

STATEMENT OF EVIDENCE OF EDWARD (Ted) L. BLAIKIE

Personal background

1. My full name is Edward Lancelot Blaikie. I live in Wellington and I am employed by Opus as a senior design engineer.
2. My qualifications are BE (1st Class Honours), ME and CPEng. I am a member of the New Zealand National Society for Earthquake Engineering. I have over 37 years experience in structural engineering, including specialisations in structural design and seismic risk assessment of a wide variety of different types of structures. In the 1990's I carried out a number seismic risk assessments of potential earthquake damage mainly for insurance companies.

Scope of evidence

3. My evidence relates to the recovery period, not the emergency period that immediately followed the September earthquake when the buildings were being placarded under the state of emergency powers. After the emergency period ended the buildings that had been red or yellow stickered during the state of emergency were dealt with by the Christchurch City Council (**the Council**) under the extended powers under the Building Act 2004 that had been given after the September earthquake. Under the 2010 modifications to the Building Act, buildings that had received red or yellow stickers during the emergency period became classified as dangerous or earthquake prone buildings when the emergency period ended. The Council then had to decide what was going to be done next with these buildings. Would they be confirmed as dangerous or earthquake prone buildings under the Building Act and if so what securing or strengthening would be required before the buildings could be safely reoccupied?.
4. I spent 3 weeks (apart from the weekends) in Christchurch, beginning Monday 20 September 2010, to assist in the recovery period from the 4 September earthquake. During this period I spent some of my time working, on secondment from Opus, in a supporting role to Neville Higgs,

the Principal Engineer in The Building Evaluation Transition Team (BETT). My last day with the BETT was 6 October 2010. After leaving Christchurch I had no further information on any changes the BETT may have made to their procedures or what procedures the Council finally followed, other than what was released to the engineering profession.

Principal concerns

5. As a result of my experience with BETT I became concerned about three issues, which I raised with the Council. They were:
 - (a) The Council did not have a clear standard against which engineers could certify that a red or yellow placarded non-residential building was “safe to occupy” and it urgently needed one. The Council needed to receive a certification against this standard before a placard could be removed.
 - (b) The Council needed to obtain expert advice, from GNS or some other organisation or person with relevant expertise, on the risk that the shaking intensity in the Christchurch CBD during an aftershock could exceed that experienced in the September 4 earthquake. I saw this as an aid to establishing the “safe to occupy” standard and as a fundamental input into managing the risk associated with red or yellow placarded buildings.
 - (c) I was also concerned about the process by which changes might be made to the initial placard. I urged Neville Higgs to resist a proposal to have teams of BETT building inspectors, possibly accompanied by a structural engineer, inspect red or yellow placarded non-residential buildings and potentially recommend a change in the designation to green after only a brief examination. In my view these buildings had been designated as “dangerous or earthquake prone” following the end of the emergency period and this designation should not be removed without a detailed assessment by a suitably qualified structural engineer. I was so concerned about this proposal that I made my concerns known to the highest level of the Council management.

6. I first became aware of this proposal during my second week in Christchurch when I returned to the BETT, either on Wednesday the 29th September, or on the following day. My understanding is that the proposal originated from outside the BETT. Initially the proposal seemed to apply to both red and yellow placarded buildings and did not necessarily involve a BETT engineer. I was on holiday in the Wairarapa on the Friday until the following Monday and when I returned to the BETT on Tuesday the 5th October the proposal, at that stage, applied only to the yellow placarded buildings and it was unclear whether a BETT engineer would be involved in every reclassification of non-residential buildings.
7. I now expand on these issues.

Lack of a clear standard

8. I saw the damaged buildings in the CBD as a risk management problem. My observation was that the Council saw it more as a bureaucratic exercise where, under the Building Act, buildings had been deemed dangerous or earthquake prone and all that was required was to put a "notice to fix" on them requiring the owner to fix the damage identified on the notice. The Council did not appear to be thinking about the issue as one of risk management. I saw the appropriate risk management process as one of assessing the risk, setting the appropriate standard for the buildings to be safe to reoccupy and then ensuring the standard was adhered to by building owners before the buildings were reoccupied.
9. I could not identify anyone in the Council management structure with responsibility for these damaged buildings who had any experience in assessing earthquake risk buildings, or risk analysis, or any of those sorts of experiences in their skill set. I found it incredible that the BETT appeared to have been set up to manage the risk associated with the damaged buildings without this expertise in its management structure.
10. I thought that the BETT process required, as part of the management structure, structural engineers experienced or qualified in assessing

earthquake damaged buildings. An alternative would have been for the management to have a team of high level advisors that included people experienced in seismic hazard assessment and the seismic risk assessment of buildings.

