

**COMMISSION RESUMES ON WEDNESDAY 25 JANUARY 2012 AT
9.32 AM**

5

JUSTICE COOPER:

Yes in this hearing we enquire into the failure of the building at 194 Hereford Street. The building was located on the eastern side of the intersection of Liverpool Street and Hereford Street. It housed the business known as Joe's
10 Garage. Gregory Tobin who worked in that business as a chef died after leaving the building during the earthquake. He was hit by falling masonry. Mr Tobin had come to New Zealand from the United Kingdom and his parents cannot be here today. If they are following the hearing on the internet we would like to extend to them our deepest sympathy and I also note that
15 Mr Tobin's friend Gary Stead is present with us here today and so to that extent Gregory's interests are being looked after.

MR ZARIFEH:

Your Honour, the building as you've indicated that we're enquiring into today
20 was at 194 Hereford Street and it was a two storey unreinforced masonry building on the corner of Hereford and Liverpool Street. It is likely to have been built in the 1930's. The original construction was with a lime-based mortar and as Your Honour has indicated the building housed a café on the ground floor, Joe's Garage. The building was strengthened and re-built
25 internally in 2005–2006 with the external walls and associated foundations being essentially the only original structural elements that were retained. The external walls were a combination of double, triple and cavity brick construction. The north and west façades had reinforced concrete bond beams over the windows and door openings at ground and first floor and the
30 ground floor had a new reinforced concrete slab. There is some photos of the building.

JUSTICE COOPER:

What is that rather bizarre symbol that accompanies all these photographs?
The red?

5 **MR ZARIFEH:**

I think these photos are from Professor Ingham and I am not sure what that symbol is but it might be something with the university.

JUSTICE COOPER:

10 I tried to read it but my glasses were not strong enough. Batch photo, trial version.

MR ZARIFEH:

Trial version, not sure what the significance of that is.

15

JUSTICE COOPER:

So that photo that has now been enlarged depicts the building from the –

MR ZARIFEH:

20 Liverpool.

JUSTICE COOPER:

Liverpool Street frontage which was the longest, the longer of the frontages, is that right?

25

MR ZARIFEH:

Yes Sir. Previously the external walls had been laterally strengthened in the east-west direction using steel portal frames which also supported the new floors and roof. The existing parapets had been tied back to the new roof with steel channels anchored into the back of them and the perimeter walls had been tied into the timber floor diaphragms at first and second floor. Following the September 2010 earthquake a level 1 rapid assessment recorded damage as being minor or none and the building was green placarded. As the building

30

had been green placarded there was no further inspection or assessment by the council after the Boxing Day aftershock. After the September earthquake the owners of the building arranged for an inspection of the building by O'Loughlin Taylor Spence Limited, the structural engineers who had designed and overseen the structural strengthening in 2005–2006 and they inspected the building and advised on required remedial work and Rhys Smith, structural engineer with that firm, is the engineer who essentially carried out that work between September and the February earthquake. In the 22 February 2011 earthquake the building suffered significant structural damage including collapse of the unreinforced masonry parapets on the north, west and south elevations, the collapse of the north façade at the first floor levels including two-thirds of a reinforced concrete roof level beam bond and collapse of the east parapet and firewall at first floor level, and there might be some photos, the police photos that are in the front there, after the February event. 333.8. I can indicate Sir that there is a video of the collapse from YouTube which will be shown. I won't show it now because Rhys Smith when he gives evidence is going to show it and explain what he believes was happening at the point and it might be more appropriate to show it then.

20 **JUSTICE COOPER:**

What are the premises next door Mr Zarifeh?

MR ZARIFEH:

That is called Calendar Girls, the CG on the left, and that was a new building, well a re-fit I understand that (inaudible 09:39:31) here had some effect on the east wall of Joe's Garage when it was, when construction work was being carried out on that building. Sir, Gregory Tobin, as you've indicated, worked as a chef at Joe's Garage, he was in the kitchen at the time of the February earthquake and was last seen by work colleagues running out of the front door onto Hereford Street where he was hit by falling masonry from above. A work colleague, Lewis Watson, saw him and it appears that once the dust settled Mr Tobin wasn't visible but following the earthquake USAR workers

searched the rubble outside 194 Hereford Street and located Mr Tobin who was deceased.

The likely issues that the Commission will have to consider in relation to this building failure are firstly the application of the council's earthquake prone
5 policy, secondly the inspection of the building following the September earthquake, thirdly the extent of remedial work carried out after the September earthquake, and fourthly the efficacy of structural strengthening work that was carried out in 2005–2006.

The witnesses that are going to be called are and in the order that it is
10 intended to call them are, firstly the, a representative of the owner James Whelan, he will give brief evidence. Secondly, the witnesses from O'Loughlin Taylor Spence Limited. Firstly John O'Loughlin who will give evidence about the structural strengthening work that was carried out in 2005–2006 and then Rhys Smith who supervised the make safe works or remedial works after
15 September. Those two witnesses are being represented by Mr Richard Raymond, Sir, and he will lead those witnesses. The fourth witness is someone called Philip Wilby who is now with Fulton Hogan but at the relevant time was involved in some of the securing works and in particular the epoxy fixing work which is mentioned in Mr Smith's report and he will speak to that.
20 He is in Wellington but a video link has been arranged with him at 11.45 so if we can break at 11.30 and have that set up. Then Mr McCarthy from the council and it may be that we can slot him in earlier. I know he's got some other engagements if it is possible. I think his evidence will be fairly brief because the council's have indicated it didn't have a lot of involvement in this
25 building, and finally Mr Smith from Spencer Holmes Limited.

JUSTICE COOPER:

30 Yes, well if we can adjust things to suit Mr McCarthy's convenience I would be keen to do that because we are taking so much of his time aren't we?

MR ZARIFEH:

Yes Sir. Well perhaps we can call Mr Whelan and then Mr McCarthy and then

–

JUSTICE COOPER:

5 If that is convenient. Mr Laing do you see any issue with that?

MR LAING:

No Sir, I am very happy if we can slot Mr McCarthy in anywhere.

10 **JUSTICE COOPER:**

And Mr Raymond, I did not note your appearance earlier but I do now.

MR RAYMOND:

Thank you Sir.

15

JUSTICE COOPER:

Just remind me, the name of your client in formal terms is?

MR RAYMOND:

20 O'Loughlin Taylor Spence, Consulting Engineers.

JUSTICE COOPER:

Thank you.

MR ZARIFEH CALLS**JAMES WARWICK KEIRAN WHELAN (SWORN)**

Q. Mr Whelan, is your full name James Warwick Keiran Whelan?

A. Yes it is.

5 Q. And you reside here in Christchurch?

A. (no audible answer 09:44:34)

Q. And you have prepared a statement, I think you have done it in the form of a statutory declaration?

A. (no audible answer 09:44:46)

10 Q. Right. Perhaps the easiest thing is for you to read that and then I will perhaps take you to some photos and just to refer you to the building, all right? Have you got it in front of you?

0945

15 **WITNESS READS BRIEF OF EVIDENCE**

My name is James Whelan. I am 46 years old and I live at 2 Bradnor Road in Fendalton, Christchurch. I am a joint director of Joe's Garage Franchise Services Limited which is licensed to own and operate the franchise arm of
20 Joe's Garage which is a café and registered trade mark operating in New Zealand.

On or about the 1st of June 2007 the company purchased a building located at
25 194 Hereford Street in Christchurch from Red Raspberry Company Limited with vacant possession.

During the due diligence period for the purchase of the building a number of matters were confirmed to us. It was a permitted use under the operative
30 scheme to operate a café which was the company's intention and, further, that the building had recently had considerable earthquake strengthening completed by the vendors to bring the building up to code which further attracted us to complete the purchase. Our solicitor who acted for us in the

purchase, Mr Steve Savill of R A Fraser & Associates, lost his file for this purchase in the February 22 2011 earthquake as their offices in Worcester Street, Christchurch, were destroyed as a result of the earthquakes.

- 5 On or about July 2007 the company entered into a franchise agreement in Memorandum of Lease with Hobart Cottage Limited to own and operate a café at the building to be known as Joe's Garage for a term of 15 years.

10 On or about August 2007 Hobart Cottage Limited opened Joe's Garage in the building to the public fully consented and fully insured for both material damage and business interruption. The term of any such business interruption was up to 18 months.

15 On or about April 2010 Hobart Cottage Limited sold and assigned its interest in Joe's Garage to La Memoire Limited to be owned and operated by Ian and Christine Watson.

20 On September 4 2010 a magnitude 7.1 earthquake hit Christchurch, together with ongoing aftershocks causing minor to moderate damage to the building. After the September 4 earthquakes Joe's Garage closed for approximately four weeks to complete such inspections and allow essential services to return to the Christchurch CBD area. After the September 4 2010 earthquakes and advice from our insurers and local council we instructed the engineering firm of O'Loughlin Taylor Spence, Mr Rhys Smith, to immediately attend to formal
25 structural inspection of the building. In late September 2010 our engineers completed its structural report and, pursuant to recommendations in the report, the company immediately instructed its building project manager, Mr Alastair Miles of Miles Construction Limited to engage contractors to attend to any such required remedial work on the building. Such remedial work was
30 duly completed and included parapet repairs, the removal of roofing to allow access for inspection, the fitting of strappings to the south wall and the fitting of brackets internally to the front wall of the building. All such remedial work

the company was required to attend to on the building it did so immediately and to the satisfaction of its engineers and local council.

In or about October 2010 the building was given a green sticker by local council and Joe's Garage re-opened to the public. At 12.51 on February 22 a magnitude 6.3 earthquake hit Christchurch, severely structurally compromising the building. During the February 22 earthquake Gregory Tobin, a chef who worked at Joe's Garage was tragically killed in the building. As a result of the February 22 earthquakes the building was determined as a total constructive loss and by order of CERA under its special powers, the building was compulsorily demolished in August 2011.

EXAMINATION CONTINUES: MR ZARIFEH

Q. Can I just ask you, you said in paragraph 11 that after advice from your insurers and local Council, what contact did you have with the Council after September, do you recall?

A. I don't recall a lot of contact, no, no. I know it was just part of the process to contact the engineers and...

Q. So general advice from the Council?

A. General advice, yes.

Q. That was perhaps made public?

A. Yes and we'd had a building in Manchester Street damaged as well so it was part of the process that we knew to follow.

Q. And essentially you engaged the engineers, they oversaw any remedial works carried out by Miles Construction and satisfied themselves that everything that should be done was done and reported to you accordingly?

A. Yes, correct.

WITNESS REFERRED TO PHOTOGRAPHS

Q. So the top left as I indicated that's looking from Liverpool Street – [reference 0009.2]?

A. That's correct.

Q. That's looking from Liverpool Street as indicated?

A. Yes, correct.

Q. And Hereford Street and people sitting out in front and can be seen on the left?

A. That's correct.

5 Q. The next one please. The top right of that series that shows more from the corner and we can see Hereford Street with the convertible car outside?

A. Correct.

10 Q. And the building next door, it's gone now from the photo, but I indicated it was Calendar Girls. When was that? Was it a re-fit of some sort do you recall?

A. It was a new building, completely new building. The site was cleared and a new building constructed.

Q. All right and do you know when that was?

15 A. During 2010.

Q. And obviously prior to the September earthquake?

A. Yes, 2009, 2010 approximately.

Q. And, apart from shaking, were you aware of any damage to Joe's Garage building during the construction of that building?

20 A. No I wasn't aware.

Q. That's something perhaps the engineers can talk about. The next photo please on that page and we don't need to go close up but the bottom left that's Liverpool Street?

A. Yes it is.

25 Q. And the bottom right is the top of the Hereford Street frontage looking at the top of Joe's Garage and the western side of the Calendar Girls building?

A. Yes.

30 Q. Right I'll just get you to look at some photographs we've got – BUIHER1940003.8. This is after February. You don't need to go close up but the top one is looking from the eastern side of Hereford Street, the eastern end?

A. Yes.

Q. And the bottom one is from the Hereford Street façade looking straight on?

A. Yes.

Q. And shows some of the damage to the Hereford Street façade?

5 A. Yes it does.

0955

Q. Okay, point 9 please. The top one is that, I'm trying to orientate myself, which direction's that from?

A. That's from the Hereford Street –

10 Q. Looking down Liverpool?

A. Looking down Liverpool yes.

Q. Okay. And then the bottom one, it's again from the corner?

A. Yes.

15 Q. And we can see rubble from the top façade of the Liverpool Street side as well?

A. Yes.

CROSS-EXAMINATION: MR ELLIOTT

20 Q. Just briefly Mr Whelan, BUIHER194.0009.2, top right-hand photograph, is that the door through which Mr Tobin would have run in leaving the building?

A. Yes. Yes that is.

CROSS-EXAMINATION: MR LAING – NIL

CROSS-EXAMINATION: MR RAYMOND – NIL

QUESTIONS FROM COMMISSIONER FENWICK – NIL

25 **QUESTIONS FROM JUSTICE COOPER – NIL**

WITNESS EXCUSED

MR LAING CALLS**STEPHEN JAMES MCCARTHY (SWORN)**

Q. Your full name is Stephen James McCarthy?

A. Yes it is.

5 Q. You've previously given evidence before the Royal Commission?

A. Yes I have.

Q. Can I ask you to start reading your evidence at paragraph 6 please?

A. Yes.

WITNESS READS BRIEF OF EVIDENCE

10 A. "Events between 4 September 2010 earthquake and 22 February 2011 earthquake.

On 5 September 2010 a level 1 rapid assessment was carried out and the building was issued with a green placard. The inspector did not recommend that a level 2 assessment or detailed engineering evaluation was required. The process that was used to determine which buildings were to receive a level 2 assessment was detailed at page 13 of the Council's report into building safety evaluation processes in the Central Business District following the 4 September earthquake 2010.

15 A rapid assessment was not carried out on the building following the Boxing Day earthquake. The assessment process following the Boxing Day earthquake is detailed at pages 31 to 32 of the Council report. Not all CBD buildings were assessed after Boxing Day but building owners were advised to get their own assessments. I understand that the Council has not found any Council records to indicate the building owner had instructed their own engineer and no independent report was received by the Council.

20 Application of relevant legislation in the Council's earthquake prone policy.

25 The building would have been deemed to be earthquake prone under the definition of section 66 of the Building Act 1991 as it was constructed from unreinforced masonry. In February 2005 building consent 10051163 was issued for earthquake strengthening work. Building consent issued in 2005 was for the first stage of a

refurbishment programme. The strengthening work involved the addition of steel portal frames which also supported the new floors and roof. A new concrete ground floor had been added and the existing parapets had been tied back to the new roof with steel channels anchoring into the back of them. All the perimeter walls had been tied to the timber floor diaphragms at first and second floor levels.

5

The first stage work was completed and a code compliance certificate was issued in May 2006. However, because the 2005 Building Regulations commenced on 31 March 2005 after the building consent had been issued and the required strength level had been raised the building was noted in the Council records as a possible earthquake prone building prior to 4 September 2010. It was also noted in the Council records that a structural engineer should be engaged to assess the significance of this building being a possible earthquake prone building due to changes to the 2004 Building Act. Previous strengthening may no longer be enough and additional strengthening may be required. After the commencement of the earthquake prone building policy 2006 when a building consent application for a significant alteration was received the strength of the building structure would be assessed and the application would be dealt with in accordance with the policy, see in particular section 1.7. Two building consent applications were made in relation to the further stages of the refurbishment work to the building after the Earthquake Prone Building Policy 2006 was introduced. When the applications were received an assessment would have been made to determine whether the work could be considered to be a significant alteration as defined by the Earthquake Prone Building Policy 2006. If the work was considered to be a significant alteration the procedures in section 1.7 of the policy were followed. This building had been strengthened to above the Building Act 1991 levels of 10% of the code and so under section 1.7 of the policy no additional strengthening was required even though the applications would have been considered to be for a significant alteration under the Earthquake Prone Building Police 2006.”

10

15

20

25

30

CROSS-EXAMINATION: MR ZARIFEH

Q. Mr McCarthy you said that there's a level 1 rapid assessment on 5th of September 2010. That's BUIHER194.0006.12?

WITNESS REFERRED TO DOCUMENT

5 A. Yes.

Q. So that's the form, I think it's incorrectly dated it appears 2011 but –

A. Yes it is.

Q. – it should be 2010. It relates to that, the day after the September earthquake?

10 A. Yes it does.

Q. All right and because that was green placarded and no further inspection recommended or required that really ended the Council involvement with that building between September and February earthquake? There was no further direct involvement?

15 A. That's correct.

Q. You talked in paragraph 11 about the, the building being noted in the Council records as possibly earthquake prone prior to the 4th of September earthquake?

A. Yes.

20 Q. When were those notes made, the notes that you're referring to or the, the noting? You say that it was noted in the Council's records?

A. Ah, we, um, we noted it following the introduction of the 2004, ah, sorry, um, that would have been in 2006.

Q. So following the legislation change?

25 A. There would have been, there was the legislation change, there was a notation I think that there was a policy to be developed then once the policy was developed I think there was, it was, there were other notations made, standard notations on the, um, for all unreinforced masonry buildings.

30 Q. Right not this building in particular but all such buildings?

A. That's correct.

Q. And you said at paragraph 12 that it was noted that a structural engineer should be engaged to assess the significance of this?

A. Yes.

Q. So again was that a standard notation?

A. Yes it was.

1005

5 Q. And was there any follow up in relation to that noting? Was a structural engineer recommended or sought from owners?

A. At that time there was no follow up.

Q. Right so what was the purpose of the noting at that point?

10 A. It was alerting building owners to the fact there had been a change in the required strength level of buildings.

Q. Right.

A. So if we took unreinforced masonry buildings in particular the required level was, had gone from 10% to 33% and it was alerting people to the fact that there had been that change made in the 2004 Act.

15 Q. Right. So and how were they being alerted, the owners?

A. By this notation on the, in the LIM records and the council's property records.

Q. So it was really a notation, a notice to future purchasers rather than current owners?

20 A. Yes and also, yes it would be to future owners or if someone wanted to investigate prior to a building development that notation would be translated into a PIM application that being a precursor for the building consent.

25 Q. So that was in line with the then council policy that upgrading would be required if there was a change of use or a building consent applied for?

A. Yes.

30 Q. And just maybe it's me I'm not clear but what, from the council's point of view what was the status or nature of the building prior to the September earthquake then in terms of whether it was earthquake prone or not?

A. There hadn't been a comprehensive assessment of the building. Clearly the strengthening works to parts of the building had strengthened the building considerably but there was no overall strength

assessment had been communicated to the council so we were still unsure as to the exact status of the building.

Q. Right. And, but you weren't requiring owners to communicate that to you were you?

5 A. No we weren't.

Q. So in terms of council records or knowledge the council wasn't sure?

A. That's correct.

CROSS-EXAMINATION: MR ELLIOTT

10 Q. Mr McCarthy, just really following on from that point. You do refer in your brief to two building consent applications after the 2006 policy was introduced.

A. Yes.

15 Q. And then you say "If the work was considered to be a significant alteration the procedures in section 1.7 were followed". So was this work considered to be a significant alteration by the council or not?

A. Yes it was.

Q. I see. So on that basis section 1.7 of the 2006 policy was followed?

A. Yes it was.

20 Q. And so that's where you say the building had been strengthened above the Building Act 1991 levels of 10% of code and so no additional strengthening was required?

25 A. Yes in terms of a full upgrade of the whole building. I think the council was keen to recognise that if people had complied with the previous Act that there wouldn't, and were progressing with that work, that it wasn't fair to require them to immediately go to the increased level.

Q. Didn't the 2006 policy in section 1.7 that you refer to require strengthening of 10% of the current code rather than the 1991 provisions?

