PUB/25

Construction waste in the Havelock North Best Home: A comparison to best and standard practice

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About This Report

Title

Construction waste in the Havelock North Best Home: A comparison to best and standard practice

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Reviewer

Abstract

This report compares construction waste management in the Havelock North Best Home with other best practice homes (Waitakere and Rotorua NOW Homes) and standard build practice.

Reference

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1 Introduction

Waste is bad for the environment, bad for our health and bad for our economy. Negative effects can include the emission of greenhouse gases and toxic leachate escaping into or over the ground from waste decomposing in poorly managed landfills. Waste requires valuable open space to be allocated for sanitary landfills, creating a nuisance for neighbours and limiting future land use.

According to REBRI, up to 50% of landfill comes from construction and demolition waste. Given that New Zealand has a significant recycling and commercial composting industry, construction and demolition wastes should be viewed as a resource that needs careful management.

The first Best Home™ was built in Havelock North in 2012 by Horvath Homes in conjunction with Hastings District Council. The 187sqm house was built to meet a minimum of six stars on the Homestar™ rating scale and at no more than 5% additional cost of a standard non-sustainable home.

The house includes:

- Solar energy
- Greater use of renewable energy resources
- Orientated to take full advantage of the sun
- Thermal mass capability
- External shade elements for summer cooling
- Low-energy lighting systems
- Kitchen / bathroom extraction ventilation
- Building waste management and reduction
- Materials and products that support Best Home™ principles
- Higher insulation standards: minimum
- R5.0 ceiling R2.8 wall, R1.9 floors

www.besthome.org.nz

2 Construction waste management for the Havelock North Best Home™

The Horvath approach was to focus on both reducing the amount of waste produced, and diverting as much waste as possible from landfill.

Hugh Campbell, the construction manager for the Havelock North Best Home, had minimising waste at the front of mind. A short waste management plan (less than 1 page) - which identified the major sources of construction waste – and where they could be recycled, was prepared ahead of construction commencing. All subcontractors were briefed on the waste management requirements.

A key difference in the management of construction waste for the Best Home building site was the absence of a skip for wastes to landfill. In fact the only bin on site was for timber, all other wastes were piled up and removed quickly when produced. This meant that the site remained tidy, and the temptation to stick recyclables in the bin destined for landfill was eliminated.

Off-cuts and other construction waste were sorted and weighed on site. Where possible, materials were re-used, or recycled – with the assistance of a range of industry partners, and only the residual materials were sent to the landfill.

Many materials suppliers took responsibility for the wastes generated by their materials. For example:

- Timber off-cuts were taken back by PlaceMakers, used for noggins, jack studs and blocking, and any remaining timber waste was used as fuel in the nearby Whirinaki Power Station
- Paint containers were taken back by the supplier for recycling, and waste water from paintbrushes was cleaned in a paint cleaning system.
- Plumbing and drainage offcuts were taken by the supplier.
- Polystyrene offcuts from the cladding were taken back by the supplier who returned them to the manufacturer for recycling

A range of local recycling companies – Full Circle (cardboard), Bio-rich (concrete, Linea weatherboards, Gib offcuts), Trans Pacific Waste (plastics) were also involved in ensuring maximum diversion of wastes to recycling.

In addition, a number of offcuts of materials (e.g. building wrap, polythene sheeting) were reused by Horvath Homes on other houses under construction.

3 Waste quantities for the Havelock North Best Home™

The Havelock North Best Home™ has a total floor area of 186.68m2. In total, 2829.15kg of waste was generated from the house's construction. This equated to 15.15kg/m^2 of floor area. Of this total, 2696.15kg of waste materials – 95% –- was diverted from landfill.

