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 NGA WHARE I HORO I NGA RUWHENUA O WAITAHA**
AND IN THE MATTER OF	**THE CTV BUILDING COLLAPSE**

SUBMISSIONS ON BEHALF OF BEREAVED FAMILIES AND THOSE INJURED

Dated: 4 September 2012

SUBMISSIONS ON BEHALF OF BEREAVED FAMILIES AND THOSE INJURED

1. Before 22 February 2011, the CTV Building appeared to be an unremarkable, relatively modern building.[1] After the earthquake at 12.51pm that day, it was unrecognisable. It was difficult to discern that it had even been a building at all.[2]

2. In New Zealand, we do not expect a building to collapse in this way. That expectation is not beyond reason. From the mid 1970s, building Codes in this country incorporated ductility requirements. This seems to have borne fruit because nearly every building designed and constructed after that time survived the earthquake of 22 February 2011 without serious failure. Only one did not.

3. Perhaps the most fundamental question bereaved families have is, *how could this happen in a developed country which has long been known to be prone to earthquakes and which has continually developed building Codes to address this risk?*

4. The law at the time the CTV Building was designed specified that collapse was to be avoided and the probability of injury and death to those in and around the building was to be minimised. These were mandatory legal obligations.

5. Yet this building collapsed in the most horrible and catastrophic way. It was the most complete and utter failure of any building in Christchurch. The PGC building, in which 18 people died and others were very seriously injured, at least remained partially standing. Some connections held around the central shear core and the ground floor was completely intact, allowing some to escape who might otherwise have died.

6. Even unreinforced masonry buildings, some of which were almost a hundred years old, did not fail in the same way as the CTV Building. In those buildings, walls and parapets fell, mostly outwards, but the building structure remained standing.

7. Every other building in Christchurch built under the same Codes as the CTV building withstood the earthquake and no one died in any of them.

8. But the CTV building did not just fail. The word 'pancaked' is the only description. It was a total collapse which left those in the building with virtually no chance of survival. Some bodies were never even recovered. To stumble from this building alive was a miracle.

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[1] See BUI.MAD249.0011.2
[2] See BUI.MAD249.0189.32

9. As the rebuild gathers pace and Christchurch looks forward, the families of those who died still wake up every morning with pieces of their lives missing. They are entitled to know why those they love did not come home after 22 February. Others who lost friends, colleagues and workmates will want to know the answer to this too. Many people in Christchurch knew someone who died in the CTV Building.

10. It is also natural for these people to ask, *could someone have done something that would have made a difference? Could the death of my wife or husband, my child, my mother or father, my friend, somehow have been prevented?*

11. Some family members have come to the Royal Commission throughout almost every day of the eight weeks of hearings, in some cases travelling several hours each day. Some who wanted to be here could not due to family or work commitments. Others have chosen to let the Commission run its course without following it at all. Many have been unable to be here since they live overseas but, with the assistance of support people, volunteers and embassies, they have been able to follow the Royal Commission's work.

12. On behalf of all of the families, I would like to thank Kate Collins, the Family and Community Liaison Officer, and Robin Major, the Commission's Senior Communications Advisor, for the care they have taken to support them.

13. Mr Mills has given an extensive account of the history of this building and invited the Royal Commission to make findings. On behalf of the families and those injured, I ask the Royal Commission to accept all of those submissions.

14. Mr Mills has covered many areas which are of particular concern to the families. I have contributed to the preparation of those submissions in my role as counsel assisting.

15. I am also required to represent the interests of bereaved families and those injured, and I make these submissions for this purpose. My comments will supplement what Mr Mills has said and articulate some of the concerns that families have outlined to me.

The Collapse

16. The evidence shows that the North Shear Core performed its role up to the point where connections with the floors were lost. The North Shear Core not only remained standing when all else had collapsed, but it showed little evidence of failure.

17. It is clear that, during the earthquake on 22 February:

    a. The connections between the floors and the North Shear Core and South Coupled Shear Wall detached.

b. The connections between the columns and the beams disintegrated such that there was nothing holding the columns to the beams.

c. Not only did the connections between beams and columns fail, but there was evidence that the columns themselves failed. They were wholly or partially crushed or they fractured and gave way.