30 A. Sorry I'm unsure as to that point. If you could bring the notation up on the screen I'd be able to.

Q. I don't have a reference. I'll just read from the section 1.7.

JUSTICE COOPER:

Mr Laing, you might be able to tell us where this policy 1.7 is in terms of our numbering system.

5 MR LAING:

I've got a copy which I can give to Mr McCarthy. I can't tell you now where it is in your document number off hand. I can give a copy but I think the problem we're getting into here is you start getting into questions of law and –

10 JUSTICE COOPER:

Are we?

MR LAING:

And I, well I think that's where it's going, but I may be, Mr Elliott may have a different idea so I don't want to sort of pre-empt what he, where he's going but 15 1991 is when the Building Act, that was the earlier Building Act and then we have the 2004 Act that came into force in 2005.

JUSTICE COOPER:

20 Yes.

MR LAING:

And the regulations under 2005 Act which dealt with the increased level of 33% so I'm not certain about the significance why Mr McCarthy is being asked 25 about this 1991 Act.

JUSTICE COOPER:

Well Mr Elliott perhaps you could share that with us.

30 MR ELLIOTT:

Well I don't want to descend into matters of law Your Honour. Ascend?

JUSTICE COOPER:

You haven't got the reference for this. I mean it would help us all if we could see the policy I think.

5

MR ELLIOTT:

Well it would Your Honour. I can just read the sentence.

JUSTICE COOPER:

10 All right.

MR ELLIOTT

The section says it's 1.7 "Interaction between earthquake prone building policy and related sections of the Building Act 2004. When an application for a consent for a significant alteration to a building is received and the building has an earthquake prone strength of less than 10% of the code the building will be required to be strengthened to at least 33% of code as part of the consent". My question was just really that appears to be referring to the code as contemplated by the Building Act 2004.

20 **JUSTICE COOPER:**

Just read it again please.

MR ELLIOTT:

"When an application for a consent for a significant alteration to a building is received and the building has an earthquake prone strength of less than 10% of the code the building will be required to be strengthened to at least 33% of code as part of the consent". And Mr McCarthy says there's evidence that the building had been strengthened above the Building Act 1991 levels of 10% of the code and so no additional strengthening was required. If that's a matter which Mr McCarthy would prefer to go away and to consider Your Honour I won't...

30

JUSTICE COOPER:

5 Q. Well Mr McCarthy your, I think you have told us as you recall it that policy was applied so that the 10%, the code there would have been a reference to the code under the 1991 Act. Is that what you're saying?

A. Yes I believe that NZS4203 was the relevant standard.

CROSS-EXAMINATION CONTINUES: MR ELLIOTT

10 Q. And just one further question on that issue. Did the council have some information therefore to satisfy itself about whether there was compliance at 10% of code?

15 A. Yes I believe, I'm not certain that we knew the exact code, the exact strength of it but certainly the strengthening works I think far exceeded that 10% level. I wasn't the structural engineer. I wasn't party to the structural engineer's consideration of that matter but clearly that would have been done.

Q. And that would just be based upon information from O'Loughlin Taylor Spence that had come to the council as part of the strengthening application?

20 A. Yes.

Q. I see. Thank you. And if you could just explain on this particular building there was no inspection after Boxing Day, whereas on other buildings after Boxing Day around town the council seemed to initiate inspections. Can you just explain why there was no inspection of this building after 25 Boxing Day by the council?

30 A. There was an initial survey by the engineers and building staff post Boxing Day and they identified buildings that were of particular concern because of immediate damage was obvious. That was the primary focus of their attentions in the CBD at that time so there wasn't a comprehensive review of all buildings. The news media was used to advise owners that they should get their buildings checked before they reoccupied them at that stage.

Q. And there were press releases to that effect?

A. Yes.

Q. Around that time?

A. Yes.

5 Q. So you're saying that there would have been perhaps just a visual inspection of the area including that building but nothing had been identified in the course of that that led to further particular inspections?

A. That's correct.

RE-EXAMINATION: MR LAING - NIL

10 **QUESTIONS FROM THE COMMISSION – NIL**

WITNESS STOOD DOWN

MR RAYMOND CALLS**JOHN STUART O'LOUGHLIN (SWORN)**

Q. Mr O'Loughlin, your full name is John Stuart O'Loughlin?

A. Yes.

5 Q. And you're a structural engineer living here in Christchurch?

A. Yes.

Q. Do you have a copy of your brief of evidence that was prepared for you there?

A. Yes.

10 Q. I will just ask you please to read that to the Commission starting at paragraph 2? I just note that we have provided and exhibited a number of documents.

JUSTICE COOPER:

15 Yes.

MR RAYMOND ADDRESSES JUSTICE COOPER

Most of which are in the brief I read into the brief where it's relevant. If it's of particular interest to the Commission we can pause and refer to them
20 otherwise I was not to go to each of them, maybe one or two.

JUSTICE COOPER:

Right, well we've got some correspondence and plans and we have had the opportunity of reading this material to some extent in advance but if we want
25 to go to something we'll ask Mr O'Loughlin to pause to let us do it alright.

EXAMINATION CONTINUES: MR RAYMOND

Q. So Mr O'Loughlin if you could just start from paragraph 2 please?

WITNESS READS BRIEF OF EVIDENCE

30 A. I graduated with a BSC from Canterbury University in 1968. I then commenced my degrees in engineering and graduated with a Bachelor of Engineering Honours in 1970 also from Canterbury University. I then worked for predecessors of what is now known as Holmes Consulting

Group. I commenced my own practice in 1974 which is now known as O'Loughlin Taylor Spence Limited the company. Since 1974 I have been engaged on a significant range of commercial and industrial buildings throughout Christchurch and the South Island. I have 42 years' experience in the profession. John Spence joined me in practice in 1986.

194 Hereford Street, Joe's Garage

I am giving this evidence to the Canterbury Earthquake Royal Commission to outline my involvement with 194 Hereford Street, the building, and in particular the strengthening work which my company was involved in. Where relevant I have referred to documents which I have provided to the Commission. In addition Rhys Smith, an associate senior engineer with my company has provided a brief detailing his involvement after the 4th of September, 2010 earthquake and the work that the company then carried out for the owner.

O'Loughlin Taylor Spence Limited initial engagement in 2002.

In August 2002 the building was owned by Mrs Dorenda Britten. She engaged Architecture Warren and Mahoney Limited AWN, Phil Gregory to consider proposed alterations to the building. At that stage she was considering changing the use of the building. As I recall the upper floor was to be for office space with the ground floor to be used for a restaurant or café. Prior to that date all of the building had been used for office space.

The company was engaged by AWN. I have a letter dated 22nd of August, 2002 to AWN confirming that the company would be happy to provide structural engineering design on the building as secondary consultants to AWN. At that stage I said that we did not see the structural work as a large part of the project as we understood a change of use of the building was not involved and therefore section 38B of the Building Act would apply for structural issues. I note that should a tenancy other than offices be involved then a change of use may apply

in which case the more severe requirements of section 46 of the Act would be invoked.

As the project progressed Mrs Britten decided she wanted to have the flexibility of a change of use to keep her options open for the ground floor. There is an account to AWN dated 31st of October, 2002 which records our inspection of the building and advising on structural items attending to the internal demolition and checking on the extent of what may be removed from the building. The fee also covered structural design and working drawings for upgrading the building to as near as reasonably practicable, and that's the terminology in the Building Act for bringing the building as close as possible to the strength of a new building. We did not do any further work on it at that stage however as of October 2002 the ground floor was essentially a shell with the original partitions removed. We had done the design work for what would be required for strengthening at that stage but the work was not done because the proposed tenant pulled out. Mrs Britten subsequently sold the building.

2004 Engagement

The company was approached by the new owners of the building, Robert Douglas and Sara Harrow, in July 2004 regarding strengthening. I refer to exhibit JS01 which is the company's report to Mr Douglas and Mrs Harrow on the existing structure as at July 2004. That report summarises what I have outlined above and records that after Mrs Britten's proposed lessee withdrew the building had been left with most of the timber frame wall linings removed, some timber frame walls removed and load bearing studs left unlined but none of the proposed strengthening work completed. The report concluded that the then condition of the building was in a worse state than when we completed the strengthening design in 2002 and would most probably be defined by the Christchurch City Council (CCC) as an earthquake prone building. On the same date we provided the owners with an estimate of the cost to supply and erect steelwork for the strengthening and also an

additional penthouse level which was then proposed to be built on the top of the first floor.

5 A further fee proposal was provided on the 6th of September, 2004 to allow for certain items of structural design to the issue of a building consent. This included the modification of the existing strengthening design which we had completed for Mrs Britten to include the new penthouse level.

10 A further fee proposal was submitted on the 27th of October, 2004 for the structural strengthening of the existing unreinforced masonry building which allowed for a proposed penthouse level in the future but we did not quote for the actual structural design of the penthouse level because at that stage the owners had not, had decided not to proceed with it. A note from Mr Zarifeh on behalf of the Commission to the company dated 21st of September, 2011 that the Commission has
15 obtained CCC's file in relation to the building. I note that a producer statement PS1 design was issued by John Spence on the 29th of November, 2004 in relation to B1 structure of the Building Regulations 1992.

1025

20 Q. Can you just pause there Mr O'Loughlin. Commissioners, the document reference for that producer statement is BUI.HER194.0015.72. If you could just continue please Mr O'Loughlin at paragraph 14?

A. JSO2 records the transfer of the company's drawings at consent stage to the owners on 30th of November 2004. The document transfer form
25 records that the set of drawings was for strengthening of the existing building to bring it out of the earthquake prone category and into compliance with the New Zealand Building Code and Earthquake Society recommendations. The same documents were sent on the date to CCC and to the contractor which was Armitage Williams Construction
30 Limited.

Mr Douglas and Mrs Harrow requested we send our invoice to a company which must have been formed by that date, the Red Raspberry Company, and our fee note is dated 30th of November 2004

in accordance with the quote dated 27th of October 2004 for the design and drawings for strengthening of existing building to seek proposed development.

5 Producer statement design. We then provided a quote for the completion of stage 1 which primarily dealt with liaising with the council providing tender documents and overseeing the tender process and answering contractor queries for the proposed construction. By fax dated 10th of January 2005 Mr Douglas sent to us a copy of the CCC's letter dated 13th of December 2004. The council was processing the
10 application and working through the further information that was required by it. For convenience a copy is produced as JSO3. I note the reference at paragraph 5 of the letter to a geotech report being required as the site had been identified by Ecan as having high liquefaction potential. Our file records that the plans we have prepared were sent to
15 Tonkin and Taylor on the 23rd of December 2004 at the owner's request. We responded to the CCC's enquiries on the 14th of February 2005, JSO4.

Q. Just pause there Mr O'Loughlin. We don't need to go to that document but that fax from your firm is signed by a Mr Andrew J Horton. Just for
20 the benefit of the Commissioners he was a structural engineer employed by your firm?

A. Yes he was.

Q. And he was primarily responsible at that stage for the strengthening work that you were undertaking at that time?

25 A. Yes he was.

Q. And he has since left your firm?

A. Yes.

Q. And the evidence you are giving is basically a reconstruction of what transpired by reference to documents you hold on file?

30 A. Sorry I didn't pick that up?

Q. The evidence you are giving to the Commission is essentially a reconstruction of events by reference to the documents you hold on file?

A. That is correct.

Q. But you generally had oversight of that project as the senior engineer?

A. Yes and I, when Mr Horton left I took over the final stages of the inspection.

Q. If you could just continue please from paragraph 19?

5 A. The project proceeded reasonably slowly. As at August 2005 we were still completing the construction set of drawings. By that stage another firm of architects, Richard Proko Limited, were working on a final architectural set of drawings. Our document transfer records show that on the 22nd of August 2005 the construction drawings were issued to
10 Armitage Williams. The plans included the earthquake strengthening details. JSO5 is our fax to the contractors concerning the detail of a 250PFC beam over the removed column in the garage. The fax includes drawings D2 and D3.

JUSTICE COOPER:

15 We will just have a look at those I think.

EXAMINATION CONTINUES: MR RAYMOND

Q. We have just pulled up on screen Mr O'Loughlin your document reference JSO5 which is the fax you've just referred to?

A. Yes.

20 Q. And that refers to enclosed detailing for the beam over the removed column in the garage?

A. Yes.

Q. I am sure the Commission knows but for the record a PFC beam is what?

25 A. Is a parallel flanged channel.

Q. And if you look at D2 and D3 which are the next documents attached, are they the drawings to which you refer?

A. Yes they are.

30 Q. Can you briefly explain to the Commission the detail there and the connection design methodology that you adopted?

A. D2 is a view from inside the building looking west which shows where a steel frame is inserted on the right-hand side and you'll see the floor

beam in section which has got the circle around it. The beam with the six crosses on it which are bolt positions is the parallel flanged channel going over to a 75x75x5 structural hollow section post and then D3 is how that you see the section of the west wall in 1/D2 with the parallel flanged channel 250PFC in section and the M16 threaded rod going into the concrete bond beam above the brickwork. The section 2/D2 shows the 75x75 post, RHS post in section with two crosses and those are bolts for the floor to hold the base of that column at ground level.

5

Q. Mr O'Loughlin, just looking at D3 and the first section 1/D2, the detailing you've got for the M16 threaded rod into the existing concrete bond beam, is that a detail that was widely used at that time?

10

A. It's a pretty standard detail to connect a steel member to a concrete bond beam.

Q. With the benefit of hindsight is there any variation to that detail that you would have possibly adopted?

15

A. It's a detail which comes up in the drawings which are excerpts from the Draught Guidelines for assessing and strengthening earthquake-risk buildings.

Q. Sorry Mr O'Loughlin, as you turn away we are losing your voice into the microphone. Can you just talk into the microphone when you are referring?

20

A. Yep, sorry. I'll bring his over here. That detail 1/D2 is a very typical detail and you see that if you look at the draft guidelines for assessing and strengthening earthquake-risk buildings. You'll find that similar detail in that document.

25

JUSTICE COOPER:

Q. That is the NZSEE guidelines is it? New Zealand Society of Earthquake Engineers?

A. Sorry?

30

Q. That document that you have just referred us to is a document that is produced by the New Zealand Society of Earthquake Engineers?

A. Yes.

MR RAYMOND:

Sir, before we move on have you any further questions in relation to those drawings?

5 JUSTICE COOPER:

No, thank you.

EXAMINATION CONTINUES: MR RAYMOND

10 Q. Paragraph 22 of your brief Mr O'Loughlin. If you could pick up from there please?

15 A. There was a site meeting with all those involved with the project on the 21st of November 2005. I have reviewed the minutes and none of the items referred to relate to the earthquake strengthening. By fax dated 29th of November 2005, JSO6, we noted to the contractors a variation in the brickwork construction in situ. I do not think this is of any particular relevance but include it because an instruction would have arisen later in relation to this issue. JSO7 is a record of the site instruction dated 6th of December 2005 which confirms that all reinforcement was in all the pads shown on our structural drawings and all foundation pads were
20 ready to pour. This was the first site instruction for the construction stage. JSO8 is the site instruction of the 12th of December 2005 dealing progress to that date. On the 19th of January 2006 we sent to the contractors details of the Hilti HY20 injection system for wall ties. The covering fax and details D5 and D6 are produced as JSO9.”

25 Q. Sir just with as with the previous drawings we might quickly refer to those please JSO9, is the covering fax sheet which then attaches pages D5 and D6 if they could be brought up please. Firstly D5 is the Hilti HY20 injection system for wall ties. Have you got any further comment you can make in respect of the positioning of the ties or the system that
30 was used.

WITNESS REFERRED TO FAX SHEET

A. It's Hilti. A very reputable international company providing specialised expertise in connections and we believe that it's a good system and I would, I continue to use their products.

5 Q. And D6 further detailing the cross-section where the Hilti goes into the masonry, the bricks? Is that correct?

A. Yes.

COMMISSIONER FENWICK:

Q. How did you ensure that the epoxy remained round the bar between the two layers of brickwork?

10 A. There's a sleeve in the system which, um, when you pump the epoxy in it, ah, transfers through that sleeve to the furthest away leaf of bricks and you can see that's, ah, you can see that drawn roughly in D6.

Q. Right so this sleeve was somehow pushed through the hole with the rod was it?

15 A. Yes.

Q. And then it sort of –

A. Yes the hole's drilled –

Q. (inaudible 10:37:45)

20 A. – the hole is drilled, the sleeve's pushed through, the epoxy is then squirted through to both leaves.

Q. And that pushes the sleeve out, thank you?

A. That overcomes the fact that you've got a gap in some places between the two leaves of bricks.

EXAMINATION CONTINUES: MR RAYMOND

25 Q. Just while we're on that Commissioner Fenwick, the next page over is the Hilti injection technique. Next page please. Which has some particulars and then the further page in the sequence is an email from Hilti to OTS and there's reference to the fixings and the reference just below the paragraph which says "all prices exclude GST based on an
30 estimation of 10 fixings per tube but as you will appreciate the amount of resin injected is not an exact science. With hollow applications it comes

down to the user” and I think that’s a reference to the injection that you were referring to. If we could move on please to paragraph 27.

5 A. “The site instruction of 10th of January 2006, JSO10, records progress in relation to the steel portal frames, the first floor joists, the 250PSC across the garage door detail and also block grouting cavity on grid 4 and A. I note that the Hilti system was extended by Mr Horton to grid 1 as well as the earlier detailed grids.

10 The site instruction for 19th of January 2006 is JSO11. Progress to that point is detailed in relation to the first floor joists and ply floor diaphragm and roof joists.

15 JSO12 is the site instruction of the 30th of January 2006 which records the progress with the roof joists, the angles carrying the floor joists and the roof joists and grouted detailed cavities left by fallen bricks with removed walls. Further details were sought by CCC by letter dated 30th of January 2006, JSO13. It includes a request for details of the restraint of the roof parapets for all four sides. By facsimile dated 10th of February 2006 Mr Horton provided confirmation of the parapet restraint and refers to the relevant drawings JSO14 OTS drawings 2808/S3B and S4B were indicative drawings. I refer to these plans further below. The site instruction JSO14 of 10th of February 2006 gives specific detail as to how the parapet restraint was to be built in response to the query from the CCC and also by way of instruction to the contractor. Later in the day Mr Horton sent a further fax to the contractors containing detailed design of the proposed parapet restraints. The fax is produced as JSO15 and includes drawings D8, D9 and D10.

25 Q. Would the Commission like to make reference to those drawings now?

JUSTICE COOPER:

Yes I think so. Thank you.

EXAMINATION CONTINUES: MR RAYMOND

30 Q. JSO15 is just the cover sheet if we could go to the second and third pages.

WITNESS REFERRED TO DOCUMENTS

Q. D8 is a typical section through a parapet. Is that correct Mr O'Loughlin?

A. Yes that's the section grids 1 and 4 which are the east and west walls.

Q. So at the lower right of the drawing we have the parallel flange channel
5 and that runs along all sides of the walls?

A. That, that's correct.

Q. And then if you could describe that fixing from the PFC into the parapet
brickwork?

A. Yes, that's the fixing from the inner, well really the outside flange of the
10 channel through that flange and into both leaves of brick.

Q. And that's referred to as an M20 chem set. Is that correct?

A. That's the M20 chem set yes.

Q. And the next page D9 is a typical section through a parapet and there's
reference there to the grid lines which this relates to. Is there any further
15 comment on that?

A. Grid A is the north wall of the building and grids E and F are the south
ends of the building which has a step in the plans so you get it on two
grid lines and you can see the 150 parallel flange channel is continuous
along those walls on those grid lines and we have the M20 chem set
20 into the, fixed into the both leaves of brick and connected to the channel
through the outset flange of the channel.

