



Determination 2018/022

Regarding the issue of a notice to fix in respect of the concrete foundations at 24 Dollar Place, Prebbleton



Summary

This determination is concerned with the compliance of a concrete slab with Clause B1 Structure. The determination considers whether the authority was correct to issue a notice to fix in relation to the concrete slab.

1. The matter to be determined

- 1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004¹ (“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 Ministry.
- 1.2 The parties to the determination are:
 - the owner of the building, S Lilly (“the applicant”), acting through an agent. Mr Lilly is also the LBP² for the work concerned,
 - Selwyn District Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.
- 1.3 This determination arises from the decision of the authority to issue a notice to fix regarding the construction of concrete foundations. The refusal arose because the authority is not satisfied the building work was built in accordance with the building consent.

¹ The Building Act, Building Code, compliance documents, past determinations and guidance documents issued by the Ministry are all available at www.building.govt.nz or by contacting the Ministry on 0800 242 243.

² Licenced Building Practitioner, Registration No. BP105432, Licence class ‘Carpentry’.

- 1.4 The matter to be determined³ is therefore whether the authority correctly exercised its powers of decision by issuing the notice to fix (No. NF0533). In deciding this matter, I must consider whether the concrete slab foundation as-built will comply with Clause B1 Structure⁴ of the Building Code (First Schedule, Building Regulations 1992).
- 1.5 In making my decision, I have considered the submissions of the parties, the report of the independent expert commissioned by the Ministry to advise on this dispute (“the expert”), the report from the agent’s consultant, and the other evidence in this matter.

2. The building work and background

2.1 The issued consent

- 2.1.1 The authority issued a building consent (BC170628) for a four-bedroom single-storey house on 12 May 2017. The proposed building is timber-framed on a 100mm thick concrete slab with a perimeter thickening, and two 375x375mm areas of thickened floor slab to receive load from the roof trusses.
- 2.1.2 The roof and wall claddings are lightweight; respectively profiled metal sheet, and fibre-cement weatherboard on a cavity. The exterior joinery is aluminium.
- 2.1.3 The proposed concrete slab is a proprietary steel fibre reinforced 25MPa concrete flooring system that has a BRANZ appraisal and a Codemark certificate. The scope for use in both documents is for residential building slabs on “good ground⁵” as defined in NZS 3604:2011⁶, and some commercial and industrial floor slabs on grade. The consented documents show the concrete slab was proposed to be 100mm thick on top of 150mm minimum compacted hardfill as shown in Figure 1. It is noted the use of the proprietary floor system was an amendment to the consent, which originally used a conventional foundation design.

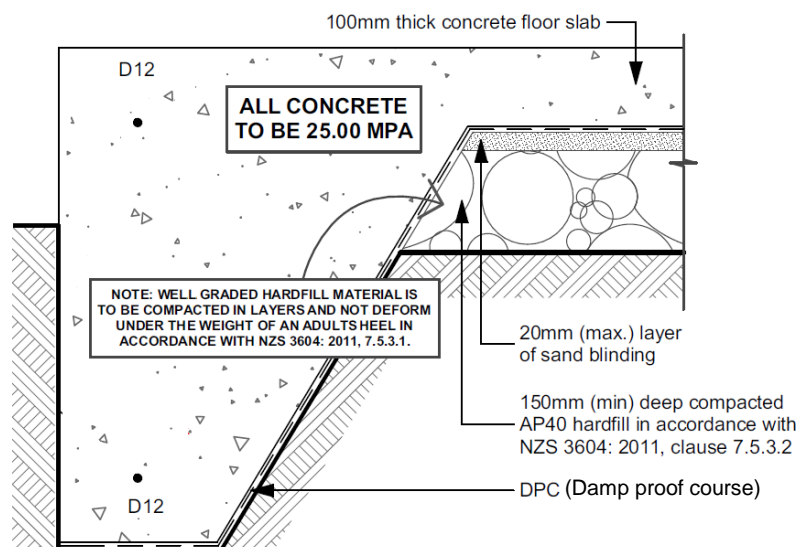


Figure 1: Perimeter foundation detail (not to scale)

³ Under sections 177(1)(b) and 177(2)(f) of the current 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 Good ground is defined in NZS 3604 as any soil or rock capable of permanently withstanding an ultimate bearing capacity of 300kPa but excludes potentially compressible ground, expansive soils, and any ground that could foreseeably experience movement of 25mm or greater.

