Christchurch City Council

UNDER	THE COMMISSIONS OF INQUIRY ACT 1908
IN THE MATTER OF	ROYAL COMMISSION OF INQUIRY INTO BUILDING FAILURE CAUSED BY CANTERBURY EARTHQUAKES KOMIHANA A TE KARAUNA HEI TIROTIRO I NGĀ WHARE I HORO I NGĀ RŪWHENUA O WAITAHA

CLOSING SUBMISSIONS OF COUNSEL FOR CHRISTCHURCH CITY COUNCIL REGARDING THE CTV BUILDING

DATE OF HEARING: COMMENCING 5 AND 6 SEPTEMBER 2012

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1. INTRODUCTION

1. These closing submissions are made on behalf of the Christchurch City Council.

2. The Council proposes to:

   (a) Respond where necessary to the closing submissions of Counsel Assisting.

   (b) Cover other matters which arose during, or were the subject of evidence, at the hearing.

3. These submissions generally follow the order of closing submissions of Counsel Assisting (**The Closing Submissions**), except in relation to paragraphs 151 to 171[1].

4. It is not proposed to canvas the introductory matters raised at paragraphs 1 to 30[2] given that they are covered in more detail later in the Closing Submissions.

5. It is also not proposed to separately respond to the submissions on behalf of bereaved families and those injured. The Council's response to those submissions is covered by its response to the Closing Submissions.

2. THE DESIGN ISSUES

6. The Council does not intend to comment on paragraphs 35 to 121 of the Closing Submissions.[3] At paragraphs 122 to 134,[4] there is comment relating to Mr Harding's role in specific matters of design. To the extent that these matters involve code compliance issues, they are again dealt with later in these submissions.

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[1] TRANS.20120827.CS.41 to .46

[2] TRANS.20120827.CS.5 to TRANS.20120827.CS.14

[3] TRANS.20120827.CS.15 to TRANS.20120827.CS.35

[4] TRANS.20120827.CS.35 to TRANS.20120827.CS.36

3. THE BUILDING PERMIT

7. This section of the Closing Submissions is at paragraphs 135 to 183[5] and relates to the following issues:

   (a) Non-compliance with Bylaw 105 and Codes at the date of permitting of the CTV building;

   (b) Mr Tapper's sign off on structural design and the 27 August 1986 letter from Graeme Tapper to Alan Reay;

   (c) The areas of non-compliance that should have been identified by the Council reviewing engineer.

8. Issues (a) and (b) will be dealt with in a preliminary way now and issue (c) is dealt with later in these submissions.

   (a) The CTV Building did not comply with Bylaw 105 and the Code at the date of permitting (paragraphs 135-150).

9. This section of the Closing Submissions discusses the concept of a shear wall protected gravity load structure, and the use of the non-seismic provisions of NZS3101:1982, leading to the general submission that the application of this approach to the design of the CTV Building did not comply with Bylaw 105.[6] There is then a discussion about various papers and seminars that may have a bearing on this topic.

10. There are two distinct issues to be considered:

    (a) Did the actual CTV design comply with Bylaw 105 and relevant codes?

    (b) Could **any** building be designed with a shear wall protected gravity load structure with the columns and beam columns joints being designed using the non-seismic provisions of NZS:3101:1982?

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[5] TRANS.20120827.CS.38 to TRANS.20120827.CS.54

[6] TRANS.20120827.CS.38 paragraph 139

11. The first question will be elaborated on later in these submissions, in relation to code compliance, but the Council accepts, as it did in opening, that the CTV Building did not comply in certain respects with Bylaw 105 and the relevant Codes. There are however important differences between the submissions of Counsel Assisting and these submissions as to both the interpretation of the Bylaw and Codes and in relation to the extent of the non-compliance of the CTV Building.

12. The Closing Submissions at paragraph 151,[7] state that the absence of guidance in relation to a non-ductile frame structure, together with the warnings set out in an article, illustrate "*the incompatibility of such a structure with the obligations of avoiding collapse and minimising injury and death.*" To the extent this submission is referring to a specific interpretation of Bylaw 105 and relevant standards, that issue is also dealt with later in these submissions.

13. More generally and contrary to what is suggested at paragraphs 142 and 146[8] of the Closing Submissions, the CTV Building was not a "hybrid structure" in the accepted meaning of the term (see clause 3.5.8.1 of NZS:3101:1982). All the loading was intended to be taken in the shear walls.

14. Further, it is submitted that there is nothing in the publications referred to in paragraphs 143 to 150 of the Closing Submissions[9] that would suggest that a shear wall protected gravity load structure **cannot** be designed in accordance with the relevant Codes, although it is accepted that the detailing will be important. This is discussed in more detail later in this evidence.

Design Certificates

15. Paragraphs 173 to 176 of the Closing Submissions[10] refer to use of design certificates in relation to the issue of building permits.

16. As indicated in the Council's opening submissions at paragraph 34,[11] clause 8.2.5 of Bylaw 105 required the designer to provide calculations to

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[7] TRANS.20120827.CS.41

[8] TRANS.20120827.CS.39

[9] TRANS.20120827.CS.39 to TRANS.20120827.CS.41

[10] TRANS.20120827.CS.46 to TRANS.20120827.CS.47

[11] TRANS.20120806.OS.11

establish that concrete elements had been designed in accordance with the requirements of the bylaw, **or** alternatively certify in an approved manner that the design method conformed with a recognised code of practice. It seems clear from clause 8.2.5 that the designer was entitled to make this election rather than the Council.

17. Mr Tapper in his letter of 27 August 1986 requested calculations. This is consistent with the fact that no design certificate had been provided by Alan Reay Consulting Engineer. The Bylaw did not expressly deal with the situation where the Council reviewing engineer was still not satisfied with a concrete design notwithstanding the provision of a design certificate.

18. However, it seems clear that even if the designer did provide calculations or a design certificate in the first instance, the Council could still decline to issue a building permit if it was not ultimately satisfied about compliance with Bylaw 105.

19. The other procedure that the Council could have adopted was to require a Structural Design Features Summary under clauses 2.4.2 and 2.4.5 of Bylaw 105, but this was not a substitute for a design certificate.

20. It is suggested at paragraph 177 of the Closing Submissions,[12] that the Council appeared to attribute a low level of skill to its own staff and their ability to identify design deficiencies or areas of non-compliance. This submission does not fairly reflect the totality of the evidence that was given to the Royal Commission by:

    (a) Mr Peter Nicholls, who disagreed with Mr Henry's view as to the competence of Mr Bluck.[13]

    (b) Mr John O'Loughlin who commented about their competence.[14]

    (c) Professor Mander[15] and Dr Reay,[16] who also commented on Mr Bluck's reputation.

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[12] TRANS.20120827.CS.47

[13] TRANS.20120806.70 L23 - TRANS.20120806.71 L3

[14] TRANS20120814.63 L1-10

[15] TRANS.20120723.17 L11 - 17

21. It is apparent that the design of the CTV Building was challenging for reviewing engineers,[17] but this should not be equated with the notion that the Council's structural design checking engineers had low levels of skill or abilities. They had to deal with a wide range of building designs in the course of their work and were well regarded in the engineering community.[18]

(b) The Graeme Tapper letter of 27 August 1986 and his structural sign off

22. It is now proposed to address paragraphs 183 to 229/119 of the Closing Submissions.[19] This section leads to an ultimate submission that the evidence supports various conclusions set out at paragraph 229[20] and that relevant circumstances do provide a reasonable assurance that the statements are reliable in terms of sections 16 and 18 of the Evidence Act 2006.

23. The key background facts include:

(a) The building permit application was lodged on 17 July 1986.[21]

(b) Structural Drawings were received by the Council on 26 August 1986.[22]

(c) Mr Tapper's letter of 27 August 1986 raised a number of issues by reference to the structural drawings.[23]

(d) Given that the original of the Tapper letter was on the Council's file, it must have found its way back to the Council at some unknown date. Mr Harding identified his writing on the top right hand corner on the front page.[24] It is however unclear as to whose handwriting *"rec'd a*

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16 TRANS.20120807.83 L19 – 29 and TRANS.20120807.110 L6
17 TRANS.20120802.136 L1-2
18 TRANS.20120814.63 L1-10
19 TRANS.20120827.CS.49-59
20 TRANS.20120827.CS.57 to TRANS.20120827.CS.58
21 BUI.MAD249.0141.8
22 BUI.MAD249.0141.8
23 BUI.MAD249.0141.14-15
24 TRANS20120807.54 L17-21

day or so after letter sent" is in the left hand margin on the front page of the letter[25].

(e) A document transfer form dated 5 September 1986 from Alan Reay Consulting Engineer, and signed by Mr Harding,[26] was received by the Council on an unknown date.

(f) Mr Tapper initialed the structural sign off on the building permit application form – the date of 10/9 appears beside Mr Tapper's initials.

(g) As indicated at paragraph 183 of the Closing Submissions,[27] some of the concerns identified by Mr. Tapper appear to have been dealt with on the permit drawings transmitted to the Council.

24. It is then further submitted at paragraph 183 of the Closing Submissions[28] that the concern about the diaphragm connections was not addressed on the structural drawings, based on the fact that there was no difference in relation to the design details between the structural drawings provided by Alan Reay Consulting Engineer and the permit drawings held by the Council. This issue is subject to further submissions below. A similar submission is made about the issue of stirrups raised by Mr Tapper in his letter.

25. The submission is then made at paragraphs 186 and 196 of the Closing Submissions,[29] that based on the evidence of Mr Peter Nichols, Mrs Tapper, Mr John Henry and others, that Dr Reay had gone over Mr Tapper's head to Mr Bryan Bluck and convinced him that it was appropriate for a building permit to be issued for the CTV building.

26. While it is clear that Mr Tapper was raising an issue about the diaphragm connection, there can be no certainty as to the precise nature of the concern identified by him. Contrary to what is suggested at paragraph 193 of the Closing Submissions,[30] the evidence of Mr Peter Nichols and Mr John Henry

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[25] TRANS.20120807.68 L23-27
[26] BUI.MAD249.0141.1
[27] TRANS.20120827.CS.49
[28] TRANS.20120827.CS.49
[29] TRANS.20120827.CS.49 and TRANS.20120827.CS.51
[30] TRANS.20120827.CS.51

has no real probative value in resolving what exactly was behind Mr Tapper's comment in his letter.

27. As is evident from questions put to Dr Reay by Mr Rennie QC,[31] if Dr Reay had gone directly to Mr Bluck, it must have been sometime between 1-10 September 1986, with a weekend intervening.

28. A significant amount of evidence was given by witnesses concerning vigorous debates between Mr Bluck and Mr. Tapper over their period together at the Council, and further there was general evidence (not accepted by Dr Reay[32]) that Dr Reay went over the head of Mr. Tapper on occasions to get Mr Bluck to intervene.

29. Most significantly, it is submitted that, this evidence does not of itself establish in relation to the CTV Building, that Dr Reay persuaded Mr Bluck to override Mr Tapper and to effectively direct him to sign off on the structural design on 10 September 1986.

30. It then becomes necessary to consider the evidence from Mr Nichols about his encounter in the street with Mr Bluck, and the evidence of Mrs Tapper of her conversations with her husband.

31. The evidence of Peter Nichols is reviewed at paragraphs 208 to 212 of the Closing Submissions.[33] Mr Nichols refers in his evidence to a "fracas" between Mr Bluck and Mr Tapper about the issue of a building permit. It is submitted that this evidence does not of itself establish that Mr Bluck overruled Mr Tapper and effectively directed him to approve the structural design on 10 September 1986.

