

Under **THE COMMISSIONS OF INQUIRY ACT 1908**  
In the matter of the **CANTERBURY EARTHQUAKES ROYAL COMMISSION  
OF INQUIRY INTO THE COLLAPSE OF THE CTV  
BUILDING**

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**STATEMENT OF EVIDENCE OF DOUGLAS ALEXANDER LATHAM**

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**BRIEF OF EVIDENCE OF DOUGLAS ALEXANDER LATHAM**

1. My full name is Douglas Alexander Latham. I reside in Christchurch. I am a Structural Engineer employed by Alan Reay Consultants Limited ("ARCL").

**Qualification**

2. I hold a Bachelor of Engineering with Honours (2010, University of Canterbury). I am a Graduate Member of the Institution of Professional Engineers New Zealand.

**Concrete sampling**

3. On 20 and 21 March 2012 I attended the Burwood Landfill where some of the remains of the CTV Building are stored. Also in attendance at different times over the two days were Dr Alan Reay from ARCL, Chris Urmson from ARCL and Murray Clist, Jessie Clist, Jacob Rayner and Mike Adams from Vertec Concrete Cutting. On 21 March 2012 Blair Olynsma from Allied Concrete attended on behalf of the Royal Commission and oversaw the sampling.
4. I have read the following US Standards:
  - (a) ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete;
  - (b) ASTM C805 - Rebound Number of Hardened Concrete;
  - (c) ASTM C823 - Standard Practice for Examination and Sampling of Hardened Concrete in Constructions.
5. The sampling and testing that I discuss below were carried out in accordance with these standards.
6. From the remains of the CTV Building at the Burwood Landfill site, I oversaw the collection of samples from a series of columns. The column remnants that samples were taken from were in a separate area from the rest of the building remains. In general, the columns selected for core sampling were to match those sampled by the DBH.
7. The procedure generally adopted was as follows:

- (a) Photographs were taken of the column remnants before any samples were taken. Many of the columns already had core holes in them, which were presumably those taken for the DBH reports;
  - (b) Schmidt rebound hammer readings were taken using an NDT James Instruments device. The readings were recorded;
  - (c) A concrete saw was used to obtain approximately 330 mm long segments of column;
  - (d) The segments were rotated so that the cut surfaces were horizontal;
  - (e) A core drill was used to obtain approximately 150mm cylindrical core specimens;
  - (f) Cores were taken at the centre of the column segments, in the vertical orientation;
  - (g) A concrete saw was used to square off the top and bottom of the cores;
  - (h) The core samples were wiped and dried, then bagged and sealed within one hour;
  - (i) Approximate measurements of the core samples were taken, and the time at which coring began, finished, when the ends were cut and when the core samples were bagged, were recorded;
  - (j) Where possible, two core samples were taken from each column, one at each end. Due to the limited length of some column remnants, existing damage, and existing cores holes, the potential locations for core sampling was limited, and for a number of the columns sampled, only one core sample was able to be retrieved;
  - (k) Many core samples had pre-existing cracks running through the column that prevented recovering the 330mm long segment in one piece. Where this occurred, it was noted on the sampling record sheets.
8. I adopted the same markings and numbering as adopted in the tests carried out on behalf of the DBH.
9. The concrete sampling record sheets and rebound hammer results are attached and marked "A".

10. Column C18 which was tested for the DBH reports was not in the separate area with the other remaining columns at the Burwood Landfill when I visited and was therefore not available to be sampled or tested:

### **Storage**

11. After removal from the Burwood Landfill, I took the core samples to the offices of ARCL at 395 Madras Street, where they were stored until shipment. The samples were left in the plastic bags.