11. As I have already noted, the recovery period was concerned with the issue of what should be done next with buildings that had been red or yellow placarded and as a result were classified as dangerous or earthquake prone under the Building Act. Although the New Zealand Society of Earthquake Engineers had set out a process to follow in the emergency period, there appeared to be nothing in place for the recovery period other than an expectation that there would be detailed analysis of the damaged buildings.
12. Before I first went to Christchurch I had a discussion with my friend David Spurr, who is the seismic risk analyst who was primarily responsible for formulating EQC's earthquake risk model and has also been involved extensively in Japanese risk modelling, mainly for insurers. When the first rupture occurred on the Greendale Fault you could see it pointing to the heart of Christchurch and I could imagine it extending right under Christchurch. I had asked David - what is the chance of slipping of the next segment of the fault extending right under Christchurch? He had done some research and could not find an example anywhere in the world where slipping of an adjacent segment had been triggered to this extent on one of these side faults. David could find examples where that had happened on the plate boundary, but not on one of these immature side faults. He thought the risk of the whole segment slipping was very low.
13. If the Greendale fault extended under Christchurch and the whole next segment extending under Christchurch slipped I would have expected an event of similar magnitude to the September 4th earthquake. As the earthquake would have been much closer to the CBD I would have expected it to produce a similar intensity of ground shaking and similar, but more widespread, damage to that caused by the February 22nd event. However, as a result of my discussion with David, I largely discounted the risk of shaking of this intensity occurring.

14. When I went to Christchurch I was initially involved in looking at some of the damaged buildings for Opus clients. The question I kept asking was – what is the standard that these buildings had to meet for them to be safe to be re-occupied? Who was setting the standard? Nobody I spoke to knew.
15. On Thursday 23rd September I was sent into the Council to work in the BETT. The first day I went around reviewing traffic barriers with another Opus engineer, John Mitchell. When we were out on that first day I asked John, was there anybody in the Council trying to establish the standard that these damaged building had to meet before they could be reoccupied and he didn't know of anybody.
16. The second day I went out with a BETT building inspector. At that stage we were mostly looking at buildings where the public had written in or phoned in about what they thought were issues of safety. These requests were called Client Service Requests (CSR's) and the council required the BETT to investigate them.

Insufficient focus on aftershock risks

17. The next week I was again initially assigned to looking at building for Opus clients. Before I had gone down to Christchurch I had asked David Spurr about the risks I would be running personally, when I went into the damaged buildings. I asked him what he thought the aftershock risk was.
18. David did a back-of-the envelope type risk analysis for me that showed that the risk of getting a magnitude 6 aftershock was about 1% per day at that time and, if the aftershock was centred in its most likely location at the eastern end of the Greendale fault rupture, the average shaking intensity that he would have expected in the CBD was somewhere between 55 and 85 percent of what had been experienced in the September earthquake. That struck me as being a relatively high risk as the probability of a magnitude 6 aftershock at the eastern end of the Greendale fault rupture (at that stage a little higher than the western end) would have be about 0.6% per day. This could be compared with the

probability of an ordinary building design level earthquake occurring, prior to the September event, of 0.2% per year. This indicated to me that the seismic risk in the CBD at that time was much higher than it was prior to the September earthquake.

19. David sent me this assessment in an email dated Monday 27 September 2010 and on 28 September I forwarded to John Mitchell in the BETT group and suggested he show it to the rest of the BETT so that they would have a better understanding of the aftershock risks. The following day (Wednesday the 29th), when I was sent back to the BETT, I went through David's risk assessment with Neville.
20. On Wednesday 29 September, when I started talking to Neville I concluded he was struggling a bit because he was starting to get reports from engineers and he was wondering how to respond to them. I suggested to him that there needed to be a standard that needed to be met before a building was considered safe to occupy.
21. I pointed out to Neville that if one of the damaged buildings received a report from an engineer saying it was safe to occupy, and this was accepted by the Council, and subsequently there was a big aftershock and someone was killed, the Council wouldn't be in a defensible position if it had accepted a building could be safely reoccupied but it was unable to point to the standard against which this assessment had been made.
22. The following day (Thursday 30th) in my first email to Neville (I do not have a copy of this email as it was sent via the BETT internal mail system) I advised him to engage GNS to give an estimate of the probability of the September shaking intensity being exceeded and also the one third of new building standard shaking intensity being exceeded for any particular building in the CBD. I also expressed the opinion that we needed to concentrate on the CBD buildings because at that stage there seemed to be a lot of effort going into domestic residential buildings, which I considered to have a relatively minor risk associated with them from a life safety point of view and very little effort was going into what I thought was the real risk, which was yellow and red placarded buildings in the CBD.