18. There has been a great deal of evidence about the sequence in which these crucial parts of the CTV Building failed. One of them may have come first; some may have happened simultaneously; one alone may have been enough to cause complete collapse, but one thing is certain: they all happened. The connections between the floors and the walls, the column-beam connections and the columns all failed to do what was required to keep the Building standing.

19. From the families' perspective, their interest is in knowing whether any of these crucial areas of failure could have been prevented and if they had been prevented, might the outcome have been different.

20. It is clear that the strength of the diaphragm connections to the North Shear Core was crucial to keeping the Building intact. However, the evidence shows that the connections were non-compliant with the Bylaw from the time they were designed until the day the Building collapsed.

21. It is also clear that the columns and beam-column connections were crucial in preventing the type of collapse that took place. Compelling photographs were produced by Dr Rob Heywood, without whom the Royal Commission's work would have been much harder.[3] Graham Frost similarly did the engineering profession proud in the way he gathered useful information about the Building. In looking at these photographs, it is not difficult to see why so many people died. It is plain why the columns were so critical, and why their failure was such an obvious risk to life.

22. It will have caused much pain to families to learn that Dr Reay and Mr Harding had a choice about whether to use the seismic or non-seismic provisions of the Code for the design of the columns and beam-column connections. Professor Priestley gave evidence that, had the seismic provisions been used, the column displacement capacities would have been sufficient to resist the forces predicted by the non-linear time history analysis of the 22 February earthquake.[4]

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[3] WIT.HEYWOOD.0001.46 and .44
[4] TRANS.201.20712.4 lines 4-8

A history of missed opportunity

23. In a sense it is not surprising that the CTV building failed so completely when one considers its history. At almost every important stage, there appears to have been a mistake or a lack of care, an oversight or an unfortunate twist.

24. There were many opportunities for people to do something that might have prevented so much injury and death. Unfortunately, every one of these opportunities was missed.

25. Some of those who missed opportunities could not be expected to have done anything different than what they did. The missed opportunity is only obvious in hindsight. For others however hindsight should not have been required. The necessary actions should have been obvious to them at the time.

Building design

26. It is submitted that there were two fundamental design areas which sealed the fate of this Building. The first related to the walls. The decision to place the North Shear Core outside the envelope of the building meant that it would be difficult to achieve effective diaphragm connections, especially with large voids. As it was an open structure, torsion was an inevitable danger, as Mr Henry's models showed. The placement of a South-Coupled Shear Wall which was not as strong as the North Shear Core resulted in asymmetry, compounding the dangers posed by torsion.

27. Secondly, the decision was made that the columns and beam-column connections would be designed using the non-seismic provisions of the Code. The dangers resulting from torsion were exacerbated given that non-seismic columns were always going to be less capable of surviving large inter-storey drifts.

28. It is inconceivable that Dr Reay did not know, or could not have easily found out, about this combination of defects, which arose from basic design decisions. Indeed, it is clear that he must have known about the placement of the walls as he discussed the matter with Mr Harding for the purpose of assessing the lateral load system. Although he denied awareness of the non-seismic design of the columns, when he was asked whether he would have designed them differently if he had known, he said that he would not.[5] So these design flaws are as much his as Mr Harding's.

29. Had Dr Reay or Mr Harding turned their minds to the mandatory legal obligations to avoid collapse and minimise the risk of injury and death, they could not have made the same decisions about the design of the Building. They would have been required to

[5] TRANS.20120712.133 L 29 to .134 L6; TRANS.20120801.71 L30 to .72 L5

reassess the placement and strength of the walls and to design the columns and beam-column connections with the seismic detailing provisions of the Code.

30. These problems were compounded by the fact that neither Dr Reay nor Mr Harding appears to have understood the requirements of capacity design. Capacity design required the designer to consider the behaviour of the building as a whole, to work out how earthquake loads would be distributed through the building, and to ensure that distribution could take place in such a way that, in the event of an extreme earthquake, the building would fail in an acceptable manner. Failure should have taken place in selected plastic hinge regions which were designed to be ductile. However, failure occurred in the worst parts of the Building in terms of safety: the beam-column connections, the columns and the diaphragm connections.

