Appendix 3

Report prepared for the Ministry of Business, Innovation and Employment

Cost benefit analysis for a minimum standard for rental housing

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sapere® research group

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Executive summary

This report considers the plausible costs and benefits associated with a minimum standard for rental housing in New Zealand. It is guided by a draft minimum standard for rental housing – under development by the Ministry of Building, Innovation and Employment (MBIE). The purpose of the analysis is to identify and quantify the additional economic costs and benefits resulting from the implementation of the minimum standard and to determine the net benefit to society.

This analysis focuses on the impacts on non-HNZC rental dwellings, including those owned by local councils, NGOs, and private landlords. The costs and benefits associated with applying the standard to HNZC stock are being considered separately by HNZC and MBIE.

We begin this exercise by assuming perfect policy uptake to determine the potential net benefit of the policy. That is, we assume the minimum standard is adhered to by landlords following its implementation and that all non-compliant features of rental dwellings are either repaired or upgraded so that the standard is met. In reality, behavioral responses are more complex and there is a range of plausible enforcement regimes with different effects on policy uptake and on the costs and benefits. We then examine how different enforcement regimes might affect the take-up and the costs, benefits and net benefit of the policy.

Estimating the costs

Our estimates of the compliance costs are based on information about the condition of the rental stock and the cost of repairing or installing components of a rental dwelling. The main source of information is BRANZ's 2010 Housing Condition Survey (HCS), which included data on 108 rental dwellings. We matched each component of the minimum standard to an HCS indicator, as far as possible (see Appendix 2). In some cases, a very close or approximate match was possible (e.g. the presence of ceiling or underfloor insulation). In other cases there was no data available on the condition of the component. Overall, we were able to match around two-thirds of the components in the minimum standard.

We then identify the proportion of rental dwellings in the HCS that would "fail" (i.e. the component is absent or is in serious condition). BRANZ has weighted the data so that the sample reflects the national rental stock. Within the sample we find that 93 out of 108 rental dwellings in the HCS sample had at least one component that would be unlikely to meet the proposed minimum standard. This means that 14% of dwellings would pass the minimum standard and 86% would be likely to fail on one or more component.

Costs are estimated for each non-compliant component to be brought up to the minimum standard, using the unit costs from a range of sources. The average cost of repairs and component upgrades is estimated to be $1,811 per dwelling with one or more components requiring action. The distribution of costs is skewed towards the lower end – i.e. relatively low costs to upgrade components to meet the minimum standard. Around 42% of rental dwellings would face compliance costs of less than $1,000. In terms of the overall cost to bring the relevant rental stock up to a compliant standard, the components making the largest contribution are underfloor insulation (36%), where this is feasible to install, and bathroom flooring – where the floor lining has holes and/or is lifting (19%). These contributions are driven by the by the relatively high unit cost to address these components as well as their prevalence as non-compliant components within the rental stock

Estimating the benefits

On the benefit side, we are reliant on the literature given the complexities of measuring outcomes and the timeframes and resourcing parameters for this work. However we have tried to focus on New Zealand research and to be transparent about parameters used.

The benefits are a stream of avoided costs to society. The largest contribution (46%) comes from avoided trips and falls due to a reduction in hazards in the home. This is followed by the contribution of health benefits (43%) arising from the installation of underfloor and ceiling insulation in dwellings where this is absent and feasible to install. In addition, there are benefits from avoided fire-related fatalities from the presence of smoke alarms (9%) and some energy savings from the installation of insulation (2%).

The benefits typically do not arise from the cost of specific component of the minimum standard, with the notable exceptions being health benefits from insulation and avoided fatalities arising from the installation of smoke alarms. This is because the evidence about benefits generally lacks the granularity of the data on the costs of meeting the minimum standard. So while it is clear that improving components to the minimum standard will give rise to additional costs and collectively bring some benefit, it is not possible to analyse the costs and benefits of each component of the minimum standard.

Headline results

We find that society would likely be better off under the proposed minimum standard although the form of the enforcement regime matters for costs and benefits and the overall quantum of net benefit to society. Under our base case – which assumes perfect take-up in the absence of an enforcement regime, we find that the net benefit of the minimum standard would be $334 million (present value basis). Underlying this headline result are total costs of $653 million (present value basis) and total benefits of $987 billion (present value basis). The benefit-cost ratio is 1.51. These results are robust in the face of alternate but still plausible assumptions about the modelled time horizon and discount rates.

Enforcement regimes

The enforcement affects the results, through the additional costs involved and the assumed impacts on compliance behaviour and therefore the overall costs and benefits. We developed and modelled four enforcement regimes, namely a self-enforcement regime (similar to the base case), a "market forces" regime (advising tenants of status), a "tax compliance" regime (targeted audits) and a "motor vehicle" WOF regime (mandatory universal checks).

Under the self-regulation option, the onus is on landlords to assess their property and undertake any actions needed to meet the minimum standard. This regime results in a benefit-cost ratio that is almost identical (1.50) to the base case. From an economic perspective, this option stands out. However, it does come at the potential cost of a large number of around 100,000 rental dwellings that might not comply with the standard.

The "tax compliance" model would appear to have merit. It still produces a robust benefit-cost ratio (1.30) meaning society is better off with a minimum standard that employs this enforcement regime. However it may be particularly effective at identifying and addressing the "tail" of the distribution through targeted monitoring. Ultimately, policy design is not the function of a cost benefit analysis but to the extent that we have estimated realistic administrative costs, then, outside of the more stringent "motor vehicle WOF" option (0.88), the enforcement regime chosen would enable the policy to deliver a net benefit to society.

1. Purpose and scope

1.1 Purpose of this report

This report considers the plausible costs and benefits associated with a minimum standard for rental housing in New Zealand. The purpose of the analysis is to identify and quantify the additional economic costs and benefits resulting from the implementation of the minimum standard and to determine their net benefit to society – relative to continuing with "business as usual" or the status quo.

The purpose of this report is to inform the design of a minimum standard for rental housing – signalled by the Government in Budget 2013 and being developed by the Ministry of Building, Innovation and Employment (MBIE).[1] The analysis in this report also considers how the net economic benefit to society from the implementation of the minimum standard might be affected by the type of enforcement regime.

1.2 Scope of the analysis

The analysis covers the components of rental dwellings included in the draft minimum standard made available for this work – included as Appendix 1. The 49 components are included and grouped into three categories:

- insulated and dry;
- safe and secure; and
- essential amenities.

In terms of rental housing stock, the analysis includes all rented dwellings except those owned by the Housing New Zealand Corporation (HNZC). The costs and benefits associated with applying the minimum standard to HNZC stock are being considered separately by HNZC and MBIE. This analysis therefore focuses on the impacts on other rental dwellings, including those owned by local councils, NGOs, and private landlords.

1 Hon. Nick Smith "Housing WOF to be developed and trialled" Media release 16 May 2013. http://www.beehive.govt.nz/release/housing-WOF-be-developed-and-trialled

2. Our approach to this work

The approach adopted here is an economic cost benefit analysis from the perspective of society as a whole. This includes the identification of benefits that accrue in the form of avoided costs that would otherwise have occurred under the status quo. Our approach has been informed by the guidance on cost benefit analysis provided by the Treasury.[2]

We have undertaken our research and analysis in an independent manner. As such, the assumptions and conclusions included here are based on our best professional judgment, following consideration of the evidence, discussions with MBIE policy makers, and feedback from technical experts at a workshop held in August 2013. The organisations represented at that workshop included MBIE, HNZC, EECA and Beacon Pathway.

2.1 Modelling timeframe

The costs and benefits are modelled over a 20-year period to ensure a sufficient time horizon for capturing the long term effects of the proposed options. We also test the sensitivity of the results to alternative time periods, namely, 10 years and 30 years.

2.2 Discount rate

To account for the 'time value of money' we discount the future stream of cost and benefits using a discount factor of 6%. We also test the sensitivity of the results to the alternative discount rates of 2%, 8% and 10%.

2.3 Policy uptake

We begin this exercise by assuming perfect policy uptake. That is, we assume the minimum standard is adhered to by landlords following its implementation and that all non-compliant features of rental dwellings are either repaired (e.g. holes in floor) or upgraded (e.g. addition of insulation) so that the standard is met. Moreover, such compliance is assumed to be achieved with minimal administrative cost – we assume 0.2 FTE of policy oversight per year.

In reality, behavioral responses are more complex and there is a range of plausible enforcement regimes with different effects on policy uptake and on the costs and benefits. However, starting in this way allows us to define a 'clean' base case that represents the potential net benefit of the policy. We then work backwards from this starting point, and examine how different enforcement regimes might affect the policy take-up, and therefore, the costs, benefits and net benefit of the policy.

In this base case and in all scenarios, we assume landlords comply with the requirements of the minimum standard in a phased manner. The nature and volume of repairs and upgrades likely to be required under the minimum standard are such that it is not realistic to expect them to take place immediately after the announcement of the policy. We therefore assume a three-year phase-in period for the policy (i.e. it takes three years for maintenance to be done). The costs and the associated benefits are assumed to accrue linearly in this phase-in period.

2 New Zealand Treasury (2005) *Cost Benefit Analysis Primer*

2.4 Useful life of repairs

We assume that the useful life of repairs and upgrades being undertaken is 15 years. That is, on average, 15 years after these repairs and upgrades are implemented, the components would need to be replaced and the costs would be incurred again. This period is a judgment, reached after discussion with technical experts and our own consideration of the issue.

Some cost items (e.g. installation of insulation) could reasonably be expected to last longer than 15 years, while others (e.g. handrails or bathroom linings) might reasonably be expected to need repair or replacement within that timeframe. In the absence of detailed information on component lifecycles and to enable the linking of benefits to costs in a more granular fashion, we have opted for this average figure.

2.5 Additionality

Survey data suggests that some landlords will be likely to undertake the sorts of repairs and upgrade activity that might be required by the minimum standard – even in the absence of such a standard. As an example, recent research into a pre-test for a warrant of fitness (WOF) under development by a consortium of local councils found that 83% of participating landlords stated that they intended to make improvements to their rental property following the WOF assessment. However, for over one-third of them, the improvements were already planned prior to the WOF assessment.[3]

This suggests that, following implementation of the minimum standard, some of the necessary measures to bring rental dwellings up to the standard would likely have occurred anyway. This issue was also addressed in the evaluation of the Warm Up New Zealand: Heat Smart Programme.[4] That research drew on regression analysis to explain the quantity of insulation installed on the basis of building consent activity and the number of rental dwellings subsidised. In its base case, that research uses an assumption that 74% of the dwellings insulated under the programme would not have installed insulation in the absence of the Heat Smart Programme.