### **Shipment to USA**


12. On 26 March 2012, I sent the first batch of core samples to DRP Consulting, Inc. in Boulder, Colorado, United States of America. The cores dispatched on 26 March 2012 were:
  - (a) Package 1: C1B(part)/C1T(part)
  - (b) Package 2: C1B(part)
  - (c) Package 3: C4T(part)
  - (d) Package 4: C4B
13. The cores, still in their plastic bags, were wrapped in plastic film. The cores were then wrapped in carpet to protect them during shipping. They were then placed in plastic PVC stormwater pipe. The carpet wrapping was carried out to ensure a tight fit and so the core could not move around within the pipe. Bubble wrap was used to fill any remaining voids. End caps were then fitted to the pipe, glued at one end and screw fixed at the other end. Appropriate labels were placed on the outside of the PVC pipe for shipping and identification.
14. On 5 April 2012, I received advice that the first batch of cores had arrived at DRP Consulting, Inc.
15. On 13 April 2012, I sent the second batch of core samples to DRP Consulting, Inc. The cores dispatched on 13 April 2012 were:
  - (a) Package 1: C1T(part)
  - (b) Package 2: R3
  - (c) Package 3: C4T(part)/C12(part)

(d) Package 4: R7

(e) Package 5: C7T

16. The second batch of cores was packaged in the same manner at the first batch sent on 26 March 2012.
17. On 27 April 2012 I received advice that the second batch of cores had arrived at DRP Consulting, Inc.

Dated this 31 day of May 2012



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D A Latham



## Concrete Sampling Record Sheet



<b>Column identifier:</b>	R3
<b>Date of sampling:</b>	21/03/2012
<b>Sampled by:</b>	DL
<b>Weather:</b>	Fine
<b>Location in building:</b>	400x300 column, Grid A, level unknown
<b>Design concrete strength:</b>	25-35 Mpa
<b>Nominal aggregate size:</b>	19mm
<b>Photo of column:</b>	
<b>Sampling Procedure:</b>	
Samples have been obtained in accordance with ASTM C42/C42M	
The general procedure was:	
<ul style="list-style-type: none"> <li>- Photographs were taken of the column</li> <li>- Schmidt rebound hammer readings were taken</li> <li>- A concrete saw was used to obtain approximately 330mm long segments of column</li> <li>- The segments were rotated so that the cut surfaces were horizontal</li> <li>- A core drill was used to obtain approximately 150mm cylindrical core specimens</li> <li>- Cores were taken at the centre of the column, in the vertical orientation</li> <li>- A concrete saw was used to square off the top and bottom of the cores</li> <li>- Samples were wiped and dried, then bagged and sealed within 1 hour</li> </ul>	
<b>Sample identifier:</b>	R3
<b>Begin coring:</b>	10:59am
<b>Finish coring:</b>	11:18am
<b>Ends cut:</b>	Not cut
<b>Diameter of core:</b>	145mm approx
<b>Length of core:</b>	80+260mm approx
<b>Bagged and sealed:</b>	12:01pm
<b>Notes:</b>	Sample broken due to pre-existing crack in concrete



# Rebound Hammer Record Sheet



<b>Column identifier:</b>	R3
Date of testing:	20/03/2012
Time of testing:	2:09pm
Tested by:	DL/CU
Weather:	Fine
Air temperature:	12-15°C
Location of sample in building:	400x300 column, Grid A, level unknown
Design concrete strength:	25-35 Mpa
Nominal aggregate size:	19mm
Form material:	Unknown
Curing conditions:	Unknown
Rebound Hammer type:	NDT James Instruments
Serial number:	86431
Last calibrated:	18/04/2011
Orientation of testing:	Vertical, downwards
<b>Photo of column:</b>	
<b>Test area (refer photo above):</b>	Top
Surface condition:	Unground
<b>Hammer rebound readings:</b>	42
	39
<b>Note:</b>	36
Readings in brackets represent	42
samples greater than +/- 6	36
outside the average of the 10	38
readings. These have not been	(28)
included in the average below	39
	36
	39
<b>Average hammer rebound:</b>	<b>38.6</b>
Testing was carried out in accordance with ASTM C805	

