

UNDER

THE COMMISSIONS OF INQUIRY ACT 1908

IN THE MATTER OF

**ROYAL COMMISSION OF INQUIRY INTO BUILDING FAILURE CAUSED
BY CANTERBURY EARTHQUAKES**

AND IN THE MATTER OF

CTV BUILDING COLLAPSE

**STATEMENT OF EVIDENCE OF R. GRANT WILKINSON IN RELATION TO CTV BUILDING
DATE OF HEARING: COMMENCING 25 JUNE 2012**

STATEMENT OF R. GRANT WILKINSON IN RELATION TO CTV BUILDING

Personal background and qualifications

- 1 My full name is Ronald **Grant** Wilkinson. I live in Christchurch. I am the Managing Director of Ruamoko Solutions Ltd, a consulting structural engineering firm.
- 2 I am a fellow of the Institute of Professional Engineers NZ (IPENZ) and a chartered professional engineer. I am a member of the New Zealand Society for Earthquake Engineering, the Canterbury Structural Group, and the Timber Design Society.
- 3 I have a Bachelor of Engineering (Hons) (Civil) from the University of Canterbury and I have worked as a consulting structural engineer since 1984.
- 4 Between 1984 and 1987 I was a structural engineer with Holmes Wood Poole and Johnstone Ltd in both Christchurch and Auckland. This is the predecessor firm of Holmes Consulting Group (Holmes).
- 5 From 1987 to 2004 I was a director of Holmes and the manager of the Christchurch office from approximately 1992 to 2004. From 2005 to 2006 I was a Project Director for Holmes in Christchurch. In July 2006 I established a consulting structural engineering firm in Christchurch, Ruamoko Solutions Ltd.

The 1990 Holmes report on the CTV Building

- 6 In January 1990 Holmes was engaged by Buddle Findlay and Schulz Knight Consultants Ltd to prepare a structural report on the office development located at 249 Madras St, subsequently known as the CTV Building. The engagement was on behalf of a potential purchaser of the building, the Canterbury Regional Council (CRC).
- 7 The terms of the engagement required Holmes to carry out a general structural assessment of the building and provide a structural report. This was part of due diligence that CRC was carrying out.
- 8 I was the project director for this assignment. The preparation of the structural calculations and report was done by Holmes' structural engineer John Hare who reported to me at that time. My involvement was primarily to review Mr Hare's assessment and report.
- 9 The Holmes report **BUI.MAD249.0005, 7 to 0005, ..16** is incomplete in so far as it doesn't state the author or the reviewer; it is unsigned and doesn't contain the limitation clause that was standard for all final Holmes' reports at that time.
- 10 Section 3 of the report records that the review was limited to a brief inspection of the building and documents, and approximate calculations. The inspection and calculations were undertaken/prepared by Mr Hare. Physical inspection was limited to areas that were readily accessible. Section 4 of the report summarises the investigations undertaken. John Hare reviewed a complete set of structural drawings and other related documentation at the offices of Alan Reay Consultants (ARC). The original design engineer for the building had left ARC and John Hare met instead with Mr Geoff Banks to discuss the building design. John also

discussed building permit and construction issues with Mr Bryan Bluck, Building Control Engineer at Christchurch City Council.