Weighing up this evidence, we make an assumption that one quarter (25%) of repairs and upgrades that would be required under the minimum standard for rental housing would have taken place regardless of the policy. As such, we reduce the benefits (and costs) accordingly. The reality is that the commencement of the minimum standard would occur at a particular point in time, whereas expenditure on property repair and maintenance is dynamic and ongoing. We believe that this assumption is reasonable on the basis of available information.

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3 Bennett, J. et al (2014) *Results from a Rental Housing Warrant of Fitness Pre-Test.* He Kainga Oranga/Housing and Health Research Programme, University of Otago, Wellington http://sustainablecities.org.nz/wp-content/uploads/Results-from-a-Rental-Housing-WOF-PreTest-May-2014.pdf

4 Grimes, A, et al (2011) Cost Benefit Analysis of the Warm Up New Zealand: Heat Smart Programme. Prepared for the Ministry of Economic Development. Final Report October 2011, revised June 2012

3. Estimating the costs

The costs of complying with the minimum standard can be grouped into:

- **physical costs** – repairs and maintenance to dwellings and "upgrades" – the installation of new items that were not previously in place (e.g. ceiling insulation); and
- **administration costs** – the costs of administering the minimum standard. These can include the development of operational policy, ongoing monitoring and reporting, and onsite assessments. These costs also depend on the enforcement regime, which could involve minimal enforcement, targeted audits or more a universal, mandatory system.

As noted above, we begin by assuming perfect compliance with the minimum standard, to determine the underlying mix of costs and benefits; we then consider different enforcement scenarios with their different costs and impacts on compliance. The costs associated with the enforcement of the minimum standard are discussed later in this report, in Section 5.4 on enforcement considerations. This chapter focuses on estimating the physical costs of the minimum standard for the base case (i.e. under the assumption of perfect policy take-up).

3.1 Data sources

Our estimates of the physical costs are based on information about the condition of the rental stock and the cost of repairing or installing components of a rental dwelling.

- **Condition of stock** – the main source of information is BRANZ's 2010 Housing Condition Survey (HCS), which was based on a sample of 494 dwellings – of which half were in the five main urban centres, with the others located across the country. We received data on 108 rental dwellings assessed in the survey – the amount determined by BRANZ to be required to provide a sufficiently representative sample. As well as assessing a large number of components, each assessor made a subjective judgment about whether the dwelling was "poorly", "reasonably" or "well" maintained.[5]
- **Unit costs** – estimates for repairing or installing each component. These costs were primarily provided by BRANZ[6] but supplemented with:
  - insulation installation costs provided by EECA (e.g. average cost per square metre for ceiling and underfloor insulation);
  - our own online research into commercial prices of specific components (e.g. the cost of installing a set of window stays).

We explored the use of data in HNZC Property Quality Index (PQI). Following analysis and feedback from HNZC, it became clear that the PQI is not well suited to this exercise. One reason is that the condition of the HNZC properties within the PQI is quite different from rental dwellings owned by other landlords (i.e. the pattern is for HNZC properties to be better maintained overall and retrofitted with insulation). Therefore, the Housing Condition Survey is likely to be a better source of data on the condition of private rental dwellings.

5 Buckett et al (2011)

6 Costs data tables provided via email correspondence with by Ian Page – Manager, Economics at BRANZ

3.2 Approach to cost analysis

Our approach to estimating the physical costs incurred to comply with the minimum standard involves the following steps.

1. We match each component of the minimum standard to an HCS indicator, as far as possible. This matching is shown in Appendix 2. In some cases, a very close or approximate match was possible (e.g. the presence of ceiling or underfloor insulation). In cases where the indicator involved is an "overall condition" rating for a component, we use the "serious" condition rating – the lowest ranking on the scale of 1-5. In other cases there was no data available on the condition of the component (e.g. subfloor ventilation or the presence of fixed wire power points). Overall, we were able to match around two-thirds of the components in the minimum standard. On this basis, it is plausible that the actual costs of the minimum standard are somewhat underestimated.

2. We then identify the proportion of rental dwellings in the HCS that would "fail" (i.e. the component is absent or is in serious condition). BRANZ has weighted the data so that the sample reflects the national stock of rental housing – excluding HNZC stock. Each record in the HCS therefore represents multiple rental dwellings of a similar type and location. These weights sum to approximately 438,600 rental dwellings.

3. We estimate the cost for each 'failed' component to be brought up to the minimum standard – using the unit costs sourced from BRANZ, EECA, HNZC, and our own online price searches. These unit costs are shown in Appendix 2. In some cases, the unit cost is fairly standard, for example, the cost of a smoke alarm, window stay or handrail. In other cases, we scale back the estimated cost of repairing a component. This is because some repairs would be aimed at bringing a component up to an acceptable moderate condition – the intention of the policy – rather than to an "as new" state.

4. We then sum the estimated cost of each component and derive the average compliance cost per rental dwelling. This figure is an input into the cost benefit analysis model.

3.3 Results of cost analysis

3.3.1 Prevalence of non-compliant components

We find that 93 out of 108 rental dwellings in the HCS sample had at least one component that would be unlikely to meet the proposed minimum standard. This means that 14% of dwellings would be likely to pass the minimum standard and 86% would be likely to fail on one or more component. Using the weightings provided by BRANZ, this result translates to 376,600 out of 438,600 rental dwellings represented by the HCS sample.

This result is not too dissimilar to the findings of a pre-test for a warrant of fitness under development by a consortium of local councils.[7] Of the 144 dwellings that were assessed in that research, eight (6%) passed the standard. Notably, this pass rate would increase to 36% if several low-cost items were addressed, such as the correct installation of smoke alarms, security stays on the windows, and hot water being set at a safe temperature range.

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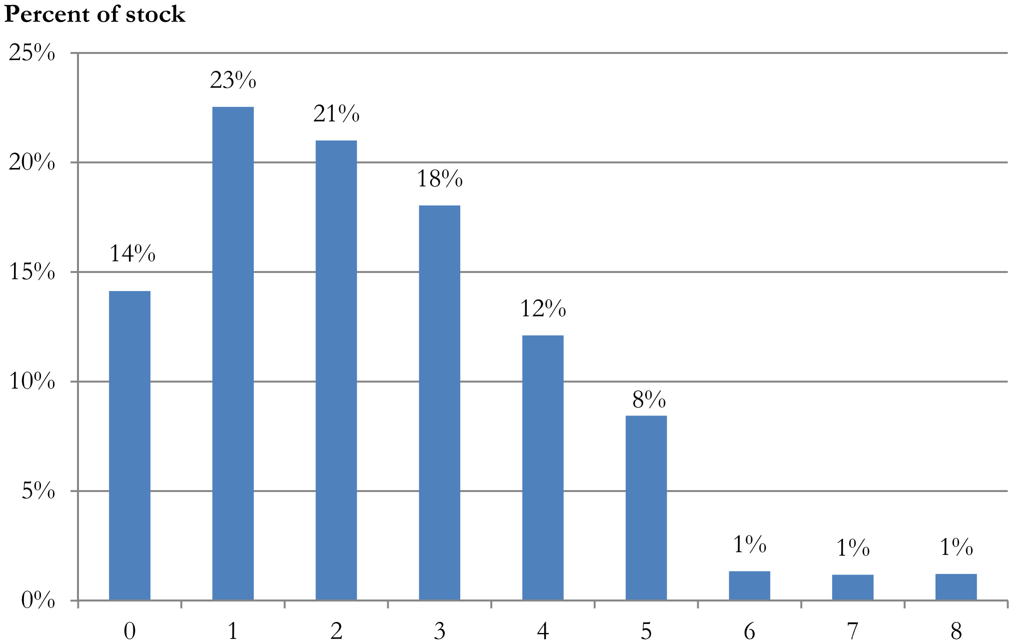
[7] [7]Bennett, J. et al (2014) *Results from a Rental Housing Warrant of Fitness Pre-Test.*

Of the 86% of rental dwellings with a component that would likely to fail the minimum standard, over half (44%) would fail on no more than two components. The highest number of non-compliant components within a single dwelling was eight. Figure 1 shows that:

- 14% of rental dwellings would likely pass the minimum standard;
- 23% of rental dwellings would fail on one component only;
- a further 21% of rental dwellings would fail on two components; and
- 3% of rental dwellings would fail on between 6 and 8 components.

Figure 1: Number of non-compliant components and percent of rental stock affected



Source: BRANZ Housing Condition Survey; Sapere analysis

Components of the minimum standard where the rental stock in the HCS sample were most likely to fail were:

- Security stays fitted to windows on first floor – 47% of rental dwellings were without window stays on any window; and
- Underfloor insulation present – 33% of rental dwellings were without subfloor insulation (this figure is calculated after excluding dwellings with no underfloor access).

With respect to the standard of smoke alarms within 2 metres of bedroom doors, we draw on research by Keall et al (2013) that found 65% of dwellings lack working smoke detectors.[8] Table 1 presents the components from minimum standard mapped to HCS indicators, where at least 5% of the rental stock would be likely to fail on a given component. In the case of underfloor and ceiling insulation, dwellings where no access was possible to the underfloor (e.g. slab concrete construction) or the ceiling excluded from the calculation.

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8 Keall, M, et al (2013) "Formulating a programme of repairs to structural home injury hazards in New Zealand" in *Accident Analysis and Prevention* 57 124–130

Table 1: Prevalence of non-compliant components – affecting ≥5% of rental stock

Minimum standard component	HCS indicator	Value	Proportion
Smoke alarms within 2 metres of bedroom doors	Lack of working smoke detectors[1]	True	65%
Security stays fitted to windows on first floor	Presence of window stays	None	47%
Underfloor insulation present	Subfloor insulation	No insulation	37%
Kitchen storage provided (i.e. safe storage for poisons)	Poison storage (laundry or kitchen)	None	30%
Visual safety strip on external glass doors	Visibility of full height clear glazing	None	21%
Floor linings intact	Bathroom floor lining lifting	True	20%
Functioning kitchen sink and taps	Kitchen joinery/taps deterioration	True	12%
Ceiling insulation present	Underfloor insulation base material	None	11%
Sewerage reticulation functioning	Subfloor plumbing waste defect/leak	True	10%
Waste water reticulation functioning	Water reticulation pipe defect/leak	True	8%
Roof intact and not leaking	Roof frame sign of water leak	True	7%
Wall linings intact	Laundry linings condition	1 (serious)	6%
No visible electrical problems (exposed wires, broken plugs or switches)	Damaged wiring outlets/switch	True	6%
Balustrades to stairs and landings	Internal stairs balustrades	None	5%

[1] Data on smoke detectors sourced from Keall, M, et al (2013) "Formulating a programme of repairs to structural home injury hazards in New Zealand" in *Accident Analysis and Prevention* 57 124–130

Source: MBIE draft minimum standard; BRANZ Housing Condition Survey; Sapere analysis

3.3.2 Costs incurred to meet the minimum standard

We estimate that the average cost of repairs and component upgrades to be $1,811 for each dwelling with one or more components requiring action to meet the minimum standard. The median cost among sample of rental dwellings is $1,425. Table 2 presents these figures along with the minimum cost for a rental dwelling to meet the standard ($30) and the likely maximum cost that would be incurred ($11,281).