23. At this time Neville was of the opinion that the standard for “safe to occupy” should be set at 1/3rd New Building Standard and I was concerned that engineers might argue that a particular building would meet this standard because it had been through the September event and was still repairable. I thought Neville needed to be in a position to respond to this argument. I also thought that the GNS analysis results would be highly relevant to establishing the appropriate standard for “safe to occupy”. The reason for wanting GNS to compute the risks for a particular building was because of the likely variation in the shaking intensity in the CBD during the September event. The shaking intensity in the CBD probably varied between 50% and 150% of the mean shaking intensity so that the shaking intensity that a particular building could have been subjected to could have varied by a factor up to 3 depending on whether the building was located at the high rather than low intensity shaken site in the CBD.
24. I sent a second email to Neville on Monday 4 October while on leave in the Wairarapa that included an attachment with an update of the aftershock risk assessment David Spurr had done. In the attachment I again suggested that Neville needed to get a proper aftershock risk assessment done, and that he could not rely on David’s back of the envelope effort to assess the risk. However, I did not find Neville very comfortable with this risk analysis approach to the problem. My understanding is that his background was mainly in roading engineering and what he said to me when we discussed David’s initial aftershock risk assessment left me with the impression that he thought seismic hazard assessments were a bit academic.

Reliance on Building Act standard

25. Neville and I drafted a notice to go out to the building owner’s engineers that were involved in the inspections, saying that buildings had to meet more than one third of the new building standard before they would be considered safe to occupy. Neville’s opinion was that this was the correct standard because the Building Act regulations use this as the standard in relation to earthquake prone buildings. It was unclear to me what the

standard should be. However, I was not too concerned at the time what standard was set. I was more concerned that engineers, making assessments for building owners, had a uniform standard to work to for safe to occupy. I thought that once the standard was released the engineering profession would have an opportunity to provide feedback and the standard could be varied up or down as required.

26. I was aware at the time that setting the standard for safe to occupy was a complex issue as it was dependant on both the level of aftershock risk and, in a democracy, also on the Christchurch community's tolerance for risk. Both of factors were varying with time. At that stage of the recovery period, the seismic risk was falling rapidly with time and I felt that the community's tolerance for risk was higher than normal because of an obvious strong community desire for the City to return to normal as soon as possible. Ideally, I now think that the standard adopted for safe to occupy, along with an aftershock risk analysis, should have been released to the community to enable it to provide feedback as it is the community ultimately that has to balance the costs of social dislocation and the economic costs of a slower recovery against the risks associated with reoccupation of damaged buildings.
27. The result of this was that Neville got agreement that this proposed standard be sent back to the engineers who had submitted reports with a requirement that they certify that the buildings were not dangerous. In other words, that the building met the more than one third of new building standard. I do not know who Neville approached to obtain approval for the standard but I remember him saying that he was waiting for approval and later that he had obtained approval.
28. Before I went down to Christchurch, the Council had passed a resolution to say that buildings had to be strengthened to two thirds of the new building standards and when I first went down to Christchurch I asked people whether that was the standard that had to be met before red and yellow stickered buildings were safe to occupy. Nobody I asked was able to give me an answer to this question.

29. When I was doing my building assessments in the BETT and for Opus clients I was thinking that the buildings without placards or with green placards should be able to go through a similar level of shaking intensity to what they had experienced in September if they were not to be reclassified as red or yellow. At the time I thought that most other engineers doing similar work were instinctively thinking in a similar way. In retrospect, I am not confident I had any insight into how other engineers were thinking.

