wood_glass_plastic_including_wood_plastic_window_frames	17-02-04	Treated wood/glass/plastic: timber - plywood, marine quality		Cutting waste	5	600	400	5	0.006	Suitable for recycling	No	No

Set up | Data input | Dashboard Costs | Dash Volume | Dash Weight | Dash Source | Dash C ...

Figure 6: CWIC Calculator 'Data input' tab

Figure 6 shows a screenshot of the completed Data input sheet. The rows, from left to right, show the categories of waste that were logged. The volume column automatically calculates how much waste has been logged. The right side of the volume column shows categories for 'Condition' of the waste (as judged by the user), and two final columns to check 'yes' or 'no', depending on whether the waste materials had been installed then removed, or replaced by new materials. If these are checked with a 'yes', then extra costs are added.

Table 1: Overview of waste costs

Overview of costs	Sample: 1.055* (m^3)	Per 1m^3	For skip on site: (12 Yards)	8 Yard skip equivalent
Total Materials*	£331.30	£314.18	£2,356.33	£1,570.89
Total Labour *	£27.24	£25.84	£129.18	£86.12
Skip Hire (mixed)	£261.56	£34.87	£261.56	£178.33
Total (excl. VAT)	£722.04	£471.55	£2,747.07	£1,835.34
VAT	£144.41	£94.31	£549.41	£367.07
Grand Total	**£866.45**	**£565.86**	**£3,296.48**	**£2,202.41**

Table 1 shows an overview of the waste costs, automatically analysed by the CWIC Calculator. The CWIC Calculator also produces charts showing various aspects of the waste sample. Figure 8 shows a breakdown of the material costs. Table 1 also shows how much this cost is per cubic meter and extrapolates the figures for the size of skip.

Figure 7: Boxes of screws, packaging & mixed demolition waste

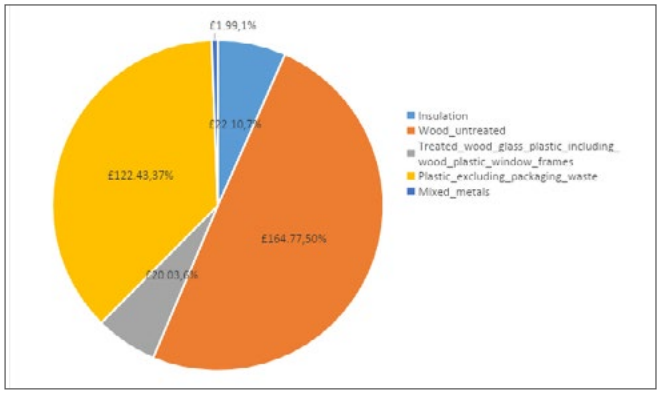

Figure 8: Material cost pie chart

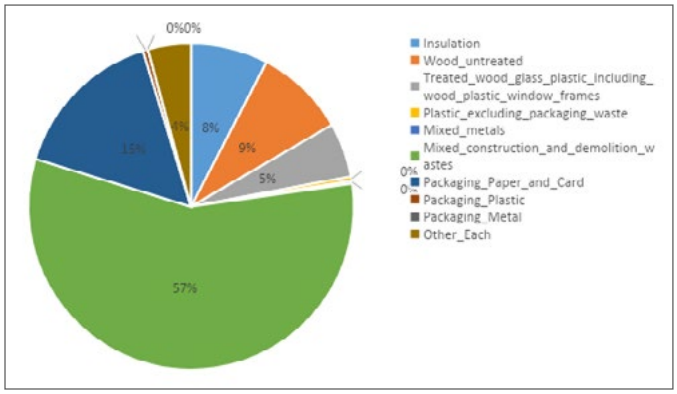

Figure 9: Volume of waste

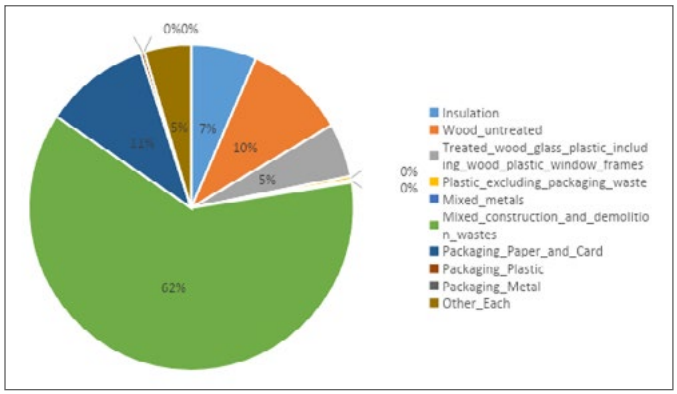

Figure 10: Weight of waste

Figures 9 and 10 show the amount of waste (including demolition and packaging) in the sample, by volume and weight respectively. These show that 57% by volume, and 62% by weight, of waste material in the sample is demolition waste.