⁶ New Zealand Standard NZS 3604:2011 Timber-framed buildings

- 2.1.4 The floor finishes comprise:
- Garage – power-floated concrete
 - Kitchen, bathroom, ensuite, entry hall – ceramic tiles
 - All remaining areas – carpet.
- 2.1.5 The geotechnical report submitted in the building consent confirmed material 300mm below ground level was considered “good ground”, that it satisfied the minimum bearing capacity required by NZS 3604.
- 2.1.6 The report also stated the following condition (“condition two”):
- All turf and any organic rich topsoil shall be removed from beneath the lightly loaded floor slab area, including any other remaining topsoil to at least 200mm below existing ground level before proof rolling or compacting the exposed subgrade to achieve a firm uniform surface. After inspection by the Engineer, the area can be backfilled by placing and compacting AP40 sandy gravels in maximum 200mm layers to achieve a minimum dry density of 2150kg/m³ up to the underside of the floor slab.
- 2.1.7 The depth of the ground removed from below the slab has not been verified, nor is there any record of the exposed surface being inspected by an engineer before the compacted backfill was placed.

2.2 The foundation assessment, authority inspections, and the slab pour

- 2.2.1 On 24 April 2017 a second engineer (the site engineer”) carried out a foundation assessment for the applicant. The record of the inspection notes that a “bearing inspection of [the] perimeter foundation” was completed; the report concluded:
- No Organics or topsoil present in the footing.
Bearing capacity exceeds 300kPa in all location around the perimeter footing.
OK to proceed with foundation.
- 2.2.2 On 17 May 2017 the authority carried out a “prepour” inspection, which failed. The inspection failed, in part, because a “large tree root” could be seen underneath the building platform, and there was “grass and root matter” growing underneath the gravel fill to the slab. The authority required evidence “to support continuation or rectify these issues”.
- 2.2.3 “Prepour” and “wastepipes” inspections were carried out on 19 May 2017 which also failed. A formal directive noted on the inspection report required the applicant to provide the engineer’s “site cut report” before he could arrange the slab inspection. The inspection report reiterated the previous comments regarding rectifying the adequacy of the building platform.
- 2.2.4 On 25 May 2017 the “floorslab” inspection was carried out and failed for the following reasons:
- Ground bearing needs to be verified. Soft spots found in east foundation⁷...
[Damp proof membrane] needs to be removed for further inspection.
Reinforcing installation is compliant. 2xD12 horizontal bars, floor slab is a [manufacturer’s name] floor. No supplementary bars
- 2.2.5 The inspection record included another “formal directive” that stated no further inspections were to be undertaken until the authority received confirmation from an

⁷ The expert has confirmed the soft spot was observed under the perimeter foundation thickening and not under the slab itself.

engineer that the ground bearing is adequate, and the organic matter has been removed. It also stated no concrete was to be poured until this advice had been received.

2.2.6 It appears the floor slab and foundation was poured early on 26 May 2017. The applicant says that he did not receive the 25 May 2017 inspection report until after the slab was laid.

2.2.7 On 26 May 2017 the applicant provided the authority with the site engineer's report referred to in paragraph 2.2.1.

2.3 Notice to fix, the site engineers response, and the producer statement

2.3.1 On 31 May 2017 the authority undertook another site visit and found that the floor slab had been poured, with "no evidence of any recent earth works been (*sic*) carried out".

2.3.2 The authority issued a notice to fix dated 1 June 2017 that stated the 'particulars of contravention or non-compliance':

Building work has been carried out in contravention of the building consent (BC170628) issues in that the base course under the floor slab contains vegetation which is in breach of condition [two] of the ground report accepted as part of the official consent documents.

The remedy stated:

Provide evidence to identify that the area under the floor slab has been correctly prepared prior to pouring or, [r]emove the concrete slab and remove all vegetation as per the building consent.

2.3.3 On 25 July 2017 the applicant provided the authority with the site engineer's "foundation bearing review", and a statement from the site excavator.

