

UNDER	THE COMMISSIONS OF INQUIRY ACT 1908
IN THE MATTER OF	ROYAL COMMISSION OF INQUIRY INTO BUILDING FAILURE CAUSED BY THE CANTERBURY EARTHQUAKES
AND IN THE MATTER OF	THE CTV BUILDING COLLAPSE

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**CLOSING SUBMISSIONS ON BEHALF OF GEOFFREY NIGEL BANKS**  
3 September 2012

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**Duncan Cotterill**  
Solicitor acting: Helen Smith  
PO Box 5, Christchurch

Phone +64 3 379 2430  
Fax +64 3 379 7097  
h.smith@duncancotterill.com

## Introduction

1. Mr Banks involvement with the CTV building was in the early 1990s and was limited to retrofit work to install drag bars addressing an area of non-compliance which had been identified by Holmes Consulting Group (HCG). It was accepted by Mr Banks that once HCG had raised the issue it was for Alan Reay Consultants Limited (ARC) to deal with it. Mr Banks communicated with Mr Hare and Mr Wilkinson of HCG to ensure that his understanding of the issue was correct and addressed the concern that HCG had identified.
2. Mr Banks had no involvement with the original design or construction of the CTV building. Mr Harding had left ARC immediately prior to Mr Banks joining the firm. Mr Banks recalls being told in 1990 that Mr Harding had designed the CTV building but he was not briefed on Mr Harding's experience with this type of building. In evidence he said that this was relevant information which, if it had been given, might have affected his inquiries<sup>1</sup>.
3. Mr Banks was advised by Mr Hare of HCG that he had identified an issue with the connection of the diaphragm to the north core and was later provided with a report from HCG which identified the "area of concern" as the tying of the floors to some of the shear walls but which also stated that "The layout and design of the building is quite simple and straight forward and generally complies with current design loading and materials codes". Mr Banks does not know who provided the HCG report to ARC.

## The HCG report

4. Mr Banks relied on a number of issues including the HCG report in focussing on the specific area of concern that was raised by Mr Hare, and not undertaking a general review of the design. In particular, that a number of people had reviewed the building before Mr Banks. He referred to Dr Reay, the draughts people, Council, the inspectors, and the contractors<sup>2</sup>. The reference to contractors is relevant because Mr Banks' evidence was that the lack of ties would have been evident on site to a contractor or inspecting engineer. Mr Banks also relied on his review of the calculations. It appeared to him as though there was a page missing or omitted in the calculation process and it seemed quite clear that

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<sup>1</sup> TRANS.20120817.52, L16 and TRANS.20120817.53, L4

<sup>2</sup> TRANS.20120817.46, L28-33

there was a problem in this one area because the calculations had stopped short in that area. Mr Banks' evidence was:

... there was nothing else that alerted me, particularly the fact that I'd read the Holmes report, there was nothing else that alerted me to any red flags about the overall building design.'

5. Counsel Assisting submits that the attempt to rely on the HCG report is disingenuous. That is rejected. Although Counsel Assisting says the report is clearly limited, it is submitted that this is not the case. Care must be taken when reviewing a document within the benefit of hindsight and dissecting its contents, now knowing all of the issues that are now being examined and questioned. At the time the report was not identified to him as being a draft, did not cause Mr Banks to consider a more detailed review should be undertaken, and it is submitted it would not having regard to the fact that he was not privy to any other information about original design or construction. The HCG report stated that HCG had:
  - 5.1 Reviewed a full set of architectural drawings and some structural drawings made available by Alun Wilkie Architect;
  - 5.2 Viewed the full design, documentation, Soils Investigation and a complete set of drawings at the office of ARC;
  - 5.3 Spoken with Council to discuss any concerns relating to the building permit and construction process;
  - 5.4 Undertaken an inspection of the building (excluding levels 1 and 4).
6. It is accepted that the report notes that HCG's review was brief, but the review undertaken nevertheless appeared extensive and there was nothing to indicate that a further general review was required. The reference to viewing a complete set of drawings is significant. These were ARC's full set of structural drawings. Further, there was nothing in his subsequent discussions with Mr Hare and Mr Wilkinson that led Mr Banks to believe a further general review of the building was warranted. Mr Hare accepted that he did not speak to Mr Banks about any other issue other than the lack of ties on lines D and D/E after its review was undertaken<sup>4</sup>. Mr Banks also gave evidence that it was clear in his later

