



Determination 2020/022

Regarding the compliance of the foundations to a new dwelling with Building Code Clause B1 Structure with respect to the protection of other property at 48C Foyle Street, Ohakune

Summary

This determination considers the stability of an existing slope after a dwelling was built along the top edge of the slope. The application for determination was sought by an owner of a property down-hill of the slope who considered the slope was unstable because the house had been built on fill material.

The determination considers whether the foundations to the dwelling comply with Clause B1 Structure with respect to the provisions that apply to the protection of other property.

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, Katie Gordon, Manager Determinations, Ministry of Business, Innovation and Employment (“the Ministry”), for and on behalf of the Chief Executive of the Ministry¹.
- 1.2 The parties to the determination are:
 - the neighbours, P Ryan, D Chung and G Knights (“the applicants”) who own an adjacent property at 163 Miro Road
 - the owner of the property at 48C Foyle Street, S Lindsey (“the owner”)
 - Ruapehu District Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.
- 1.3 A previous determination, 2016/028² issued on 3 August 2016 (“the first determination”) considered the compliance of a retaining wall and siteworks on another property adjacent to the applicants’ property, at 46B and 46C Foyle Street (“the retaining wall”), which at the time of the first determination, belonged to the owner. The first determination found the retaining wall complied with Clauses B1 Structure and E1 Surface water, and the component parts of the retaining wall complied with Clause B2 Durability. The first determination found the authority incorrectly exercised its powers in respect of the issue of the code compliance

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.

² Determination 2016/028 Regarding the authority’s exercise of its powers in issuing a code compliance certificate for a retaining wall (3 August 2016).

certificate, but the determination confirmed the issue of the code compliance certificate. The first determination notes the retaining wall was constructed sometime after September 2006 but before 2010.

- 1.4 Subsequently, construction of a new dwelling (“the new dwelling”) was carried out at 48C Foyle Street by the owner. This determination arises because the applicants are of the view that as the foundations of the new dwelling are founded on fill material, this will have an adverse effect on the stability of sloped ground to the north east of the retaining wall, which will in turn affect the applicants’ property. The applicants also consider the authority should have issued a notice to fix for the building work.
- 1.5 Accordingly, the matters to be determined³ are:
- whether the foundations to the new dwelling comply with Clause B1 Structure, with respect to the provisions that apply to other property and consequently the protection of such property; and
 - whether the authority was correct not to issue a notice to fix in regard to this.
- 1.6 The applicants have also referred to section 37⁴⁵ of the Act, which relates to building work that requires a resource consent where one has not yet been obtained, and section 75⁶ of the Act, which relates to construction occurring over two allotments. The applicants are a neighbour to the property on which the building work to construct the new dwelling was carried out, and not the owner, therefore under section 176(e)(1), the applicants are only entitled to seek a determination in respect of those clauses of the Building Code that have the purpose of protecting other property. In this case, Clause B1 applies, with respect to the foundations of the new dwelling being founded in fill material, because the objective of Clause B1 is “to protect other property from physical damage caused by structural failure”. I have therefore not considered any other aspects of the Act or Building Code beyond those required to decide on the matter to be determined.
- 1.7 In making my decision, I have considered the submissions of the parties, the report of the expert (“the expert”) commissioned by the Ministry to advise on the particular technical matters raised by the applicants, and the other evidence in this matter.

2. The site and building work

- 2.1 The owner’s property (48C Foyle Street) and the applicants’ property (163 Miro Street) share a common boundary that is 3.3m in length (“the shared boundary”). The shared boundary is the southern corner of the owner’s property. The relative location of the properties and the shared boundary are shown in Figure 1.
- 2.2 The retaining wall is a 40m long timber pole retaining wall, with a maximum height of 1.9m, was constructed along the south east boundary of the 46B and 46C Foyle Street, shown in Figure 1.
- 2.3 The retaining wall reduces in height at either end and does not encroach onto 48C Foyle Street on which the new dwelling is built; the northern end of the wall closest to the new dwelling is about 0.5m high. The compliance of the retaining wall was the subject of the first determination (refer paragraph 1.3).

³ Under sections 177(e)(i) of the Act.

⁴ In this determination, references to sections are to sections of the Act and references to clauses are to clauses of the Building Code.

⁵ Section 37 contains provisions regarding the issue of a notice that identifies that consent is required under the Resource Management Act.

⁶ Section 75 contained provisions about construction of buildings located over two or more allotments.