Table 1: Breakdown of wastes generated in the Havelock North Best Home™ by weight and proportion

Material	% by weight	Total waste (kg)	Diverted from landfill
Timber (treated and untreated, incl. engineered wood)	12.5%	353.5kg	All timber returned to PlaceMakers – either reused for nogs etc or waste to energy at Whirinaki
Polystyrene	2.3%	64kg	All recycled
Plasterboard	8.9%	252kg	All recycled
Cardboard	1.4%	38.9kg	All recycled
Concrete and Masonry	58.9%	1667kg	All recycled
Metals	4.2%	119.2kg	All recycled
Plastics	1.1%	32.45kg	Most recycled -16.5kg of strapping, flashing offcuts, & wallboard adhesive tubes not recycled
Linea and cement board offcuts	4.4%	124kg	All recycled
Hazardous (fillers, solvents, paint, adhesives, sealants)	0%	0 kg	Eliminated use of hazardous products through careful selection
Other (food scraps, wrappings, sweepings, etc)	6.3%	178.1kg	Some recycled. 116.5kg of mixed rubbish went to landfill.
Totals	**100%**	**2829.15kg (15.15kg/m2)**	**2696.15kg**

4 Comparison with other best practice homes

Construction waste at the Waitakere NOW Home (built 2005) and the Rotorua NOW Home (built 2007) was also monitored and quantified. REBRI guidelines for the management of construction wastes were followed for both the NOW homes and substantial efforts were made to divert wastes from landfill. Table 2 compares the waste types, weights and diversion rate across the three homes.

Table 2: Weight of construction waste across three monitored high performance houses

Material	Havelock North Best Home™ kg total	Waitakere NOW Home kg total	Rotorua NOW Home kg total
Timber (treated and untreated, incl. engineered wood)	353.5kg	457.78kg	622kg
Polystyrene	64kg	Incl. in "other"	Incl. in "other"
Plasterboard	252kg	705kg	778kg
Cardboard	38.9kg	68.54kg	89kg
Concrete and masonry	1667 kg	413.7kg	267kg
Metals	119.2kg	48.96kg	133kg
Plastics	32.45kg	Incl. in "other"	Incl. in "other"
Linea and cement board offcuts	124kg	Incl. in "other"	Incl. in "other"
Hazardous (fillers, solvents, paint, adhesives, sealants)	0 kg	4.9kg	22kg
Other (food scraps, wrappings, sweepings, etc)	178.1kg	729.5kg	312kg
Totals	2829.15kg (15.15kg/m2)	2448kg (16.8 kg/m2)	2223kg (15.8 kg/m2)
Diverted from Landfill	2696.15kg	189kg	178kg

As can be seen from Table 2, the Havelock North Best Home™ generated a similar (slightly lower) weight of construction waste per square metre than either of the Beacon NOW Homes. The house is somewhat larger than the two NOW Homes, so the overall total weight is greater, although (see Table 3) it is still at the lower end of the construction waste generated in residential construction. The notable difference between the Havelock North Best Home™ and the two NOW Homes was that 95% of the waste was able to be diverted from landfill. This very large percentage diverted reflects the strong commitment of the site manager – and all the tradespeople working on the site – to sorting waste at the time of generation, and of the making use of every possible recycling option.

5 Types of construction waste

When comparing the Havelock North Best Home™ data to the Waitakere and Rotorua NOW Homes, of particular note is the much smaller weight of plasterboard (approximately a third of that in the NOW Homes) and timber waste produced, despite the fact that the Best Home™ was a larger house. This must reflect very good practice on behalf of both the designer Andrew Whitney and the builder Richard Gearey.

The Havelock North Best Home™ had a metal roof. As for the Rotorua NOW Home (which had a metal roof and some metal cladding), the amount of metal waste was much higher than for the Waitakere NOW Home, which had a concrete tile roof.

Over 58% of the waste produced was concrete/masonry, almost entirely as a result of the decision to install a concrete thermal wall in the house. The slightly unusual specification led to an error by the blocklayer which meant the wall had to be completely reworked, creating an extra 900kg waste - 31.8% of total waste generated. While this was able to be recycled, it is notable that errors and the need for rework generated substantial extra waste in the Rotorua NOW Home also (metal) and is clearly a common problem in the industry.