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<sup>3</sup> TRANS.20120817.3, L28-33

<sup>4</sup> TRANS.20120816.71, L14-19

discussions with Mr Wilkinson that HCG's concern was limited only to the tying of the floors to some of the shear walls<sup>5</sup> and that Mr Wilkinson advised that HCG had no concern with the other walls<sup>6</sup>. At no time did HCG suggest that there were any other issues identified or that their report was limited such that a further more general review may be warranted. Ultimately, there was nothing to indicate to Mr Banks that a further more general review was required.

#### **The retrofit works**

7. Counsel Assisting submits that Mr Banks' subsequent conduct was influenced by liability concerns. It is implied that Mr Banks' actions were affected by the prospect of a claim; the suggestion is that a full review was not undertaken for fear of a claim if the sale did not proceed. Mr Banks rejects this suggestion entirely. There is no evidence to support it. Mr Banks accepted ARC's obligation to follow through with addressing the problem, and did so. ARC carefully followed normal notification processes with its PI insurer. This is a process consistent with PI insurer requirements and is quite formal, but did not prevent ARC from rectifying the problem. Mr Banks had noted that "preliminary advice from insurance point of view is no further action". However, ARC did not allow the matter to rest there. The fact that advice was sought and paid for by the insurer suggests that ARC was taking a contrary position to that advised to it by its insurer and was seeking to notify the new owner of the issue in spite of the preliminary insurer's advice, as it ultimately did.
8. Counsel Assisting submits that there was a "charade" perpetuated by Mr Banks in relation to the H12 bars. It is submitted that Counsel Assisting has misunderstood the evidence. Mr Banks evidence was that:

From the drawings it appeared that there were only a limited number of light 12 millimetre diameter reinforcing bars ... although their location was not clear and there were no larger ties to the floor. It appeared therefore that the effectiveness of the wall system to carry north-south seismic loads may have been reduced without better tying of the two eastern walls to the floors. These walls are in gridlines D and D/E.<sup>7</sup>

9. This is a straightforward factual matter, stated accurately and consistent with the observations of HCG. Mr Banks has never suggested that the presence of H12

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<sup>5</sup> TRANS.20120817.3, L2-4

<sup>6</sup> TRANS.20120817.18, L29-30

<sup>7</sup> TRANS.20120817.6, L8-15

bars would have had anything other than a minor benefit. However, it had been suggested to him by Dr Reay that the area of non-compliance might have been addressed in construction. For that reason, holes were drilled in October 1991, prior to the installation of the drag bars. Through those investigations the presence of some H12 bars was located. The location of H12 bars only meant the issue had not been resolved in construction, not that the H12 were unexpectedly located. The suggestion that the issue had been rectified in construction had been made by Dr Reay and Mr Banks reasonably thought it may have because the building had been given a building permit.<sup>8</sup>