2.3.4 The site excavator's statement, dated 28 June 2017, said the requirements of NZS 3604 had been met, and that:

...dug founds (*sic*) and Site scraped off grass removing all spoil (*sic*) from site then compacted AP40 in layers up to 200mm for one pour foundation ... compaction with a 450kg plate compactor as the AP40 was being placed. ... We tested the compaction by heel test on completion.

2.3.5 The site engineer's foundation bearing review, dated 9 June 2017, said:

- Photographs provided show one tree root and rootlets around the perimeter under the gravel, and tufts of grass in two locations. As the excavations and gravel have been left for at least one month before the photographs were taken it is possible the grass has grown since the excavation.
- A site scrape has been undertaken but there is evidence of small amounts of organic matter around the perimeter. However, the visible matter is not excessive, although "we cannot validate what exists under the centre of the slab".
- There is likely to be organic material underneath the slab base course. The organic material will decompose and the slab may sag with it. Although, there are no strength or structural concerns because a "small sag in the slab" will not decrease its overall strength.
- At "worst case" the estimated settlement could be up to 10-15mm based on 30-50mm layer of organic material, but noting a "significantly" narrower layer of

organic matter was noted at the perimeter. The maximum extent of any potential settlement would occur after 1-2 years.

- The ground will have consolidated in the month before the slab was poured and may not settle at all given the low bearing pressure being applied to the slab (estimated to be less than 30kPa). The floor slab could also span localised areas.
- The site engineer considered if a 15mm settlement occurred the slab would still comply with the Building Code, although it may be unsatisfactory to a homeowner.

2.3.6 On 14 June 2017 the authority requested the following from the applicant:

- Acknowledgement from the property owner that they accept the site engineer's foundation bearing review.
- An amendment to remove the slab from the building consent, as it has not been constructed in accordance with the consented documents.

I have not seen a response to this request.

2.3.7 The site engineer provided a producer statement PS4 - Construction Review dated 14 July 2017 provided to the applicant via a covering letter of the same date. The PS4 said it was in respect of the "Perimeter bearing inspection"; the covering letter said PS4 was based on the 24 April 2017 inspection (refer paragraph 2.2.1) and was for the "Bearing inspection of perimeter slab foundation only".

2.3.8 The Ministry received an application for a determination on 22 August 2017.

3. The submissions

3.1 The applicant provided a submission that outlined the documentation provided, and supplied copies of the following documents:

- geotechnical report dated 4 November 2016
- foundation perimeter inspection dated 24 April 2017
- notice to fix dated 1 June 2017
- the excavator's statement dated 28 June 2017
- photographs of the building work
- consented plans and specifications
- correspondence between the parties.

3.2 On 4 October 2017, I requested additional information from the applicant regarding the engineer's foundation review, and regarding the perimeter reinforcing, querying the thickening of the slab and seeking to clarify why the slab pour proceeded despite the authority's written advice to the contrary. The applicant responded in a letter dated 16 October 2017 as follows:

- The site has been scraped in accordance with NZS 3604.
- In one corner tree roots and sprouts were identified, but the site was left for six weeks.

- The failed inspection report was sent by the authority after 5pm on 25 May 2017 and was not read until the next day, by which point the slab had been poured.
- The reinforcing and slab thickenings had been inspected by the authority.

3.3 The authority acknowledged the application for determination on 18 October 2017. The authority provided a submission that outlined the background to the dispute, and included copies of the following:

- notice to fix dated 1 June 2017
- consented drawing of the concrete slab
- the consented geotechnical report and PS1
- inspections records
- photographs of the site
- the site engineer's inspection report, foundation bearing review, and PS4
- the excavator's statement dated 28 June 2017.

3.4 A draft determination was issued to the parties for comment on 2 March 2018.

4. Responses to the draft determinations

4.1.1 The first draft determination concluded there was insufficient information regarding the slab to confirm compliance. As a result, I was unable to determine whether the authority correctly exercised its powers of decision in issuing the notice to fix.

4.1.2 The determination suggested a limited number of sample sections of the slab could be removed so the material underneath the slab could be independently verified.

4.2 The agent's response

4.2.1 The agent engaged an independent consultant, who is a building surveyor, ("the consultant") to verify the ground underneath the concrete slab. The consultant visited the site on 4 April 2018 and completed a report dated 6 April 2018, which the agent provided on 9 April 2018.

