BBS/10

Spreydon 1: Build Back Smarter Case Study

A report prepared by Beacon Pathway Incorporated
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About This Report

Title

Spreydon 1: Build Back Smarter Case Study

Authors

Lois Easton, Beacon Pathway Inc

Reviewers

Bill King, Beacon Pathway Inc

Abstract

The Build Back Smarter Project aims to develop evidence that residential performance upgrades at the point of earthquake repair is able and worthwhile to be implemented as part of the Canterbury earthquakes recovery process. Using the case studies of ten homes, the project is exploring and demonstrating what is possible as part of the repairs. This report documents the third completed case study – the upgrade of a house known in the project as Spreydon 1.

Reference

Easton, L. (November 2013). Spreydon 1: Build Back Smarter Case Study. Report BBS/10 for Beacon Pathway Incorporated.

Disclaimer

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1 Introduction

Over the past 2 ½ years Beacon Pathway Inc has been undertaking research into how energy and water efficiency and indoor environment quality improvements can be incorporated into earthquake repairs from the 2010 and 2011 Canterbury Earthquakes. The research has involved the use of case studies to explore and demonstrate what is possible as part of the repairs. This report documents the third completed case study – a house known in the project as "Spreydon 1".

2 Spreydon 1

Figure 1: Spreydon 1

Spreydon 1 is a modest, 1930s weatherboard bungalow. The house consists of three bedrooms, a living room, dining room, kitchen, laundry and bathroom, with a separate garage. The exterior cladding of the house is timber weatherboard and it has a suspended timber floor. The internal wall linings were lath and plaster. The total dwelling area is 109m^2. The roof is clad with chip coated steel tiles. Heating in the home was with an older inset woodburner combined with two heat pumps and hot water was supplied by a 1980s electric hot water cylinder combined with a wetback.

The house is owned by a couple who have lived there for the last 33 years and brought up their family in the home.

2.1 Earthquake damage

The house suffered from significant damage to foundations from the earthquakes. Ground movement caused uneven settlement of ring foundation and piles, damage to sewer and stormwater drains. Most interior lath and plaster ceiling and wall linings were badly cracked. Because of the foundation failure, repair also required the removal of the internal brick chimney.

Figure 2: Earthquake damage to Spreydon 1 wall linings

The house was insured by IAG and the Project Management Office (PMO) was Hawkins.

In terms of the scope of the earthquake repairs:

- The house was jacked up and the concrete ring foundation replaced, including piling down to 6 metres
- Lath and plaster ceiling linings were replaced throughout
- Lath and plaster wall linings replaced throughout
- Doors and windows were eased and adjusted throughout
- Sewer and stormwater drainage was checked and minor repairs were made
- Full interior and exterior redecoration.

The total value of earthquake repairs is estimated at $160,000 excl. GST. The repairs were undertaken over a period from November 2012 to September 2013. Because the foundations were replaced, a building consent was required from Christchurch City Council.

2.2 House performance assessment and retrofit

The house was assessed using Beacon's House Assessment and Prioritised Plan tool. The pre-retrofit condition and performance interventions undertaken are outlined in Table 1 below.

Table 1: Pre-retrofit condition and interventions

Spreydon 1	Pre-retrofit condition	Interventions	Cost (excl GST)
Thermal	Thick ceiling insulation – disturbed due to trades activity in the ceiling.	Replaced as part of insurance work	
	No wall insulation or building wrap	R 2.8 wall insulation installed in whole house with building wrap segments inserted between the frames	$2,398
	No underfloor insulation or vapour barrier. Damp underfloor.	R1.6 underfloor insulation installed Polythene vapour barrier installed	$2,544 $946
	Draughty external doors	Draught excluder installed on 1 door – Not charged	
	Cold conservatory facing due south with large area of glass.	Homeowner funded extension to the house, replacing conservatory and installing double glazed windows in extension.	
Hot water	Old (1980s) hot water cylinder unwrapped with wetback on insert woodburner	New hot water cylinder and wetback installed by homeowner. Additional pipe lagging post completion	Paid by homeowner $108
Heating	Old inset woodburner in lounge. Internal chimney. Heat pump in lounge.	New low emission freestanding woodburner installed by homeowner, chimney removed as part of earthquake repairs.	Chimney removed as part of earthquake repairs. Homeowner funded new wood burner.