Q. And D10 next page please?

A. D10 shows what happens to the 150 parallel flange channel when it
gets to a corner and you see in grid 1 the channel running horizontal
25 and then there's a section 1 which is shown down the bottom left-hand
corner of the page and you see that there's a flat coming down from the
end of the channel with bolts through to the brickwork.

1045

WITNESS CONTINUES READING BRIEF FROM PARAGRAPH 33

30 JSO 16 is the site instruction of the 22nd of February 2006 in relation to
preparing to cast the ground floor slab. I carried out this inspection. JSO 17
is my site instruction of the 24th of March 2006 confirming that the structural

work was complete. I issued a producer statement PS4 construction review on the 21st of April 2006, JSO 18.

Damage to the east wall 2008:

5 By August 2008 the tenant on the first floor of the building was Miles Construction Limited. We received instructions from Alastair Miles of that company to review and have professional structural input on the party wall issues in relation to the building. Our brief was to keep a watch on the repairs being carried out by the owner at 196 Hereford Street. The old building at 196
10 Hereford Street had been demolished and a new building was being erected for Calendar Girls. When the old building was demolished it left the eastern wall exposed, that's the eastern wall of Joe's Garage, and some damage to the block work. My letter to Miles Construction on these issues dated 18th of November 2008 is produced as JSO 19. My further report to Alastair Miles
15 dated 27th of March 2009 is produced as JSO 20. Due to the nature of the works at Calendar Girls where deep excavation was required at basement level, further underpinning works were required on the building to protect the integrity of the foundation on the east wall. My email to Alastair Miles in relation to that issue dated 21st of August 2009 is JSO 21.

20

The Strengthening Work Drawings:

I produce as JSO 22 the structural engineering drawings for the building S1B, S2B, S3B and S4B. I have read the brief of evidence of Rhys Collin Smith. He refers to a report dated 18th of January 2011 he prepared for Joe's Garage
25 (Hereford Street) Limited which summarises the construction of the building and the strengthening which was carried out as described above. I concur with the summary of the work completed and refer to it. Finally I note that I have produced the above documents taken from my files which I regard as relevant to the matters at issue. The complete file is, of course, available to
30 the Commission or counsel assisting the Commission for inspection if required.

CROSS-EXAMINATION: MR ZARIFEH

Q. Just a few questions Mr O'Loughlin. In relation to the strengthening work that was completed I think you've read or had access to Mr Peter Smith's report. Have you seen that?

A. Yes I've seen that.

5 Q. And he raises the possibility I think is probably the way to put it as to whether workmanship was an issue in terms of the failure of the walls in the February earthquake. You read that section?

A. Yes.

10 Q. Have you got any comment to make about that general concern or issue that he has raised?

A. My view is that with brick masonry walls, whether they are triple brick, double brick or cavity brick, that a 1930 building the lime mortar is very weak and the vertical accelerations we had in the 22nd of February event flicked bricks up in the air so it doesn't matter what sort of connection you put between bricks, some connections will inevitably go into a mortar course, some will go into the centre of a brick, some will go very close to the side of a brick. They all have different end strength levels if you tested each one but the most dramatic thing I saw when I went in on the 22nd of February to the CBD was cars upside down and I thought what idiot has been tossing cars over but I realised that as a car sits on the camber side of the road and it's sitting in an angle and you get a thump from below it flicks like a pancake and that's what happened to the brick walls and so the quality of workmanship is a factor but the fact that the bricks are separating during a vertical acceleration far higher than the code has ever allowed for means that no matter how well or poorly the connections are made they are going to fail under those circumstances.

25 Q. And he also makes a comment about the vertical acceleration and how more thought should be given to that possibility in the future. Do you agree with that then?

30 A. Yes. I was looking after several buildings, brick buildings, following September 4th and watched them degrade. The bricks near the top of the building don't have much actual load on them whereas the bricks

- down at the bottom of the wall have a high axial load so they aren't so affected but unfortunately when we are dealing with parapets you're trying to tie in bricks which don't have a high, what we call, P/A or axial load on them and so they are the most vulnerable. What I was doing
- 5 with one building is the parapets were crumbling and bits falling off. I took that lot of parapet off and then noticed that the next metre or so of bricks down then started to crumble with aftershocks and fall off so it's a progressive failure as you go down. So to answer your question I think with brick buildings you've got to get some sort of axial load from the
- 10 very top of the parapet down through the wall like putting stressing rods each side of the wall down to a foundation and holding the wall down and then if they're held effectively together then you're not going to get the bricks jumping away and then the bolts which are between two bricks being able to come apart.
- 15 Q. So are you talking about rods on the outside of the brick wall or the inside or drilled down?
- A. Yes it's done in the Great Hall at Canterbury University. There's stressing rods each side of the stone walls and I've done it at a building in Oamaru, an historic building where we drilled down through the
- 20 middle of a limestone block and stressed the total column so that we had an axial load on it.
- Q. Right so back in 2005, 2006 when this work was being done, would any, not just on this building I'm talking about, but generally would any thought have been given to going that extra step further?
- 25 A. The code really if you look at the highest vertical acceleration you could justify from the design codes was probably on the part of a building and you'd be looking at something like .5g, half the weight of the building upwards, ah, half the weight of part of a building upwards and then you look at .9g as a conservative measure coming down so you always
- 30 imagine that the walls and the bricks and the brick components in a brick wall are going to be wanting to not move up in the air and so of course in hindsight you look at what's happened to buildings and you would say now that you might have looked at it differently at that time

having had the event and the vertical accelerations we've experienced on buildings in Christchurch but certainly not at the time. I was just following or Mr Horton was following standard engineering practice at that time.

5 Q. Right so generally in relation to the strengthening of a building like that at that time what you were doing would be the standard –

A. That's just standard practice.

1055

10 Q. Right but I take it from what you're saying that you agree that there has to be changes given the benefit of hindsight?

A. And going forward from now –

Q. Yes.

A. – there should be changes.

15 Q. Yes.

A. In fact my personal view is structural walls composed, comprised of bricks should be very seriously looked at as to whether they should be replaced.

20 Q. Right. Right, in relation to the Joe's Garage building the, these steel channels that were put in they were on the top weren't they of the parapets?

A. Yes.

Q. And they were on the north and west and south perimeters?

A. And east.

25 Q. And east, so the whole lot?

A. So that's lines A, D and lines sorry, A, E.

Q. Okay, it doesn't matter but –

A. Yeah, yeah.

Q. – on all the perimeters yeah?

30 A. Yes.

Q. And you talked about I think it was yourself who had checked JSO17 where you note that you have "checked the fixing of portal frames to brick walls and okay"?

A. Yes.

Q. You've written that? I'm just wondering if you can tell us just thinking about this workmanship issue. What's involved in that checking that you've noted there, well what did you actually do?

5 A. There is, bolts go from the portal frames which were on lines B, C, D and E, and they, the, the vertical leg of the universal beam goes down the side of the inside face of the brick wall.

Q. Right.

10 A. And you look to make sure that the bolts which are detailed go into the, go into the wall.

Q. So to make sure that they're actually into the wall and –

A. Yes.

Q. – presumably the right number of bolts?

A. And the right number of bolts.

15 Q. Right, so the actual fixing the injection of the epoxy and the fixing of the bolts, that's done by the contractor?

A. Yes.

20 Q. And the engineer doesn't oversee that actual process. He designs it and specifies it but you presume that it's been done to the right standard and the right instruction according to the manufacturer?

A. Yeah the engineer is only on site at specific intervals.

Q. Right.

25 A. Maybe once a week. You rely on the contractor and specialised subcontractors doing the work correctly. You can come along afterwards, they might have put those in on a Monday morning or Tuesday morning, you inspect on a Thursday. You look at the vertical leg of the steel post and see that the heads of the bolts are there and that the contractor that's been nominated to do that work has been on site doing it. But it's an observation process the engineer goes through
30 rather than a supervision process.

Q. I understand.

A. To supervise you'd have to be there 100% of the time.

- Q. All right and with these brick walls, they're of different thicknesses, some were double?
- A. Yes.
- Q. Some were triple?
- 5 A. Yes.
- Q. So the bolts aren't going through the whole width or whole thickness are they?
- A. No they go in and you try and have it at a certain length, a minimum length.
- 10 Q. But if it's a triple wall it wouldn't go in as far would it or do you use longer bolts?
- A. It would be the, a triple wall would not go the same percentage through the thickness of the wall as it goes into a double brick wall. A double brick wall it might go 70 to 80% into the wall, the triple brick wall it might
- 15 go 50 to 60%.
- Q. Right and so not connect with some of the bricks?
- A. They, when a triple brick wall is built some of the bricks aren't laid in stretcher bond they're laid back through the wall so they effectively tie the two inner layers to the outer layer.
- 20 Q. Right, and can you tell us which walls of the north, west and south of Joe's Garage which ones were double or triple? Do you recall?
- A. There was double brick at first floor, there was generally the triple brick is at ground floor.
- Q. Ground floor.
- 25 A. Partly that relates back to where very old buildings were built and you created a ledge at each floor level to sit the floor joists on so you started off with maybe four layers of bricks stepping back to three at first floor with a 50mm ledge and then subject to going up the building it keeps stepping back to you end up with a double brick wall at the top floor.
- 30 Q. Right.
- A. In this case it was a two story building so you have three.
- Q. And two?
- A. Going to two.

Q. And is there a cavity between the layers?

A. In some places there was, it was complicated the, the east wall did have a cavity in it in most places but where there is an old strong room that changed a bit because they had solid construction of brickwork in that strong room to the south end of the building.

5

Q. Right so if there's a cavity that means the bolt won't go as far in as well?

A. Yes that was what we were talking about earlier with one of those details that you use the sleeve and you try and get the grout going through the cavity to the furthest away layer of brick.

10

Q. Right and in that process of strengthening and the tying in of the walls with those rods was there anything done about the mortar or could anything be done about the mortar because it's lime-based mortar in those old buildings isn't it?

A. It was a recommendation I read where some of the, there's two parts to the mortar course, there's the lime mortar and the pointing. The pointing weather-proofs the lime mortar from the climate.

15

Q. Right.

A. And the, in this case the pointing had gone into disrepair in some places and so the bricks were re-pointed which would hold any ground up lime mortar in place and it would also provide weathertightness for a future number of years.

20

Q. Right but the lime-based mortar could well have disintegrated couldn't it?

A. Sorry?

25

Q. It could well have disintegrated and not be effective?

A. Yeah it, from September, well lime mortar does degrade anyway and become more like a loose sand. With the aftershocks that we were expecting in Christchurch through from September the 4th there was a certain amount of grinding as well which reduced any bond between sand particles from the lime. It broke that bond.

30

Q. Right.

A. And so it was getting more like sand rather than a mortar.

Q. And was any thought given after September to this kind of vertical strengthening that you talked about before?

A. Not to my knowledge.

Q. Given the effect it might have had on the mortar, the earthquakes?

5 A. It's not so much the, well I suppose you could argue that any bond which was left after 80 years, 70 yeah 80 years it was always going to be a low strength mortar from after that period of time.

Q. Okay, you talked briefly about the, some damage to the east wall and the foundations from the construction of the building next door?

10 A. Yes.

Q. Did that have any effect on the structural integrity of the building, I'm talking about after repairs were made as you've outlined in terms of what we're dealing with the September and February earthquakes?

15 A. The east wall of Joe's Garage was what they call a party wall so there was a single wall between Joe's Garage at 194 Hereford Street and the building to the east at 196 Hereford Street.

Q. Right.

20 A. When the building at 196 Hereford Street was demolished then there was damage to that party wall. They had a requirement to leave the party wall in place because that was only half theirs and half the owners of Joe's Garage and some of their floor joists were embedded in that wall so in the demolition process there was parts of the east face of the east wall of Joe's Garage damaged and that's what I referred to in some of those site instructions. That was subsequently repaired and put back
25 to pre-demolition condition and I was satisfied that at the end, they were slow doing it, but at the end it got back to a reasonable condition and I don't think it had a lot of effect in the bulk of the wall, maybe a little bit at the north end and the south end.

Q. So to the north façade of Joe's?

30 A. No to the east facing side –

1105

Q. Oh the north end of the east side?

A. – of the north end of the east wall.

Q. Just wanted to refer you to Rhys Smith's evidence that he is going to give. And he, just trying to find the paragraph sorry, but he referred to some, a beam where the bolts were missing. I think it's in photos 3 and 4 on the 29th of October. I don't know if you have got a number for that
5 Mr Raymond? Page 7 of his brief, photos 3 and 4. I don't know if you know what I am talking about?

A. Yes I know what you're talking about.

Q. Okay.

A. I think if you refer to...

10 Q. Just wanted you to explain to us whether, this is a purlin cleat without bolts?

A. Yep.

Q. We'll get the picture brought up.

JUSTICE COOPER:

15 Suffix 2.32.

CROSS-EXAMINATION CONTINUES: MR ZARIFEH

Q. Now I just wanted you to explain, I mean when I saw it I see no bolts in and I think that's a concern. Can you tell us about that?

A. Yes.

20 Q. Where it is and the effect?

A. If you go back to JSO15 and you look at D9, that's a cross-section of the parapet grid A, E and F, and I believe that photo is taken at grid A which is the north, inside the north wall of Joe's Garage and you can see in D9 there is a DH15 purlin, you can see the roofing in profile and you can
25 see the cleat sitting on top of the 150PFC channel and there is two crosses and that photo is of that cleat where that should have been bolted to the purlin and it was missed out.

Q. So what effect would, I presume that is the only such cleat that didn't have bolts from the inspection?

30 A. Yes, well, what effect did it have?

Q. Yes.

A. If you look at D8, that is the west wall of the building and there the channel is connected by welding to each portal frame and so that channel is securely fixed between the steel portals and couldn't move and then the connection from the outside flange to the brick wall is very similar to what is in D9.

5

Q. Right.

A. The end result, both that west wall and the north wall parapets fell down. One we know was well connected, one had two, and that was the west side. The north side had bolts missing and it also fell down. So they should have been there but I personally believe that looking at the west wall and what happened to that and how that parapet fell down that the parapet failure was due to the vertical acceleration on the brickwork of the parapet flicking the bricks in the air where there is no, at the top of the wall where there is very little axial load and sending the bricks and the concrete bond beam down and the connections probably whether they were there or not didn't have too much effect because we know they were there on one case, the west wall, we know there was some bolts missing on the north wall and the result was the same.

10

15

Q. And more relevant is the attachment of the bricks to the strengthening. Is that what you'd say?

20

A. Yeah, it would have been desirable to have them there and they were put there for a purpose. They didn't get connected up by the contractor for whatever reason I don't know. It was in an inaccessible place under the roof and it was closed off so you couldn't just go and look and see whether they were there or not because it was in a sealed off area and it may have been why they were left out because the roofer came along and put the roof on before the contractor put the bolts in.

25

Q. And just finally, I should have asked you before, Mr Wilby is giving evidence about the fixing.

30

A. Yes.

Q. Did you have any contact with him in relation to this strengthening work?

A. No I didn't.

Q. Have you got any comment about his statement?

A. Yes, he talks about the strength of the bolts and the strength of the bond between the peripheral area of where the grout goes into the brickwork but if the bricks have parted from one another then it is irrelevant.

Q. Thank you.

5 **CROSS-EXAMINATION: MR ELLIOTT**

Q. Mr O'Loughlin, thank you for that very thorough account of what took place. The building we are looking at today is somewhat different to others we've looked at in that others, in some cases, were not strengthened at all. This one, however, was strengthened and strengthened very recently. However, a man tragically died. Obviously
10 his family and friends would want to know that if there are any lessons that we can learn going forward that we learn them and of course New Zealand has this issue now of unreinforced masonry buildings across the country which may be earthquake prone and which even, although
15 strengthened, may suffer some failure as Professor Ingham's enquiries have shown. So you've already given a volunteered number of points which is appreciated. You may have answered the question but really it is just whether you have any observations that you can make about how this issue of unreinforced masonry buildings is addressed, any
20 comments about the way they might be addressed in their strengthening or the way that the consenting process might operate in that context, anything at all that you draw from this that we can take and learn.

A. The strengthening work which was done was successful in that the building as a total didn't collapse.

25 Q. Yes.

A. But parts of the building did collapse, and so we have got to distinguish between the overall building and the parts of the building and some of the photos I've seen of Joe's Garage after the event, the interior was relatively okay. It was the danger period, or the danger area is around
30 the peripheral parts of the building and especially where parapets can be flicked off with vertical acceleration. I think there has got to be a lot more recognition of not only this building has got frames every four

metres, five metres, therefore that's catering for the lateral loads. You've got to look at the little bits of building like heavy chandeliers, ceilings, parapets, beams which are considered. The building is made up of parts and every part has got to be secured one way or another. That is a very
5 broad view of how you have got to look at a building whereas I think in the past to strengthen a building means there is a certain lateral load on it therefore you put frames in it and those frames will hold up the lateral loads and that's true, it does, but between those frames there's sections of structure and sections of building which are vulnerable and so you've
10 got to extend your thinking beyond just the overall building and down to the components of buildings.

1115

Q. And that could be part of the consenting process for example?

A. I think the rule governing strengthening a building is that it has to
15 encompass more and there is provision for looking at parts of a building but it's got to be strengthened to be more sort of encompassing on all the parts.

Q. Thank you. Just one other question. Mr Smith says in his statement that
20 there was a standard notation which was agreed as a company to include on reports to clients and I think by that he's referring to evacuate if aftershocks greater than five and await engineer's inspection is that right? Was that a standard –

A. Yes, we decided as a company that when the aftershocks were being
25 experienced what is the level of earthquake which is taking buildings as a general rule outside the normal design criteria and there is a lot of factors involved with an earthquake. You can talk about a level five or whatever level but it's the distance from that building the epicentre is and just as importantly the depth of the earthquake as to what accelerations a particular building might get so it's a very loose rule of
30 thumb but we felt that any and people have learnt to gauge. My wife can tell me when we get a shake at home that's a four or that's a three or that's a big one I think that's a five and so it's that sort of intuition which has got to be acquired to building owners to say well stay inside the

building while it's shaking but when it's over evacuate and have an engineer come and inspect it and we thought that the level five would be about at that point. There's another thing that there's only so many structural engineers in Christchurch and you're imposing a huge task on them to suddenly go out and look at all the buildings after a particular level earthquake so from that point of view you'd try and look at the upper level. From security you look at the lower level and that so that's where we came in as a five.

5

Q. In hindsight, I accept it may be difficult given resource constraints but would it be possible to tighten up that sort of rule by reference more to horizontal accelerations that might be expected rather than just to a magnitude reference or is that just too hard to do in the circumstances?

10

A. The 22nd of February earthquake it was the vertical accelerations in my view which did most of the damage and I've looked at lots of buildings.

15

I've seen crushed columns in basements, raft slabs which were piled sitting there thumped like that. It's the first columns which collapsed and then it's also the tops of the walls, the parapets which suffered. It's like getting the five steel balls hanging from wires, swinging the first one against the first ball and the end ball pops off and you can turn that up 90 degrees and you get a thump from below and there's a shock wave goes through the wall and pops the top off and I've seen block work colonnades in a very extensively landscaped garden and it was the top metre of these 400 square posts made of block work where there's a crack right round and that was the top wanting to jump off and they were reinforced.

20

25

Q. Even though reinforced it still, it stayed in place are you saying even though, so the reinforcing worked in that case?

A. Yes.

RE-EXAMINATION: MR RAYMOND

30

Q. Mr O'Loughlin, you were shown RCS9, photo 4 which was the unbolted cleat. Mr Smith will give evidence that that was actually on the south

parapet. I think you referred to the north parapet. Mr Smith took that photo so does that change any of your observations now that you –

A. No the D9 is grids A, E and F so E and F are the south, the same detail at both ends. Yes I wasn't aware that it was the south end.

