Residential New Build Construction
Skip Dive Waste Audit Summary

(Huapai Site)

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1.0 Project Overview:

A waste audit was carried out on a residential building site in West Auckland from February 2023 till October 2023. The house being constructed was a three-bedroom standalone dwelling with a single internal garage.

The purpose of the audit was to better understand the overall weight and broad composition of the waste created in residential construction. Auckland Council has been using an assumption of 4.5 tonnes of waste per new build which was based on figures provided by AUT in 2015 (Reference for that study yet to be found). This audit will help provide some certainty around the total volume of waste produced and help to understand in more detail the types of waste produced at various stages of the build. This more granular data will help us better understand the opportunities for diversion of waste from landfill.

The project did not intend to explore the impact of design or site practices on waste.

2.0 The House being constructed.

2.1 House design:

~170m2 floor area, hip roof, 3 bedrooms, 2 bathroom with internal access garage.

2.2 Construction materials:

- Roofing. Metal tiles.
- Exterior cladding. Aluminium cladding with some PVC cladding on one side.
- Fibre cement soffit.
- Framing. Pre nailed framing.
- Insulation. Glass wool wall and ceiling insulation.
- Linings. Plasterboard internal wall linings.
- Tiling in kitchen and bathroom partially tiled.
- Concrete driveway with a concrete vehicle crossing.

2.3 Building project management:

The project was managed centrally by Sentinel Homes with aspects of the work undertaken by sub-contractors. The site was managed by a visiting site manager.

FIGURE 1 THE SITE IN VARIOUS STAGES OF DEVELOPMENT

3.0 Waste Audit Methodology:

3.1 Methodology

3.1.1 Waste Containment:

The site was fully fenced and locked after hours. A 9m3 skip bin was provided by our contractor inside the fenced area which was for the sole use of the project site. Signage was installed to ensure all waste produced on that site was deposited in the skip and to deter illegal dumping.

FIGURE 2 SITE SECURITY FENCING

3.1.2 Monitoring:

The site was monitored weekly by Council staff to follow the progress of the build and monitor the filling of the skip. Care was taken to observe any illegal dumping and ensure that the purpose and audit methodology were communicated regularly to new contractors working on site.

Development areas are often targets for illegal dumping and this has certainly been the case in this location. Most houses in the locality are still under construction and with few occupied properties, dumping was unmonitored. An initial bin was provided which was positioned outside the site fence due to initial site works still being undertaken. This quickly filled with illegal dumping, mostly domestic in nature. This waste was discounted from the survey.

Additionally, theft was an issue with an air conditioning unit being taken from the site. The build also had some issues requiring rework of wiring and some insulation. The insulation materials were recovered for reuse and were not included in the site waste figures.

FIGURE 3: EXAMPLES OF SKIPS FILLING UP ON SITE.

3.1.3 Bin collection and delivery:

When nearing full (as per monitoring by Council staff), the bin was swapped out by our collection contractor with the full bin being tracked from site to the weighbridge at the Council owned Waitakere Transfer Station.

The bin was weighed over the weighbridge and recorded on a special account created for the audit (using preloaded tare weight for truck and empty bin). The waste was then tipped out of the skip on to a clear pad/ bunker ready for sorting. A tarpaulin was used to cover the pile to ensure loose material was contained and remained dry.

FIGURE 4 SKIP WASTE AWAITING SORTING

FIGURE 5: WEIGHBRIDGE DISPOSAL DOCKET EXAMPLE.

3.1.4 Waste Sorting:

Waste sorting and weighing was completed by another contractor working in pairs. The sorting was completed by bulk sorting of the largest waste streams into piles (i.e. timber, fibre cement board etc) to give a breakdown of the major material groups.

FIGURE 6: PRE-SORT AND PART-SORT OF IN TO WASTE.

3.1.5 Data aggregation:

Once the waste was sorted and weighed, the data was then aggregated on a spreadsheet with the weight per type by skip.

3.1.6 Waste disposal:

On completion of the audit, the waste was recovered, recycled or disposed to landfill. Items of value were first offered to community groups to sell, recycled where possible (i.e. timber, plasterboard, cardboard, metal) or disposed to landfill. Where materials were sold by community groups, the value was recorded.

FIGURE 7 WASTE PACKED FOR DISPOSAL

3.2 Health and Safety:

One of the reasons often cited for the lack of data around construction waste is the risk involved in entering skip bins. Health and safety was of paramount importance in this audit. We worked with our audit contractor to develop a detailed Health and Safety plan that identified key risks and mitigations in this project.