31. Dr Reay and Mr Harding clearly did not have sufficient experience to design this building. Dr Reay compounded this in his failure to review the drawings before they were sent to the Council and to satisfy himself that Mr Harding's work was acceptable. However, given Dr Reay's evidence that Mr Harding was more familiar with the relevant Code than he was, it appears that this would not have made a difference anyway. Dr Reay should never have taken this job on.

32. Dr Reay compounded this mistake when he persuaded Mr Bluck that a permit should be granted even though he had limited knowledge of the Building and limited understanding of the applicable Code.

The Permit

33. The bereaved families are concerned that the Christchurch City Council allowed a permit to be granted for a building which did not comply with Bylaw 105. Clearly the reviewing officers were concerned about this building, which is not surprising given the number of defects, all of which have been described by Mr Mills. The permit should not have been granted until all of these defects were properly addressed.

34. It is no excuse to say that the Council had limited resources. There was an obligation to ensure the building complied with the Bylaw before a permit was granted. Mr Tapper and Mr Bluck should have identified the problems outlined already and the likelihood is that they did. The evidence shows that Mr Bluck was nevertheless persuaded by Dr Reay to grant a permit and in doing so the Council missed the opportunity to ensure that this building was designed according to Code.

35. The assumption that the Building was compliant infected subsequent important decisions about the Building, in particular during inspections following the earthquake on 4 September 2010.

Construction

36. Once again, when one looks at the circumstances of construction it is no surprise that serious deficiencies resulted. A dispute between directors, a period during which construction inexplicably stopped, a construction manager who is a convicted fraudster and was described as being 'not up to the job,'[6] an ongoing turnover of workers and a company which ended up in receivership are hardly compatible with achieving quality construction.

37. This problem may have been at least partially addressed if there was effective ongoing supervision during construction. However, the Council's records show only rudimentary inspections and there was evidence that Mr Harding sometimes did not turn up before concrete pours but told them to go ahead anyway.[7]

The retrofit

38. Dr Reay had a further opportunity in 1990 and 1991 to address the defects with the design. He did not. Even after the retrofit work had been carried out, the building remained non-compliant with the Bylaw and Codes in the ways Mr Mills described.

39. Dr Reay must have known that Mr Harding had violated a very basic engineering principle relating to ensuring adequate load parts. This should have sent a very clear message to him about Mr Harding's limited abilities which should in turn have triggered a full review of the building.

40. Dr Reay initiated work on the building without a permit. The decision that he, and not the legally established territorial authority, should decide not only that a retrofit would be adequate to address the issue, but the form it would take, demonstrated the same indifference to the requirements of the Bylaw which he demonstrated at the time of the original permit.

41. This series of events also shows that engineers who become aware that a building is not compliant with the Code applicable at the time of the original permit should be legally obliged to inform the territorial authority about the non-compliance.

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[6] TRANS.20120808.26 L32
[7] TRANS.20120808.132 L15-19

42. This would mean that an independent authority makes the decision about what should be done and can ensure that remedial work is carried out not only promptly but effectively.

Change of use

43. The Council had another opportunity to address the shortcomings with the Building in 2001. An application for a building permit for the Going Places tenancy triggered a change of use. There was a statutory obligation to ensure that the building complied with current Codes, as nearly as practicable. The Council does not seem to have given any consideration to this requirement or to possible methods of structural upgrade. It failed to comply with section 46(2) of the Building Act 1991. Had it complied, a structural upgrade of at least the columns should have resulted.

44. It seems also that the Kings Education tenancy would have amounted to a change of use for the same reason as the Going Places tenancy did. However, the Council was not informed of this tenancy.

45. Change of use categories are based upon the number of likely users of a building. It is likely that the Kings Education tenancy resulted in more people being on that floor than was legally permissible. The tenancy should not have been in the building without the Council approving the change of use.

46. Unfortunately it is unlikely to have made any difference if the Council was informed of this tenancy given its failure to require an upgrade in the case of the Going Places tenancy.

