



Earthquake Repairs to Canterbury Homes

Home Inspection Survey Report

August 2015



Executive Summary

Concerns have been raised about the quality of the repair work carried out through the Canterbury home repair programmes. In response, the Ministry of Business, Innovation and Employment (MBIE) initiated a survey to assess the Building Code compliance of these repairs. As the building regulator, MBIE is required to monitor current and emerging trends in the building sector.

The survey focused on homes with completed structural repairs that were exempt from a building consent under Schedule 1 (repairs and maintenance) of the Building Act. This exempt repair work was considered to have a greater risk of potential non-compliance or defective work due to the lack of formal inspection procedures, as would be required for a building consent.

The quality of cosmetic repair work, such as paint finish, and contractual obligations between insurers and homeowners were outside the scope of the survey. Defects in cosmetic repair work are more easily identified than defects in structural repair work, which may be hidden from view.

IAG, Southern Response, the Earthquake Commission (EQC) and Housing New Zealand provided in total 2795 addresses of homes that were expected to meet MBIE's selection criteria, including 450 EQC opt-outs. From these, MBIE randomly selected homes and invited homeowners to participate.

Between March 2015 and June 2015, the repairs to 101 homes were reviewed by a team of independent technical experts. Eleven of the inspected homes had no structural repair work carried out, so 90 of the survey homes met the criteria of having repair work that was completed and exempt from a building consent, and incorporated structural repairs.

The repairs were assessed using the following categories:

- Compliant – repair work complies with the Building Code
- Minor defect – minor defect with the repair work inspected. The compliance of this work may be marginal and a strict application of the Building Code may deem the repair work as being non-compliant.
- Non-Compliant – repair work does not comply with the Building Code.

The main finding of the survey is that 32 of the 90 survey homes that had structural repair work carried out were non-compliant with the Building Code. As shown in Table 1, an additional 23 homes were assessed as having minor repair defects. However, no life-safety risks to occupants due to the repairs were identified and remediation of the non-compliant repair work is considered relatively easy for most of the homes.

Table 1: Summary of repair quality assessment results

Repair quality category	Number of homes
Compliant	35
Minor defects	23
Non-compliant	32
Structural work not undertaken	11
TOTAL	101

A key finding from the survey is that 30 of the 32 homes with non-compliant repairs involved floor re-levelling using the jack and pack repair method. This is an established repair method and has been widely used in New Zealand to re-level homes that have settled unevenly. It typically involves the temporary jacking of the home to allow the installation of packing material between foundation piles and timber subfloor framing.

Non-compliance issues were essentially restricted to jack and pack repairs and crack repairs of perimeter concrete foundations in homes with suspended timber floors. Other repair methods were generally undertaken to an acceptable standard.

The number of homes with exempt structural repairs is considered to be a relatively small proportion of the total number of homes within the wider Canterbury home repair programmes.

The survey did not ascertain who carried out the repair work. However, records indicate at least nine of the homes with non-compliant repair work were supervised by a Licensed Building Practitioner (LBP). MBIE is undertaking further investigations into these builders.

Recommendations for addressing the repair quality issues identified by this survey are as follows:

Home inspection survey issues

- Agencies and/or their PMOs to rectify Building Code compliance issues identified by the survey.

Wider home repair programmes

- Agencies and/or their PMOs to undertake a review of completed repair work that has been exempted from a building consent, targeting houses where the repair works involved jacking and packing repair, to ensure compliance with the Building Code.
- Agencies and/or their PMOs to ensure that inspection and quality assurance procedures for current and future foundation repair work are robust.
- MBIE to facilitate further training of staff doing repair work to ensure they understand compliance/workmanship requirements for the work they are performing.
- Agencies and/or PMOs to ensure that only staff experienced or trained for particular repair work are doing that work.
- Agencies and/or their PMOs should further investigate any non-compliant work signed off by a Licensed Building Practitioners regime and consider laying a complaint with the Building Practitioners Board.

Broader issues

- MBIE to undertake a review of the appropriateness of exemptions for foundation related building work.

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Introduction

Approximately 167,500 residential dwellings were damaged because of the 2010 and 2011 Canterbury earthquakes. The subsequent residential repair and rebuild of the damaged homes is one of the largest residential building projects in New Zealand's history. A number of home repair programmes have been established by government agencies and private insurers to do this work.