5

JUSTICE COOPER:

Q. Well if it was the south end could it have been influential with respect to the performance of the north wall?

A. It wouldn't, the fact that there was bolts missing at the south end
10 wouldn't have had any effect on the north end of the building.

MR RAYMOND:

Sir, the topic which counsel and I have been discussing quietly is it relates to other evidence which Mr O'Loughlin might be able to give which might be of general interest to the Commission and Mr O'Loughlin and I have discussed it
15 at length previously when we've met. He's not briefed on it but he is very familiar with the territory. Whether you'd like to hear that now after the break or whether you would prefer to hear it at a later stage.

JUSTICE COOPER:

20 Well perhaps because he is here –

MR RAYMOND:

I can briefly indicate what it relates to. It's about names. The central city building, major commercial retail, unreinforced masonry which was inspected
25 post Boxing Day and which Mr O'Loughlin closed the building completely and it's an interesting episode because it relates to some of the commercial pressures –

JUSTICE COOPER:

30 Well I think we'll come on to that. I will just ask Commissioner Fenwick if he has any questions about the evidence so far.

COMMISSIONER FENWICK:

- Q. I have one minor point. I must say I'm impressed by the clear little diagrams you have here, the drawings, that makes it easy to follow. On drawing D3 which is in 0001.16 you did show us before you've got a diagram of the fixing of the column to what I assume is a concrete pad below it, detail 2/D2.
- 5 A. Yes.
- Q. And you have two 12 millimetre tru-bolts going through the base pad into the concrete?
- A. Yes.
- 10 Q. How were those bolts placed? Was one right in the middle of the RHS? I presume they must have been put in there before the end was welded on to the RHS.
- A. You put the plate down, bolt it to the floor and then weld the RHS to the plate.
- 15 Q. The bolt's below the plate. Good thank you.

COMMISSION ADJOURNS: 11.24 AM

COMMISSION RESUMES: 11.45 AM

20 **MR RAYMOND ADDRESSES THE COMMISSION**

Sir, after further discussion we consider it is probably more appropriate to deal with the matter I raised at a later hearing to give other parties an opportunity to hear what has been said in advance.

25 **JUSTICE COOPER:**

I have no questions for Mr O'Loughlin but I would like to say that we are very grateful to you Mr O'Loughlin for the thoroughness and the clarity of the brief that you have read to us which obviously has involved you in a lot of work. So we are very grateful for that and to you, Mr Raymond, for briefing him in that way.

30

WITNESS EXCUSED

MR ZARIFEH CALLS**PHIL WILBY (AFFIRMED) (VIA VIDEO LINK)**

Q. Mr Wilby can I ask you please to give your full name to the Commission?

5 A. My full name is Philip Morgan Wilby.

Q. And you have prepared a statement, a two page statement, in relation to the evidence that you are going to give?

A. Yes. The statement is prepared in response to a query through Armitage Williams and was prepared on the basis of the information in the PDF documents that were given to me.

10

Q. That's right and in particular in relation to Mr Peter Smith's report and some of the comments he made?

A. The comment about workmanship was the principal area of interest, yes.

15 Q. Have you got a copy of your statement?

A. Yes I do.

Q. Can I ask you to read that out aloud please to the Commission.

20

A. It starts out as background. The work carried out on Joe's Garage building as a sub-contractor to Armitage Williams consisted of the drilling for and installation of threaded rod and reinforcing bars using epoxy resin. The work was carried out by staff employed by NZ Civil and Construction Limited of which I was general manager, a director and half owner. I have a BSc (Hons) from Swansea University in the UK and am an engineering technologist member of the Institute of Professional Engineers New Zealand. I have been involved in specialist civil engineering contracting for approximately 25 years with particular interests and experience in heritage structures, post tensioning, rock and ground anchors, specialist grouting and seismic strengthening, including FRP which, for clarity, is Fibre Reinforced Plastics and is typically carbon fibre strengthening. I emigrated to New Zealand with my family in 1993 and worked as project branch manager for Construction Techniques for seven years. I left Contech at the end of 1999 and in conjunction with Darryn Oakley formed NZ Civil and

25

30

Construction Limited. Fulton Hogan Civil purchased the assets of NZ Civil Group as a going concern in November 2008 and it now operates as a specialist division of Fulton Hogan Civil South, with myself as divisional manager.

5 Relevant Experience: One of NZ Civil's areas of expertise included specialist site testing work for seismic strengthening both pre design and during construction. Generally this included dry diamond coring, rip joint shear testing and pull out tests on mechanical and grouted starters. With reference to the specifics of the Joe's Garage site, we do not have
10 full paper job records for the project as not all job files were retained following the sale of the company. Computer file records indicate that the project was re-priced for varying methodologies largely due to the presence of cavity wall construction and a job instruction for the site was appended to the email that this report was originally sent. I don't have
15 that with me unfortunately.

Workmanship: My comments on the Spencer Holmes report and photographs are interpretive and are based on a PDF copy of the document with limited definition available. Further visual analysis of actual samples would be of benefit in interpreting failure modes. We
20 took care to ensure quality of work and trained staff in the importance of preparation. Many of the same staff were involved in testing work or had their work subjected to proving tests as part of our contract work. Our staff had a clear understanding of the importance of the work and the care required in its execution. It's my belief that the work was
25 carried out in a workmanlike manner in accordance with the specification and from the limited evidence available from the PDF photos that were attached in the report that I have and I note that two of the other reports had reference to photographs which weren't available to me. The top photo on page 21 of the report shows –

30 Q. If I can get you to pause there I will just get that photo brought up. It's page BUIHER1940030.21.

A. The top of page 21 shows a fully covered starter with a textured surface and a fill of epoxy consistent with filling into joint void. The lower photo

on page 22 shows a fully coated starter with a rough textured surface indicative of a fully filled drill hole. Top photo on page 23 appears to show a fully coated thread rod with either a sack of epoxy from the sleeve of the cavity or a fin extruded into the joint. That's the centre section of the bolt I'm referring to there and the lower photo on the same page, again the textured surface of the epoxy is consistent with a fully filled drill hole.

JUSTICE COOPER:

10 Q. Just going back to your observation about the previous photograph, the top face on page 23. I don't understand what you mean by a "fin extruded into a joint". What's a "fin"?

A. The fin of epoxy is simply the epoxy is put in as a paste effectively so when it's being forced into the borehole. If there's a void that goes into a joint the epoxy will extrude into that narrow crack and if you then took the mortar away subsequently you would be left with a thin fin of material of the epoxy so in that photograph underneath the bar there appears to be a small piece of epoxy that's hanging down from underneath and that could either have been where the epoxy is spread out into a joint between two bricks where there is a bit of a gap or if that's the sleeve position and the photograph is not particularly clear I don't have good definition to investigate it further. There was a mesh sleeve used to bridge the cavity in the brickwork when it was installed and the epoxy is retained but still extrudes through the holes in the sieve and you can get a situation where you get material hanging down from the underneath of the sieve.

EXAMINATION CONTINUES: MR ZARIFEH

30 Q. And can I ask you Mr Wilby in relation to those photos that you've referred to, what's the significance of the, you've talked about fully covered or coated starter. What's the significance of that?

A. The significance to my view is relevant to the workmanship issue in that the boreholes have been fully filled with epoxy so they are in intimate

contact with the brickwork. There are no obvious voids or sections that haven't been filled or large bubbles of air where you're not getting a contact between the epoxy and the drill hole.

1155

5 Q. Right. Can you go back to your statement please, continue reading?

A. So started by expectations. The comments, to diverge from my comments the item in the report noticed that there's not a great deal of damage to any starter bars and to the steelwork and this was an analysis to sort of take a look at that so the expectations of effectively
10 damage to the starter bars my comments were it should be noted that the indicative loads are based on, it's not come through properly. I'm not surprised that the starters do not show significant damage. Based on our job instruction the starter bar sizes were D12 and M16 thread rod with hole diameters of 18 and 22 millimetres respectively. A D12 bar
15 has a yield of approximately 30 kilonewtons while a 4.6 grade thread rod would have a yield of 48 kilonewtons. Taking a generous brick shear value of 2MPa from the drill hole contact areas the available load development for the fully bonded D12 hole would be 23 kilonewtons and for the M16 32 kilonewtons and that indicates that the capacity of the
20 epoxy to bond to the hole is less than the capacity of the bar so the failure mode would be disengagement or shear of the brick at the brick and epoxy interface rather than tensile stretching of the bar. We also did a quick trawl through some of our brick shear test results which indicate lime mortar failure loads around a pair of bricks retained by
25 common starter bar could be expected to vary from 15 to 35 kilonewtons with as little dead load ie., near the top of the wall under a parapet or a dead load is relieved by a vertical acceleration component in the earthquake. In a situation with dead loaded joints with say or three or four metres of wall above can have a static bricks pullout value in the
30 range of 50 to 85 kilonewtons and that point was again to illustrate that the loads required to pull out the bricks that the starters were attached in were consistent or less than the capacity of the bolts themselves. So that was, a fairly crude analysis and it was done so I could do a check

on why the bars appeared to be undamaged and my interpretation of those, of that quick analysis is that the bars had a greater capacity than the other failure modes so the bars were effectively apparently undamaged.

5 Q. Right. So the bars are stronger than the –

A. The bars than the epoxy bond to the brick and they are generally speaking appear to be stronger than the available brick to brick, the likely brick to brick capacity.

Q. And what about the bond to brick, epoxy to brick?

10 A. The epoxy to brick is limited by the shear strength of the brick itself and 2MPa for brick shear is probably reasonably generous in terms of an interpretative value. Brick shear would probably certainly for a brick wall would considered a fairly good value if you got 2MPa out of it to shear.

15 Q. So just to try and put it more in lay terms in relation to the failure of those bricks or the bricks coming off the dowels/rods. Have you got any comment about that and obviously it happened because of the earthquake but in terms of workmanship contributing?

20 A. No that was really the purpose of that analysis was to get an idea of what the weakest part of the link was, so the workmanship relates back to the apparent lack of damage to the bars and also to the visual appearance of the bars. The bars appear to have been well epoxied into the brick work and the bars appear to be undamaged and the weakest part of the system if you like is the bricks themselves or the jointing between the bricks so it was my view that based on that that workmanship wasn't a contribution to the failure of the wall of the whole
25 or of the strengthening system.

30 Q. Right but if the bricks are weak, the joint between the bricks is weak and there's a good bond between the epoxy and the brick itself or bricks that it's attached to. Would you not expect those bricks to still be attached to the rods?

A. Certainly you'd probably expect as we do in the upper picture of page 23 there's still some brick cover apparent on the epoxy but you have to bear in mind that the height of a brick is somewhere in the order of 65

millimetres. The hole diameter is in the order of 22 millimetres so you've effectively got a weaker point in the brick that if it's subjected to impact the brick is quite likely to shatter around that connection.

5 Q. And does the company that you're involved with now carry out similar work still?

A. Yes. Fulton Hogan obviously is well known for roading but they also have a fairly substantial civil engineering division and I'm effectively carrying out the same sort of work that we used to at NZ Civil now as a division of Fulton Hogan Civil.

10 Q. Has the methodology –

A. Sorry.

Q. I was going to say has the methodology changed since this job in 2005/2006?

15 A. No, methodologies for doing things like starter bars haven't changed significantly. The two main means of putting starters into the wall is either with a cement-based grout or an epoxy grout and generally speaking in weak materials like brick work often cement grouts are used which are a much lower strength but still quite effective and epoxies are generally used for connections into concrete with a higher strength has
20 a benefit.

Q. And just in general terms in relation to this work, from your experience has there been any change since the February earthquake in what happened to buildings like this in the methodology used or being contemplated?

25 A. No there is another brick strengthening system that we've been involved in for quite a number of years prior to the earthquake which is mentioned in the report which is the Helifix tie which is a mechanical connection on a relatively low capacity but they've put in at quite frequent intervals and I believe that there has been a greater use of that
30 technique post earthquake compared to –

Q. Why's that?

A. Partly because of the ease of installation as a mechanical connector that doesn't require a bond system. It's basically it's a twisted stainless

5 steel rod with fins on the side of it so it's a little bit like a screw and it's driven, you drill a pilot hole and you drive it in and it holds by mechanical means into the brick. It's used for tying cavities together and for tying lines of brickwork together so it's not used as much for tying parts of a structure to large seismic frames. It's more a question of maintaining the integrity of the brickwork and providing and stiffness between the two lines of a cavity wall.

CROSS-EXAMINATION: MR ELLIOTT

Q. Do you have a copy of Peter Smith's report?

10 A. Yes I do.

1205

Q. And in our reference that's BUIHER1940030.7 and I refer you to page 7 of that document.

A. Okay, so appraisal of unreinforced masonry buildings.

15 Q. Am I right in saying that the evidence that you've given addresses the points raised by Mr Smith under the heading 'epoxy fixings'?

A. Yes, I believe I've addressed the issues there. Certainly the comments that are made there about the importance of the preparation of the hole prior to epoxy's are very relevant. The work instruction that I submitted by email via in my responses to Armitage Williams details our procedures for that particular contract for drilling and checking and preparation of the holes for the epoxying and those would be at least equivalent to the requirements that are noted here.

20 Q. I just wanted to refer you to the sentence at the beginning of the last paragraph, "If the Chemset epoxy was not placed in accordance with the manufacturer's installation requirements, workmanship may have contributed to the failure of the north and west walls".

A. Yeah.

30 Q. Have you responded to that point as to whether or not the epoxy was placed in accordance with installation requirements?

A. Yeah I think so. In the top of the second page of my statement I've said that it's my belief that the work was carried out in a workmanlike manner

in accordance with the specification and the specification would have included the beads of the epoxy that was to be used and how it was to be installed.

Q. What is the basis of your belief?

5 A. The basis of my belief is the experience of the personnel that we employed to carry out this kind of work. Our systems for instructing and managing the work, and the known performance and compliance, not on this contract specifically, but on similar work where we were actually doing testing of the load capacity of starters in similar circumstances.

10 Q. Was your belief based upon any personal direct observation of the work itself?

A. That would be correct, yes. We did a lot of strengthening work. I am familiar with the fact that we worked on that building. I don't have photographs of the site myself while we were doing the work on it. It was
15 a fairly routine kind of strengthening work that we were involved in so from what I see in those photographs in terms of how well the bore holes are filled and what records we still have from the computer files and my knowledge of the workmanship of our crews it is my belief that that work was done properly and in accordance with the requirements.

20 Q. I just wasn't clear if you had understood my meaning which is whether you personally had seen the requirements (inaudible 12:08:25) –

A. (inaudible 12:08:27)

Q. – you're assuming that they did because –

A. I'm sorry –

25 Q. – I'm just asking whether you personally –

A. No I would –

JUSTICE COOPER:

Q. Just a minute, Mr Wilby?

A. Yes.

30 Q. You are tending to talk over Mr Elliott's questions so –

A. Yep.

Q. – I will just ask you him to put the question –

A. My apologies.

Q. – again –

A. Yep.

Q. – and then let him finish and –

A. Yes.

5 Q. – then answer, thank you.

CROSS-EXAMINATION CONTINUES: MR ELLIOTT

Q. My question is just whether the belief that you've stated in your evidence is based upon you personally having observed that the manufacturer's installation requirements were complied with?

10 A. Yes, during the course of that contract I would have been on site, not all of the time, I would have been on site some of the time and I would have inspected our crew's installation procedures and that the work was being done in accordance with the requirements.

Q. Thank you and you've also said that you also base your belief on your
15 knowledge of the training procedures of the people on site?

A. That's correct.

Q. That is, are you saying that you made it clear to those applying the epoxy that they must comply with manufacturer's requirements?

A. Yes, that would be a standard requirement for any of the work that we
20 did with any epoxies or purpose-made cement grouts, things like Sika 212 for example, mix ratios, water ratios, that kind of thing. Temperature requirements and I think, I'm not sure if you have a copy of our work instruction for that contract available there but that detailed the requirements of the drilling of the hole, how to blow the dust out of it and
25 how to do post-clearing of the hole inspections by putting a rag down to check that there is no dust remaining on the sides of the bore hole.

Q. And Mr Smith refers in that paragraph to the prospect of proof testing for quality assurance. Was there some sort of proof testing or quality assurance check done on this occasion?

30 A. I don't think for this particular contract that was done. Some contracts that we did had a requirement for testing and some of our contract work involved testing of bars that have been put in by other contractors as a

QA exercise. I think with what, as I say it was reasonably routine work for us. We weren't in the practice of load testing as an internal QA requirement.

Q. Thank you.

5 CROSS-EXAMINATION: MR LAING - NIL

CROSS-EXAMINATION: MR RAYMOND - NIL

COMMISSIONER FENWICK:

10 Q. The technical material gives the bond strength somewhere does it? Can you point me to where the bond strengths are given in the technical material?

A. The technical material for?

Q. For the epoxy?

15 A. For the epoxy? No, the bond strengths that I have put in there are based on a calculation of an indicative bond, shear strength of the brick as 2MPa and that's related to the diameter and length of the contact area of the epoxy. So if a lower value was actually achievable in a brick of say 1MPa then those achievable loads would be half and in general materials 2MPa to shear for brick would be a relatively high value so I think there would be unlikely to be able to achieve higher loads than those and very likely the achievable loads would be lower.

20 Q. Rather than, if I interpret what you are saying, rather than giving a bond strength you've given a safe load for the diameter of bar drilled into a certain distance? I have two pages here which is handed out for Ramset –

25 A. Yep.

Q. – and I am wondering where is the strength, pullout strength given, the design pullout strength given for these fixings?

A. As far as I'm aware we weren't given a design pullout strength for those fixings. The numbers that I've got there are based on the mechanical

properties of the steel that would have been used for those components and their yield strength.

Q. You have just said that that can never be achieved so how is a designer to use this information if you say well the strength of the bar can never be achieved because the epoxy is going to fail first so surely then –

5

A. That's correct, yes.

Q. – you (inaudible 12:13:27) based on the epoxy strength?

A. Yep. The point that I was trying to make with those calculations. That was an exercise to look at why the bars appeared to be undamaged and that they hadn't stretched and they hadn't (inaudible 12:13:47) from the tensile failure in the failure of the wall and the seismic strengthening. I presume that the designers when they are designing the overall strengthening are working with safety factors and they're looking, they may only be designing that tensile capacity to be say their required tensile capacity for the design might only be 10 kilonewtons for the D10.

10

15

Q. I am trying to look –

A. So in terms of it being able to achieve their design requirement for a particular connection then the epoxy, that system as a whole would achieve that requirement. Obviously in the circumstances here we're in a situation where we've gone to a failure rather than a safe design load and it's the mode of failure which is what I'm exploring here not its ability to meet a design load requirement.

20

Q. Yes, but Mr Wilby, I am approaching this from the point of a designer who has never used these things at all and I have not seen the technical information. What I am trying to find out is, as a designer you would need to know what the capacity of the system was?