4.2.2 The consultant stated he undertook testing at three locations to establish and confirm the condition of the ground supporting the hardfill and concrete slab. He also provided comment on the draft determination and the documents provided by the applicant and the authority.

4.2.3 The consultant carried out a 'hammer test' on the concrete slab. During this test, there wasn't any variation or 'drummy' sound, which would indicate voids below the slab. The consultant considered the consistent pitch across the slab indicated it was "fully supported".

4.2.4 The consultant removed sections of the concrete slab in three areas to inspect underneath the slab (see Figure 2). The compacted hardfill was removed, with further removal of earth underneath the hardfill to reach the original ground surface.

4.2.5 In regard to the authority's concerns about the ground underneath the slab, the consultant noted the hardfill was appropriately compacted in all three sample areas. Also, the hardfill exceeded the minimum 200mm thickness as specified in the building consent.

- 4.2.6 Sample areas two and three⁸ revealed “minimal to no organic material found”, the organic material identified as “minor” fibres. The consultant considered any organic material present is likely due to “deep rooted vegetation” from a previous land use. He was of the view the organic matter was minimal and would not affect the concrete slab. Also, he noted there was good ground resistance, which indicated suitable ground bearing.
- 4.2.7 The consultant considered the testing provided evidence a site scrape had occurred. He noted there was no evidence to suggest the hardfill had settled and it appeared to be supporting the concrete slab.
- 4.2.8 The consultant’s report concluded as follows (in summary):
- The hardfill beneath the concrete slab is free from organic material, and has been compacted as set out in the building consent.
 - The ground beneath the hardfill in the three sample areas were considered ‘good ground’ as set out in NZS 3604. The ground bearing capacity beneath the slab is acceptable.
 - The testing did not provide significant or sufficient organic matter to require the removal and replacement of the concrete slab.

4.3 The authority’s response

- 4.3.1 On 1 May 2018 the authority provided a response stating it did not accept the draft determination. It provided a submission in response to the draft determination and the consultant’s report as follows (in summary):
- The site engineer undertook the foundation assessment before the consent was issued.
 - There was “substantial” organic material, including an established rooting system that was clearly greater than six weeks old.
 - The statement from the earthworks contractor did not confirm the site was scraped of all organic material. There was no independent verification that 200mm of topsoil was removed.
 - The expert’s report did not provide a guarantee the slab wouldn’t settle “in years to come” due to vegetation decomposition.
 - The notice to fix was issued because the authority believed the site scrape had not been carried out.
 - The concrete pour occurred without notice being taken of the failed inspection.
 - The consultant did not test samples in the perimeter of the concrete slab, which was where the majority of the organic matter was identified. The authority considers there is not sufficient information to confirm organic material was removed entirely underneath the concrete slab.
 - The findings of the consultant’s report were not accepted.

4.4 The agent’s further response

- 4.4.1 On 8 May 2018 the agent provided responses from the consultant and the site engineer.

⁸ The consultant stated sample area one did not contain any organic matter.

The site engineer's advice

4.4.2 The site engineer reviewed the consultant's report, and inspected the sample areas on 27 April 2018. The engineer provided a letter to the agent dated 7 May 2018 with the following comments (in summary):

- The engineer assessed the soil with a 50mm hand auger. The results of this investigation show the slab is founded on approximately 250mm of compacted gravel hardfill on top of 150mm dark silt material, with organic matter, which sat over "brown silty Clay".
- Scala penetrometer testing of the 150mm dark silt material under the hardfill showed the material had sufficient bearing capacity to support the slab. The ultimate soil bearing capacity was measured with results "in excess of 200kPa and 300kPa" in the layers underneath the hardfill.
- The hardfill layer is lower than the adjacent ground, which is evidence the site scrape occurred.
- While organic matter was identified, the soil has good bearing properties and the conclusions previously stated stand. The estimated potential settlement would "conservatively not exceed 10-15mm over time".