Spreydon 1	Pre-retrofit condition	Interventions	Cost (excl GST)
	Poorly located hallway heat pump. Front bedrooms very cold, but living area overheats.	Heat pump relocated to other end of hallway. Heat transfer system installed taking heat to two bedrooms and hallway – was intended to go to all three bedrooms but homeowner altered spec. during construction.	$610 $961
Lighting	Incandescent lights throughout the house.	Homeowner didn't want to replace with CFLs. Installed multiple IC –rated downlights as part of extension and kitchen upgrade.	
Ventilation	Old ineffective extract vent in kitchen. No bathroom extract.	New rangehood externally vented installed as part of kitchen upgrade by homeowner. New bathroom extract installed.	 $400
Water	Efficient showerhead. High flow kitchen and bathroom taps. Single flush toilet. Good opportunity for rainwater tank installation.	Tap aerators specified as part of work but not installed by builder. Dual flush toilet installed as part of wider bathroom upgrade by homeowner. 1000 litre rainwater tank installed.	 $598 $2,952
Total BBS Retrofit Cost before EECA subsidy			**$11,517**

Figure 3: The house was lifted up for foundation repair – enabling access to install underfloor insulation and a ground vapour barrier in Spreydon 1

Figure 4: South facing conservatory / dining area. The homeowner removed this and extended the house into the area, including double glazed windows.

Figure 5: An old inset wood burner with a wetback was replaced with a modern freestanding woodburner, wetback and new hot water cylinder.

2.2.1 Homestar™ assessment

Prior to the repair and retrofit, the house was assessed by a Homestar™ Homecoach using the simplified online tool. The house was assessed as being 2 Star. Following the retrofit and repair, a reassessment indicated the house now meets a 5 Star on the online tool. A Certified Homestar™ assessment has not been undertaken. The Homestar™ Homecoach reports are attached in Appendix One.

3 Findings – Repair process

Figure 6: A new system of installing pile foundations was trialled by the repairer of Spreydon 1.

Figure 7: Lifting the house up to replace the foundations enabled easy access for both underfloor insulation and ground vapour barrier installation for this previously cold and damp house underfloor

3.1.1 Inclusion of Build Back Smarter upgrades

As with the previous Huntsbury 2, Halswell 1 and Somerfield 1 case studies, inclusion of Build Back Smarter upgrades in the Spreydon 1 repairs appears to have had no impact on the pace or difficulty of the repair process for the case study household, PMO or the insurer. In fact there were substantial delays with the implementation of repairs for this house which arose because the foundation replacement method was a new one being trialled. The house sat up 2m above the ground with no work being undertaken for most of the summer – over 4 months. As with the other case studies, the Build Back Smarter upgrade measures were a minor part of the overall project. Like the Somerfield 1 case study, however, there were some issues with the quality of the installation of the Build Back Smarter upgrade features and the tap flow restrictors not being installed by the contractor.

3.1.2 Costs of upgrade features

The costs of these installations were relatively high. As with other case studies, the upgrades went through the appointed builder, who charged 12% P&G and 10% builder's margin on top of the cost of the work quoted (including that undertaken by CEA). The same builder who worked on the Halswell 1 case study was also used for this work.

Interestingly, the homeowner had a substantial extension, kitchen, bathroom and bedroom upgrade undertaken at the time of repair. Because the costs for the hot water cylinder and other fixtures quoted by the builder was so high, she sourced these items herself – including windows off TradeMe and a solar/wetback ready hot water cylinder which she bought online from Auckland and had freighted to Christchurch for a substantially lower cost than the builder was able to source a cylinder in Christchurch.

This gives an indication that, alongside the high builders' costs, materials and products may also be the subject of inflated supply costs within Christchurch. After her success in sourcing a much cheaper hot water cylinder, the homeowner was asked by the builder for the supplier details so that they could also use them to supply hot water cylinders in future jobs.

As outlined above, the homeowner also sought substantial additional work to be undertaken at the time of repair – an extension, complete new kitchen and associated appliances, upgrades to the bathroom and toilet, and a new woodburner and hot water cylinder were also installed. This work was undertaken by the appointed builder at the same time as the repair work and came to approximately $60,000 including GST.

