



FINAL

poriruacity

**Construction and Demolition Waste
Minimisation**

Report 1 – Materials Composition

April 2021

Document status

| Job # | Version | Approving Director | Date |
|--------------|----------------|---------------------------|---------------|
| 2613 | Draft V1 | Alice Grace | 13 April 2021 |
| 2613 | Final V2 | Alice Grace | 30 April 2021 |

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1 Context

Porirua City Council (PCC), and its partners (Kainga Ora, Hutt City Council (HCC) and Kapiti Coast District Council (KCDC)) are seeking to put forward a business case to utilise, repurpose and sell resources arising from construction and demolition activities in the district. To inform the business case, seven reports have been commissioned (Figure 1), ultimately culminating in one consolidated report (Report 8).

This is Report 1 – Product Composition, which summarises the composition and quantities of the C&D waste in the district expected in the near future. The sources of C&D waste include old builds, new builds, and renovations of residential and commercial buildings.

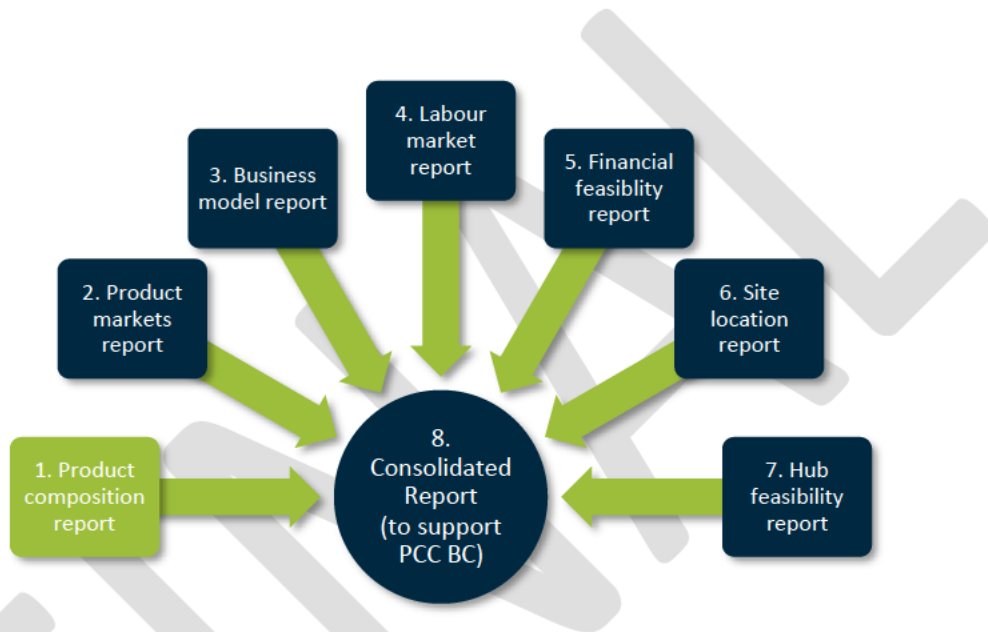


Figure 1 Report structure to inform the business case

2 Method for establishing material composition

Our methodology for establishing the composition of the C&D waste materials consisted of the following:

- **Review of solid waste composition (SWAP) data**

SWAP and waste audit data was gathered from PCC's transfer station and Spicer Landfill, HCC's transfer station and Silverstream Landfill and KCDC's transfer station.

- **Review of industry data**

A summary data set was sought from industry for comparison with the Council SWAP data. This data set was gathered by an experienced waste contractor when providing analysis data to clients for eco build labelling (Greenstar and Homestar for example) and it may not be representative of a typical C&D waste stream as the material was collected with an external motivation for diversion i.e., achieving an eco-build rating.

- **Interviews with industry**

Discussion with industry was used to ascertain the availability of data as it relates to the composition of C&D materials. These discussions confirmed that historic data is not readily available and has not traditionally been collected by the industry. This is changing with the emergence of eco-build labelling requirements.

- **Review of Kainga Ora site clearance and redevelopment programme**

As a key partner to the project, Kainga Ora provided their relevant programmes which facilitated an understanding of a demolition to construction ratio associated with residential development.