- 2.4 The new dwelling is located 4.8m from the south east boundary of the owner's property, and 8.2m from the south west boundary. The new dwelling is 9.4m from the retaining wall at its closest point. The approximate location of the new dwelling is shown in Figure 1.
- 2.5 The building work consists of construction of the new dwelling, which is a 23m x 6.2m single storey dwelling with an attached carport and decking. The dwelling comprises a concrete foundation, timber-framed walls and roof, vertical weatherboard cladding and profiled metal roofing.
- 2.6 The roof is extended to the north west to form a veranda – the 220 x 220mm laminated timber veranda posts are founded on 600mm diameter x 900mm deep concrete foundations. The posts have stone cladding to the bottom 1.0m.
- 2.7 The near flat building platform for the new dwelling slopes steeply down to the south east. The sloped ground comprises some fill over natural ground. The dwelling is located adjacent the top of the slope – the north-eastern wall of the dwelling runs along the slope's edge. The toe of the slope at its southern-most point adjoins the applicants' property along the 3.3m shared boundary.
- 2.8 At the southern end of the new dwelling, at the closest approach to the applicants' property, is a store room behind the attached carport. The ground slopes steeply to the south east at this location.
- 2.9 According to the approved consent drawings the depth of the foundation was to be confirmed by 'the [design] Engineer' on site. The foundation wall is stepped along the south west and south east sides of the dwelling. Based on the consented drawings, the foundation has a minimum depth of 1.2m adjacent the top of the slope.

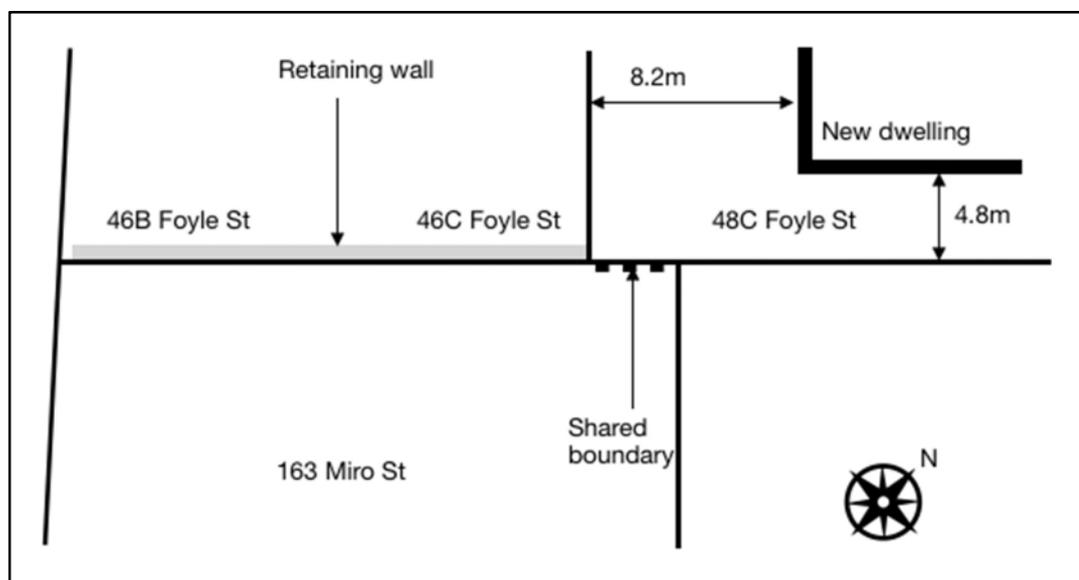


Figure 1: Site plan sketch (not to scale)

3. The background

- 3.1 The authority granted building consent No. 23208 on 2 November 2018 for the construction of the new dwelling. The building consent documentation includes structural design work for the foundations, and a foundation design report that was carried out by the owner's engineer ("the design engineer").