Concerns have been raised through the media, by advocacy groups and individual homeowners, about the quality of the repair work carried out through the Canterbury home repair programmes. In response, the Ministry of Business, Innovation & Employment (MBIE) initiated a survey to assess the Building Code compliance of repairs to Canterbury's housing stock. As the building regulator, MBIE is required to monitor current and emerging trends in the building sector (Sec 169 of Building Act).

In 2014, MBIE inspected the completed repair work to 14 homes where homeowners had expressed concerns about the quality of the repair work to their homes. Non-compliance issues were found with 13 of the homes, but because the inspections focused on issues identified by homeowners the findings were not considered to be representative of the wider Canterbury home repair programmes. Therefore, MBIE decided to inspect a further 100, randomly selected homes with structural repair work, to better understand the Building Code compliance of repairs to earthquake-damaged homes.

The survey focused on homes with completed repairs involving structural work that was exempt from a building consent under Schedule 1 of the Building Act (repairs and maintenance). Structural work, such as repairs to foundations, is critical to the overall lifetime performance of a building. Repairs exempt from a building consent were selected because it was considered any compliance issues with the Building Code were more likely to occur with exempt repair work, since this work is not reviewed by Councils. It's the responsibility of the builder to ensure that work complies with the Building Code.

The number of homes with exempt structural repairs is considered to be a relatively small proportion of the total number of homes within the wider Canterbury home repair programmes.

Most homes in the wider repair programmes are considered to have a significantly lower risk of non-compliance than the survey sample because most of the repairs are either cosmetic (i.e. non-structural) or completed with a building consent and Council inspections.

Cosmetic work, such as paint finish quality, and whether repair work met the requirements of the EQC Act and the contractual requirements between insurers and homeowners were outside the scope of this project. Defects in cosmetic repair work are more easily identified than defects in structural repair work which may be hidden from view. There are established processes for homeowners to complain about defective cosmetic repairs.

This report outlines the methodology for inspecting the survey homes, provides a summary of the findings and provides recommendations that respond to the issues identified in this project.

Methodology

This section outlines the method for selecting homes for the survey, a description of the survey sample and the inspection and assessment procedures.

■ Selection of survey homes

The Earthquake Commission (EQC), two private insurers and Housing New Zealand (HNZ) were approached and agreed to provide a list of relevant addresses for homes that were expected to meet selection criteria set by MBIE for inclusion in the survey. MBIE then randomly selected addresses and invited homeowners to participate in the survey. The selection criteria for inclusion in the survey were as follows:

- The repair work was complete.
- The repair work was exempt from a building consent.
- The repair work incorporated structural work, such as replacement or repair of foundation elements (e.g. pile to bearer connections).

To meet the Privacy Act requirements, insurers contacted homeowners with a letter from MBIE inviting participation in the survey. All homeowners accepting the invitation were included in the survey. Participating homeowners were questioned about their satisfaction with the repairs to their home to gain an indication of whether there was bias in the survey sample towards dissatisfied homeowners. About two thirds of the survey participants indicated they were satisfied with their repairs.

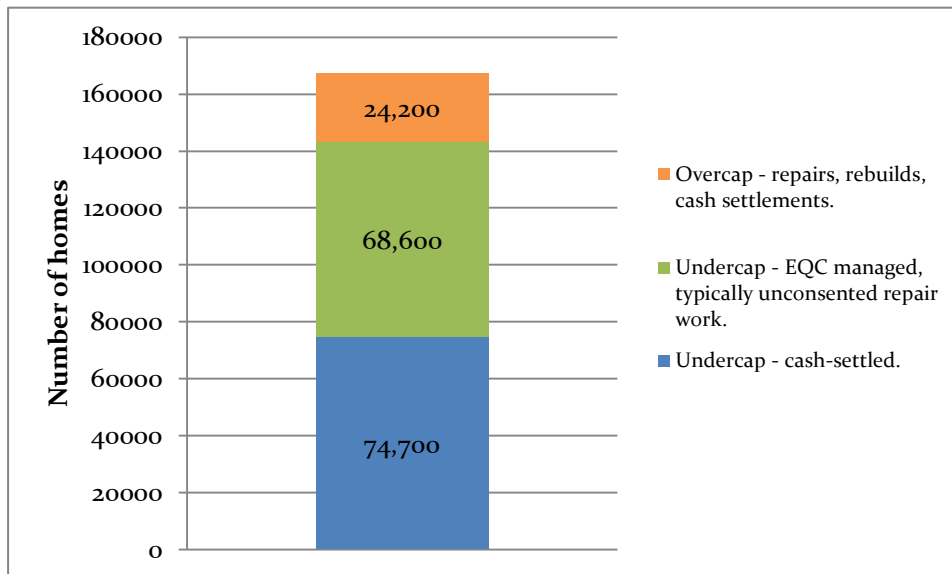
The number of home addresses provided by the agencies, the number of invitations to participate in the survey sent to homeowners and the number of homes inspected is shown in Table 2. Figure 1 shows the types of damage categories and number of homes in each category.