- 11 Mr Hare identified an area of serious concern with the connections of the structural floor diaphragm to the shear walls at the north face of the building. The problem was identified from the drawings by Mr Hare and he reported it to me. I agreed with his assessment.
- 12 The structural drawings showed that the connections of the floors to the walls at the north face of the building were tenuous. Both John and I were concerned that in the event of an earthquake the building would effectively separate from the shear walls well before the shear walls themselves reached their full design strength.
- 13 There was a professional obligation under our code of ethics to notify ARC when reviewing their work, that we had identified an area of serious non-compliance with the design codes. Mr Banks at ARC was alerted to this issue (see paragraphs 3.0 item 3 and 6.3 of the report).
- 14 Holmes provided a work to date copy of the report to Schulz Knight on 31 January 1990 **BUI.MAD249.0005 .7 to 005:** 16. We got instructions to consider, in a preliminary way, the estimated cost to remedy the lack of adequate connection between the walls and shear walls.
- 15 John Hare did some calculations and sketches for remedial ties for the purpose of establishing a budget cost for remediation work so that the client could have a rough estimate of the cost of that work. Mr Hare's sketch allowed for the insertion of a steel connecting angle to both of the affected walls at levels 2 to 6 in the building, a total of 10 angle ties. Mr Hare's sketches were not intended to be for construction. **BUI.MAD249.005 .19/20/21.**
- 16 On 1 February 1990 I sent a file note to Kerry Mason at Warren & Mahoney, CRC's architect. **BUI.MAD249.005 .17.** I reported that Martin Charles, a quantity surveyor with Russell Drysdale & Thomas, advised that the cost to carry out the remedial structural work would be approximately \$14,000 plus GST. (I had provided a scope of work to Mr Charles. My file note refers. **BUI.MAD.249.005 .18.**) I asked if Kerry Mason needed anything else from us on this job. I don't recall his answer, if he gave one.
- 17 My recollection is that Holmes' engagement was terminated after sending the memo to Kerry Mason at Warren & Mahoney.
- 18 On 02 February 1990 Geoff Banks at ARC and I discussed the serious issue that Holmes had found. I can't be absolutely sure, but I think my discussion with Mr Banks followed the instruction from one of CRC's agents, that Holmes were to proceed no further with the due diligence assessment and report.
- 19 The discussion with Mr Banks is referred to in a letter he wrote to me dated 2 February 1990: **BUI.MAD249.0005 .2**
I note that letter is stamped as being received in the Holmes office on 07 February 1990 but the facsimile cover sheet that refers to that letter is dated 2 February 1990. I have no explanation for the difference in those dates, except that the letter and accompanying sketch may have been posted and received after the facsimile was sent.

- 20 Mr Banks' letter and sketch confirmed the two shear wall lines that Holmes had identified as having possible non-complying connections to the floor diaphragm, the floor levels affected by that non-compliance, and that the remedial work, if required, would consist of two ties per floor level, the maximum load per tie and it made reference to the relevant Loadings Standard, NZS4203:1984.
- 21 I don't recall the specific details of the conversation that I had with Mr Banks on the morning of 2 February 1990, but the letter asked that I contact ARC if my understanding was different from what was outlined in the letter. I don't believe I replied to the 2 February letter. I would have seen no need to reply because it was clear from the letter that Mr Banks understood the serious issue Holmes had identified.
- 21 Once I have advised a fellow professional engineer of a serious issue of non-compliance, as the building designer I consider that it is their professional obligation to take any and all actions necessary to check that issue thoroughly and action any remedial works that may be necessary.
- 22 I heard nothing further from Mr Banks.

Signed: 

R Grant Wilkinson

Date: 30 05 12



HOLMES CONSULTING GROUP
STRUCTURAL AND CIVIL ENGINEERS

WIT.WILKINSON.0001.5
BUI.MAD249.0005.7

STRUCTURAL REPORT

**OFFICE BUILDING
249 MADRAS STREET**

Prepared for

CANTERBURY REGIONAL COUNCIL

by Holmes Consulting Group, Christchurch

**in association with Buddle Findlay Limited
and Schulz Knight Consultants Limited**

January 1990

Holmes Consulting Group Limited,
61 Cambridge Terrace,
P.O. Box 701,
Christchurch, New Zealand.
Telephone: (03) 663-366
Facsimile: (03) 792-169

Offices in Christchurch, Wellington, New Plymouth, Auckland

CONTENTS

1.0	Introduction.
2.0	People involved with construction of this building.
3.0	Conclusions.
4.0	Summary of Investigation.
5.0	Structural Design Aspects.
6.0	Condition Report.

W8165REP

JANUARY 1990

1.0

INTRODUCTION

Holmes Consulting Group Limited were engaged on 24th January 1990 by Buddle Findlay Limited and Schulz Knight Consultants Limited to prepare a structural report on the office development located at 249 Madras Street. The building was completed during 1987 and is currently untenanted.