Concerns regarding green stickers

30. In addition to the problem of no prescribed standard there was a problem about having the time required to do building assessments in sufficient detail that a conclusion could be reached that any standard was met. Quite a lot of study is required to make that decision. It cannot be done in an hour or so. For some buildings it is several days or even weeks of work, particularly for some of the masonry buildings for which the engineering assessment procedures are limited and underdeveloped. There was a lot of pressure to get the buildings re-occupied, coming from both the community and owners of buildings.
31. One of the issues that came up was if the building had a red or yellow sticker a detailed investigation should have been required of that building before it was re-occupied. However, if it had been given a green sticker in the emergency period there was no legal requirement for the building to be re-assessed. However, that green sticker had often come from an assessment that was based on no more than someone just walking around the building and checking it from the outside to see if they could see damage.
32. In the situation the City was in after the September earthquake it had to try to identify the biggest risks, and concentrate on them. The placarding system is what I would call a triaging system. There probably wasn't the resource to deal with all the buildings in Christchurch and I saw what was going on in the early recovery period in that light even though it was clear that there were deficiencies in some of the initial assessments. I went into a green stickered building that supposedly was undamaged and I

saw significant damage, so I knew the system was not perfect. This was a building at 78 Cashel Street, which I understand was demolished after the February event. I don't think anyone had been inside the building before putting the original green placard on it. One of the tenants of the building raised concerns about the building because of obvious damage to it and asked the Council if someone could have a look at it. That is why I became involved with this building. My recollection is that the Building inspector and I had a Client Service Request form for the building which included a copy of a letter or email from the tenant.

33. As a result of my review of the building and the concerns I had relating to the precast panel fixings, the pub next door had been closed for a night and a day and I became aware there were quite a lot of internal consequences at the Council about that. I had concerns about the Cashel Street building because the stair landings had slumped on all levels and there was some spalling at the base of some second floor level columns. I remember helping the building inspector fill in a Level 2 report for the building. This report recommended a detailed structural evaluation which I thought was appropriate before the building status was changed. However, from the damage I could see, I did not think the building was dangerous and needed to be immediately vacated.
34. I did not inspect the whole building and was unsure what the structural system was. I could see that some of the beams were structural steel but could not tell if the columns were also structural steel with concrete fire proofing encasement. Also, I did not know if the building had shear walls in both directions. To make further progress I would have needed access to the building's structural plans and I saw my BETT role as identifying the need for a detailed structural analysis rather than carrying it out.
35. In the week following my visit to the building there was a meeting to discuss the Council's response and whether or not closure of the pub next door was appropriate. At the meeting I heard that there was a Beca report on the building that stated that it was undamaged. The next day, September 29th, I told Esther Griffiths, the BETT group manager, about the damage I had seen and indicated that the green sticker might be

inappropriate. I do not know what happened after that because I was not further involved. I do not know whether the building was re-classified.

Reliance on Council building inspectors

36. I was also very concerned about the Council's proposal to have teams of building inspectors, possibly accompanied by an Engineer, assess non-residential buildings and potentially recommend reclassifying the placarding. My concern was that a building inspector making a cursory examination would not have the skill or experience to do this properly. Even an engineer making a cursory examination was not appropriate. I was aware that a lot of building owners had qualified engineers looking at their buildings in more detail and determining what needed to be done and the Council's proposal seemed to be an almost duplicate system, where engineers were conducting detailed inspections for owners and the BETT was trying to repeat the exercise in a questionable manner using building inspectors.
37. It appeared to me that it was proposing to do these re-assessments in this way because the Council believed it had an obligation to issue notices to fix under the Building Act. Therefore it had to determine what the damage to be fixed was so it could issue these notices. I considered what the Council was proposing was unsound. The Council was asking building inspectors to just make a cursory examination and from that to determine what needed to be done to make the buildings safe to occupy. I told the Council staff I was dealing with that I thought this was unsound and if one of those buildings subsequently collapsed and killed someone I did not think the Council would be in a defensible position. The building inspectors simply did not have the expertise or training to do what they were being asked to do.
38. Even an engineer making a very cursory examination was not appropriate. I could not see the point of the building inspectors, possibly accompanied by an engineer, going around and inspecting these buildings and determining what needed to be done to them when there were suitably qualified engineers looking at these buildings in more detail for the building owners and determining what needed to be done. There

seemed to be parallel systems running. Non-residential building owner's engineers reporting to Neville in the BETT stating what needed to be done to make buildings safe to occupy after a detailed examination. At the same time, BETT building inspectors, with or without a BETT engineer, were trying to determine the same thing after a cursory examination.

