COMMISSION RESUMES ON WEDNESDAY 4 JULY 2012 AT 9.30 AM

MR ZARIFEH ADDRESSES THE COMMISSION

MR WESTON QC ADDRESSES THE COMMISSION

Good morning, Sir. May it please the Commission, as Mr Zarifeh has just said; I am going to call Mr Coatsworth first.

Introduces Ms Jackie Frankton appearing for Madras Equities.

MR WESTON CALLS

WILLIAM DAVID COATSWORTH (SWORN)

MR WESTON ADDRESSES THE COMMISSION

Just while Mr Coatsworth is getting settled in, may it please the Commissioners, there is a new version of his brief that has just been circulated. New, only in that it has references to the Commission's database inserted. It has not otherwise changed the text. That is the first thing. The second thing is, I discussed with my learned friend Mr Zarifeh, whether it would be necessary and/or helpful or useful for particular photos or transcript references to be beamed up as we go through this. I said I had formed the view that it probably would not be because there was a risk in pulling one or two out, that I might be aiding one party's theory but not another and it might be more sensible to leave it to parties who wish to cross-examine to highlight individual bits. Now Mr Zarifeh, with some reservations that he expressed to me, agreed with that. However, as we go, may it please the Commissioners, there may of course be photos that you would be interested in having us beam up and of course if you signal that, that will be done. And I suggest to Mr Zarifeh if, in the course of Mr Coatsworth reading his brief, Mr Zarifeh thinks there would be something that could usefully brought up, we should do that but, other than those exceptions, my proposal is that Mr Coatsworth simply read his brief without particular stuff being shown because there are 120 photos and there's quite a lot of transcript reference and it could take us a

long time without a great deal of benefit. (Commissioners confer and agree). And then there will be four extra quite small points that will be mentioned too during the course of the brief – two at the end – that have arisen from other evidence but that shouldn't take us very long at all. So, the two during the course of the briefs I'll just interrupt Mr Coatsworth at the appropriate point.

EXAMINATION CONTINUES: MR WESTON

Q. You are William David Coatsworth?

A. Correct.

Q. You are an engineer practising in Christchurch?

A. Correct.

Q. And you have in front of you a written statement of your evidence?

A. Yes.

WITNESS READS BRIEF OF EVIDENCE AT PARAGRAPH 1

A. "My name is William David Coatsworth and I reside at 211 Jeffs Drain Road, R D 2, Kaiapoi. I am employed as a Senior Associate, Structural Engineer by CPG New Zealand. I have been employed by CPG since 2008. I have been practising as an engineer specialising in civil and structural engineering for approximately 40 years. I am a Chartered Professional Engineer and an International Professional Engineer and a Member of the Institute of Professional Engineers of New Zealand. By way of brief background summary, in 1971 I graduated from the University of Canterbury with a Bachelor of Engineering with Honours. From '73 to 1994 I worked as a civil and structural engineer for Sheppard Partners, becoming a partner in 1979. Sheppard Partners specialised in structural engineering and design with a particular focus on the health and education sectors. For example, between 1980 and 1994, I was responsible for much of the design of the Christchurch Hospital redevelopment. In 1994 Sheppard Partners merged with another company to become AC Consulting Group. I was a shareholder and a principal of AC Consulting Group until 2008, when the company was sold to the organisation that is now CPG. AC Consulting Group's principal focus was on the energy sector and during those years, I

performed structural engineering and design services for buildings and structures in that sector. As a structural engineer I have an understanding of failure mechanisms for structures – what can cause a building to collapse and why. Structural engineers are trained to design buildings to resist such failures, including failures induced by earthquake. In my career, I have designed many buildings. With our emphasis on the health sector, seismic design was a particularly important focus during my work with Sheppard Partners. All of the hospital structures we designed had to meet stringent earthquake design standards. In addition to the Christchurch Hospital redevelopment I designed buildings at Burwood Hospital, Wellington Hospital, Keneperu Hospital, Princess Margaret Hospital and at the Christchurch Training College. New Zealand's natural propensity to earthquakes and improvements in the understanding of how buildings respond to seismic events, have resulted in changes to earthquake design requirements. These changes have led to Government authorities requiring ongoing building seismic assessments and strengthening. Throughout my career I have undertaken numerous projects of this nature. One such project (while I was working for Sheppard Partners) was the Christchurch Women's Hospital built in the 1940s, for which I managed a seismic assessment in the late '80s or the early 1990s. During my tenure with AC Consulting Group, I performed seismic assessments on numerous fire stations throughout Canterbury and Westland. Other projects included the seismic securing of Waitaki Boys' High School Hall of Memories and the structural assessment and design of seismic strengthening works at many power stations for ECNZ, and at many substations for power distribution utilities such as Transpower. I have continued to perform assessments during my employment with CPG. For example, between February and May 2010, I inspected and prepared seismic assessments for approximately 60 commercial buildings in Kaiapoi and Rangiora for the Waimakariri District Council. During the course of my career I have also assessed and designed the repair of various damaged buildings and structures.