- 3.2 With respect to the foundations for the new dwelling, the building consent documentation states excavation for foundations, reinforcing for foundations, reinforcing masonry, damp proofing floor, plumbing under floor, and sanitary drainage inspections are required. The building consent also requires a Producer statement – Construction review (“PS4”) be provided by the design engineer for the inspection of excavated ground works.
- 3.3 Building work commenced with the first foundation inspection completed on 10 December 2018. The authority carried out further inspections of the foundations on 17 December 2018, 21 December 2018 and 22 March 2019; the 17 December 2018 inspection was primarily of the masonry foundation walls. The inspection notes were recorded in a series of sheets entitled ‘Inspection Prompt Sheet’ and a Field Inspection Sheet and were accompanied by a series of site photographs .
- 3.4 The Inspection Prompt Sheet dated 10 December 2018 relates to the foundation footings and notes the footing widths (500mm) and the reinforcing in place and notes ‘Foundation Depth & Width’ ‘Bearing Capacity’ and ‘Reinforcing...’ as a “Pass”. The Inspection Prompt Sheet dated 21 December 2018 notes ‘2 x holes 700² x 900d post holes in place’. The Inspection Prompt Sheet dated 22 March 2019 notes ‘900 x 600 post holes x 6’. (In this regard I note the post hole foundations provide support to eight veranda posts located along the north west elevation of the building. The posts are located about 7.8m from the top of the slope and 16m from the boundary.)
- 3.5 On 27 March 2019 the applicants wrote to the authority setting out their concerns about the excavation and construction of the foundations for the new dwelling adjacent the slope. Based on the content of that correspondence, it appears there was earlier correspondence between the parties on this matter.
- 3.6 A PS4 was provided by the design engineer dated 28 March 2019, which refers to the inspection and approval of excavation for foundations in respect of Verification Method B1/VM1⁷.
- 3.7 On 9 April 2019, the applicants wrote to the authority again about their concerns about the construction of the foundations for the new dwelling.
- 3.8 On 17 April 2019, the authority wrote to the design engineer requesting confirmation that the fill on site has been properly taken into account in the investigation, design and construction review of the new dwelling, and that the PS1⁸ and PS4 “comply with B1/VM1 and B1/VM4”.
- 3.9 The Ministry received an application for a determination on 17 April 2019.
- 3.10 The authority commissioned a geotechnical and structural engineering peer review of the ground conditions and design of the foundations for the new dwelling. In the report dated 10 June 2019, the peer reviewer stated, with respect to the geotechnical investigations undertaken by the peer reviewer:
- Scala penetrometer tests and hand-augered boreholes⁹ indicate that under the topsoil layer, the soils are relatively uniform in consistency and colour, which would corroborate the design engineer’s geotechnical investigations (referred to in the foundation design report) that the site did not contain uncertified fill materials

⁷ Verification Method for Clause B1 Structure

⁸ Producer Statement – Design

⁹ The report did not include the Scala penetrometer test results or the borehole data.

- the ground at base footing level did not meet the requirements for good ground as defined in NZS 3604¹⁰, although the tests were not carried out directly under the footings
 - these findings are different to the design engineer's geotechnical investigations, which determined that good ground as defined in NZS 3604 was found at relatively shallow depths and non-certified fills known to be present in the vicinity did not carry over to the site.
- 3.11 The peer reviewer noted that even though the original geotechnical investigations, which formed the basis of the foundation design referred to good ground as defined in NZS 3604, specific engineering design was carried out for the foundations, rather than using the standard designs from NZS 3604 and were therefore not required to meet the conditions of NZS 3604.
- 3.12 The peer reviewer reported that the design PS1 indicates allowable soil bearing capacity of 120kPa and expected maximum factored loads of 47kPa from the roof, walls, floors, and foundations. The results of the peer reviewer's geotechnical investigations were that the expected allowable bearing capacity of the soil is approximately 65-80kPa at the base of the footings, and therefore the soil type and strength was suitable for the expected maximum loads.
- 3.13 On 18 June 2019, the design engineer wrote to the authority in response to the authority's 17 April 2019 letter (refer to paragraph 3.8). The design engineer stated:
- the design and construction review for the dwelling have been carried out in accordance with Verification Method B1/VM4
 - the building consent documentation demonstrates the issue of fill on site has been properly taken into account in the investigation, design and construction review of the dwelling.

4. The submissions

4.1 The initial submissions

The applicants

- 4.1.1 The applicants provided copies of the following with their application:
- a submission summarising the background and the applicants' views
 - correspondence with the authority from 27 March 2019 and 12 April 2019 regarding the compliance of the foundations to the new dwelling and sitework, and the consenting and inspection processes followed by the authority
 - a copy of Determination 2016/028.
- 4.1.2 The applicants are of the view that:
- the dwelling is located in close proximity to an unretained slope with unknown slope stability, with the slope made of fill material, and the dwelling constructed on fill. This is inconsistent with engineering reports provided as part of the building consent process

¹⁰ New Zealand Standard NZS 3604: 2011 Timber-framed buildings

- as the foundation design is based on incorrect assumptions, the building consent was incorrectly granted, as the requirements of Clause B1 of the Building Code have not been satisfactorily addressed
- the conditions of the building consent have not been satisfied, as the ground conditions and excavations have not been inspected by the design engineer or authority as required by the building consent
- the authority should have issued a notice to fix for these identified deficiencies.