Table 2: Number of survey homes provided by agencies

Agency	Number of home addresses provided to MBIE	Number of invitations sent to homeowners	Number of homes in survey
EQC	2182	355	74
EQC opt-out (private)	450	50	7
HNZ	112	5*	5
IAG	22	22	7
Southern Response	29	29	8
TOTAL	2795	461	101

*HNZ was both the agency managing the repair and the effective homeowner so no invitation was required

Figure 1: Dwelling claims (as at 31 March 2015)



■ Description of survey sample

The location, construction era, foundation technical categories and foundation types of the 101 surveyed homes are described in this section.

The number of homes in each territorial authority covered by the survey is shown in Table 3. Most homes (95%) are located in the northern, eastern and southern suburbs of Christchurch, as shown in Figure 2.

The construction era of the surveyed homes is shown in Table 4. Most (74%) were built before 1980.

The foundation technical category of the surveyed homes is shown in Table 5. Most of the homes are located on land with technical category TC2 (37%) or TC3 (45%).

The type of floor construction of the surveyed homes is shown in Table 6. Most of the homes (64%) have a suspended timber floor with a concrete perimeter foundation.

Figure 2: Locations of survey homes in Christchurch

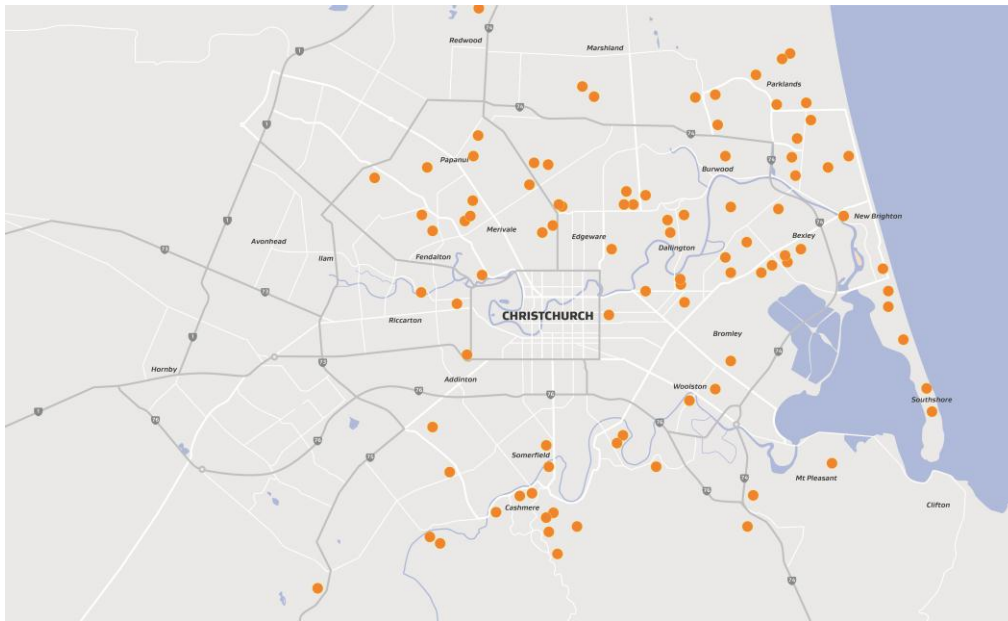


Table 3: Territorial authority of survey homes

Territorial authority	Number of homes
Christchurch City	95
Selwyn District	1
Waimakariri District	4
Hurunui District	1
TOTAL	101

Table 4: Construction era of survey homes

Construction era	Number of homes
Pre 1930s	17
1930s	3
1940s	5
1950s	13
1960s	15
1970s	22
1980s	6
1990s	13
Post 2000	7
TOTAL	101

Table 5: Foundation technical category of survey homes

Foundation technical category*	Number of homes
Port Hills and rural/unmapped	19
TC2	37
TC3	45
TOTAL	101

* Refer to MBIE guidance document *Repairing and rebuilding houses affected by the Canterbury earthquakes* for a description of technical categories

Table 6: Foundation type of survey homes

Foundation type*	Number of homes
Type A (timber floor with piles)	4
Type B (timber floor with perimeter footing)	64
Type C (slab on grade)	29
Mixed foundations (Type B and C)	4
TOTAL	101

* Refer to MBIE guidance document *Repairing and rebuilding houses affected by the Canterbury earthquakes* for a description of foundation types

Table 7: Date of reported repair completion of survey homes

Date of reported repair completion	Number of homes
2012: January – June	2
July – December	2
2013: January – June	17
July – December	26
2014: January – June	29
July – December	20
2015: January – June	5
TOTAL	101

■ Assessment of repairs

Assessment of home repairs took place from March 2015 to June 2015. The assessment involved the following steps.

