



Determination 2020/002

Regarding the consented alterations to the walls and roof of a house and its compliance with Building Code Clause B1 at 25 Sturrocks Road, Redwood, Christchurch



Summary

This determination considers whether alterations to the walls and roof of a house comply with Building Code Clauses B1 Structure, E2 External moisture and F7 Warning systems. The determination also considers whether changes to the consented building work can be considered a minor variation to the building consent, and the issue of the code compliance certificate for the alterations.

1. The matter to be determined

1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004 (“the Act”) made under due authorisation by me, Ingrid Bayliss, General Manager, Housing and Tenancy Services, Ministry of Business, Innovation and Employment (“the Ministry”), for and on behalf of the Chief Executive of the Ministry.¹

1.2 The parties to the determination are:

- Christchurch City Council carrying out its duties and functions as a territorial authority or a building consent authority (“the authority”), and who applied for the determination
- A Steentjes, the current owner of the house (“the owner”)

¹ The Building Act and Building Code are available at www.legislation.govt.nz. The Building Code is contained in Schedule 1 of the Building Regulations 1992. Information about the Building Act and Building Code is available at www.building.govt.nz, as well as past determinations, compliance documents and guidance issued by the Ministry.

- P Paterson, a chartered professional engineer (“the engineer”), who is a licensed building practitioner² concerned with the building work and who provided the structural engineering design for alterations undertaken by the previous owners of the house
 - S Cranfield, a licensed building practitioner³ (“the builder”), who carried out the alterations.
- 1.3 This determination arises from internal alterations (“the alterations”) carried out under a building consent to remove two walls to open up the kitchen, dining, and living areas of a residential house. The work was carried out by the previous owners. The work involved removing parts of loadbearing and non-loadbearing walls, and installing framing in the ceiling space above to support the roof structure. The application for a determination was made by the authority because the alterations as-built did not accord with the building consent and the owner raised concerns about compliance of the building work with Clause B1 Structure⁴.
- 1.4 The owner has asked that the determination also consider compliance with Clauses E2 External moisture and F7 Warning systems, as well as the authority’s decision to issue the code compliance certificate. The authority agreed to include the additional compliance matters and the decision to issue the code compliance certificate within the scope of the determination application.
- 1.5 The matter to be determined concerns the building work carried out under the building consent and the departures from the consented design. The matters to be determined⁵ are:
- whether the alterations as-built comply with Clauses B1 Structure, (including for the period specified in Clause B2 Durability), E2 External moisture, and F7 Warning systems of the Building Code,
 - the authority’s exercise of its power of decision in issuing the code compliance certificate for the alterations.
- 1.6 In deciding these matters, I must consider:
- whether the alterations comply to the extent required under section 17 with regard to the new building work and to the extent required under section 112(1)(b)⁶ of the Act with regard to the existing building; and
 - the information available to the authority at the time it made its decision to issue the code compliance certificate; and
 - whether the departures from the approved design are a minor variation⁷ from the building consent.
- 1.7 The owner has raised concerns regarding several matters that are outside the scope of this determination, including actions of other people or entities. I have not addressed those issues as they are outside the matters that can be determined under section 177 of the Act. The owner has identified concerns regarding the bracing of the altered loadbearing wall, which is outside the scope of this determination. The owner also

² Chartered Professional Engineers under the Chartered Professional Engineers of New Zealand Act 2002 are treated as if they were licensed in the building work licensing class Design 3 under the Building (Designation of Building Work Licensing Classes) Order 2010.

³ LPB No. BP102909, Site and Carpentry.

⁴ Unless otherwise noted, references to clauses in this determination are to clauses of the Building Code and references to sections are to sections of the Building Act.

⁵ Under section 177(1)(a), (1)(b), and (2)(d) of the Act.

⁶ Section 112 Alterations to existing buildings.

⁷ As defined in the Building (Minor Variations) Regulations 2009.

raised concerns regarding the compliance of the kitchen alterations, the gazebo, and potential presence of asbestos in the ceiling, which were outside the scope of the building consent and are not within the scope of this determination.

- 1.8 In making my decision, I have considered the application, the submissions of the parties, the reports of the independent experts engaged by the Ministry (a registered building surveyor and licensed building practitioner (“the first expert”), and an engineering firm (“the second experts”), and the other evidence in this matter.
- 1.9 Relevant sections of the Act and clauses of the Building Code are included in Appendix A. The inspections as set out in the building consent are included in Appendix B. The relevant photographs and sketches from the expert reports are included in Appendix C.

2. The building work and background

- 2.1 The house was built in 1968, with permitted alterations carried out in 1985 and a consented extension to the south in 1995. The house is located on a flat site. It is single storey and is constructed from light timber framing, with brick veneer cladding and aluminium joinery.
- 2.2 The house has a framed roof, with a trussed roof over the kitchen and dining room. Roofing is corrugated galvanised steel as is the spouting and downpipes. The house has a suspended timber floor supported primarily by continuous concrete perimeter foundations with pre-cast concrete piles.

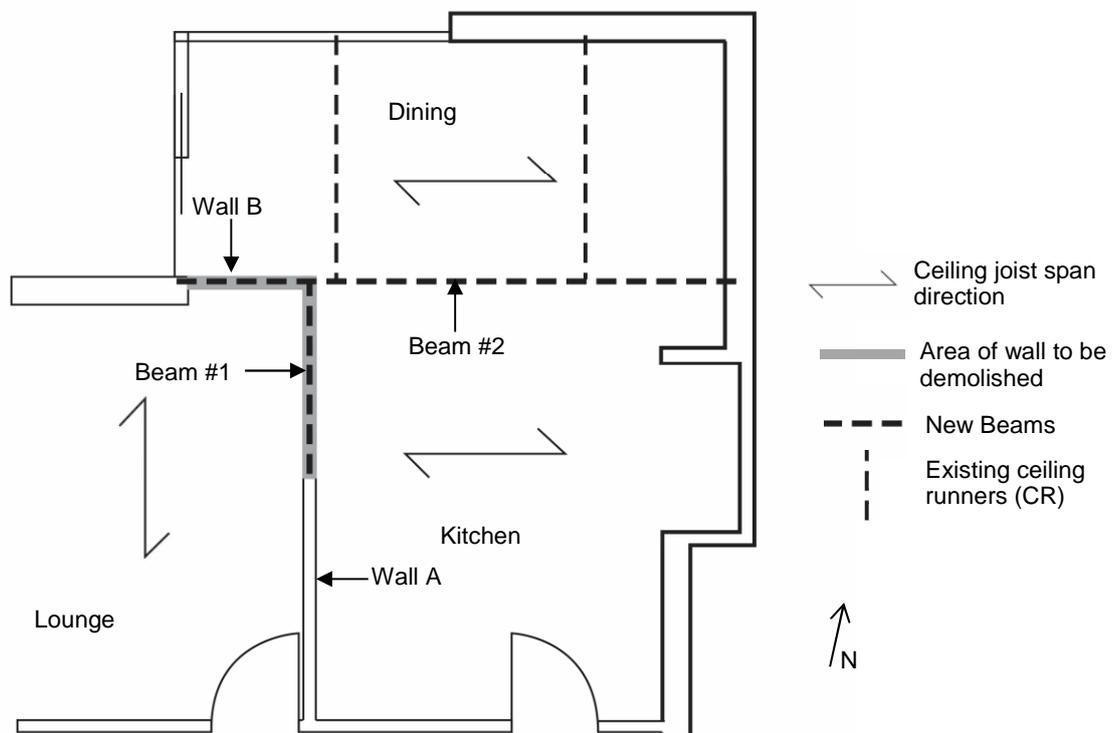


Figure 1: Drawing showing proposed demolition and new beams (not to scale)

- 2.3 In 2013 the previous owners decided to alter the house by removing sections of two walls (1.1m and 1.9m long) between the lounge and kitchen/dining areas (refer Figure 1). They engaged the engineer to provide structural engineering advice and drawings for this to allow the builder to carry out the alterations.

- 2.4 The engineer provided a design on 31 October 2013 and issued a Producer Statement – Design (PS1) for “structural alterations including roof support beams and lateral wall bracing for the removed wall section”. The engineer noted the following inspections would need to be carried out:
- “Lining removal and opening up, prior to demolition”.
 - “Support beams and preliminary”⁸.
- The building consent was applied for on the same day.
- 2.5 The engineer’s design and the consented drawings include two simply-supported beams to span the gap left by removing part of the walls, labelled as Beam #1 and Beam #2 in Figure 1. Beam #1 (a 290x90mm VSG⁹ or 240mm LVL¹⁰ beam) was to be installed between the east and west walls, to provide end support to Beam 2 (190x90mm), and spans between Beam 2 and the end of Wall A. The consented drawings detailed a double stud at the north end of Wall A. A note on the engineer’s drawings required confirmation of the existence of a pile underneath the end of Wall A.
- 2.6 The building consent noted two existing smoke alarms that were to be replaced if they were not “hush button type”.
- 2.7 On 24 January 2014 the authority issued building consent No. BCN/2013/10302 for “dwelling alteration – remove loadbearing walls, install beam and modify wall bracing”. Refer to Appendix B for a list of the specified inspections.
- 2.8 On 23 March 2014 the engineer carried out the first specified inspection to check the existing structure once the lining had been removed. The engineer also carried out the second inspection (for support beams and pre-lining) at the same time because the existing structure and connections were visible at the site visit.
- 2.9 During the inspection the engineer discussed with the builder and the then owners a proposed revision of the beam design, which involved the replacement of the simply-supported beam structure with a cantilevered beam above Wall A. This revision was required because the inspection had established there was insufficient clearance in the roof space to accommodate the new supporting beams as designed.
- 2.10 The engineer revised the design to include a single cantilevered beam tied into the existing roof and wall structure (refer Figures 2 and 3). The engineer also confirmed a pile and footing was to be installed under the north end of Wall A between the kitchen and lounge, with double studs above and hold down straps at both the top and bottom on one side. In addition, the south end of Wall A and the end of the cantilevered beam at the hallway were to have hold down straps and blocking “to ensure the stability of the top of the support beam”.

⁸ The engineer later clarified the PS1 should have stated “Support beams and pre-lining”.

⁹ Visually stressed grade solid timber.

¹⁰ Laminated veneered lumber.

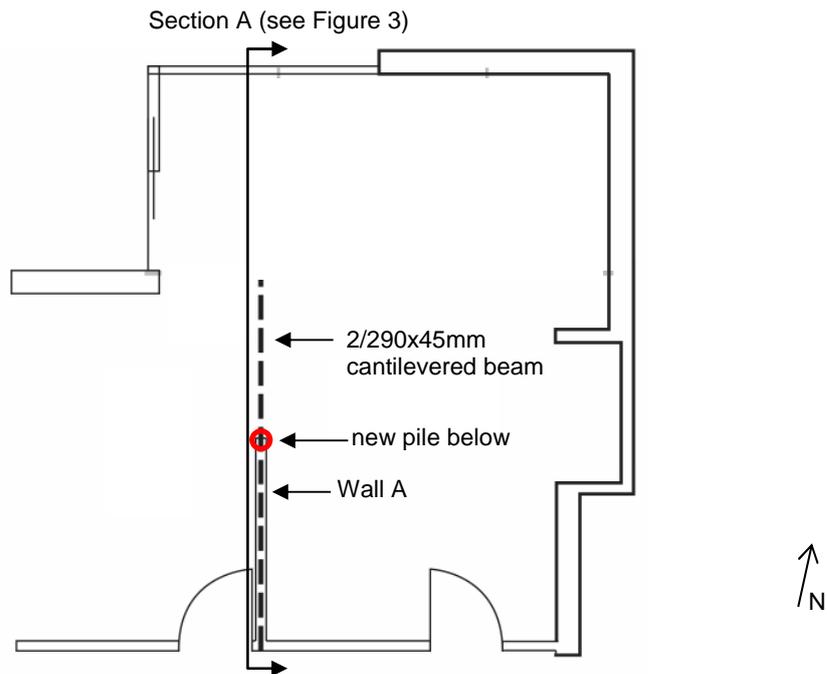


Figure 2: Sketch of the revised design based on the amendments to engineer's design sheet SK-2 (not to scale)

- 2.11 The engineer issued a site report dated 26 March 2014 to the builder to this effect along with a marked up-sketch showing the changes (refer Figure 2). The site report also stated that once the new work is completed another engineering inspection would be completed so the PS4¹¹ could be issued. I note that the authority can find no record of receiving the site report and associated details in 2014. I have received conflicting and changing accounts of whether the authority was informed and approved of the change in design as a minor variation.