Figure 2 shows the distribution of costs is skewed towards the lower end – i.e. relatively low costs to upgrade components to meet the minimum standard. Around 42% of rental dwellings would face costs of less than $1,000, with 24% of dwellings facing less than $200.

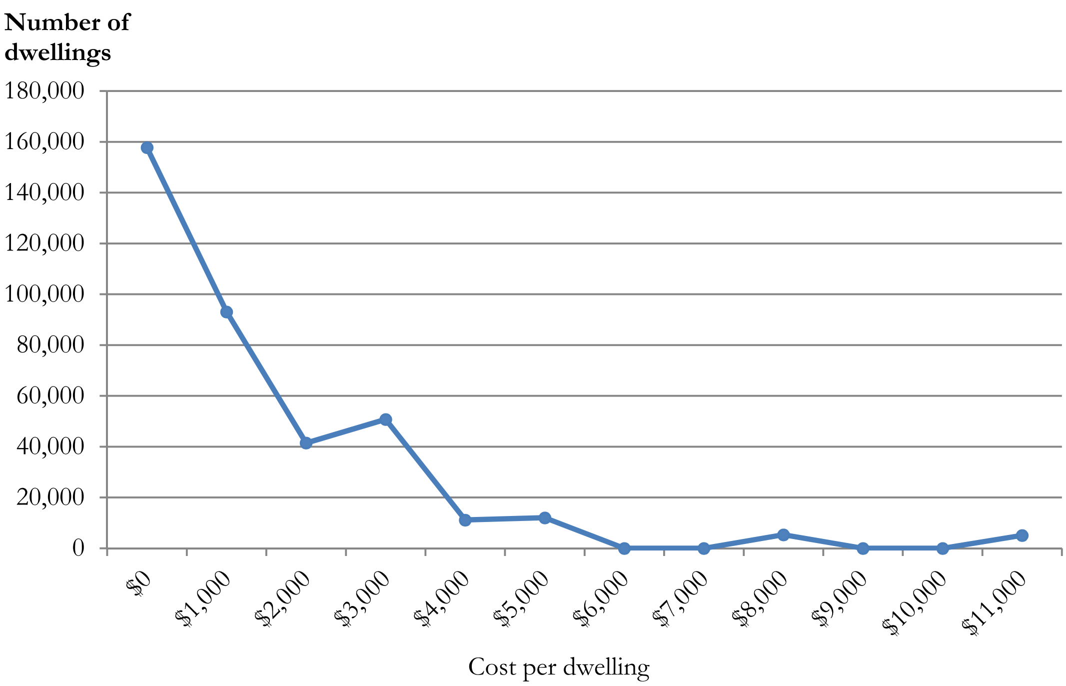
Table 2: Estimated costs to meet the minimum standard – key findings

Indicator – cost to meet the minimum standard	Cost per dwelling
Minimum cost	$30
Median cost incurred	$1,425
Average cost incurred	$1,811
Maximum cost	$11,281

Note: These findings are inputs into the cost benefit analysis model. The model assumes that 25% of aggregate costs would be incurred in the absence of the minimum standard.

Source: BRANZ Housing Condition Survey; Sapere analysis

Figure 2: Distribution of dwellings by cost to meet the minimum standard



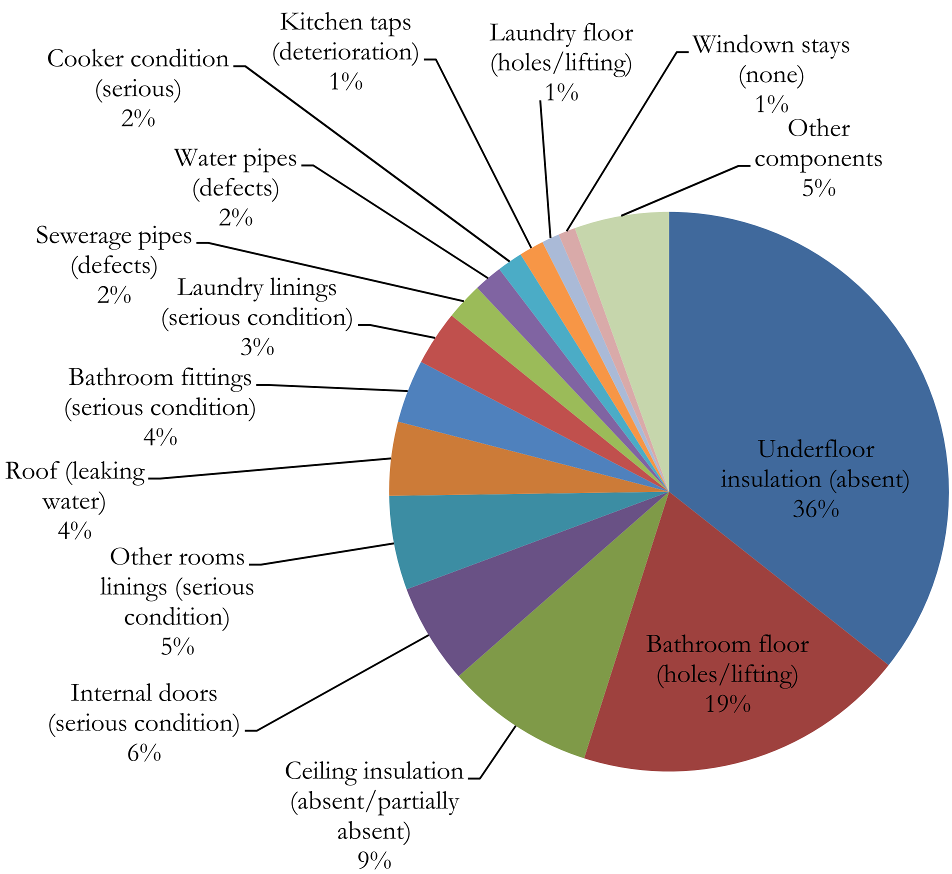
Source: BRANZ Housing Condition Survey; Sapere analysis

Figure 3 presents the contribution of each component to the aggregate compliance cost to meet the minimum standard. In terms of the overall cost to bring the relevant rental stock up to a compliant standard, the components making the largest contribution are:

- underfloor insulation – in dwellings where this is absent and able to be installed (36%); and
- bathroom flooring – where the floor lining has holes and/or is lifting (19%).

These contributions to overall costs are, to some extent, driven by the by the relatively high unit cost to address these components as well as their prevalence as non-compliant components within the rental stock. Underfloor insulation, for example, is absent in 33%% of rental dwellings – of those where it is possible to be installed – and has a relatively high unit cost of $1,726. Other components may have much lower unit costs and so account for a smaller share of overall costs. As an example, window stays are absent in 47% of rental dwellings but have a relatively low unit cost ($35).

Figure 3: Compliance costs to meet the standard – contribution of components



Source: BRANZ Housing Condition Survey; Sapere analysis

4. Estimating the benefits

In considering the benefits of a minimum standard being introduced to rental housing, we draw on a range of relevant studies. We find that the benefits are likely to take the form of avoided costs as a result of health improvements for inhabitants (i.e. from dwellings being warmer and drier due to installation, heating and ventilation), energy savings (also from insulation being installed), and safety benefits (i.e. fewer hazards resulting in a reduction trips and falls and a reduction in smoke-related mortality).

In terms of the relationship between costs and benefits, there is not a perfect match. That is, specific benefits typically do not arise from the cost of specific component of the minimum standard (with the notable exceptions being health benefits from insulation and avoided fatalities arising from the installation of smoke alarms). This is because the evidence about benefits generally lacks the granularity of the data on the costs of meeting the standard. Therefore, while it is clear that improving components to comply with the minimum standard will give rise to additional costs and that raising all non-complying components to the minimum standard will collectively bring some benefit, it is not possible to analyse the costs and benefits of each component.

4.1 Health-related benefits

The health-related benefits arise primarily from the retrofitting of insulation. We draw on findings from the evaluation of the Warm Up New Zealand: Heart Smart Programme (Telfar-Barnard et al, 2011; Grimes et al, 2012) which conducted a study that involved 31,400 'treated' households being compared with a control group of a similar number of households. The evaluation found the following benefits.

1. **A reduction in mortality** was the largest benefit – preventing 18 deaths per year among those aged 65 and over who had been hospitalised with circulatory illness. This was found to be a statistically significant decrease, equivalent to an annual reduction of 0.852 deaths per 1,000 households. The annual gain in life years was conservatively valued at $439.95 per treated household.

2. **A reduction in hospitalisation costs** that was small but statistically significant – despite there being no statistical change in hospitalisation rates. The lower costs were instead explained by changes in hospital transfers, readmissions and the severity of illnesses being incurred (as measured by length of stay and cost of procedures). The study estimated an average saving of $64.44 in total hospitalisation costs per year for each treated household.

3. **A reduction in pharmaceutical costs** among treated households, which was found to be very small but highly statistically significant at $11.04 per year.

The authors also draw on data from their two prior research trials – the Housing, Insulation and Health Study and the Housing, Heating and Health Study. These trials were undertaken as part of the Housing and Health Research Programme at the University of Otago. Using that data, the authors estimate annual health-related benefits – in addition to hospitalisation and pharmaceutical savings – in the form of fewer days off school and reduced medical visits. They estimate those benefits as being worth $95.49 per household per year.

We use an annual figure of $636.33 in avoided costs per household with insulation installed as a result of the minimum standard, which is the "conservative "insulation-related figure developed by Telfar-Barnard et al (2011) and reported in the Grimes et al (2012) cost benefit analysis of the Warm-up New Zealand initiative.

Our base case scenario includes the full benefits from both ceiling and underfloor insulation being included in the minimum standard. We assume that 60% of the insulation benefits found in the published research arise from the presence of ceiling insulation, with 40% being attributed to underfloor insulation. In the absence of definitive evidence, this split is a judgment based on discussion at a workshop with technical experts, held on 30 August 2013.

HCS data indicates that 57% of rental dwellings already had underfloor insulation (among those cases where installation is possible) , while around 88% of rental dwellings were estimated to have sufficient celling insulation and so they would be unlikely to be affected by the introduction of the minimum standard. In addition, there were a number of dwellings without access to the underfloor (22%) or ceiling (19%) and therefore do not affect the costs or benefits associated with insulation installation. We removed these houses from the total stock used to estimate the benefits from insulation (and energy savings – see below). The relevant stock of rental dwellings that could benefit from underfloor insulation was estimated as being approximately 139,100, while the stock for ceiling insulation was 40,300.[9]

4.2 Energy saving benefits

Intuitively, insulated homes require less energy to heat and this can potentially result in an economic saving in the form of avoided energy use. We assume that the energy savings from the implementation of the minimum standard will be modest, based on our reading of the literature and discussions with technical experts at the workshop held for this project.