4.1.3 The applicants provided further submissions dated 3 May 2019, 10 May 2019, 15 May 2019 and 18 June 2019. In these submissions, the applicants:

- reiterated their concerns set out in the submission accompanying the application for determination, and provided a copy of correspondence with the authority dated 26 April 2019, which sets out the applicants concerns, and includes the statements from the design engineer's foundation design report and geotechnical completion report that are incorrect in terms of the presence of fill
- noted that slope failure may impact the applicants' property, and provided a topographical survey plan to illustrate the extent of fill under the south west corner of the building; the plan was marked-up to show the direction of the "likely" slope failure
- noted that internal correspondence from the authority dated 19 April 2019 indicates that the authority now accepts there is fill on the site, as the authority sought confirmation that the PS1 dated 19 October 2018 and the PS4 dated 28 March 2019 address the fill. However, the design engineer's report that accompanies the PS1 dated October 2018 expressly says there is no fill on site, the date of the PS4 is months after the dwelling foundations were completed, and the authority's inspection notes are dated March 2019. There are no records that demonstrate the authority or design engineer completed inspections at the time of construction of the dwelling foundations.

4.1.4 The applicants provided a submission on 8 July 2019 about the report of the peer reviewer. The applicants stated:

- the report incorrectly supports the results of the original geotechnical investigation that the site does not contain uncertified fill
- the footing at the southern corner of the foundation is not installed in natural ground, and appears to be 750mm deep, which is less than the depth of fill at that part of the site. This corner of the foundation is built in ground comprising over a metre of fill that makes up the steep, unretained bank, and this has not been taken account of in the design
- the foundation design report dated 18 September 2018 and the plans state the design complies with NZS 3604:2011.

4.1.5 The applicants responded to the expert's report on 4 October 2019. The applicants submitted:

- they agreed there is an obvious presence of fill on site and with the expert's comments that the excavation should have been inspected and tested to confirm assumptions, and the risk of this not happening is the soil may be worse than assumed

- the design engineer’s foundation report is based on assumptions that the fill did not extend to the footprint of the building and the fill was proximate to the site. The peer reviewer considers the geotechnical tests corroborate the design engineer’s assumptions, and states the proposed site did not contain uncertified fill materials. As the majority of the site contains fill, these assumptions, which underpin the foundation design, are incorrect
- they agreed there is no evidence of ground inspections prior to construction and footing
- the authority’s foundation inspections do not address the presence of fill, do not mention design engineer’s ground inspections, and the authority did not ensure required third party verification of compliance, and did not seek the PS4 until months after the work was complete
- the authority’s inspection records have inconsistencies with the requirements in the consented plans; the inspection records for the 17 December 2018 inspections (which comprise the ‘Masonry Inspection Prompt Sheet’ and the ‘Field Inspection Sheet’) are inconsistent. There is a 22 March 2019 foundation inspection record which refers to post holes being “down to solid grit¹¹ and clear of debris”, but this was after the foundation was constructed.

The authority

- 4.1.6 The authority acknowledged the application in a response received on 7 May 2019.
- 4.1.7 On 10 May 2019, the authority provided a copy of the certificate of title for the owner’s property. On 15 May 2019, the authority provided a copy of:
- the building consent file and inspection records
 - the PS4
 - the foundation design report dated 18 September 2018
 - the geotechnical completion report dated May 2013.
- 4.1.8 On 17 June 2019, the authority provided a copy of a peer review that it commissioned to carry out a geotechnical investigation and assess the design of the foundations to the new dwelling (refer to paragraphs 3.10 to 3.12).
- 4.1.9 On 18 June 2019, the authority provided a copy of the response from the design engineer to the authority’s queries about the design and construction review and the fill on the site (refer to paragraph 3.13).
- 4.1.10 On 24 September 2019, the authority provided a copy of an inspection record entitled ‘Field Inspection Sheet’, with records of inspections from 10 December 2018, 17 December 2018, and 21 December 2018.