Concerns raised with Council

39. I felt very strongly about this issue, which I considered completely indefensible and I felt an obligation to raise this. On Monday 4 October, while on leave in the Wairarapa, I had emailed a long note to Neville that set out the concerns I had at the time, including the above issue. When I returned to the BETT the following day I talked at some length to Neville about the issues I had raised in my note to him. He did not agree that there was a problem, but he agreed to show my email to Esther Griffiths. John Mitchell was also present during this discussion and I showed a copy of my note to him as well. I got Neville's approval to take it to Esther Griffiths, who was the manager of the BETT group. I talked to her and told her I believed the current proposals were not sound as they were based on a building inspector being able to determine if a building is earthquake prone. After getting her approval I got to take the issue to Steve McCarthy. He was the next level of management up. I then spoke to him and he agreed to take my note to Peter Mitchell. On Wednesday 6 October after giving further thought to this issue overnight and after making further enquiries that appeared to confirm that there were no CPEng engineers in the chain of command above the BETT I sent an email to Peter Mitchell that attached my note to Neville. I recorded that I had an ethical duty to bring my concerns to the attention of the first CPEng. qualified engineer in the management structure above the BETT.

Engagement with BETT terminated

40. Later that day I was told by Sheryl Keenan of Opus, who was allocating the engineers from Opus to various Opus clients, that I would not be going back to the BETT. I was told this in a phone call when I was out with two building inspectors. My understanding was that she had been contacted by someone at the Council and she was conveying what she

had been told to me. She did not tell me who at the Council had told her to tell me this. I had little doubt that this was the result of the email I had sent to Peter Mitchell.

Other issues of concern

41. When I returned to Wellington and thought about the process that the BETT was possibly using at the time to issue “notices to fix” there was a further issue that concerned me. This was that, when the building inspectors and engineers were going around completing the level 2 assessments of the yellow and red placarded buildings, if they did not tick a box on the forms saying the building required a detailed structural report then, effectively, the damage identified on the form would be converted into a “notice to fix” and no further detailed engineering assessments would be made. If the owner then fixed the damage on the notice the owner would assume that the building was then safe to occupy. The engineer was effectively certifying the building as safe to occupy after the damage on the notice had been fixed.
42. I saw this as a risk for the engineers doing the work in the BETT and advised Neville Higgs of this in my third email to him, on 13 October. I also sent an email to the Opus principal structural engineer in Christchurch recommending that he let the engineers who were completing the assessments know this, so they would at least be aware of what could happen if they did not tick the box. I was aware that some engineers when they were filling in these Level 2 forms did not even fill in that section of the form.

Concluding thoughts

43. Overall my conclusion from what I experienced was that the Council saw the process required to manage the damaged buildings as a bureaucratic exercise dictated by the Building Act. It seemed to me that the Council saw a series of boxes they had to tick off. The Building Act said that if these buildings are dangerous or earthquake prone the next step is for the Council to issue a notice to fix. So that is what they were required to do. Although I did not see any of these steps as straightforward I thought

that the correct process for the Council to adopt was one of risk management where the Council ensured that the seismic risk from aftershocks was assessed, a standard that the damaged buildings would need to meet before they were safe to occupy was established and a process was developed for ensuring this standard was met by building owners.

44. I did not think that the BETT had adequate engineering and building inspector resources itself to determine what work was required to the red and yellow placarded non-residential buildings before they were considered safe to occupy. I considered this assessment work to be the responsibility of the building owners and their engineer advisors. I saw the Council's role as ensuring that a suitably qualified engineer was engaged by building owners and then reviewing the engineer's report.
45. On Monday 11 October after I returned to Wellington I telephoned John Buchan. I had been at a meeting of engineers interested in the earthquake recovery at the University on the evening October 6 or 7 and John had fronted for the BETT at that meeting. I noted at the meeting he was a CPEng and thought he might have some responsibility for the BETT. I passed on my concerns to him. I told him I had not had a response from Peter Mitchell, other than being sacked. I asked him if there were any engineers in the management structure above the BETT and he said he didn't think there was. He had no responsibility personally for the BETT and although he agreed to follow up my concerns said he was not in the habit of second guessing the decision of his superiors. I heard nothing more.
46. I hope that this statement will assist the Commission develop recommendations that will enable Local Authorities to strike the difficult balance between the social and economic dislocation costs, and life safety risks in the recovery period following future earthquakes.



Edward L Blaikie

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