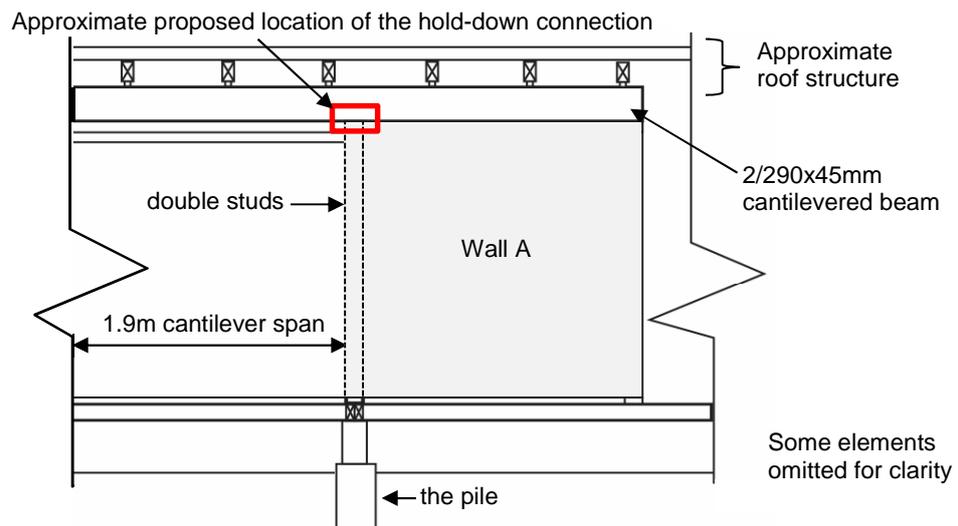


Figure 3: Sketch of section A of the as-built construction (not to scale)

¹¹ Producer Statement – Construction review (PS4).

- 2.12 The authority has since referred to a note made on the 31 March 2014 inspection record that noted a “Pass” against the “Site report for engineering work”. The authority considers it reasonable to assume an officer of the authority had viewed the details of the revised design because the engineer’s site report for the revised design had been provided to the builder on 26 March 2014 and would or at least could have been available to the authority on 31 March 2014.
- 2.13 On 31 March 2014 the authority carried out ‘Sub Floor’, ‘Pre Line including Plumbing’, and ‘Pre Stopping’ inspections, which all passed (refer Appendix B).
- 2.14 Once the alterations were completed, the engineer issued a PS4 on 17 September 2015. The engineer did not inspect the cantilevered beam as installed after the design was revised, and instead relied on phone conversations and previous experience with the builder to be “comfortable” in issuing the PS4 for the completed building work.
- 2.15 The PS4 included the statement: “instructions [from the engineer] have been issued during the course of the works”. The site report referred to in paragraph 2.11 of this determination and associated calculations were not attached to the PS4.
- 2.16 The authority carried out a final inspection of the alterations on 22 September 2015 (refer Appendix B) and issued a code compliance certificate with the building work scope described as “Dwelling Alteration – Remove loadbearing walls, install beam and modify wall bracing” on 4 December 2015.
- 2.17 Later in December 2015 the owner took possession of the house. However, after inspecting the roof and subfloor areas, the owner found that the completed building work differed from the consented plans. The owner subsequently discussed this with the engineer and builder, who explained the changes and supplied to the owner details of the alterations made as the authority had no record of the changes at that time.
- 2.18 Sometime in 2016 the builder visited the house, and went into the roof and subfloor space. In the roof space the builder viewed the struts that “had gaps around them”, which he believed were “ok structurally”. The owner informed the builder the pile did not have a fixing, despite the authority inspecting the subfloor space. The builder inspected the pile and found there was no fixing between the pile and the floor joist above it, so he installed a stainless steel bracket to the pile. On the same day the engineer visited and provided a “marked up sketch” to the owner, and I understand the engineer did not inspect the alterations.
- 2.19 The owner then contacted the authority in early 2016 to express concern about the structural adequacy of the cantilevered beam and what the owner considered was the authority’s failure to pick up the design changes at the final inspection. The owner was concerned the building work was not in accordance with the building consent, and was of the view the authority should not have issued the code compliance certificate.
- 2.20 On 8 March 2016 the authority wrote to the owner to say it considered the cantilevered structure met the requirements of the Building Code. The authority also said it did not believe the code compliance certificate was issued in error; “albeit that there was information provided after the [code compliance certificate was issued] that should have been made available” prior to its issue. I note the authority has subsequently reached the view that an officer of the authority had reviewed the changed details at the time (refer paragraph 2.12).

- 2.21 Following further correspondence with the owner, three officers of the authority visited the house to inspect the alterations and informed the owner on 28 February 2017 that:
- The beam was in accordance with the [revised] engineer drawings but not the building consent, and looks to be performing as expected i.e. in accordance with B1 of NZBC. Equally the structure as presented is of no structural concern.
- 2.22 On 8 March 2017 the owner called the authority to request an investigation. The owner also commissioned an engineering firm (“the engineering firm”) to review the alterations.
- 2.23 The engineering firm made a site visit on 9 March 2017 and sent its report to the owner on 24 March 2017¹². This report concluded:
- The alternative beam arrangement has been assessed using alternative calculations and checked against the original calculations to confirm that this design was an acceptable alternative to the original consented design. Both of these checks conclude that the alternative design was acceptable, although different to the original design...
- The alternative beam design provided gives adequate support to the structure and replaces the support provided by the original wall in that location. While the work carried out on site is not in accordance with the consented documents, assuming the workmanship is up to the required standard and all connections are confirmed as adequate by an LBP¹³, the alternative design is deemed to be suitable for the required purpose.
- 2.24 The owner has not accepted the conclusions in this report and has asked for it not to be used to inform the determination. I have not used this report in forming my conclusions on the compliance of the alterations.
- 2.25 Following further contact by the owner, the authority wrote again on 20 June 2017 stating:
- [The authority] has fully investigated your concerns and we are completely satisfied on reasonable grounds that the associated work complies with the New Zealand Building Code. The cantilever beam was fitted in variation to the consented documents but was detailed and supported by a final producer statement from the consent engineer...
- 2.26 The matter remained in dispute between the owner and the authority, and on 11 April 2018 the authority applied to the Ministry for a determination.

3. Submissions

3.1 The authority

- 3.1.1 In support of the application for determination the authority supplied copies of the building consent, the code compliance certificate and associated documents, including the engineer’s PS1 and PS4 and related correspondence. In an email on 17 April 2018 the authority described the building work and sequence of events.
- 3.1.2 The authority does not contest that the building work was not completed in accordance with the consented plans, but submitted that:

... there are reasonable grounds to consider that the work complies with the Building Code. We understand that, on review, [the fixing added] to the new pile was installed after issue of the code compliance certificate.

¹² The owner supplied this report to the Ministry on 25 June 2018.

¹³ Licensed Building Practitioner.

- 3.1.3 The authority said it was proposed and approved as part of the consented documents that the engineer would carry out two inspections (“lining removal and opening up prior to demolition”, and “support beams and preliminary”) and issue a producer statement once these inspections were complete. It said the engineer ultimately only carried out a single inspection, but the authority had received a producer statement (a PS4) before issuing the code compliance certificate.
- 3.1.4 The authority outlined the events that had taken place regarding the change in design. It stated it had received the engineer’s sketch detailing the cantilevered beam instead of the two simply supported beams after the code compliance certificate was issued. The authority stated it had no record of receiving the sketch before issuing the code compliance certificate. However, the authority subsequently stated it is a “reasonable assumption” that an officer of the authority reviewed the details on-site based on the inspection record dated 31 March 2014.
- 3.1.5 The authority noted its final inspections were an overview of the completed job and did not include inspection of the roof space, especially as the engineer was to inspect the structure and was verifying this separately with a producer statement.
- 3.1.6 The authority added that the engineer involved was a chartered professional engineer, noting:
- The work undertaken was simple residential work and we consider that the provision of the producer statement – construction review [PS4], along with our own observations, formed reasonable grounds to issue the code compliance certificate.
- 3.1.7 The authority noted the issue of a code compliance certificate could not be overturned except by way of a determination. However, the authority was of the opinion that there were reasonable grounds to consider that the building work complied with the Building Code and therefore no benefit or value in overturning the decision to issue the code compliance certificate.

3.2 The owner

- 3.2.1 In a series of emails between 17 April 2018 and 17 January 2019 the owner provided various submissions as well as a substantial amount of material regarding the authority’s application for determination, the first expert’s report (described in paragraph 4), and other issues to do with the house and alterations.
- 3.2.2 The information supplied to the Ministry by the owner over this period includes, but is not limited to:
- submissions providing a description of events and reasons for requesting compliance with other clauses of the Building Code be considered as part of this determination
 - photographs of the house, including details of the building work and floor levels, and a video of the pile
 - the “auction pack” the owner received before purchasing the property
 - the engineer’s revised plans for the alterations and associated documents, including the engineer’s 26 March 2014 site report
 - the report of the engineering firm and correspondence relating to that report
 - copies of correspondence with the parties and others regarding the consented alterations and various associated documents, including complaints lodged with the authority and other entities.

3.2.3 The owner did not agree with the conclusions reached by the authority or the engineering firm that the as-built structure complied with the Building Code. The owner expressed a number of concerns about the alterations, and their compliance with the Building Code, such as:

- The connections and removal of support from the structure has allowed for excessive movement and caused the ridge of the roof to sag, which has resulted in the rafters spreading. The movement of the rafters has caused deflection to the top of the east wall, which has caused the spouting to tilt and rainwater could flow behind the cladding.
- The ceiling runners were cut and top plates removed, which has caused a general loss of lateral bracing to the house. I have not seen any evidence that shows there has been a loss of bracing.
- There was only one smoke alarm instead of two and it was not the correct type of alarm.
- The building work has caused the foundation to rotate and sink resulting in an uneven floor level in the kitchen.
- The roofing and flashing were installed poorly, and building paper has been left in the spouting.
- The ground capacity was not confirmed before construction.

3.2.4 The owner was of the view the alterations had caused various negative effects to the building's structure. While I have not summarised the various effects the owner refers to, I have taken the owner's submissions regarding the building's structure into account in considering whether the as-built work complies to the extent required by the Act.

3.2.5 On 2 March 2019 the owner sent through another submission that noted the following (in summary):

- A site notice from the authority dated 15 September 2015 referred to the status of support documentation and noted documentation from the engineer was required. An authority document titled "CCC¹⁴ Statement of Compliance" dated 10 November 2015 noted the information from the engineer was outstanding, and therefore the code compliance certificate should not have been issued until that information was received.
- The bracing to Wall A has not been installed correctly.

The bracing to the wall is outside the scope of this determination.

3.2.6 I note in the authority's "Code Compliance Summary" dated 4 December 2015 that the PS4 from the engineer had been marked as received.

3.3 The builder

3.3.1 On 9 August 2018 the builder provided a submission regarding the alterations. This submission described the events relating to the alterations and revision in engineering design, the builder's subsequent communications with the owner, and the installation of a bracket to secure the pile.

¹⁴ Code compliance certificate.

3.3.2 On 2 October 2018 the builder answered questions from the Ministry regarding the construction of the pile and concrete footing, and provided an invoice for materials he stated were for the building work dated 24 March 2014.

3.4 The engineer

3.4.1 On 18 June 2018 the engineer provided a response to the first expert's report. I have described the engineer's response in paragraph 4.8 below.

3.4.2 On 12 December 2018 the engineer responded to a request from the Ministry to clarify the inspections the engineer had carried out. The engineer advised that the two inspections noted in the building consent documentation were able to be carried out during the one site visit (I note the engineer did not carry out the inspection stated in the site report to inspect the building work after it had been completed, refer paragraph 2.14).

4. The first expert's report

4.1 On 9 May 2018 I engaged the first expert (as described in paragraph 1.8) to review the as-built documentation and other information relating to the alterations (supplied by the authority and the owner), to verify the building work on site and to provide a view on its compliance with Clauses B1, E2, and F7 of the Building Code with regard to the concerns raised by the owner. The scope of the first expert's engagement recognised that additional structural engineering advice may be required at a later date.