We were able to mitigate many of these risks by virtue of the space made available at the Waitakere Transfer Station. This allowed us to safely tip the bins out of the way of other traffic and ensured that we had plenty of room to separate the waste carefully and safely.

While we had a good idea of the types of materials that might be placed in the skip at each stage of the build, we did not initially factor in the risks associated with illegal dumping, especially in the early stages of the project. This led us to put in place two additional procedures:

1. A summary of the expected waste materials in each skip (which would help sorting staff to identify any fly tipped or potentially hazardous waste).
2. A process to deal with any potentially hazardous materials encountered in the skip.

3.3 Staff and subcontractor engagement:

We were fortunate to have the full support of the developers of the site. We specifically asked them not to change any of their usual processes for this build. Normally in a development like this they would utilise skip bins which are emptied as required. The main change for this build was to require waste be captured in the 9m3 gantry bin on site that was arranged by Waste Solutions.

The Developers project managers were responsible for communicating the audit process to the sub trades. Council staff also engaged directly with the subtrades on site who were also highly engaged and cooperative. We found that there was a lot of interest from all the trades who interacted with the audit and intend to work with The Developer to present the results/ data with them in future.

4.0 Audit Results:

The total weight collected from the skips was 3679kg. This excludes the first skip which was deemed to have attracted too much illegal dumping. Driveway and landscaping waste was additional to this.

4.1 Summary of key data:

The total weight of materials collected in the skips was 3.32 tonnes. This compares favourably with the skips taken from the other Skip Dive project site in Whenuapai which was 3.62 tonnes.
It needs to be noted that in addition to the waste collected in skips, there will have been additional and unaccounted for waste from:

- Waste removed by individual trades people e.g. scrap metal.
- Waste sent straight to recyclers.
- Waste resulting from earthworks and landscaping.

The breakdown of waste by the major materials is as follows:

Material	Kg
Cardboard	840.00
Hardie Board	120.75
Tiles	180.00
Plastics	226.65
Metal	261.85
Plaster Board	1200.00
Timber	494.00
	3323.25

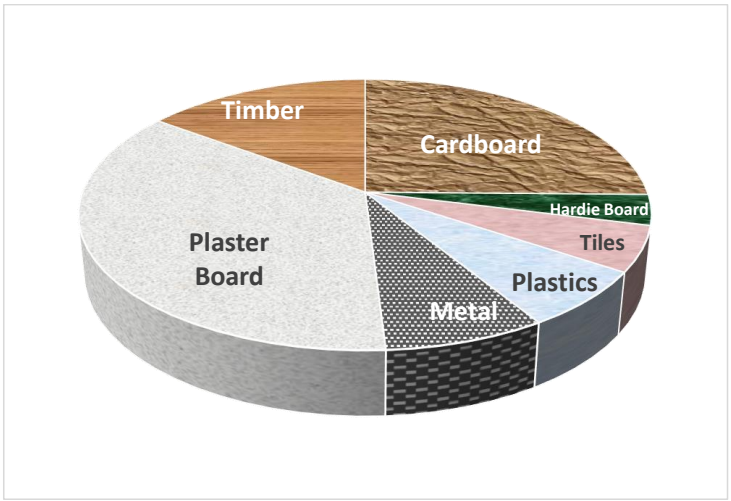

FIGURE 8: PIE CHART SHOWING BREAKDOWN OF THE MAJOR WASTE COMPONENTS – EXCLUDING CONCRETE AND SPOIL.

4.2 Insights From the build process:

4.2.1 Illegal Dumping/ Fly Tipping:

Fly tipping has been highlighted as a significant issue on building sites and this study has most certainly backed that up that claim.

In practice there is always a component of illicit waste in bins with the cost of that waste disposal either being passed through to the homeowner or covered by the builder/developer. It is easy to see why builders often give fly tipping as the main reason why they do not keep skip bins on building sites.

As identified in the Health and Safety section of this document, fly tipping also creates additional risks for site staff, collection contractors and staff at transfer station facilities due to potentially hazardous waste being hidden in bins.

4.2.2 Foundations and site preparation:

Due to timing constraints, this project was already at the foundation stage when we began the audit. This meant that we did not monitor the slab being poured however we were able to observe the floors being poured at neighbouring sites and interviewed the contractors about their processes. Very little waste is produced at foundation stage with the formwork being reused and moved from house to house in the development. Reinforcing rod and ties left on site and were captured in the audit.

