

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

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BRIEF OF EVIDENCE OF JOHN FLETCHER TROWSDALE  
IN RELATION TO THE CTV BUILDING

DATE OF HEARING: COMMENCING 25 JUNE 2012

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**BRIEF OF EVIDENCE OF JOHN FLETCHER TROWSDALE  
IN RELATION TO THE CTV BUILDING**

1. My full name is John Fletcher Trowsdale. I live in Queenstown but am currently based in Christchurch. I am a Project Director for Holmes Consulting Group and am a USAR Support Engineer for the New Zealand Fire Service (NZFS).
2. I worked as a USAR Support Engineer after the February Earthquake. I was at the CTV Building, Christchurch in this role from the evening of 22 February. I have been asked to give evidence about my observations of the state of the Building and its elements after the collapse.

**Qualifications and Experience**

3. I have 7 years experience as a consulting engineer with prior experience in the construction industry. I graduated from the University of Canterbury with a Bachelor of Engineering (Civil) (Hons). I have worked as a Consulting Structural Engineer since 2005 in New Zealand. I am a Chartered Professional Engineer and a registered International Professional Engineer. I hold a professional membership with the Institute of Professional Engineers of New Zealand (IPENZ).
4. My role involves the management of the Queenstown office for Holmes Consulting Group and the delivery of engineering solutions for projects throughout the South Island . I have been involved in a number of significant projects including the Post office precinct and Kawarau Falls Station, both in Queenstown. I am currently involved as the Project Director for the strengthening and rebuilding of the Arts Centre in Christchurch.
5. I have read and agree to comply with the Code of Conduct for Expert Witnesses.

**Evidence**

6. My evidence will address the following topics:
  - a. My role at the Building site;
  - b. My general observations of the Building in its state of collapse;
  - c. My observations of specific elements of the Building.

7. I have been asked to comment on any observation which, given my qualifications as a Consulting Structural Engineer, could be relevant to the Building collapse.
8. I have not been asked to express an opinion about how the Building failed or what the collapse mechanism was.
9. I confirm that, where I express an opinion about the Building, I am qualified to do so.

### **My Role at the Building Site**

10. After the 22 February 2011 earthquake I spent 5 days in Christchurch as a USAR Support Engineer, assisting with the search and rescue and recovery efforts at the Building site. I arrived at the site around 7.30pm on the evening of 22 February 2011.
11. My primary role in the days after the Building collapse was to minimise the risks to USAR and police teams while performing their recovery work. This involved identifying hazards and advising on matters such as stability and the debris removal sequence.
12. On arrival, my initial job was to:
  - a) Complete initial building assessments and broadly sketch out the floor plan;
  - b) Determine the main structural elements plus beam lines and column lines;
  - c) Ascertain the occupancy of the Building.
13. No official drawings of the Building or documentation were available to me on arrival or during my time at the Building site. I was later given some tenant drawings showing the internal layouts of each Level. We set out sensible gridlines to work out where the beams and other elements would be located. I also used Google Maps to see what the Building had looked like before the collapse.
14. I took several photographs during my time at the Building site. The initial purpose of this was to assist in internal briefs to USAR team members. However, I later became aware of the likelihood of an investigation into the Building collapse and knew the taking of photographs would become useful for future reference.
15. Engineers at the Building site also categorised samples of structural elements for any future investigation that may take place.

16. During my time at the Building site I made a number of observations about the arrangement and condition of the debris from the Building collapse. I discuss these below.

### **My General Observations of the Building in its Collapsed State**

17. On arrival at the Building site, there was already engineering assistance on the west side of the Building. Some beams had also been moved onto the street.
18. I observed that the Building had a pin-connection gravity frame. It appeared to me that the frame was not designed as the primary lateral restraint; the beams and columns were for gravity support only. Seismic loading went to the walls, being the North Core and the South Wall.
19. I observed that the North Core was still standing. Concrete floor slabs hung off it and leaned against it with the bottom on top of the rubble.
20. The Building site was almost split in half either side of the collapsed South Wall. The layout of the debris differed between the two sides at the time I arrived. There appeared to be less congestion on the west side of the Building.
21. On the east side I observed a classic pancake collapse. The concrete floor slabs had literally come down on top of each other, particularly in the south east corner. The clean floor to beam separation was reasonably apparent, especially at the south end of the Building. The South Wall was down to the top of the concrete floor slabs and was sitting on top of the debris. Various beam elements had been dragged in over the collapsed Building by the South Wall.
22. I observed there appeared to be very little east/west translation. The floor slabs appeared to have come straight down.
23. The photograph referenced WIT.TROWSDALE.0001.8 is taken in a NZFS snorkel basket elevated in a north-west direction from the south-east corner of the Building. The South Wall stairs can be seen lying on top of the collapsed Building. Concrete spandrels which connected to the supporting beam are also visible. The spandrel with the Kings Education sign on it is the spandrel from the Cashel Street side of the Level 4