32. The observation is then made at paragraph 212 of the Closing Submissions[34] that the relevant evidence of Peter Nichols was not challenged. This of course highlights the difficulty with hearsay evidence of this nature. Mr Nichols may be a perfectly truthful witness and may have had a good recollection of events, but affected parties are deprived of the opportunity of testing the underlying factual matters, and seeking clarity on some highly relevant issues:

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[31] TRANS20120807.54 L17-21

[32] TRANS.20120807.106 L25 - TRANS.20120807.107 L10

[33] TRANS.20120827.CS.54

[34] TRANS.20120827.CS.54

(a) What exactly were the precise design issues in contention between Mr Tapper and Mr Bluck that led to the "fracas"?

(b) What initial misgivings did Mr Bluck have in terms of a design involving a "novel technological approach" and how were these misgivings first raised with Mr Bluck?

(c) How did Dr Reay's involvement (not recalled by him) come about? Did he or some other person in his office make the first contact with Mr Bluck, Mr Tapper, or some other Council Officer?

(d) What was the precise nature of the discussions between Mr Bluck and Dr Reay (if any)?

(e) What factors led to Mr Bluck being persuaded that his initial reservations were unfounded?

(f) Was Mr Tapper in any way involved in the discussions, and if so, was he also ultimately persuaded that his concerns (whatever they were) were unfounded?

33. Putting aside all those questions for which, it is submitted, there can be no clear answers, there is nothing in Mr Nichol's evidence, if accepted, to indicate that Mr Bluck did not apply himself in a professional manner to the design issues, and it would, in any event, be unfair to draw any such inference many years after the alleged events, especially as he cannot now defend himself.

34. It is then necessary to turn to Mrs Tapper's evidence.

35. Mrs Tapper's reference to 1986[35] as the date of her conversation with her husband, was in answer to a question by Counsel Assisting which mentioned 1986 (and 1987).

36. In answer to a question about her husband losing his job, she agreed that it could have been a "*throw away comment*"[36]. She stated that he would stand up

[35] TRANS.20120802.80, L8 to 12

for what he believed was right.[37] She also stated that Mr Bluck and Mr Tapper were good personal friends.[38] In answer to a question from Mr Rennie QC, Mrs Tapper said that her husband never really mentioned the incident again.[39] All of this evidence could suggest that Mr Tapper was not seriously concerned about the loss of his job.

37. Mr Hutt's evidence about the lack of other qualifying buildings is dependent on the discussion between Mrs Tapper and her husband actually taking place in 1986. As discussed in a Memorandum of Counsel filed on 29 August 2012, the Council conducted a wider search and found evidence of a dispute in 1990.

38. Further and as in the case of the evidence of Mr Nichols, the immediate difficulty with Mrs Tapper's evidence is that she could not assist the Royal Commission with some important issues (some in common with those set above in relation to the conversation between Mr Bluck and Mr Nichols) that potentially reflect on the reputations of Mr Bluck and Mr Tapper:

(a) How was the debate between Mr Bluck and Mr Tapper on the day in question resolved?

(b) In particular, did Mr Tapper and Mr Bluck finally have a meeting of the minds on whatever the precise design issues in contention were?

(c) If Mr Tapper had reservations about approving the structural design, did he document his concerns?

(d) Was Dr Reay in fact involved in the discussion on the day described by Mrs Tapper in her evidence?

(e) Did Mr Bluck in fact put pressure on Mr Tapper to sign off on the structural design?

(f) How real were his job loss concerns? Was anything said by Mr Bluck to give him cause to fear for his job?

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[36] TRANS.20120802.80 L31 - TRANS.20120802.81 L5

[37] TRANS.20120802.78, L12 to 16

[38] TRANS.20120802.80, L21 to 30

[39] TRANS.20120802.8, L24-26

39. None of the questions can now be satisfactorily resolved even assuming Mrs Tapper's evidence is accepted at face value.

40. In summary, it is submitted that it is not appropriate to draw any of the conclusions listed at subparagraphs (c) to (k) of paragraph 229 of the Closing Submissions and certainly not in a way that is potentially adverse to the reputations of Messrs Tapper and Bluck. The only way that these conclusions can be drawn is to put considerable and unjustified weight on general evidence of the relationships between the various persons concerned. It is submitted this is not appropriate as this evidence simply does not establish what actually happened in relation to the CTV building in any reliable manner.

4. THE COLLAPSE CAUSES

41. The Council does not consider that there is any need for it to comment on evidence of Mr Morris (paragraphs 234 to 236 of Closing Submissions[40]), or the issues surrounding the construction of the internal staircase (paragraphs 237 to 241 of Closing Submissions[41]).

42. It is however proposed to address the Closing Submissions in relation to the change of line involving the Going Places tenancy.

Change of Use – Going Places

43. This section of the submissions addresses paragraphs 242 to 256 of the Closing Submissions.[42]

44. Firstly, to clarify paragraph 242 of the Closing Submissions and the Council's opening submissions at TRANS.20120806.OS.21, Dr O'Leary's dispute with Dr Reay relate to two very specific issues:

(a) Dr Reay's suggestion that the change of use involved a change in the seismic risk factor; and

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[40] TRANS.20120827.CS.60

[41] TRANS.20120827.CS.60-61

[42] TRANS.20120827.CS.61 to 64

(b) Dr Reay's calculation of the reduced seismic design live load as 1.8kPa.

45. It is accepted, as indicated at paragraph 245 of the Closing Submissions, that there were changes in the code standards between 1986 and 2001, but the risk factor did not increase with the change of use (paragraphs 78 to 81 of the Council's opening submissions[43]).

46. While in the Council's opening submissions, it was indicated that there was no contemporaneous record as to how the Council addressed the change of the issue, apart from the Council's structural check list, Mr McCarthy's subsequent evidence under cross examination cannot be categorised as "entirely speculative" (see Closing Submissions, paragraph 251[44]).

47. Mr McCarthy gave evidence[45] that he had spoken to Mr Harrow, the Council engineer involved in the change of use application, and that Mr Harrow:

(a) Looked at the layout of the particular floor involved and determined that the increase in people numbers would not have structurally increased the live load to the extent that there was a structural upgrade required (lines 6-11);

(b) Gave consideration to the age of the building and the code that it was built under (lines 12-17);

(c) Advised Mr McCarthy that typically buildings built after 1976 were generally considered to be about two thirds of the design code as at early 2000 (lines 18-22); and

(d) Would have been aware of changes to the code in relation to transverse reinforcement in columns (lines 23-32).

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[43] TRANS.20120806.OS.20-21

[44] TRANS.20120827.CS.63

[45] TRANS.20120807.21

48. It is again submitted that contrary to what is suggested at paragraph 253 of Closing Submissions,[46] there is in fact evidence that the Council was aware of the differences in applicable codes and the implications of these changes in terms of building performance and in particular changes in live loadings.

49. It is submitted that having regard to a range of factors including age of the buildings, and the fact that the change of use related to one floor and 20 additional people, the Council could have reasonably concluded that the building "*as nearly as reasonably practical*" complied in terms of structural behaviour. It is not appropriate to single out changes to requirements for transverse reinforcement to columns as something that Mr Harrow should have specifically addressed in terms of the possibility of strengthening columns. This is setting an unreasonably high standard of scrutiny in the exercise of Council's powers relating to a change of use. It would have involved a significant and detailed review of the structural drawings as a whole, and the relevant codes.

50. What was required, consistent with the High Court's decision in *Auckland CC v NZ Fire Service* [1996] 1 NZIR 330, at pages 338-339 (Council opening submissions at paragraph 84), was a weighing exercise, and in particular a consideration of the purpose of the requirement and the problem involved with compliance ("the sacrifice").

5. CODE COMPLIANCE AND BEST PRACTICE

Christchurch City Council Bylaw Number 105 (1985)

Context

51. In understanding the relationship between the Christchurch City Council Bylaw Number 105 and the various Codes in force at the time and relevant to the permitting of the CTV Building, it is helpful, it is submitted, to understand the wider context within which the Bylaw was developed.

52. The Bylaw making functions of Local Authorities with respect to building control were contained in the Local Government Act 1974 and its predecessors prior to the reforms effected by the Building Act 1991. Although the regulation of building was in this way devolved to Local Authorities, it was clearly desirable

[46] TRANS.20120827.CS.59

that there be a degree of consistency across the country as to the development and implementation of building controls.

53. Under the Standards Act 1965, the Standards Council was tasked with developing and promulgating standard specifications for use within New Zealand. Section 27 provided that Bylaws could be made by adopting Standard Specifications issued by the Standards Council. Early on a practice had already developed of issuing Model Building Bylaws for use by New Zealand local authorities.[47]

54. A Model Building Bylaw was first published in 1936 as NZS 95.[48] In 1964, this became NZS 1900 and it continued to be known by this designation until superseded by the Building Act 1991.

55. The Model Bylaw contained separate chapters dealing with relevant topics such as basic design loads, concrete, steel and so on. From 1970 onwards, these separate chapters evolved into separate New Zealand Standards, commencing with NZS 3101P:1970 relating to concrete, and NZS 4203:1976 relating to general structural design and design loadings for buildings. The remaining chapters of the Model Bylaw were from around this time onwards greatly shortened in a summary format.

56. The Model Bylaw took the approach of recognising the other New Zealand Standards which had previously been chapters, as a "*means of compliance*" with NZS 1900. These Standards were listed in a Schedule. The change is explained in the introduction to the Model Building Bylaw, Chapter 8 published in 1976 as follows:

> *"The Model Building Bylaw*
>
> *It has been recent practice to publish in each reprint or revision of any chapter of NZS 1900 a list of the current versions and amendments to the whole series.*
>
> *With the introduction of the standardized adoption procedure for NZS 1900 making use of the 'schedule' system, this list is now published in January of each year under the designation MP 101.*

[47] IPENZ, Standards and Regulation for Building Construction in New Zealand, p19
[48] IPENZ, Standards and Regulation for Building Construction in New Zealand, p19

As local authorities will be making use of these schedules to identify standards relating to the model building bylaw, and as the schedules will be in general use throughout the building industry, it is no longer necessary to publish this list in each chapter of NZS 1900.

For versions current in any one year, now see –

MP 101 : 19xx, First, second and third schedules to the Model Building Bylaw (NZS 1900)."

57. The Christchurch City Council Bylaw generally adopted the changes to the Model Bylaw as part of its bylaw. Bylaws 51 (1979), 54 (1972), 54A (1973), 67 (1979) and 105 (1979) expressly adopted NZS 1900 subject to local exceptions laid out in Appendix 4 of each Bylaw.

58. Apart from these local matters, the substance of the Model Bylaw was generally reproduced in Christchurch City Council Bylaw 105. For example, the summary chapter 8 of the Model Bylaw for NZS 1900 relating to General Structure Design and Design Loadings stated as follows:

"8.1 Except as specifically provided by this bylaw, all buildings shall be designed in accordance with methods of design that admit of a rational analysis in accordance with the established principles of mechanics and of structural design.

8.2 The general structural design method (as distinct from detailed design appropriate to particular construction materials as required elsewhere in this bylaw) and the design loadings shall be approved as appropriate to achieve the following:

(a) All loads likely to be sustained during the life of the building will be sustained with an adequate margin of safety.

(b) Deformations of the building will not exceed acceptable levels.

(c) In events that occur occasionally, such as moderate earthquakes and severe winds, structural damage will be avoided and other damage will be minimized.

> *(d) In events that occur very seldom, such as major earthquakes and extreme winds, collapse and irreparable damage will be avoided, and the probability of injury to or loss of life of people in and around the building will be minimized.*
>
> *8.3 General structural design and design loadings complying with NZS 4203 shall be approved as complying with the requirements of clause 8.2."*

59. This is in identical terms to clauses 11.1.4 to 11.1.6 of Bylaw 105. It is submitted that it is clear from this context that the Model Bylaw was intended to set up, for Local Authorities who chose to adopt it, a consistent regulatory framework in which the New Zealand Standards were a means of compliance. It would, in general terms, have been inconsistent with this framework if the Model Bylaw contained different requirements in terms of compliance than the standards.