Figure 8: Building wrap inserts were stapled into the framing as part of the wall insulation installation process

3.1.3 Impact of homeowner-funded improvements on the interventions

The homeowner-funded improvements were designed by a third party architect without input from the Build Back Smarter team. Their implementation was overseen by the homeowner, who made decisions and changes throughout the construction period. Some of these decisions had consequential – positive, neutral and negative - impacts on the overall performance of the upgrades. For example:

- The outlet from the heat transfer system was not installed in the master bedroom – the homeowner decided to reuse the tongue and groove ceiling from the kitchen extension in the bedroom, and didn't want it disfigured. The outlet was instead installed in the hallway outside the bedroom. While the homeowner was happy with this arrangement, research indicates that heat transfer outlets should be located in the room where the heat is required. Location in hallways is ineffective for heating adjacent spaces.
- The intake from the heat transfer system was installed above the wood burner, rather than on the other side of the room. This will have a positive impact in terms of reducing the ducting length (and therefore heat loss into the ceiling cavity). While, generally, it is recommended that the intake is taken from the other side of the room, the thermostat is located near the doorway to the hall which should mean that the transfer doesn't start until there is excess heat to transfer.
- Downlights were installed in the ceiling of the kitchen extension. However, care was taken to ensure these were IC rated – therefore there should be no impact on the ceiling insulation performance.

Beacon

Figure 9: Unknown to Beacon, a new ceiling was installed in Bedroom 1 as part of the homeowner funded improvements – as a result the homeowner got the builder to install the heat transfer outlet in the hall rather than the bedroom.

Figure 10: Homeowner-funded house extension replacing the south-facing conservatory

3.1.4 Water retrofit measures

Like other case study houses, some water retrofit measures were included in this upgrade. As with the other houses, the planned flow restrictors were omitted by the builder/plumber but an attempt was made to charge for these. These types of small interventions seem to be particularly susceptible to omission and are better not included in the wider upgrades at time of repair.

The house also received a dual flush toilet cistern, and was the first in which a rainwater tank had been installed. The tank is a 1000 litre tank with a leaf guard and plumbed overflow and was installed by CEA, with the primary purpose of garden watering and a secondary purpose as an emergency water supply. As with the hot water cylinder, the materials/product prices being charged to installers in Christchurch appears to be substantially higher than other parts of the country with the final price of this modest system being double what might be expected in other parts of the country.

Figure 11: A 1000 litre rainwater tank was installed as part of the water retrofit measures

4 Homeowner experience and willingness to pay

The owner of Spreydon 1 was interviewed six weeks after her house was completed.

The main expectations she had around the project were that the house would become much warmer and easier to heat. In this respect, despite the short post repair timeframe, she felt that the upgrade had delivered a substantial improvement. The homeowner was originally from France, and had found the house cold and draughty throughout their tenure.

As a result of the earthquakes, the homeowners decided that the time of repair was a good time to address a number of other issues in the house, and take some steps to modernise it. The conservatory was recognised as a major problem – facing south it made the house very cold. The homeowner noted that in undertaking renovations she did a lot of research, and read widely about the options. In this respect she found the Upgrade Plan and Homeowner Manual particularly helpful. Unfortunately, the homeowners were already out of the house, and the design of the extension was largely complete by the time the Home Assessment was undertaken. As result, this was not able to influence the design of the extension in any way.

The most notable change for the homeowner post-repair and upgrade was the ease with which the house was able to be heated. Because of the extensive renovation to kitchen, bathroom, main bedroom and living area, undertaken by the homeowner, it was difficult for her to separate out which improvements gave the greatest benefits.

4.1 Experience of the repair and upgrade process

The timeframe for repairs, and in particular, the period of time during which no work occurred on the house but it was jacked up and the homeowners living in a motel, was seen as a significant stress on the household. In addition, because the homeowner undertook a degree of project management of the renovation and extension, she found dealing with the builder – the costs, getting the quality of workmanship right – quite stressful, and had a long list of post completion defects that she felt needed to be addressed.

4.2 Cost and willingness to pay

The homeowners spent approximately $60,000 incl. GST on the extension, upgrade of the kitchen, bathroom, master bedroom and hot water cylinder during the repair process. This was about double what they had originally budgeted, and as a couple approaching retirement they felt this was the maximum they were able to pay.