The basis for our calculation of energy saving benefits is the relativities documented in other studies between energy saving benefits and health-related benefits from occupants being warm and dry. The major study was Grimes et al (2011), where the energy saving benefits were found to be around 1% of health benefits. In contrast, Chapman et al (2004) estimated energy savings to be equivalent to 38% of health-related benefits.

We are also aware that a Beacon Pathway study in Papakowhai, near Wellington, found that occupants in newly-insulated homes tended to use the energy, which would otherwise be lost, to heat their home to a higher standard than they had experienced prior to insulation. That is, avoided energy losses were "taken back" and used for comfort rather than "saved".[10]

Taking these studies into account, as well as feedback at a technical expert workshop that energy savings are likely to be modest given that this is not the focus of the minimum standard, we used an assumption of energy savings as being 5% of health-related benefits. This gives a nominal annual value of $31.82 in energy-savings benefits per household that are fitted with both ceiling and underfloor insulation. This value was applied to the total relevant stock where insulation and related energy savings might accrue – 139,100 for underfloor insulation and 40,300 for ceiling insulation. As noted above, we assume 60% of the benefits of insulation arise from ceiling insulation, with 40% being from underfloor insulation.

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9 Note that the effective stock for both estimates is reduced by a further 25% to account for activity that would have taken place in the absence of the minimum standard. This is covered further on in the section

10 Burgess et al (2009) *Final Performance Monitoring from the Papakowhai Renovation Project*. Report TE106/15

4.3 Safety benefits – hazard reduction

The introduction of the minimum standard would require the remediation or replacement of non-compliant items in rental dwellings. We posit that this would result in a reduction in the number of hazards present in rental dwellings. As a consequence, tenants would be likely to experience fewer accidents that give rise to social costs (i.e. lower levels of harm resulting from hazards which lead to costs to both the tenant themselves and society in general).

The estimates of the health-related benefits discussed above include mortality-related impacts, such as deaths avoided by addressing cold, damp housing. We also include a separate estimate of avoided mortality arising from the installation of smoke alarms as a result of the introduction of the minimum standard.

4.3.1 Reduced fatalities from installation of smoke alarms

The basis for the inclusion of benefits from the installation of smoke alarms is that fire-related fatality data indicates that, on average, there are 20.6 fire-related fatalities a year in New Zealand – with reasonably strong correlations between smoke alarms that are not present/non-functioning as well as with rental housing.[11] Furthermore, there is evidence that functioning smoke alarms can reduce fire-related fatalities by one-third to one-half.[12]

Using an assumption that fire-related fatalities are spread evenly between rental and non-rental properties implies that 10 fire-related fatalities in rental housing occur each year. Assuming that half of these fatalities could have been prevented with working smoke alarms means up to five lives might be saved each year as a result of the minimum standard. We discount this further by noting that the hazard-related data shows that up to 65% of all homes do not have a working smoke alarms. This implies that the introduction of the minimum standard could plausibly lead to a reduction of 3.0 fatalities per year.

There is debate around the best value of statistical life, a measure commonly used in road transport evaluation procedures. Some suggest that the value of statistical life for fire-related events is lower than that for road transport, which stands at about $3.9 million in 2013.[13] Others suggest the opposite is true.[14]

For our purposes we have used a conservative figure of $3.0 million per fatality. This implies benefits, in terms of avoided mortality, that are monetised at $9.0 million per year – from the installation of functioning smoke alarms. This is separate from potential reductions in home injuries from the presence of smoke alarms, which are not able to be individually quantified or modelled – as discussed below.

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11 See New Zealand Fire Service (2010) *Emergency Incident Statistics 2009-2010* www.fire.org.nz/about-us/facts-and-figures/documents/stats-09-10s.pdf

12 See www.ofc.alberta.ca/.../Smoke_Alarms_UFV_Research_-_Full_Report.pdf and www.nfpa.org/research/...and.../fire.../smoke-alarms-in-us-home-fires

13 Sanderson, K., Goodchild, M., Nana, G., and Slack, A. (2007). "The Value of Statistical Life for Fire Regulatory Impact Statements." Wellington. BERL

14 Miller, T. (1990) "The Plausible Range for the Value of Life – Red Herrings Among the Mackerel" *Journal of Forensic Economics*, 3(3), pp. 17-39; and Access Economics (2008). *The Health of Nations: The Value of a Statistical Life*. Report for Australian Safety and Compensation Council.

4.3.2 Relationship between hazard reduction and injury

There is some degree of conjecture around the nature of the relationship between hazard reduction and injury. In particular a Cochrane systematic review of studies into the effects of home environment modifications on injury rates identified no studies that found a reduction in injury rates that could be reasonably attributed to the interventions used. Possible reasons for this finding included problems with study design, poor uptake of interventions by the groups studied and insufficient sample sizes. On the other hand, there have been studies that show promising results from programmes with interventions that address both extrinsic and intrinsic injury risk factors for particular at-risk-groups.

The impacts used in this analysis rely on prior New Zealand research that gathered detailed housing data that were thought to have impact on the health and safety of the residents, and which trialed a method for assessing dwellings and approaches to linking aspects of housing quality to health and safety (Keall et al).[15] This data was matched with estimates of the social costs of home injury to provide quantified and monetised estimates of the injury and harm costs that could be avoided from the introduction of the minimum standard.

We are comfortable relying on the Keall et al research for two reasons. Firstly, the authors acknowledge the existence of studies that are unable to find an attributable effect on home injury from the presence of hazards. Indeed, they expressly mention those studies, and purposefully designed their method with that constraint in mind. Secondly, the data and analysis is from New Zealand. We place greater weight on this local research, as opposed to more general estimates that are applied in a cross-country fashion, without correction for local idiosyncrasies or context.

4.3.3 Social cost of home injury

We have taken a conservative approach to estimation of this benefit stream. We have discounted the previously estimated values for the social cost of a home injury, which includes the loss of quality of life as a result of impairment and the estimated loss of output from temporary incapacitation. This was done as a means of controlling for factors outside the physical environment that might contribute to home injury (e.g. consumption of alcohol, lifting injuries in the garden, trampoline and other recreational injuries) and thereby avoiding overstating the benefits.

Based on the available study material, we assume 38% of the social cost of a (minor) home injury relates to structural matters that are affected by the minimum standard (i.e. 62% of the estimated social cost that would be avoided is unrelated to the standard).

4.3.4 Effect of the minimum standard on relevant hazards

Keall et al (2008) estimated that the odds of injury occurrence in the home rose by 22% with each additional injury hazard present. We matched the hazards studied in Keall et al (2013) with those that most closely approximated the hazard in the minimum standard. This led to eight of 16 Keall et al (2013) hazards identified as likely to be affected by the standard although the match was not perfect.

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[15] See Keall et al (2008), (2011) and (2013). Research published by Keall et al in September 2014 was not included in the analysis due to timing but indicates that low cost home modification and repairs can reduce injuries. (*Home modifications to reduce injuries from falls in the Home Injury Prevention Intervention (HIPI) study: a cluster-randomised controlled trial.*)

1. Hot water temperature at tap exceeding 60 degrees
2. Poison hazards: lack of safe storage in kitchen or laundry
3. Lack of visibility stickers or strips on ranch sliders or low level windows
4. Bathroom floor: uneven, slippery or rotten
5. Kitchen floor: slippery or rotten
6. Stairs without handrail or uneven, in disrepair, with excessive nosings or insufficient tread size
7. Balcony: in disrepair/slippery surface/climbable balustrades/large openings
8. External steps: uneven risers, lack of handrail, poorly defined step edges, slippery, missing treads

We assume, conservatively, that the combined effect of the minimum standards is to **remove one hazard from each dwelling** (i.e. a 22% reduction in occurrence of trips and falls). That is, we treat the hazards listed above as a single, generalised or combined hazard. We express that odds ratio in terms of a reduction in the expected social cost of a minor injury in the home. The social cost has been calculated, with reference to road transport analogues, as $13,708 per year. We derive a total social cost of home injury as approximately $1,270 per year in 2013 dollars (i.e. $13,708 times the proportion relating solely to the physical environment of 32% adjusted to 2013 dollars equals $5.702, which is then multiplied by 22% to give the expected value of a minor home injury of $1269.76).

This cost of minor home injury ($1269.76) was then multiplied by the estimated number of households where a trip/fall was likely. The first input into this calculation was the stock of rental dwellings where we estimate that at least one component would be non-compliant (414,858 dwellings). We then calculated a simple average hazard incidence by taking the mean incidence in our single record unit data of the eight hazards relevant to the minimum standard, which was 13%. Thus, the estimated number of households was 53,932[16] (i.e. 414,858 being the stock of relevant rental dwellings times 13% – the average incidence of relevant hazards in this sample).

4.4 Other evidence considered

Beyond the research into insulation and heating that is already included in our model, the most similar intervention is a WOF for rental housing being developed by five city councils in conjunction with the Housing and Health Research Programme at the University of Otago and ACC. A pre-test has been carried out on 144 dwellings, with assessors carrying out inspections and participant interviews being conducted. It is too early to see any results of this intervention, although we note that only 6% of rental housing (8/144) passed the warrant of fitness standard. If low-cost items had been addressed, such as installation of smoke alarms, security stays on windows, and hot water within a safe temperature range, the pass rate would have been 36%.

[16] Note that this figure was effectively reduced by 25 per cent in order to account for activity that would have taken place even in the absence of the minimum standard - see discussion of the counterfactual below.

We considered other New Zealand sources of evidence. An example is the Healthy Housing Programme, a joint programme between Housing New Zealand and district health boards that aims to improve housing conditions and health for Housing New Zealand residents. Although research by Baker et al (2011) found the Programme to be effective in reducing acute hospitalisations among children, the mix of interventions (i.e. insulation and heating, as well as access to health and social services, interventions to reduce overcrowding and install ventilation) is not equivalent to the proposed warrant of fitness and so we conclude that the benefits are not suitable for inclusion in our model. This conclusion applies to a research by Jackson et al (2011) into the same Programme, despite differences in research methodology.