2.0 **PEOPLE INVOLVED WITH CONSTRUCTION OF THIS BUILDING**

Developer	Prime West Corporation
Contractor	Williams Construction Limited
Architect	Alun Wilkie Architects
Structural Engineer	Alan M. Reay Consulting Engineer
Mechanical Consultant	
Electrical Consultant	
Soils Consultant	Soils & Foundations Limited

3.0

CONCLUSIONS

Due to the limited time available for the report, our review has been limited to a brief inspection of the building and documents, and approximate calculations. No materials testing has been undertaken, and inspection has been limited to such areas as were readily accessible. Given these qualifications, our conclusions are as follows:-

1. The building is in a condition appropriate to its age and the contractor-as-developer form of construction.
2. The layout and design of the building is quite simple and straight forward and generally complies with current design loading and materials codes.
3. A vital area of non-compliance with current design codes, seen in the documents, is in the tying of the floors to some of the shear walls. This item is under review with the original consultants, but if confirmed will require potentially expensive remedial work. However, this cost is a matter for discussion between the current owner and their consultants.
4. Apart from ongoing maintenance costs which should be minor, no major costs are anticipated in association with the structure, subject to 3. above.

4.0

SUMMARY OF INVESTIGATION

A full set of Architectural drawings, and some structural drawings were made available from Alun Wilkie Architects.

In addition, we were able to view the full design, documentation, Soils Investigation and complete set of drawings at the office of Alan M. Reay Consulting Engineer, on 26 January 1990. The original design engineer was unavailable for comment, having since left the company, but Mr Geoff Banks was available for comment on aspects of the design.

We have spoken to Mr Bryan Bluck, Buildings Control Manager at the Christchurch City Council, to discuss any concerns relating to the building permit and construction process.

An inspection was made on 30th January 1990. Levels 1 and 4 were unavailable for inspection, but the remaining floors were taken as representative. Access was gained to the Lift Machine room, Cooling tower and onto the roof.

5.0	<u>DESCRIPTION</u>
1. No. storeys and occupancy:	5 storeys office (floor to floor height typically 2600 clear) and ground floor parking.
2. Gross Floor dimensions:	approx. 31m x 22.5 m.
3. Foundation type:	Shallow strip footings and foundations pads, with large foundation walls under structural shear walls.
4. Suspended Floors:	200mm overall insitu concrete on metal tray, supported by precast concrete beams on insitu columns on a 7.5m x 7.0m grid generally.
5. Roof construction:	Lightweight metal cladding on steel purlins and beams, supported on insitu concrete columns.
6. Floor Design liveloads:	2.5 kPa typically (minimum load level required by NZS 4203 : 1984).
7. Lateral load resistance:	This is via a reinforced concrete coupled shear wall on the south face of the building, and a system of reinforced concrete walls around the service core on the north face of the building.
8. Exterior Cladding:	400 deep x 100 mm precast spandrel panels with glazing between, or on West elevations 140 mm blockwall to level 4 with metal cladding above perforated for windows.
9. Exterior maintenance:	No allowance for a Building Maintenance Unit has been made. Access for external cleaning is through windows. With opening windows restricted to a single pair approx. 1.0 m wide per 7.5 m bay, this is limited, although the spandrel panels are sufficiently wide for a person to stand safely.

6.0

STRUCTURAL DESIGN ASPECTS

6.1 Foundations

From the soils investigation report prepared by Soils and Foundations Limited, we note that settlement was highlighted as a potential problem, particularly in the north-east corner of the site, causing differential settlement concerns. The pad and strip foundations were sized using the recommendations of the report on maximum allowable stresses. However the recommendations of the report on a maximum pressure to limit settlement appear not to have been followed. It is not known whether any ground improvement work was undertaken to compensate for this.

However, inspection of the site revealed no sign of any significant settlement. Given that most settlement occurs within a relatively short time of construction, this should not become a significant problem in the future.

6.1 Gravity Structure

From our perusal of the drawings, and our investigation of the building, it appears the gravity structure is sound and complies in all respects with the appropriate design loading and materials codes. Furthermore it was noted in the documentation that although only a 2.5 kPa standard office live load was called for, the floor will withstand a live load of up to 3.4 kPa. This would be subject to further confirmation.

6.3 Lateral load resistance

Resistance to lateral loads is via reinforced concrete shear walls.

The shear walls themselves appear to have been generally well designed to the requirements of the correct design loading and materials codes. The building was apparently analysed using a 3 dimensional computer analysis programme checked by a static hand analysis.