10. The remedial works were undertaken 21 months after the issue was identified in early 1990. There was a difference of opinion between Mr Robertson and Mr Wilkinson as to whether the time taken was reasonable. Mr Robertson believed that the matter should have been dealt with more expeditiously and gave the timeframe of 3-6 months. Mr Wilkinson considered a longer time frame of 21 months was acceptable in the circumstances. He drew an analogy to the time the CCC allowed for earthquake-prone buildings to be upgraded, which is far in excess of 21 months.
11. Counsel Assisting submits that neither Dr Reay nor Mr Banks could satisfactorily explain that delay. Mr Banks held no information in his own right relating to the building. He relied on information provided by Dr Reay. Mr Banks' evidence was that there is a gap in documentation between April 1991 and September 1991 and he cannot remember what occurred during that period<sup>9</sup>. Mr Banks therefore accepts that he could not, because of circumstances and 21 years passed, explain the delay. It is submitted that care needs to be taken if the Royal Commission intends to draw conclusions about the delay because the gaps in the evidence do not establish what the reasons for that delay are. Mr Banks accepts that the process took longer than desirable but this was impacted by the lack of communication from the owner, both with ARC and the subsequent purchaser.
12. Counsel Assisting has submitted that further clarification of an engineer's ethical obligations is required particularly where the owner is a receiver whose first obligation is to the debenture holder and, absent any misrepresentation, the receiver may for this reason feel obligated to avoid disclosure of a critical structural weakness as they appear to have done in this case. This may be an

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<sup>8</sup> TRANS.20120817.59, L28

<sup>9</sup> TRANS.20120817.22, L1

issue that the Royal Commission sees fit to address. Mr Banks' position, however, was that he had notified the owner and he did not consider that the owner would measure that information against obligations to the debenture holder in the way that has now been suggested by counsel assisting.

13. Counsel Assisting submits at para 619 that Mr Banks may have been "laying low", perhaps hoping the problem might disappear". The submission is inflammatory and there is no evidence to support it. To the contrary, Mr Banks had raised the issue with the receiver and he and Dr Reay had met with them. Mr Banks did not seek to down play the issue. It is notable that KPMG had a copy of HCG's report which referred to the issue as an "area of concern" and one that would in the event of an earthquake means that "the building would effectively separate from the shear walls well before the shear walls themselves reach their full design strength". KPMG also referred in its letter of 2 February 1990 to non-compliance with the current design codes.
14. There was no "laying low". ARC actively sought out the new owner when it became aware that the building had been sold. Although in a very technical sense ARC had complied with the letter of the IPENZ ethical obligations which is to advise the owner of the problem Mr Banks did not rest on having advised KPMG. It was a surprise to Mr Banks that KPMG appeared not to have passed on to the purchasers information it held as to the issue that had been identified.
15. Mr Banks does not accept (and did not accept in cross examination) that he had adopted the attitude that the issue was not overly significant<sup>10</sup>. He did not attempt to minimise the reality of the situation in his dealings with KPMG or, later, with Madras Equities. Mr Banks' evidence was that although the repair might be considered minor he would not have advised that the problem was a minor nature because "the issue was a serious one that needed to be addressed".<sup>11</sup> That he did not attempt to minimise the reality of the situation is also reflected in Mr Ibbotson's letter of 30 September which confirms ARC's advice that there may be an engineering design fault omission in the structure which could impact on insufficient loadings to meet normal earthquake requirements<sup>12</sup>. Mr Ibbotson was clear in his response to questioning that he was aware of the significance of the problem.

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<sup>10</sup> TRANS.20120817.78, L17

<sup>11</sup> TRANS.20120817.25, L17-18

<sup>12</sup> BUI.MAD249.0129.50

16. Much has been made of who paid for the remedial works. The ultimate obligation for payment for the remedial works is completely irrelevant to the work that was undertaken and why. If this is an attempt by Counsel Assisting to use this as a means to tarnish the design undertaken by Mr Banks, it is rejected. The matter of payment was to be addressed in a meeting between ARC and Madras Equities Limited<sup>13</sup>. No evidence was adduced as to whether that meeting took place and if so, what was discussed at that meeting and why Madras Equities Limited paid for the works. It is inappropriate for criticism to be levelled at Mr Banks when he was not involved in that meeting, when the reasons for payment have not been fully explored and also when, ultimately, who bore the cost has no impact on whether the works were designed to meet the Standards of the day.