Beacon Pathway has funded a cost benefit analysis of three packages of "sustainable housing refits" that included improvements to the thermal envelope, water efficiency, heating appliances, moisture control and lighting (Page, 2009). The benefits were measured in terms of energy and water savings, with health care savings being drawn from earlier work by Howden Chapman et al (2007) and adjusted for inflation. Most of the retrofit efficiency measures were found to have net benefits in the four centres that were modelled individually. From a national perspective the benefit to cost ratio was 2.8. However, there is limited cross over between the refit measures used (which included a range of water and energy conservation measures) and the proposed minimum standard – other than ceiling and underfloor insulation. Therefore, in our view, the results are not useful for this analysis.

There are other potential benefits, referred to in New Zealand and international literature, which have not been included in this model due to a lack of robust quantitative evidence, and the fact that research to date has focused the short-term outcomes of improving housing quality (i.e. within the first 1-2 years post improvement, rather than longitudinal effects). These other potential benefits include:

- improved mental health for occupants;
- improved family relationships due to increased liveable space within a dwellings;
- improved adult health outcomes, as a medium-term outcome of improving child health;
- improved educational and labour market outcomes, as a medium-term outcome of improving child health.

4.5 Summarising the benefits

The volume and price parameters used for modelling the benefits of the minimum standard as summarised in Table 3.

- Insulation – the average an annual figure of $636.33 in avoided costs per household (underfloor and ceiling insulation being installed) was split on a 60-40 basis for the contribution of ceiling versus underfloor insulation. These amounts were applied to rental dwellings that lacked underfloor or ceiling insulation or both – for those rental dwellings where installation is feasible.
- Energy savings – our assumption of the average annual energy savings of $31.82 per household – arising from the installation of ceiling and underfloor insulation – was also split on a 60-40 basis for the contribution of ceiling versus underfloor insulation. As above, the relevant portion was applied to rental dwellings that lacked either underfloor or ceiling insulation, while the whole amount was applied to those lacking either feature.
- Social costs – our derived cost of minor home injury ($1269.76) was multiplied by our estimate number of households where a trip/fall was likely and would be reduced under the minimum standard – i.e. 13% of rental dwellings.

- Fire-related fatalities avoided – we assume that 3 out of the average of 20 fire-related fatalities per year could be could be avoided by the presence of working smoke alarms in rental stock. This is on the basis of an assumption that half of these fatalities occur in rental dwellings (i.e. 10) and on the basis of evidence that half are avoidable (i.e. 5) and that only 65% of dwellings have smoke alarms (i.e. 5 * 0.65). We value these avoided fatalities using a conservative figure of $3.0 million per fatality.

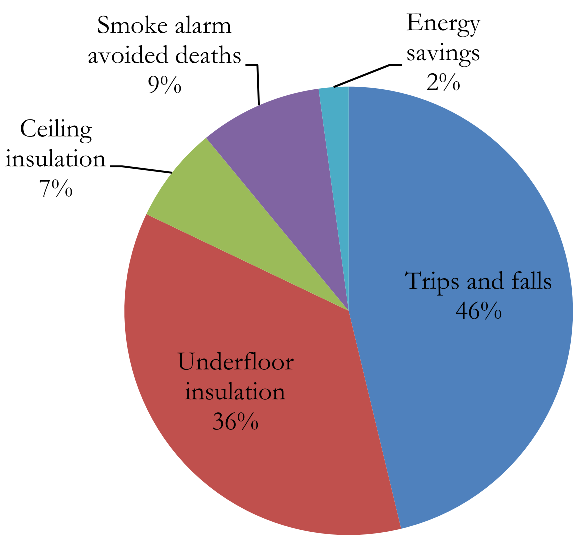
Table 3: Summary of benefit parameters used in the cost benefit analysis model

Category	Unit of volume	Unit of value ($)
Health care costs avoided	139,143 Dwellings without underfloor insulation	$636.36 * 60%
	40,324 Dwellings without ceiling insulation	$636.36 * 40%
Energy savings	139,143 Dwellings without underfloor insulation	$31.82 * 60%
	40,324 Dwellings without ceiling insulation	$31.82 * 40%
Social costs from trips/falls avoided	53,932 (i.e. 13%) Dwellings with potential hazards	$1,269.76
Fire-related fatalities avoided	3.0 deaths per year – based on fire related mortalities apportioned to rental stock	$3.0 million

Note: These findings are inputs into the cost benefit analysis model. The model assumes that 25% of aggregate costs (and therefore benefits) would be incurred in the absence of the minimum standard.

The composition of aggregate benefit, in present value terms, is shown in Figure 4. The largest contribution is from avoided trips and falls (46%), followed by the health benefits arising from insulation (43% combining underfloor and ceiling insulation), avoided mortality from smoke alarms installation (9%) and energy savings (2%).

Figure 4: Composition of modelled benefits (present value basis)



5. Results and discussion

5.1 Summary of key results

We find that the net benefit of the proposed minimum standard for rental housing would be **$334 million** (present value basis). Underlying this headline result are total costs of $653 million (present value basis) and total benefits of $987 billion (present value basis). The benefit-cost ratio – i.e. present value benefits divided by present value costs – is **1.51.** These results are shown in Table 4. In other words, the economic benefits to society from the introduction of the minimum standard for the relevant private rental stock exceed the costs to society by 50% over a twenty-year period.

Just under half (46%) of the benefits relate to safety benefits, such as the reduction in the social costs associated with trips and falls, as a result of the repairs and maintenance work to comply with the minimum standard. A further 43% of the estimated benefits are health-related benefits that arise from the installation of floor and ceiling insulation. A reduction in fire-related mortality from the installation of smoke alarms accounts for 9% of the benefits with energy savings from the installation of insulation accounting for 2% of the benefits.

We explore the sensitivity of these results to alternative assumptions and different enforcement regimes in subsequent sections of this report.

Table 4: Summary of key results

6% discount rate 20 year timeframe		Undiscounted ($ million)	Discounted ($ million)
Benefits	**Total benefits**	**$1,834.7**	**$987.5**
	Health benefits [1]	$785.2	$422.6
	Energy savings	$39.3	$21.1
	Safety benefits	$848.2	$456.5
	Fire-related mortality	$162.0	$87.2
Costs	**Total costs**	**$1,034.6**	**$653.2**
	Administration	$0.5	$0.3
	Physical upgrades	$1,034.0	$652.9
Net benefit		**$800.1**	**$334.3**
Benefit-cost ratio		1.77	1.51

1 Includes ceiling and underfloor insulation

5.2 Time profile of costs and benefits

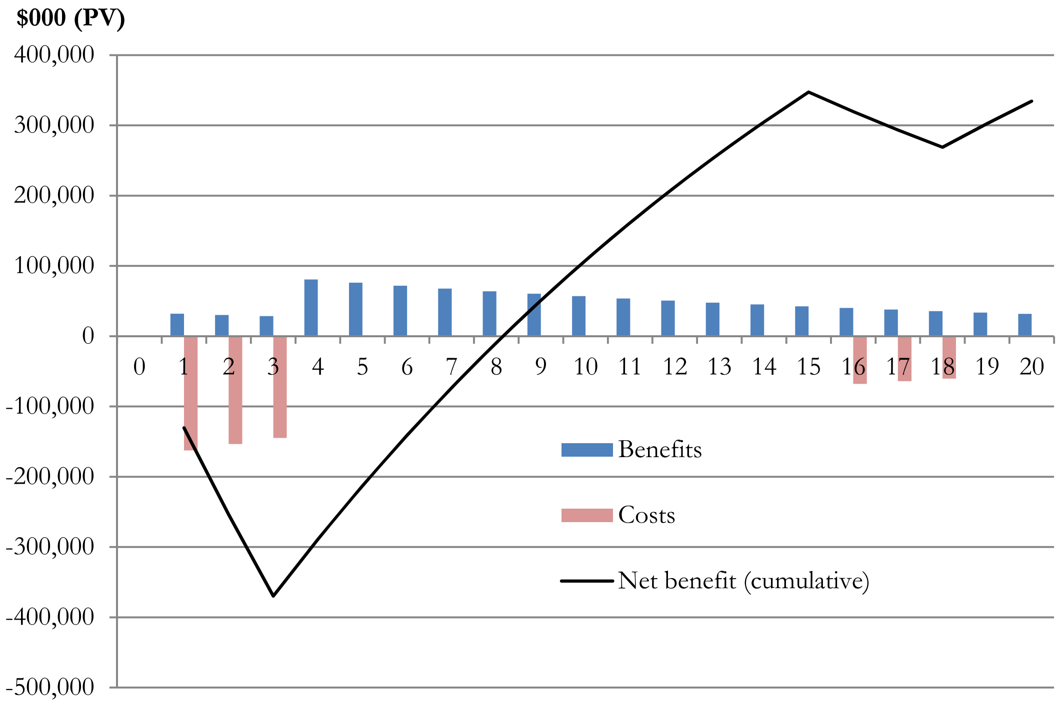
The time profile of the modelled costs and benefits under the base case is shown in Figure 5. The upfront costs (present value) are shown as being incurred evenly across Years 1-3. The intuition is that it would take a minimum of three years for landlords to bring non-complying components of the rental stock up to the minimum standard – even in a world of perfect policy take up. This assumption factors in time for information dissemination about the minimum standard, assessment of properties against the standard, and the planning and implementing of repairs or installation of components.

The benefits are assumed to fully accrue by Year 4, following the assumption that all non-complying components are brought up to the minimum standard in Year 3. The benefits remain constant thereafter.

As noted earlier, the useful life of the repairs/new components is, on average, assumed to be 15 years. Accordingly, the costs associated with the replacement cycle in Years 16-18 are also spread over a three-year period. This replacement cycle is a simplification, for modelling purposes, of what would likely be a more complex reality in terms of policy take up and maintenance cycles.

The cumulative net benefit is also presented. It shows that, following the upfront costs, the minimum standard would likely break even (i.e. pay for itself) in Year 8 following implementation.

Figure 5: Time profile of costs, benefits and cumulative net benefit (present value)



5.3 Sensitivity analysis

In order to test how sensitive the findings are to key parameters, we varied the discount rate (see Table 5) and time periods (see Table 6) applied in the study. The tables below illustrate that the base case results are reasonably robust, for instance, changes in the discount rate do not make a great deal of difference in terms of the robustness of the result. The discount rate that would lead to a "break-even" benefit-cost ratio of 1.0 is 17.5%, which is well outside the reasonable bounds for this type of analysis.

In terms of timing, the intervention has a benefit-cost ratio of 1.23 over a 10-year period, which increases to 1.79 over a 30-year period. We find that the effective "payback period" for the intervention is about 8 years – that is, the benefits of the intervention are outweighing the costs at this point.