60. Counsel Assisting relies on clause 11.1 of part 11 of Bylaw 105 and states at paragraph 263(g) of the Closing Submissions that:

> *"To the extent that NZS 4203:1984 or NZS 3101:1982 contradicted or failed to fulfil the critical requirements of clause 11.1.5(d), compliance with the Codes was not sufficient to comply with the Bylaw."*[49]

61. As indicated above, clause 11.1.5 is in identical terms to clause 8 of the Model Bylaw. For this reason, Counsel Assisting's submissions are, it is submitted, contrary to the manner in which the Model Bylaw and the Standards were intended to operate. That is, as part of an overall structure designed by the Standards Council to facilitate the control of building in New Zealand.

62. There is also evidence that when the Council adopted Bylaw 105 it did not intend the Bylaw to operate to introduce any substantial changes to the Model Bylaw apart from relating to matters that had no local application. The report to the Council at the time Bylaw 105 was introduced (**Annexure A**) said:

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[49] TRANS.20120827.CS.66

> *"In 1981 the Council began a comprehensive review of all of its bylaws. In the intervening years most of the bylaws have been rewritten and are in a form where they are readily available to the general public.*
>
> *The building bylaw has been the one exception. It had been revised to conform to the general pattern of the other bylaws but much of the text was still contained in New Zealand Standards which are often amended and are now quite expensive.*
>
> *A revised Building Bylaw is attached to this report. As far as is possible it has incorporated clauses from the New Zealand Standards but the New Zealand Standards have been severely edited to remove clauses that are not particularly relevant to present building conditions.*
>
> *The more recent standard bylaws have been in the form of a relatively simple bylaw with the means of compliance being contained in a separate document. The means of compliance documents, the technical documents that explain how to comply with the bylaws are not changed and are being used throughout the country."*

63. Occasionally the Model Building Bylaw appears to have dealt with issues left unresolved by the Standard. This was the case in relation to the additional words of 11.2.5.2(a) of Bylaw 105 noted in paragraph 302 of Counsel Assisting's submissions.[50] The detail of this addition is discussed below.

Legal basis for issue of permit

64. In addition to the context set out above, there are a number of provisions in the Bylaw which confirm that it was always intended that compliance with the applicable Standard would be sufficient to constitute compliance with the Bylaw. This was stated to be so in relation to the general requirements of the Bylaw, such as clause 5 and the opening statement in the Second Schedule of the Bylaw. It was also the case in relation to each category of building material.

65. The relevant Code or Codes of Practice are referred to at the end of each materials section for timber, masonry, concrete and steel as a "means of compliance". For concrete, clause 8.4 followed this scheme and provided:

[50] TRANS.20120827.CS.73

"*MEANS OF COMPLIANCE*

8.4.1 Design

Concrete elements designed in accordance with the requirements of NZS 3101 or a recognised equivalent standard shall be deemed to comply with the requirements of this Bylaw."

66. Part 11 relating to general structural design and design loadings did not follow this structure. However clause 11.1.6 stated:

"11.1.6 General structural design and design loadings complying with NZS 4203 shall be approved as complying with the requirements of Clause 11.1.5."

67. Clause 11.1.5 set out the objective of structural design and design loadings applicable to all buildings in summary form, and as noted reproduced the Model Bylaw. The reference in clause 11.1.6 meant that compliance with NZS 4203 was sufficient for the purposes of Part 11.

68. Furthermore, clause 8.2.5 made it clear that the Council did not intend there to be a relevant distinction for concrete purposes between compliance with the Bylaw and compliance with a "recognised Code of Practice". The provision provided:

"*8.2.5 Design Certification*

The designer of any concrete element shall provide calculations which establish that the concrete element has been designed in accordance with the requirements of this Bylaw or alternatively certify in an approved manner that the design method conforms with the requirements of a recognised Code of Practice."

69. Thus a designer could provide calculations to establish that a concrete element met the requirements of the Bylaw as a whole or alternatively provide certification that the design method conformed with a recognised Code of Practice and made no distinction between the two.

Requirement for ductility in Code and Bylaw

70. At paragraph 302 of the submissions of Counsel Assisting[51] it is noted that clause 11.2.5.2 of the Bylaw relating to ductility does not accord with clause 3.2 of NZS 4203:1984. The two provisions are set out as follows for convenience with the difference underlined:

Bylaw:

"*11.2.5.2 Ductility*

(a) The building as a whole, and all of its elements that resist seismic forces or movements, or that in the case of failure are a risk to life, shall be designed to possess ductility; provided that this shall not apply to small buildings having a total floor area not exceeding 140m² and having a total height not exceeding 9m.

(b) Structural systems intended to dissipate seismic energy by ductile flexural yielding shall have "adequate ductility".

(c) "Adequate ductility" in terms of Clause (b) shall be considered to have been provided if all primary elements resisting seismic forces are detailed in accordance with special requirements for ductile detailing in the appropriate material code."

Standard:

"*3.2 Ductility*

3.2.1 The building as a whole, and all of its elements that resist seismic forces or movements, or that in case of failure are a risk to life, shall be designed to possess ductility; provided that this shall not apply to small buildings complying with clause 3.4.8.1 designed in accordance with

[51] TRANS.20120827.CS.73

clause 3.4.8.2 nor to tied veneers (item 3(b) of table 8) and unreinforced or partially reinforced walls and partitions (item 4 of table 8) designed in accordance with clause 3.4.9.

3.2.2 Structural systems intended to dissipate seismic energy by ductile flexural yielding shall have "adequate ductility".

3.2.3 "Adequate ductility" in terms of clause 3.2.2 shall be considered to have been provided if all primary elements resisting seismic forces are detailed in accordance with special requirements for ductile detailing in the appropriate material code."

71. The added portion of clause 11.2.5.2 which relates to an exemption from the ductility requirement for small buildings not exceeding a certain area and height is added in the Bylaw as against the Standard. The exemption provided for in the Standard referred to clause 3.4.8 which also related to small buildings. This provision was deleted from NZS 4203:1984.

72. In other words, the ductility clause as it stood in NZS 4203:1984 was incomplete and it is submitted that this must be the reason the additional words in the Bylaw were included.

Relationship between the Codes

73. Counsel Assisting submits at paragraphs 284 – 291[52] that NZS 4203:1984 took precedence over NZS 3101:1982 effectively because of the timing of the two documents: NZS 4203:1984 being later in time. The effect of this argument is that if, on a proper reading of the Codes, aspects of NZS 4203 are inconsistent with NZS 3101, the inconsistent aspects of 3101 are to be treated as being redundant.

74. In statutory interpretation terms, it might be argued by analogy that Counsel Assisting's argument amounts to a submission that aspects of NZS 3101 have been impliedly repealed by NZS 4203. The courts have repeatedly cautioned

[52] TRANS.20120827.CS.70-71

against the use of the doctrine of implied repeal except in cases where the two inconsistent provisions simply cannot be read in a consistent manner.[53]

75. Counsel Assisting refers at paragraph 286 of the closing submissions[54] to the statement in the introduction to NZS 4203:1984 that pending revision of the various other New Zealand Standards, NZS 4203:1984 was to be regarded as the "master document" with other Standards, where appropriate, subject to it.

76. It is noted however that NZS 3101:1982 was drafted in the context of the revision to NZS 4203:1984 being finalised, as it is clear from the statement in paragraph 12 that:

> *"It should be noted that some provisions of this Code are based on proposed amendments to NZS 4203 which at the time of publication are being finalised."*

77. The inference is that the drafters of NZS 3101 may have been aware of the likely nature of the amendments to NZS 4203. NZS 4203 came into effect some 2 years after NZS 3101 and it appears that the early to mid-1980s revisions to the two documents were being developed together.

78. As to the principles to be applied when interpreting standards, Counsel Assisting submits at paragraph 297 that the Interpretation Act 1999 applies.[55] It is noted however that the 1999 Act did not have retrospective effect and the Acts Interpretation Act 1908 would have applied to the interpretation of Standards in the mid-1980s. The principle set out in section 5(1) of the Interpretation Act 1999, that the meaning of any enactment shall be ascertained from its text and in the light of its purpose, is accepted as a correct statement of general principle applicable prior to 1999 in any event.

79. It is submitted therefore that New Zealand Standards 3101:1982 and 4203:1984 should be interpreted:

- In context - which in the case of New Zealand Standards means so as to be consistent both internally and with each other so far as practicable. The drafter of the Standards was the Standards Council and they were clearly intended to be utilised together.

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[53] *Mayor of Christchurch v Christchurch Drainage Board* [1925] NZLR 837

[54] TRANS.20120827.CS.70

[55] TRANS.20120827.CS.72

- In light of and with reference to engineering practices and understandings at the time of drafting.

80. The principle issue of inconsistency identified by Counsel Assisting relates to the interpretation of the ductility provision of NZS 4203:1984 (Clause 3.2.1) as against the ductility provisions of NZS 3101:1982 (clause 3.5.14). The interpretation of these clauses is considered below.

Interpretation of clause 3.2.1 NZS 4203:1984

81. It is submitted that the correct interpretation of clause 3.2.1 of NZS 4203:1984 is as follows:

(a) Clause 3.2.1 of NZS 4203 is in materially the same terms as the Bylaw and there is no relevant distinction to be made between the Code and the Bylaw for the reasons set out above.

(b) Clause 3.2.1 provides for buildings as a whole and all elements that resist seismic forces or movements, or that are in case of failure a risk to life, to be designed to possess ductility.

(c) *Ductility* is defined in the definitions section of the Standard (clause 1.1.3.1) as follows:

> *Ductility means the ability of the building or member to undergo repeated and reversing inelastic deflections beyond the point of first yield while maintaining a substantial proportion of its initial maximum load carrying capacity.*

(d) These provisions are qualitative rather than quantitative. They do not provide any guidance as to the magnitude of the deflections that the building or member is required to be designed for.

(e) On its face therefore, the provision is incapable of being given effect to in a meaningful way without reference to the quantitative provisions of NZS 4203 and for concrete NZS 3101 equally. This is consistent with the approach taken in the Standard for deflection limits and seismic loads. These requirements of NZS 4203 are also incapable of being given effect to on their own. They are only relevant to a particular

building in the context of a Standard describing how they are to be used relative to a particular building or member. For concrete, these provisions are contained in NZS 3101.

(f) The general ductility requirement in clause 3.2.1 is expanded upon in clause 3.2.2 with respect to "***systems*** *intended to dissipate seismic energy by ductile flexural yielding.*" These "*systems*" are to have "*adequate ductility*".

(g) Adequate ductility for the purposes of clause 3.2.2 is considered to have been provided where all primary elements resisting seismic forces are detailed in accordance with the special requirements for ductile detailing in the appropriate material Code (in this case NZS 3101).

(h) Although the definition of primary elements in NZS 4203 includes columns and beams by virtue of the definition of primary elements, the principle reference is to the appropriate material Code and what is sufficient for ductility purposes is determined in accordance with that Code.

82. Counsel Assisting recognises at paragraph 306 of the closing submissions[56] that there is disagreement between members of the Department of Building and Housing expert panel about the meaning of ductility, especially given the commentary to clause 3.2 of NZS 4203 which contains a lengthy discussion of the ductility requirement. Counsel then says:

> *"307. It is accepted that it could be argued that the "members not designed for seismic loading" set out in NZS 3101:1982 contains some degree of ductility. However this is nowhere near the level of ductility provided by the seismic provisions of the Code.*
>
> *308. It is submitted that clause 11.2.5.2 of the Bylaw makes it clear how much ductility the CTV Building was required to possess. The building was designed to dissipate seismic energy via ductile yielding. It was therefore required to have "adequate ductility". Adequate ductility would have been provided where the special*

[56] TRANS.20120827.CS.74

requirements for ductility detailing in NZS 3101:1982 (seismic loading provisions) were met. They were not."