An area of concern however has been discovered in the connections of the structural floor diaphragm to the shear walls. While this is not a concern on the coupled shear wall to the south of the building, connections to the walls at the North face of the building are tenuous, due to penetrations for services, lift shafts and the stairs, as detailed on the drawings.

The result of this would be that in the event of an earthquake, the building would effectively separate from the shear walls well before the shear walls themselves reach their full design strength.

Discussion has continued on this matter with Mr Geoff Banks of Alan Reay Consulting Engineer , and it currently appears that there may have been some provision made for this during construction. However, no documentation apparently exists, so it would only be safe to assume that this aspect fails to comply with current design codes.

6.4 Roof

Due to its light weight nature, the roof is prone to deflections, particularly in wind. A brief check shows that the deflections should be within allowable limits, as prescribed in the current codes. However, in our experience, movement may be quite perceptible and disconcerting for the occupants and in extreme wind, may cause damage to ceiling tiles.

Furthermore, it was noted on inspection that the internal butynol lined gutters at roof level have only one downpipe with no provision for an overflow. This is a potential problem in the event of a blockage to a downpipe.

6.5 Fire Escape

On the south face there is a steel cantilevering fire escape. This is currently in good condition but it should be noted that this type of construction is prone to corrosion and should be the subject of an on-going maintenance programme.

7.0 CONDITION REPORT

As expected for a building of this age, the structure appears generally in sound condition. Although mainly concealed by carpets and ceilings, those parts of the structure accessible to view reveal no signs of distress.

Standards of workmanship are adequate although finishes and details appear to have been given the minimum of effort. This is commensurate with the type of development and the time at which it was built.

There has been some water damage to ceiling tiles at level 5 adjacent to the wall between the lifts and the stairwell. This is probably due to a failed flashing.

During the inspection it was noted that there is evidence of cracking on the end of the spandrel panels on either side of the fire escape. The finish in these areas is different to the rest of the panels. It appears that the crack has formed at the interface between the spandrel panel itself and the beam supporting it. In the worst instance this crack may propagate above floor level and cause waterproofing problems.

The roof is mainly in good condition, although several panels of the Trimdek roofing have been dented quite badly. Furthermore, there is evidence of some ponding in the gutters which appear to have minimal fall. (refer to section 6.4 for further comment).

The Trimdek cladding should be subject to a performance guarantee. This would have to be checked with the current owners.

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STRUCTURAL AND CIVIL ENGINEERS
Offices in Christchurch, Wellington, New Plymouth, Auckland