The homeowner saw particular benefits from the relocation of the heat pump, the addition of the heat transfer system, the bathroom extract fan and the installation of insulation in the walls and underfloor. She noted that her husband (not interviewed) was particularly interested in the rainwater tank.

The underfloor insulation was the feature of the Build Back Smarter upgrade that the homeowner noted as being a priority measure for her if she had to pay herself, but she felt that other insulation improvements weren't affordable for them despite the substantial investment they made in other aspects of renovation and extension of the house. The homeowner did note that, in the future, she was keen to investigate double glazing of the existing windows. The experience of the double glazed windows in the extension meant she noted a tangible improvement in performance.

5 Discussion

5.1 Cost of products and materials in Christchurch repairs

This case study highlights something which has become an increasing concern to Beacon during the Build Back Smarter pilot: the high prices being charged for products such as hot water cylinders and rainwater tanks. Throughout the pilot, there have been items cut from the upgrade budget because of the high price quoted by the PMO's builder. While a proportion can be attributed to the (now) high cost of labour in a tightly constrained market, combined with high builders' margins for the work, there is a third element – the actual cost of the products/ materials being supplied.

In this case, the homeowner refused to pay the price for the hot water cylinder replacement she wanted to be done at the time of repair, and instead bought a cylinder online from an Auckland supplier and had it transported down to Christchurch. In doing this, she had undertaken significant research into prices, and was unable to source a cylinder as cheaply in Christchurch. She made substantial savings in doing this, and subsequently the builder sought the details of her supplier, so that he could also source hot water cylinders more cheaply for other projects.

The rainwater tank installed as part of the pilot was also priced substantially higher than similar tanks supplied in other parts of the country. We relied on CEA getting the best price they could, but it is clear that the price of rainwater tanks and associated fittings such as first flush diverters is substantially cheaper in the North Island.

5.2 Cost of repiling

The repiling of Spreydon 1 used a new technique developed specifically for repairing earthquake-damaged foundations. The Spreydon 1 house was the first IAG/Hawkins house to utilise this methodology so a fixed price wasn't available to the PMO/Insurer. The length of time and complexity involved was far greater than anybody anticipated, and this would have caused a significant escalation in costs to the insurer. In hindsight, it is quite likely that, if they had known the costs, this house would have been tipped into the "rebuild" rather than "repair" category.

6 Conclusions

The conclusions of the previous case studies[1] are supported by the Spreydon 1 case study. A number of additional conclusions can also be drawn:

- Insurers are only just starting to understand the potential for higher repair costs on items that are unseen or unforeseen at the non-invasive "scoping" stage. For example:
  - Foundation repairs are proving to be substantially greater than estimated.
  - "New" foundation systems or approachs being used have often not been site tested for actual cost as opposed to estimated costs.
  - Drainage system damage is not picked up at the scoping stage.
- Planned flow restrictors were omitted by the builder/plumber but an attempt was made to charge for these. These types of small interventions seem to be particularly susceptible to omission and are better not included in the wider upgrades at time of repair.

7 References

Easton, L. (2013a). Huntsbury 2: Build Back Smarter Case Study. Report BBS/6 for Beacon Pathway Incorporated

Easton, L. (2013b). Halswell 1: Build Back Smarter Case Study. Report BBS/9 for Beacon Pathway Incorporated

Easton, L (2013c). Somerfield 1: Build Back Smarter Case Study. Report BBS/11 for Beacon Pathway Incorporated.

[1] ***Easton (2013a), Easton (2013b) and Easton (2013c)***

Appendix One: Homestar™ Homecoach pre-upgrade report

Homestar™ report

Homecoach assessed

Your Homestar rating

2

Analysis

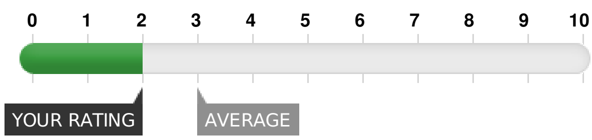
Congratulations, on completing the Homestar™ rating.

This house has achieved a rating of 2 stars under the Homestar Residential Rating Scheme.