Another notable feature of the waste stream is the absence of hazardous waste, compared with 4.9kg on the Waitakere NOW Home and 22kg on the Rotorua NOW Home. This is a positive synergy arising from the use of low VOC and non toxic materials and products.

6 What has changed?

When the Waitakere and Rotorua NOW Homes were built (2005 and 2007), the following reasons were identified for the low diversion from landfill rate.

- Lack of practical recycling options for some bulky wastes, such as plasterboard and concrete
- Many specialist fields often working separately
- Very tight time deadlines
- Site workers familiar only with the basics of good waste practices
- Contamination problems, with not all on site participating

The availability of recycling options for plasterboard, concrete waste and timber were critical to achieving the project outcomes for the Havelock North Best Home™, as these three wastes represented nearly 79% of the total waste generation. In this respect the presence of Biorich, a recycling company taking concrete, plasterboard, Linea and cement board offcuts, was a substantial benefit to the project. Hawkes Bay has a relatively small population (approx. 100,000 people) and building sector, so it is expected that good recycling facilities for these bulky wastes are now available in similar or larger centres in New Zealand in 2013.

Notable in this project was the amount of product stewardship from the material suppliers – Iplex Pipelines, PlaceMakers, Rooftech and Styrobeck. In terms of weight of waste recycled, the PlaceMakers Timber Bin was a major positive industry initiative. To what extent these initiatives are available in other centres is not clear, but they clearly are a positive contributing factor in minimising construction waste to landfill.

With regard to the other problems faced on the Waitakere and Rotorua NOW Home projects – good project management and very clear briefing and commitment by Horvath Homes explains why the waste management practices were so much better. All the tradespeople and subcontractors involved in the site were briefed and understood the waste management objectives. This was reinforced by the frequent presence of the site manager and the absence of a "general waste" receptacle on the site. In order for waste to be sent to landfill, it also had to be sorted into a pile of stuff that wasn't able to be recycled, a totally different approach to the normal waste management on a construction site where the large landfill skip dominates.

7 Comparison with standard industry practice

In 2009 the Christchurch City Council undertook a number of case studies of the construction waste produced in "normal" homes being built around the city. This study known as the Christchurch City Council Target Sustainability House Builders Project looked at the construction waste produced in 8 different homes built by 8 different builders. While much of the waste quantification methodology was different to that used here (while the total waste weight was recorded, estimates of volume were made of individual waste types, rather than actual weights measured), Table 3 shows a comparison of some of the key metrics of that study.

Table 3: Comparison of construction waste weights – Christchurch

Builder	House Size	Total Waste (weight in kg)	Waste by floor area (kg/m^2)	3 largest waste components	Waste management method
GJ Gardner	300m^2	5002	16.73	Bricks & tiles Timber Plasterboard	All waste in skips (2.5 *7.5m^3 skips used)
Jennian Homes	247.5m^2	4570	18.46	Plasterboard Plastics Cardboard	All waste in skips (4 *7.5m^3 skips used)
Mike Greer Homes	240m^2	5380	22.42	Plasterboard Plastics Timber	All waste in skips (4.5 *7.5m^3 skips used)
Orange Homes	180m^2	4080	22.67	Timber Plasterboard Cardboard	All waste in skips (3 *7.5m^3 skips used)
Stonewood Homes	180m^2	3740	20.78	Cardboard Plasterboard Timber	All waste in skips (3 *9m^3 skips used)
David Reid Homes	230m^2	4380	19.04	Cardboard Plasterboard Concrete	All waste in skips (4 *7m^3 skips used)
Benchmark Homes	283m^2	6960	24.59	Concrete Timber Plasterboard	All waste in skips (43*7.5m^3 skips & 2*3m^3 skips used)
Golden Homes (Steel framed)	143m^2	1690	11.82	Timber Cardboard Metal	All waste in skips (2*7m^3 skips used)