47. There is no evidence that the additional weight introduced to the Building due to these and other tenancies contributed to the failure of the Building. Dr Hyland and Mr Smith noted in their report that potential additional weight was not considered to be significant taking into account the vacant tenancies at other levels.[8]

48. The Clinic tenancy went into the Building only weeks before 22 February. Once again the Council was not informed of this. Counsel for the Council said that the establishment of a medical clinic in a commercial building would not have constituted a change of use[9], and Mr McCarthy said that Mr Drew was entitled to move The Clinic into the Building having only made one phone call to the Council.[10] It is a particular concern to the families of those who died in that part of the Building that it is possible

[8] BUI.MAD249.0189.78
[9] TRANS.20120806.OS.25
[10] TRANS.20120807.22

to move a medical clinic into a commercial building without any need to address the particular needs associated with the operation of a medical facility.

Post earthquake assessments

49. Tenants in the CTV Building expressed concerns to each other and to the building manager about whether it was safe to be in the Building. They were worried about the way the Building moved when buses went past and during the demolition next door. Unfortunately they were never aware of the real dangers the Building posed.

50. We now know that the Building was not compliant at the time of design, that a retrofit was needed to address a major defect and that a retrofit could not be as effective as getting the design right in the first place,[11] that the retrofit did not fully address the defect, that the Building had a capacity of between 40% and 55% of current Codes at the time it collapsed[12] and that the reinforcing steel in the columns and beam-column connections was much less than would be allowed under current Codes.

51. The tenants of the building were never aware of any of this. They may have made different decisions about continuing to occupy the building had they known.

Christchurch City Council

52. The Council's level 2 assessment on 7 September 2010 should have been conducted by an engineer. A green placard should not have been assigned to the building given that the three Council officers were not sufficiently qualified to form a view about the risk the building posed, two had identified a gap in the stairs which warranted further attention and they had not examined all of the building due to inaccessibility.

53. As was the case with other buildings, the green placards placed on the CTV Building prompted unjustified complacency. I note that the placarding system has been the subject of a separate hearing. Families will be encouraged to know that a number of areas of possible improvement in post-earthquake building assessment are being considered.

John Drew

54. Mr Drew was the Building Manager and therefore responsible for ensuring that all reasonable steps were taken to verify that the Building remained suitable for occupation during the thousands of aftershocks that followed 4 September 2010.

[11] See the evidence of Professor Priestley: TRANS.20120711.55 L10-16
[12] According to the Hyland/Smith report: BUI.MAD249.0189.145

Unfortunately Mr Drew failed to do everything he could have done to ensure that he and others in the Building were safe.

55. Mr Coatsworth told Mr Drew that the drawings would be very helpful in understanding the structural systems in the Building.[13] Mr Drew should have asked Mr Coatsworth to review them once they became available in October 2010.

56. He should also have asked Mr Coatsworth to come back and assess the Building after the Boxing Day earthquake. There was ample reason to do so: the strength of the shaking in that earthquake given its proximity to the CBD, the further damage to the CTV Building, the concerns expressed by Joanne Vivian, the extent of damage to the building next to The Clinic on Gloucester Street which was severe enough to result in a red placard for both, the fact that the Boxing Day event was treated as a new event for the purposes of insurance claims and his decision to introduce The Clinic tenancy to the Building.

57. The failure to obtain a further assessment after the Boxing Day earthquake was a critical omission. Mr Drew's approach was cavalier at best and reckless at worst. I put it to Mr Drew that he could have done more to ensure the safety of himself and others and he agreed with this.[14]

David Coatsworth

58. Mr Coatsworth's assessment fell somewhere along the spectrum between a brief visual inspection and a full detailed assessment of the Building's capacity. It is clear that he determined where on that spectrum the assessment should be.

59. He identified the desirability of looking at drawings but did not tell Mr Drew that he should provide them to him as soon as they became available. Mr Coatsworth should have done this.

60. It is likely that, had Mr Coatsworth looked at the drawings, he would have identified the deficiency in the connections between the diaphragms and the North Shear Core, as well as the very low level of reinforcing steel in the columns and beam-column connections. What might have happened then can only be speculation. He may have recommended closure of the Building to investigate these issues. Possibly some tenants, once informed of such issues, may have refused to enter the building again. We will never know. It may have made a difference.