- Obtaining documentation from the agency to confirm the repair strategy and scope of work, and to gather information useful to the assessment.
- Visiting the home to inspect the repaired work.
- Assessing the quality of repair work.

The team doing the inspections included an independent Chartered Professional Engineer (Structural), an independent Registered Building Surveyor, an MBIE structural engineer and a homeowner liaison person.

Upon completion of the inspections, the inspection team, assisted by senior management staff of the MBIE Building System Performance branch, MBIE, moderated the 101 provisional draft inspection reports to ensure consistency of assessment and reporting.

MBIE also sought feedback and further information from the insurers and their PMOs about specific aspects of repairs of individual homes, to maximize the accuracy of the repair assessments.

■ **Assessment Criteria**

The primary criteria for assessing the quality of repair work were compliance with the structural and durability provisions of the Building Code in Clause B1 Structure and Clause B2 Durability. Clause B1 safeguards occupants from unacceptable structural performance, such as structural failure or excessive movement of structural components. Clause B2 safeguards building components from premature deterioration.

The assessment applied the same standards as would be applied by the Council had the work been consented. It should be noted that an element of judgement is necessary when undertaking assessments, especially when taking into account the existing house condition and the Code requirements at the time of the original construction.

Assessments did not consider cosmetic work (e.g. quality of paint finish) and did not consider whether the repair work met the requirements of the EQC Act or the contractual requirements between private insurers and homeowners.

Repair work was generally assessed against Acceptable Solutions documents including:

- NZS3604 Timber-framed buildings
- NZS4229 Concrete masonry buildings not requiring specific engineering design

Reference was also made to the MBIE guidance document *Repairing and rebuilding houses affected by the Canterbury earthquakes* and the Fletcher EQR Technical Hub Red Book.

The quality of repair work was assessed using the following categories:

- Compliant – repair work complies with the Building Code
- Minor defect – minor defect with the repair work inspected. The compliance of this work may be marginal and a strict application of the Building Code may deem the repair work as being non-compliant. (e.g. isolated examples of non-installation of damp proof course between concrete foundations and timber sub-floor framing or non-complete/partial connection of foundation elements)
- Non-compliant – repair work clearly does not comply with the Building Code.

Findings

■ Main findings

Eleven of the homes included in the survey had no structural repair work carried out, so 90 of the 101 surveyed homes met the survey criteria of having repair work that was completed, exempt from a building consent and incorporating structural repair work.

The main finding of the survey is that 32 of the 90 survey homes that had structural repair work carried out were non-compliant with the structural and/or durability provisions of the Building Code. There were, however, no life-safety risks identified and the remediation of the non-compliant repair work is considered relatively easy for most of the homes. Table 8 shows the number of homes in each repair quality category.

Table 8: Summary of repair quality assessment results

Repair quality category	Number of homes
Compliant	35
Minor defects	23
Non-compliant	32
Structural work not undertaken ¹	11
TOTAL	101

Table 9 shows that 30 homes in the survey had repair work that was non-compliant with the requirements of Clause B1 Structure of the Building Code. All of these were associated with floor re-leveling by the jack and pack² repair method. A further 21 homes were assessed as having a minor defect with respect to structure. Table 9 also shows that 15 of the survey homes were non-compliant with the requirements of Clause B2 Durability of the Building Code and a further 25 homes were assessed as having a minor defect with respect to durability. It should be noted that most homes with repairs that were non-compliant with respect to structure were also non-compliant with respect to durability.

Table 9: Number of survey homes with different repair quality categories

Repair quality category	Home numbers for structural repair quality	Home numbers for durability repair quality
Compliant	39	51
Minor defect	21	25
Non-compliant	30	15
Structural work not undertaken	11	10
TOTAL	101	101

¹ In some cases work was not undertaken as per the repair scope of work or the work undertaken was not structural.