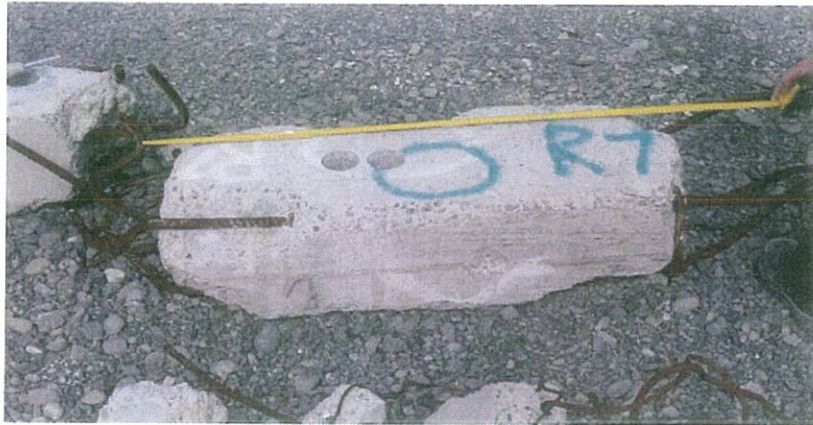
Signed:



# Concrete Sampling Record Sheet

<b>Column identifier:</b>	R7
Date of sampling:	21/03/2012
Sampled by:	DL
Weather:	Fine
Location in building:	400x300 column, Grid A, level unknown
Design concrete strength:	25-35 Mpa
Nominal aggregate size:	19mm

## Photo of column:



## Sampling Procedure:

Samples have been obtained in accordance with ASTM C42/C42M


The general procedure was:

- Photographs were taken of the column
- Schmidt rebound hammer readings were taken
- A concrete saw was used to obtain approximately 330mm long segments of column
- The segments were rotated so that the cut surfaces were horizontal
- A core drill was used to obtain approximately 150mm cylindrical core specimens
- Cores were taken at the centre of the column, in the vertical orientation
- A concrete saw was used to square off the top and bottom of the cores
- Samples were wiped and dried, then bagged and sealed within 1 hour

<b>Sample identifier:</b>	R7
Begin coring:	10:22am
Finish coring:	10:48am
Ends cut:	Not cut
Diameter of core:	145mm approx
Length of core:	260+70mm approx
Bagged and sealed:	11:32am
Notes:	Sample broken due to pre-existing crack in concrete



# Rebound Hammer Record Sheet

<b>Column identifier:</b>	R7
Date of testing:	20/03/2012
Time of testing:	12:50pm
Tested by:	DL/CU
Weather:	Fine
Air temperature:	12-15°C
Location of sample in building:	400x300 column, Grid A, level unknown
Design concrete strength:	25-35 Mpa
Nominal aggregate size:	19mm
Form material:	Unknown
Curing conditions:	Unknown
Rebound Hammer type:	NDT James Instruments
Serial number:	86431
Last calibrated:	18/04/2011
Orientation of testing:	Vertical, downwards
<b>Photo of column:</b>	
	
<b>Test area (refer photo above):</b>	Centre
Surface condition:	Unground
<b>Hammer rebound readings:</b>	46
	48
Note:	45
Readings in brackets represent	51
samples greater than +/- 6	43
outside the average of the 10	46
readings. These have not been	48
included in the average below	51
	49
	49
<b>Average hammer rebound:</b>	47.6
Testing was carried out in accordance with ASTM C805	

Signed:





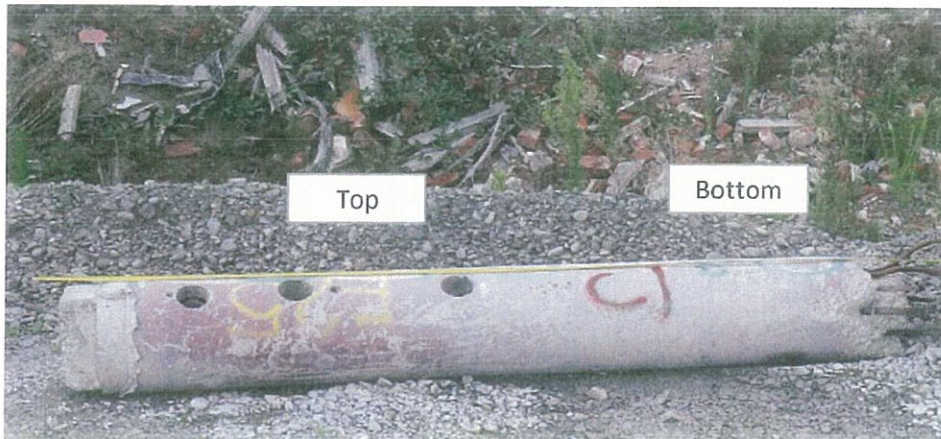
# Concrete Sampling Record Sheet



Alan Reay Consultants

<b>Column identifier:</b>	<b>C1</b>
Date of sampling:	20/03/2012
Sampled by:	DL/CU
Weather:	Fine
Location in building:	400 diameter column, Level 6, plan location unknown
Design concrete strength:	25 Mpa
Nominal aggregate size:	19mm

## Photo of column:



## Sampling Procedure:

Samples have been obtained in accordance with ASTM C42/C42M

The general procedure was:

- Photographs were taken of the column
- Schmidt rebound hammer readings were taken
- A concrete saw was used to obtain approximately 330mm long segments of column
- The segments were rotated so that the cut surfaces were horizontal
- A core drill was used to obtain approximately 150mm cylindrical core specimens
- Cores were taken at the centre of the column, in the vertical orientation
- A concrete saw was used to square off the top and bottom of the cores
- Samples were wiped and dried, then bagged and sealed within 1 hour

<b>Sample identifier:</b>	<b>C1-T</b>	<b>C1-B</b>
Begin coring:	12:34pm	12:59pm
Finish coring:	12:47pm	1:29pm
Ends cut:	Not cut	Not cut
Diameter of core:	145mm approx	145mm approx
Length of core:	130+210mm approx	120+220mm approx
Bagged and sealed:	1:35pm	2:18pm
Notes:	Sample broken due to pre-existing crack in concrete	Sample broken due to pre-existing crack in concrete









# Concrete Sampling Record Sheet

<b>Column identifier:</b>	C4
Date of sampling:	20/03/2012
Sampled by:	DL/CU
Weather:	Fine
Location in building:	400 diameter column, location unknown
Design concrete strength:	25-35 Mpa
Nominal aggregate size:	19mm

## Photo of column:



## Sampling Procedure:

Samples have been obtained in accordance with ASTM C42/C42M

The general procedure was:

- Photographs were taken of the column
- Schmidt rebound hammer readings were taken
- A concrete saw was used to obtain approximately 330mm long segments of column
- The segments were rotated so that the cut surfaces were horizontal
- A core drill was used to obtain approximately 150mm cylindrical core specimens
- Cores were taken at the centre of the column, in the vertical orientation
- A concrete saw was used to square off the top and bottom of the cores
- Samples were wiped and dried, then bagged and sealed within 1 hour

Sample identifier:	C4-T	C4-B
Begin coring:	2:11pm	1:36pm
Finish coring:	2:49pm	2:04pm
Ends cut:	Not cut	Not cut
Diameter of core:	145mm approx	145mm approx
Length of core:	200+140mm approx	230mm approx
Bagged and sealed:	3:45pm	2:45pm
Notes:	Sample broken due to pre-existing crack in concrete	Sample broken due to pre-existing crack in concrete

Photos of samples:

C4-T



C4-B



Signed:

*D. Latham*





# Concrete Sampling Record Sheet



**Column identifier:** C7  
**Date of sampling:** 20/03/2012  
**Sampled by:** DL/CU  
**Weather:** Fine  
**Location in building:** 400 diameter column, location unknown  
**Design concrete strength:** 25-35 Mpa  
**Nominal aggregate size:** 19mm

**Photo of column:**



**Sampling Procedure:**

Samples have been obtained in accordance with ASTM C42/C42M

The general procedure was:


- Photographs were taken of the column
- Schmidt rebound hammer readings were taken
- A concrete saw was used to obtain approximately 330mm long segments of column
- The segments were rotated so that the cut surfaces were horizontal
- A core drill was used to obtain approximately 150mm cylindrical core specimens
- Cores were taken at the centre of the column, in the vertical orientation
- A concrete saw was used to square off the top and bottom of the cores
- Samples were wiped and dried, then bagged and sealed within 1 hour

<b>Sample identifier:</b>	<b>C7-B</b>	<b>C7-T</b>
Begin coring:	11:16am	10:52am
Finish coring:	11:27am	11:05am
Ends cut:	11:32am	11:15am
Diameter of core:	145mm approx	145mm approx
Length of core:	290mm approx	295mm approx
Bagged and sealed:	12:17pm	11:54am
Notes:		





# Rebound Hammer Record Sheet

<b>Column identifier:</b>	C7
Date of testing:	20/03/2012
Time of testing:	9:26am
Tested by:	DL/CU
Weather:	Fine
Air temperature:	12-15°C
Location of sample in building:	400 diameter column, location unknown
Design concrete strength:	25-35 Mpa
Nominal aggregate size:	19mm
Form material:	Unknown
Curing conditions:	Unknown
Rebound Hammer type:	NDT James Instruments
Serial number:	86431
Last calibrated:	18/04/2011
Orientation of testing:	Vertical, downwards
<b>Photo of column:</b>	
	
<b>Test area (refer photo above):</b>	Centre
Surface condition:	Unground
<b>Hammer rebound readings:</b>	(52)
	44
Note:	43
Readings in brackets represent	48
samples greater than +/- 6	44
outside the average of the 10	43
readings. These have not been	46
included in the average below	40
	42
	50
<b>Average hammer rebound:</b>	44.4
Testing was carried out in accordance with ASTM C805	

Signed: \_\_\_\_\_





# Concrete Sampling Record Sheet

<b>Column identifier:</b>	C12
Date of sampling:	21/03/2012
Sampled by:	DL
Weather:	Fine
Location in building:	400 diameter column, location unknown
Design concrete strength:	25-35 Mpa
Nominal aggregate size:	19mm

**Photo of column:**



**Sampling Procedure:**

Samples have been obtained in accordance with ASTM C42/C42M

The general procedure was:

- Photographs were taken of the column
- Schmidt rebound hammer readings were taken
- A concrete saw was used to obtain approximately 330mm long segments of column
- The segments were rotated so that the cut surfaces were horizontal
- A core drill was used to obtain approximately 150mm cylindrical core specimens
- Cores were taken at the centre of the column, in the vertical orientation
- A concrete saw was used to square off the top and bottom of the cores
- Samples were wiped and dried, then bagged and sealed within 1 hour

<b>Sample identifier:</b>	C12
Begin coring:	9:22am
Finish coring:	9:38am
Ends cut:	Not cut
Diameter of core:	145mm approx
Length of core:	160+120+40mm approx
Bagged and sealed:	10:23am
Notes:	Sample broken due to pre-existing crack in concrete

Photos of samples:

C12



Signed:

*W. Latham*

# Rebound Hammer Record Sheet

<b>Column identifier:</b>	C12
Date of testing:	20/03/2012
Time of testing:	2:19pm
Tested by:	DL/CU
Weather:	Fine
Air temperature:	12-15°C
Location of sample in building:	400 diameter column, location unknown
Design concrete strength:	25-35 Mpa
Nominal aggregate size:	19mm
Form material:	Unknown
Curing conditions:	Unknown
Rebound Hammer type:	NDT James Instruments
Serial number:	86431
Last calibrated:	18/04/2011
Orientation of testing:	Vertical, downwards

**Photo of column:**



<b>Test area (refer photo above):</b>	Centre
Surface condition:	Unground
<b>Hammer rebound readings:</b>	47
	44
Note:	44
Readings in brackets represent	44
samples greater than +/- 6	46
outside the average of the 10	48
readings. These have not been	46
included in the average below	47
	52
	51
<b>Average hammer rebound:</b>	46.9

Testing was carried out in accordance with ASTM C805

Signed: \_\_\_\_\_

*A. Latham*