The consultant's advice

4.4.3 The consultant provided additional comments in response to questions from the Ministry:

- The sample areas were chosen to limit the visible damage to the concrete slab.
- The organic matter identified by the authority was situated along the edge of the foundation. Cutting samples through the perimeter foundation would have affected the structural properties of the slab. If the organic material was as prolific as indicated by the authority, matter would be present in the sample areas, especially one and three which are closest to the perimeter.
- Based on the geotechnical report, the type of soil identified provides good support and is classified as 'good ground' under NZS 3604. In regard to the organic matter identified, he clarified "minor" fibres were found. An enlarged photograph provided by the consultant show fine rootlets in the soil.

4.4.4 The consultant also responded to the authority's submission as follows:

- The concrete slab will support a light weight structure, and is situated over good ground. It is unlikely the slab will settle because of the uniform loading across the slab and support provided by the foundations and thickenings.
- Approximately 10 – 11 months have elapsed since the slab was poured, and there is no current evidence to suggest settlement of the soil. In regard to the authority's concern regarding the settlement of the supporting soil, he is of the view settlement is unlikely to occur in another year's time.
- The site engineer has reviewed the consultant's report, and conservatively stated should any settlement occur it would be minor.

4.5 Responses to the second draft determination

4.5.1 A second draft determination was issued to the parties for comment on 17 May 2018.

- 5.1.2 The expert compared the as-built foundation with the building consent documents and observed no discrepancies.

5.2 The expert's observations

- 5.2.1 The expert observed the sawcuts had been cut into the floor slab at 6.07m and 6.18m, close to the 6.0m spacings identified on the consented drawings. He noted minor ponding and hairline cracks on the floor slab (see Figure 2).
- 5.2.2 The expert took measurements of the floor level using a level that had a tolerance of +/- 2mm. The largest variance from the specified floor level was measured at 20mm from the datum point.
- 5.2.3 The expert sought the comment of the site engineer who considered the condition of the slab and maximum 20mm difference in level was satisfactory. The site engineer said the soft spots under the perimeter foundation could have been due to rainwater ponding in the trench around the foundation, noting the authority's inspection was a month after his inspection. The site engineer said the bearing capacity of the perimeter ground would not be affected by ponding rainwater. The site engineer considered the present condition of the slab (in terms of the difference in heights observed) was satisfactory.

5.3 Conclusions

- 5.3.1 The expert considered the minor ponding and hairline cracks were typical for a hand-screeded and power-floated concrete floor slab. He did not believe the differences in floor height were excessive.
- 5.3.2 Overall, he considered there was no deficiency in the floor levels observed that could be directly attributed to settlement arising from excessive organic material underneath the slab.

6. Discussion

6.1 The presence of organic matter underneath the concrete slab

- 6.1.1 The concern is that any organic matter under the concrete slab will decompose, settle, leaving voids underneath the slab. If the concrete slab is not strong enough to span the voids, it will crack and also settle, which can cause damage or a loss of amenity resulting in non-compliance with Clause B1.
- 6.1.2 The geotechnical report required 200mm of the topsoil to be removed to ensure all organic matter was removed. There is no independent verification that removal of the topsoil to this depth occurred before the slab was poured. The authority is of the view a site scrape has not occurred based on the photographs that show organic matter in the soil. The applicant disputes these photographs as evidence the site scrape was not carried out. He contends the organic matter was confined to one location and is a result of the ground being uncovered for six weeks which allowed seeds to sprout.
- 6.1.3 The concrete slab has since been poured and it is no longer able to be easily observed whether there is organic matter underneath the slab.
- 6.1.4 After the site engineer reviewed the sample areas, he confirmed the site scrape had been carried out; identifying the hardfill layer was lower than the adjacent ground. I consider this in conjunction with the earthworks contractor's statement as providing reasonable grounds the site scrape occurred.

- 6.1.5 Both the site engineer and consultant considered the hardfill supporting the slab had the appropriate thickness as specified in the building consent. NZS 3604 defines ‘good ground’ as soil with an ultimate bearing capacity of 300kPa, and this soil capacity was identified underneath the slab.
- 6.1.6 The consultant and site engineer confirmed there is some organic matter, rootlets, underneath the concrete slab. The consultant considered it was part of a deep-rooted vegetation from a previous land use. While the site engineer predicted settlement of 10-15mm was possible, I note the layer depth of 30-50mm required for this degree of settlement was not evident in any of the samples taken.
- 6.1.7 The expert stated he did not observe any clear correlation between the variations in floor level he observed during his site assessment to the possible presence of organic matter underneath the slab.