The owner

- 4.1.11 The owner did not acknowledge the application for determination or make a submission in response.

4.2 The draft determination and submissions received

- 4.2.1 A draft determination was issued to the parties for comment on 10 December 2019.

¹¹ The inspection record as provided is indistinct: the word “grit” is more likely to be “grnd” (being ground).

4.2.2 The applicants responded to the draft determination on 15 January 2020. In response to the draft determination, the applicants noted the following:

- it was not accepted that the presence of the fill on the site had been taken into account by the design engineer. The adequacy of the foundation was to be confirmed on site, this had not been done so no confirmed foundation design has been provided
- the draft determination does not address matters arising from the PS4, namely:
 - the PS1 requires inspection and approval of excavated ground at the time of construction and the issue of a PS4. The PS4 does not provide for the inspections required by the PS1 and the conditions of the building consent with respect to the inspection of the foundations
 - “there is no record of how deep the foundations are or what “grade/amount of reinforcing steel has been used”
 - “Given the risks associated with steep unretained banks, this paucity of information cannot be sufficient to assure compliance...”
- the results of the Scala penetrometer tests and hand augered boreholes that informed the peer review dated 10 June 2019 commissioned by the authority have not been provided to the applicants
- there were discrepancies in the width of the foundation wall footings as described in the peer review and the authority’s inspection sheet (the peer review noted footings 300mm wide, whereas the inspected footings were 350mm and 500mm wide). “There appears to be no inspection, design or certainty about these ... footings, other than a brief note of ‘post holes’ ... on 21 December 2018, which may well refer to the veranda [post footings].” This absence of detail “is a significant failure” and the authority should have confirmed the footings required by the approved plans.
- the draft determination took the view that the 22 March 2019 inspection was for the foundations to the veranda posts, but if this is correct there are two posts that were not inspected. The applicants also queried whether the information supporting this statement had been provided to the applicants. (I note here that advice from the inspection of all eight post foundations has been included in paragraph 3.4.)
- Section 37 of the Act should be within the scope of the determination. In addition, section 75 of the Act appears to apply as the building is located over two allotments. (My consideration of this matter is addressed in paragraph 1.6.)

4.2.3 On 28 January 2020, the Ministry acknowledged the applicants’ submission and advised the applicants that the 22 March 2019 inspection records were provided as part of the authority’s initial submission on 17 June 2019. The Ministry also sought evidence that supported the applicant’s position that the work was not compliant. In an email dated 19 February 2020 in response, the applicants said that they were unable to make any informed technical submission in response to the matter because:

[W]e have repeatedly requested the test data from the peer review undertaken by the [the authority]. We have not been provided that data and cannot be reasonably expected to provide evidence without access to those detailed test results. ...

In response, I note that this information was not provided to the Ministry nor its expert, but the expert was specifically asked to confirm the relevance of this information to his conclusions regarding the slope stability (refer paragraph 5.5.7).

4.2.4 On 24 February 2020, the Ministry sought further information from the applicants about their submission regarding the foundations to the veranda posts.

4.2.5 The authority and the owner did not respond to the draft determination.

4.3 The second draft determination and submissions received

4.3.1 Following the issue of the first draft determination, I engaged the expert to provide further advice on the stability of the slope below the new dwelling (refer to paragraph 5.5). A second draft determination was issued to the parties on 4 May 2020 that took account of an addendum report provided by the expert.

4.3.2 The authority accepted the second draft determination without comment on 11 May 2020.

4.3.3 On 29 May 2020, the applicants provided a response, advising that they did not accept the second draft determination. The applicants submitted:

- the issue the applicants wanted addressed did not relate to the veranda posts or retaining wall and additional loads on the retaining wall. It is our view that the review focus should be on the foundation design above the steep unretained bank
- the foundation wall footings required in the foundation design at the rear of the building were not inspected by the authority or the design engineer. The consented plans state the design complies with NZS 3604 and was subject to confirmation from the design engineer at the time of construction
- the peer review does not address the design assumption that there was no fill in proximity to the building and boundary, or the absence of inspections to the footings
- the applicants disagreed with the view expressed in the second draft that the authority's inspection records demonstrate appropriate inspections. There is no record of inspection to the foundation wall footings required and there is no record confirming they exist. It cannot be demonstrated that there have been satisfactory inspections, because neither the design engineer nor authority conducted inspections of the foundation wall footings.