4.2 I also asked the first expert to carry out an assessment on site of the defects identified by the owner (refer paragraph 3.2.3) and provide a view on whether the alterations were likely to have caused these.

4.3 The first expert and an assistant visited the site on 18 May and 28 May 2018. A final report was sent to the Ministry on 7 June 2018 and I forwarded this to the parties for comment the next day.

4.4 The first expert concluded that the "cantilevered beam and all work associated with it (including the roofing) is meeting the...Building Code". The first expert also noted while the roof strut was poorly fitted there was no indication the roof had moved as a result of the strut.

4.5 However, the first expert also said that if the sub-floor and roof space had been inspected by the authority the lack of pile fixing and poorly connected roof strut would have been observable at the time, and that should have prevented the alterations passing the authority's final inspection. These items would have required remedial work before the code compliance certificate could have been issued.

4.6 In the first expert's view:

- The lead edge on one side of the roof hip flashing was torn in two places where the roof cladding had apparently been removed to provide access for the building components. The hip flashing capping should ideally have been replaced. It was raining during the first expert's second site visit and there were no signs of water entering the roof space. The lead edge was not pressed down onto the roof cladding on the other side of the roof, but the first expert pushed this down while on site.

- The roofing sheet appeared to have been removed and replaced from the east face above the dining room. The roof underlay was protruding from under this part of the cladding into the spouting by approximately 35mm, which is recommended as shown in Figure 45 of E2/AS1¹⁵.
- The owner showed the expert a smoke alarm the owner said was installed in place when he took possession of the house. If this alarm was the one in place during the authority's final inspection it was not in accordance with the Acceptable Solution F7/AS1¹⁶ (with Clause F7 Warning systems) and the expert considered it would have been non-compliant with Clause F7. However, the expert could not confirm whether this smoke alarm was in place during the final inspection and noted the consented documents show compliant smoke alarms.
- The floor levels were checked in the kitchen, dining room, and east half of the lounge. A shallow slope from the centre of the lounge towards the north and east half of the lounge was identified. In the first expert's view the increased slope to the east wall is due to the added weight of a masonry chimney, which has now been partially removed. The owner provided the first expert with a floor survey plan dated January 2016, which showed the same slope trends. The walls between the kitchen/lounge and east wall were leaning 6mm to the east, which correlated with the floor slope.
- The ceiling levels in the kitchen, dining room, and east half of the lounge generally matched the slope of the floor in sloping from the centre of the lounge ceiling towards the north and east.
- Observation of the east wall of the dining room showed the veneer along the left side of the dining room window had drifted 5mm from the wall framing; there was a slight bow out of 2–3mm in the centre of the top half of the veneer; the veneer on the left side of the dining room east window was approximately 20mm out of alignment with the bricks on the right side of the window; and the veneer on the right side was leaning out 10mm at the top. However, the east edge of the roof was straight, which confirmed the roof had not moved.
- The bottom of the fascia and spouting were being pushed outwards by the brick veneer. This is causing the spouting to tilt backwards towards the wall. In the event of a spouting blockage the tilt could cause water to spill over the back, down the face of the fascia and outer face of the brick veneer. However, water is designed to spill over the back edge as that edge is considerably lower than the front edge, as shown in Figure 45 of E2/AS1. The first expert advised this is unrelated to the building work associated with the cantilevered beam.
- The floor levels indicate the foundation has undergone minor settlement in the south-east corner. There was no indication of recent movement in the foundation. The settlement is at least partially historic and likely due to the added weight of the chimney.

4.7 The authority's response

- 4.7.1 The authority advised on 12 June 2018 that it accepted the findings of the first expert's report. The authority also noted that the building consent had been for:

¹⁵ Acceptable Solution for New Zealand Building Code Clause E2 External moisture.

¹⁶ Acceptable Solution for New Zealand Building Code Clause F7 Warning systems.

simple work at a residential property, which was viewed and carried out by a licensed building practitioner. The [authority] received a producer statement for construction review from a qualified engineer (CPEng) and [the authority] therefore believed [it] had reasonable grounds to accept it complied with the building consent documents.

4.8 The engineer's response

4.8.1 The engineer emailed on 18 June 2018 and also accepted the findings of the first expert's report. The engineer supplied "for reference" a copy of an adjudication report from the IPENZ (now Engineering New Zealand) Investigating Committees¹⁷ about a complaint made previously by the owner regarding the alterations, which had been dismissed¹⁸.

4.9 Owner's response to the first expert's report

4.9.1 The owner responded to the first expert's report in a series of emails from 12 June 2018 to 17 February 2019. Comments and concerns included the following (in an initial email responding to the expert's report):

- The report seemed to be "very incomplete and inaccurate", for reasons such as it not including an accurate drawing of what was built, and not addressing issues raised by the owner.
- The owner questioned the accuracy of the expert's measurements, saying the cantilevered beam had deflected by 13mm from the end of Wall A to the end of the beam in spite of the expert finding otherwise. The owner also stated the ceiling had deflected and cracked at both ends in the lounge, kitchen and hallway.
- In the owner's view the problem with the work carried out had to do with the bracing in the roof and the structure's resilience to earthquakes. "Structural damage has occurred and this is due to the bracing being compromised in the gable roof over the lounge".
- There was no confirmation of the ground bearing capacity.

4.9.2 The owner's later submissions reiterated his previous concerns and raised new concerns regarding the weathertightness assessment and description of the cladding.

4.9.3 In an email on 13 June 2018 the owner challenged the authority's response to the expert's report and the information it had relied on in issuing the code compliance certificate. In a further email on 16 June 2018, the owner again challenged the acceptance of the expert's report by the authority and other parties. The owner said many of the report's photos showed "obvious substandard work", such as the packers underneath the beam were not connected, and some significant defects not mentioned such as the concrete footing to the pile. The owner sent a video showing that concrete to the pile footing was able to be gouged with a screwdriver.

4.9.4 A draft of this determination was then issued to the parties for comment on 7 March 2019.

¹⁷ 11 May 2017 IPENZ Ref 431, Report to IPENZ Chief Executive from Chair Investigating Committees (Adjudicator).

¹⁸ The Adjudicator dismissed the complaint on the basis the authority had classified the building work as a minor variation; the engineer had followed an appropriate process in making the change in design; there was no evidence received that the variation had caused damage to the building, and noting the code compliance certificate had been issued.

4.10 The first draft determination and parties' responses

- 4.10.1 A first draft of this determination was issued to the parties for comment on 7 March 2019. The first draft concluded the authority incorrectly exercised its power of decision in issuing the code compliance certificate because the pile fixing did not comply with Clause B1. However, without additional information regarding the compliance of the cantilevered beam, roof structure and pile, there were insufficient grounds to reverse the authority's decision to issue the code compliance certificate. There was also insufficient information to determine whether the alterations constituted a minor variation or required an amendment to the building consent. The draft also concluded that the alterations complied with Clauses E2 and F7.
- 4.10.2 On 7 March 2019 the owner provided his first response to the draft determination. The owner then provided a number of submissions that canvassed a wide range of issues, including aspects outside the scope of this determination. I have summarised the salient comments in Table 1 below.
- 4.10.3 On 11 March 2019 the authority accepted the decision of the draft determination and provided a submission, which is included in Table 1 below.
- 4.10.4 On 21 March 2019 the builder accepted the decision of the draft determination, and provided a submission regarding an incorrect description of the roof framing (the description has been amended accordingly).
- 4.10.5 On 22 March 2019 the engineer did not agree with the decision of the draft determination and provided a submission, which I have included in Table 1 below.

Table 1: Summary of the responses to the first draft determination

Minor variation
<p>Authority's response:</p> <ul style="list-style-type: none"> The process for minor variations that was used by the authority in 2016 should be considered, rather than the process that is currently in place. <p>Engineer's response:</p> <ul style="list-style-type: none"> They only provided the site report to the parties named on the report and cannot confirm if the authority was aware of the site report or whether it was given to the authority. The change in design from two simply supported beams to one cantilevered beam and a pile is similar to a framing change. The revised structural design took into consideration that the beams were designed to support the roof, ceiling, and all applicable loads, including the ceiling joists, roof framing, and self-weight. The engineer noted they were involved in the original building consent application. The variation in design complies with the Building Code in respect of section 112 of the Building Act. <p>Owner's response:</p> <ul style="list-style-type: none"> The building work was not carried out as per the consented plans. The change in design could not be considered a minor variation as the engineer needed to carry out new structural calculations. The change in design has resulted in a different beam layout, change of beam size, cantilever used instead of simply supported beams, and the installation of a pile. The parties have provided conflicting and changing accounts of the circumstances regarding whether the authority were informed of the change in design.

<ul style="list-style-type: none"> The owner questioned the fact the engineer's PS4 stated the engineer had not sighted the building consent.
<p>Compliance of the pile</p>
<p>Authority's response:</p> <ul style="list-style-type: none"> The inspection record noted "galvanised" under fixings and it can be assumed there were fixings at the time of the inspection. Accepts the current fixings (the steel bracket) to the pile at the time the first expert carried out the assessment do comply with the Building Code. <p>Engineer's response:</p> <ul style="list-style-type: none"> The pile provides support to the double studs at the beginning of the cantilevered section of the beam that replaced the removed section of Wall A. There was no bearer connected to the double stud, and therefore it was not possible to connect the pile to a bearer. The soil was assumed to have a bearing capacity of 50kPa, which was taken from a previous building consent. The calculated size of the pile at 350x350mm would result in an applied load on the soil of 38kPa, which is less than the assumed bearing capacity.
<p>Compliance of the beam</p>
<p>Authority's response:</p> <ul style="list-style-type: none"> The engineer would have carried out an analysis of the loads imposed on the cantilevered beam or designed conservatively for the worst-case scenario. <p>Engineer's response:</p> <ul style="list-style-type: none"> The cantilevered beam has been designed to support the roof and ceiling loads that were previously supported by the part of Wall A that had been removed The cantilevered beam has been designed to support the ceiling joists above Wall B. The governing criteria for a beam in this type of alteration is the deflection, which is determined by the beam's stiffness. The calculated deflection of the cantilevered beam at 2.8mm to 5.6mm is within tolerance limits. The cantilevered beam has sufficient strength to resist the applied roof and ceiling loads. The design of the cantilevered beam and pile comply with Clause B1. There were aspects of the building work that needed modification at the final building inspection, but they were of a minor nature.
<p>Compliance of the roof and ceiling structure</p>
<p>Engineer's response:</p> <ul style="list-style-type: none"> Wall B did not support the roof or ceiling elements at the time of construction. The ceiling joists support the ceiling above Wall B and their load is supported through a load transfer mechanism to the cantilevered beam. The beam has been designed to support the ceiling joist load. The ceiling joists also are supported by the ceiling runners that transfer the loads to the interior and exterior walls. It was clear a small amount of deflection would occur as a cantilevered beam will move more than a solid full height wall. However, as support along where Wall A was removed has been provided, the engineer stated the deflection would be low. <p>Owner's response:</p> <ul style="list-style-type: none"> Provided a description of the ceiling layout.

- Wall B provided support to the roof and ceiling.
- The roof struts are poorly connected to the roof structure.

5. The second experts' report

5.1.1 After consideration of the submissions from the parties, including the owner's concern that the first expert did not possess structural expertise, I engaged a firm of consulting engineers to assist and prepare a report on the compliance of the alterations. The second experts were asked to carry out their own assessment and calculations to provide their opinion on the compliance of the alterations with Clause B1. The second experts provided a report on 3 July 2019, which was sent to the parties on 4 July 2019.

5.1.2 The second experts looked at the following during the site visit:

- the cantilevered beam
- the roofing elements landing on the cantilevered beam
- connections to the cantilevered beam and connections of the beam to Wall A
- the pile
- the underside of the ceiling.

5.2 Observations

5.2.1 The second experts provided sketches of the original and as-built alterations (Appendix C.5 – C.7) and made the following key observations during the site visit:

- The cantilever beam comprises two 290x45mm SG8¹⁹ timber members located side-by-side.
- An existing valley beam has been notched out over the cantilever beam.
- Some roof struts have been reinstated and re-fixed to the top of the cantilever beam, although an under-purlin strut and a valley beam strut are missing. In both cases there is a timber block that appears to be intended to connect to the adjacent rafter to reinstate the support, but the block is ineffective in replacing the missing under-purlin strut.
- The ceiling joists appear to be supported by the new cantilever beam in a manner consistent with the support provided prior to the alterations being carried out.
- The pile is fixed to a floor joist.
- The quality throughout the concrete footing is poor, and it cannot be confirmed whether the concrete is compliant, but this seems unlikely from observation during the inspection.
- The nailed connection at the top of one of the roof struts is inadequate (refer photographs in Appendix C.1).