- **Review of historic building consent and forecast development data**

Council's published building consent data was reviewed, and forecast development data supplied on request. This provided an understanding of the quantum of building and renovation works being undertaken regionally but did not yield any specific conclusions regarding C&D material composition.

3 C&D waste composition

3.1 Materials in and out of scope

In general, C&D waste that can be recycled or reused includes timber, concrete, plasterboard, cladding (bricks and weather board), metals (ferrous and non-ferrous), cardboard packaging, plastics, quality building components, left-over paint, insulation, garden waste and soil (topsoil and cleanfill).

To derive the composition of C&D waste for this report, we have limited our analysis to the following material descriptions provided in the PCC, HCC and KCDC waste analysis reports (SWAPs):

- Paper and cardboard
- Plastics
- Ferrous metals
- Non-ferrous metals
- Glass
- Rubble (concrete, plasterboard)
- Timber (treated)
- Timber (untreated)

Our analysis excludes the following materials associated with C&D waste:

- Soil – more likely to be delivered in separated loads directly to landfill, cleanfill and managed fill operations. It is not usually comingled with other C&D loads.
- Garden waste – a small amount of green waste was identified in material classified as C&D waste; however, it was minimal, and the majority of green waste from C&D operations is separated from other C&D components and then delivered to composting operations or chipped and mulched on site.
- Paint – requires special handling as a hazardous waste and can be returned directly to paint suppliers.
- Insulation – this is not identified separately in the C&D waste data available. The quantity is unable to be estimated.

- Textiles – these are not identified separately in the C&D data available to allow the quantity to be estimated.
- Quality fixtures and fittings – these are not identified separately in the C&D data available to allow the quantity to be estimated, these items are more likely to be separated from the C&D waste stream at source and delivered directly to salvage operators.

3.2 Deriving material types and composition

Appendix A – Compiled Material Composition Data summarises the composition of C&D waste based on the councils’ waste analysis reports (SWAPs) and data provided by industry. Included in Appendix A is a national composition of C&D waste to landfill. The C&D waste composition at the PCC, HCC and KCDC sites is similar to the national composition, but with slightly less ferrous metal and slightly more timber (both treated and untreated).

Table 1 provides the percentages assumed to calculate the adopted quantities for the material types targeted in this analysis, along with commentary on why a particular percentage has been used. Typically, the approach has been to ensure a relative composition, for example the quantity by weight of steel is higher than that of cardboard.

Table 1 Adopted percentages by material type and commentary

| Material type | Adopted percentage composition | Commentary |
|--------------------|--------------------------------|--|
| Cardboard | 4% | Cardboard packaging and other paper and card is a divertible component of C&D waste |
| Glass | 1% | Glass is a small component of C&D waste, varying from 0-1% in the data analysed. A nominal figure of 1% has been adopted. |
| Hardfill | 15% | Hardfill is the term that has been adopted to describe material that is received at facilities that is free of contamination with plasterboard. See also sections 3.3 and 3.4. |
| Plasterboard | 5% | Figures provided by industry seem low in comparison to those seen at the tip face, this difference is attributed to what is recorded as plasterboard versus general waste see also sections 3.3 and 3.4. |
| Plastic | 2% | Plastics comprise a small percentage by weight of C&D waste. This may be due to its relative low weight when compared with other materials such as concrete, timber or steel. |
| Ferrous metal | 18% | The percentage of ferrous metal varies between SWAP and industry data. SWAP data indicates a very low quantity. This may be due to separation of steel at source prior to disposal at a landfill tip face or transfer station. This percentage reflects a more accurate proportion of the total C&D waste stream and is therefore considered additional to the C&D tonnages reported in the SWAP data. |
| Non-ferrous metals | 1% | Non-ferrous metals are a small component of C&D waste and are light relative to ferrous metals. |

| Material type | Adopted percentage composition | Commentary |
|--------------------|--------------------------------|---|
| Timber – treated | 32% | All data sources concur that the quantity by weight of treated timber is high relative to all other C&D material types. |
| Timber – untreated | 2% | Untreated timber can be difficult to distinguish from treated timber. The risk of misclassifying treated as untreated in terms of end use means that it is often kept mixed with treated timber unless its source is readily identifiable. Consequently, the percentage of untreated timber is low. |
| General waste | 20% | This figure is included to capture both the components of C&D waste that are not separated and the material that is unable to be separated. It is also likely that a significant amount of material identified as ‘rubble’ in the SWAP analyses would fall into this category. |