83. These submissions are, it is submitted, correct except in relation to the last two sentences of paragraph 308.[57] The words in the Bylaw and in clause 3.2.1 do not reference NZS 3101:1982, rather they reference the *"appropriate material Code"*. There is nothing in the Bylaw nor in the provisions of NZS 4203 indicating that "special requirements for ductility" means that only the seismic loading provisions of NZS 3101:1982 applied.

84. The reference in the Standard and Bylaw to the "*appropriate material Code*" is intended to reference the whole of the ductility provisions of the relevant Code rather than simply part of it. Counsel Assisting's submissions are to the effect that only part of the ductility provisions of NZS 3101:1982 apply, but there is no indication at all in the words of the clause that this is the case.

85. The conflict that Counsel Assisting refers to at various places in the submissions between the two Codes and the need to resolve it via a ranking of the two Codes arises, it is submitted, in part because of the erroneous submission in paragraph 308.[58]

Interpretation – 3.5.14 of NZS 3101:1982

86. NZS 3101:1982 clause 3.5.14 provides as follows:

"3.5.14 Secondary structural elements

3.5.14.1 Secondary elements are those which do not form part of the primary seismic force resisting system, or are assumed not to form such a part and are therefore not necessary for the survival of the building as a whole under seismically induced lateral loading, but which are subjected to loads due to accelerations transmitted to them, or due to deformations of the structure as a whole...

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[57] TRANS.20120827.CS.74

[58] TRANS.20120827.CS.74

3.5.14.3 *Group 2 elements shall be detailed to allow ductile behaviour and in accordance with the assumptions made in the analysis. For elements of Group 2:*

(a) *Additional seismic requirements of this Code need not be satisfied when the design loadings are derived from the imposed deformations v Δ, specified in NZS 4203, and the assumptions of elastic behaviour.*

(b) *Additional seismic requirements of this Code shall be met when plastic behaviour is assumed at levels of deformation below v Δ."*

87. The columns and beams in the CTV Building did not form part of the primary seismic force resisting system for the building. The "*seismic resisting system*" for a building designed in accordance with the design principle described by Mr Henry as a "*shear wall protected gravity load system*" can only, it is submitted, be the shear walls. The columns and beams may be subject to seismic loads but they are not part of the *"primary"* seismic force resisting system. They may nevertheless resist seismic forces. However this is secondary to the primary system for the building.

88. The phrase "*and are therefore not necessary for the survival of the building as a whole under seismically induced lateral loading*" is not an additional requirement but a consequence of the design approach to the building, which is that the shear walls are the primary seismic force resisting system.

89. This interpretation is supported by the commentary to the clause which provides:

"C3.5.14 *Secondary structural elements*

C3.5.14.1 *The definition of a secondary element is more particular than that in NZS4203, and includes such primary gravity load resisting elements as frames which are parallel with stiff shear walls and do not therefore participate greatly in resistance to lateral loads. Caution must however be exercised in assumptions made as to the significance of*

> *participation. Frames in parallel with slender shear walls should be designed and detailed as fully participating primary members. For convenience of reference and specification of requirements, secondary elements have been subdivided into groups, that is, Group 1 and Group 2 elements."* [Emphasis added]

90. The commentary is intended to be explanatory of the words of the Code itself and it is not therefore necessary to enter into a minute analysis of words of the commentary. The intention is clear, it is submitted, that in a design system such as used in the CTV Building, the frames may be treated as secondary elements. However, both Dr O'Leary and Dr Jacobs discuss in detail in their evidence the issue of whether the "*frames*" are in parallel with *"stiff"* shear walls in the CTV Building. The question of whether the shear walls are *"stiff"* arises.

91. The issue between the two experts focused around whether the shear walls were sufficiently *"stiff"* to fall within the words of the commentary. Dr O'Leary's view, set out at paragraphs 40 and 41 of his first amended brief of evidence,[59] was that:

> *"the widely held interpretation at the time would have been whether the frame would provide a significant contribution to the lateral load resistance of the structure."*

92. Dr Jacobs' view was that the north core should be regarded as "*slender*" because of the notch at the base of the north shear core wall[60].

93. It is accepted that there is room for different views on this issue, but the question is not critical for the reasons identified above.

94. Counsel Assisting correctly notes at paragraph 405[61] that it is implicit in the evidence of Dr Hyland, Mr Smith, Mr Jury, Dr O'Leary, Mr O'Loughlin, Mr Henry and Mr Hare that it was permissible to categorise the columns as secondary elements. In this regard therefore, Dr Jacobs' view does not accord with the consensus of expert opinion.

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[59] TRANS.20120809.118 L20-24

[60] TRANS.20120809.114 L28 - .115 L2

[61] TRANS.20120827.CS.93

Capacity Design

95. Counsel Assisting's submissions at paragraphs 374 – 391 are to the effect that capacity design dictated that the additional seismic requirements of NZS 3101 were effectively mandatory and overriding.[62]

96. So far as Counsel has been able to determine, no witness maintained that capacity design was critical to issues of compliance with the CTV Building in evidence in chief provided to the Commission. The only evidence provided on the issue relates to questions answered by Professor Mander in cross-examination.[63] The issue was not put to Dr O'Leary, Mr O'Loughlin, or Dr Jacobs

97. . The precise role of capacity design in the overall context of the standards has not received specific attention by the experts called in relation to code compliance.

98. There is clearly an issue as to whether clause 3.5.7 of NZS 3101 (relating to capacity design) applies generally or only in relation to the seismic resisting elements of a building. The clause is headed "Ductile Shear Wall Structures". If the argument that Counsel Assisting makes in relation to capacity design at paragraphs 374 to 381 is correct, then capacity design required the seismic loadings provisions set out in clauses 6.5.4.3 and 9.5.6.1 to be used rather than the non-seismic provisions of the Code.

99. The implication is that buildings could not be detailed using the non-seismic provisions of NZS 3101:1982. A conflict would therefore be set up with clause 3.5.14.3 of NZS 3101:1982. Quite how this conflict would be resolved is unclear given that the issue was not directly addressed by the experts.

Evidence of practice at the time and underlying design approach

100. A number of witnesses gave evidence as to the practice adopted at the time by engineers in interpreting the ductility provisions of NZS 4203 and 3101:

- Dr O'Leary
- Mr O'Loughlin

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[62] TRANS.20120827.CS.86

[63] TRANS.20120724.101 L26 - .102 L16

- Mr Hare
- Mr Henry
- Mr Holmes
- Dr Hyland.

101. These witnesses gave evidence expressly, or by implication, to the effect that the Codes were at the time interpreted so that where the frames of a building stayed elastic at v Δ, the columns did not need to be detailed using the "*additional seismic requirements of NZS 3101*". Mr Smith and Dr Jacobs gave different evidence, which is considered below.

Dr O'Leary

102. Dr O'Leary identifies the relationship between the ductility provisions of NZS 4203 and NZS 3101 at paragraphs 21 – 27 and 32 – 42 of his first statement of evidence.[64] Dr O'Leary's view was that some of the columns in the CTV Building could have been detailed under the non-seismic provision of NZS 3101. He states that from the perspective of a reviewing engineer, an assessment along the lines of "*gravity only columns in a building with adequate shear walls should not need to be designed for seismic loading had a reasonable basis*".[65] Dr O'Leary does not give evidence as to how widespread the interpretation was.

Mr O'Loughlin

103. Mr O'Loughlin addressed the issue in detail. Mr O'Loughlin's evidence was that when it is obvious that columns did not form part of the lateral load resisting system of a building, the approach would have been that the columns did not need to be designed for ductility.[66] This evidence was given in the context of his evidence about what a competent engineer could reasonably have been expected to pick up in the context of a Council review. His view that an engineer would have or could have taken this view, implies that it was legitimate for engineers to rely on the non-ductility provisions of NZS 3101 where the requirements of clause 3.5.14 were met.

[64] TRANS.20120809.114 L1 - .120 L20
[65] TRANS.20120809.136 L26-29
[66] TRANS.20120814.64 L27-30

Mr Henry

104. Mr Henry is an engineer of considerable experience practicing in Christchurch during the 1980's. He designed the building used as a guide for the design of the CTV Building (Landsborough House). He described in detail the design approach for Landsborough House and the detailed analysis he carried out with respect to it[67]. He consulted with Professor Paulay as to the layout of the building and the reinforced concrete shear walls.[68]

105. Mr Henry was employed at Holmes Wood Poole & Johnstone between 1980 and 1984. While he was there, he designed a number of multi-storey buildings in central Christchurch, including 58 and 60 Kilmore Street and 329 Durham Street. All three of these buildings were designed using the same underlying structural premise for the design of the structure in relation to the gravity load carrying elements. The CTV Building, Landsborough House, Bradley Nuttall and the Age Concern building are other buildings referred to in his evidence that were also designed on this principle. He stated:

> *"The principle is that the shear walls are designed to carry the seismic load of the building, leaving the columns and beams to carry only the gravity loads, or building weight, imposed on them. The design of the gravity load system is therefore simplified because the reinforcing requirements are a lot less compared to those required for seismic loading. The premise underlying this design method is that stiffness, or inflexibility, of the shear walls prevents the relatively flexible columns and beams from excessive deformation under seismic loading and therefore from suffering significant seismic forces and stresses. However with this premise if excessive deflections do occur in a major seismic event the gravity load system is vulnerable to overloading and possible collapse.*
>
> *This is a critical design principle, which reoccurs throughout my evidence. For ease of description, I will refer to it as the "**shear wall protected gravity load system**"* (Counsel emphasis).[69]

[67] TRANS 20120801.125 L28 – .132 L2
[68] TRANS.20120801.130 L14 - 20
[69] TRANS.20120801.121 L11 - 25

106. It appears that Mr Henry became somewhat of an expert in Christchurch in relation to this design approach. It is implicit in Mr Henry's evidence that the design approach he described was permissible on the basis that the deflections calculated from the ETABS analysis of these buildings was directed at ensuring compliance with the requirements of 3.5.14.3.

Mr Hare

107. Although Mr Hare is highly critical of the design of the CTV Building, he is not critical of the underlying design principle adopted with respect to it. Mr Hare was practising in Christchurch from 1981 to the present. He had no issue with the general design approach adopted in the CTV Building. He said in answers to questions:

> *"Q: No, when you reviewed the plans though did you note that the general approach to design was that of a gravity frame protected by stiff shear walls?*
> *A: There were two independent systems, one for lateral load resistance and one for gravity, yes.*
> *Q: And that general approach to design, that of a gravity frame or stiff shear walls, was that a general approach that you were familiar with?*
> *A: Yes.*
> *Q: Had you encountered that approach before.*
> *A: Yep.*
> *Q: And that approach in itself didn't give rise to any concerns on your part?*
> *A: Not as a matter of principle, no."*[70]

Dr Hyland

108. Dr Hyland confirmed that the analysis undertaken in the Hyland/Smith report concerning the columns related to whether the columns were able to meet the requirements of 3.5.14.3(a).[71] He specifically confirmed that if the drift requirement of 3.5.14.3(a) was able to be satisfied, then the way that the

[70] TRANS.20120816.96 L10-23
[71] Transcript reference 20120609.15, Line 5-30

columns were in fact detailed in the CTV Building would have been an acceptable approach.[72]

Dr Jacobs

109. Dr Jacobs did not know whether the approach described by Mr Henry was common in New Zealand in the 1980's[73] although it was clearly not his practice.

Mr Smith

110. Mr Smith practised in Wellington in the 1980s. He held a different view as to the interpretation of the Codes (dealt with below). Mr Smith's view was the Codes did not permit columns to be detailed for non-ductility in any circumstances.[74] He was not aware that there were differing views within the profession at the time.[75] He accepted however that on his interpretation, if the buildings described by Mr Hare at 58 and 64 Kilmore Street and 329 Durham Street had been detailed as Mr Hare described, (that is with gravity frames and stiff shear walls) this would have been illegitimate.[76]

Professor Mander

111. Professor Mander stated in cross-examination that clause 3.5.14.3 was a "*loophole*". In questions by His Honour, he said this meant it was not a legitimate way to interpret the Codes. It appeared however from Professor Mander's evidence that he was not involved in the design of multi-storey buildings in the 1980's, certainly not in Christchurch.