CALCULATIONS

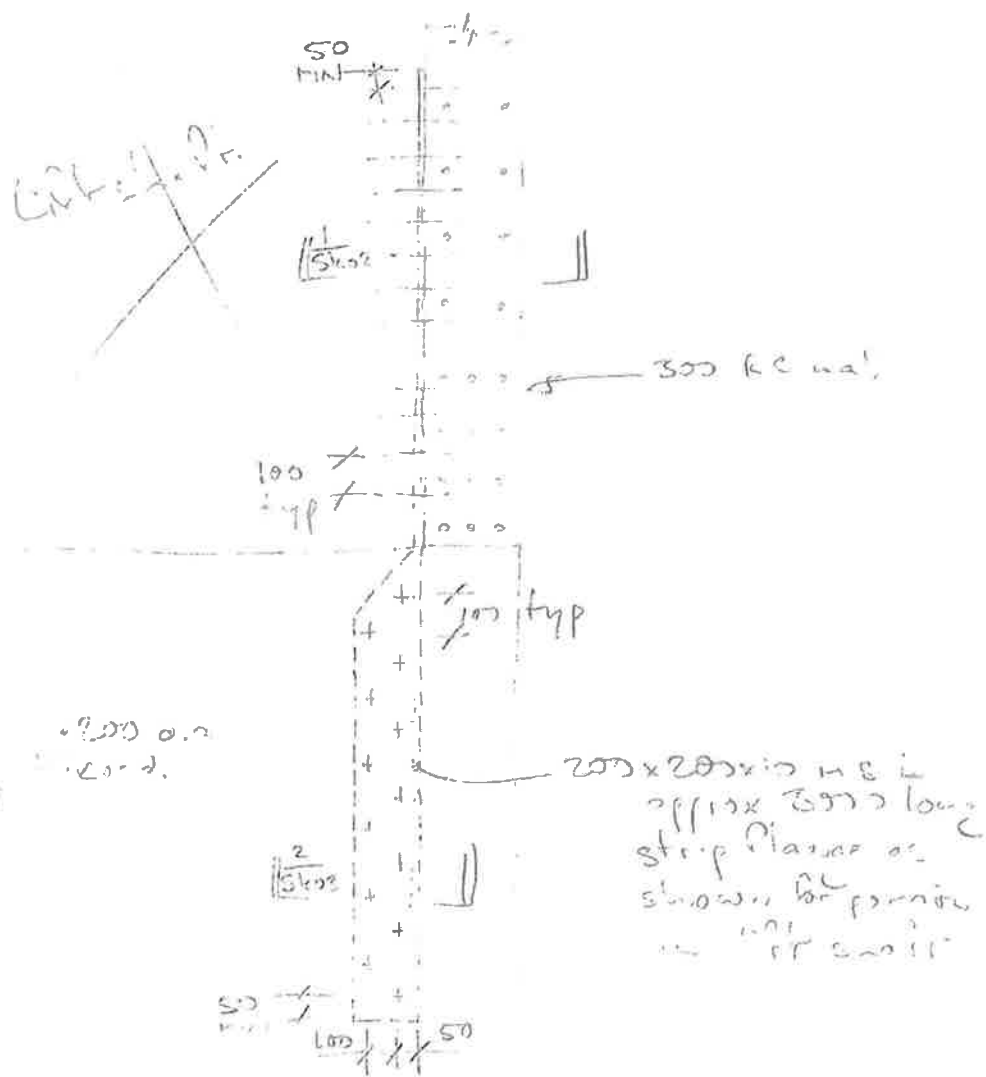
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PAGE

DATE



Plans 50 approx

- Designing design in the wall as shown in the plan
- Designing design in the wall as shown in the plan
- Designing design in the wall as shown in the plan

MEMBERSHIP CATEGORIES

Offices in Christchurch, Wellington, New Plymouth, Auckland

JOB NAME

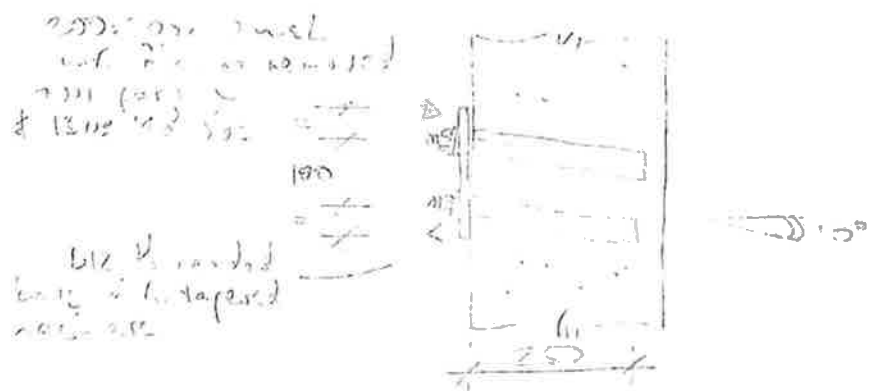
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- Many are a dark blue color, called a "dark blue" steel, which is a dark blue color.
- There is a dark blue color, called a "dark blue" steel, which is a dark blue color.