4.3.4 The applicants also provided a copy of a page of the consented plans, showing the section of the foundation and house construction. The applicants highlighted the foundation wall footings (referred to as the "post footings") at the rear of the building.

4.3.5 The owner acknowledged receipt of the second draft determination without comment on 2 June 2020.

5. The expert's report

5.1 General

5.1.1 As mentioned in paragraph 1.7, I engaged an expert, who is a Chartered Professional Engineer, with expertise in geotechnical engineering to assist me. The expert

provided a report dated 16 September 2019. Copies of the report were sent to the parties on 23 September 2019.

- 5.1.2 The expert reviewed the documentation, aerial photographs, site photographs, and plans and found the retaining wall to be no closer than 9.4m from the southern corner of the new dwelling, where it reduces in height to about 0.5m, and it is not present along the shared boundary between the applicants' property and the adjacent property.
- 5.1.3 The area behind and adjacent to the north end of the retaining wall was backfilled. A steep slope has been created to form a near flat building platform on the owner's property. The fill / slope batter has been formed at a slope of between 31 and 36 degrees from horizontal and rises approximately 3.5m to 4m.
- 5.1.4 The expert analysed drawings from the subdivision of the site and found fill up to 3m of depth was to be placed on the site, based on the existing and proposed design contours, with fill of approximately 1.5m depth at the southern corner of the new dwelling.
- 5.1.5 The expert noted that the as-constructed fill is slightly different from the proposed fill design, with the as-constructed level being approximately 0.5m lower at the southern corner of the new dwelling. Therefore, the expert found the depth of fill at the southern corner of the new dwelling to be 1m from original ground level to current ground level.
- 5.1.6 The expert analysed the levels and heights based on plans and details for the site at the southern corner of the new dwelling and found:

Level type	RL ¹² or height
Finished floor level	RL 100.8
Current ground level	RL 100.1
Original ground level	RL 99.1
Depth of fill	1m
Footing level (assuming 1.2m height)	RL 99.6
Assumed thickness of fill beneath footing (which may be 0.2-0.3 greater as this does not allow for stripping of topsoil from the area)	0.5m

- 5.1.7 The expert concluded that fill has been placed on the site, forming the steep slope along the south east boundary of the owners property.

5.2 Effect on the retaining wall

- 5.2.1 The expert calculated the effect of the lateral thrust on the wall compared to the thrust from the retained wall prior to the construction and found the total lateral thrust on a 0.5m high wall, which is the height of the wall where it is closest to the southern corner of the new dwelling, to be 1.5kN per metre of wall¹³.
- 5.2.2 The expert calculated the increase in lateral thrust on the wall is approximately 0.016kN per metre of wall, which is an increase of approximately 1%. The expert noted this is conservative due to assumptions in the calculation, and the actual increase is expected to be less than 1%.

¹² Reduced level, which is the height above a specified datum.

¹³ This was based on the previous analysis of the retaining wall using a proprietary geotechnical software undertaken as part of the first determination.

5.2.3 The expert concluded that based on the distance from the wall, the footing width, foundation loads, and the pressure distribution of these loads into the ground, the foundation wall of the new dwelling would not apply any significant additional loads to the retaining wall.

5.2.4 The expert therefore considered the foundation to the new dwelling would not result in any additional significant loads on the retaining wall and would have no adverse effect on the performance of the retaining wall.

5.3 Effect on the fill slope

5.3.1 The expert found that based on the distance to the shared boundary (of 6.8m on the diagonal from the southern corner of the new dwelling), the foundation loads, and the pressure distribution of these loads into the ground, the foundation of the new dwelling would not apply any significant load into the slope above the shared boundary that would lead to failure of the slope.

5.3.2 The expert therefore considered the foundation to the new dwelling would not result in any additional significant loads on the fill slope and would have no adverse effect on the performance of the slope.

5.3.3 The expert also noted that the collection of rain water from the roof area and the diversion of rain runoff from other hard surface areas of the property to the surface water system is likely to reduce infiltration into the ground and may have a beneficial effect on the stability of the slope.

5.4 Suitability of the ground below the footing

5.4.1 The expert noted that the excavation for the foundation at the southern corner of the new dwelling should have been inspected by the design engineer and tested to confirm any assumptions prior to foundation construction. The expert observed the risk of this not happening is that the soil may be worse than assumed in the design, leading to excess settlement of the foundation.