Summary

112. It is submitted that the evidence described above demonstrates generally a consistency of view amongst those practicing in the 1980's that Mr Henry's described "*gravity frame protected by stiff shear wall approach*" was regarded as legitimate and appears to have been widespread, at least in Christchurch.

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[72] TRANS.20120709.19 L5-12
[73] TRANS.20120809.34 L31 - .35 L35
[74] TRANS.20120809.78 L25 .79 L9
[75] TRANS.20120809.81 L11-19
[76] TRANS.20120809.82 L8-12

Experts' Views on Interpretation

113. The analysis in the Hyland/Smith report, the expert panels view as reported by Mr Jury and the Royal Commission Peer Review Dr Holmes, all proceeded on the basis that the appropriate inquiry was as to whether the drift limits contemplated by the non-seismic provisions of the Code were complied with.

114. The analysis in Appendix F of the Hyland/Smith report was that of Dr Hyland's and he accepted that it was based on clause 3.5.14.1 of NZS 3101:1982.

115. Mr Holmes' peer review discussed in detail the application of the Code and the requirements of 3.5.14.3.[77] Dr Holmes' powerpoint presentation[78] analyses the provisions of NZS 3101:1982 in detail. He describes this as the "controlling Code".[79] He agreed with the analysis in Tables 13 and 14 of Appendix 4 which identified the flaws where the indicator columns considered in the report (C – 1 and F – 2) did not stay elastic at v Δ in accordance with 3.5.14.3(a) such that full seismic detailing was required.

116. Counsel Assisting notes at paragraph 405[80] that it is implicit in the evidence of Dr Hyland, Mr Smith, Mr Jury (on behalf of the expert panel), Dr O'Leary, Mr O'Loughlin, Mr Henry and Mr Hare, that it was permissible to categorise the columns as secondary elements. It is also implicit in the evidence that there is no other reason why, provided the columns met the drift requirements of clause 3.5.14(a), they could not be detailed under the non-seismic provisions of the Code.

117. Dr Jacobs was the only expert who held a different view. He appeared to express the view that the columns could not be classified as secondary elements. He clarified his view however in cross-examination where he said:

> "Q. *And that proposition that arises out of this clause 3.5.14(a) and its commentary, the proposition that columns may need not be designed for ductility if they stay elastic at B delta, that applies regardless of the directions in 4203 regarding ductility. Isn't that correct?*

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[77] BUI.MAD249.0372.3 – 7

[78] BUI.MAD249.0437.1

[79] BUI.MAD249.0437.5 – 8

[80] TRANS.20120827.CS.93

A. *I don't know the exact legal requirements that you have, but if one code says you should do something and the other code say it's an out then I guess, I suppose it is correct because 3101 does apply specifically to concrete.*

Q. *Yes, yes, so just so that we're clear that's your evidence about how the interrelation between the two codes works, is it, that as we've been discussing columns stay elastic at B delta therefore no ductility required and that's true regardless of the direction in 4203?*

A. *Yes that is correct."*[81]

118. Dr Jacobs was re-examined on this issue and confirmed the view expressed in cross-examination.[82]

119. Counsel Assisting submits at paragraph 406[83] that the views of the experts does not assist Dr Reay and Mr Harding because:

- Compliance with the Bylaw is a question of law. Opinions expressed by these experts are not definitive.
- The fact that engineers generally appear to have adopted an approach inconsistent with that which the Royal Commission has invited to accept does not prove that it is lawful."

120. It is accepted that evidence as to the correct interpretation of the Codes by expert engineers is not determinative of the question. However, their evidence should, it is submitted, be persuasive given that they worked with the Codes day to day.

121. Mr Smith and Dr O'Leary gave comprehensive evidence concerning the non-seismic provisions of the Code. Dr O'Leary's views on clause 3.5.14 one are expressed at paragraph 37 – 43 of his evidence in chief.[84] His views are in accordance with the interpretation set out above.

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[81] TRANS.20120809.28 L1-20
[82] TRANS.20120813.98 L29 .99 L17
[83] TRANS.20120827.CS.93
[84] TRANS.20120809.118 L7 .119 L35

122. Mr Smith's view was that 3.2.1 of NZS 4203 meant that only the ductile and limited ductile provision of NZS 3101 were appropriate to be used. He said that his view was at least the limited ductility provisions of NZS 3101 would apply to the columns in all buildings, so that it was inappropriate to detail any columns in any building for non-ductility.[85]

123. It is submitted that his view is not consistent with the views of any of the other experts and suffers from the issue identified at paragraphs 309 and 310 of the submissions of Counsel Assisting.[86] The obvious question is if it is impermissible to utilise the non-ductile provisions of NZS 3101 at all, what is the purpose of these provisions? Counsel Assisting answers the question at 310 as follows:

> *"It is submitted that the answer to the question is also provided by clause 11.2.5.2 of the Bylaw. The ductility requirements applicable to buildings did not apply to small buildings. Non-seismic columns would have been permissible in such a building. Mr Smith agreed with this."*[87]

124. As submitted above, the reason for the amendment to clause 11.2.5.2 of the Bylaw relating to small buildings was to fill a gap left by the deletion of a small building clause in NZS 4203 rather than anything to do with resolving an interpretation problem between NZS 4203 and NZS 3101.

Compliance issues

Asymmetry

125. Clause 11.2.5.2 of the Bylaw and clause 3.1.1 of NZS 4203:1984 provided:

> *"The main elements of a building that resist seismic forces shall, as nearly as is practicable, or be located symmetrically about the centre of mass of the building."*

126. Dr O'Leary's view is that clause 3.1.1, which is part of the introductory provisions of part 3 of NZS 4203, does not raise a specific standard compliance issue. The issue of compliance needs to be considered under clause 3.4.7.1

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[85] TRANS.20120809.78 L25 .79 L9

[86] TRANS.20120827.CS.75

[87] TRANS.20120827.CS.75

which gives more detail and quantitative guidance as on the issue of asymmetry.

127. The issue is as to whether the circumstances in which the apparently mandatory requirement in 3.1.1 is able to be departed from. Dr O'Leary accepted that in answers in questions from the Commission that the expression "*as nearly as practicable*" required an exercise in engineering judgement.

128. Unlike the concept of "*ductility*" the concept of symmetry is not susceptible, it is submitted, to quantitative assessment and issues of judgement will always arise.

129. Where issues of judgement are involved, it is submitted that determining compliance or otherwise becomes problematic. How the Council would enforce a requirement for symmetry subject to engineering judgement is not at all clear.

130. It is however accepted as Mr Nicholls indicates that where a building is asymmetric a particularly careful approach to deflection limits will be appropriate.[88]

The drift capacity of the columns, column confinement and minimum shear reinforcing in the columns

131. It is accepted that the columns would not have complied in terms of confinement and shear reinforcing with the seismic requirements of NZS 3101. Whether or not the columns complied, is therefore a question that falls to be determined in terms of the application with the drift requirements of clause 3.5.14.3.

132. Confinement reinforcing in the columns was governed by the application of clause 6.4.1 (b) of NZS 3101 for non-seismic columns, and clause 6.4.7.1(a) for seismic columns.

133. Dr O'Leary carried out calculations that determined that the columns on grid F should have been detailed for seismic loading and therefore did not comply with the Code.

134. Dr Hyland's Appendix F analysis which was relied upon by Mr Jury and Dr Holmes showed that the indicator columns could not be detailed on a non-seismic basis.

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[88] TRANS.20120806.77 L20 – TRANS.20120806.79 L8

135. The ERSA analysis at Appendix F showed that column C1 did not meet the drift requirements for an east/west earthquake at four of the five levels considered.

136. Column F2 did not meet the drift requirements in a north/south direction on levels five and six only. Otherwise this column complied at all other levels for north/south and east/west earthquakes. The elastic deformation limit for column F2 was calculated at .62% whereas the calculated drift was .64%. It was put to Dr Hyland in cross-examination that these margins were "*fairly fine.*"[89] Dr Hyland did not agree with this on the basis that the analysis was conservative. That may be the case, but it is submitted that the analysis as it was undertaken indicated that for some of the columns in some of the locations, the margin was fine.

137. It is accepted of course that any breach of the drift limits would require that the column in question was required to be detailed for seismic purposes, but from a reviewing engineer's perspective there is, it is submitted, a question of the obviousness of the non-compliance based on the analysis undertaken in Appendix F.

138. Dr Hyland also confirmed that the Appendix F analysis took an approach which mixed how the analysis would have been undertaken at the time (1986) with more modern analyses where a better more modern approach was available.[90]

139. Mr Latham late in the hearings carried out an analysis "*as it would have been done at the time*", although ultimately it was conceded that the analysis was done on the basis of how it "*might*" have been done at the time.

140. Dr O'Leary's approach was to use the drift limits obtained from the ERSA analysis in Mr Harding's calculations.[91]

Transverse reinforcement of beam/column connections

141. It is accepted that the non-seismic transverse requirements in NZS 3101:1982 were set out in clauses 9.4.2, 9.4.5 and 9.4.6 were not met.

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[89] TRANS.20120609.20 L24 - .21 L15

[90] TRANS.20120709.24

[91] TRANS.20120813.31 L19 -27

Diaphragm connection and north shear wall

142. It is accepted that the diaphragm connection to the north shear wall did not comply with NZS 4203.

Spandrel panels

143. The issue here is that although the measurements in the structural drawings are such that they contemplate a 10mm gap either side of the panels, a gap is not specifically provided for.

144. Dr Hyland did not agree that the extrapolation of the gap from the measurements on the plans was sufficient and he thought the gap was too small in any event[92]. Dr O'Leary's view was that the gap was sufficient and the plans clear enough as to the required gap. It is submitted that, from a compliance perspective, a gap was provided for. The issue is whether the plans were sufficiently detailed and the question is really an issue of best practice.

Best practice

145. Professor Priestley gave evidence that the structural drawings submitted for permitting in 1986 failed the test of best practice to the current state of knowledge. In paragraph 77 of his evidence, he lists the matters where the building did not meet best practice. Professor Priestley was cross-examined as to the Council's role from a best practice perspective and he said:

> *"Q. So I'm not sure whether this is a disagreement but in relation to your evidence at paragraph 77 –*
>
> *A. Yes.*
>
> *Q. Just to summarise his evidence, as I understand it, he's saying that from a compliance perspective which is the perspective that the Council would be looking at it from –*
>
> *A. Yes.*

[92] TRANS.20120709.34 L14 – TRANS.20120709.35 L6

Q. - best practice is not something that's able to be dealt with by the Council as, would you agree with that?

A. Yes, I completely agree with that."[93]

146. It is submitted that Professor Priestley's view on these matters is correct and issues of best practice fall outside the ambit of the Council's compliance assessment role.

Should the areas of non-compliance have been identified by the Council's reviewing engineer?

147. The Council's evidence on this topic was from Mr John O'Loughlin and Dr Arthur O'Leary. In addition, Mr Peter Nichols and Mr John Henry also gave the Council's approach to structural engineering review during the periods when they were employed by the Council.