¹⁹ This refers to the structural grade of the timber.

5.3 The second experts' conclusions

Cantilever beam

5.3.1 The second experts concluded:

- The two cantilevered beams are not nailed together in a manner that satisfies the requirements of NZS 3604²⁰.
- The hold down connection at the south end of the cantilevered beam is adequate. However, the hold down connection at the midpoint of the cantilevered beam (refer Figure 3) cannot be confirmed as compliant. It is not clear whether the connection continues through the timber blocking into the wall framing below, which is necessary to resist uplift loads.
- After measuring the ceiling slope the second experts calculated the theoretical deflection of the cantilevered beam to be 2.7mm. NZS 1170.0²¹ suggests an appropriate deflection limit for a cantilevered beam as 7.6mm, so the calculated deflection is within the suggested limits.

Compliance of the existing roof and ceiling structure

5.3.2 In respect of the roof and ceiling structure:

- The connections of the ceiling runners to the cantilevered beam are adequate.
- The ceiling support has not been worsened by the alterations.
- Where the purlin connections were amended, the fixings are consistent with the prior connections.
- The support struts to the valley beam and an under-purlin have been removed. The equivalent support to the valley beam has been reinstated through blocks placed under adjacent rafters. However, there is no support to the under-purlin strut, which has resulted in the support being worse than before the alteration and does not comply with Clause B1.
- Wall B did not previously provide any support to the roof prior to the alterations, and its removal does not appear to have affected the roof structure.
- The ceiling between the end of the cantilever and the junction where the two walls were removed varies between 10–15mm but this is not related to the structural performance of the beam. The ceiling deflection may have been pre-existing or a result of the placement and plastering of the lining during construction, and is not a compliance issue.

Compliance of the pile

- The loading demand on the pile would be acceptable should the ultimate ground bearing capacity exceed 200kPa, which the second expert considers likely because the site is classified as “TC2”²².
- A suitable load path is provided through the connection of the pile to the floor joist, and the connections have sufficient strength to transfer the loads to the pile.

²⁰ New Zealand Standard NZS 3604:2011 Timber-framed buildings.

²¹ Australian/New Zealand Standard NZS 1170.0:2002 Structural design actions – Part 0: General principles.

²² In terms of the Ministry's foundation repair guidance *Repairing and rebuilding houses affected by the Canterbury earthquakes* (December 2012), issued by the then Department of Building and Housing under section 175 of the Act, TC2 is defined as having minor to moderate land damage possible from liquefaction in future significant earthquakes.

- The concrete used to secure the pile is of poor quality and did not appear to have been properly mixed. The surface of the concrete was soft, could be indented when pressed by hand, and was friable. The strength of the concrete was unlikely to satisfy NZS 3604 throughout its entirety, and subsequently it would fail to comply with Clause B1.

5.3.3 Based on the observations above, the second experts concluded the following aspects of the alterations were not compliant with Clause B1:

- The cantilevered beam was not correctly laminated (nailed together) in accordance with NZS 3604 to form a built-up member.
- The hold-down connection at the commencement of the cantilever cannot be confirmed as resisting the uplift demand.
- The connection of the roof strut is inadequate.
- The removal of an under-purlin strut has not been reinstated and as such the support to the under-purlin is deemed worse than before the alteration.
- The concrete used for the pile is of poor quality and is considered unlikely to comply.

5.4 The responses to the second experts' report

5.4.1 On 19 July 2019 the engineer and the builder provided responses to the second experts' report.

5.4.2 The owner provided their first response to the report on 22 July 2019, and made further submissions after that date.

5.4.3 On 24 July 2019 the authority responded to the second expert's report noting that it relied on the expert opinion of the engineer, as a chartered professional engineer, and considered this was reasonable given the nature of the work.

5.4.4 I have summarised the parties' comments in Table 2.

Table 2: Summary of the responses to the second experts' report

Compliance of the beam
<p>Engineer's response:</p> <ul style="list-style-type: none"> • The beam lamination does not need to satisfy NZS 3604. • The 45mm thick members making up the beam are evenly loaded through the struts to the rafters, and the 90mm deep strut sits over both timber members. • Despite the nailing not satisfying NZS 3604, the fixings transfer shear between the two beams to assist in load sharing. • The cantilevered beam is performing within the deflection limits. • A complete inspection of the hold down connection has not been carried out. • There is insufficient information to assert that the hold down connection is "absolutely not compliant" with Clause B1. • The second experts' calculations demonstrate that there is no net uplift on the hold down connection. <p>Builder's response:</p> <ul style="list-style-type: none"> • The blocks would have been gun nailed to the top plate using 3 – 4 nails.

- The same number of nails are shown on the photo of the hold down connection to the block, and other photos show at least 4 – 5 nails on each connection.

Owner's response:

- The beam is not compliant.

Authority's response:

- The compliance of the hold down connection cannot be confirmed as meeting the required uplift demand but this does not mean it does not comply.
- While aspects of the alterations do not satisfy NZS 3604 this does not mean it does not comply with Clause B1.

Compliance of the existing roof and ceiling structure

Engineer's response:

- The roof strut connection exhibits poor workmanship.
- Calculations have not been provided to assert that the roof strut connection is not compliant with Clause B1.
- There is no evidence to assert that the removal of the under-purlin strut does not comply with Clause B1.

Builder's response:

- The first expert's report noted while the roof strut was installed poorly it complied with Clause B1 (I note that the first expert was a building surveyor not a structural engineer).
- Only one under-purlin strut would have been removed by his builder and not replaced where it was propped directly onto a ceiling joist over the kitchen/dining room area.
- This under-purlin strut would have been removed to "stop loads deflecting and/or damaging the ceiling", and its location meant it was not possible to replace the strut.

Owner's response:

- Many of the blocking connections are not adequately connected.
- A block identified in the report as evidence of poor workmanship does not comply with Clause B1 and is adding additional loading to the cantilevered beam.
- The notched valley beam has not been strengthened nor had its support replaced.
- The ceiling has deflected due to the performance of the cantilevered beam.
- The removed under-purlin strut has affected the roof bracing. (I note that under-purlin struts would not have contributed to the roof bracing.)

Compliance of the pile

Engineer's response:

- The concrete has not been tested to assert it is not compliant with Clause B1.
- Concrete is a compressive element that transfers load from the pile into the ground. The compressive strength of the concrete will be far greater than the supporting soil.
- At the base of the pile the concrete strength is only required to be 2.5MPa²³ to transfer the load from the pile to the concrete and comply with Clause B1.

Builder's response:

- The concrete would have been mixed correctly by his "experienced builder", possibly some left over dry mix was placed on top of the concrete footing and water poured over it.

²³ Megapascal.

Owner's response:

- The ground capacity of the soil was not checked.
- The connection of the pile to the floor joist is not compliant.

5.4.5 On 30 July 2019 the Ministry requested the builder provide the licensed building practitioner details for his employee who carried out work on the house. The builder responded on the same day stating:

He was not an LBP. I was on site most of the time. We did most of the work together but I did leave the site to check on other jobs. So I missed the concrete being done. The [b]uilder who did the work with me had about 30yrs of experience and had worked for me for 12yrs.

5.4.6 On the same day the Ministry requested the engineer provide the following information to support their submission on the second expert's report, noting the engineer had issued a PS4 – Construction review for the work:

- Calculations to show the fixings as installed will transfer shear between the two beam laminations to assist in load sharing.
- Calculations or other appropriate evidence to show the hold down connection is compliant.
- Evidence that the roof strut connection is compliant with Clause B1 and will adequately transfer the roof load.
- Evidence that the removal of the under-purlin strut has not affected the building's compliance with regard to the requirements of section 112.
- Evidence that the concrete pile will have sufficient strength to comply with Clause B1.

5.4.7 On 7 August 2019 the engineer responded to the Ministry's questions and the second experts were asked to provide comment on the submission from the engineer. The engineer's submission and the second experts' response to that is summarised in Table 3.

Table 3: Responses to the Ministry's questions

Engineer's response	Second experts' addendum response
Nail lamination of the beam	
<ul style="list-style-type: none"> • Some nominal fixings for the two beam laminations are required. • However, the roof struts, ceiling joists, and other roof elements are loaded onto both laminations that comprise the cantilevered beam. • Therefore, it is not relevant to provide shear transfer calculations because the cantilevered beam will resist the applied loads as the nails connecting the two members are at 600mm centres 	<ul style="list-style-type: none"> • The fixings to the hold down strap at the end of the cantilever beam only extend onto one timber member. The other member does not have any hold down capacity at this point if the members are not adequately nailed together to provide full shear transfer. • The fixings at the hold down connection at midpoint of the cantilevered beam are applied to only one of the members. Full shear transfer would be required

Engineer's response	Second experts' addendum response
<p>and the roof and ceiling elements are located across both of the timber members.</p>	<p>between both timber members.</p> <ul style="list-style-type: none"> Using NZS 3603²⁴ that is a Verification Method cited in B1/VM1²⁵, there is adequate load sharing between the two timber members for the cantilevered beam to act compositely. Compliance with Clause B1 is achieved through this route.
Compliance of the roof and ceiling	
<ul style="list-style-type: none"> Two skew nails are sufficient to resist the uplift loads of 0.5kN, although good practice would require more than two nails. The original calculations assumed the wind uplift would be insignificant, and this was still appropriate. There are four skew nails to the roof strut and NZS 3604 only requires three nails to an under-purlin strut, so this connection was compliant. No evidence that an under-purlin strut has been removed. (I note the engineer did not visit the site after the cantilevered beam was installed, and the builder has confirmed his subcontractor removed an under-purlin strut). 	<ul style="list-style-type: none"> A 3kN net uplift was identified on the cantilevered beam, and if the load is evenly split, this results in 1.5kN uplift at each cantilever support. Two nails are inadequate to resist the uplift. The uplift at 3kN is not insignificant, and as such compliance with Clause B1 is not achieved. The roof strut fails to satisfy the requirements of NZS 3604 and NZS 3603 due to the significant splitting, edge distances, spacing requirements, and depth of penetration is not achieved (refer Appendix C - C.1). Photographs from before the alterations and those after clearly identify that an under-purlin strut has not been reinstated.
Compliance of the pile	
<ul style="list-style-type: none"> The concrete in this instance, "as per NZS 3604 section 6.4.5.2 and section 4.5, states a mass concrete foundation need only be 10MPa". A concrete footing of 10MPa will be suitable based on the bearing capacity required on site. Testing or confirmation of the concrete strength of a pile footing would not normally be inspected during a site visit as a requirement for issuing the PS4. 	<ul style="list-style-type: none"> The engineer's calculations as part of the change in design appear to refer to a standard pile, and it is reasonable to expect the pile to be in accordance with NZS 3604, which generally requires a minimum of 17.5MPa. NZS 3604, section 3.4.1, sets out when mass concrete can be used, and in this case it is not appropriate. Alternatively compliance could be established through NZS 3101²⁶ but this required a minimum strength of 25MPa.

²⁴ New Zealand Standard NZS 3603:1993 Timber Structures Standard.

²⁵ Verification Methods For New Zealand Building Code Clause B1 Structure.

²⁶ New Zealand Standard NZS 3101.1&2:2006 – Concrete structures standard.