Table 5: Alternative discount rates

Discount rate	Benefits (discounted, $m)	Costs (discounted, $m)	Benefit-cost ratio
4%	$1,196.7	$744.2	1.61
6% (base case)	$987.5	$653.2	1.51
8%	$825.6	$584.4	1.41
10%	$698.8	$531.4	1.31

Table 6: Alternative time periods

Time period	Benefits (discounted, $m)	Costs (discounted, $m)	Benefit-cost ratio
10 years	$568.6	$460.9	1.23
20 years (base case)	$987.5	$653.2	1.51
30 years	$1,221.4	$683.3	1.79

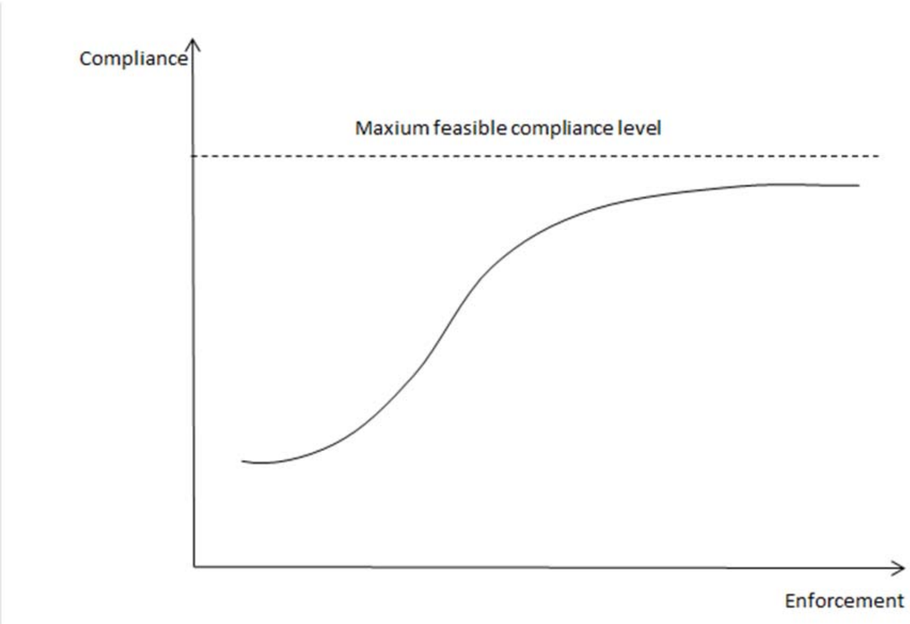
5.4 Enforcement considerations

The results above are predicated on assumed levels of perfect policy "take-up". The assumption was that once the policy is announced, all landlords would move to comply with the requirements of the minimum standard, albeit in a phased manner. Moreover, such compliance would be achieved with minimal cost (i.e. the only administrative cost is a 0.2 FTE policy oversight resource per year). In reality, there will never be perfect take-up and there will never be costless enforcement arrangements in place to support regulatory announcements of this kind. The degree of compliance is likely to be influenced (at least at the margin) by the degree of effort and resource dedicated to enforcement. All else equal, the greater resource commitment given to enforcement, the more likely that compliance will greater (i.e. a positive relationship between enforcement and compliance).

We posit a sigmoid ("s-curve") relationship between enforcement and compliance, as shown below. This non-linearity indicates that at relatively low levels of enforcement, additional resource dedicated to enforcement yields material incremental gain, but that the gains exhibit diminishing returns as more resources are poured into enforcement. This is a stylised depiction of what landlord surveys have shown us – that there are a number of landlords who would be likely to comply with a minimum standard as well as a number of landlords who would resist compliance.

The nature of the relationship between enforcement and compliance is important as it affects both costs and benefits, but asymmetrically. The key difference is due to administrative cost. While the cost of repairs and maintenance moves in line with benefits (i.e. a 5% reduction in compliance results in fewer landlords incurring costs and the same proportion of households not receiving any benefits), the administrative cost burden is standalone in nature and offsets the reduction in costs.

Figure 6: Stylised enforcement-compliance relationship



We considered four graduated enforcement scenarios that range from extremely light-handed to more heavily prescriptive. Variations or combinations of the enforcement scenarios are not explicitly modeled, but the impacts of such options are reasonably easy to determine (i.e. they will lie somewhere between the range estimated).

1. *Information provision only* – essentially a **self-regulation** option where the onus is on landlords to assess their property and undertake any actions needed to meet the minimum standard, which would be set out in forms provided by government

2. *Information provision plus tenant notification* – as above, with the addition of a requirement on landlords to advise current and potential tenants of the property's status with respect to the minimum standard. There is no sanction for non-compliance. In essence this can be characterised as a "**market forces**/consumer sovereignty" option

3. *Information provision plus sample audits and non-complying sanction* – as above, plus the government undertakes a small sample of inspections to audit self-assessment results and stores records on a central register. In addition, there is legal provision for non-compliance to result in a sanction against the landlord (most likely a fine). In essence, a variant of the **tax compliance model**.

4. *Universal inspections and certification with non-complying sanction* – as above, but with the addition of mandatory and regular site inspections (under the management responsibility of government). This is akin to the **vehicle WOF regime**.

Determining the effects of the enforcement regime is necessarily imprecise. There is no readily available quantitative information that can be applied to this situation. Analogous qualitative information points to the following:[17]

- Monitoring by public authorities, enhanced by a system of risk-assessment is likely to be cost-effective in a jurisdiction where there is not a culture of pro-active complaints by consumers or representative associations, or where the contravention is unlikely to be easily detected by consumers (in this case tenants) themselves.
- Where the prospect of legal sanction is real, enforcement agencies should have the power to choose between dismissing a case (with or without a warning) and initiating procedures for penalties
- There are cost-effectiveness arguments for allowing administrative agencies themselves to impose some form of financial penalty. Fixed penalties are easier to administer, but may not adequately represent the circumstances of the transgressor, while variable penalties may be more effective from a deterrence perspective. Discretion is preferred.
- "Naming and shaming" and compensation orders may also be cost effective (i.e. achieve high levels of compliance at relatively low cost).
- Criminal prosecutions and the involvement of the judiciary should be reserved for repeat offenders who do not appear to be deterred by other instruments, or whose behaviour is so morally repugnant that such proceedings are justified, irrespective of deterrence considerations.

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17 OECD (2006) *Best Practices for Consumer Policy: Report on the Effectiveness of Enforcement Regimes*. Directorate for Science, Technology and Industry Committee on Consumer Policy, DSTI/CP (2006) 21/FINAL

Implicit in this material is an economic explanation for landlord behaviour. Landlords will be induced to comply with the requirements of the standard if the costs of contravening exceed the benefits to them of the contravention. The costs landlords face will essentially be those related to the enforcement regime and any possible "market reactions" through tenants leaving properties or not entering in the first place. We have been informed that tenants do not, in general, have much by way of market power, which we factor into our treatment of enforcement options.

5.4.1 Self-regulation model

Our assessment is that the self-regulation option would reduce compliance by a third. That is, relative to the case where we have close to complete compliance (as modelled in the base case) a third of landlords would not comply with the standard in a self-regulation option where only information and guidance is provided. This 'ballpark' estimate is assumed to be double the rate of landlords surveyed, who indicated that they would not install insulation under any circumstances (i.e. even if it was free), which we use as a proxy for landlord reluctance. This estimate accounts for lack of awareness as well as a reluctance to comply.

Administrative costs associated with this option are based on the costs of a national information campaign ($300,000, made up of a one-off design cost of $160,000 and ongoing awareness costs of $140,000) plus an overhead allowance of 40%, totalling $420,000. We also anticipate increased call centre activity which doubles the existing of dealing with queries that might be related to the minimum standard. This totals $64,000 annually. We assume that the information is provided at that level for a period of three years, and then ongoing costs (including increased call centre activity) of 20% per year are incurred for the remaining years.

5.4.2 "Market forces" model

The "market forces" enforcement scenario results in additional costs (to landlords) as a result of the notification burden, but we believe the compliance story would essentially remain unchanged, due to the lack of "market power" we heard in relation to rental tenants, particularly those who might be at the end of the distribution requiring more repair/maintenance work. In essence, this option adds administrative cost (relative to self-regulation) but does not provide any other difference.

The additional administrative cost of this option is calculated by multiplying the estimated cost of notification production ($64, representing a fifth of the estimated assessment cost of $322) by the stock of homes that are likely to be affected by the minimum standard. We phase these costs in over a period of three years and are incurred again on a five-year cycle.

5.4.3 "Tax compliance" model

The "tax compliance model" option involves additional capital costs of $1.5 million to set up the central register, as well as $500,000 on-going annual costs to maintain it. These estimates were derived from costings for a national register in the health space. We also include audit costs of $1.5 million, phased in over three years. These costs are derived by assuming 1% of the 414,858 rental homes would be audited, at a cost of $354 (the cost of assessment plus 10%). Following the phase-in period annual costs of $1.5 million would be incurred.

Compliance (and consequently the repair costs and the benefits) was reduced by 20% relative to the case where we have near complete compliance (i.e. modelled in the base case). This estimate is based on the insights from the literature that monitoring is a cost-effective means of ensuring compliance, particularly where a culture of consumer activism is not strong.

5.4.4 "Motor vehicle WOF" model

We estimate that this "hands on" model would result in the lowest drop in compliance – 10% relative to the base case where we have near-complete compliance. In other words, it is the most effective option in terms of compliance, consistent with insights from the literature and intuition. This option also entails the most significant administration costs of around $27 million annually. This estimate is derived by multiplying the cost of an inspection ($322, based on comparative costs of house inspections by local authorities for other purposes) by the stock of homes that are likely to be affected by the minimum standard and distributing that figure across a five-year period on an ongoing basis. That is, it takes five years to inspect the entire stock and then the process starts all over again. If the intention of this option was to inspect all homes in a year, the costs would be around $134 million per year.

Summary of enforcement regime results

Table 7 compares the benefit-cost ratios of the modelled enforcement options. Relative to the "base case" the self-regulation option results in a benefit-cost ratio that is almost identical to the base case (i.e. perfect compliance). From an economic perspective, this option stands out. However, it does come at the potential cost of around 100,000 rental dwellings that might not comply with the minimum standard. If these were dwellings that require only marginal maintenance work, then this approach would probably be acceptable from a policy perspective. However, it is just as likely that these dwellings would require non-trivial work being done to them.

In that regard, the "tax compliance" model would appear to have merit. It still produces a robust benefit-cost ratio (meaning society is better off from the minimum standard with that enforcement regime), but is also likely to be particularly effective at identifying and addressing the "tail" of the distribution through targeted monitoring. Ultimately, policy design is not the function of a cost benefit analysis, but to the extent that we have estimated realistic administrative costs, then, outside of the more stringent "motor vehicle WOF" option, the enforcement regime chosen will produce a net benefit to society.