148. The areas of non-compliance which Mr O'Loughlin or Dr O'Leary accepted should have been identified are as follows:

(a) The diaphragm connection to the north wall;[94]

(b) The insufficient spiral reinforcement in the beam column joints.[95]

149. Mr O'Loughlin in his first statement of evidence at paragraph 14[96] drew a distinction between the design role of an engineer and the Council's review role. He stated that the Council's role involved checking at a general level that the designer had considered and dealt with compliance issues appropriately. Other aspects of relevance that were noted by him include:

(a) The amount of time available to Council engineers to carry out a review as compared to a full peer review.[97] Mr Wilkinson stated in

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93 TRANS.20120712.7 L24 – 20120712.8 L3

94 WIT.JOLOUGHLIN.0001.14 and TRANS.20120813.42 (Dr O'Leary)

95 TRANS.20120814.81 (Mr O'Loughlin)

96 TRANS.20120814.61 L16-25

97 TRANS.20120814.60 L29 – TRANS.20120814.61 L7

evidence that a report such as that carried out by Holmes Consulting in 1990 would take approximately 34 hours of staff time, but this would only identify any significant structural issues, it would not be sufficient time to carry out a full peer review. In comparison, Mr Wilkinson noted that the full design process for a building like the CTV building would take between 300 and 600 hours.[98]

(b) The Council's structural checking section did not have the staffing resources that were available to consulting engineers, although the Christchurch City Council's resourcing compared favourably with Dunedin and Wellington Cities.[99]

(c) The Council did not have computers and software analysis systems[100] or the ability to do an ETABs analysis[101].

(d) The Council was processing a higher than average number of building permit applications at the time.[102]

(e) Mr O'Loughlin commented that it must have stretched the capacity of the Council staff to fully understand how the building was behaving. Mr Henry made a similar comment in answer to a question,[103] while Dr O'Leary thought that the design of the building was not too difficult for the Council to adequately perform its task of verifying compliance.[104]

150. In relation to the issue of inadequate reinforcement of the beam column joints, this was accepted by Mr O'Loughlin as an issue that possibly should have been picked up by a Council reviewing engineer. However, Mr O'Loughlin also noted in respect of this issue that there were four different drawings that a reviewing engineer would need to visualise and assemble in his mind to determine the

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[98] TRANS.20120816.118 L8-29
[99] TRANS20120814.63 L1-10
[100] TRANS20120814.63 L11-16
[101] TRANS.20120814.78 L5-12
[102] TRANS20120814.64 L2-4
[103] TRANS20120802.136 L1-2
[104] TRANS.20120813.22 L31-33

particular arrangement of reinforcing in the beam column joint, and that it would have been difficult to visualise that arrangement.[105]

151. It appears to be conceded in the Closing Submissions that it could not be expected that a Council reviewing engineer would be involved in the fine detail of design (paragraph 161),[106] but it is then submitted (at paragraph 162) that the Council reviewing engineer should have detected a wide range of issues about the CTV Building. In response:

(a) Asymmetry

(i) Dr O'Leary agreed that the imbalance between the south shear wall and the north wall was something of note for a Council reviewing engineer, and would lead to that person looking at the drawings and the calculations to see whether it was adequately accounted for in the design.[107] Dr O'Leary did however note that the lack of balance between the walls was a situation that was not uncommon at the time, and it would not have "raised alarm bells" if he was confronted with this layout.[108] The issue was also subject to comment by Mr Peter Nichols and Mr John O'Loughlin in evidence (see Closing Submissions at paragraphs 171-172.[109]

(ii) However Mr O'Loughlin's unchallenged evidence[110] was also that a Council reviewing engineer could have reasonably formed the view that the building was reasonably symmetrical about the centre of gravity.[111] Mr O'Loughlin was not questioned on this point in cross examination by other Counsel.[112]

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105 TRANS.20120814.79 L12-17 and TRANS.20120814.81 L24-25

106 TRANS.20120827.CS.41

107 TRANS 20120813, Lines 21-31

108 TRANS.20120813.41 L19-26 and TRAN.20120813.42 L16-22

109 TRANS.20120827.CS.46

110 TRANS20120814.67 L1-20

111 TRANS.20120814.67 L4-6

112 Commissioner Fenwick discussed this issue with Mr O'Loughlin at TRANS.20120814.109 – 111.

(b) The inadequate connections between the diaphragms and the north shear wall

(i) It is clear from Mr Tapper's letter of 27 August 1986 to Alan Reay Consulting Engineer,[113] that he in fact had identified an issue relating to the diaphragm connection to the north wall. As a line of questioning directed to Mr John O'Loughlin illustrates,[114] it is not clear exactly what Mr Tapper picked up. Mr O'Loughlin also commented that in his experience there was a lot of phone connection between a review engineer and the designer,[115] but whether any such contact occurred between Mr Tapper and Mr Harding cannot be determined.

(ii) Further and contrary to what might be suggested in Closing Submissions at paragraph 183,[116] the mere fact that the plans received by Counsel Assisting from Dr Reay and the permitted plans showed no differences in terms of the diaphragm connection, does not establish that there was no change in the plans by Dr Reay's office between 27 August and 10 September 1986 in relation to that connection.

(iii) Dr Reay's solicitors submitted a memorandum to the Royal Commission on 24 July 2012, noting the differences in the plans held by ARCL and the permitted drawings. The only differences noted in the memorandum are on S.25 and S.26, and for S.25 there is a note stating "*amended 29/4/87*" which is after the building permit had been issued.

(iv) As indicated at paragraph 191[117] of the Closing Submissions, it is evident from carrying out a review of the permitted drawings in conjunction with the Tapper letter, that a number of other changes had been made to the drawings in response to that letter.

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[113] BUI.MAD249.0141.14-15
[114] TRANS.20120814.87,lines 1 to 25
[115] TRANS.20120814.87 L18-22
[116] TRANS.20120827.CS.401
[117] TRANS.20120827.CS.50

(c) The absence of calculations relating to the diaphragm connection and error in which Mr Harding dropped a zero

(i) Mr O'Loughlin was questioned about the dropping of the zero, and he concluded the review process could not have expected to identify the error, as a line by line review could not be carried out.[118] Mr O'Loughlin later noted in his evidence that a Council reviewing engineer's role in relation to the calculations is to check that proper processes have been followed through.[119] It is telling that Mr O'Loughlin was the only structural engineer giving evidence at the hearings who mentioned this error in S57 of the calculations. It is submitted that this reinforces the view that a reviewing engineer could not have been reasonably expected to pick up this error.

(ii) It is further submitted that the absence of specific calculations relating to the diaphragm connection is in the same category. It is again noteworthy that this issue was not raised in the Hyland Smith report or the peer review by Mr William T Holmes. It appears to have been first raised in the evidence of Mr Banks.[120]

(d) Building prone to torsion and the dangers resulting from this

(i) It is difficult to fully respond to this general assertion given that the point is not further developed in this part of the Closing Submissions. However, to the extent that the submission relates to specific aspects of the CTV Building design, and in particular building inter-storey drifts and the drift capacity of columns, the issue was discussed in the evidence of Mr John O'Loughlin.[121] Mr O'Loughlin said:

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[118] TRANS 20120814, lines 60 to 70

[119] TRANS.20120814.113 L28-31

[120] TRANS20120817.6 L23-31

[121] TRANS.20120814.64 L16- TRANS.20120814.65 L19

"When it is obvious that the columns do not form part of the lateral load resisting system of a building, the approach would have been that the columns did not need to be designed for ductility. Columns for these types of buildings were simply treated as props. In my view, it would have been completely impracticable for a reviewing engineer to carry out the kind of review necessary in order to make fine judgements about the application of NZS 4203 and NZS 3101 to the design of concrete columns".[122]

(ii) He later went on to say:

"In my view, the precise determination of whether the columns were required to be detailed for seismic purposes in terms of the standard required complex analysis. A number of the present day expert commentators giving evidence in these proceedings, have used computer based mathematical modelling that would simply not have been readily available to the Council reviewing engineers at the time the CTV building was permitted".[123]

(iii) In cross examination, Mr O'Loughlin confirmed that in order to decide whether the gravity frames in the building were to be designed for seismic purposes, it was necessary to carry out a complicated calculation by ETABs analysis, and the Council simply did not have the capacity to do that sort of calculation.[124] Later in re-examination Mr O'Loughlin confirmed that the Council would need to rely on the designer having completed a competent ETABs analysis.[125]

(iv) John Hare also confirmed in his evidence that in order to identify the various alleged non compliances with the columns, it would be necessary to carry out a detailed analysis of the building, effectively a peer review. Mr Hare's

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[122] TRANS.20120814.64 L27 - TRANS.20120814.65 L2

[123] TRANS.20120814.65 L13-19

[124] TRANS.20120814.78 L5-10

[125] TRANS.20120814.115 L1-8

evidence was that a computer analysis would be required to establish the drifts that may be imposed on the gravity structure of the building.[126]

(v) The evidence concerning the design of columns for gravity loading only is also reinforced by Mr Peter Nichols' evidence where he said:

> *"It is my recollection that, at the time the CTV Building was designed, it was accepted that where adequate shear walls were included to provide the required lateral restraint to the structure, the columns could be designed for gravity loads only, with the proviso that the shear wall disposition was sufficiently symmetrical to ensure an equitable distribution of lateral loadings between them"*[127].

(vi) Given the on-going debate that has taken place before and during this hearing as to the necessity for the CTV Building's columns/beam column joints to be designed for ductility, this is again a matter of fine judgment on a design matter and one which a reviewing engineer could not be reasonably expected to pick up.

(e) Inadequacy of non-seismic columns and beam column joints to meet the requirements of Bylaw 105 and the incorrect treatment of the columns as secondary elements

In relation to the beam column joints, reference is made to Mr O'Loughlin's comments above on this point. In terms of the columns, the submissions under (d) above are repeated here. It is also noted that in any event, the Council does not accept that the treatment of the columns as secondary elements was incorrect.

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[126] TRANS.20120816.97 L1-19

[127] TRANS.20120806.68 L17-22

(f) Columns and beam-column joints were a risk to life in the event of failure

As stated earlier, a Council reviewing engineer's role is in relation to code compliance and not wider issues of good or best practice. To the extent however that "risk to life" raises an interpretation issue about code compliance, this is also dealt with above.

(g) The absence of further calculations relating to the determination of v delta and whether the columns would be elastic at v delta

Whether a Council reviewing officer should have picked up this issue was not specifically put to Mr John O'Loughlin or Dr O'Leary in cross examination. However, it is submitted that it is essentially an aspect of other issues discussed above at (d) above.

In relation to the non compliance identified for Line F, Mr O'Loughlin was asked whether a Council reviewing engineer should have given particular attention to these columns. Mr O'Loughlin's view was that a Council reviewing engineer would not have seen these columns as being more significant than any others in the building.[128]

(h) The columns and the beam column joints should have been designed under the seismic provisions of the Code as drift levels were likely to be excessive

Again, previous submissions related to (d) above are repeated. This is an issue requiring fine judgements about the interpretation and application of the codes to the design of the columns and beam column joints. As also submitted above, on one view of the Hyland Smith material, the margin of non-compliance for some of the columns was very fine.

[128] TRANS.20120814.94 L17 – TRANS.20120814.95 L25

The Standards to be Applied

152. At paragraph 169 of the Closing Submissions,[129] it is submitted that the evidence of the standards *actually* applied by Mr Tapper sets an appropriate benchmark for the *expected* standard, at least in relation to identifying compliance issues.

153. While there was considerable evidence about the general approach adopted by Mr Tapper, the only direct evidence of Mr Tapper's standards as related to the CTV Building is his letter of 27 August 1986. If this letter reflects the "benchmark" standard, then it would seem to follow that the letter reflects what a reviewing engineer should at that stage have identified – at least prior to the receipt of the calculations that were forwarded on 5 September 1986. In the absence of any further documentation or record of discussions with the design engineer, it is uncertain what further matters may have been considered by Mr Tapper upon receipt of the calculations and amended plans.

8. BUILDING ASSESSMENTS

154. The post earthquake assessment of the CTV building is discussed at paragraphs 476 to 554 of the Closing Submissions.[130] The Council wishes to respond to some points raised by Counsel Assisting in this section, in particular in relation to reliance on the green placard; training; the 7 September assessment team not including an engineer; the Council's information systems; access to structural drawings; and red stickering by fiat. For ease of reference, the Council has adopted the headings and numbering used by the Closing Submissions when discussing these matters.