#### **Design to NZS 4203:1984**

17. Mr Banks designed the drag bars to exceed by some margin the Standards of the day. Hyland and Smith appear to suggest that whilst the drag bars met the NZS 4203: 1984 they do not consider they would have met best practice at the time. The reason for that has not been explored and it is submitted can only be explained by witnesses approaching matters with the benefit of hindsight. It is submitted that Standards are used to reflect industry best practice. It is accepted that in some cases Standards may not always reflect the most current research and developments as there can be a “lag”. For that reason it is accepted that designers must be aware of on-going developments and ensure that they comply with best practice. In terms of the retrofit works, Mr Banks designed according to the relevant Standard and best practice. There was no lag between NZS 4203:1984 and best practice. The first amendment to NZS 4203:1984 was in 1992 and included no changes that would have impacted on the retrofit works<sup>14</sup>. Mr Banks cannot be criticised therefore for failing to meet either the code or best practice requirements.
18. The criticism of Mr Banks appears to be that he did not take “a conservative approach of installing drag bars on all Levels”. It is not clear what is meant by “a conservative approach”. Dr O’Leary did not raise any issue with the lack of drag bars on levels 1 and 2; he considered those levels complied without the drag

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<sup>13</sup> Refer BUI.MAD249.0129.53

<sup>14</sup> TRANS.20120817.15, L20-25

bars and further considered drag bars could possibly also have been omitted one floor higher<sup>15</sup>.

19. Counsel Assisting relies on HCG's preliminary assessment of a remedial design to support his submission that the easy approach would have been to install drag bars on all levels. He also relies on the cost of the works. It is submitted that the cost of the remedial solution is irrelevant. What Mr Banks did was undertake detailed calculations to confirm the deficiency and the remedial solution required. As noted by Counsel Assisting Mr Banks said that it was not simply a matter of taking the easy approach, but rather a matter of properly calculating the loads. Mr Banks went further to say that as an engineer he looks to whether and where the strength is needed and that is what he did in this case<sup>16</sup>.
20. Counsel Assisting submits at para 337(h) that Mr Banks should have used capacity design. It is not clear what basis this is proposed other than it is understood that this is now current practice. However, this was not a requirement of the Standards, and so is irrelevant to compliance of the retrofit works. In fact, the Standards specifically provided for an alternative to using capacity design.
21. Mr Banks rejects the submission that the "easy" course was not adopted because it may have been part of the culture developed under Dr Reay which Mr Harding described as detailing only what was absolutely necessary. Mr Banks' evidence is that he was not working to the limit of the code and he was not aiming just to meet the code. The design had a number of conservatisms which Mr Banks had applied. In particular, Mr Banks had determined the relevant loads according to the Parts and Portions but agreed in a discussion with Mr Wilkinson to round those up by 7% and 30% as appropriate to 300 kN. Further, although the ties were not required to transfer the weight of the walls that was included in the calculations that were undertaken thereby adding another 11-12% of conservatism into the design<sup>17</sup>. This was not an approach consistent with designing to only what was "absolutely necessary".
22. Counsel Assisting relies on evidence from Dr Priestly and Dr Jacobs. However, neither appears to have reviewed the calculations undertaken by Mr Banks or Mr

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<sup>15</sup> TRANS.20120813.38, L31

<sup>16</sup> TRANS.20120817.28, L20-23

<sup>17</sup> TRANS.20120817.28, L22-.29, L7



Hare. Further, it is submitted that their comments need to reflect that they are necessarily approaching this issue with the benefit of 22 years of hindsight and engineering development. It is significant that both ARC and HCG reviewed the matter in 1990 and independently came up with very similar solutions to the issue which had been identified.