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[13] Email from Mr Coatsworth to Mr Drew dated 24 September 2010: WIT.DREW.0001.RED.13
[14] TRANS.20120702.67

61. A full detailed evaluation, an assessment that was not just damage-based, would have identified that the Building was between 40-55% of current Codes. It should also have identified the areas of structural weakness which are now obvious to other engineers. If the tenants were told about these things, they may have made a different decision about whether they were willing to continue to work there during the many ongoing aftershocks. Again, we will never know.

Dr Reay and Madras Equities Ltd

62. Dr Reay and the building owner Madras Equities Limited were aware that a retrofit had taken place in 1991. This information would have been relevant to those inspecting the Building. Madras Equities is unlikely to have appreciated the significance of this, given that the problem was represented by ARCL in 1990 as being minor.[15]

63. However, this was the only building in which it had been necessary for Dr Reay to arrange drag bars and it was rare for him to notify his insurer of a claim.[16] The CTV Building should have stood out in his mind for these reasons. Despite this, he did not take any action to alert those in the CTV Building to possible dangers during the many aftershocks, despite that fact that he called Professor Mander to give evidence that all buildings should have been closed by fiat following September 4.

The demolition

64. The demolition at the neighbouring property remains a source of concern for many. A wrecking ball was used during the demolition even though this was not referred to in the Demolition Methodology Statement that was submitted to the Council. The Council does not appear to have monitored the demolition and was therefore not aware of the use of the wrecking ball.

65. Clearly the demolition caused much distress to those in the Building. However, there is no evidence that the demolition work caused any structural damage to the CTV Building or that it contributed to its collapse on 22 February 2011.

Summary of missed opportunities

66. This tragedy might have been prevented if one or more of the following had happened:

    a. If Dr Reay had recognised that no one in his firm had the expertise to design the Building and refused to take the job on.

[15] TRANS.20120817.153
[16] TRANS.20120712.134 L23-28

b. If Dr Reay and Mr Harding had designed the Building to comply with Bylaw 105 and best practice.

c. If the Christchurch City Council had required design flaws to be addressed before a permit was granted.

d. If, when notified in 1990 of the serious defect in the original design, Dr Reay had recognised the extent of Mr Harding's lack of competence and arranged for a peer review of the original design.

e. If the council had required a structural upgrade when informed of a change of use.

f. If Dr Reay had told the owner and tenants of the Building after 4 September 2010 that a retrofit had been carried out to a critical area of the Building in 1991 which should be taken into account in post-earthquake assessments.

g. If David Coatsworth had carried out the most complete possible assessment of the Building, including analysis of drawings, identification of potential weaknesses and assessment of the extent of compliance with current Codes.

h. If Mr Drew had asked Mr Coatsworth to review the drawings when they became available and if he had arranged for Mr Coatsworth to come back and assess the Building after the Boxing Day earthquake.

The fire

67. The fire is a real concern for many families. How did it start, and how could it burn with such intensity for so long?

68. In an attempt to answer these questions, the Royal Commission heard evidence from a member of the Fire Service. This evidence showed that there would have been hundreds of potential ignition points throughout the Building and many sources of fuel. Cross-examination served only to amplify this evidence.

69. Given the appalling state of the Building following the collapse and the need to shift debris during the rescue and recovery, unfortunately it was not possible to get answers to these questions.

Dr Reay

70. Some bereaved families consider that Dr Reay had more opportunity that anyone else to prevent what happened on 22 February. Some feel that Dr Reay's actions have been disrespectful towards them and the Royal Commission.

71. Dr Reay's counsel said that Dr Reay is committed to the Commission's work of understanding the causes of the collapse and ensuring that buildings are safer in future.[17] Unfortunately these words were not always borne out by his actions.

72. Dr Reay did not make any real attempt to answer one of the most fundamental questions about this Building, which is whether it was designed in accordance with the applicable Bylaw and Codes.

73. On the fourth occasion Dr Reay gave evidence, he said that he had identified two compliance issues, namely the connections of the diaphragm to the North Shear Core and the amount of confining reinforcement in the beam-column connections.

74. Even then, he described these as being 'possible' areas of non-compliance in the face of clear evidence to the contrary.[18] The use of the word 'possible' in itself indicates not only how disingenuous he was, but how reluctant he is to accept when he has done something wrong.