One example is Burwood Hospital, where I designed repair and strengthening works for roof trusses on a building that had been damaged by snow loads. I've also designed remedial works for older buildings damaged by settlement at Christchurch Hospital and other places. The Christchurch Hospital work involved managing the underpinning and jacking of a two storey brick building that had suffered settlement caused by the construction of a new multi-storey building alongside. While I was with AC Consulting Group my damage assessment work included investigating and replacing braces in several large power transmission towers that had fractured due to fatigue caused by vibration of the braces in the wind. Also managed strengthening of piled foundations to power transmission towers that were affected by landslips. Prior to the 4 September 2010 Christchurch earthquake, I had not undertaken any post-earthquake building assessment. However, I believe that my training and experience (as summarised above) gave me a good understanding of structural failure mechanisms that could be caused by an earthquake and what to look for in assessing a damaged structure. As I shall detail in my evidence, I discussed some of my key conclusions with relevant colleagues and specialists before I finalised my report. This is standard engineering practice. In the present case these inquiries confirmed my own opinions. At the time of the September earthquake I was on leave, annual leave and travelling overseas. I returned to Christchurch on the 19th of September 2010. In common with other structural engineers in Christchurch during the weeks following the September earthquake I became engaged in examining buildings for earthquake-related damage. The September quake was, and is, widely considered in the engineering profession, to be a design event; it is to say an event which generated seismic loads that reached design loads for many structures. One of my first inspections was of the CPG building in Armagh Street. Over the following week I inspected a number of residential properties, and the Papanui Substation buildings and equipment. Over the months that followed, and after the 22nd of February 2011 aftershock, I

inspected dozens of buildings and, indeed, am still continuing to devote significant time to ongoing assessment of damage to structures and design of remedial works. On or about the 24th of September 2010, I spoke by telephone with John Drew, the building manager of 249 Madras Street, Christchurch, the CTV building. During the telephone call we discussed the possible damage inspection by CPG of the CTV building. I sent John Drew an email on the 24th of September 2010 setting out CPG's proposal for the building inspection. A copy of the email that I sent to John Drew is annexed at attachment 1. As set out in the proposal, CPG proposed to conduct a visual inspection of the CTV building and determine whether there was any pattern to the damage observed that would explain any deficiencies observed in the performance of the building following the September earthquake. We would prepare a report describing the building and the damage observed, comment on any reasons for the observed damage, and briefly comment on possible remedial works. I quoted a price of $3000 for the service. As I shall explain in more detail, we did not propose to remove any internal linings or to perform structural analysis. We did not receive any written instructions, however sometime over the following few days, John Drew telephoned me and confirmed that the building owner, Madras Equities Ltd, wanted to proceed with the inspection as set out in the proposal. We agreed that the inspection was to commence at 10.00 am on the 29th of September 2010 and that I would be accompanied by Mr Drew and Leonard Pagan of Rawlinsons (Quantity Surveyors) who would assess the cost of repairs. Other than the proposal no formal contract or other document set out the scope of work. In the proposal, I asked Mr Drew whether any structural or architectural drawings of the CTV building were available. Mr Drew told me (I think during the second telephone conversation we had) that he did not have copies of the drawings. I then telephoned the Christchurch City Council to obtain drawings from them but they told me that their records were in disarray following the September earthquake and that they did not know when drawings would become available."

EXAMINATION CONTINUES: MR WESTON

Q. Pause there Mr Coatsworth, the first additional matter I will have you address is that last sentence. There has been evidence that the City Council does not have record of you making such a call, you're aware of that?

A. I am.

Q. Yes, who did you telephone at the City Council?

A. I don't know.

Q. What number did you telephone to get hold of the City Council?

A. Just their general line I believe.

Q. And so you got someone that you might describe as a 'call centre'?

A. I imagine so.

Q. You didn't take the name of the person you spoke to?

A. No, I didn't.

Q. And can you just tell the Commission please, the - briefly, the nature of your request so that they understand what you did ask the Council for?