23. Dr Jacobs says that the drag bars should have extended back to line 3. Counsel Assisting relies on this statement in his submissions. However, Dr Jacobs has not commented on how that might have been achieved given there was a beam in the way preventing extension of the angle directly back to line 3. Mr Banks does not accept that the drag bars needed to connect to the slab back to line 3 to be effective and neither, it seems, did Mr Hare.
24. It is notable that HCG's design was a very similar solution to that designed by Mr Banks and both solutions were reached independently of the other. However, it is submitted that any comparison beyond that and specifically with regard to the detail of the HCG preliminary assessment of a remedial design is inappropriate. It is acknowledged that the HCG design indicated drag bars on each level but the solution was developed prior to the discussion between Mr Banks and Mr Hare regarding redistribution on the lower floors. Mr Hare had agreed that redistribution could be considered, but had not done so in his earlier calculations. However, care needs to be taken when relying on that aspect because a detailed design was not undertaken by Mr Hare for all levels. Mr Hare had simply undertaken a preliminary design for costing purposes at level 6 where the loads were higher and therefore the likely remedial work would be higher. Mr Hare then simply applied that across all floors.
25. It is submitted that the comparison with Mr Hare's design therefore is inappropriate; it is not comparing like with like. Mr Hare's design was not a final design; it was a possible remedial detail developed purely to establish cost. Mr Hare acknowledged that he was making an unfair comparison<sup>18</sup>, he accepted that he had used the highest floor where the loads were highest and therefore the greatest amount of remedial work was required and applied that down the rest of the building. In his words it was not "refined at all"<sup>19</sup>. The differences and errors in the conclusions reached by Mr Hare were dealt with in cross examination<sup>20</sup>. Counsel Assisting has drawn on only one of those, possibly

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<sup>18</sup> TRANS.20120816.76, L8-11

<sup>19</sup> TRANS.20120816.73, L10-30

<sup>20</sup> TRANS.20120816.76, L21-.82, L8

because of the concessions made by Mr Hare. He submits that the drag bars detailed by Mr Hare were longer than those which Mr Banks designed. The real issue, however, is that Mr Hare's design only had an overlap with the floor slab of 1350mm compared with the ARC design which had a longer overlap of 1700mm<sup>21</sup>. Ultimately, the drag bars as designed by Mr Banks were stronger than the equivalent similar design by HCG at the time, with more steel area, a longer drag bar overlap with the floor slab, and removing less of the floor to effect the repair.

26. Mr Hare said that he would not have agreed to omit the drag bars at the lower two floors. However, he acknowledged that his evidence was affected by hindsight. Further, Mr Banks did discuss the issue with Mr Hare in 1990 and no such concern was raised at that time – refer Mr Banks' file note dated 14 February 1990<sup>22</sup>. Mr Hare suggested that Mr Banks' record of the conversation was not correct. It is submitted, however, that Mr Banks contemporaneous file note of the conversation must be relied on in favour of Mr Hare's recollection of what he described as a short conversation some 22 years ago. Mr Banks' evidence was that had Mr Hare raised a concern he would have noted it. He did not.

### **Building permit**

27. It is acknowledged that when the drag bars were installed in October 1991 no separate building permit was obtained from the CCC by ARC.
28. Mr Banks does not accept Counsel Assisting's submission that by not applying for a permit it was a "further attempt to minimise the potential issues with the Building and avoid making the CCC aware of them and enlarging the liability risk that was already a source of concern." There is simply no evidence to support that submission. Mr Banks' evidence was that the building permit process was much less structured that it is now<sup>23</sup> and recent attempts to obtain building permit records of older buildings for post-earthquake assessments have indicated that many records do not show all changes actually made to buildings. To suggest therefore that this was a conscious decision by Mr Banks to minimise issues is grossly unfair.

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<sup>21</sup> TRANS.20120816.81, L1

<sup>22</sup> BUI.MAD249.0130.19.