(e) Reliance on the Green Placard

155. This section of the Closing Submissions discusses the relevance to the building occupants and Mr Drew of the green placards issued for the CTV building following the September and Boxing Day earthquakes.[131]

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[129] TRANS.20120827.CS.46

[130] TRANS.20120827.CS.105 - 119

[131] TRANS.20120827.CS.106

156. The Council has indicated its support for a review of the placarding system in separate submissions made to the Royal Commission for the building management after earthquakes hearing (**"building management submissions"**). The Council agrees with Counsel Assisting that this review should include consideration of the colours of the placards and the wording on them.[132]

157. Counsel Assisting also notes at paragraph 488 that there was no legal requirement for the CTV building owner to arrange their own inspection of the building following the earthquake.[133] The Council has noted this issue in its building management submissions. The Council's submission is that there is a need for a standard power in legislation, that can be used both during and following a state of emergency, to require a building owner to provide a detailed engineering evaluation.[134]

158. The Council wishes to specifically respond to the comments in the Closing Submissions concerning the apparent reliance placed by Mr Drew on the green placards. At paragraph 488, Counsel Assisting refers to Mr Drew placing "significant reliance" on the green placard, although noting that he understood it was recommended that an owner obtain its own inspection. Again, at paragraph 489, Counsel Assisting states that Mr Drew should have obtained a further inspection from Mr Coatsworth after Boxing Day, but that he appeared to continue "to place reliance on the green placard".[135]

159. It is submitted that, although Mr Drew suggested that he did rely on the green placard, this could not in fact have been the case. Mr Drew's evidence was that, through discussion with other business people, discussion with Murray Wood and through information in the media, in September he became aware that:

> *"Council inspections only went so far and it was the responsibility of owners to get a more detailed inspection".*[136]

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[132] ENG.CCC.0049.14 and 15
[133] TRANS.20120827.CS.106
[134] ENG.CCC.0049.21
[135] TRANS.20120827.CS.106
[136] TRANS.20120702.13 L27-29.

160. Mr Drew said it was for this reason that he asked Mr Coatsworth to carry out his inspection in September.[137]

161. Mr Drew also agreed that he was aware of the wording on the green placard[138]. This says, "*Inspected. No restriction on use or occupancy*" and then:

> "*This building has received a brief inspection only. While no apparent structural or safety hazards have been found, a more comprehensive inspection of the exterior and interior may reveal safety hazards…Owners are encouraged to obtain a detailed structural engineering assessment of the building as soon as possible"…Subsequent events causing damage may change this assessment. Re-inspection may be required*".[139]

162. It is clear from the wording on the placard that only a limited inspection has been carried out and that there is a need for a more detailed inspection to follow, arranged by the building owner. Media releases made by the Council following the September and Boxing Day events also conveyed this message.[140]

163. Given that Mr Drew accepts he had read the green placard and that he was aware in September that the rapid assessments carried out by Civil Defence were not detailed assessments, it is submitted that it is not reasonable for him to suggest that no inspection was arranged following Boxing Day because Mr Drew "*continued to place reliance on the green placard*". It is clear that he could not reasonably have done so.

164. As a final comment in relation to this section, the Council notes that the Closing Submissions at paragraph 491[141] refer to the evidence of Mr Kehoe. Mr Kehoe's evidence was that in the United States the wording on the green placard had been changed from "safe to occupy" to "inspected". As noted above, the green placard used after the September and Boxing Day earthquakes likewise did not include the words "safe to occupy".

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137 TRANS.20120702.13 L24-29

138 TRANS.20120702.68 L7-26

139 ENG.CCC.0002F.78

140 ENG.CCC.0002F.17 and ENG.CCC.0002F34

141 TRANS.20120827.CS.107

(f) Lack of Training/Understanding of the Assessment Process

165. This section of the Closing Submissions refers to a lack of training of the participants in the building assessment process.[142] The Council noted in opening submissions that formal adoption of a national building safety evaluation framework would assist in ensuring on-going training for building officials.[143] In addition, the Council's building management submissions support a recommendation by the New Zealand Society for Earthquake Engineering (**"NZSEE"**), that a formal system be established for the training, registration and authorisation of engineers trained in building management.[144]

166. However, the Council does not consider that the totality of the evidence heard by the Commission from participants in the CTV building assessment process demonstrated a "l*ack of training/understanding of the assessment process*". The officers generally indicated that more training would be beneficial, but their evidence also on the whole indicated a good understanding of the rapid assessment process.

167. The evidence from Mr Van der Zee, who participated in the Level 1 assessment of the CTV building, indicated that the briefings he attended following the 4 September earthquake were sufficient to give him an adequate understanding of the rapid assessment process. He was aware that the purpose was to look for any obvious damage or hazards.[145] Mr Van der Zee was also aware that a Level 2 assessment would be done if the Level 1 form identified any issues.[146]

168. Mr Calvert indicated in evidence that he had attended a seminar in 2009 concerning the Emergency Operations Centre and how this would operate. This seminar included a presentation by Mr Brunsdon about the rapid assessment process.[147] Both Mr Calvert and Mr Flewellen also accurately explained in evidence the difference between the rapid assessment placards.[148]

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[142] TRANS.20120827.CS.107
[143] TRANS.20120806.OS.27
[144] ENG.CCC.0049.17 and 18
[145] TRANS.20120628.7 L30-32
[146] TRANS.20120628.8 L 16-21
[147] TRANS.20120628.17 L18-24
[148] TRANS.20120628.23 L11-18 (Calvert) and TRANS.20120628.65 L26-29 (Flewellen)

169. Marie Holland, who carried out the post Boxing Day rapid assessment, also indicated in evidence that she understood the differences between the placards and the distinctions between a level 1 and level 2 assessment.[149]

170. The Closing Submissions at paragraph 492[150] refer to a comment from Mr Simson that they *"were left to second guess and use [their] combined experience as to what was safe or otherwise".* It is submitted that a level of judgement will always be required of teams carrying out rapid assessments. In the particular case of the 7 September assessment, Mr Flewellen, Mr Calvert and Mr Simson all had considerable experience in the building and construction industry. Mr Flewellen commented that:

> *"we all come from building backgrounds and have a fair bit of experience and we know what shear walls are, floor diaphragms and connections and we know appropriate places to look where you'd expect stress".*[151]

171. Counsel Assisting also states at paragraph 493[152] that a lack of training was highlighted by the different understandings each of the three had regarding the nature of the Level 2 assessments they were supposed to carry out. It is submitted this is not supported by the evidence that each of the witnesses gave.

(g) Level 2 Assessment – No engineer involved

172. There are three matters in this section of the Closing Submissions that the Council wishes to comment on. First, the statement in paragraph 496[153] that there were other occasions when level 2 assessments were carried out without an engineer.

173. Counsel Assisting suggests at paragraph 496 that Ms Holland's evidence was to the effect that there were other Level 2 assessments carried out without an engineer. However, Ms Holland's evidence was that, while she thought there

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149 TRANS.20120702.90
150 TRANS.2012.0827.CS.107
151 TRANS.20120628.67 L9-12
152 TRANS.20120827.CS.108
153 TRANS.20120827.CS.107-108

may have been other occasions when a level 2 assessment was carried out without an engineer, she was not aware of any specific examples. Ms Holland also said the types of buildings where this could have occurred would perhaps be buildings below three levels or non-critical facility buildings.[154]

174. The other officers involved in the rapid assessment process also gave evidence on this issue. Mr Flewellen stated that he conducted numerous rapid assessments on the 4th, 5th and 6th of September and all of those assessments were conducted by him in association with an engineer[155] and that it was "out of the ordinary" to be directed to conduct the CTV assessment without an engineer.[156] Similarly, Mr Simson agreed, in response to a question from Counsel Assisting, that it was a "fixed rule" that a level 2 assessment required an engineer to be in the group.[157]

175. While Mr Calvert's evidence was that there were not always engineers on the assessment teams,[158] he was not aware of any other cases where the assessments carried out without an engineer were Level 2 assessments.[159]

176. Therefore, it is submitted that Mr Flewellen's comment that it was "out of the ordinary" for an assessment to be carried out without an engineer, is a more accurate reflection of the evidence on this issue than that suggested by Counsel Assisting, in particular in relation to Level 2 assessments.

177. Next, the Council wishes to address the comments made in the Closing Submissions at paragraphs 497 and 498. Counsel Assisting's submission is that Messrs Calvert, Flewellen and Simson knew that a level 2 assessment should be carried out by an engineer but, although they knew this, they were content to rely on an assurance from a man they understood to be the Building Manager, that an engineering inspection would be arranged. Counsel Assisting states that this reliance was inappropriate and potentially dangerous.[160]

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[154] TRANS.20120702.91 L11-12
[155] TRANS.20120628.50 L30-32
[156] TRANS.20120628.51 L16-18
[157] TRANS.20120628.100
[158] TRANS.20120628.21
[159] TRANS.20120628.31
[160] TRANS.20120827.CS.108

178. While Mr McCarthy did accept during cross examination that it would have been preferable if the three inspectors had returned to the EOC and requested that an engineer carry out a level 2 assessment of the building,[161] it is submitted that the submissions made by Counsel Assisting do not include any consideration of the context at the time. The Council also submits that the comments do not reflect the full extent of the steps taken by the three inspectors.

179. It is now two years since the three visited the building. At the time of their visit, it was three days after a very significant earthquake event. On-going aftershocks were being experienced and there was widespread damage across the city. Civil Defence was receiving a large volume of requests from both commercial and residential building owners for assistance. These requests had to be prioritised and a large number of Council staff and volunteers had to be managed and allocated to the more urgent response efforts.

180. It was against this background that three urgent jobs apparently came to the attention of Mr McCarthy, including a request to inspect the CTV building. It is uncertain now why the request in relation to the CTV building was urgent, but that appears to be how it was understood by Mr McCarthy at the time and it seems this was conveyed at least to Mr Flewellen.

181. The evidence is that at the time the request was received, all available engineers had already been assigned to other tasks, so Mr McCarthy turned to three senior staff from his unit and asked them to attend to the three jobs. As Mr McCarthy noted in evidence, the basis for this decision was:

> *"there's no engineers available,…we need to do these jobs…we need to protect the public, we need to protect workers, we need to do what we can to address these issues that have been brought to our attention".*[162]

182. When the three officers arrived at the building it was already occupied and a Level 1 assessment had been carried out. Although they were aware that a level 2 assessment would normally require an engineer, they made the decision to check the building for any obvious signs of damage. While they are not

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[161] TRANS.20120703.35

[162] TRANS.20120703.29 L 15-18

engineers, they are experienced in building matters and could at least check for any signs suggesting that the building occupants were in immediate danger.

183. All three officers assessed the exterior of the building. Mr Calvert checked the ground floor.[163] Mr Flewellen went into the stairwell, he believes probably to the top, and began working his way down looking for any evidence of damage,[164] including in the area of the connection of the floors to the north core of the stairwell.[165] Mr Flewellen also accessed a tenancy on one of the upper floors of the building,[166] but was unable to access other tenancies because the "building manager" had not been able to locate any other keys.

184. Mr Simson and Mr Flewellen also gave close attention to an area at the bottom of the stairwell where there was a gap between the floor and the block wall on the north side of the building. Mr Flewellen's conclusion was that this gap was not caused by earthquake movement.[167]

185. Mr Flewellen stated that he and Mr Simson also entered the covered carpark and when in the carpark they viewed four or five columns, checking their connections to the floor beams. They also checked the connections between the stair shaft and the floor slab.[168]

186. As Mr Calvert notes, if the three inspectors had seen any signs of significant damage at that stage, they would have told the occupants to get out of the building straight away.[169]

187. In addition to this visual inspection, they also discussed with the "building manager" and the receptionist whether they had any specific concerns about any areas of the building.[170] Mr Calvert's evidence is that they did not indicate any areas of concern.