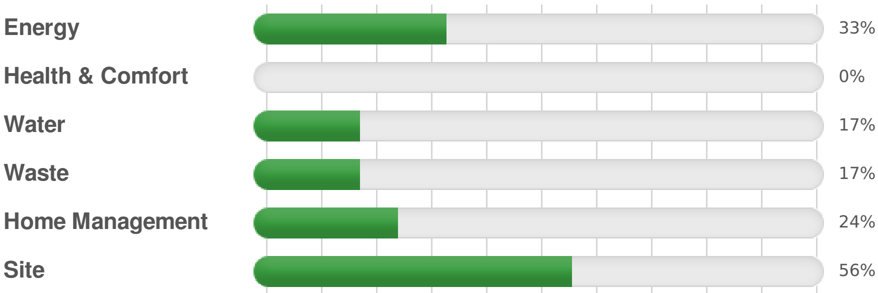
It is possible for this home to achieve a higher star rating, except that it is currently being held back by a mandatory minimum performance level in the core issue of overall warmth and comfort (specifically the ability for the house to achieve healthy winter-time temperatures without using excessive energy). To gain a higher star rating address this core issue first, and then reassess the house once the changes have been made.

A small part of the rating tool rewards non-permanent fixtures of the home such as fridges, freezers, dishwashers, compost facilities etc. If these are removed (for instance when the house changes occupancy) this could affect the star rating of the house.

Compare your rating
The average score for your type of house (California Bungalow (1920–1940)) is 3



Your house has been identified as a type of bungalow. These are relatively easy to retrofit and should perform well once they have been upgraded. Extra insulation can be put into the ceiling and under the floor easily in most cases, and bungalows are suitable for a wide range of heating types. Issues with heritage restrictions in certain neighbourhoods may make interventions such as fitting double glazing or providing solar hot water panels slightly more complicated. However, overall, providing the 'bones' of your house are sound, a range of retrofit interventions will work well.



Recommendation information

Use the recommendations in this report to prepare a plan for your whole house. This will guide you through the process of making your home cosy, warm, healthy, cheaper to run and with a higher rating. Some recommendations involve simple actions you can take at little or no cost. Others involve investments that will pay for themselves through lower running costs or other benefits like making your home more comfortable.

The recommendations are provided in order of priority for improving your overall health and comfort in the home, but you can re-prioritise based on the potential to improve your star rating, the operational cost savings, or whether the recommendation will be kinder on the environment – simply click on the headings to change the order.

Costs and improvement potential

Appendix Two: Homestar™ Homecoach post-upgrade report

1. Homestar™ Report: Self Assessed

Your Homestar Rating

5

Analysis

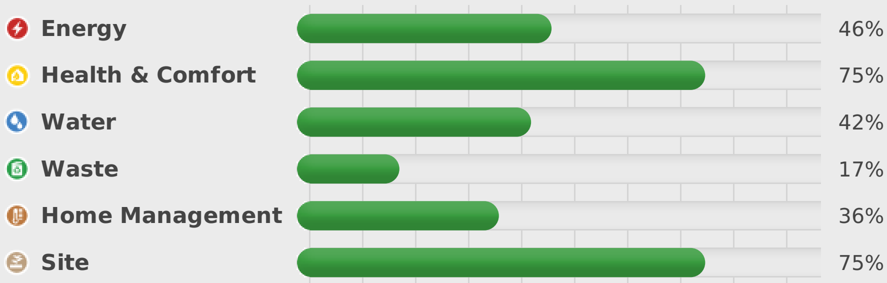
Congratulations Adam, on completing the Homestar™ rating.

This house has achieved a rating of 5 stars out of 10 under the Homestar™ Residential Rating Scheme. Most New Zealand houses currently score between 2 and 4 stars.

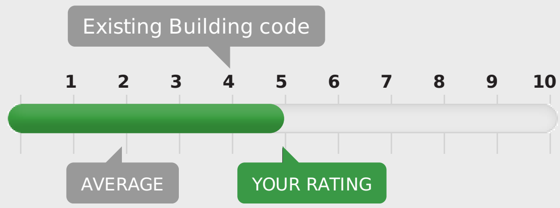
The Homestar™ rating system rates houses on a variety of categories which look at health, comfort, resource use and environmental effects of residential dwellings. Individual Category scores are provided below.

More information (/report-more-info)

Home Performance Categories:



Compare your rating:



Recommendations: Follow us, we've got a plan

Use the recommendations in this report to prepare a plan for your whole house. This will guide you through the process of making your home cosy, warm, healthy, cheaper to run and with a higher rating. Some recommendations involve simple actions you can take at little or no cost. Others