A. I asked, or I said that I was requesting drawings for the CTV building, and they, and the person I was speaking to, made the reply that, that as I said that their records were in disarray, I think there was reference to racking systems having fallen over and that they didn't know when the drawings would be available and from that I, the inference from that that I took, was that it was going to be some time before they were going to be available.

Q. Since you've learnt that the City Council's of the view that you did not make that call or they don't have a record of it, I should say. Have you endeavoured to search your own telephone records to see if they show that you did make such a call?

A. I have, but haven't succeeded in obtaining a record at this stage.

Q. You're going to continue making such efforts?

A. Yes.

Q. And if they become available they'll be made available to the Commission?

A. Yes.

Q. If you keep going at 22 please?

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 22

A. "I considered that the structural and architectural drawings would have been useful for me to familiarise myself with the structural systems in place at the CTV building in advance of undertaking my visual inspection. Also, I generally prefer to have more information rather than less. Having said that, I did not (and do not) think the drawings were required for me to be able to conduct a meaningful inspection of the building. I believe that I was able to identify key structural systems from my visual inspection. After my visual inspection and subsequent report I did not make any further attempts to obtain the drawings. If I had observed significant structural damage I would have done so or recommended that the client do so, since information from the drawings would be necessary in order to perform a quantitative analysis of how the structure had responded to loads experienced in the September earthquake. However, as I shall explain, I saw no evidence of significant structural damage in the CTV building. I was able to obtain architectural plans of the ground and first floors from the CTV manager during my inspection. CTV occupied these two floors. These plans identified the locations of the structural elements including the shear walls and the columns. In the immediate aftermath of the September earthquake civil defence and council inspectors did some rapid assessments and applied a sticker system to structures. A red sticker meant the building was a hazard and could not be entered, green meant that the building represented no obvious structural damage or hazards or hazardous conditions, and therefore could be entered, and a yellow sticker indicated that there were some hazardous conditions or structural damage such that there should be only restricted access. The CTV building was green stickered. My assessment which occurred after the building was green stickered included a visual inspection of the damage to the structure. In accordance with my proposal I reported on the

damage observed, commented on the reasons for the observed damage, and briefly commented on possible remedial works. In my proposal I said that I would not suggest removing internal wall linings unless there was some obvious reason to do so. Consistent with this I did not remove all linings during my inspection. However, as explained in more detail later in my report, I did recommend as a follow up procedure, removal of some linings on the ground storey south shear wall and the first floor west end wall. I did not carry out an initial evaluation procedure assessment of the building. An IEP is a method of assessing the approximate capacity of a building as a percentage of New Building Standard. The procedure is described in the New Zealand Society of Earthquake Engineers document *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes,* and is most commonly performed on buildings that are considered potentially earthquake-prone, i.e. less than 33% of new building standard. However, buildings designed to NZS4203 are not likely to be earthquake-prone. Because the CTV building was designed in the 1980s after the introduction of NZS4203, I considered it unlikely that the building was earthquake-prone and did not consider it necessary to perform an IEP assessment to verify this. I understand that the subsequent IEP undertaken by consultants to the Department of Building and Housing confirmed that the CTV was not earthquake-prone. I expressly excluded structural analysis from the scope of my investigation, thus, I stated in my proposal that we had not included an allowance for any analysis of the structure, although in the event of significant structural damage it would ultimately be necessary to carry out structural analysis to determine the strengthening and repair work requirements. If as a result of my investigation I had thought the building exhibited significant structural damage, I would have recommended further investigation, including structural analysis. The inspection took place on the 29th of September 2010. At approximately 10.00 am I met John Drew and Leonard Pagan at the CTV building. Peter Brown of CTV accompanied us during the inspection of the first

two floors of the CTV building. These were the areas leased and occupied by CTV. During the course of the inspection I talked to a number of the occupants. I remember talking to two women on the top floor of the north-west corner of the building who pointed out damage to partition walls and cracking. On the third floor I talked to people from Kings Education concerning sagging in the floors and, of course, Peter Brown pointed out damage he was aware of when we were going through the floors occupied by CTV. There were other people that we talked to as we progressed through the building, although I no longer recall the specific individuals.