25

A. Yes.

1215

30

Q. What the safe design strength capacity of the system was?

A. Yep.

Q. What I'm asking is where is that identified?

- 5 A. That from, from our point of view as a subcontractor that would not have been provided or identified to us. The size of the bar, the diameter of the hole and the material to be used to bond that into the hole are provided specified by the designer. So we're, we're working in accordance with a specification that says "use a D12 bar, drill the hole 18 diameter and use a epoxy to bond it into the hole".
- Q. Yes but as a designer having done all that you now want to know what its strength is?
- A. Yep.
- 10 Q. Now to know the strength you've had to know –
- A. Yep.
- Q. – the bond capacity between the bar –
- A. That's right.
- Q. – the epoxy and the epoxy to the brick?
- 15 A. Yep.
- Q. Now there must be –
- A. Yep.
- Q. – some information surely that the designer is supplied with by Ramset or whoever's doing it to achieve that objective?
- 20 A. The material, the material suppliers will provide tables of pullout capacities and things of that nature. I believe that they work typically on about a 4 MPA maximum bond in concrete which is about half I guess of the shear capacity of concrete and about equivalent to its tensile strength. I don't know what numbers that they would use for brickwork
- 25 or if they provide that directly for brickwork. In my experience with this seismic strengthening work, um, very often before a project proceeded we'd be involved with the designers to go in and do things like brick shear tests to assess the strength of the mortar and quite often to do pullout test. on trial starters to establish the parameters that could be
- 30 achieved at a particular site. That would typically be done for larger or more heritage orientated projects and something of this scale is not something we would necessarily have expected to see happen at a design point of view because the numbers operate within a range and

5 so you could equally well take typical values and apply them to design with suitable safety factors. Um, some of the testing work that we have done would be on, on contracts such as Christchurch Cathedral and the Basilica and other large heritage structures where usually there was a, either a greater interest in fine-tuning the design or in assessing the site specific requirements.

Q. Thank you.

QUESTIONS FROM JUSTICE COOPER - NIL

Yes Mr Wilby thank you for your time, I have no questions thank you.

10 **WITNESS EXCUSED**

JUSTICE COOPER:

Mr Raymond I wonder if just in relation to that last issue you might seek instructions on whether there was some prescription of the strength of the epoxy or whether the designers had an understanding of that because we
5 infer from the evidence that's just been given that Mr Wilby's firm did a job. He thinks they did it well but they were using an epoxy which somebody else had ascertained was fit for the purpose.

MR RAYMOND:

10 Sir, you may have seen me approaching my clients and that was the issue I was talking to them about.

JUSTICE COOPER:

Well no, I didn't see you do that. Well done.

15

MR RAYMOND:

I just provided them with their file and looked for that information but there is a Ramset technical data sheet which is not attached to Mr Smith's report which contains that epoxy strength specification which the designers use and I was
20 going to lead some evidence from Mr Smith on that.

JUSTICE COOPER:

All right that's good, thank you.

25 **MR LAING:**

If Your Honour pleases, before you embark on further evidence I was wondering if I could be excused for the rest of the day, my friend –

JUSTICE COOPER:

30 Certainly, certainly Mr Laing.

MR LAING:

I've no questions for Mr Smith or, well sorry either of the Mr Smiths so if I can be more accurate.

JUSTICE COOPER:

5 Yes thank you Mr Laing.

MR LAING:

In terms of road width you asked about the other day Your Honour.

10 **JUSTICE COOPER:**

Yes.

MR LAING:

20.12 metres which is one chain in old parlance.

15

JUSTICE COOPER:

It's what?

MR LAING:

20 One chain. So that is the road width. I'm still working on the building height but I was wanting to talk to Mr Peter Smith about that to make sure there was a reasonable degree of agreement.

JUSTICE COOPER:

25 Right, so –

MR LAING:

If I can just read you what I have here, "The legal road width including footpaths will be 20.12 metres. All streets were initially set out as a chain
30 under the imperial measuring system." So one chain equals 20.12 metres.

JUSTICE COOPER:

I thought there was a standard answer.

MR LAING:

It was very standard.

5 **JUSTICE COOPER:**

Especially in a well organised city like Christchurch.

MR LAING:

10 But that's looking at obviously survey plans. If Your Honour wants the street
measured we'll be happy to do so.

JUSTICE COOPER:

No, no, not at the moment thank you.

15 **MR LAING:**

So hopefully tomorrow I can give you the information about the building
height.

MR RAYMOND CALLS:**RHYS SMITH (SWORN)**

Q. Mr Smith your full name is Rhys Colin Smith and you're a structural engineer living here in Christchurch?

5 A. Correct.

Q. You have a copy of your brief of evidence with you?

A. Yes.

Q. I'll ask you to read that in a moment and Commissioners, as with the previous witnesses refer occasionally to the odd exhibit although with the photos was intending to go through those in some detail because he took them and they're different photos to what we've seen. I'll be guided by you if we're going into too much detail. Paragraph 2, if you could read from there please Mr Smith?

10

A. Okay.

15 **WITNESS READS BRIEF OF EVIDENCE**

A. "Upon completing my school studies I took up a position at O'Loughlin Taylor Spence Limited the company and also studied architectural drafting at Christchurch Polytechnic. I obtained my New Zealand certificate in architectural drafting in 1990. In 1992 I moved to the UK and continued to work in drafting for structural engineering companies in London. I completed my honours degree in civil engineering at the University College London in June 2000. I took up employment as a structural engineer with WS Peer Group a large multi-disciplinary international company, engineering firm, from 2000 until August 2009 when I returned for family reasons to New Zealand. I rejoined the company at that time.

20

25

Q. If you just pause there Mr Smith because it doesn't actually arise in the sequence of your evidence, that point that we've just been discussing with the Commission because the design that we were concerned with was during the time that Mr O'Loughlin had done the strengthening design with Armitage Williams but whilst you're in the box the specifications for, or the technical data is available from Ramset I think it was in relation to the detail that we were discussing?

30

A. Yes for all propriety fixings we hold technical data catalogues so for Hilti or Ramset or the likes and those documents have load capacity tables within them. Those two sheets that were reproduced from Ramset there didn't include those load capacity tables but those tables are what we use for the, for determining the strength of the, sorry, we, we usually have a, a load that we require to resist and we choose a fixing that will resist that load from those tables.

Q. So when you specify a 12 is it D, 12 –

A. Diameter 12.

10 Q. Yeah, and an 18 diameter hole and so on you've made reference to those specifications?

A. Correct.

Q. And you just provide that to the subcontractor and they are expected to act on that without further reference to the data?

15 A. We wouldn't provide those tables to the contractor. They would be expected to follow the other sheets which are in the documentation which are about the methods of installation for those fixings.

Q. And that technical data from Ramset. You have access to that still?

A. Yes.

20 1225

Q. And you can make that available to me to make available to counsel assisting the Commission?

A. Yes.

Q. If you could just pick up again please from paragraph 4 Mr Smith?

25 **WITNESS CONTINUES READING BRIEF**

A. 4TH of September earthquake.

At the time of the first earthquake I was on holiday in UK. I was returning to New Zealand on the Monday morning following the earthquake in any event. I literally hit the ground running with numerous instructions to inspect client buildings at the request of the building's insurers or building owners. There was a huge amount of work confronting the company. At the time the premises from which we operated were damaged and we were unable to gain access to the

30

building. There was no predetermined formal process that we were working to. Our instructions were invariably the same. Please check the building to see what damage it had suffered and advise whether it was safe for the occupiers to return to it. We approached it on that basis.

5

194 Hereford Street Joe's Garage the building

The first inspection on the 10th of September, 2010. By email dated 9th September 2010 Alistair Miles of Miles Construction Limited, a tenant on the first floor of the building and builder for the owner made contact with me. He is also a close personal friend. The email is produced as RCS1. He had earlier telephoned me with the instructions. I was aware from a brief discussion with John O'Loughlin that the company had completed some earthquake strengthening for the building some years earlier. Alistair confirmed that in his email.

10

I inspected the building on 10th of September, 2010 for earthquake damage. I recorded my findings on a standard company site instruction sheet which is produced as RCS2, two pages. I refer later in my evidence to the formal report I prepared and sent to the owners of the building Joe's Garage, Hereford Street Limited or Joe's Garage dated 18 January 2011. In that report I described the construction of the building as I determined it and I refer to that report. I also described the strengthening which has been done as at 18 January 2011 which I again refer to. As noted above I did not have access to our premises at the time of the inspection so I was unable to refer to the plans that we would have had in the company files. By the time I completed a report on the 18th of January, 2011 I had regained access to the files and therefore the plans.

15

20

25

30

My record of 10th of December, 2010 details the damage I observed. I also took photos of the damage which are produced in RCS3. I have numbered the photos 1 to 11 and detailed what I identified in each photo.

Q. If you could just bring up RCS3. Sorry I don't know the reference number.

JUSTICE COOPER:

It's WITSMI0002.16.

5 EXAMINATION CONTINUES: MR RAYMOND

Q. We'll move through these reasonably quickly and the Commissioners or counsel assisting may refer back to these photos later Mr Smith and I may talk you through some of them but photograph 1 we've already seen as the front or north elevation of the building which we already know is constructed from unreinforced brick masonry and had likely reinforced concrete bond beams that ran the full width over each level of windows, correct?

A. Correct.

Q. And photograph 2 is a close up of the upper left corner of the wall of the north elevation and we can see a crack there. What was the significance of that? Why did you photograph that?

A. You can see the crack runs from the, there's an outlet for the rainwater goes into the down pipe, the crack appears to run diagonally from there up towards the right and up through the parapet and that raised a concern about the stability of the parapet.

Q. Okay and at the very top left some of the plaster has come away from the parapet where it joins the new Calendar Girls building. Was that of any significance?

A. No I suspect that was probably knocked off from some pounding damage from when the building would have been swaying and hit the Calendar Girls building.

JUSTICE COOPER:

Q. Is the first crack that you described on the parapet itself? I just couldn't really follow from your description of it because you talked about the water intake there. The parapet is some distance above that and it too appears to have a crack in it.

- A. Should I point it out to you sir.
- Q. Well there's a mouse there somewhere.
- A. So the crack starts from here.
- Q. Yes.
- 5 A. Runs up here, it runs through the piece there, tends to go across the bottom of that ornate part, up through the ornate and then goes –
- Q. I see it now.
- A. And then goes up through the parapet.
- Q. Well it's much clearer on the screen than it is in the hard copy.
- 10 A. Yes a lot of the cracks are hairline cracks and they are difficult to see and often in the office I would rely on zooming into the photos to be able to interrogate them.

EXAMINATION CONTINUES: MR RAYMOND

- Q. Photograph 3 is a general view of the south wall is that right?
- 15 A. Correct.
- Q. And photograph 4 if you could describe the crack that you observed there please and again use your mouse to highlight that?
- A. So here there's a crack runs up to the right here vertically. There's a crack runs horizontally along these fixings. It only seems to run for
- 20 about three or four of the fixings and then there is some cracks running up to through the parapet and a small crack across here as well indicating that the top of this parapet seems to have been flexing a bit.
- Q. Just before we leave that page photograph 3 I skipped over that and it's probably the best photo of that area at the right of the photo. I'm not
- 25 quite sure how you'd describe that which, it features later on in your evidence.
- A. The description of this area?
- Q. Yes behind the barbed wire.
- A. Sir this is effectively a light well or a service area in the back of the
- 30 building so there's this wall here stands on its own and there is a crack between that wall and the building and that crack had evidence of being

pre-existing i.e. it existed before the earthquake because you could see, I could see where it had been plastered up.

JUSTICE COOPER:

5 Q. What elevation is this?

A. This is the south.

EXAMINATION CONTINUES: MR RAYMOND

Q. So Hereford Street is on the left of that photo?

A. Sorry Liverpool Street's is on the left.

10 Q. Liverpool Street. And on the right you can see the back of the Calendar Girls new building, the concrete panels?

A. Yes and you can see where the damaged wall had been reconstructed after Calendar Girls construction.

15 Q. And that's obviously a flue coming up from Joe's Garage kitchen, from the service yard?

A. Yes.

Q. And also in that area there was a self contained cool store?

A. Yes, pretty much almost filled a large part of the area with just a cool store in there.

20 Q. And we'll see later on the video clip that we'll play but you might want to refer back to photo 3 because as I think your evidence will be that you observed the back wall in the top right hand corner of that south façade as being the initiation point where the bricks peeled away?

A. Correct.

25 Q. Photograph 5 is again a close up of the right upper area of the rear wall showing hairline cracks in the wall and again the photo on the screen might be better if you could point out please with the mouse?

30 A. Sir, the previous photo I was pointing to kind of caught this area here and this was just catching this crack along here and that one going down there. It was pretty much all in that area but I was taking photos of the whole wall so I could monitor the cracks.

Q. Photograph 6. Again that's a close up of the upper return wall over the service yard and further hairline cracks in that wall?

A. Yes you can see a crack just down from the window here and there's a crack up the top above the window. Some of this looks like it's been plastered up before, some of these cracks.

5

Q. And photograph 7 is a close-up of the upper south east corner again showing hairline cracks in the wall. So this is again taken from Liverpool Street looking at the south wall where it joins the west wall?

A. You see there's a crack generating from the ornate corbel. It goes across there and there's a vertical crack down here.

10

Q. And photograph 8 is a close-up of the junction of the lower wall with the main rear wall showing the vertical crack, correct?

A. Correct.

15 1235

Q. And have you got any observation as to whether that crack was pre-existing?

A. There was evidence that it had been re-plastered over before.

Q. Photograph 9, would you describe that please?

20

A. This is taken from within that service yard, the lightwell, showing where the end of that back wall had been reconstructed by the builders of Calendar Girls.

Q. So the wall that is reconstructed is at the end of that metal flashing –

A. Yes –

25

Q. – where the plaster has peeled away?

A. – this part with the new plaster on it. It wasn't of any significance at the time, I was just taking photos as a record and interested to, when I went back to the office asked John about that piece of wall so he wasn't aware of it being reconstructed at the time.

30

Q. And that flashing is a weatherproofing detail? It's of no structural moment?

A. No.

Q. Photograph 10 shows where the builders of number 186 have fitted a flashing over the gap between the buildings?

A. Yes.

Q. Correct?

5 A. Yes.

Q. Again it's of no structural moment but some interest to you?

A. No structural significance but it's a demonstration of what happens on a lot of buildings in earthquake areas where people don't take cognisance of the fact that the buildings move differently. The flashings between them should allow for that. That flashing allowed for no movement between buildings in the case of an earthquake.

10

Q. Finally, photograph 11 in this sequence shows a vertical crack in the wall over the west side of the service yard which is pretty clear, even in the hard copy?

15 A. Yes.

Q. Moving on to paragraph 13 please Mr Smith?

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 13

A. "There was an issue in relation to the building which in my view required immediate attention which was the stability of the front left of the north parapet. The second page to RCS2 is the design detailing I completed for Miles Construction to carry out. I note section xx in the drawings 10th September 2010..."

20

Q. Can you just pause there. We will pull up RCS2 please on page 2 of that exhibit.

25

A. So you see on the middle left of the drawing section xx in the drawing. The drawing is accurate with the exception that the ceiling was actually level with the top of the bond beam. The bond beam is what you see has had the decorative corbel shown on that section. Also the roof plan is drawn as a hipped, or a hip roof whereas in fact it was a monoslope roof. I did not climb up into the roof at the time. As above I thought that the danger from the building related to the north parapet. Once that was tied back as detailed I regarded the building as being satisfactory to

30

occupy. That is recorded on my work sheet. There were no other serious signs of structural damage and it was apparent that the earlier earthquake strengthening work which had been carried out and as described in the brief of Mr O'Loughlin which I have read was successful.

5

Q. If that could be put back. The detailing we see in section xx obviously shows the connection between the parapet and the roof with the qualification that you've made. You later observed that work and satisfied that it was done in accordance with that detailing?

10

A. Yes. The plates in the detail in the right-hand side we put some plates to bolt through to to capture the brickwork and those plates are evident on the photos you'll see later of that parapet.

Q. And in terms of whether that is standard detailing or something that you'd drawn from some other source or your own engineering analysis, what can you say on that? What did you draw upon for that detail?

15

A. Similar standard, well there was a standard detail shown on the original strengthening drawings which effectively showed a fixing anchored into the back of the parapets. I wanted something a bit more positive to grab hold of the whole parapet which is why I decided to bolt right through with and put plates on the outside to, just to make sure we had hold of that parapet.

20

JUSTICE COOPER:

Q. I am not sure if I follow. It may be obvious to others, how the connection was made to the roof if the roof was flat?

25

A. Yes, so in the photos later you will see that the, that section on the left in fact the roof is horizontal at that point and so the strut came down diagonally and then fixed into the top of the roof.

Q. I see.

EXAMINATION CONTINUES: MR RAYMOND

30

Q. If we could just flick back to RCS2 please which is your site instruction sheet which accompanied those drawings. In the third to last bullet point you refer to tying back the front parapet with RHS angle brackets as

detailed and then the second to last bullet point your view that it was satisfactory to occupy after those above make safe measures were carried out?

A. Correct.

5 Q. We might come back to this or it might be a question Mr Elliott might ask you but with the benefit of hindsight, looking back now at that detailing and that comment that it was safe to occupy with those measures in place, are you still of the view that that was correct conclusion at the time based on the information you then had?

10 A. At that time, yes. In hindsight I would probably have approached it differently when we learn further about the structure of the building.

Q. So what alternatives were there at that stage had you not detailed this tie-back mechanism? Is it a complete removal of the parapet and reconstruction with a lighter material or what?

15 A. Yes, and that is what I proposed in my later report.

Q. As a long term solution?

A. Yes.

Q. Thank you, we will come to that. I think we had finished reading paragraph 15.

20 A. 16.

Q. 16 please.

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM AT PARAGRAPH 16

25 A. "My second inspection on the 14th of September 2010. On 14 September 2010 I carried out a follow-up inspection to check that the works which I had requested following the first inspection had been carried out. I produce as RCS4, my site instruction dated 14 September 2010 in relation to the building. I went onto the roof to check the north parapet restraints and was satisfied that they had been installed
30 correctly and were satisfactory. While I was on the roof I checked the other parapets where visible. I noted some loose bricks at the top rear of the south parapet. They were not of concern to me, that is because the loose bricks, if they were to fall anywhere, would have only fallen a short

distance on to the roof adjacent so they were on the inside leaf. The third bullet point records “monitor cracks to south wall, east façade needs better connection to south wall”. I did not consider that the cracking in the outside wall brickwork was of significant concern because it is a double skinned brick and I checked the interior surface of that wall and there was no cracking. I was satisfied that the strengthening work which had been carried out was sufficient to maintain the structural integrity of the wall. As recorded in the site instruction record of 14 September 2010 I regarded the building as satisfactory to occupy. The final bullet point notes that if there was an aftershock of magnitude greater than 5 then the building should be evacuated and further engineering inspection carried out to ensure the building remains safe. This was a standard notation which we had agreed as a company and we would include in our reports to ensure that there were ongoing inspections in the event of significant aftershock.

JUSTICE COOPER:

Q. There are various ways of reporting earthquake magnitudes. What did you mean by referring to a magnitude of 5? What scale are you using?

A. The general, we were getting information from GNS about magnitudes of the earthquakes so we were basing it on the publicly-available information.

Q. So was that a Richter scale or –

A. Yes, a Richter scale.

Q. – modified Richter scale?

A. Yes.

Q. Modified Richter?

A. Yes.

EXAMINATION CONTINUES: MR RAYMOND

Q. Your third inspection on 27 September?

A. I re-inspected the south wall of the building on 27 September 2010 and took further photograph which I produced as RCS5. I have labelled those photos 1 to 7 and describe what is in each photo further below.

1245

Q. Just pause while they come up please, RCS5. So photographs 1 and 2 on that page show the front parapet and the plates of the temporary restraints that you had instructed be installed?

5

A. Correct.

Q. Okay, if you go to photograph 3. It's a view, again, of the south end of the Liverpool Street frontage and there was no damage evident on that side?

10

A. Correct.

Q. And photographs 4 and 5. Firstly 4 is a close-up of the upper left side of the rear wall recording the extent of the cracks?

A. Yes.

Q. And is there anything of concern on that –

15

A. There is no noticeable difference in those cracks from the first photos. I was taking these photos as a monitoring process.

Q. The same with photograph 5?

A. Yes.

20

Q. And photograph 6 is a close-up of the upper side of the rear wall recording the extent of the cracks and a horizontal crack ran along the line of the strengthening bolts and there were some cracks higher up in the parapet. Is that right?