Table 7: Enforcement scenario results

Enforcement scenario	Benefits (discounted, $million)	Costs (discounted, $million)	Benefit-cost ratio	Uptake assumption
Base case	$987.5	$653.2	1.51	100%
Self-regulation	$658.3	$438.2	1.50	67%
Market forces	$658.3	$497.7	1.32	67%
Tax compliance	$790.0	$609.0	1.30	80%
Vehicle WOF	$888.7	$1,011.7	0.88	90%

5.5 Alternative scenarios

While the previous section showed that the positive benefit-cost ratio is largely invariant to the enforcement regime, for the purposes of these alternative scenarios, we use the "theoretical" base case in a comparative sense to look at alternative scenarios. We construct these alternate scenarios to give a sense of the possible range of costs and benefits – namely, an "optimistic" scenario and a "pessimistic" scenario.

The **optimistic scenario –**

- Uses the upper end of the odds ratio confidence interval for hazards giving rise to home injury (i.e. 41% versus 22% used in the base case). This effectively increases the reduction in injuries resulting from the removal of home-based hazards as a result of repairs and maintenance;
- Increases the hazard incidence in relevant dwellings by one-third (from 13% to 17.3%). This means we assume that there are relatively more hazards in dwellings that are in poorly maintained condition; and
- Lowers the "displacement factor" to indicate that less repair/maintenance work would otherwise be done in the absence of the minimum standard. Instead of assuming that 25% would otherwise occur, we assume that only 15% of this work would occur in the absence of the standard (thereby increasing the impact attributable to the policy).

The **pessimistic scenario** –

- Uses the lower end of the odds ratio confidence interval for hazards giving rise to home injury (i.e. 6% versus 22% in the base case);
- Reduces the hazard incidence in relevant homes by one-third (from 13% to 8.7%); and
- Raises the "displacement factor" from 25% to 50%.

There is considerable scope for the costs and benefits to be higher under alternative inputs and assumptions, as Table 8 shows. While both scenarios are at the extreme, the figures further highlight the importance of the contribution of home injuries to the overall analysis. Careful consideration of both the odds ratio and the hazard incidence is warranted.[18]

Table 8: Alternative base case scenario results – optimistic and pessimistic

Scenario	Benefits (discounted, $m)	Costs (discounted, $m)	Benefit-cost ratio
Optimistic	$1,872.6	$740.3	2.53
Base case	$987.5	$653.2	1.51
Pessimistic	$438.6	$435.6	1.01

[18] Given the odds ratio was derived using econometric techniques in another study and the hazard incidence is "assumed" the latter would appear to warrant more thought and discussion.

5.6 Heat pump substitution

As discussed above, there are a number of rental dwellings where insulation is not an option, due to the lack of access. The total number of such dwellings was estimated at 101,670 (57,060 with no underfloor access and 44,610 with no ceiling access). These dwellings were removed from the estimation of health and energy-related costs and benefits. As an alternate scenario, we looked at the impact of installing an efficient fixed heating source installed instead of insulation for any dwelling that did not have access to either the ceiling and to the underfloor.

A heat pump, costing $2,750 was assumed to be the heating source. We also assumed that there was no fixed heating source already in place – a somewhat conservative assumption.[19] To calculate the number of likely rental dwellings where a heat pump would be installed, we took the combined figure above 101,670 dwellings and subtracted our estimate of dwellings where there was no access to the ceiling and to the underfloor (i.e. 35,020 dwellings). This left a total of 66,650 dwellings where a heat pump might, under this scenario, be installed.

We used an expected life for a heat pump of 15 years and phased the costs in over three years.[20] On the benefits side, we assumed that the health and energy savings benefits that had previously been excluded for these dwellings were now included (i.e. the benefit of a heat pump is equivalent to that of insulation). The results shown below indicate that despite costs rising considerably, the total benefits still exceed the costs by 30%. The overall impact is to reduce the benefit-cost ratio from the base case of 1.51 to 1.30.[21]

Table 9: Heat pump substitution scenario

Scenario	Benefits (discounted, $m)	Costs (discounted, $m)	Benefit-cost ratio
Base case	$987.5	$653.2	1.51
Heat pump substitution	$1,070.9	$826.8	1.30

19 We assume that none of these dwellings have a heat pump installed; additional HSC data suggests up to 19% of rental dwellings had a heat pump installed, however we have retained our original assumption of there being no fixed heating source, so as to remain on the conservative side.

20 Sourced from http://www.hannabery.com/hp101_2_pg3.shtml

21 It is worth noting that the benefits of a heat pump may potentially be greater than the benefits of insulation due to higher energy savings; a heat pump only uses a third as much electricity to produce the same output as a fixed electric heater. However, it is unknown whether the tenants would be using an electric heater or not before installation of the heat pump.

6. Caveats and limitations

There are caveats and limitations that should be borne in mind when considering this work. On the cost side there are several issues with the available data.

- The robustness of the data on the underlying condition of the rental stock. The HSC is the best national source of data on non-HNZC rental dwellings but it must be noted that the sample is relatively small at approximately 100 rental dwellings. The sample was not designed for the sort of detailed and nationally-representative analysis undertaken for his cost benefit analysis. Therefore it is plausible that there is some bias in some of the indicators of the condition of rental dwellings. This uncertainty is not easily able to be tested at this point. The results of a forthcoming HCS will offer a second data point for comparisons and we understand that it will include a larger sample of rental stock. The results from the ongoing WOF development work by a consortium that involves local councils may also offer some useful comparative data in future.
- We were able to match around two-thirds of the components in the minimum standard to comparable indicators in the HCS. This means that the actual costs of the minimum standard could be somewhat underestimated. Keeping this in mind, we have tended to take relatively conservative assumptions elsewhere, so as avoid exacerbating this potential underestimation, for example:
  - Useful life of repairs, where we assume 15 years is the average lifespan of components covered by the minimum standard. This was increased from our assumptions in earlier drafts after debate about the longer duration of some of the more costly components (e.g. insulation, wall and floor linings);
  - The concept of additionality, where we have discounted some of the uptake following the implementation of the minimum standard on the basis that some landlords are likely to conduct repairs as part of a planned maintenance cycle. Drawing on a range of sources we assume that only 75% of would be reasonably attributable to the impact of the minimum standard and that 25% would still occur in the absence of the standard.

On the benefit side, we are reliant on the literature given the complexities of measuring outcomes and the timeframes and resourcing parameters for this work. However we have tried to focus on New Zealand specific research and to be transparent about the parameters used. The bulk of the benefits come from installing insulation and from hazard reduction and it is fair to say that the evidence for the insulation impacts is recent and highly relevant to the design of the minimum standard. On the other hand, we have had to adapt the hazard reduction evidence so that it better aligns with the form of the minimum standard. To test the sensitivity of our assumptions we developed a "pessimistic" scenario that treats this evidence base more conservatively – as well as our assumption about additionality effect of the policy being 75%. Even under these extremely cautious assumptions, we find that the policy would still break even with a benefit-cost ratio of 1.01. We further address uncertainty by providing a range around the headline results of net benefit and the benefit-cost ratio and by testing different enforcement scenarios.

Finally, it should also be noted that this report is designed to identify and quantify the costs and benefits of the version of the minimum standard provided for this work. Decisions on the final version of this proposed policy and whether it is implemented will ultimately be will determined by a wider range of qualitative considerations.

7. Conclusions

Condition of rental stock and compliance costs

1. We find that 93 out of 108 rental dwellings in the HCS sample had at least one component that would be unlikely to meet the proposed minimum standard. Nationally, this means that 14% of dwellings would be likely to pass the minimum standard and 86% would be likely to fail on one or more component.

2. The average cost of repairs and component upgrades would be $1,811 for each dwelling with one or more components requiring action to meet the minimum standard. The distribution of costs is skewed towards the lower end – i.e. relatively low costs to upgrade components to meet the minimum standard. Around 42% of rental dwellings would face compliance costs of less than $1,000.

3. In terms of the overall cost to bring the relevant rental stock up to a compliant standard, the components making the largest contribution are underfloor insulation (36%), where this is feasible to install, and bathroom flooring – where the floor lining has holes and/or is lifting (19%). These contributions to overall costs are, to some extent, driven by the by the relatively high unit cost to address these components as well as their prevalence as non-compliant components within the rental stock.

Benefits

4. The benefits are a stream of avoided costs to society. The largest contribution (46%) comes from avoided trips and falls due to a reduction in hazards in the home. This is followed by the contribution of health benefits (43%) arising from the installation of underfloor and ceiling insulation in dwellings where this is absent and feasible to install. In addition, there are benefits from avoided fire-related fatalities from the presence of smoke alarms (9%) and some energy savings from the installation of insulation (2%).

5. The benefits typically do not arise from the cost of specific component of the minimum standard, with the notable exceptions being health benefits from insulation and avoided fatalities arising from the installation of smoke alarms. This is because the evidence about benefits generally lacks the granularity of the data on the costs of meeting the minimum standard. So while it is clear that improving components to the minimum standard will give rise to additional costs and collectively bring some benefit, it is not possible to analyse the costs and benefits of each component of the minimum standard.

Headline results

6. We find that society would likely be better off under the proposed minimum standard although the form of the enforcement regime matters for costs and benefits and the overall quantum of net benefit to society.

7. Under our base case – which assumes perfect take-up in the absence of an enforcement regime, we find that the net benefit of the minimum standard would be $334 million (present value basis). Underlying this headline result are total costs of $653.2 million (present value basis) and total benefits of $987.5 billion (present value basis). The benefit-cost ratio is 1.51. These results are robust in the face of alternate but still plausible assumptions about the modelled time horizon and discount rates.

Enforcement regimes

8. The enforcement affects the results, through the additional costs involved and the assumed impacts on compliance behaviour and therefore the overall costs and benefits. We find the enforcement regimes considered have a range of benefit-cost ratios, namely a self-enforcement regime (1.50), a "market forces" regime (1.32, a "tax compliance" regime (1.30) and a "motor vehicle" WOF regime (0.88).
9. The self-regulation option, the onus is on landlords to assess their property and undertake any actions needed to meet the minimum standard, which would be set out by government. The self-regulation option results in a benefit-cost ratio that is almost identical to the perfect compliance case. From an economic perspective, this option stands out. However, it does come at the potential cost of around 100,000 rental dwellings that might not comply with the minimum standard. If these were dwellings that require only marginal maintenance work, then this approach would probably be acceptable from a policy perspective. However, it is just as likely that these dwellings would require non-trivial work being done to them.
10. The "tax compliance" model would appear to have merit. It still produces a robust benefit-cost ratio meaning society is better off with a minimum standard that employs this enforcement regime), but is also likely to be particularly effective at identifying and addressing the "tail" of the distribution through targeted monitoring. Ultimately, policy design is not the function of a cost benefit analysis but to the extent that we have estimated realistic administrative costs, then, outside of the more stringent "motor vehicle WOF" option, the enforcement regime chosen would enable the policy to deliver a net benefit to society.