3.3 Rubble, cleanfill and plasterboard

In the SWAP analysis from the HCC, PCC and KCDC facilities, the term “rubble” has been used to cover a broad range of materials including concrete, bricks, tiles, plasterboard, soil, gravel and asphalt. The SWAPS have further categorised these, but the subcategories used are different across the different sites. Further, the industry data did not use the term rubble but separated hardfill from plasterboard. The categories used are as follows:

- PCC
 - Plasterboard, concrete
 - Cleanfill, soil, gravel, asphalt
- KCDC and HCC
 - Cleanfill
 - Plasterboard
 - Other
- Industry
 - Plasterboard
 - Hardfill

Given more detailed analysis of the rubble category is difficult to obtain at this stage, for the purposes of this analysis we have adopted the following categories:

- Plasterboard
- Hardfill

3.4 General waste

For any material received at the C&D facility, there will be a portion of unrecoverable, mixed material that cannot be separated and recovered. This cannot be identified through the SWAP methodology, but industry data suggests this accounts for 20% of C&D loads.

4 Construction versus demolition

There is very limited data available regarding the differentiation between construction and demolition waste. Logic suggests that material arising from construction is in better condition than deconstruction or demolition and the quantities are less. Further, that construction would produce fewer tonnes of rubble material, for example. The primary inhibiting factors to distinguishing between the two are:

- The companies that provide waste collection services generally target both sectors and often demolition and construction occur through the same company.
- It is difficult to distinguish the difference of C&D compared to commercial and industrial waste which are both delivered to facilities in similar form.
- The two streams are not differentiated at landfill or transfer station weighbridges.

Anecdotal evidence suggests a 1:4 ratio, where construction produces approximately a quarter of the waste of demolition. Reporting data from Kainga Ora's deconstruction and demolition and development programmes may contribute to increased confidence levels in this area as it becomes available.

5 C&D waste quantities

Table 3 provides a summary of current and future C&D waste tonnage across the Wellington region. It includes material received at Class 1 landfills (Spicer, Silverstream, Southern and out-of-district) and also material received at Class 2-4 landfills. The material received at Class 1 landfills is further broken down into the material received at the PCC, HCC and KCDC sites.

Population growth for Porirua, Hutt and Kapiti Coast from the councils' Long Term Plans was reviewed and used as an indicator of residential development in these areas. For their LTP's the councils project future growth based on a number of factors including available land supply and rate of construction alongside demographics. As such, these growth rates are seen as a reasonable indicator of long-term housing development and associated long term growth in C&D waste production.

Assumption: The growth rate for the region is 1.2% per annum.

The 2050 projection is further extended out based on the 2030 figure estimated in the Regional C&D Waste Issues and Options Paper with the same growth assumption of 1.2% growth per annum.

Of the 6,000 to 8,000 tonnes per annum of C&D waste delivered to Spicer landfill from the surrounding Porirua area, waste from Kainga Ora development is expected to contribute 10%.

Table 2 Wellington region C&D waste generation and projection

| Landfill type | Estimated tonnage (2016) | Estimated tonnage (2018) | Future tonnage (2030) | Future tonnage (2050) * |
|-----------------------|--------------------------|--------------------------|-----------------------|-------------------------|
| Class 1 | 32,000 | 33,000 | 38,000 | 43,000 |
| Silverstream Landfill | 12,000 | 13,000 | 15,000 | 16,000 |
| Spicer Landfill | 10,000 | 10,000 | 11,000 | 13,000 |
| KCDC material | 4,000 | 4,000 | 4,000 | 5,000 |
| Other material | 6,000 | 6,000 | 7,000 | 8,000 |
| Other landfills | 10,000 | 10,000 | 12,000 | 14,000 |
| Class 2-4 | 525,000 | 546,000 | 634,000 | 805,000 |
| Total | Est 557,000 | Est 580,000 | Est 672,000 | Est 850,000 |

*1.2% growth per annum in alignment with population growth

Class 2-4 landfill tonnes are significantly higher than Class 1 landfills. Although a large proportion of this material is cleanfill, there may be some concrete, timber or metals that could be diverted from these facilities into a C&D waste facility.