² The 'jack and pack' method typically involves the temporary jacking of the house to allow the installation of packing material between foundation piles and timber subfloor framing. This method typically requires the disconnection of foundation elements while jacking and packing is performed followed by the reconnection of the foundation elements. Jacking and packing is an established repair method and has been widely used in New Zealand to re-level houses that have settled unevenly. Refer to Appendix A for example pictures of jack and pack.

Table 10 shows the number of survey homes with non-compliant structural repairs for the different types of repair work. The main area of non-compliant repair work involved floor re-levelling using the jack and pack method, where 30 of the 50 houses with this type of repair were assessed as being non-compliant with the structural provisions of the Building Code. Of the 40 in-scope homes where the repair work was not via the jack and pack method, 2 of these were assessed as being non-compliant with the structural provisions of the Building Code.

Table 10: Number of survey homes with non-compliant repairs for different types of repair work (note that some homes had more than one type of repair work carried out)

Type of repair work	Number of homes surveyed	Number of homes with non-compliant repairs
Floor re-levelling by 'jack and pack'	50	30
Crack repairs of perimeter concrete foundations	39	20
Crack repairs of concrete slab	13	0
Floor re-levelling by grout injection	9	0
Floor re-levelling by floor levelling compound	9	0
Replacement of portion of perimeter concrete foundation	6	1
Replacement of portion of concrete slab	6	0

Common examples of non-compliant repair work observed included the following:

- Homes re-levelled by jacking and packing with inadequate fixing of pile to bearer connections and/or packing between foundation and superstructure elements.
- Inadequate bearing surfaces between piles and subfloor timber framing resulting in packing material being poorly installed or unstable – in some instances packing materials had fallen out or come loose.
- Use of inappropriate material, for example, compressible material or fibre cement board used for packing between piles and bearers.
- Inadequate concrete repair work, for example, incomplete penetration of epoxy repairs to cracked concrete perimeter foundation walls.
- Lack of damp proof course between concrete foundation elements and timber framing.

Although non-compliant structural repair work was observed in some homes, no life-safety concerns were identified for the occupants of these homes due to the repairs. However, the quality of this work is not acceptable and requires remediation, as do the minor defect repairs. The consequences of not remediating this work may be premature deterioration of repaired building elements, which may make the home more vulnerable to damage in future earthquakes and lead to reduced levels of amenity.

No compliance issues were observed with the more technically complex repair methods, such as re-levelling of concrete slab floors by grout injection.

Table 11 provides a breakdown of the non-compliant homes for each of the agencies participating in the survey. Due to the small sample sizes for the private insurers and HNZ firm conclusions cannot be drawn about the quality of the repairs undertaken in their wider home repair programmes. Firmer conclusions about the compliance of repairs to EQC homes with exempt structural repairs such as jack and pack can be drawn from the survey, because of their larger number of homes in the survey.

Table 11: Number of non-compliant survey homes for the different agencies

Agency	Number of survey homes	Non-compliant survey homes
EQC	74	26
EQC opt-out (private)	7	2
Southern Response	8	0
IAG	7	3
HNZ	5	1
TOTAL	101	32

■ Other findings

Exemptions from building consent

With the possible exception of one home, the use of Building Act Schedule 1 exemptions from a building consent was considered to be applied appropriately.

Floor re-levelling

Approximately 50% of the survey homes that had been re-levelled by the jack and packing did not have acceptable floor slopes when surveyed, based on the criteria in MBIE guidance document *Repairing and rebuilding houses affected by the Canterbury earthquakes*. The houses with unacceptable floor slopes generally had non-compliant repair work or repairs with minor defects.

Licensed Building Practitioner involvement

MBIE did not ascertain who actually carried out the repair work in the surveyed homes. However, records indicate that at least nine of the surveyed homes that were assessed as non-compliant had the repair work supervised by a Licensed Building Practitioner (LBP).

It is to be noted that this exempt repair work did not require LBP supervision, but if an LBP was involved in the supervision it was expected that their duties would have been to review the work for Building Code compliance.

It is also to be noted that a similar percentage of the surveyed homes assessed as compliant were supervised by a LBP.

Structural repair work not undertaken

Eleven of the homes included in the survey had no structural repair work carried out. In most of the cases the inspection confirmed the repair work was cosmetic and these homes should not have been part of the survey. In the case of three homes it appears that the structural repair work specified in the documentation provided by the PMOs was not carried out.

Discussion

Findings from the survey have identified Building Code compliance issues for houses with structural repairs exempted from a building consent. Non-compliance issues were essentially restricted to jack and pack repairs and crack repairs of perimeter concrete foundations in homes with suspended timber floors. Other repair methods were generally undertaken to an acceptable standard.