south-east corner. The edge of the Level 6 floor slab runs underneath at a right angle to the left of the Level 4 spandrel. The end of the Level 5 beam can be seen in the bottom right corner of the photograph and to the right of the Level 4 spandrel.

### **My Observations of Specific Elements**

#### *North Core*

24. The North Core was relatively intact. I observed minor cracking around the base. The photographs referenced WIT.TROWSDALE.0001.9 and WIT.TROWSDALE.0001.10 are close up photographs of the back wall of the North Core. You can see minor cracking around the base of the wall, but little apparent damage other than this.
25. The concrete floor slabs to Levels 5 and 6 (counting the ground floor as floor 1) had broken off about 1 to 2 metres or slightly more out from the North Core. The floor slabs to the south of the break had fallen. The remnants to the north were still attached to the North Core. They were projecting out from the North Core [see WIT.TROWSDALE.0001.11]. This was considered a danger to rescue crew working below and the decision was later made to remove these sections of floor and other material. The upper concrete floor slabs (I am referring to floors 5 and 6, if the ground floor is treated as floor 1) had equal angles that were bolted on the underside of the floor through to the wall. These equal angles had to be cut away with an oxy-cutter to release the overhanging floor slab.
26. There were spandrels leaning against the north-west corner of the North Core. Photograph WIT.TROWSDALE.0001.12 is taken from the northwest corner of the Building facing east.

#### *South Wall*

27. Only the base of the South Wall was still standing. All floor slabs had collapsed down to the top of Level 1. The remainder of the wall had folded in above everything that had collapsed.

### *Columns*

28. The columns were a mess and were lying all over the place. It was hard to determine whether the end or the middle of the columns were intact. Beams had disconnected from the columns but it was hard to determine whether they had disconnected from the tops or the bottoms of the columns.

### *Beams*

29. The beams were precast shell beams and they appeared to be largely intact, although largely separated from both columns and floor slabs. From these observations it was clear the vast majority of beams had separated from the floor slab.
30. Perimeter beams were largely intact and were able to be removed as full beams.
31. I was able to tell the difference between the precasting in the beam and the in-situ concrete. It was hard to ascertain whether starter bars had broken but the starter bars from the beams to the concrete floor slab appeared to be sporadic and variable. There was not a lot of consistency with beam construction.
32. Photograph WIT.TROWSDALE.0001.8 shows the Level 4, 5 and 6 beams were intact to the side of the wall after the floors had collapsed and fallen in after the floor slabs.

### *Beam-Column Connections*

33. I did not observe any beam-column connections intact during my time at the Building site.


### *Concrete Floor Slabs*

34. The concrete floor slabs had pancaked on top of each other, especially at the southern end of the Building.
35. There was a very thick concrete topping on the floor slab. The reinforcing mesh was variable throughout and some of these variations were quite big in places. On sighting the drawings later, I noted the mesh was detailed as being "draped" as opposed to being placed central in the depth of the concrete floor slab.

- 36. I observed a very small amount of large intact concrete floor slab sections. The concrete floor slab was very broken up. There was also a significant amount of delamination of the concrete slab and metal decking.
- 37. The concrete used in the North Core and South Wall appeared to be of better quality.

**Conclusion**

- 38. The photographs taken from the fire snorkel looking down on the collapsed Building show the Southern wall debris on top of the pancaked floor slabs. It therefore appears that the floor slabs collapsed before the Southern Wall.
- 39. Based on what I saw at the Building site the concrete floor slabs appeared to have separated quite cleanly and completely from the beams at the Southern end of the building.
- 40. Also, from my observations of the South Wall, the location of the upper beams and the pancaked concrete floor slabs, I concluded that sections of the frame were still attached to the South Wall after the floors had collapsed. The south beams must have remained in the air after the floor slabs had collapsed.
- 41. There did not appear to have been significant east/west lateral displacement based on observations of the North Core and South Wall.

Signed:   
John Trowsdale

Date: 24/05/12