In developing the business model for the C&D waste facility, the focus is assumed to be material delivered to Class 1 landfills, but with the ability to expand the facility to accept some Class 2-4 material as a secondary opportunity. However, even if 5% of the material currently received at class 2-4 landfills (27,000 tonnes) was received at the facility, the throughput would approximately double.

5.1 Kainga Ora build programme

The Kainga Ora site clearance and redevelopment programme data shows that for every unit they are demolishing, they are constructing approximately four new dwellings (Table 2). Demolition occurs approximately 1-2 years ahead of construction.

It has been assumed that across the construction sector, on average 4 to 5 tonnes of waste are produced for every new house built. Kainga Ora new builds are a mixture of houses, walk ups, duplex, town houses and apartments. The actual tonnes per unit may differ from the average but will not be able to be determined until construction occurs.

An equivalent industry estimate for tonnes of demolition waste has not been published, however anecdotally with a 1:4 ratio it is estimated that demolition generates 20 tonnes per house.

For the Kainga Ora build programme, this means approximately 50% of the waste is from demolition and 50% from construction. The ratio of demolition to construction is likely to be similar for commercial developments and therefore, it would not be unreasonable to assume, at this stage a 50% demolition to 50% construction split for all waste in the region.

Table 3 Kainga Ora site clearance and redevelopment

| Year | 20/21 | 21/22 | 22/23 | 23/24 | Total | Tonnes per unit | Total tonnes |
|-------------------|-------|-------|-------|-------|-------|-----------------|--------------|
| Units removed | 26 | 159 | - | - | 185 | 20 | 3,700 |
| Units constructed | 72 | 57 | 164 | 426 | 719 | 4.5 | 3236 |

6 C&D waste quantities by type

Figure 2 illustrates projected tonnages for each C&D component based on the estimated composition outlined in Table 3. The treated timber and hardfill together account for approximately 40% of the waste stream.