6. The second draft determination and parties' responses

- 6.1 A second draft of this determination was issued to the parties for comment on 13 September 2019. The second draft concluded that the authority incorrectly issued the code compliance certificate because the departures from the approved consent did not constitute a minor variation. Therefore, an amendment to the building consent was required. Some of the alterations did not comply with Clause B1 and there was insufficient information to establish whether other aspects complied with Clause B1. The decision to issue the code compliance certificate was reversed.
- 6.2 Between 17 September 2019 and 14 February 2020 the owner provided a number of submissions, which commented on the following issues: the ceiling deflection could have been caused by the performance of the pile; the removal of the under-purlin strut has affected the roof bracing; according to the Simple House Acceptable Solution²⁷ a pile is required to be connected to the foundation via a bearer; the walls were removed before any support was put in place; and repeated that the ground bearing should have been confirmed before the building work started.
- 6.3 The owner also made a submission in response to the engineer's submission (paragraph 6.7) regarding the calculations carried out by the engineer to calculate the uplift on the cantilever beam. The owner is of the view incorrect assumptions regarding the roof area and wind shelter were used by the engineer.
- 6.4 On 30 September 2019 the builder did not accept the decision of the second draft determination and requested access to the property to review the building work. The builder provided comment on the hold down connection noting the number of nails in the other elements of the beam would "surely" lead to the conclusion that there is adequate nailing through the blocking. The builder also noted the second experts had stated apart from deflection of the beam, there had been no movement of any of the structural parts of the beam and this must mean the structural elements are performing adequately.
- 6.5 On the same day the authority made an interim submission on the second experts' report. The authority also had a question regarding the assessment of the pile if the experts were not reviewing the compliance of the pile as an alternative solution proposal.
- 6.6 On 25 October 2019 the authority provided a further submission (in summary):
- Any non-compliance in the roof strut fixings is a "very minor issue to rectify". Overturning the code compliance certificate in order to enforce the compliance of this fixing is "disproportionate".
 - As no conclusion was reached regarding the compliance of the pile footing this is not a reason to overturn the code compliance certificate. It is likely that the footing has been installed using a product that has left a slurry on the top giving the appearance of being low strength. The concrete strength required to support the loads is low.

²⁷ The Simple House Acceptable Solution is a prescriptive deemed-to-comply for a specific scope of building work. An Acceptable Solution is only one way of demonstrating compliance with the Building Code. This Acceptable Solution has been revoked.

- Taking into account Determination 2017/079²⁸ the change in design is a minor variation. The authority considers it significant that the amendment was carried out by the original engineer; the design was simple; the loadings were the same although the scale of the loads varied; the additional pile was always intended in this location with the same design; and the same type of material (timber) was used.

6.7 Also on 25 October 2019, a lawyer acting for the engineer said the second draft determination was not accepted. The submission stated in summary:

- Additional calculations provided by the engineer show there is no net uplift on the cantilevered beam and therefore a hold-down connection is not required for the beam to be compliant.
- The connection of the roof strut could be considered compliant, because photographs from the second experts report show four nails are present and three of those appear to be connecting the strut into the ridge beam (refer Appendix C – C.2).
- A sample must be taken and tested of the concrete pile footing. A strength of 10MPa will be suitable to support the compression loads. The engineer disagrees with the second experts' view of when the requirements for mass concrete can be applied.
- While NZS 3604 specifies 17.5MPa minimum strength for pile concrete footings, 10MPa would be suitable in the case of an unreinforced concrete pad supporting compression only loads.
- The change in design is a minor variation. The engineer's lawyer referred to examples on the Ministry's website, and notes it was appropriate to instruct a variation to the design onsite and for the authority to be notified of the change by the contractor when the authority's inspection took place.

6.8 The second experts' response to the engineer's submission

6.8.1 I asked the second experts to comment on the different methodology used by the engineer to calculate uplift and to consider whether their opinion on compliance had changed. On 12 December 2019 the second experts provided their response as follows.

Difference in roof uplift

6.8.2 The second experts clarified a different methodology was used by the engineer to calculate the net uplift. The engineer also used a 20° roof pitch, in comparison to the 10° roof pitch used by the second experts. The higher roof pitch meant the wind pressure that contributes to the uplift forces is reduced. The second experts reviewed the drawings and concluded the 20° pitch was appropriate and the methodology used by the engineer was also acceptable.

6.8.3 Therefore, the second experts agreed with the engineer that a hold-down connection was not required at the mid-point because there was no net uplift on the cantilevered beam. Subsequently, as-built the cantilevered beam without a hold-down connection complied with Clause B1.

²⁸ Determination 2017/079 Regarding the decision to issue a notice to fix for building work (7 November 2017).

Roof strut

- 6.8.4 The second experts stated they had not previously identified the nails that connected the roof strut to the ridge beam. Upon reviewing the photographs included in the engineer's submission they were satisfied there are three nails adequately connecting the strut to the ridge beam, which satisfies NZS 3603.

The second experts' response to the Ministry's questions

- 6.8.5 On 18 December 2019 the Ministry sought further information regarding the lack of a hold-down connection and how torsion would be resisted, as well as clarification regarding how deflection was calculated. Their response was received on 22 January 2020, and this was sent to the parties on 31 January 2020.
- 6.8.6 The second experts clarified they considered torsion in the cantilevered beam was sufficiently restrained by the ceiling runners that connected to the beam. Therefore, their view remained unchanged, as they believed the cantilevered beam was compliant without a hold-down connection.
- 6.8.7 The second experts confirmed their view that the ceiling deflection was pre-existing based on the site investigation. They also clarified how they calculated the theoretical deflection of the beam. Based on their onsite observations they considered their approach and conclusion that deflection was within the tolerance limits was appropriate in this case.

Responses to the second experts' response

- 6.8.8 On 14 February 2020 the owner provided a submission in response to the 22 January 2020 response of the second experts. The owner stated the ceiling deflection is 15mm when measured from where the walls were removed. The owner is of the view the deflection is not pre-existing and considers the "gap" between the blocking and cantilevered beam is evidence that movement has occurred. The owner also disputes that there is an adequate connection between the roof strut and the ridge beam, as the nails are connecting to a "valley board" and not the ridge beam. The owner supplied several videos of the roof strut.
- 6.8.9 The owner continued to provide submissions regarding errors he believed were contained in the second experts' report and his concerns that his submissions were not being passed to the experts. I do not consider the owner provided technical evidence that required consideration by the second experts. I have considered the owner's submissions and where appropriate have addressed them in the determination.

7. The third draft determination and parties' responses

- 7.1 A third draft of this determination was issued to the parties for comment on 26 February 2020. The third draft also concluded that the authority incorrectly issued the code compliance certificate because the departures from the approved consent did not constitute a minor variation. Therefore, an amendment to the building consent was required. Some of the alterations did not comply with Clause B1 and there was insufficient information to establish whether other aspects complied with Clause B1. The decision to issue the code compliance certificate was reversed.

- 7.2 On 11 March 2020 the authority responded that it did not accept the third draft determination and made the following submission (in summary):
- The loads imposed on the pile are “very low” and therefore it is “highly likely” the concrete pile footing will comply even if the footing has significantly lower strength.
 - The fixing of the strut is “very untidy” but does not necessarily lead to non-compliance with the Building Code.
 - The change in design should have been considered as a minor variation. A pile was always required for the simply supported beam system. The change in design was carried out by the qualified engineer. The loads are low and the design was simple.
 - The authority disagrees with the conclusion that it relied on the engineer’s PS4 in error due to the lack of an inspection by the engineer after the installation of the cantilevered beam. The engineer was involved throughout the process, whether in person or through other communication. The authority is of the view it would have been “unreasonable” to question the engineer on this simple work.
 - There appears to have been an administrative error regarding the engineer’s site instructions detailing the change in design. The builder either missed it off information that was provided to the authority prior to the issue of the code compliance certificate or the authority has misplaced this document.
 - Overturning the code compliance certificate and requiring a certificate of acceptance for building work already undertaken is “an extreme action”. Any rectification work required is likely to be minor.
- 7.3 On the same day the builder responded that the third draft determination was not accepted and provided the following submission:
- The code compliance certificate should not be reversed for the completed building work.
 - While, the roof strut has been described as “untidy” it should still satisfy “structural standards”. The experts engaged by the Ministry have stated there has been no movement from the beam or struts other than deflection, which was within the tolerance limits. Therefore, the structural elements are performing as expected.
- 7.4 On the same day the owner also responded that the third draft determination was not accepted. The owner’s submission stated an engineer (“the owner’s engineer”) had been engaged and another building professional had visited the building. The owner has since stated in his emails that his engineer has identified a number of concerns regarding the building work. However, this information has not been provided by the owner’s engineer, and I have not been provided with evidence to support the owner’s concerns. I note that throughout the determination process the owner has stated a number of times that an expert has been engaged. However, no expert reports have provided.

7.5 On 13 March 2020 the lawyer for the engineer responded that the third draft determination was not accepted and provided the following submission (in summary):

- The third draft determination concluded the pile fixing was non-compliant despite it having been rectified. The calculations provided by the engineer show there is no net uplift on the cantilevered beam and as such a pile fixing strap is not required to comply with Clause B1. Therefore, the code compliance certificate should not be overturned in respect of this issue. I note the purpose of a pile fixing is to ensure the pile does not lose its connection with the timber framing when exposed to lateral forces.
- The second experts agreed with the engineer that there was a sufficient connection between the roof strut and the ridge beam. It is not clear whether there is significant splitting, and if there is it has occurred in the years after the installation. Photographs included with the submission show there was no significant or discernible damage to the roof strut in March 2016. This indicates the roof strut would not have been compromised when the code compliance certificate was issued.
- The engineer, builder, and Ministry's experts have not had an opportunity to consider the "apparent splitting" of the roof strut and should be given an opportunity to do so. I note the parties have been provided with the owner's submissions that included the videos identifying the splitting, as well as the first expert's report that showed the splitting.
- As previously stated the engineer agrees that it appears an under-purlin strut is missing. The builder has since stated the under-purlin strut was removed and not reinstalled because it was believed to be adversely loading the ceiling of the kitchen. The second experts stated an attempt was made to the load the rafters, which were previously supported by the under-purlin strut, onto the cantilevered beam using timber blocks. However, these timber blocks appear to have shrunk and are not in contact with the rafters they were installed to support. The work to remedy this is "extremely minor".
- The Ministry has received evidence regarding the concrete footing from the second experts, engineer, authority, and the builder. Testing the concrete pile is the only option to demonstrate compliance but this cannot be carried out by the engineer.
- However, the engineer stated the calculated ultimate bearing strength of the concrete footing to resist the applied load is less than 1MPa. Given that the pile has been in place for over six years, if there was insufficient strength cracking or movement of the wall directly above the pile would have been observable. Therefore, there is a reasonable basis due to the lack of damage and no apparent cracking or movement that the pile has sufficient strength to comply with Clause B1.
- In the ordinary course of construction the engineer would not have been required to inspect or test the pile. Instead, the engineer could rely on the builder's advice that the required concrete strength had been achieved.

- Regarding the minor variation the engineer included a summary of how the original design system was intended to support the roof, ceiling, and applied loads. The only framing change between the two designs was limited to the back span of the cantilevered beam over Wall A. The load path, outcome of the loads, and where they go do not change significantly. The changes to the framing and initial design are considered “minor”.
- In the engineer’s experience it was acceptable and appropriate for items designed by the engineer, who was also responsible for observation of the construction, to make any variation to the design onsite. The authority would then be notified of the change by the contractor when the authority’s inspection took place.

8. Discussion

8.1 General

- 8.1.1 The following sections set out my conclusions regarding the compliance of the alterations and the issue of the code compliance certificate. In considering these matters I have considered the purposes of the Act, including section 3(a)(i) of the Act that sets performance standards for buildings to ensure that people who use buildings can do so safely and without endangering their health. I have also considered the principles of the Act, including section 4(2)(a), (c) and (q) of the Act, regarding the role that household units play in the lives of the people who use them and the importance of ensuring household units comply with the Building Code; the importance of ensuring that a building is durable for its intended use; and the need to ensure that owners, builders, designers, and building consent authorities are accountable for their role in ensuring that the necessary building consents are obtained for proposed building work and that the building work for which a building consent is issued complies with the building consent.

9. Discussion Matter 1: Compliance of the building work

- 9.1.1 The first matter I will consider is whether the alterations comply with Clauses B1, E2, and F7. Section 17 requires all building work to comply with the Building Code to the extent required by the Act. The new building work, e.g. the cantilevered beam, roof strut, and the pile must be assessed against the Building Code as required by section 17.
- 9.1.2 Assessing the compliance of the building work also includes consideration of the compliance of the building as a whole after the alterations, e.g. the existing roof and ceiling structure after the cantilevered beam was installed, to the extent required under section 112(1)(b) of the Act. This section of the Act effectively requires that the code compliance of the existing building is not lessened by the alterations:

112 Alterations to existing buildings

- (1) A building consent authority must not grant a building consent for the alteration of an existing building, or part of an existing building, unless the building consent authority is satisfied that, after the alteration,—
- ...
- (b) the building will,—

- i) if it complied with the other provisions of the building code immediately before the building work began, continue to comply with those provisions; or
- ii) if it did not comply with the other provisions of the building code immediately before the building work began, continue to comply at least to the same extent as it did then comply.