5.4.2 The expert noted the report of the peer reviewer contained results of onsite geotechnical investigations, which found the expected allowable bearing capacity to be 65-80kPa. The report of the peer reviewer also contained a calculation for factored foundation demand of 45kPa and concluded that the soil encountered was suitable for the expected maximum loads.

5.4.3 The expert considered that as the load on the foundation is relatively light, based on the soil types present (i.e. the materials used as fill at the site), this conclusion set out in the report of the peer reviewer appears to be reasonable.

5.5 The expert's addendum report

5.5.1 As outlined in paragraph 4.3.1, I engaged the expert to further consider the stability of the slope below the new dwelling. The expert furnished an addendum report dated 30 March 2020. Copies of the report were sent to the parties on 31 March 2020.

5.5.2 The expert carried out a stability analysis both before construction of the new dwelling, and post construction, when the foundation of the new dwelling applies additional load to the top of the slope. The assessment was based on material parameters agreed by the parties during the course of Determination 2016/028, consented contour plans, and foundation design loads from the original calculations and confirmed by the peer review.

- 5.5.3 The expert carried out the stability analysis using proprietary limit equilibrium modelling software. The expert noted the stability of the slope is represented by the Factor of Safety (FoS), being the ratio of the resisting forces to the driving forces, and that a ratio of less than the target limit means the driving forces are greater than the dependable resisting forces and accordingly that there is an unacceptable risk that the slope will fail.
- 5.5.4 The expert analysed three loading cases and compared the results to typical minimum target FoS. The results of the analysis were:

Case	Typical minimum target FoS	FoS without building load	FoS with building load
Static, typical groundwater	1.5	1.983	1.677
Seismic, ULS (ultimate limit state), typical groundwater	1.0	1.326	1.171
Static, extreme adverse groundwater	1.2	1.761	1.491

- 5.5.5 The expert found that the analysis indicated that the FoS pre-building for all cases exceeded the minimum FoS. Analysis including the foundation load indicates the FoS for all cases reduces, however they all still exceed the minimum FoS requirements for the compliance of the building platform with respect to Clause B1.
- 5.5.6 The expert noted this analysis models the slope directly below the foundations of the new dwelling, which is approximately 4.9m from the shared boundary. The expert found that the analysis indicated that the additional foundation load imposed by the new dwelling on the slope does not adversely affect the stability of the slope directly below the foundations.
- 5.5.7 The expert was asked to respond to the applicants' position (refer paragraph 4.2.3) that the peer review was open to challenge because the review does not disclose the results of the Scala penetrometer tests and hand-augured boreholes. In response the expert advised:
- There is no correlation between Scala blows and soil strength for use in the stability analysis (especially for volcanic soils). The strength values used for the stability analysis, developed from the performance of similar materials for the fill, and agreed for the natural soils during the hearing for the first Determination, are considered appropriate, and are not reliant on the peer reviewer's Scala testing. Based on the assumed blow counts for the Scala testing ... the strength values selected for the fill material and natural ground would not change.
- The log of the hand auger and Scala penetrometer testing was not provided in the [peer review] report and has not been sighted. Based on the types of materials used for the filling on the property, the results of this testing would not materially alter the selection of the material strength parameters, and would not alter the results of the stability analysis.
- 5.5.8 The expert therefore concluded that the foundations to the new dwelling do not adversely affect the slope above the shared boundary with the applicants' property, where the effects of the building load are significantly reduced.

6. Discussion

6.1 Compliance with Clause B1 Structure

6.1.1 The Act and the Building Code both require that any building work, including sitework, must be constructed in such a manner as to protect ‘other property’. Other property is defined¹⁴ as:

... any land or buildings or part thereof which are –

- a) Not held under the same allotment; or
- b) Not held under the same ownership ...

6.1.2 The objectives of the Clause B1 of the Building Code include “to protect other property from physical damage caused by structural failure.” The performance criteria for Clause B1 include:

B1.3.2 Buildings, building elements and sitework shall have a low probability of rupturing, becoming unstable ... throughout their lives.

...

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.

6.1.3 “Sitework” is defined in section 7 as meaning:

work on a building site, including earthworks, preparatory to, or associated with the construction, alteration, demolition, or removal of a building.