Most of the non-compliant work was considered relatively minor and easy to fix. No life-safety concerns were identified with the repairs.

The survey focused on structural repairs exempt from a building consent as this was considered to have a greater risk of defective work due to the lack of formal inspection procedures as would be required for a building consent. The findings therefore relate to a small portion of the wider repair work done by the Canterbury home repair programmes. It is not considered indicative of the quality of structural repair work undertaken with a building consent process or of cosmetic repairs.

The level of non-compliance observed in the survey is similar to the 30-35% failure rate of building consent inspections currently being experienced in Christchurch and Auckland for consented projects. It should be noted however that building work failing building consent inspections is required as part of the building consent process to be rectified so that Building Code compliance is achieved.

The homes surveyed in this project did not have a Council inspection as they were exempt from a building consent. The levels of non-compliance observed in the survey suggest the quality control, quality assurance and sign-off processes for some exempt repair work was inadequate. It is therefore recommended that the agencies and/or their PMOs ensure that inspection and quality assurance procedures for current and future foundation repair work are robust.

The non-compliant exempt repair work is of such a standard that it should be rectified by the repair contractors under the direction of PMOs as a priority. Exempt repairs that are considered to have minor defects should also be rectified by the repair contractors under the direction of PMOs. It is recommended that repair contractors under the direction of PMOs also review previously completed repair work targeting houses where the repair work involved jacking and packing.

The survey indicates that a significant proportion of the houses that were assessed as having non-compliant repair work had the work supervised by a Licensed Building Practitioner (LBP). Non-compliant work supervised by a LBP should be reviewed to identify if the LBP has performed negligently and whether a complaint to the Building Practitioners Board is warranted.

Builders have a responsibility to ensure that building work meets the requirements of the Building Code. The findings from this project indicate the need to review the suitability of the LBP regime and the appropriateness of Schedule 1 exemptions for undertaking structural repairs.

MBIE has in the past year provided training to target tradespeople performing jack and pack repairs. Over 500 tradespeople have attended MBIE-led seminars and an on-line tutorial has been developed by MBIE to provide a basic overview of the requirements of jack and pack repairs. MBIE, together with the insurers and their PMOs, will be prepared to facilitate further training to improve the industry knowledge for this repair technique.

Formal recommendations that respond to the findings of the survey have been developed to improve the quality of exempt repair work. These are shown in the following section of this report.

Recommendations

Recommendations for addressing the repair quality issues identified by this project are as follows:

Home inspection survey issues

- Agencies and/or their PMOs to rectify Building Code compliance issues identified by the survey.

Wider home repair programmes

- Agencies and/or their PMOs to undertake a review of completed repair work that has been exempted from a building consent, targeting houses where the repair works involved jacking and packing repair, to ensure compliance with the Building Code.
- Agencies and/or their PMOs to ensure that inspection and quality assurance procedures for current and future foundation repair work are robust.
- MBIE to facilitate further training of staff doing repair work to ensure they understand compliance/workmanship requirements for the work they are performing.
- Agencies and/or PMOs to ensure that only staff experienced or trained for particular repair work are doing that work.
- Agencies and/or their PMOs should further investigate any non-compliant work signed off by a Licensed Building Practitioners regime (LBP) and consider laying a complaint with the Building Practitioners Board.



Broader issues

- MBIE to undertake a review of the appropriateness of exemptions for foundation related building work.

Acknowledgements

MBIE would like to thank the homeowners who agreed to participate in the survey. MBIE would also like to thank the various agencies and their PMOs for providing their time and information to allow MBIE to conduct the survey.

Appendix A – Example Pictures of Jack and Pack Repairs

 A photograph showing a compliant jack and pack repair. A concrete pile is supported by a timber bearer. A yellow packer is placed between the pile and the bearer, and a blue beam is fixed to the pile. A metal rod is also visible, secured to the pile.
<p>Example of Compliant 'jack and pack'</p> <ul style="list-style-type: none">• Packers fixed to bearers• Piles fixed to timber bearers
 A photograph showing a non-compliant jack and pack repair. A concrete pile is supported by a timber bearer. A red packer is placed between the pile and the bearer, but it is not fixed to the bearer. A metal rod is also visible, but it is not fixed to the pile.
<p>Example of non-compliant 'jack and pack'</p> <ul style="list-style-type: none">• Packers not fixed to timber bearers• Timber bearer not fixed to piles