9.1.3 For example, the roof strut itself must meet specific criteria because it is a building element, but the strut is also part of a larger assembly which must satisfy the section 112 test.

9.2 Clause B1

9.2.1 The objectives of Clause B1 include safeguarding people from injury caused by structural failure and from loss of amenity caused by structural behaviour (Clause B1.1). The functional requirement (Clause B1.2) is that buildings, building elements and sitework must “withstand the combination of loads that they are likely to experience during construction or alteration and throughout their lives”, and the building work must achieve the performance criteria in Clauses B1.3.1 to B1.3.7.

9.2.2 At the time the code compliance certificate was issued for the alterations the building work in the roof space had not been inspected by either the engineer or the authority.

9.2.3 Having considered all of the evidence and opinions submitted to me, I make the following observations and conclusions in respect of the alterations to the roof structure:

- The cantilevered beam consists of two timber members, which are required to act as a composite to transfer load from the ceiling and roof through to the foundations. Having considered the second experts’ report and the information provided by the engineer, I accept that the cantilevered beam will act compositely, satisfying NZS 3603, which is a standard cited in B1/VM1.
- The calculations provided by the engineer have identified that a hold-down connection is not required to the cantilever beam as there is no net uplift at the base of the beam where it is supported by Wall A (refer Figure 3 – proposed location of hold-down connection) . I agree with this view reached by the engineer and second experts, and consider in this aspect the cantilevered beam complies with Clause B1.
- The cantilevered beam has been in place for approximately 6 years and it has not ruptured, and its deflection has been well within the suggested tolerance limits set out in AS/NZS 1170.0. I consider the cantilevered beam has adequate strength to resist the roof and ceiling loads placed upon it.
- The roof strut has not complied with Clause B1 for the period of 50 years as required by Clause B2. Regardless of whether there is a sufficient connection between the roof strut and the ridge beam the strut itself is compromised. The videos provided by the owner show significant splitting down the face of the strut. There also appears to be a split on the side adjacent to the ridge beam. Splitting to this extent does not appear to be evident in photographs taken in March 2016 that were provided by the engineer’s lawyer, or in photographs taken in May 2018 and May 2019 by the first and second experts (refer Appendix C – C.1, C.3, and C.4).
- The deflection of the ceiling is not caused by the performance of the cantilevered beam, and is not a compliance issue in regard to Clause B1.

- The second experts identified an under-purlin strut that provided support to the rafters had been removed and not reinstated. Instead, timber blocks were installed to support those rafters but were not providing the necessary support. Therefore, the removal of the under-purlin strut means that the existing roof structure in that area is worse off than before the alterations occurred. For this reason, the building work does not comply with Clause B1 to the extent required by section 112 of the Act.
- The removal of Wall B has not worsened the ceiling joist support.

9.2.4 As noted in paragraph 9.2.1, the objectives of Clause B1 include safeguarding people from injury caused by structural failure and from loss of amenity caused by structural behaviour. There is a difference between the requirements necessary to achieve compliance with the Building Code for the purpose of safety (e.g. avoiding rupture or collapse) and amenity (refer Appendix A – A.2), and those that are relevant in terms of workmanship, such as deflection that can cause cracking but is not indicative of structural failure. It is likely in some situations building work may comply with the Building Code, but still not be satisfactory to building owners due to workmanship or cosmetic issues.

9.2.5 The owner has raised concerns regarding cracks in the ceiling. I note that there are a variety of possible causes for cracking – in some cases cracking may be an indication of movement of the structure and that could raise concerns regarding compliance, while in other cases the cracking may simply be cosmetic or a workmanship issue.

9.2.6 In this case I consider the cracks are not so significant as to affect the health, physical independence, or well-being of the building's users, i.e. there is no loss of amenity and no failure to achieve compliance in this respect.

9.3 Compliance of the pile

9.3.1 Regarding the owner's concerns about the pile and the ground bearing capacity in particular (refer paragraph 3.2.3), I note that this pile was to support the transferred load from the cantilevered beam to Wall A and its only purpose is to support that load.

9.3.2 The builder has stated the following:

- the timber pile is treated to H5²⁹
- the concrete footing size is 400x400mm
- the concrete strength is 20MPa.

9.3.3 In a typical construction the pile would be connected to the bearers. However, in this case the pile is connected to the double joists under the loadbearing wall, and the owner considers this assembly is not compliant because the design is not in accordance with NZS 3604.

9.3.4 The connection of the pile to the floor joists, rather than the bearers as shown in NZS 3604, does not automatically mean that this assembly fails to comply with Clause B1. I agree with the second experts' conclusion that the connection between the floor joists and the pile complies with Clause B1 as the assembly will adequately transfer the load to the pile.

²⁹ This is a timber treatment level for timber that is contact with concrete or the ground.

- 9.3.5 The authority inspected the pile during a ‘Sub Floor’ inspection, which subsequently passed. However, the authority did not identify that at that time the pile lacked fixings. This has subsequently been rectified by the builder after the code compliance certificate was issued.
- 9.3.6 The concrete footing needs to be of adequate strength to support the transferred loads from the cantilevered beam to the foundation of Wall A. The second experts identified that the concrete footing is likely to lack the strength throughout its entirety to comply with Clause B1. I acknowledge the calculations provided by the engineer regarding the assumed loads applied to the pile. However, it is also necessary to take into account that the concrete footing construction was not supervised by the builder, so no certainty can be provided that the footing will comply with Clause B1 for the period of 50 years as required by Clause B2.
- 9.3.7 Taking into account the observations of the second experts and the information that has been supplied by the parties; I consider I have not been provided with sufficient evidence to show that the concrete footing complies with Clause B1.
- 9.3.8 The owner also raised concerns regarding the “TC2”³⁰ classification of the land under the building. I note the pile does not alter the overall foundation system that is designed to support the building to withstand vertical and horizontal loads. Instead, the pile provides localised support to the cantilevered beam. Taking into account that I have received no evidence to the contrary, I am of the view the land classification on its own does not affect the pile’s compliance with Clause B1.
- 9.3.9 Regarding the ground capacity, the engineer has stated the design of the pile took into account the lower allowable bearing pressure of 50kPa from the soil, taken from a previous building consent. The engineer stated the footing size of 400x400mm would have an applied bearing to the soil of 23 – 27kPa, which is less than the 50kPa allowed for from the soil.
- 9.3.10 After due consideration of the second experts’ report as well as the other evidence in this matter, I am not satisfied the concrete footing as-built complies with Clause B1 because I have not been provided with evidence that sufficiently addresses the concerns raised by the owner and the second experts regarding the concrete’s strength.

9.4 Compliance with Clauses E2 and F7

- 9.4.1 In regard to Clause E2, I have seen no evidence of moisture ingress to the roof space. I note the first expert stated “ideally” the roof capping should be replaced, which the owner could well undertake as part of the ongoing maintenance of the building. The owner has expressed weathertightness concerns regarding the roof but has not provided evidence to show the roof is non-compliant with Clause E2 causing undue dampness or damage to the building elements.
- 9.4.2 The first expert identified the tilted spouting was unrelated to the alterations and in respect of the building work does not cause an issue regarding Clause E2.
- 9.4.3 In respect of this matter I consider the alterations as built comply with Clause E2 of the Building Code.

³⁰ In terms of the Ministry’s foundation repair guidance *Repairing and rebuilding houses affected by the Canterbury earthquakes* (December 2012), issued by the then Department of Building and Housing under section 175 of the Act, TC2 is defined as having minor to moderate land damage possible from liquefaction in future significant earthquakes.

9.4.4 The owner stated only one smoke alarm was present at the time the code compliance certificate was issued for the alterations. The building consent detailed there were two existing smoke alarms. The first expert observed during the site visit that there were two smoke alarms installed. The first expert could not confirm what smoke alarms were previously installed. The first expert did not raise any concerns over the smoke alarms that are currently installed.

9.4.5 I note the authority did inspect the smoke alarms as part of its 'Final' inspection and no compliance issues were raised. Given the contradictory information provided, I consider there is insufficient evidence to establish whether the smoke alarm(s) present complied with Clause F7 at the time the code compliance certificate was issued.

9.5 Compliance conclusion

9.5.1 I have come to the conclusion that the following aspects did not comply with Clause B1.3.3 when the code compliance certificate was issued (with relevant sections of the Act in brackets):

- the pile fixing did not comply with Clause B1 (section 17), which should have been apparent to the authority during its sub floor inspection. This has been rectified and is now compliant with Clause B1.
- the connection of the roof strut (section 17)
- the removal and failure to reinstate an under-purlin strut (section 112)

9.5.2 I cannot conclude the concrete footing complies with Clause B1 and subsequently Clause B2 because the concerns raised by the owner and second experts have not been sufficiently addressed.

9.5.3 I have come to the conclusion the alterations currently comply with Clauses E2 and F7.

10. Discussion Matter 2: Issue of a code compliance certificate

10.1 Section 94 of the Building Act outlines what an authority must consider when issuing a code compliance certificate:

- (1) A building consent authority must issue a code compliance certificate if it is satisfied, on reasonable grounds,—
 - (a) that the building work complies with the building consent;...

10.2 Minor variation

10.2.1 In order to determine whether the authority was correct in issuing the code compliance certificate, I must consider whether the variation to the approved design required an amendment to the consent or was a minor variation. The authority is of the view the alteration to the consented building work was a minor variation, although the owner disagrees.

10.2.2 If the change from two simply-supported beams to a cantilevered composite beam and a pile did not constitute a minor variation, an amendment to the building consent should have been sought before the work was undertaken. Without the amendment being granted the building work would not have been in accordance with the consent as required under section 94 for a code compliance certificate to be issued.

- 10.2.3 If, on the other hand the change was a minor variation, no application for an amendment to the building consent would be required. The change would come within the scope of the existing building consent and would be covered by the code compliance certificate. For a minor variation all that would be required would be for it to be recorded by the authority as described in the Ministry’s guidance³¹.
- 10.2.4 The sections of the Act that apply to variations to building consents are sections 45 and 45A (refer Appendix A).
- 10.2.5 A minor variation is defined in the Building (Minor Variations) Regulations 2009 (“the Regulations”):
- (1) A minor variation is a minor modification, addition, or variation to a building consent that does not deviate significantly from the plans and specifications to which the building consent relates.
 - (2) The following are examples of minor variations and do not constitute an exhaustive list:
 - (a) substituting comparable products (for example, substituting one internal lining for a similar internal lining):
 - (b) minor wall bracing changes:
 - (c) a minor construction change (for example, changing the framing method used around a window):
 - (d) changing a room's layout (for example, changing the position of fixtures in a bathroom or kitchen):
- ...
- 10.2.6 The purpose of the Regulations is to set out when changes to building work require an amendment to the building consent, and those that do not require an authority to assess the compliance of the change.
- 10.2.7 The Ministry’s guidance³² outlines a three-step process for an authority to consider whether a variation from the consented building work is a minor variation or not as below.
- Step 1:** “Does the proposed change involve building work that is required to comply with the Building Code?” If not, the authority does not need to approve the work.
- Step 2:** Does the proposed change come “within the definition of ‘minor variation’ contained in the [Regulations]” (refer paragraph 10.2.2).
- Step 3:** Does the proposed change:
- comply with the Building Code
 - reflect common appropriate industry practice or standards
 - not significantly increase the likelihood of a building element’s performance failure.
- 10.2.8 The Ministry’s guidance recommends that agreement to minor variations be sought beforehand, and as previously stated it is not clear whether that occurred in this case. However, for the purpose of this determination the question of whether the change to a cantilevered beam is a minor variation or not does not rest on the authority approving it before installation occurred.