75. Further, he coupled this statement with the assertion that documents may have gone missing such that it is not possible to be definitive about whether the building complied with the Bylaw.[19] This is ironic given that Dr Reay continued to find and produce documents months after his lawyers told Counsel Assisting that all documents had been provided. Dr Reay did not produce timesheets relating to the CTV building to the Royal Commission until June 2012. Even during the hearing, he continued to produce documents.

76. The families are also concerned that Dr Reay or someone in his firm disposed of a computer disk containing documents about the CTV building. The only proof that we have that all of the documents which were on the disk have now been provided to the Royal Commission is the word of Dr Reay.

77. Rather than criticising the Hyland/Smith report in February 2012, Dr Reay could have announced publicly at that time that he agreed there were at least two areas in which the building was non-compliant.

78. Dr Reay's assertion that five potential causes of collapse had not been investigated by the Department of Building and Housing also seemed to designed to divert rather than assist. Even though it was obvious that none of these potential causes would reflect

[17] TRANS.20120712.94 L20-23
[18] TRANS.20120815.34 L6
[19] TRANS.20120815.19 L22-27

any responsibility on his part, he was unwilling to accept this when it was put to him by Mr Mills.[20]

79. Further, upon questioning, it emerged that he had not investigated any of these issues in depth.[21] This did not stop him from suggesting that quake table shaking should be conducted. It emerged during questioning from Commissioner Fenwick that this would cost several million dollars.[22]

80. This approach of putting forward possibilities without any substantiation was consistent with his approach throughout the hearing. He instructed his lawyers to call a witness who accepted that his evidence that hundreds of holes had been drilled in the CTV Building was a guess which could be 'wildly out.'[23]

81. The first two times he gave evidence, Dr Reay did not examine the drawings in detail or put himself in a position to give substantive evidence about the design of the Building, or review the evidence of Professor Mander, notwithstanding his desire to assist. When asked why he had not done the latter, he said he did not have time.[24] However, a short time thereafter, he said it was because he had been advised by his lawyer not to read evidence so that his knowledge was not tainted by evidence from other people.[25] And yet he was immediately able to cite Mr Strachan's evidence that exposure to chemicals affected his memory.[26]

82. These contradictions in his evidence and his general approach were of great concern to the families. They are entitled to be equally cynical about what purported to be an apology.

Lessons

83. It is not clear whether those who were involved with this Building remained conscious of it at all times, but the design and construction of a building carries life and death implications. Anyone who is in position to make the occupation of a building safer, or to restrict occupation if it is not safe, is in a position to ensure that people are not at risk. Conversely, anyone who does not do something which they could plays a part in exposing people to the risk of injury and death.

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[20] TRANS.20120712.114 L5-10
[21] TRANS.20120712.113 L13-19
[22] TRANS.20120716.44 L18-28
[23] TRANS.20120705.43 L7-14
[24] TRANS.20120801.19 L 33
[25] TRANS.20120801.94
[26] TRANS.20120801.67 L10-15

84. Bereaved families and survivors of the collapse want to ensure that lessons are learned from the collapse of this Building. It is submitted that much can be learned.

Codes

85. Engineers' legal obligations were set out in Bylaw 105. To the extent that the relevant Codes conflicted with the Bylaw, the latter was to prevail. However, it is submitted that there were deficiencies in NZS3101:1982, in particular in relation to:

    a. The design of diaphragm connections. Although capacity design applied to the structure, the Codes appeared to allow the use of loadings derived from the parts and portions provisions. Loadings derived from capacity design should have been applicable.

    b. The definition of 'secondary elements,' which was invoked (I submit, erroneously) by engineers to design buildings on the basis of a 'shear wall protected gravity only columns' principle. This approach was inconsistent with the obligation to avoid collapse and minimise the risk of injury and death and the requirement for ductility in the Bylaw.

86. When asked whether the design of the CTV Building included any provisions to facilitate safety in the event of collapse or fire, Dr Reay said these would result from compliance with the Code. It is submitted that there should be a review of the current Codes to determine whether they could include features to minimise or prevent injury and death in the event of earthquake and fire.

Peer review

87. Dr Reay said that he did not carry out any review of Mr Harding's work before the drawings left the office.

88. If this is still the practice in any engineering firm, and in particular small firms, the collapse of this building shows that it should be brought to an end.