A. Yes.

25

Q. And finally in photograph 7 a close-up of the junction which I think we saw before of the lower wall with the main rear wall showing a vertical crack?

A. Yes and it appeared to have, I thought it had increased slightly.

Q. So if you just pick up from paragraph 21 please.

WITNESS CONTINUES READING BRIEF OF EVIDENCE

30

A. "The reason I had returned to inspect the building on 27 September is that I had been contacted by Alastair Miles who had noticed the new crack in the north parapet which had formed as a consequence of further aftershocks between the restraints and which had been, which

had been installed as illustrated in photograph 1. On the 6th of October I received a telephone call from Alastair Miles. He was concerned about the movement at the join between the east wall and the bond beam of the north wall. I asked Alastair to take a photo of the area and send it to me. RCS6 is his covering email and attached photos of the area of concern to him.”

5

Q. Okay we'll just briefly refer to RCS6 itself as the covering email but the photos attached to that email will come up in a moment and they are the two photos taken by Alastair Miles.

10 A. The photos are on the next page.

Q. RCS6 in – the next page, not there, okay. Are they in the hard copies of the briefs? No, okay. For some reason they don't appear to be there but RCS6 – and I'll make these available – attached to it some photographs taken by Mr Miles from, I think inside his office where the east wall and the bond beam join. Is that right?

15

A. Correct.

Q. And there had been some separation right in the corner. A large crack had developed.

A. Yep.

20 Q. And that was the reason for your fourth inspection on the 14th of October?

A. Correct.

Q. If you could just continue on please from paragraph 23.

**WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM
25 PARAGRAPH 23**

25

A. “I re-inspected the building on Thursday, 14th October 2010. RCS7 is my email to Alastair Miles of 15 October 2010 referring to the 14 October inspection and attaching a structural inspection report of two pages. This was as a consequence of the observation Mr Miles had noted of a new crack in the north parapet following aftershocks. The site instruction on page 1 under Observations and Comment notes that the front parapet had moved in between previously installed restraints. The structural solution noted was to extend the restraints to join them

30

together and add a diagonal brace and an additional tie-back as detailed. This was intended as a temporary solution to the front parapet issue. I was satisfied that it would provide the necessary strength as an interim solution. However, my intention was to consider a permanent solution which would not have been so obvious from the front to retain the character of the building or to consider rebuilding the parapet. The site instruction also records that further work was required in relation to the front bond beam and wall which was still moving out with the aftershocks.”

5

10 Q. Just pause there and if we could bring up please RCS7 – is the covering email and the second page is your structural inspection report, page 1 of 2 dated 14 October. This is the instruction you’ve just referred to, correct?

A. Yes.

15 Q. So the detailing under the first bullet point is for the front parapet, further strengthening?

A. Yeah.

Q. And the second bullet point relates to the front bond beam, still moving out with aftershocks and further restraints being required?

20 A. Correct.

Q. We’ll just pause there in case there’s any questions from the Commissioners on that detailing. So on the second page further detailing. You refer to the rear parapet being unstable. Perhaps, I think you refer to this at paragraph 25. It may be easier if you just read from there.

25

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 25

A. “So at page 2 of 2 of the report I provided a detail in relation to the rear parapet which was potentially unstable above the existing restraint line. The solution was to fit a flat strap at an angle just below the capping and to bolt through. I noted that the contractor was to provide an access first in order to investigate the roof framing to check if it was feasible to tie back into. It was also recorded that I was to meet with the city council to

30

get a steer on the extent of strengthening required for the back wall. On the same day I sent a further email to Alastair Miles, RCS8, as I realised the earlier site instruction did not cover the bond beam at the front pulling out at the east end. The email indicates that by that date we had access to the original strengthening drawings. As noted the drawings indicated that brackets should have been fixed from the roof level framing into the back of the walls to restrain them. At that stage I had not been into the roof space but I concluded given the damage that either the brackets were not fitted on the north façade or if they were they had been ineffective. I noted that the steel frames that I had discussed with Alastair Miles would be a permanent solution. However, in the short term to stop movement to the beam a bracket would be required as detailed in the sketch dated 15 October 2010 which accompanied the email.”

15 Q. Does the Commission wish to refer to that detail?

JUSTICE COOPER:

Yes.

20 **MR RAYMOND:**

RCS8. If that could be brought up please – and the second page please. Thank you.

EXAMINATION CONTINUES: MR RAYMOND

Q. If you could just talk to that detail please Mr Smith.

25 A. So above part of the sketch is a plan. You're looking down on the bond beam along the north elevation. The movement was very minor between the bond beam and the side wall so my intention was just to try and arrest that movement in the aftershocks and the detail below is just a section through the beam showing that, that angle bracket fixing into the return wall.

30

Q. Turning then to your fifth inspection on the 29th of October. You inspected the building again. Paragraph 28 please.

**WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM
PARAGRAPH 28**

5 A. "I had been advised that the roof space had been opened up so that I could have a look. This enabled inspection inside the roof adjacent to the south wall. I took a series of photos which I produce as RCS9 and I refer to each photo numbered 1 to 10 below."

Q. Just pause please. Thank you. So photograph 1 is a view of the south-east corner of roof where the roofing had been removed. Correct?

A. Yes, correct.

10 Q. And photograph 2 likewise but at the south-west corner. Correct?

A. Yes.

Q. Photograph 3, 4 and 5 is the next sequence. So if you could please talk to photographs 3, 4 and 5.

15 A. So this is referring to the PFC bit which was discussed in Mr O'Loughlin's evidence. The top left photo shows the PFC running alongside the inside of the parapet with, supporting the purlins and the purlins are shown in the cleat as not being fixed to that channel. So in the distance is the west parapet.

1255

20 Q. So photograph 4 the parapet that that connects to I understood to be the south parapet is that right?

A. Correct.

25 Q. And any observations on photograph 4 just appears to be some of the lime mortar which has fallen out of the brick. That wouldn't have been a surprise?

A. That was indicating the, how the mortar was being ground apart and parts were falling out and the bricks were starting to degrade.

30 Q. And photograph 5 is a close-up showing some cracked bricks on the inside leaf of the parapet and again the lime-based mortar having fallen out?

A. Correct.

Q. And clearly a significant crack in that brick. What was the long-term solution that you were proposing in relation to that wall?

A. Ah, long-term solution was, my preference was to completely remove the wall.

Q. Photograph 6 a view inside the south-west corner of the parapet. I just have to have you acknowledge that Mr Smith for the record?

5 A. Yes. Yes it is.

Q. And photograph 7 is a view showing the end connection of the PFC restraining the west parapet?

A. Yes. As brought up on a detail in Mr O'Loughlin's brief.

10 Q. And photograph 8 is a close up of a typical fixing of the PFC restraint into the parapet brickwork?

A. Correct.

Q. Photograph 9 a general view of the roof space looking north-west at the back of the west parapet?

A. Correct.

15 Q. And photograph 10 a view of the temporary restraints installed at the rear of the north parapet His Honour was referring to before how they would be connected to the roof. Is that the photograph you were referring to which might assist with that?

A. Yes.

20 Q. Just before we move off those photographs. Photograph 4 is the one we've seen a few times now with bolts missing from the PFC into the purlin. What's your view on the significance of that on the overall performance of the south parapet in the 22 February event?

25 A. Um, the same as what, as Mr O'Loughlin described. When you see the CCTV footage you'll see that not only does this parapet fall off but so does the west parapet so, and in the west parapet which was anchored correctly you will see the, the bricks are left attached to the anchors and I expect the same would have happened on this parapet. Had that channel been bolted to the purlins it would have been left up there and
30 that parapet still would have disappeared.

Q. Yes thank you if you can please continue reading from paragraph 29.

WITNESS CONTINUES READING BRIEF

A. "RCS10 is an email from Alistair Miles to David Ralfe the loss adjuster for McLarens Young International confirming that the earthquake making safe measures which I had detailed had been completed.

5 A. Now the sixth inspection on the 28th of December 2010. Following the Boxing Day earthquake I re-inspected the building for any additional damage. I took another series of photographs on that day which I produce as RCS11. There are 14 photos which I describe as follows".

WITNESS REFERS TO PHOTOGRAPHS

10 Q. Photographs 1 and 2 are close-ups of the, at an angle toward the east end of the north parapet?

A. Yes. It show, it demonstrates a slightly, slight increase in the degradation in some of the plaster coming off probably from pounding against the Calendar Girls.

15 Q. And photograph 3 is that same north elevation showing the temporary restrains for the parapet?

A. Yes there was no –

Q. Any further significant damage?

A. No. They were, they were doing the job that they had intended.

20 Q. And photograph 4 is a close-up of the right side of the front bond beam showing minor cracking?

A. Yes there is cracking just above and below the bond beam in that corner column.

Q. If you just point that out please with your mouse?

A. You see a line there and a line here with this being the bond beam here.

25 Q. So that was new cracking?

A. Yes.

Q. And why or was that of concern to you?

30 A. Um, I was recording it to monitor it but as the movement was very minor it was cracking through the plaster it didn't, I wasn't too concerned about that at the time.

Q. Photograph 5 shows some further minor cracks in the brickwork panel to the right of the front door?

A. Yes.

- Q. And 6 a vertical crack in the end of the wall below the window to the left of the front door? Is that right?
- A. Ah, yes, yes.
- Q. Photograph 6 is that –
- 5 A. Yes sorry it's just come up yes.
- Q. Photograph 6 is that the Christchurch City Council inspection notice from the September event or Boxing Day?
- A. Yes. Green placard yes.
- Q. And those further cracks then in photographs 5 and 6 what, you've
- 10 taken photos of them. They're of some moment to you. Were they of concern?
- A. They were indicating that there is some significant sway action happening on that north elevation, so the building, that north elevation that's swaying was starting to damage the lower part of the elevations
- 15 indicating that further strengthening would be required to restrain that north façade to stop it swaying so much.
- Q. Photograph 7, shows where the bottom left corner of the right front window frame had moved inward by about 15 millimetres?
- A. Yes I think that's a consequence of the, of the swaying of that façade.
- 20 Q. Could you just highlight where that is that 15 millimetres you were referring to?
- A. Just in there in that bottom corner, left corner of the window it's pushed in.
- Q. Okay. And photograph 8 what's that of?
- 25 A. It's showing a crack in the unreinforced masonry column adjacent to the Calendar Girls half way up the first floor.
- Q. And 9?
- A. Sorry just waiting for 9, ah, it's a close-up of the column in the north façade at windowsill level ground floor.
- 30 Q. And probably we can do 10, 11, 12 all in one hit, as again the south wall showing hairline cracks?

A. Yes so you can see the restraint strap that had been put along the top there and then just a minor increase of the cracking on most parts of the wall.

5 Q. So that restraint that's been, that you can see across the top. I think that's the first photo we've seen of that remedial solution that you'd imposed earlier?

A. Yes.

Q. So you were satisfied that that was doing its job at that time? Post Boxing Day?

10 A. Yes.

Q. And photograph 13 is a view of the back of the front upper bond beam showing minor movement between the beam and the ceiling?

A. Correct.

Q. I can't see it on the photo perhaps you could highlight?

15 A. There is just a small probably three millimetre movement indicated there. The gap between basically the paint line and the beam.

Q. Okay and finally photograph 14 shows a crack in the back of the front upper bond beam?

20 A. Yes and I'm not too sure if that was pre-existing or as a result of the earthquake shaking.

Q. Okay. If you could just read from paragraph 31 please.

WITNESS CONTINUES READING BRIEF

25 A. "RCS 12 is an email exchanged between Joe's Garage and myself in relation to the Boxing Day earthquake. My email of 6 January 2011 notes the main points to be aware of following the further damage.

JUSTICE COOPER ADDRESSES COUNSEL – TIMETABLING

COMMISSION ADJOURNS: 1.04 PM

30

COMMISSION RESUMES: 2.46 PM

EXAMINATION CONTINUES: MR RAYMOND

Q. Mr Smith if we could just continue please reading from paragraph 32,
18 January report to Joe's Garage.

5 **WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM
PARAGRAPH 32**

A. "RCS13 is the covering email to Joe's Garage attaching the company
report dated 18 January 2011. As noted in Mr O'Loughlin's brief the
report details the construction of the building and summarises the
10 existing strengthening to which I refer. I summarise the earthquake
damage to the building on page 2."

Q. Can you just pause there please. If we could look at RCS13.

MR RAYMOND:

15 Sir there's a paragraph there in that report dated 18 January about the
construction. I don't know whether you want that read into the record. It
seems to be reasonably non-controversial but –

JUSTICE COOPER:

20 No that's all right. Thank you.

MR RAYMOND:

And the existing strengthening is also set out there Sir. It can maybe be taken
as read given the evidence of Mr O'Loughlin?

25

JUSTICE COOPER:

Yes.

EXAMINATION CONTINUES: MR RAYMOND

Q. So if you could just pick up at paragraph 33 please Mr Smith.

30 **WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM
PARAGRAPH 33**

A. “In the discussion section I note the previous strengthening work and deal with three options for addressing the damage. Option A related to repairing the cracks using the Helifix bars or something similar to return the walls to the pre-earthquake condition and to strengthen or rebuild the parapets in lightweight construction. As noted on page 3 of the report I had preliminary discussions with the city council as I thought it would be the case they would not accept that option for a building already strengthened to 33 percent NBS. That is because in the damaged state the URM walls strength is less than 33% NBS and I agreed with this. The second option noted was to repair and strength the walls to 67% NBS or as close as reasonably practicable to that and to rebuild the parapets in lightweight construction. The third option was the same for the façades but to rebuild the south and cool room area walls in reinforced concrete block. My view was that option B would be the best way to minimise disruption to the tenants whilst at the same time reducing the likelihood of similar damage in a future earthquake. I noted that the option would not guarantee that damage would not occur and that Joe’s Garage’s insurer would need to be in agreement with the approach as opposed to a more comprehensive option C. Attached to the report are drawings of the building where I have noted the cracks and damage I observed.

By email dated 20th of January 2011 to Joe’s Garage Steve Ward of that company asked me to proceed with option B including sketches for pricing and city council approval. This is RCS14. I had a further email exchange with Alastair Miles on 20th January 2011. This is RCS15. Alastair said that he had noticed further cracks to the Hereford Street and Liverpool Street corner where the column meets the ring beam. The email attached photos which are also produced. Having reviewed the photos I concluded that there appeared to be some shear movement between the concrete and the brick. My view was that it was not a real concern but would be addressed in the proposed remedial strengthening which was then underway. Before the option B remedial

strengthening work could be implemented the 22nd of February event happened.

5 I note that completely independently of the company and without any consultation with us the city council carried out their own inspection of the building after the 4th of September earthquake. The building was green stickered. I do not know what processes they were following at the time to arrive at that conclusion but in any event it accorded with my own view that after the September event because of the strengthening work which had been carried out in 2005/2006 and the further interim
10 measures I implemented that the building was safe to occupy.

22nd of February 2011 Earthquake. The damage to the building is graphically shown on the CCTV footage taken from the opposite side of the building in Liverpool Street. I have provided a link to the YouTube which shows the damage to the building at the time of the earthquake.
15 The sequence of damage to the building is self-evident from the video footage, however my observations are that the footage shows the massive forces the building was subjected to. Secondly, the south wall collapsed from the top eastern end and peeled away. The whole west parapet, despite the strengthening, collapsed.”

20 Q. If you just pause there.

MR RAYMOND:

Commissions after discussions with Mr Zarifeh we thought this might be the appropriate point to play that.

25

JUSTICE COOPER:

Yes.

MR RAYMOND:

30 Just before we do – it's in two stages Sir. I'm not sure whether you've seen it but the first sequence is as we see on the screen at the moment and then there's a further sequence taken from another angle.

JUSTICE COOPER:

So we're looking north are we, north, north – north-east?

MR RAYMOND:

5 We're standing on Liverpool Street so I guess looking north-east. So that's the south wall that we can see with graffiti at the bottom and a garage door with the bins in front of it and –

JUSTICE COOPER:

10 I don't know anything about this footage Mr Raymond so what were the circumstances. This was on Television One was it?

MR RAYMOND:

15 That's where it ended up but it was the CCTV footage taken from a building across the road which just happens to have its fixed camera on that angle as I understand it.

JUSTICE COOPER:

20 Is this some sort of security camera is it?

MR RAYMOND:

Yes and it's just fortunate that it recorded the event, and the second, I think, have we got the ability to pause it as we go through [confirmed] and the second clip is taken from an entirely different camera. You don't see the building so clearly but you do see the west parapet collapse onto the footpath and you actually see, ironically, a man stepping into the entranceway which you can see half way along that western façade. There's a doorway there and a passerby goes into that doorway to seek refuge from the falling parapet. It then collapses and he steps out over it and continues on his way which tends to illustrate that the building itself was structurally sound. It was the parapet which caused the damage, in this instance fatality and also the, this video image shows graphically again the violent movement of the building from the west to the east in the first sort of second and then the bricks start peeling

25
30

away from the upper right-hand corner and then it jerks violently back to the west and it's that flick which causes the western façade to fall onto the footpath. We might have to play it a couple of times to see that but if, if we can pause and stop as we go. Mr Smith will explain what he's seeing.

5

JUSTICE COOPER:

Right.

MR RAYMOND:

10 It takes a wee while to get underway.

CCTV FOOTAGE PLAYED

MR SMITH:

15 Just after the truck goes past you'll see it start to shake and then you watch the top right corner of the building.

JUSTICE COOPER:

Good Grief.

20 **EXAMINATION CONTINUES: MR RAYMOND**

Q. If you just pause there please whilst the dust literally settles. Mr Smith's correct that the, for the record the, and we've just played the CCTV footage, for the record, the south wall has come away.

A. Yes it has.

25 Q. And from your observation did that commence at the top right-hand corner or the south-eastern top edge of the building?

A. I've looked at this several times and it appears that in combination with peeling from the top right-hand side the wall also appears to fail what we call out-of-plane. It goes inwards at the middle of the first floor there.

30 So it also contributes to that end falling, that parapet falling.

Q. And at the top we can see the western façade has, has pulled away from the building?

A. Correct, that's just peeled off.

1356

5 Q. You can see there Commissioners if you do not mind me talking into the record, the building tilting towards the east and if we play it another split second then stop it again it violently pulls back to the west and it's that flick, I think it's that flick or movement which causes the façade to stop, and then it's the south wall has peeled away and the beginning of the collapse of the western façade and it's some speculation as to when
10 northern façade then peeled away. Are you able to comment on that Mr Smith?

A. Yeah when you see through the sequence here and we see the south goes first, there is the guy who is standing in this doorway here, then that parapet there drops. After that drops you will then see the dust
15 happen at the north end as that drops.

Q. Just play it again and stop it immediately. We'll see the man step out of the rubble in a moment and walk on. This is the second CTV footage taken from across the road so just where that truck is passing behind that is Joe's Garage and it starts –
20

JUSTICE COOPER:

Liverpool Street again is it? Are we still in Liverpool Street?

MR RAYMOND:

25 We are in Liverpool Street, taken directly across the road almost so where the man's legs are at the far left is the corner and the earthquake segment starts you will see the Range Rover bouncing up and down. Just pause there. I don't know whether you noticed but the man that was walking along the footpath just, as soon as the shaking started went into that doorway. If you just go back
30 a second. See the man's legs at the top and you will see him walk into the western entrance. Just play it again please. Starts shaking and he walks in there now and stands there, a moment later the façade crashes down, lucky escape for the runner, and you see the same man walk out of the entrance in

a moment, steps over that rubble and on his way. Here he comes. Apparently he was going to a meeting at the IRD which didn't go ahead. That's actually all there is really of that sequence. Would the Commission like to see the whole lot again or...?