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163 TRANS.20120628.22
164 TRANS.20120628.52 L32-33
165 TRANS.20120628.74 and .75
166 TRANS.20120628.53
167 TRANS.20120628.54
168 TRANS.20120628.55
169 TRANS.20120628.21
170 TRANS.20120628.21

188. Mr Calvert said that he had a clear memory of talking to the "building manager" about the need for an engineer to conduct a thorough inspection of the building.[171] Mr Calvert said that this was stressed to every person they came across in the building.[172]

189. It is submitted that, contrary to what is said in the Closing Submissions, the three were not content to merely rely on a statement from the building manager that an engineer would be coming. They carried out an assessment of the parts of the building they could access and did not see any signs of significant damage. They checked with two occupants of the building whether they were aware of any issues and they impressed upon all people they met in the building that an engineer's assessment was required. They were told that this would be carried out, and in fact it was.

190. Given the scale of tasks arising from the 4 September earthquake, the response and recovery relied on the significant involvement of many Council employees and volunteers, including Mr McCarthy, Mr Flewellen, Mr Calvert, Mr Simson, Mr Van der Zee and Ms Holland.

191. Mr Calvert's evidence is that, after making sure his family was safe, he arrived at work at 6.15am on 4 September[173] and on subsequent days he would normally arrive at the Art Gallery at 7am.[174] He notes that what followed was *"a very busy and unusual time".*[175] Mr Flewellen returned from holiday to provide assistance on 4 September, he arrived at the Art Gallery at 7am that day.[176] Similarly, Ms Holland returned from her Christmas holidays to assist with the post Boxing Day response.[177] As Mr Flewellen noted in evidence, they were all simply trying to *"do their bit"*.

192. Out of necessity, these people had to make judgment calls about appropriate action in what was a new and stressful environment. Counsel Assisting's description of the decision made by Messrs Calvert, Flewellen and Simson as

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[171] TRANS.20120628.21 L20
[172] TRANS.20120628.31
[173] TRANS.20120628.15.L29-32
[174] TRANS.20120628.19 L11
[175] TRANS.20120628.18 L20-21
[176] TRANS.20120628.50 L5-10
[177] TRANS.20120702.88

"inappropriate and potentially dangerous" is an unfair characterisation of the actions they took on the 7th of September to satisfy themselves that the occupants of the building were not in immediate danger. As discussed below, their assessment of the building as occupiable was subsequently confirmed by Mr Coatsworth.

193. The final matter that the Council intends to comment on in this section is in respect of paragraphs 502 and 503,[178] where Counsel Assisting discusses Mr McCarthy's comment that the level 2 assessment was "superseded" by Mr Coatsworth's subsequent inspection. Mr McCarthy's point was that Mr Coatsworth carried out a more detailed inspection of the building on behalf of the building owner.

194. This assessment confirmed that the building could be occupied. Mr Coatsworth did not identify any damage that would indicate that the green placard was inappropriate. Any detailed assessment will always take precedence over anything less detailed that has gone before – if Mr Coatsworth's assessment was that the building should not be occupied, this would equally have superseded the 7 September assessment carried out by the three officers.

195. It is also noted that the green placard had in fact ceased to have any legal effect at the end of the state of emergency on 16 September 2010.

(h) Inadequate Information Systems

196. The Council agrees with the comments in paragraph 506[179] of the Closing Submissions that an adequate information system is imperative following an earthquake. The Council does not however agree with Counsel Assisting's description of its record keeping system as "inadequate" at the time.

197. The Council does have a record of the two rapid assessments carried out after 4 September and the rapid assessment carried out following Boxing Day. These records were attached to Mr McCarthy's evidence. The issue with record keeping related more to how to deal with a vast amount of hard copy information in a timely manner. For example, in September, level 1 rapid assessments had been carried out for all commercial buildings in the central

[178] TRANS.20120827.CS.109
[179] TRANS.20120827.110

business district, including the CTV building, by midday on 6 September 2010.[180] These rapid assessment forms contained a significant amount of data which had to be recorded electronically, obviously taking time and resources.

198. As noted in the Council's Opening Submissions, the need for electronic emergency management information systems is a matter arising from the response to the 4 September earthquake that needs further consideration.

(j) Structural Drawings

199. It is submitted at paragraph 522 of the Closing Submissions[181] that in future all structural drawings of multi-level buildings should be available electronically, in order to ensure that the drawings can be reviewed for owner initiated and possibly also level 2 building assessments.

200. The Council agrees with the recommendation that plans should be available electronically. It already has a process underway to scan its hard copy commercial and residential property files. However, as noted in the Council's building management submissions, this process takes time and a requirement to scan all files within a short timeframe could be quite onerous for some Councils to achieve.[182]

(p) Red Stickering by Fiat

201. The final part of the Building Assessment section that the Council wishes to comment on is the section on "red stickering by fiat", beginning at paragraph 541 of the Closing Submissions.[183] This concerns a proposal put forward by Professor Mander. Counsel Assisting refers to some comments made by Mr Kehoe in response to this proposal.

202. The Council notes that Mr Holmes also viewed Professor Mander's proposal unfavourably. Mr Holmes commented that the suggestion that the building should have been red stickered due to its age and the apparent code level

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[180] ENG.CCC.0002F.12
[181] TRANS.20120827.CS.113
[182] ENG.CCC.0049.25
[183] TRANS.20120827.CS.117

shaking would be *"unjustified and impractical"*.[184] Mr Holmes also said that he totally disagreed with the suggestion that reports of a more lively floor should have led to further investigation of a red sticker.[185]

203. Professor Mander also in fact accepted in response to questions from the Commissioners that his proposal would have led in September 2010 to all buildings in the central business district, and all buildings in commercial centres in the suburbs, being closed pending a review of the building plans and "at least a reasonable inspection", preferably to a level 2 standard.[186]

10. DRAG BAR RETROFIT – 1990 HCG REPORT

204. As submitted in opening, the Council considers that the remedial works required a building permit.

13. CONCLUSIONS

205. The Council has responded where appropriate to the Closing Submissions. There is some overlap with the hearings on 3 and 4 September 2012.

Dated: 4 September 2012

DJS Laing / KG Reid / ND Daines
Counsel for Christchurch City Council

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184 TRANS.20120711.5 L30-31
185 TRANS.20120711.5 L33 - .6 L1
186 TRANS.20120724.17 L6-24

ANNEXURE A

CLAUSE 7. SIX MONTHLY REVIEW OF RECEIPTS AND EXPENDITURE:

It was resolved that the information be received.

CLAUSE 8. LAID ON THE TABLE DOCUMENTS:

It was resolved that the information be received.

CLAUSE 9. HOSPITAL BOARDS - EXTRAORDINARY VACANCY:

It was resolved that the Chairman's recommendation be adopted and be referred to the Council.

CLAUSE 10. INVESTMENTS OF GENERAL FUNDS:

It was resolved that the information be received.

CLAUSE 11. NEW BUILDING BYLAW NO. 105 (1985):

It was resolved that the new Building Bylaw No. 105 (1985) be approved and be referred to the Council for adoption.

CLAUSE 12. AUSTRALIAN NATIONAL WORKSHOP ON SMALL BUSINESS COUNSELLING SERVICES:

It was resolved that the Chairman's recommendation be adopted.

CLAUSE 14. QIN SHI HUANG TI BURIED WARRIORS EXHIBITION:

This Clause was taken in Open Meeting at this stage of the meeting.

It was resolved to recommend that the Qin Shi Huang Ti Buried Warriors Exhibition be proceeded with subject to the sponsorship being confirmed at the levels indicated.

NEW BUSINESS:

. INVITATIONS TO CIVIC FUNCTIONS:

Cr Close suggested that a more representative cross-section of the public could perhaps be invited to civic receptions in the future by having the recipients for some invitations selected at random from the Council's District Electors Roll.

The Mayor said that the point made by Cr Close had been noted.

It was resolved, pursuant to Section 4 of the Public Bodies Meetings Act 1962 that the public be excluded from the remainder of this meeting because the Committee was of the opinion that (a) Publicity would be prejudicial to the public interest by reason of the confidential nature of the business to be transacted or for other special reasons arising from the nature of that business or of the proceedings; or (b) Publicity would be likely to cause unnecessary personal embarrassment to or unnecessarily damage the personal reputation of any person.

The Committee then went "In Committee".

11. NEW BUILDING BYLAW NO. 105 (1985):

The following clause was before the Town Planning Committee at its meeting on 3 October 1985:

"In 1981 the Council began a comprehensive review of all of its bylaws. In the intervening years most of the bylaws have been rewritten and are in a form where they are readily available to the general public.

The building bylaw has been the one exception. It had been revised to conform to the general pattern of the other bylaws but much of the text was still contained in New Zealand Standards which are often amended and are now quite expensive.

A revised Building Bylaw is attached to this report. As far as is possible it has incorporated clauses from the New Zealand Standards but the New Zealand Standards have been severely edited to remove clauses that are not particularly relevant to present building conditions.

The more recent standard bylaws have been in the form of a relatively simple bylaw with the means of compliance being contained in a separate document. The means of compliance documents, the technical documents that explain how to comply with the bylaws are not changed and are being used throughout the country.

One of the major reasons that a new bylaw is necessary is that the New Zealand Standard relating to fire resistant construction has been amended and most fire resistance ratings have been halved. Until the new bylaw is adopted the benefits of that change cannot be passed on to developers.

The Municipal Association has been advised by many Local Authorities that they are not happy with the prospect of eliminating concrete or masonry fire walls. Officers of both Waimairi District Council and the Christchurch City Council are of the opinion that while the reduction in fire resistance ratings should be welcomed they should recommend to their respective Councils that the requirement that fire walls be of concrete or masonry should be retained.

The proposed bylaw has therefore reduced the requirement for firewalls down from 4 hours to 1½ hours but retained the requirement that such walls be of concrete or masonry.

The other significant change is to simplify the bylaws relating to accessory buildings. As far as possible siting requirements have been left as a matter more properly considered by the District Scheme and the bylaw has attempted to deal only with structural and fire resistance matters.

Prior to the adoption of the bylaw a meeting will be held with Architects, Engineers and Draughtsmen to explain the changes incorporated in the bylaw and an information sheet will be prepared for builders."

11 Cont'd

The Town Planning Committee resolved that the proposed Building Bylaw No. 105 (1985) be forwarded to the Policy and Finance Committee with a recommendation that it be approved at the October Council meeting, confirmed at the November Council meeting and made operative as from 1 December 1985.

Recommendation: That the resolution of the Town Planning Committee be adopted and that the Bylaw be referred to the Council for approval.

12. AUSTRALIAN NATIONAL WORKSHOP ON SMALL BUSINESS COUNSELLING SERVICES:

The Employment Promotion Senior Co-ordinator reports:

"At the time the current budget was set there was discussion of the fact that it may be necessary for a member of the Employment Promotion Division to travel to Australia to obtain fresh ideas in the field of Small Business.

At the Business and Development Conference hosted by this Council on 11 and 12 February of this year it became obvious that we could not obtain any ideas for future development in New Zealand and it was in fact also obvious that the delegates attending were looking to Christchurch to provide the ideas for new initiatives.

This is borne out by the fact that the only work undertaken in the Business Development Area by local authorities is a direct copy of work undertaken here in every case the background research carried out in Christchurch has been used by other authorities in the development of their ventures.

For us to advance it is now beyond doubt that we must look overseas for examples or ideas on which to base that advance.

In Australia there are advances being made in the "*Business in the Community*" concept and in the principle of the shifting of business development from State to local government, and in the idea of the involvement of industry in the funding of the Enterprise Agency concept.

This is topical as not only are we considering the advance of this Council in the role but we are doing it when there is a mood for and a possibility of change in the roles of central/local government