6.2 Compliance with Clause B1 Structure

- 6.2.1 I must consider whether the concrete slab as built will comply with Clause B1.
- 6.2.2 The performance requirement Clause B1.3.2 states that:
- Buildings, building elements and sitework shall have a low probability of causing loss of amenity [my emphasis] through undue deformation, vibratory response, degradation, or other physical characteristics throughout their lives, or during construction or alteration when the building is in use.
- 6.2.3 A loss of amenity is defined in Clause A2 Interpretation of the Building Code as:
- 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.
- 6.2.4 The consented specification cites Table 4⁹ in NZS 3109¹⁰, which provides the tolerances for the formwork. This standard does not provide the tolerances for the surface finish which are provided for in NZS 3114¹¹, which NZS 3109 itself cites.
- 6.2.5 NZS 3114 provides the tolerances for variations in the concrete surface depending on use and intended finish. The concrete slab is proposed to be covered by tiles and carpet, except in the garage where it will be left exposed. Table 3 of NZS 3114 limits “gradual” changes to 5mm maximum in a 3m length for U2 and U3 finishes (floated and trowelled finishes respectively), except where the floor has a thin sheet or tile flooring, where a 3mm change in a 3m length applies.
- 6.2.6 The expert’s measurements of the present slab levels indicate the tolerances stated in NZS 3114 are likely to have been exceeded in some places. However, the expert has not measured the levels in a 3x3m grid, so an accurate picture of the surface tolerances has not been accurately captured. (I note the tolerances provided for in NZS 3124¹² provide for greater surface tolerances being an 8mm depression to floor surfaces measured between high points 3m apart.)
- 6.2.7 However, while the tolerances stated in NZS 3114 are likely to have been exceeded, I accept that the surface variations in the slab are not untypical of a hand-screeded concrete slab and I do not consider this will result in a “loss of amenity” in respect of Clause B1.3.2 for the floor slab in its present state. I accept the expert’s opinion in

⁹ The table cited in the specification does not exist. I have assumed the applicant meant to refer to Table 5.2 ‘Tolerances for *in situ* construction’. Table 5.2 provides profile tolerances, and similar, but not surface finishes

¹⁰ NZS 3109:1997 Concrete construction

¹¹ NZS 3114:1987 Specification for concrete surface finishes

¹² NZS 3124:1987 Specification for concrete construction for minor works

this respect. I also accept that the bearing under the perimeter foundation thickening is acceptable.

- 6.2.8 However, the floor slab is required to meet the requirements of Clause B1.3.2 for the minimum period stated in Clause B2.3.1(a), being not less than 50 years.
- 6.2.9 I have received evidence from the consultant's report and the site engineer's review regarding the material under the concrete slab, and whether it may affect the amenity of the slab over time should the subgrade consolidate and settle.
- 6.2.10 I am of the view the amount of organic matter under the slab itself is significantly less than identified in the authority's photographs. Should that level of organic matter have been that prevalent, I would have expected it to also be present in the sample areas. The amount of rootlets observed and their concentration is minimal.
- 6.2.11 I consider the limited organic matter is unlikely to cause the slab to settle to an extent that would make it non-compliant. My view is further confirmed by the slab having been in place for nearly a year with no significant settlement or cracking in excess of what may be reasonably expected from a hand-screened residential concrete floor slab.
- 6.2.12 I consider the number and placement of the sample areas as adequate. I agree with the consultant, if the organic matter was as abundant as suggested by the authority, it would be reasonable to see this reflected in the sample areas.
- 6.2.13 Based on the evidence provided, I consider the concrete slab itself will satisfy Clause B1.3.2 for the minimum period required by Clause B2.3.1(a).

7. The decision

- 7.1 In accordance with section 188 of the Building Act 2004 I determine the concrete slab complies with Clause B1 Structure of the Building Code.
- 7.2 I also determine the authority was correct to issue the notice to fix (No. NF0533) based on the information it had at the time the notice was issued.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 24 May 2018.

Katie Gordon
Manager Determinations