Waitakere NOW Home	146m^2	2448	16.8	Plasterboard Timber Concrete	Sorted on site with bins for each waste type
Rotorua NOW Home	141.2m^2	2223	15.8	Plasterboard Timber Concrete	Sorted on site with bins for each waste type
Havelock North Best Home	186.68m^2	2696.15	15.15	Concrete Timber Plasterboard	Sorted on site with bin only for timber

It can be seen from Table 3 that all three research houses fall at the bottom end of the waste production/ m^2 floor area metric, and also the total waste produced per house. It should be noted that these houses are somewhat smaller than many of the more "normal" new homes looked at in the Christchurch study so waste production/m^2 floor is probably the most useful comparison.

It is interesting to note that the sole steel framed house – the Golden Homes house – had the lowest weight of construction waste, and weight/m^2 floor area . Steel framed homes are built based on factory manufactured steel framing being assembled on site. Any framing waste produced is diverted back to recycling in the factory. The possibility that this is an inherently low construction waste producing methodology would seem worth investigating.

The construction wastes produced in the Christchurch study were all sorted off site[1] and diversion from landfill rates quantified. In the case of treated timber, and some plastic wastes, this was not diversion into recycling, but stockpiling for potential future reuse or recycling.

[1] ***This option is no longer available in Christchurch, as both companies which offered this service are no longer operating. As far as the author is aware, in Christchurch now all construction wastes, unless sorted on site, are going to landfill.***

Table 4 compares the diversion from landfill rates of the Christchurch study homes and the Best Practice homes.

Table 4: Comparison of diversion from landfill rates – normal and best practice homes

Builder	Waste Diverted from Landfill	Waste (kg/m2) to landfill
GJ Gardner	70%	5.02
Jennian Homes	75.5%	4.52
Mike Greer Homes	54%	10.31
Orange Homes	60%	9.07
Stonewood Homes	80%	4.16
David Reid Homes	84%	3.04
Benchmark Homes	82%	4.42
Golden Homes (Steel framed)	76%	3.07
Waitakere NOW Home	8%	15.46
Rotorua NOW Home	8%	14.54
Havelock North Best Home™	95%	0.71

As can be seen from Table 4, the presence of waste sorting companies in the market can make a substantial difference to waste diversion rates from landfill. When the Waitakere and Rotorua NOW Homes were built, this service was not available in Auckland or Rotorua.

While creditable diversion rates are achieved with this method, it can be seen that the actual weight of waste to landfill can still be quite high. For example the Benchmark Homes house achieved a reasonably high 82% diversion rate – but at 4.42 kg/m^2 for their 283m^2 house, 1.251 tonnes of waste still went to landfill.

This compares with the Havelock North Best Home™ where only 133 kg of waste from their 168.8m^2 house went to landfill. Clearly a combination of good waste reduction practices combined with sorting and diversion from landfill are required to deliver the best outcomes.

8 Conclusions

Clearly the Havelock North Best Home™ has achieved excellent results from the implementation of its approach to construction waste management.

In terms of drivers of waste production, it's hard not to conclude that disposal method (the big skip) does not result in larger than necessary quantities of waste – with an "out of sight – out of mind" approach. Advice from Horvath Homes is that a major motivation for their approach to waste is that the cost of skip hire and landfill disposal of construction waste is substantial, so there does seem to be an economic driver for change. Most New Zealand homes are built on the basis of a number of subcontractors being involved

While the companies operating the waste sorting service in Christchurch no longer operate, sorting of construction waste is a service offered by at least one waste management company in Auckland, and this is used by builders working in the Hobsonville Point development for their waste disposal, with one recently monitored house achieving 8kg/m^2 of waste going to landfill. While compared to industry standard practice 8kg/m^2 of floor area of construction waste to landfill is a good result but falls very short of what is achievable with best practice.