5

JUSTICE COOPER:

Yes, I would.

MR RAYMOND:

10 Perhaps if it can be taken right back to the beginning, we will watch the whole thing through, thank you.

VIDEO CLIP IS RE-PLAYED TO THE Commission

15 **MR RAYMOND:**

Commissioners you may have noticed that further people came out of Joe's Garage from that middle entrance. I think including a pram, and I am not sure whether there is any evidence as to the number of people that were inside Joe's Garage at the time of the event who got out.

20

JUSTICE COOPER:

Not that I am aware of.

MR RAYMOND:

25 I did notice just in that sequence three or four people coming out that same door.

EXAMINATION CONTINUES: MR RAYMOND

Q. Mr Smith, if we could just continue please with the heading "Friday 25 February" please?

30

1406

WITNESS CONTINUES READING BRIEF

A. Friday 25th of February, 2011 John Spence and I were tasked to carry out emergency inspections after 22nd of February event. We were instructed in the first instance to inspect our client's buildings. This was under the authority of Civil Defence. RS16 is a bundle of photos of the damaged building. As I recall the first photo is the only one I took on that occasion. I believe the remainder of the photos were taken on a subsequent day. This is because in the first photo two thirds of the bond beams lying intact in the foreground photo whereas in photo 4 it has been broken into two and a red sticker is on the front entrance window.

Q. The photos have just come up Mr Smith on the screen. Photograph 1 you can see the bond beam lying across the front of Joe's Garage and then if we flick to photograph 4 that is then broken in two.

15 **JUSTICE COOPER:**

Q. Does that suggest a USAR inspection in the meantime?

A. Yes.

Q. When was the, you only took the first photograph did you say?

A. Yes on the 25th.

20 Q. On the 25th?

A. Yes.

EXAMINATION CONTINUES: MR RAYMOND

Q. The top if we can zoom in on those two T shaped steel structure at the top here. That is the back of the temporary restraint for the north facade?

A. Yes.

Q. So the T features that we can see would have been attached to the roof?

A. Correct.

30 Q. And then the red PFC, the parallel what's it called?

A. PFC channel that's down on the ground or is hanging sorry it's hanging on the right hand side.

Q. The red rusty coloured one that's hanging down?

JUSTICE COOPER:

Not in that enlargement. Can we see the beginning of it perhaps?

5 EXAMINATION CONTINUES: MR RAYMOND

Q. And that was the PFC which sat behind the north façade and was affixed to the brick work?

A. You see now there's almost no bricks left, attached to it.

10 Q. That was a question that wasn't a statement from me, is that right Mr Smith? The PFC was attached behind the brick work of the north facing facade?

A. The earlier photo that showed the lack of bolts on the south façade is obviously evident here. If the bolts were there the channel would have been still attached to the purlins in the north façade as well.

15 Q. So as you noted in the brief these photos are reasonably self evident but very quickly if you could just go through photographs 2 onwards and describe the elevation that we're looking at?

20 A. So photograph 2 shows the western façade and you see where the brick parapet has come off and there's still bricks left in the channel restraint and on the top. Not all of them. Some of them seem to have come off the fixings as well but the majority of the façade has remained intact. Notably the columns behind where the steel portal frames are so the first column in and then the next three are all where the brace is, the frames were. The last column on the right is the greatest.

25 Q. Could you just indicate those please with your pencil?

A. So in behind here is where the steel portal frame is same with this column, this column and this column.

Q. And you see that protruding at the top behind the open façade?

A. Sorry say that again.

30 Q. Can you see those columns continuing up behind the façade?

A. Yes you can just make it out there. You see the grey line there of the edge of the column through that window.

- Q. And photograph 3 obviously from the south-west side of the building.
- A. Yes you see where the, so this was cavity wall construction so we've got the inner leaf there and this outer leaf has peeled off and so that channel there has disappeared from the top. The wall was also fixed in
5 along what we called the second floor. This is for the future penthouse so you can see where the bricks are still attached to fixings there and it would also have been affixed along here, the first floor.
- Q. We've already looked at photograph 4. Photographs 5 and 6, that's the upper east wall in the north bay which was supported by the bonding?
- 10 A. So the east wall has failed out of plane what we in its weak direction it has collapsed into the room.
- Q. So just to be clear there's no party wall anymore with that adjoining building. It's obviously a new concrete wall for Calendar Girls?
- A. Correct so that's the new wall of Calendar Girls that was built beside the
15 party wall and here you can see the double leaf cavity wall of the party wall. To the right is some remaining parapet left in the temporary restraints that we had installed.
- Q. If you could just indicate in photo 6?
- A. Which is just there which with the loss of the wall below is of little help.
- 20 Q. And photographs 7 and 8?
- A. Photograph 7 is looking inside at the east wall near the front showing your first portal frame line and showing where that party wall is collapsed into the room and photo 8 shows damage to the northwest corner column at first floor.
- 25 Q. And photo 9 is taken from inside the upstairs office that we have seen several times from the north?
- A. Looking at the north. Looking out towards the street towards Hereford Street.
- Q. And behind that pile of bricks that is the Calendar Girls concrete wall?
- 30 A. Correct.
- Q. And photograph 10?
- A. Again a close-up of the restraints on the north parapet and these, you will note it's anchored back into the roof. These had been bolted down

into these purlins that the force pulling this out was so much that it's ripped them out of those purlins.

Q. And photograph 11 it shows the standard detailing from the Earthquake Society recommendations?

5 A. Correct showing the anchoring into the bolts and into the parapet.

Q. And along the PFC there's the odd brick attached to the fixing?

A. Yes and you can see where there's fixing left on its own without the brick.

Q. Can you just indicate that one please?

10 A. Sorry it's in the middle here.

Q. And the bricks that are left there, is that the bottom part of the façade or is it the top of the wall?

A. That's the bond beam there above the first floor and this is the rest of the parapet.

15 Q. So this is taken, is that from Liverpool Street elevation?

A. Correct.

Q. And photograph 12 again south west view and 13 a close up of that, taken near that light well?

20 A. Yes it's the wall facing east in the light well. It appears to have peeled around towards the east.

Q. And photographs 15, 16 and 17 on the next page are taken from inside Joe's Garage showing it relatively intact it would seem?

A. Correct.

Q. So photograph 15 is taken looking out towards the north-west?

25 A. Yes.

Q. And photograph 16 is looking towards the north-east?

A. Sorry picture 15 was towards the north-east and this is towards, sorry to north-west and this is to the north-east.

30 Q. That's right. And in photo 16 just between the lights against the brick wall behind the servery is a steel beam. Is that part of the strengthening?

A. Are you talking about this column –

Q. To the right of the blackboard yes.

A. So that's the portal frame column, yes that frame went across at each floor.

Q. And that wall seemed to be entirely intact was that the case?

A. Yes I looked at that wall after the earthquake and you could see, could
5 not find any damage to that wall at the ground floor.

JUSTICE COOPER

Q. Do you know when this photograph was taken?

A. Yes it was probably about a month after the earthquake or more, just
10 prior to writing a report on the feasibility of retrieving contents from the building.

1416

Q. So is it a row of, do not know what they are, they could be soup bowls or cups?

15 A. Yes, still sitting on the shelf.

Q. The suggestion is that they have stayed there throughout the earthquake?

A. Correct. The centre of the building did not move anywhere near as much as the ends of the building due to the strengthening that had
20 provided.

Q. Is that the eastern –

A. Yes.

Q. – side of the building?

A. Correct.

25 Q. And you can see the pepper and salt shakers on the table which has been apparently knocked over?

A. Correct.

EXAMINATION CONTINUES: MR RAYMOND

Q. But equally in photograph 16 the bar stools standing up and the mirror
30 behind the bowl is intact?

A. Correct.

JUSTICE COOPER:

Q. And is that what appears to be an empty bottle at the end of the bench there?

A. Yes.

5 Q. Further along to the left? So why has this state, interior of the building so undisturbed?

A. We saw this in quite a lot of other buildings as well where relatively lightweight components would not get thrown around whereas heavier components would get thrown around purely based on their mass and acceleration. Earthquake forces is a function of the mass of being
10 thrown sideways or upwards so the lighter you are the less effect on you there is, so, and that's combined with the centre of the building being stiffer than the rest I think.

Q. Because of the frames?

15 A. Well the bottle for example is actually completely irrelevant of the strengthening to the building because that is just sitting on the bench there but it's empty so it didn't have much loading I guess applied to it laterally.

Q. Just if we could pick up at photograph 17? You'll see just to the
20 immediate right of the, I think, microwave, if we can go to that? There is a beam –

A. Column, yes.

Q. – column, sorry, is that the second beam along that eastern wall?

A. Correct, yes.

25 Q. And when you look then at photograph 16 and 17 together you can see in photograph 17 the end of the mirror and in 16 the full shot. I think it's 16 and 17, on the page at the same time. So looking at photograph 16 the second beam is at the far right of that picture.

A. Yes so you get the first frame set back on the left of the column and
30 then the second frame is on to the left of the mirror and the second frame is to the right of the mirror. The third frame is hidden within the kitchen.

Q. And all of the ceiling tiles in photograph 16 seem to be in place?

A. Correct.

Q. I don't want to put words into your mouth but it would tend to suggest that the columns which have been built and the strengthening work that was done in 2005 have been very effective in maintaining the structural integrity of the inside of the building at least on the ground floor?

5

A. Correct, and part of the reason for that is that those columns were designed for an additional floor on the top storey but that didn't, apart from the floor itself, the upper walls in the roof did not exist so there was less loading on those frames than what they were designed for.

10 Q. Over-designed for what it was –

A. Effectively, yes.

Q. – used for?

A. Yes.

Q. Turn to the next sequence, photos 18, 19 and 20.

15 A. These are just recording the spaces around the building so the 18 is in the storage space at the rear of the building and it's looking at the remainder of the south wall and showing how the wall is anchored into the, fixed into the first floor, underside of the first floor, you can see the steel channel along there bolted into the brickwork.

20 Q. Sorry I'm a bit lost? Where are you referring to?

A. This is the south wall.

Q. Yes.

A. And the storage area –

Q. Yes.

25 A. – at ground floor.

Q. And the steel channel you just referred to?

A. So the steel angle runs along here between the –

Q. I see.

A. – edge of the floor fixed into the brickwork wall, and there's no apparent damage on the inside leaf of that wall either.

30

Q. And photograph 19?

A. 19 is back of the north façade just looking at the brickwork below the windows.

- Q. Back of the north facade?
- A. I think it might be the west, the west façade, I'm just trying to work, orientate myself with that door to the right. I'm not 100% sure where that one is.
- 5 Q. Mr Whelan's indicating, if I may, from the back that's the north façade?
- A. Okay.
- Q. Just by the entrance, is that right?
- A. Yeah that must be the entrance on the right, yeah.
- Q. Photograph 20 is that to the right of the entrance looking out?
- 10 A. Correct. Yes.
- Q. Photographs 21 to 23? Anything of interest there?
- A. 21 is just again inside the storage area at the south end where the roller shutter door is in the west elevation, and then 22 is looking to the east end in that storage area and then 23 is just a general view in the first
- 15 floor of the Miles Construction office looking to the north where some of the façade is collapsed out.
- Q. Thank you. And 24 to 26?
- A. 24 is a view looking up the stairs going up to the first floor, just showing some of the plaster board cracking in the wall. Photo 25 is looking at
- 20 some, a little bit of dust that had come out of the brickwork around one of the portal frame legs onto the floor at first floor, and photo 26 is general view in the first floor showing where the portal frame beams go across the roof, ceiling level, looking towards the north-east.
- Q. So just in photograph 26 there's no further floor above those beams that we can see across the ceiling?
- 25 A. The floor has been constructed but there wasn't a, then there's that short space to the roof.
- Q. Roof space. Again, looking at 25 and 26 and that beam construction are you able to comment on the effectiveness of that work?
- 30 A. Yeah it shows that the, you can see where the bolts go through the flange of the column into the brickwork and there was no noticeable movement between the brickwork and those columns. So those bolts

go, they were alternating sides through the column up into the brickwork. I think they're about 450 centres or something like that.

Q. Thank you. Photographs 27 to 29 finally.

5 A. 27 is a view in the rear first floor. There was an office in there for Joe's Garage and that's just showing the, no sorry, this is in that space in the back of Miles Construction in the south-east corner overlooking that light well so looking south. So remember in plan that the wall stepped in at the back –

Q. Yes.

10 A. – around the light well?

Q. Yes.

A. So this is the south wall of that, where it steps in –

Q. Yes.

15 A. – at first floor shown there. That wall is still relatively intact except you can see in the top right where I think the next photo focuses in. Photo 28 shows where that returning wall that heads south had rotated out and the end of the bond beam you can see is rotated around.

Q. And photograph 29 finally?

20 A. 29 is just showing the, some diagonal damage, diagonal cracking to the plaster board within the building indicating the sway of the building in the north-south direction.

Q. Just before we pick up from paragraph 49 of your brief do the Commissioners have any questions arising out of those photos?

JUSTICE COOPER:

25 No, thank you.

EXAMINATION CONTINUES: MR RAYMOND

Q. If you could just read from paragraph 49 please?

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 49

30 1426

A. "In response to the questions from the counsel assisting the Commission, Mr Zarifeh had previously written to the company with a

series of questions. Through Mr O'Loughlin's brief and my own we have endeavoured to answer the matters raised. There are some matters raised not specifically responded to in the narrative above which I now address.

5 Mr Zarifeh asked what the company's understanding was as to what was required of us in relation to the inspections I carried out. RCS1 is the email from Alastair Miles dated 9 September 2010 requesting an inspection. Our view of the instruction was to inspect the building for earthquake damage, advise on any immediate making safe requirements and state if the building could be re-occupied. The requested report was to identify any deficiencies in the building structure and advise the owner on what would be required to remedy these.

10 I was also asked whether or not I had given consideration to the impact of the 4 September earthquake and subsequent aftershocks on the structural integrity of the building and its ability to withstand further aftershocks being diminished. That was most certainly taken into account as discussed in my brief. I looked at the strengthening frames and systems and their connections to the URM structure. There was no apparent degradation to these systems. However, there was degradation to parts of the original building which I instructed to be repaired.

15 Counsel also asked whether I considered information from GNS or any other source about the likelihood, location or extent of further aftershocks. Yes, in as much as I read articles in the media by GNS and other sources to generally keep abreast of the research into the seismic activity. Given the time that has since elapsed and the high volume of information being released I do not recall the exact content of those articles. My considerations were typically based on my general knowledge concerning the probability of further aftershocks after such a significant earthquake.

20 Counsel assisting also asked whether I was aware that GNS had advised of the possibility of an aftershock approximately one magnitude less than the 4 September 2010 earthquake and if so to provide details

of that knowledge of that possibility and whether it was taken into account in carrying out the inspections/assessments. In response I was not specifically aware of the GNS advice of one magnitude less but I was aware of the general media comments from reported expert sources to the effect that there was no clear consensus on what the level of future aftershocks would be or where they would occur. I had heard Professor Furlong making comments to that effect. If GNS made the comment referred to it could only have been referring to the Greendale fault whereas I understood the 22nd February event was a different fault which unleashed a series of extraordinary forces which I had not contemplated and which any unreinforced masonry building whether strengthened or not would struggle to withstand.

Counsel also asked whether in reaching any conclusions in relation to the building we gave consideration to information from the city council regarding to building standards or the inspection of buildings following an earthquake. We did so to the extent that we referred to the earthquake prone policy 2010 issued by the city council.

Counsel asked whether we took consideration of information from any other person or body relating to building standards or the inspection of buildings following an earthquake. We did to the extent that I attended Canterbury Structural Group forums and engaged in (inaudible 14:29:53) discussions with colleagues and peers in the profession. Finally, in response to counsels' questions we are not aware of any other inspections or assessments being carried out on the building other than the city council."

Q. You don't need to worry about the last paragraph. If you could just please remain there and answer any further questions.

CROSS-EXAMINATION: MR ZARIFEH

Q. Mr Smith is it fair that your main concern following the September earthquake with the building was the concrete bond beam on the northern façade in terms of damage?

A. No it was not my main concern. It was one of my concerns.

Q. But that's certainly one that you addressed on a number of occasions?

A. Yes and in my report on how to move forward with strengthening I addressed a way of restraining that beam.

5 Q. Right and if I'm, if I recall it correctly you put a restraint on the north-east corner?

A. Correct.

Q. And then you extended that restraint?

A. This is at the parapet level?

Q. Yes.

10 A. Yes.

Q. For that beam or that parapet.

A. It was just for the parapet only.

Q. For the parapet, and then in relation to long-term solution you proposed what in relation to that parapet – to remove it and rebuild it essentially?

15 A. Yes.

Q. So as at the, or post the Boxing Day aftershock you, you inspected the building on the 28th of December. That was the, the most recent and following the Boxing Day.

A. Yes.

20 Q. What was your view as to that front, that northern parapet then?

A. The northern parapet had not moved. The cracks had increased slightly but generally had not moved and had been restrained effectively by the temporary restraints I put in.

25 Q. And so the cracking that you did see, I think you talked about some cracking in the front, front upper bond beam.

A. Correct.

Q. The cracking that you did see didn't raise further concerns for you?

A. Not at that time. It was a very minor crack.

30 Q. Well from that 28th of December inspection you then went on to prepare your report of 18th January?

A. Correct.

Q. And in that report was when you addressed long-term solutions?

A. Yes.

- Q. So as at that, talking post Boxing Day, on the 28th of December am I right that you thought that it definitely needed a long-term solution of strengthening and getting rid probably of that parapet at the front but in the short-term it was all right?
- 5 A. It was, that was based on the premise that the, in the future, in the long term we would, there's a risk of a large earthquake again as we know the Alps, Southern Alps fault line has not gone yet –
- Q. Right.
- A. – and the temporary restraints were to contain movement based on
10 ongoing minor moderate aftershocks. It wasn't envisaged that we would have an earthquake the magnitude of what happened in February.
- Q. Right I understand that.
- A. And I hadn't designed for that.
- Q. No. So as at the 28th of December though I take it from what you said
15 that you were happy for the building to be occupied given the measures you'd taken?
- A. Yes.
- Q. And the long term solution as you say hadn't had a chance to be implemented before February occurred?
- 20 A. Correct.
- Q. How long would they have taken? Would it have taken some time to implement?
- A. No the, the measures that we were looking at doing would have been work that may have been, with the approval of the insurance
25 companies, probably would have been underway by say April/June, that sort of thing because by the time we'd designed the system, got it drawn up and approved you'd be half way through the year and you could start on that work.
- Q. Okay.
- 30 A. And then it probably would have taken two months to complete if that.
- Q. Okay. The other problem, this is from a lay person, but it seems from what you're saying that the structural strengthening that had been

carried out in the past was very effective in the middle of the building on the ground floor.

A. Correct.

5 Q. And the damage that we saw from the February earthquake was effectively the walls, the brick walls, peeling off the south-western, part of the north façades -

A. Mhm.

Q. – and that beam dropping on the north.

A. Mhm.

10 Q. So it was not the, the shell if you like or the steel strengthening that had been put in that wasn't effective but rather the attachment of the walls to those structural elements?

A. Yeah the –

Q. I'm not saying it critically. I'm just saying as a fact that's what –

15 A. Yeah but there's also a difference between the expected performance of the attachments to the walls and what actually happened. So for example both those north and south walls were connected at ground, at first floor and at the second floor into the floor diaphragms. They were bolted all the way along and for some of it connected at a higher level at
20 the parapet and then also in the detailing that we'd provided there were additional fixings through those leaves. We would normally have expected that to have been sufficient but obviously it wasn't.