Education

89. Dr Reay and/or Mr Harding apparently did not have a good understanding of the implications of capacity design, the need to ensure adequate load paths in a building, the dangers arising from the placement and design of walls, the problems resulting from torsion and the use of non-seismic columns and beam-column connections.

90. Dr Reay even expressed uncertainty about what best practice actually means. It is clear that he regarded the Code as both a minimum and maximum. As Professor Priestley made clear, this is not the case.

91. I note that there will be a separate hearing addressing the education of engineers and counsel assisting will ask members of the industry to consider whether such matters are sufficiently addressed in the current education of engineers.

The design approach used

92. As Mr Mills said, the Department of Building and Housing has initiated inquiries about buildings which may have similar weaknesses to the CTV Building.

93. If the Royal Commission makes findings that the flaws in the CTV Building design amounted to non-compliance, owners of buildings with similar flaws will have no choice but to upgrade them.

Post earthquake assessment

94. This and many other buildings have illustrated many problems in the assessment of buildings following a major earthquake. I note that the Royal Commission is giving extensive consideration to this issue and that there has been a further hearing on it.

Building information

95. Information about buildings should be available to the public in electronic form.

96. If any engineer becomes aware of an area of non-compliance with the Codes applicable at the time of design, there should be a legal obligation to inform the local authority. That information should also be available to the public.

97. The ongoing assessment of the integrity of buildings does not compare favourably to the system applied to motor vehicles. In the case of the latter, regular warrants of fitness are required to assess the vehicle, with safety as the primary purpose. Yet once a permit has been granted for a building, its structure is not considered unless a change of use occurs.

98. The families would support a system whereby buildings are assessed and given a classification based upon their level of compliance with current Codes. Once again, this should be publicly available.

Design philosophy

99. Above all, those involved in designing, permitting and constructing buildings should keep the people who will use the building in the forefront of their mind. Buildings are for people and the safety of those people should override every other consideration.

Conclusion

100. The hours following the collapse of the building must have been the most painful in the lives of the families of those trapped inside. As darkness fell on 22 February and smoke rose from the Building many of these people sat in Latimer Square waiting and hoping, looking across towards the ruined pile of concrete and twisted steel. But most families were thousands of miles away. They had to rely upon media reports and any information provided by embassies about what had happened to their sons and daughters, their mothers and fathers, their brothers and sisters, their friends.

101. By the time the fire was out and the rubble had been hauled away, 115 people had been named as dead. 39 were born in New Zealand or were New Zealand citizens born in other countries. The other 76 had come from all over the world: 11 from the Philippines, 23 from China, 28 from Japan, 6 from Thailand, the others from Taiwan, Canada, France, South Korea, Malaysia and Iraq. Most were visitors to New Zealand.

102. Many of those who escaped the collapse will live with their injuries all their lives. For example, Okuda Kento and Iwakura Rika, who were Japanese students at Kings Education, both had a leg amputated after the Building collapsed. Kendyll Mitchell and her children were lucky to get out from the wreckage. Her son Jett was 3 and her daughter, Dita, only 10 months old.

103. Those who died were aged between 18 and 66 years old. They included doctors and their patients, nurses, television production staff and reporters, English language teachers, administrators, sales consultants, a paediatrician, midwives, an osteopath, a clinical psychologist, receptionists, practice managers, an accounts manager, a managing director, a director of studies, an IT systems operator, a marketing manager, a finance administrator and many students, some of whom were nurses.

104. It is a striking feature of this Building that all its tenants were engaged in doing work for others: a medical centre, a counselling agency, a community broadcaster, a language school.

105. Some people who were in the Building on 22 February, like Matthew Beaumont, were doing work they loved when they died. He was a programme scheduler for CTV and had hosted programs such as *Matty B's Kids Clubhouse*. Isaac Thompson was a sound operator and IT technician with CTV who was fascinated by technology and machinery from the time he was a child. He once wrote, 'Lord, if I get nothing else done today, I want to spend time loving you and loving others, because that is what life is all about.'

106. Others who died in the Building were working towards fulfilling a dream. Lee Hsin Hung, from Taiwan, wanted to work as a nurse in New Zealand and join the Red Cross and was studying English.