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CALCULATIONS

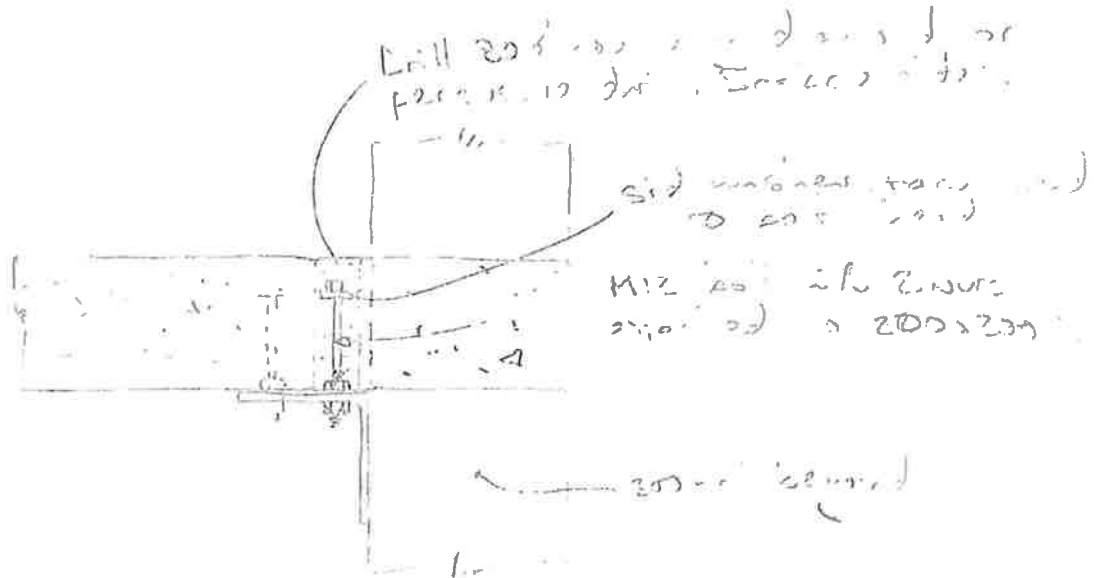
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PAGE 5 of 8

DATE



- Place in the top layer of concrete 200mm bars top side of the concrete slab.
- Mark the position of the holes through the slab prior to casting.
- After pouring the concrete, temporarily fix a 200mm x 200mm x 200mm bar and see around gaps in the concrete.
- Remove gaps using a silt, or similar.

(2/5/17)

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STRUCTURAL AND CIVIL ENGINEERS
Offices in Christchurch, Wellington, New Plymouth, Auckland

MEMO

JOB NAME 249 Madras St.

JOB No WB165

DATE 01/02/90

To: Warren & Mahoney

Attn: Kerry Mason

Kerry

Martin Charles advises that the cost to carry out the remedial structural works (as per attached sheets) will be approx \$14,000 + GST.

Do you need anything else from us on this job?

Regards



Grant Wilkinson.

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STRUCTURAL AND CIVIL ENGINEERS
Offices in Christchurch, Wellington, New Plymouth, Auckland

MEMO

JOB NAME 249 Madras St.
JOB NO W8/65

DATE 01/02/90

Remedial Works

Steel angle reversed
2 per level at 5 levels.

- 4 levels have suspended tile ceilings in gar.
- 1 level has plasterboard + paint ceiling

- assume all levels have carpet

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WIT.WILKINSON.0001.20
BUI.MAD249.0005.2

ALAN REAY CONSULTANTS LIMITED

ALAN M. REAY
B.E (Hons.) Ph.D.
M.N.Z.I.E.
Registered Engineer
Structural Consultant

147 KILMORE STREET
BOX 25-028, VICTORIA ST
CHRISTCHURCH 1
Telephone: 660-434
Fax No: (03) 793-981

File 3608

2 February 1990

RECEIVED	RAP
- 7 FEB 1990	JMH
HOLMES CONSULTING GROUP LIMITED CHRISTCHURCH 1	RGW ✓
	HJH

Mr Grant Wilkinson
Holmes Consulting Group
PO Box 701
CHRISTCHURCH

Dear Sir

RE: 249 MADRAS STREET

Further to our discussions by telephone this morning, we confirm that the scope of the possible non-compliance referred to in your report on the building is the connections between the walls on gridlines D and D/E, as shown on the attached sketch SK1 from levels 2 to 5 inclusive (Level 1 being the ground floor carpark).

The proposed remedial work, if required, would consist of a total of two ties per floor, tying the walls to the floor diaphragm.

The agreed maximum tie load is 300 kN per tie. We understand that this load would be reduced on lower floors in accordance with the "Parts and Portions" section of NZS 4203:1984.

Please contact this office today if your understanding of the situation is not as outlined above.

Yours faithfully



G.N. Banks