Pessimistic and optimistic scenarios

11. There is considerable scope for the costs and benefits to be higher under alternative inputs and assumptions. To test the sensitivity of our assumptions we developed a "pessimistic" scenario that treats key assumptions about hazard reductions and avoided costs more conservatively – as well as our assumption about additionality effect of the policy being 75%. Even under these extremely cautious assumptions, we find that the policy would still break even with a benefit-cost ratio of 1.01. However this does not factor in the effects of different enforcement regimes. We also test an "optimistic" scenario that offers more generous but still plausible treatment of the hazard reduction and additionality effects and find the benefit-cost ratio is 2.53.

Heat pump scenario

12. As a further alternate scenario, we looked at the impact of installing an efficient fixed heating source installed instead of insulation for any dwelling that did not have access to either the ceiling or underfloor. Despite costs rising considerably, at an additional $2,750 for 101,670 dwellings where a heat pump might be installed under this scenario, the total benefits still exceed total costs by over 30%. The overall impact is to reduce the benefit-cost ratio from the base case of 1.51 to 1.30. This suggests that this design refinement is viable from an aggregate, societal perspective.

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Appendix 1: The minimum standard

Table 10 presents the elements included in the proposed minimum mapped to an indicator from the Housing Condition Survey – where there is a reasonably close match. This work has been guided by the minimum standard tabled at the workshop at HNZC on 30 August 2013. It incorporates some additions – provided to us on 26 September 2013.

Table 10: The minimum standard for rental housing

Category	Component
Insulated and dry	Lounge space able to be ventilated by opening window/s, door/s or mechanical ventilation
	Bedroom spaces able to be ventilated by opening window/s or mechanical ventilation
	Bathroom space able to be ventilated by opening window/s or mechanical ventilation
	Toilet space able to be ventilated by opening window/s or mechanical ventilation
	Kitchen space able to be ventilated by opening window/s or mechanical ventilation
	Laundry space able to be ventilated by opening window/s or mechanical ventilation
	Subfloor ventilation present (as required)
	Habitable spaces to have natural light
	Fixed wired power point in lounge
	Ceiling insulation present
	Underfloor insulation present
Safe and secure	Balustrades to stairs and landings
	Where required, BWoF shall be current
	No obvious gas smell
	Hot water temperature controls (thermostat or tempering valve) - not retrospective
	Smoke alarms within 2 metres of bedroom doors
	Exterior doors have securable locks
	Windows can be secured
	Security stays fitted to windows on first floor (ground level) (security)
	Functioning exterior doors
	Visual safety strip on external glass doors
	No visible electrical problems (exposed wires, broken plugs or switches)
	Steps to front door
Essential amenities	Fixed wired power point in bedrooms
	Fixed wired power point in kitchen
	Fixed wired power point laundry
	Functioning doors to bedrooms
	Functioning doors to bathroom
	Functioning doors to toilet

Category	Component
	Functioning kitchen sink and taps
	Functioning plumbing tap/s for washing machine
	Functioning basin in bathroom
	Functioning toilet
	Functioning means of cooking
	Food preparation facilities provided
	Bedrooms meet minimum size (1.8m wide and 6m2)
	Combined kitchen/dining/living room meets minimum size (related to # bedrooms)
	Artificial light in all spaces except cupboards
	Roof intact and not leaking
	Sewerage reticulation functioning
	All rooms have acceptably low mould levels at time of letting and free from external moistures sources conducive to mould
	Waste water reticulation functioning
	Functioning bath and/or shower
	Floor linings intact
	Ceiling linings intact
	Wall linings intact
	Kitchen storage provided
	No vermin presence due to structural features or faults at time of testing/inspection
	Potable water provided

Appendix 2: Mapping the minimum standard to condition indicators and unit costs

Table 11: Minimum standard mapped to Housing Condition Survey indicators

Minimum standard component	HCS indicator	Percent of rental stock	Unit cost for upgrade/repair	Unit cost – source
Lounge /bedroom / bathroom / toilet / kitchen / laundry able to be ventilated by opening window/door or mechanical	No data	-	-	-
Subfloor ventilation present (as required)	No data	-	-	-
Habitable spaces to have natural light	No data	-	-	-
Fixed wired power point in lounge	No data	-	-	-
Ceiling insulation present	No ceiling insulation	11.0%	$1,643	EECA
	Less than 50% ceiling insulation	3.0%	$1,220	EECA
Underfloor insulation present	No underfloor insulation	37.0%	$1,726	EECA
	Less than 50% underfloor insulation (no data)	-	-	-
Balustrades to stairs and landings	No handrail	15.5%	$100	assumption
Where required, BWOF shall be current	No data	-	-	-
No obvious gas smell	No data	-	-	-
Hot water temperature controls	Thermostat not operating / broken	1.6%	$100	HNZC PQI
Smoke alarms within 2m of bedroom doors	No smoke alarm fitted[1]	65.0%	$20	online price search
Exterior doors have securable locks	No close match	-	-	-
Security stays fitted to windows on first floor (ground level) (security)	No window stays	50.0%	$35	online price search

Minimum standard component	HCS indicator	Percent of rental stock	Unit cost for upgrade/repair	Unit cost – source
Functioning exterior doors	Exterior doors in serious condition	2.0%	$800	BRANZ
Visual safety strip on external glass doors	No visibility strip on vulnerable full-height clear glazing	37.0%	$30	online price search
No visible electrical problems (exposed wires, broken plugs, switches)	Damaged wiring/outlet/switches	5.3%	$100	assumption
Steps to front door	Steps/ramps in serious condition	1.7%	$60	BRANZ
Fixed wired power point in bedrooms / kitchen / laundry	No data	-	-	-
Functioning doors to bedrooms / bathroom / toilet	Interior doors in serious condition	2.0%	$3,750	BRANZ
Functioning kitchen sink and taps	Deteriorated kitchen taps	12.3%	$180	online price search
Functioning taps for washing machine	No data		-	-
Functioning basin in bathroom	Bathroom fittings in serious condition	3.0%	$2000	BRANZ
Functioning toilet	Broken wc seat or cistern	2.3%	$200	BRANZ
Functioning means of cooking	Cooker in serious condition	2.0%	$1,250	BRANZ
Food preparation facilities provided	No data	-	-	-
Bedrooms meet minimum size (1.8m wide and 6m2)	No data	-	-	-
Combined kitchen/dining/living room meets minimum size (related to # bedrooms)	No data	-	-	-
Artificial light in all spaces except cupboards	No data	-	-	-
Roof intact and not leaking	Signs of current water penetration in roof space	6.7%	$989	BRANZ
Sewerage reticulation functioning	Plumbing wastes defects – leaking	11.0%	$300	Assumption
All rooms have acceptably low mould levels at time of letting and free from external moistures sources conducive to mould	Interior 'dampness' – subjective assessment of feeling quite damp or damp throughout	3.0%	No remedy included	-
Waste water reticulation functioning	Reticulation pipe defects - leaking	8.5%	$300	Assumption
Functioning bath and/or shower	No data	-	-	-

Minimum standard component	HCS indicator	Percent of rental stock	Unit cost for upgrade/repair	Unit cost – source
Floor linings intact Ceiling linings intact Wall linings intact	Kitchen linings in serious condition	1.0%	$1,100	BRANZ
	Kitchen lining defects – holes in floor	1.4%	$1,100	BRANZ
	Laundry linings in serious condition	6.0%	$900	BRANZ
	Laundry lining defects – holes in floor	1.7%	$900	BRANZ
	Bathroom linings in serious condition	0.0%	$1,390	BRANZ
	Bathroom floor – holes/cracks/split	2.0%	$1,390	BRANZ
	Other linings in serious condition	2.0%	$4,281	BRANZ
	Other lining defects – holes in floor	2.0%	$1,390	BRANZ
Kitchen storage provided	Kitchens without poison storage (i.e. no high-level cupboard or latches)	28.9%	$30	online price search for a lock
No vermin presence due to structural features or faults at time of inspection	No data	-	-	-
Potable water provided	No data	-	-	-

Source: MBIE; BRANZ Housing Condition Survey (2010) data: Branz unit cost estimates; EECA unit cost estimates (insulation); online search using www.priceme.co.nz

1. Indicator and parameter sourced from Keall et al (2013)

Appendix 3: Pass-through considerations

This appendix briefly considers the pass-through of the compliance costs associated with the minimum standard to the rents charged by landlords. The issue is complex and caution should be observed in the absence of a well-developed model of supply and demand pressures that also factors in regional differences. However some basic points are offered as a starting point for discussion.

- The average compliance cost for a rental dwelling to meet the minimum standard is modelled in this report as being $1,691. The maximum cost is modelled as being $11,218.
- This report has assumed, on the basis of some evidence, that in 25% of cases a landlord would incur this expenditure anyway as part of a their cycle of property maintenance – even in the absence of the minimum standard. In the remaining 75% of cases, this amount represents expenditure that a landlord may judge as being an imposed additional cost through regulation.
- Whether these landlords would seek to recover all or some of their compliance costs through increases in rents depends on a range of factors that are specific to their situation. These include their ability to absorb the costs (i.e. level of debt, the rental stream, other expenses associated with the property); their ability to offset some of the maintenance-related costs through their tax bill; and their market position given the supply and demand for rental housing in their area.
- It is plausible that some landlords may seek to recover some portion of their compliance costs and that their path of future rent increases would be higher than would otherwise be the case. The probability and quantum of this is uncertain but two observations are worth noting:
  - pre-test interviews for a WOF under development by councils found that 12% of private landlords would increase the rent as a result of WOF improvements. Participation in that pre-test was voluntary but the result suggests some cost recovery is likely to occur;[22] and
  - if landlords have full freedom to raise rents (an assumption) and seek full cost recovery via rents then the upper amounts for weekly rent increases can be estimated. Table 12 shows that full cost recovery of the average compliance cost of $1,691 would mean weekly rent being higher by approximately $16 per week over a two-year cost recovery horizon and approximately $3 per week over a ten-year recovery horizon. The weekly amounts are higher for the maximum compliance cost of $11,218 (being $108 and $22, respectively).

Table 12: Scenario of full recovery of compliance costs through rent – weekly increase

WOF compliance cost	Rent increase over 2-year horizon	Rent increase over 10-year horizon
Average compliance cost – $1,691	$16.26	$3.25
Maximum compliance cost – $11,281	$108.47	$21.69

Note: these are high-level estimations and the approach excludes consideration of landlord position with respect to debt, expenses, tax and local demand and supply pressures for rental housing.

22 Bennett, J. et al (2014) *Results from a Rental Housing Warrant of Fitness Pre-Test.* http://sustainablecities.org.nz/wp-content/uploads/Results-from-a-Rental-Housing-WOF-PreTest-May-2014.pdf