³¹ <https://www.building.govt.nz/projects-and-consents/build-to-the-consent/making-changes-to-your-plans/minor-variations-guidance/>

³² Minor variations to building consents: Guidance on definition, assessment and granting (1st edition, 1 January 2010)

- 10.2.9 In respect of the first step described in the Ministry's guidance, it is clear the alterations are building work required to comply with the Building Code.
- 10.2.10 In respect of the second step, I have considered the examples provided in the Regulations (refer paragraph 10.2.2). These examples suggest that limited changes can be made to the building's structure and be classified as a minor variation to a building consent. I would expect a minor variation to perform in the same manner as the approved work (in this case how the loads are carried and transferred).
- 10.2.11 I have considered the following in coming to the conclusion that the change in design from two simply-supported beams to a cantilevered beam is not a minor variation:
- While the structural design is straightforward and carried out by the same engineer using similar materials, almost every aspect of the design was altered. The change in design has resulted in a different structural layout; change of beam size; a cantilevered beam used instead of two simply-supported beams with revised support for the roof and ceiling structure. The altered design imposed a greater load on the remaining part of Wall A.
 - The Ministry's guidance comments on variations that involve aspects of specific engineering design, such as changing the size of a specific engineered design beam as work that could be considered a minor variation. However, as described in the bullet point above the change is significantly more than only altering the size of a beam. The scale of the changes included a new layout, new type of beam, altered support, different loads, and additional loading to Wall A, which resulted in making it a building consent matter.
- 10.2.12 The authority has referred to Determination 2017/079 in forming its view that the change in design was a minor variation. That determination considered the additional building work was an extension of the consented building work, the extension used the same construction and design methodology as the consented work, and the extension was not a significant deviation from the consented work. I also note the consented building work was built in accordance with that consent.
- 10.2.13 The basis for the decision reached in Determination 2017/079 is not applicable to the current case where the work has not been built in accordance with the building consent. The as-built work also represents a significant departure from the consented work in terms of the construction methodology used.
- 10.2.14 I conclude therefore that the authority was incorrect in its view that the alterations came within the definition of a 'minor variation'. Therefore, I consider an amendment to the building consent was required for this building work.

10.3 Reliance on the PS4

- 10.3.1 The authority stated it relied on the PS4 provided by the engineer and its own inspections when issuing the code compliance certificate. In a previous Determination³³ it has been noted that authorities are entitled to rely on inspections by others, or verification by another means.

³³ Determination 2011/080 The exercise of powers in respect of a notice to fix issued for a house (31 August 2011)

- 10.3.2 When relying on a PS4, in many cases an authority may not need to look beyond the opinion of a competent practitioner, as long as it is satisfied the practitioner has the requisite skills, qualifications and experience, and knowledge and expertise in the particular field, and the views expressed apply directly to the building work in question. In this instance, the authority checked the qualification and registration of the engineer involved and no concerns were raised.
- 10.3.3 The engineer inspected the existing structure once the linings had been removed, and based on that site visit revised the beam design. However, the engineer did not visit the site again, as stated in the site report, but instead relied on conversations with the builder to assess how the construction was progressing and the completed work.
- 10.3.4 I note the authority did not appear to question the lack of observation of the building work by the engineer after the cantilevered beam was installed, with the two specified inspections limited to inspecting the building prior to the beam installation; in this respect I conclude that the authority relied on the PS4 in error.

10.4 Code compliance certificate

- 10.4.1 Establishing the compliance of completed consented work is a two-step process. Firstly, I need to consider whether the work was completed in the accordance with the building consent. Secondly, where the building work differs from the building consent I need to consider whether the work meets the requirements of the Building Code.
- 10.4.2 I have established that the alterations were not completed in accordance with the building consent. The alterations were not a minor variation, and the change in design constituted a significant departure from the consented drawings.
- 10.4.3 Having considered the parties' arguments and the experts' reports, I have reached the conclusion that there were non-compliant aspects of the alterations when the code compliance certificate was issued (refer paragraph 9.5) that should have been obvious to the authority and the engineer.
- 10.4.4 Accordingly, I consider the authority was incorrect in its decision to issue the code compliance certificate.
- 10.4.5 I must now consider whether or not to confirm or reverse the authority's decision to issue the code compliance certificate, and in doing so I have considered the scope of the alterations and whether the building work now complies with the Building Code.
- 10.4.6 The consent was for the removal of two small sections of internal walls and the installation of two simply-supported beams and associated work in the ceiling space above to allow for the walls' removal. The change from the two simply-supported beams to the single cantilevered beam represents a significant change to what was shown on the building consent drawings.
- 10.4.7 Taking into account that I have concluded parts of the alterations are non-compliant and the change in design was not a minor variation and therefore the alterations are outside the scope of the building consent for which the code compliance certificate was issued, I conclude the code compliance certificate for building consent No. BCN/2013/10302 should be reversed.

11. What happens next?

- 11.1 Once the issue of the code compliance certificate has been reversed, the owner can seek an amendment to the building consent for the work needed to bring the non-compliant alterations (which includes the items referenced in paragraph 9.5.1) up to the standard required by the Building Code. The owner can put forward a detailed proposal to the authority that outlines how the non-compliant alterations will be rectified as part of an amendment to the building consent. The owner could then apply for a code compliance certificate for the amended scope of the building work that was carried out in accordance with the building consent.
- 11.2 If the owner wishes to regularise the unconsented alterations that are considered compliant (e.g. the cantilevered beam), this can be considered by the authority through a certificate of acceptance issued under section 96 of the Act. The owner could use the findings of this determination to support an application for a certificate of acceptance if he wishes to do so.

12. The decision

- 12.1 In accordance with section 188 of the Building Act 2004, I hereby determine:
- the authority was incorrect to issue the code compliance certificate because the departures from the approved consent did not constitute a minor variation and accordingly an amendment to the building consent was required
 - some aspects of the alterations as-built do not comply with Clauses B1 Structure, and subsequently B2 Durability, and there is insufficient information to establish whether other aspects comply with Clauses B1 and B2
 - the alterations comply with Clauses E2 External moisture, and F7 Warning systems.
- 12.2 Accordingly, authority's decision to issue the code compliance certificate for building consent No. BCN/2013/10302 is reversed.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 17 March 2020.

Ingrid Bayliss
General Manager, Housing and Tenancy Services

Appendix A: The relevant legislation

A.1 The relevant sections from the Building Act:

17 All building work must comply with building code

All building work must comply with the building code to the extent required by this Act, whether or not a building consent is required in respect of that building work.

45 How to apply for building consent

...

(4) An application for an amendment to a building consent must,—

(a) in the case of a minor variation, be made in accordance with section 45A;...

45A Minor variations to building consents

(1) An application for a minor variation to a building consent—

(a) is not required to be made in the prescribed form; but

(b) must comply with all other applicable requirements of section 45.

(2) Sections 48 to 50 apply, with all necessary modifications, to an application for a minor variation.

(3) A building consent authority that grants a minor variation—

(a) must record the minor variation in writing; but

(b) is not required to issue an amended building consent.

112 Alterations to existing buildings

A building consent authority must not grant a building consent for the alteration of an existing building, or part of an existing building, unless the building consent authority is satisfied that, after the alteration,—

the building will comply, as nearly as is reasonably practicable, with the provisions of the building code that relate to—

means of escape from fire; and

access and facilities for persons with disabilities (if this is a requirement in terms of section 118); and

the building will,—

if it complied with the other provisions of the building code immediately before the building work began, continue to comply with those provisions; or

if it did not comply with the other provisions of the building code immediately before the building work began, continue to comply at least to the same extent as it did then comply.

A.2 The relevant sections from the Building Code:

Clause A2 – Interpretation

amenity means an attribute of a building which contributes to the health, physical independence, and well being of the building's users but which is not associated with disease or a specific illness

Clause B1—Structure

Performance

B1.3.1 Buildings, building elements and sitework shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during construction or alteration and throughout their lives.

B1.3.2 Buildings, building elements and sitework shall have a low probability of causing loss of amenity through undue deformation, vibratory response,

degradation, or other physical characteristics throughout their lives, or during construction or alteration when the building is in use.

B1.3.3 Account shall be taken of all physical conditions likely to affect the stability of buildings, building elements and sitework, including:

- (a) self-weight,
- (b) imposed gravity loads arising from use,
- (c) temperature,
- (d) earth pressure,
- (e) water and other liquids,
- (f) earthquake,
- (g) snow,
- (h) wind,
- (i) fire,
- (j) impact,
- (k) explosion,
- (l) reversing or fluctuating effects,
- (m) differential movement,
- (n) vegetation,
- (o) adverse effects due to insufficient separation from other buildings,
- (p) influence of equipment, services, non-structural elements and contents,
- (q) time dependent effects including creep and shrinkage, and
- (r) removal of support.

B1.3.4 Due allowance shall be made for:

- (a) the consequences of failure,
- (b) the intended use of the building,
- (c) effects of uncertainties resulting from construction activities, or the sequence in which construction activities occur,
- (d) variation in the properties of materials and the characteristics of the site, and
- (e) accuracy limitations inherent in the methods used to predict the stability of buildings.

B1.3.5 The demolition of buildings shall be carried out in a way that avoids the likelihood of premature collapse.

B1.3.6 Sitework, where necessary, shall be carried out to:

- (a) provide stability for construction on the site, and
- (b) avoid the likelihood of damage to other property.

B1.3.7 Any sitework and associated supports shall take account of the effects of:

- (a) changes in ground water level,
- (b) water, weather and vegetation, and
- (c) ground loss and slumping.

Appendix B: The inspections

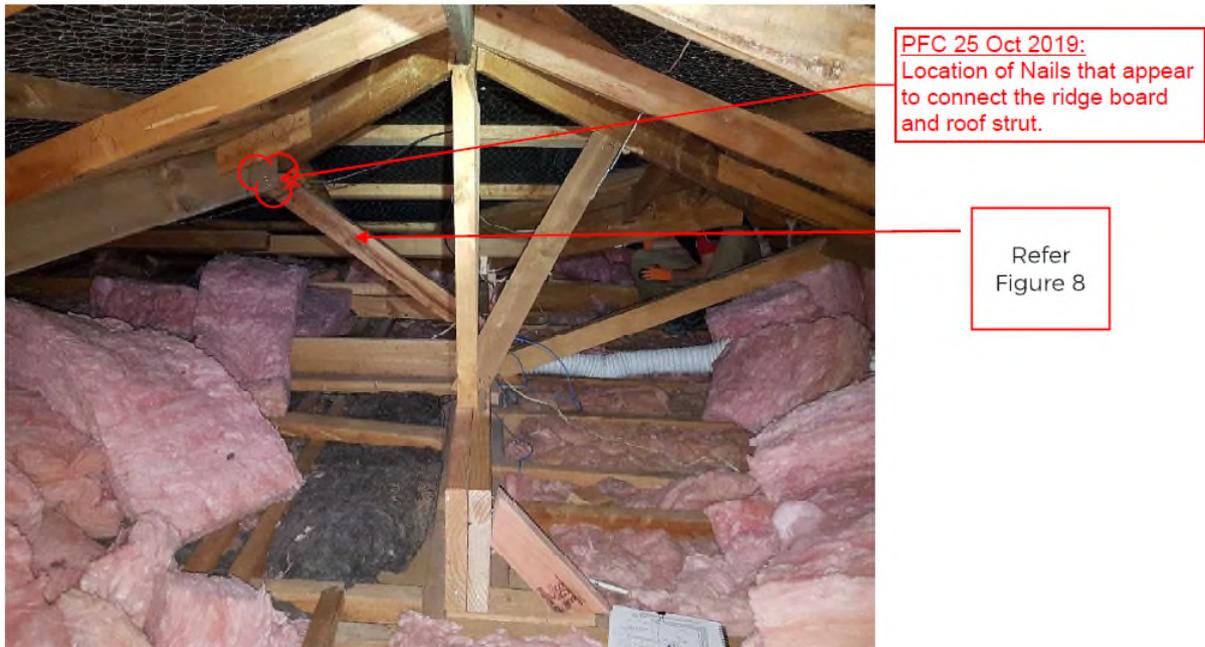
Where specified	Date carried out	Carried out by	Comment
In authority's schedule of inspections			
Sub floor	31 March 2014	Authority	Pass
Pre line including plumbing	31 March 2014	Authority	Pass
Pre stopping	31 March 2014	Authority	Pass
Final inspection	15 September 2015	Authority	Fail
	22 September 2015	Authority	Pass
In the engineer's Producer Statement Design dated 31 October 2013			
1 Lining removal and opening up, prior to demolition	26 March 2014 (ref site report)	Engineer	Revised beam design to cantilevered beam
2 Support beams and preliminary	26 March 2014 (ref site report)	Engineer	

Appendix C: Photographs and sketches from the expert reports

C.1 Photographs of the roof strut dated 18 May 2018 taken from the first expert’s report.