107. Some had come from other countries to New Zealand to give their families a better life, such as Dr Husam Sabar Al-Ani, who had come from Iraq. He provided healthcare for youth.

108. Nurses had come from overseas to study English, for example Mary Amantillo, who was Filipino. She initially survived the collapse and sent a text message to her mother, 'Ma, I got buried.' And then later, 'Ma I can't move my right hand.' She and her friend Valquin Bensurto both died.

109. Lai Chang, who was studying English, rang her father in China after the earthquake and told him she wouldn't make it.

110. Dr Tamara Cvetanova spoke to her husband Alec as late as 1am on 23 February. His search for answers will continue at an inquest next month.

111. Some were only in the building for a short time, such as Pam Brien who was there for a work-related appointment with psychologist Susan Selway. Heather Meadows was seeing Dr Maysoon Abbas for an appointment. Xin Sisi, who was from China, was in the Building because she accompanied her Turkish friend Didem Yaman to a medical appointment.

112. Some like Susan Chuter had been working in the building for only a short time. Kyle Jack-Midgley had just taken up a new position with Ashley and Martin Medical Hair Centres three weeks before the February earthquake. His favourite quote was, 'Dream as if you'll live forever, live as if you'll die today,' by James Dean.

113. Others had been working in the building for years, such as Shawn Lucas, a production manager with CTV, and Joanna Didham, a program coordinator for *Let's Go Shopping*, who had worked with the company for years.

114. Some, like Marina Arai from Toyama College of Foreign Languages, arrived in Christchurch days before the earthquake. She lived with her father, mother and older sister in Toyama in Japan.

115. Twelve students from the Toyama College of Foreign languages died. The family of one, Sakuda Saya, told *The Press* she was very kind to other people and had a strong sense of justice.

116. Ezra Medalle, who was 24, died alongside her boyfriend Jessie Redoble. Both were nurses and it was their first day of English class at Kings Education. Jessie made phone calls after the building collapsed in which he told friends that they were fine but their limbs were growing cold.

117. Gillian Sayers was working in the Building as an English Teacher. Her favourite quote by Albert Einstein was, 'Only a life lived for others is worth living.'

118. Elsa Torres De Frood was working as a director of studies at King's Education. She had written on Facebook, 'Love my job!!! I meet interesting people all the time and the people I work with are great!! Who could ask for anything more??" Her remains were never found but her wedding ring was discovered in the ruins.

119. Yu Gilhwan and his sister Yu Naon, both from Korea, were killed. They had both spent worked as volunteers supporting teenagers from broken families.

120. Paul Wu was finance administrator at CTV and will be remembered as their hacky-sack king. In the last year of his life he spent hours tending his rose, herb and vegetable garden.

121. Xu Linlin, from China, who lost her mother when she was 19, swore she would become a doctor and was studying English at King's Education.

122. One of the youngest who died, Ishikuro Tomoki from the Toyama College of Foreign Languages, loved playing the electric guitar and carried his guitar pick wherever he went.

123. Hyuga Rika, an only child from Japan, wrote a poem about being a nurse. The final three lines were, 'The world is like a jigsaw puzzle made of a thousand pieces. Smiles and trust are two small pieces next to each other. If these two do not stand by one another, then the whole world will shatter.'

124. Zhong Yantao was a midwife from China. She was studying English. Her husband has described her as 'an angel in white.' Her daughter Lily was 5 when her mother died.

125. Since 22 February 2011, at least fifty children have had birthdays, woken up on Christmas morning, or gone to school for their first day, without their mother or father. At least one child now has no mother or father at all.

126. Tetaki 'Wally' Tairakena worked as an English language teacher at King's Education. His favourite quote was, *He aha te mea nui o tea o? He tangata! He tangata! He tangata! What is the most important thing in the world? It is the people! The people! The people!*

Dated: 4 September 2012

Marcus Elliott

Counsel Assisting


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Figure 17

View of the edges of the slabs near Line A looking towards the North Core from near the southwest corner of the Building (6:30 AM 24 February 2011).

Figure 15

Collapsed slabs lie on top of each along Line A. The ends of the Line 3 internal beam reinforcement have been circled and floor levels of the slabs labelled.