1436

25 Q. At paragraph 17 you talked about or referred to your report, previous report, and “monitor cracks to south wall and façade needs better connection to south wall”. So you didn't consider the cracking on the outside brick work was a significant concern. It was a double skin brick and you checked the interior surface. I'm just trying to understand, so it's double brick, there was cracking on the outside?

30 A. Mhm, mhm.

Q. But you checked the inside and there was no cracking?

A. It was cavity brick so it was the outside leaf that was damaged. The inside leaf was undamaged. My main concern was the inside leaf was

carrying the vertical loading so the gravity loading and in the north/south direction it would have also been resisting lateral loading for that part of the building so the outside leaf is typically a weathering skin.

5 Q. What I was going to ask you is the cracking to the outside, could that show a potential for that outside layer to come away?

A. Yes and I was struggling to understand why that was cracking given that the leaves were supposed to have been connected together throughout the building so I hadn't concluded as to why that wall was cracking like that. I didn't think it should be.

10 Q. Right, but did you have any plans to do anything about that?

A. Yes, get rid of it as I had proposed to completely rebuild that wall.

Q. Right so when you talked about these measures being temporary you meant a period of months before something permanent could be put in place?

15 A. Correct. It was a way of putting some restraint in that was quick and fast and effective as opposed to a full strengthening system which would take longer and requires building consent, et cetera, et cetera.

Q. Right but the test you were applying, as you said, was an issue of safety of occupants as well?

20 A. Yes.

Q. And you obviously considered that it was safe given the measures?

A. Yes and effective.

Q. I just wanted to refer to when you were looking at those, referring to those photos of the bolts missing from the cleat, I think they are RCS9,
25 I'm not sure of the number. WITSMI0002.32. So the cleat where the bolts are missing, that's on the south wall?

A. The photo was taken on the south wall, yes.

Q. And the bottom photo which has that large crack –

A. Correct.

30 Q. – was that a concern, that kind of cracking?

A. It was in the parapet level and yes I was starting to get concerned about it and that's why I wanted to get that replaced in the long term but in the short term I didn't think it would be a problem.

- Q. And the mortar that we see, is that an indicator that the mortar's degraded the lime mortar come out of the bricks?
- A. Correct.
- Q. From age or other shaking?
- 5 A. From shaking.
- Q. So it's not so much the age but more the aftershocks?
- A. A combination. If it wasn't old it wouldn't shake apart like that.
- Q. If you look at the next page, .33, photo 7, what's that a photo of?
- A. That's looking at the end cleat of the channel. So that channel is the
- 10 channel that's fixed to the west parapet and it shows where that channel fits into the south parapet.
- Q. And is that a bolt missing from the top?
- A. There's a bolt missing from the very top and there's a nut missing from the bolt going into the wall.
- 15 Q. Right in the close-up we can see it a bit better on the screen can't we?
- A. Yeah.
- Q. So was that a problem, the bolt missing?
- A. Ah, it's right at the end of the wall and the wall returns around the corner so the wall also does have restraint right close to it at the corner as the
- 20 bricks are tied in and overlapped so it wasn't an immediate concern.
- Q. Okay and the nut –
- A. – it would be more concern if it was further along. Sorry, I was referring to the nut, yeah. At the end –
- Q. So you're referring to the nut on the right in the photo?
- 25 A. Yes, sorry. Your first question was about the missing bolt at the end. There was three bolts in there. In hindsight whether there was a third one in there or not it didn't make any difference. The whole parapet disappeared anyway.
- Q. In the end, yes.
- 30 A. Yes but in reality in a well constructed building and well supervised building all those fixings should have been in place.

- Q. And we've got two photos where bolts or nuts are missing. Does that show all the bolts and nuts that might have been missing in the building or not in terms of your inspections?
- A. Ah, no it doesn't show all the ones that would be missing.
- 5 Q. Do you recall when you did inspect it having any concerns about things like missing bolts or nuts?
- A. Yes I did have concern.
- Q. And other than what we see in those two photos?
- A. I didn't see anything missing anywhere else. I didn't have access to the
10 north end on the inside so I couldn't see what was missing or not missing there but it's evident from later photos after the February earthquake what was missing and so it was only that south end where I could see.
- Q. Where you got access through the roof?
- 15 A. Yeah.
- Q. And in the north what were your concerns once you were able to see it about missing bolts?
- A. I didn't see the north end until after it collapsed.
- Q. Right, but you said you had concerns after that?
- 20 A. Yes.
- Q. What were they?
- A. The bolts were missing. The channel wasn't attached to the purlins
- Q. So how many bolts were missing?
- A. All of them.
- 25 Q. So as an engineer what does that say to you?
- A. That whoever put that in there didn't finish their job. Mr O'Loughlin alluded to there is a point where quite often we review the construction and at that point when we review the construction sometimes what we're supposed to be reviewing has been built in, has been covered up
30 and unfortunately that appears to be the case here that when he went to inspect that building he had no chance of seeing that because it had all been covered in.

Q. Right and you said that it raised concerns for you. What about in relation to the structural integrity of the building at not having those bolts?

5 A. Ah, yes, but at the north end I knew had already put some restraints in there and the south end was where I had put that strap in to help restrain it and I was anticipating that would be sufficient.

Q. Right so I think you said in your evidence that you weren't sure if there had been proper fixing because you couldn't see and that's another reason ...

10 A. That's referring to –

Q. – the beam?

A. No, it's referring to the fixings between the two leaves in the cavity wall so as we saw earlier there was those Hilti HY20s that go through the, connect the two cavities together and, as I said before, the inside leaf of the south wall was undamaged but the outside leaf was damaged. Those were the fixings that I couldn't see if they were there or not.

15 Q. Did you see them after February?

A. No.

20 Q. So the other concern that was raised by Peter Smith in his report if you've had a chance to read it was the fixing of these rods through the bricks?

A. Mhm, mhm.

Q. And I don't know if you've got any comment or you had any concerns about that from the photos you've seen and the building itself?

25 A. Um, some of them we can see, some of them did hold onto the bricks okay. Some of them would have been near the edge of bricks and when they were put in they would weaken the edge of the brick so as the brick falls away you're left with just seeing that epoxy around the rod so I accept that's what can happen and there is also the possibility that some of them broke off when they hit the ground. There was also I would say the possibility that some of them may not have been cleaned out properly and may not have bonded properly but it's hard to distinguish.

30

- Q. And the detailing, the reference, but the detailing for those bolts showed them to be on an angle?
- A. Correct.
- Q. Is that to get more grip on the material?
- 5 A. It's to help the situation where you may end up going into a mortar course which is not very strong. If you go at an angle you've got a better chance of getting, catching through bricks rather than just through a mortar course so you go through multiple bricks.
- Q. So looking at that photo, photo 8 at the bottom of that page. Should that
- 10 bolt have been on an angle?
- A. It is on a slight angle but probably not, it is not on the same angle as what's shown in the drawing.
- Q. Right. So what do you put that down to?
- A. Workmanship I guess.
- 15 Q. And should all the bolts be on a reasonable angle as shown in the drawings?
- A. They should.
- Q. Ideally.
- A. Yes.
- 20 Q. That's just one photo but can you make any comment about other bolts, similar bolts in the angle of those?
- A. Sorry say that again.
- Q. Well that's just one bolt that we can see that looks almost horizontal on a slight angle as you say. Can you make any comment about other bolts
- 25 that we can't see, we haven't got photographs of in the building and whether there were others like that?
- A. Yes when I looked at them I hadn't seen those, that detail that Mr O'Loughlin in his brief, I hadn't seen that before so I didn't know that they were supposed to be at an angle in that detail and so I was
- 30 surprised to find them all at angles in the channel. I thought why haven't they put them in straight, so yes they were at an angle generally.
- Q. So there might have been one or two exceptions is what you're saying?
- A. Yes.

Q. Right. So is it not standard practice to have them on an angle?

A. Well it's probably you can do it two ways. You can either go at an angle or straight through and none of them, if you go straight through and you know you're connecting positively into a brick then you've got hold of the brick and you're relying on the connection of the bond of the mortar around that brick with the other bricks. From what I understand it the idea of putting it in an angle is to safeguard when you're not going exactly into a brick.

Q. Right. I just mean would it not be standard practice to design for that for the angle rather than not?

A. It is standard practice like shown on the NZSE drawings.

CROSS-EXAMINATION: MR ELLIOTT

Q. Mr Smith, you may have answered this already. It was referred to in your very detailed examination in chief but it's just based on your inspection of this building and indeed of any unreinforced masonry buildings during that post September 4 period whether in hindsight there are any lessons that you can draw from those things that you could tell the Commission about?

A. I would say it's probably being more aware of, not being afraid to understand that you know there could be bigger earthquakes round the corner and that we really do need to make sure everything is well captured and held in place and when we do see the distress like we saw in that building that it may not, probably won't withstand a large aftershock and that it needs to be dealt with in a quick way. The really tough thing is having the resource even now having the resource to respond to all the buildings in such a thorough way that gets them strengthened in a approved manner is impossible. So it's a process that we have to go through. In that building looking back and when I see it and if I knew the magnitude of that earthquake then I would have done things differently.

Q. Do you want to tell us what they were?

A. Probably would have removed some of that wall straightaway.

Q. The south wall?

A. Yes or cordoned it off. The bond beam, that was pretty unexpected the way that failed. I didn't expect that to go out like that so that you know I had seen it moving slightly and we had a plan on how to restrain that.
5 It's just unfortunate that we hadn't got to that plan on how to hold it in properly. So it's those small parts of the building it's focusing also on those small parts of the building and making sure they're all safe as well as the main part of the building.

Q. So it's the point Mr O'Loughlin was making earlier about considering
10 particular components of the building in addition to the building as a whole and is that particularly applicable to unreinforced masonry buildings?

A. In part yes, but also to even new buildings. We're seeing failure of components in new buildings which shouldn't fail because they're not
15 normally part of the structural engineering design. They're a non-structural part and they're failing and they should have stronger systems to resist them.

RE-EXAMINATION: MR RAYMOND

Q. On those inspections I think between the September event and the
20 Boxing Day event you inspected Joe's Garage six times?

A. Correct.

Q. And then a seventh time obviously after the 22 February event and then again later when you took further photos about whether or not it was safe to enter the building so up to eight times. Generally speaking
25 giving the strains you have said, the whole series of events put on engineers generally, was that an unusually large number of inspections for a single building that you were involved in or was it reasonably -

A. Yes it was.

Q. And why was that? Was it because of the fact that your firm had carried
30 out the structural engineering in the first place or was it just you were responding to the request from Mr Miles to return time and again to check?

A. Yes I had been responsive to a good client. As I said he was a friend anyway so I made sure I did respond but there was I guess trying to understand why parts of the building weren't performing as well as it was supposed to given the extent of the strengthening that it had.

5 Q. You may not be coming back to this Commission so in terms of your assessment of other buildings would have not have received the same number of visits post September before February?

A. Sorry say that again.

Q. In terms of your other inspections of other buildings.

10 A. Yes.

Q. Between September and February 2011, you wouldn't have carried out the same number of inspections on a single building?

A. Some of the buildings had you know between four and five inspections of them yes if that what was, if we were looking into how we were strengthening them and what we were doing with those buildings and as things were opened up for us to investigate or quite often like two of those visits were going back simply to check on what had been in put in place, the safety systems that had been put in place, the temporary restraint systems put in place.

20 Q. Checking the work had been done satisfactorily?

A. So when you're instructing stuff you want to make sure, go back and make sure it's been done.

Q. And in the initial stages of this building and indeed others that you were involved with, were you unduly hampered by the fact that you were unable to access documents in your premises because of the earthquake?

25 A. Yes.

Q. Why?

A. Because I was trying, I needed to understand how the strengthening of that building worked. What were the fixings that would tie things in and without the documentation of the, the details of what had been done there you know I had to do more inspections to try and ascertain what was happening with this building and once we did get that information

30

then it became clear as to what was there and how it was being restrained.

- 5 Q. Knowing what we do now about the façades which fell off the building the next best option apart from the strengthening which is seen in the photos tied back into the roof and the general strengthening that had been done already, what alternative was there?

1456

A. Ah, for the parapets?

Q. Yes.

- 10 A. The best alternative was to remove them and rebuild in lightweight but that was, we also realised that can be counter-productive in as much as it reduces the load, the compression load on the structure below, so we would also have to be looking at how we strengthen that as well and my proposals at the time were to look at putting in fibre reinforced plastic
15 around those columns, around those brick columns to contain them.

Q. Fibre reinforced plastic?

A. FRP, yeah.

COMMISSIONER FENWICK:

- 20 Q. I'd just like to say thank you very much for the photographs and the comments you've made.

A. Thank you.

JUSTICE COOPER:

- 25 Q. Yes well I agree, once again very well organised, comprehensive brief for which we are very grateful. You've taken a lot of care putting that together thank you.

A. Thank you.

WITNESS EXCUSED

MR ZARIFEH CALLS**PETER SMITH (SWORN)**

Q. Mr Smith you have prepared a written report for the Commission on the failure of this building?

5 A. Correct.

Q. And you've been here listening to the evidence today particularly from Mr O'Loughlin and Mr Smith?

A. I have.

10 Q. Thank you. I think unless the Commissioners want to have you amplify on it we can leave the description of the building and the structural failure unless what you have a disagreement in terms of the failure with any of the comments that have been made by Mr Smith in particular?

15 A. No I think it's been pretty well investigated pretty thoroughly. What I did find interesting was to monitor the movements of the Land Rover that was in the foreground of the second video which clearly showed that the shaking was north-south initially and then turned east-west and consequently that led I think to the western parapet failing after the south wall. It was actually quite, it may be worth even replaying it because it was quite dramatic showing how the ground was actually
20 moving.

Q. Right.

JUSTICE COOPER:

Well perhaps we should see that again because I hadn't, there's so many things to watch.

25 **EXAMINATION CONTINUES: MR ZARIFEH**

Q. So that in the –

A. Second video.

Q. – video sequence yes.

A. Yeah.

30 Q. Second video.

JUSTICE COOPER:

Q. Have you seen that footage before Mr Smith?

A. I hadn't see that one. I'd seen the previous one.

Q. You'd seen the first one but not the second?

5 A. Yes, mhm.

VIDEOS PLAYED

A. That's the first one I think isn't it?

EXAMINATION CONTINUES: MR ZARIFEH

Q. The second actual video?

10 A. The second one is more dramatic I think. That's the one.

JUSTICE COOPER:

Q. So that's the end of -

A. So that's after isn't it.

Q. – the event?

15 A. That's after the event yes.

Q. Yes we need to go earlier.

A. That's it, you can see the north/south there and all of a sudden it starts rocking backwards and forwards, quite dram- quite ah, decisively. And I think that's really consistent with the scratch plate, um, records of that earthquake that it was not directional to the same extent as the
20 September earthquake.

EXAMINATION CONTINUES: MR ZARIFEH

Q. Or that it involved both directions?

A. Mhm, yes.

25 Q. Right. And so the comments that Mr Smith has made you have no disagreement with the structural, the failure of the building?

A. No I don't.

Q. All right. So perhaps we can turn to some of the issues you raised in your report and which have already been touched on today. The – one

of the issues you raised was this issue of vertical acceleration and Mr O'Loughlin commented on that you'll recall?

A. Correct.

Q. Just tell us about that and what you're saying about that, generally?

5 A. I think it's particularly relevant to lime mortar, um, although unreinforced masonry generally is relatively weak. With lime mortar the bricks are literally sitting in a bedding of sand, there's not a lot of cohesion between the bricks and the mortar and I think when it's subject to vertical acceleration it's very vulnerable to out-of-plane failure and I think that's what was demonstrated by the video of the collapse.

10

Q. Right. And in terms of lessons to be learnt and what can be done in the future what, what are you saying about vertical acceleration and consideration of...?

15

A. I think consideration needs to be given to including some possibly even some vertical elements to the upper floors in particular of unreinforced masonry buildings to provide some restraint against the vertical acceleration effects. I think there is need for further research on this to provide greater confidence of the upper floor walls in unreinforced masonry in the event of a moderate to severe earthquake.

20

Q. Right. Because clearly in this, in relation to this building the, the middle ground floor seemed to fare all right but it was really the upper floors and the ends?

25

A. Yes I think certainly the portal frames were effective in restraining the west wall and the east wall. I think the building did have a slight torsional response because of the stiffness of the south wall and I think that's why we saw some hammering of the building against the adjoining building the Calendar Girls, but yes clearly the portal frames were effective. It was the unreinforced masonry elements that –

Q. Right.

30

A. – led the focus of any strengthening work.

Q. So dealing with the unreinforced masonry elements. In this case you've raised an issue with the fixing, the epoxy fixing of the rods to the, or through the bricks into the structural element?

A. Correct.

Q. You've heard, we heard the evidence from Mr Wilby?

A. I did.

Q. Have got any comment about that?

5 A. I think it's very unfair almost to try and draw too many conclusions when we haven't been able to look at the evidence that was on the ground. To work from photographs is I think unfair to those involved almost but I do have some concerns that they, either the holes were properly cleaned or that the epoxy actually had developed its strength in those
10 locations.

Q. Right so they're possible factors is what you're saying?

A. Yeah I think there's a, it's certainly an issue that needs careful consideration and maybe the profession needs to do more testing of those fixings which are critical really to restraint of the unreinforced
15 masonry during project, ah, construction projects.

Q. So more on site testing of actual work?

A. I believe that's appropriate.

Q. Right, what about Mr Smith's comments about the missing bolts, particularly that north façade? Do you have any concerns about, after
20 hearing that?

A. I'm not sure whether the extent to which he investigated that afterwards. I take it that he was satisfied they didn't just tear out of the purlins but certainly that is an issue. I've reflected on the circumstances that might have led to that and I think it just emphasises the importance of seeing
25 structural connections before enclosure. If you look at the way the building was constructed I'm sure the, the roof framing, the timber framing for the next floor would have been put in place, the flooring material placed on top of those timbers and then they would have placed the steel work and the purlins for the roof and if the engineer did not inspect prior to the placing of the roofing it was virtually impossible
30 or extremely difficult to get access into that small space between the upper, what would be the second floor and the underside of the roofing and really it's the need to inspect those locations prior to enclosure just

the same as we do with reinforcement in reinforced concrete elements before the concrete's poured.

1506

5 Q. And is there any other comments you want to make, any other general comments?

A. No I think that ...

CROSS-EXAMINATION: MR ELLIOTT – NIL

RE-EXAMINATION: MR RAYMOND

10 Q. Mr Smith in your report at page 5 you discuss the code lateral load coefficients for the façade and so on and towards the end of that paragraph you talk about your calculated figure of 0.9 g, ground acceleration. Do you see where I'm looking at, about the last seven lines up?

15 A. That's the recorded acceleration?

Q. Yes and then the level of ground acceleration equates to an acceleration of 1.25 g and then you say the analysis assumes no vertical acceleration occurs when the wall is subjected to the horizontal acceleration.

20 A. Correct.

Q. A review of the earthquake records establishes that high vertical accelerations did occur over the period of intense horizontal shaking and you conclude the above figures demonstrate that failure of the second unreinforced lime-watered parapets and walls was almost inevitable?

25

A. Yes.

Q. It may be a small point but I just put to you or challenge you on the use of the word "almost." In the circumstances as you've just described them, in those preceding paragraphs and given what we know about the building, wasn't the failure of the parapets inevitable?

30

- 5 A. I think it's, it, engineering isn't quite that exact a science to say that it was absolutely inevitable. There'll be cases where walls of similar construction may well have survived purely because of the dynamic response of the various elements that are attached there. So to be absolute I think is too difficult.

QUESTIONS FROM THE COMMISSION: JUSTICE COOPER AND COMMISSIONER FENWICK – NIL

WITNESS EXCUSED

COMMISSION ADJOURNS: 3.08 PM

10