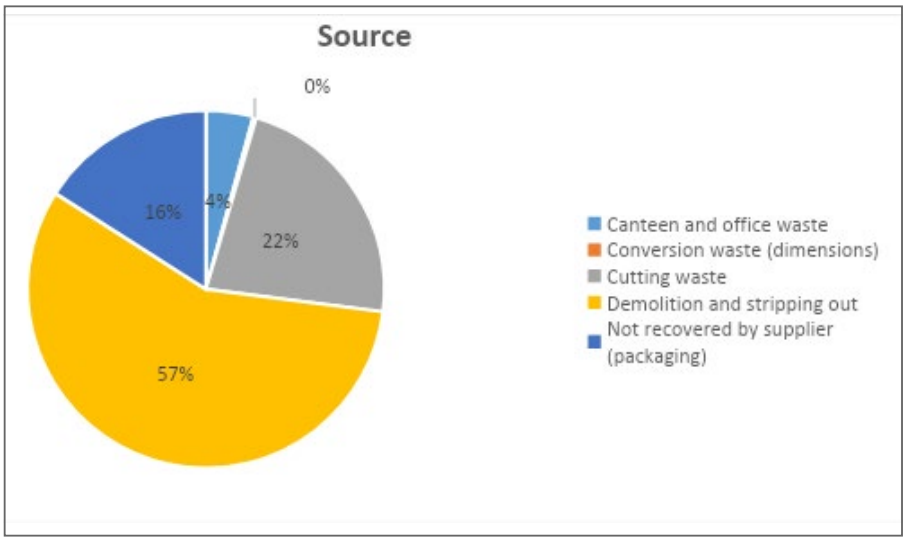

Figure 11: Source of waste

Figure 11 shows the waste sources by volume. Demolition and packaging sources usually mirror the materials' breakdown percentages, as demonstrated here with 57% and 16% respectively. Besides the expected 'cutting waste' (off-cuts) and canteen waste, the analysis shows some waste materials are due to 'conversion waste', which means the materials had to be ordered in boxes or packages of more quantities than was required. In this case, perfectly useful screws and metal fixings had to be skipped as they were surplus to requirements.

This indicates a potential opportunity for better supply chain engagement as offering smaller pack quantities or running a 'take-back' scheme, could reduce waste.

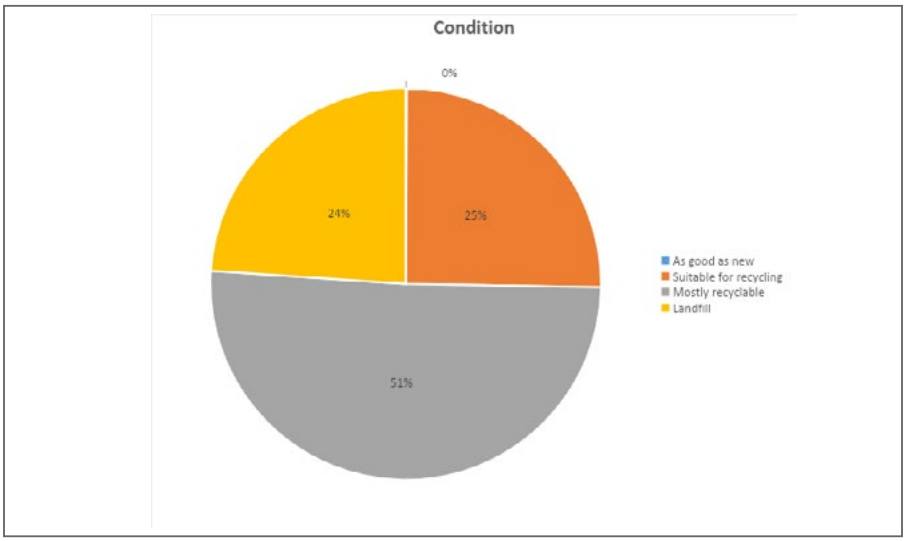

Figure 12: Condition of waste

Figure 12 shows that 51% of the sampled waste would need to go to landfill. Whilst this is a subjective estimate, the analysis also shows that just under 1% of the waste was 'as good as new', consisting of screws and fixings.