<sup>23</sup> TRANS.20120817.31, L9

29. In evidence both Mr Robertson and Mr Wilkinson spoke to changes required to the IPENZ code of conduct regarding notification to a territorial authority. Mr Banks would also welcome a change to require engineers who become aware that a building is non-compliant with the code applicable at the time of the original permit should be legally obliged to inform the territorial authority about the non-compliance.
30. Mr Banks was cross examined about the requirements of the permit and the suggestion made that compliance with the permit required a higher standard and a different focus. However, as noted by Mr Banks in re-examination the Bylaw specified that compliance with NZS 4203 shall be approved as complying with the requirements of the Bylaw.
31. Mr Banks' evidence was that the requirements of the Building Act are now quite explicit and that he would expect this type of work to be subject to building consent approval if it were done now. That remains Mr Banks' expectation. However Mr Banks recounted some recent experience which suggests that there may still be some confusion, with some territorial authorities concluding that no consent is required for work to strengthen a building under Building Act 2004, exclusion (ag) of Schedule 1 and that it is for the owner to determine whether the exclusion clause applies.<sup>24</sup>.
32. Clause (ag) states:
- A building consent is not required for the following building work:
- (ag) the alteration to the interior of any non-residential building ... if the alteration does not- (i) reduce compliance with the provisions of the building code that relate to ... structural stability.
33. The manner in which that clause has been recently interpreted means that no consent is required where work is being undertaken which does not reduce code compliance. It also illustrates that Council records will not necessarily be a complete record of work undertaken on a building. The Royal Commission may wish to clarify this issue, particularly in light of the extent of strengthening work to buildings that is currently underway.

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<sup>24</sup> TRANS.20120817.32, L1-26

## Conclusion

34. Mr Banks designed the retrofit works to exceed the applicable Standards of the day. This does not appear to be disputed. Mr Banks gave clear evidence as to the process which he followed and the Standards to which he designed the retrofit works. However, as noted by Mr Banks in his evidence, the Hyland January 2012 report at p119 states:

The Parts and Portions in the NZS 4203: 1984 design provisions for the connection of diaphragms to seismic lateral resisting walls seem inadequate. They did not ensure that diaphragm ties were not a weak link limited the overall strength of the structure under severe seismic demands. The provisions did not appear to account for full displacement and strength demands, or higher mode response characteristics of the structural systems.

35. Mr Banks has acknowledged that he agrees with those comments now, but at the time he applied NZS 4203:1984 as it was the relevant Standard of the day. The fact that no changes were made to that Standard relevant to the retrofit work when it was amended in 1992 also goes to Mr Banks' design complying with best practice.

36. It is submitted that the design of the drag bars is more an issue as to the adequacy of the Standard than the adequacy of the design, acknowledging the significant research in the intervening period resulting in major changes to the Standards. As noted by Mr Banks in his evidence Mr Charles Clifton in table 2 on page 7 of his report of November 2011<sup>25</sup> shows that the diaphragm demand based on the actual ground accelerations was 2,859 kN at all levels of the building. This differs from NZS 4203:1984 which reduced the loads going down the building. It also compares with the diaphragm demand of 1241 kN at the top of the building, reducing to 761 kN at the lower levels, calculated using NZS 4230:1984.

37. In evidence Graham Frost noted that:

The upward slope of the floor slabs towards the North Core is a strong indication that separation from the North Core occurred later rather than earlier in the collapse sequence. If the floor slabs had separated from the North Core before they lost support along the central column lines, I believe that we would have

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<sup>25</sup> BUI.MAD249.0223.7

found them in a more horizontal orientation, or even sloping down towards the North Core, after the collapse. -

38. Regrettably the actual seismic loads applied to the building, based on recent modelling, were substantially greater than anticipated by the Standard of the day. In spite of that, it appears that the drag bars did do their intended task. Mr Frost's observations and comments are consistent with that.

Dated 3 September 2012



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H R Smith  
Counsel for G N Banks

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<sup>26</sup> WIT.FROST.0001.8 at para 33.