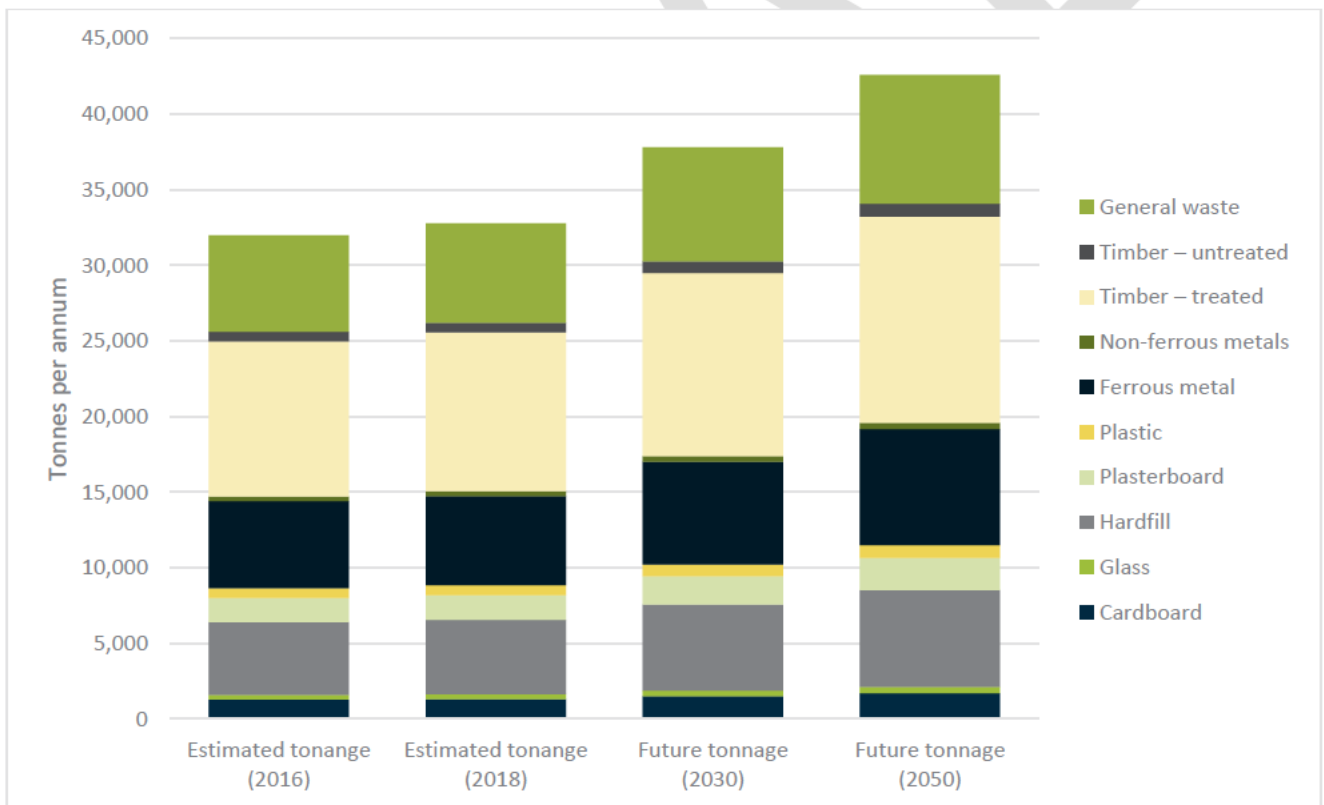


Figure 2 Projected C&D waste stream in the Wellington region (Class 1 landfills)

Table 4 Projected C&D waste stream in the Wellington region (Class 1 landfills)

| C&D component | Estimated tonnage (2016) | Estimated tonnage (2018) | Future tonnage (2030) | Future tonnage (2050) |
|--------------------|--------------------------|--------------------------|-----------------------|-----------------------|
| Cardboard | 1300 | 1300 | 1500 | 1700 |
| Glass | 300 | 300 | 400 | 400 |
| Hardfill | 4800 | 4900 | 5700 | 6400 |
| Plasterboard | 1600 | 1600 | 1900 | 2100 |
| Plastic | 600 | 700 | 800 | 900 |
| Ferrous metal | 5800 | 5900 | 6800 | 7700 |
| Non-ferrous metals | 300 | 300 | 400 | 400 |
| Timber – treated | 10200 | 10500 | 12100 | 13600 |
| Timber – untreated | 600 | 700 | 800 | 900 |
| General waste | 6400 | 6600 | 7600 | 8500 |
| | 32000 | 32800 | 37800 | 42600 |

7 Processing and storage considerations

Good material sorting and handling practices will increase the recovery rates of C&D materials as they reduce contamination and damage. In general, material sorting can be accomplished either onsite or at a dedicated sorting facility. Potential environmental impacts such as stormwater contamination by leachate from C&D materials and noise and visual nuisance during stockpiling will need to be considered. Table 5 outlines some of the processing and storage considerations for the different material type.

Table 5 Processing and storage considerations

| C&D component | Processing and storage considerations |
|----------------------|--|
| All waste in general | <ul style="list-style-type: none"> • Provide adequate access and manoeuvring for all vehicles and personnel, including stockpile areas • Stockpiling areas / bays for different material types, both indoor and outdoor • Unloading area for incoming mixed loads, preferably indoor and flat • Loading areas for various products and residual waste • Mobile plant to extract large, bulky items prior to further processing • Conveyor line with screens, trommels, magnets to sort heavy from light, small from large and magnetic from non-magnetic fractions • Reduce moisture damage to materials (e.g., from dust suppression equipment) • Manuals for operating and maintaining equipment • Emergency and health and safety procedures • Asbestos may be found with building materials. Procedures and training are needed to adequately identify and isolate asbestos • Quality and environmental monitoring requirements |
| Concrete | <ul style="list-style-type: none"> • Require concrete crushing equipment and screens, similar to that required for aggregate production from virgin rock • Concrete crushing creates dust, and stockpiling creates dust during windy, dry |