FIGURE 9 EPS WASTE FROM THE FLOOR INSTALLATION AWAITING COLLECTION FOR RECYCLING

Most metal from the foundations appeared to have been recovered by the floor contractor. Some retaining wall poles were topped and these are likely to be the most significant waste from the site preparation.

FIGURE 10 TOPPED RETAINING POLES.

4.2.3 Building and finishing:

There is a common assumption that pre nail framing does not produce any site waste. This audit has highlighted that this is not the case – with a total of almost 500kg of timber ending up in the skip. Framing timber waste came from the cutouts of the bottom plate for doorways and some of the joinery.

Due to the fact that the frames were fully made there is no opportunity to utilise that timber for nogging so it typically ends up in the bin. The other component of the framing waste comes from the props used to brace the frames as they are stood. The source of this is typically random lengths that come with the frame order.

The plasterboard was not separated and it was noted that some GIB pallets (with deposits paid) were placed in the skip.

FIGURE 11 DEPOSITED GIB PALLET PLACED IN A SKIP.

Whilst the landscaping was not included in the study, it was observed that a cut out was made in the footpath to enable a single concrete pour from the gutter to the entrance of the garage. This design typically contributes around one tonne to total waste.

FIGURE 12 CONCRETE DRIVEWAY WITHIN THE FOOTPATH CUT OUT.

Finishing work typically attracts a lot of cardboard waste from packaging and this totalled over 800kg. Whilst volume wasn't specifically tracked, carboard also tends to contribute waste volume as the photos below indicate.

FIGURE 13 CARDBOARD WASTE

4.2.4 Rework:

It was noted that some rework of the electrical wiring was undertaken after the insulation was installed. An unknown amount of waste would have been produced from this work, including an amount of insulation.

FIGURE 14 INSULATING MATERIAL DURING INSTALLATION.

5.0 Key conclusions:

On the basis of this audit, the typical estimate of 4.5 tonnes of waste per new house build seems to be accurate but high. This house at ~170m2 was close to the current average size (158m2 in 2019) with a typical standard stud height.

A surprising component of the skip waste was the amount of brand new and unused building products that ended up in the skip. Some examples included timber and fibro-cement products. The hypothesis is that this material was simply cleared in to the skip as part of a site clean-up potentially because it was easier than finding/ moving somewhere for the materials to be reused. There seems to be an opportunity for a small business or Community Recycling Centres to be more active in helping recover materials from sites before they reach the skip.

The most significant volume of waste on this site was the plasterboard and timber.

Based on this audit, it seems that the simplest and most effective way for building sites to maximise their diversion is to ensure they have a recovery pathway for timber waste and plasterboard waste. Those components alone account for over half of the building waste stream and simple diversion solutions are available.

5.1 Opportunities for further analysis:

This project provides a good starting point for further research. As time and resources allow, it would be good to explore further:

- More detailed analysis of individual materials.
- A repeat analysis of skip waste with interventions such as provision of cardboard and plasterboard separation.

- Quantification of the (monetary) value of discarded materials.
- Quantification of the emissions factors of the discarded materials (life cycle analysis, embodied emissions, emissions when disposed of to landfill).
- Cross check frame and truss order to confirm quantity of random lengths included.
- Explore in more detail what materials could be recovered/ sold via a CRC (Community Recycling Centre) e.g. insulation successfully sold on TradeMe, ferrous metal (from roofing)?, PVC pipe?, corrugated cardboard?
- Cross check tonnages from this build with other sites and extrapolate across all building consents to compare against our estimates across Auckland.
- How much waste could have been designed out of the build?
- Estimates on concrete waste produced with each new vehicle crossing built in Auckland (utilise VCA data from Auckland Transport).
- Explore alternative ground surface coverings to reduce metal (gravel) requirement and spoil waste during the build process.
- Explore how efficiencies such as use of left over plasterboard in next house in the development can be applied to a) other materials and b) other builds (e.g. those that are not necessarily part of a larger development).
- Barriers to cement board recycling in New Zealand – or exporting for recycling.
- Sorting and storing "waste" materials requires space – audit used transfer station. Barriers to finding spaces for sorting and storing for diversion.
- Quantifying illegal dumping/fly tipping into skips on sites.
- Spoil and concrete created from the build.

Commented [ED1]: Line of enquiry: in new subdivisions - what is the reason for a newly laid footpath pre-build which will be removed later? Is it a requirement? Is it practical? Is there an alternative? If unavoidable, how can the negative effects be mitigated?