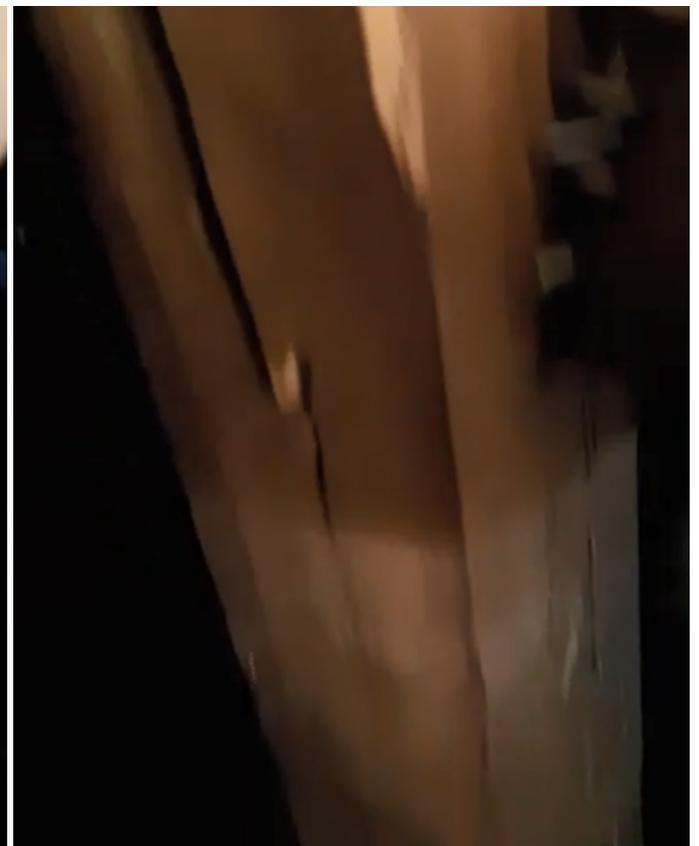
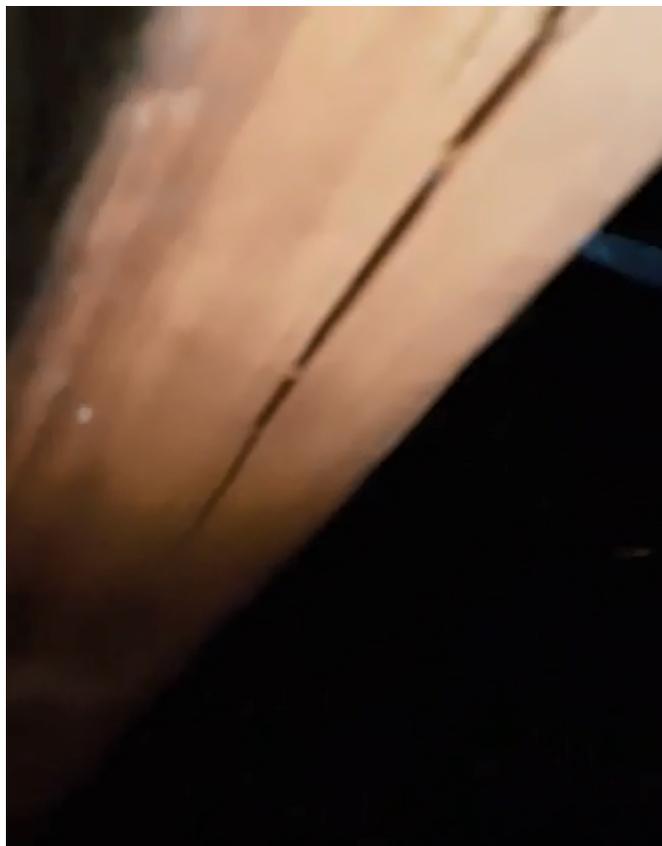


C.2 Photograph of the roof strut by the engineer, which was taken from the second expert's report, with the engineer's comment provided 25 October 2019.



C.3 Screenshots of the roof strut taken from the owner's videos provided 5 February 2020.





Splitting shown below the bottom nail



Connection from the strut to the ridge beam

C.4 Photographs from March 2016 provided by the engineer in response to the third draft determination provided on 13 March 2020.



Photo 1, showing the strut which has been noted as being poorly installed.



[Photo 2. Bottom of strut with very little splitting of the timber.](#)

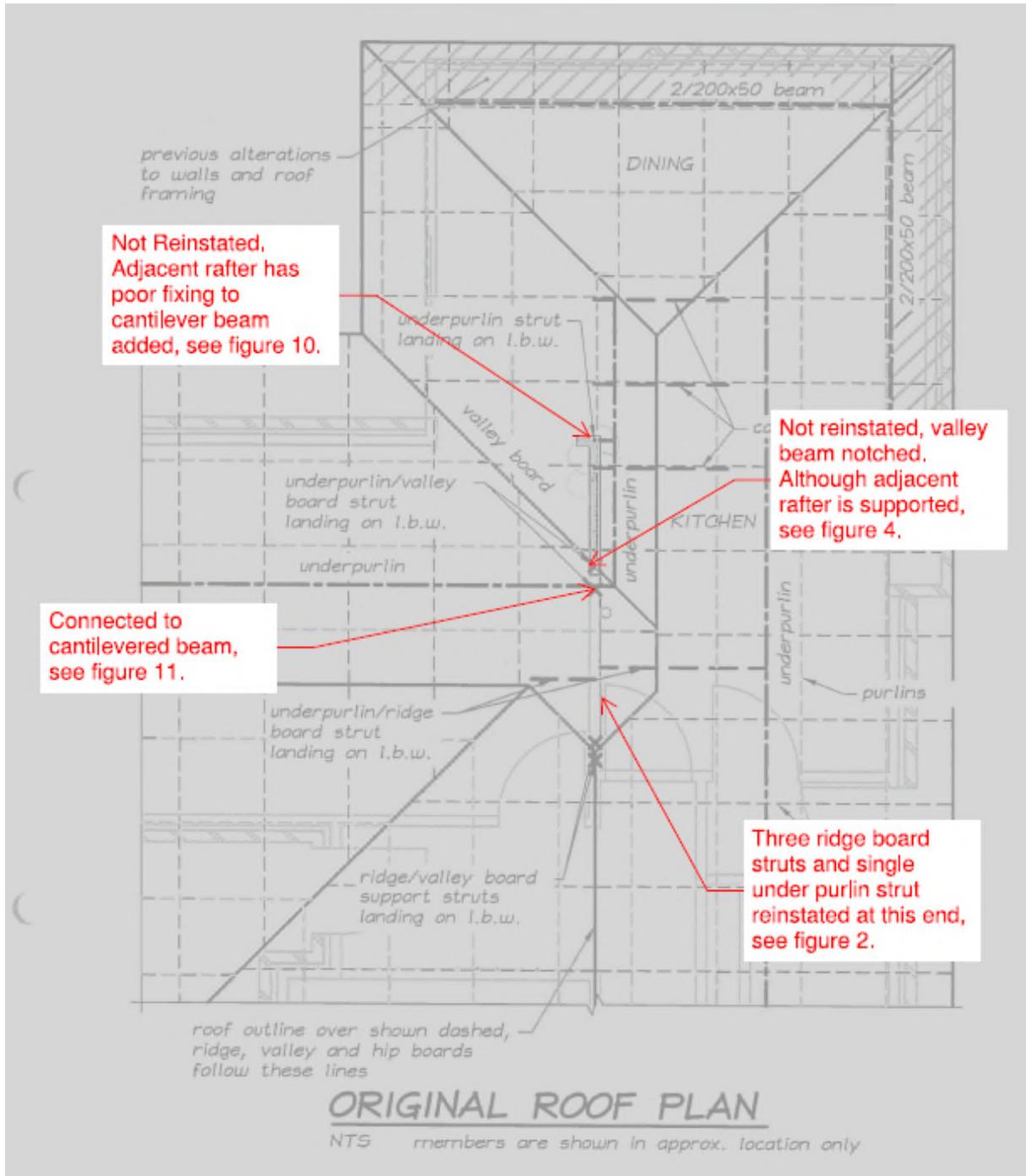


[Photo 3. Top of strut with nails present and no observable splitting in the timber.](#)

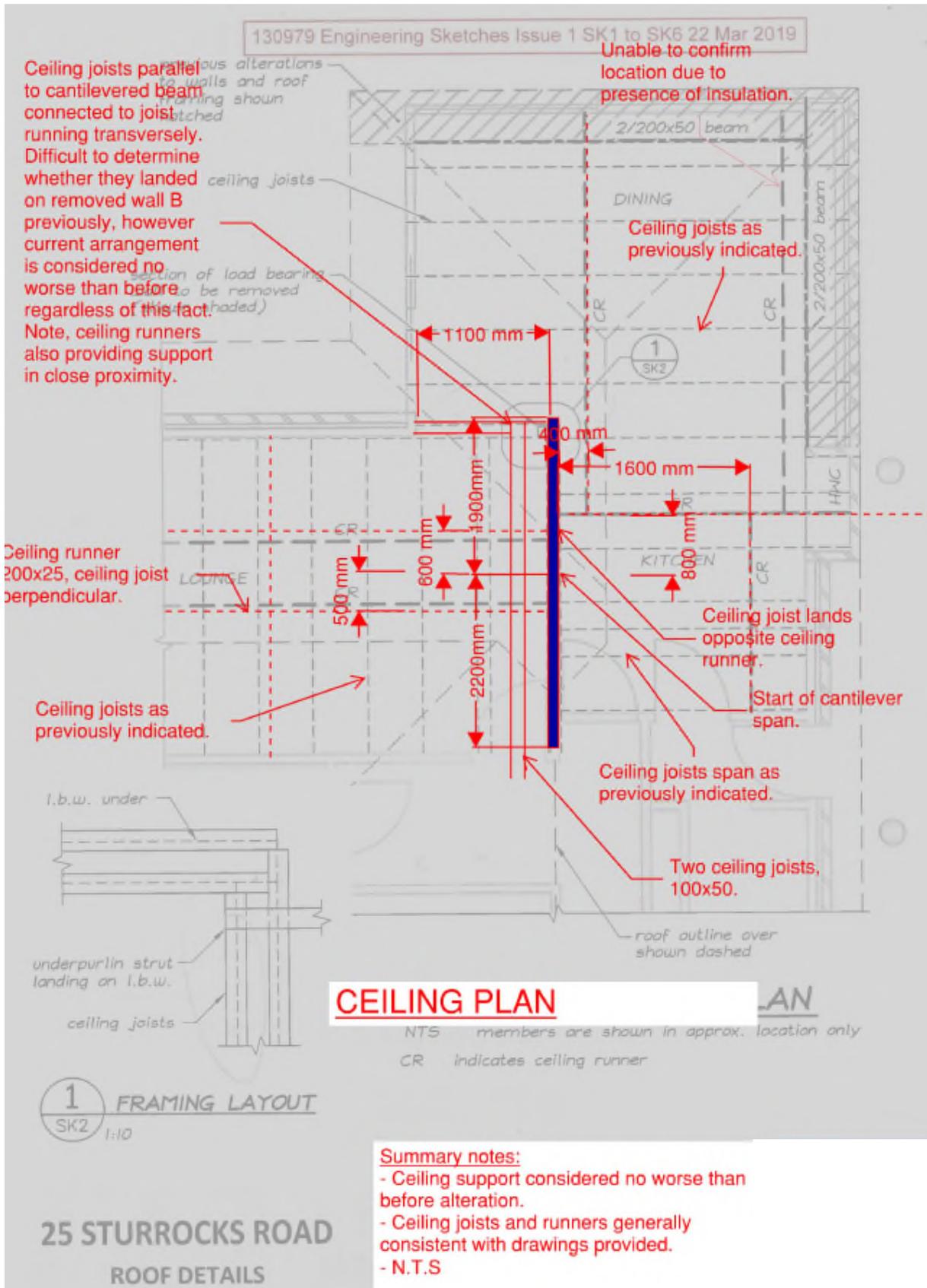


Photo 4, Top of strut with no observable splitting of the timber as installed.

C.5 The second experts' comments on the original roof plan provided by the engineer, included in the report dated 3 July 2019 (note the comment in the first text box that states "Not Reinstated" is in reference to the under-purlin strut).



C.6 The second experts' sketch included in the report dated 3 July 2019 of the ceiling plan over the ceiling plan provided by the engineer.



C.7 The second experts' sketch of the roof support, included in the report dated 3 July 2019, over the roof support plan provided by the engineer.