| C&D component | Processing and storage considerations |
|---------------|---|
| | <p>conditions</p> <ul style="list-style-type: none"> ● Sort incoming concrete into different types such as non-concrete rubble, reinforced concrete and non-reinforced concrete to protect product quality ● Large areas are generally needed to stockpile products ● Storage required for metal extracted from processing reinforced concrete |
| Metal | <ul style="list-style-type: none"> ● Magnetised grapples can be used on open sorting pads to extract large metal. ● Magnets can be used to separate ferrous from non-ferrous metals ● The metal recycling industry in New Zealand is well established. The primary consideration here is on its collection and transportation. ● Provide skips, trailers or other containers to separate metal from other wastes to reduce contamination ● Remove contamination before transportation to improve quality ● Consider different collection methods such as a council operated collection or drop-off service |
| Plaster board | <ul style="list-style-type: none"> ● Plasterboard crushing creates dust, and stockpiles can create dust during windy, dry conditions ● Stockpile plasterboard indoors or under cover or store in enclosed containers to prevent moisture damage and to control dust ● Different products and certified batches should be stored separately to avoid cross-contamination |
| Timber | <ul style="list-style-type: none"> ● Timber processing creates dust, and timber stockpiles produce dust during dry, windy conditions ● Contaminants such as glass, tiles, metal, concrete and soil can affect the grade of the final product. ● Metal can be extracted from shredded product by magnet ● If exposed to rainfall and poor drainage, timber piles start to decompose, which can result in odour ● Chip and mulch products absorb moisture, which affects the quality of the product. Most buyers will be unwilling to accept wet chip product because of the extra weight ● Too much moisture in boiler fuel chips can affect boiler productivity and its ability to meet resource consent conditions. ● Large stockpiles can spontaneously combust ● Contamination across different timber types will affect end use |

Appendix A Compiled Material Composition Data

| Material | KCDC (SWAP) | | HCC (SWAP) | | | | PCC (SWAP) | | National (SWAP) | Industry | Derived material breakdown |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------------|---------------|----------------------------|
| | RTS's | | Landfill | | RTS | | Landfill | RTS | Class 1 LFs | RTS | |
| | C&D only | All Waste | C&D only | All Waste | C&D only | All Waste | All Waste | All Waste | C&D only | C&D only | |
| Paper | 3.2% | 8.3% | 2.6% | 10.7% | 2.7% | 5.8% | 5.0% | 9.1% | 2.6% | 4.1% | 4% |
| Plastic | 4.6% | 11.0% | 3.5% | 12.3% | 1.9% | 3.2% | 3.8% | 2.1% | 3.4% | 0.1% | 2% |
| Ferrous metals | 1.0% | 2.3% | 1.3% | 2.0% | 0.3% | 1.5% | 0.5% | 6.3% | 4.8% | 29.2% | 18% |
| Non-ferrous metals | 0.1% | 0.9% | 0.0% | 0.5% | 0.1% | 0.1% | 0.2% | 0.3% | 0.4% | | 1% |
| Glass | 0.3% | 2.8% | 0.1% | 3.7% | 0.8% | 1.0% | 1.5% | 1.9% | 1.4% | | 1% |
| Rubble (other) | 21.0% | 6.0% | 8.6% | 4.0% | 4.6% | 5.6% | | | | | |
| Rubble (cleanfill) | 20.2% | 5.4% | 7.2% | 1.5% | 17.2% | 5.9% | | | | | |
| Rubble (cleanfill, soil, gravel, asphalt) | | | | | | | 50.9% | 0.0% | | | |
| Rubble (Plasterboard) | 5.0% | 0.9% | 7.7% | 1.4% | 15.4% | 5.1% | | | | 1.1% | 5% |
| Rubble (Concrete, Plasterboard) | | | | | | | 2.2% | 27.5% | | | |
| Rubble (Hardfill) | | | | | | | | | | 12.2% | 15% |
| Rubble | | | | | | | | | 39.2% | | |
| Timber (treated) | 38.1% | 1.2% | 56.5% | 8.9% | 51.8% | 1.0% | | | | | 32% |
| Timber (untreated) | 3.4% | 12.8% | 7.8% | 1.9% | 1.7% | 27.9% | | | | | 2% |
| Timber | | | | | | | 4.4% | 32.0% | 41.2% | 32.2% | |
| Residual waste | | | | | | | | | | 21.1% | 20% |
| Total | 96.9% | 51.6% | 95.3% | 46.9% | 96.5% | 57.1% | 68.5% | 79.2% | 93.0% | 100.0% | 100.0% |