6.1.4 As discussed in previous determinations¹⁵, including in the first determination, I consider ‘other property’ is not limited to the protection of buildings and that the land itself must also be protected from likelihood of damage. With respect to the likelihood of damage, I refer to the reasoning in *Auckland CC v Selwyn Mews Ltd*¹⁶, where the Judge stated:

... In cl B1.3.6 “the likelihood of damage to other property” refers to a real and substantial risk of such damage.

6.1.5 The applicants are concerned about the protection of their property (i.e. the “other property” in this case) following the construction of the new dwelling to the north east of the retaining wall and 3.3m shared boundary.

6.1.6 The expert has assessed the foundations to the new dwelling as designed and built, with respect to the protection of other property. The expert is of the view that the foundations to the new dwelling near the retaining wall and shared boundary will not apply any additional significant loads to:

- the retaining wall, and therefore the foundation does not have an adverse effect on the performance of the retaining wall
- the slope immediately above the shared boundary, and therefore the foundation does not have an adverse effect on the performance of the slope.

6.1.7 The expert considered the foundations to the new dwelling comply with Clause B1, with respect to the protection of other property. The expert also considered the soils would be appropriate for the expected loads from the foundation to the new dwelling.

¹⁴ In Building Code Clause A2 Interpretation

¹⁵ For example, Determination 2019/029 Regarding the compliance of a retaining wall and associated sitework with Building Code Clause B1 Structure and whether a notice to fix should have been issued (27 June 2019).

¹⁶ Refer 18/6/03, Judge McElrea, DC Auckland CRN2004067301-19

- 6.1.8 The applicants maintain the foundation design and findings set out in the peer reviewer report cannot be relied upon because of the assumptions being made about the location, depth and nature of the uncertified fill material, and the absence of verification by the design engineer of the ground immediately below the foundations. The applicants are of the view that as the majority of the site contains fill the assumptions being made about adequacy of the foundation design are incorrect.
- 6.1.9 I consider the expert has addressed this issue (refer to paragraph 6.1.7). The expert expressly considered the conclusion set out in the report of the peer reviewer that the soils were appropriate for the expected loads. The expert was of the view this was a reasonable conclusion based on the types of foundation soils (i.e. materials used as fill at the site) and the expected loads from the foundation to the new dwelling.
- 6.1.10 I accept the expert's views on these matters. Accordingly, I consider that the foundations to the new dwelling do not present a "real and substantial risk" of damage to other property.
- 6.1.11 Therefore, I conclude that the foundations to the new dwelling comply with Clause B1 for structural stability and to avoid the likelihood of damage to other property (i.e. Clause B1.3.6(b)).
- 6.1.12 I note the applicants have raised a number of issues relating to the process carried out by the authority in processing the building consent, and inspecting and documenting the building work, in particular referring to the lack of evidence that the excavation was inspected by the design engineer, that the footings to the foundations were not inspected, that the authority's inspection notes do not mention the presence of fill, and that the authority did not seek the PS4 until well after the work was complete. The applicants are particularly concerned that the foundation wall footings required in the foundation design at the rear of the building were not inspected by the authority or the design engineer.
- 6.1.13 With respect to the authority's inspections, I consider the authority's inspection records from 10 December 2018 to 22 March 2019 demonstrate inspections were carried out of the foundation wall footings, the masonry foundation walls and the eight veranda post foundations. I am of the view that the 10 December 2018 inspection show the key foundation footings were inspected and passed, the following three foundation inspections also verify the likely compliance of the completed work. I note that even if this was not the case, I am of the view that a missed inspection or a lack of inspections of all or part of a piece of building work is not in itself a reason to consider that a piece of building work does not comply with the Building Code.
- 6.1.14 I consider that there are some inconsistencies in the inspection documentation with respect to the verification of the assumptions made about the ground conditions in the design in that the approved building consent required be confirmed and documented by the design engineer prior to the construction of the foundations. However, these inconsistencies do not change my view of the compliance of the foundations of the new dwelling with Clause B1 with respect to the protection of other property.

6.2 Notice to fix

- 6.2.1 As I consider the foundations to the new dwelling comply with Clause B1 of the Building Code in respect of the protection of other property, I also consider that the authority was correct not to issue a notice to fix in these circumstances.

7. The decision

- 7.1 In accordance with section 188 of the Building Act 2004, I hereby determine that:
- the foundations to the new dwelling comply with Clause B1 of the Building Code in respect to protection of other property
 - the authority was correct not to issue a notice to fix in regard to this.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 14 August 2020.

Katie Gordon
Manager Determinations