Q. Mr Coatsworth, pause there. The second matter I'll have you address arises out of Dr Mander's statement of evidence, which you've read since preparing this, haven't you?

A. Yes.

Q. And in that he talks about what he calls the 'liveliness' of the building following the September earthquake, you recall that?

A. I do.

Q. And in terms of the discussions that you had with occupants of the building, did you discuss the question of liveliness, as Dr Mander uses that term, with any of those people in the building?

A. I don't believe they used the term 'liveliness'.

Q. But the concept that is incorporated within that term, was that discussed with any of them?

A. Yes.

Q. And can you tell the Commission what that was?

A. Um, they had, um, commented that the floors, um, well there was deflections in the floors and the vibrations in the floors.

Q. Now when you say "they" are we talking multiple people or one person?

A. Um, not sure, there was two or three people at the Kings Education level that I talked to about it.

Q. Now when you say "it". Are you talking about deflections in the floor or the movement in the floor?

A. I think my recollection primarily was, um, was the deflections but, um, but they may have mentioned vibrations as well.

Q. I'd also understood you to tell me beforehand that one of the two women on the top floor that you spoke with mentioned the movement of the building during aftershocks, is that right?

A. Yes.

Q. Can you tell the Commission about that?

A. Um, she just simply said that the building moved quite a lot in an earthquake.

Q. Did she talk about –

A. Or an aftershock.

Q. – any movement other than during an earthquake?

A. I don't think so.

Q. During the course of the time you were in the building did you make any personal observations about, again to use Dr Mander's terms, the liveliness of the building?

A. Um, yes. I was in the building for four hours and, um, like all relatively modern buildings, um, I was able to feel people walking, vibrations from people walking about the floors. Um, I don't specifically remember any effects from vehicles, heavy vehicles going past but, um, it wouldn't surprise me if that was possible because I know many buildings reflect that and our own CPG building in Armagh Street I used to feel the trucks going past on the street, and so, um, yes I was aware of these things but I didn't believe that there was anything out of the ordinary.

Q. You got up to paragraph 32?

A. During the inspection I made notes and sketches of the damage that I observed and also took a number of photographs. This was my normal practice and it would assist me in later preparing my report. A copy of my notes and sketches are annexed at attachment 2, along with some diagrams of the north side shear walls that I made some days later to record cracks in the walls. The notes are very abbreviated and were, of course, created as an aide memoire rather than for publication. On occasions they are somewhat cryptic and have what, on subsequent

review when preparing my report, appeared to me to be the odd error. Accordingly, I've also included in attachment 2 with reference to each note a more detailed description of the damage that I observed and clarification of any ambiguities or errors in what I wrote down. A copy of the photographs are annexed at attachment 3.

Q. So have you, in the text that you've used in the typed version of your notes, highlighted the differences, drawn attention to the –

A. Yes.

Q. – points where you're departing from the handwritten?

A. Yes.

Q. I could see instances where you've done that. Did you? You've tried to do that in every case have you?

A. Um, my handwriting on the handwritten notes at the site were probably not that legible for some people and so that was part of the reason for doing that.

Q. Yes.

A. And I added a few explanations underneath.

Q. In cases where there was a change you've explained it?

A. Yes. I took a total of 109 photos during the inspection on the 29th of September 2010, numbered 1 to 109. I included some of these in my subsequent report and also sent Mr Drew a full set. In addition I took two photographs of the south elevation of the building for use as cover photos for the report. These were designated A and B. The results of my inspection are summarised in my report dated the 8th of October 2010. A copy of my report is annexed at attachment 4. In my following evidence I will refer to my notes and diagrams and photographs in my report. I began my inspection by walking around the outside of the building before moving inside on the ground floor and progressing to the roof on a room by room and floor by floor basis. The inspection took approximately four hours, concluding at about 2.00 pm. Although I asked Mr Drew, Mr Brown and others that I spoke to about areas of damage they had observed, I myself decided where I should look and what I should examine. The most obvious form of damage that

I was looking for was cracking, particularly in the structural concrete, but also in other surfaces. I was also looking for evidence of alignment divergences, settlement and separations between structural elements. With respect to vertical alignment, although I made visual observations I did not perform a vertical alignment survey. This is something normally performed where there are signs of settlement or liquefaction, which was not the case with respect to the CTV building. As a result of my investigation I determined that the structure consisted of a reinforced concrete shear tower along the north side of the building and reinforced concrete coupled shear walls along the south side resisting lateral loads, reinforced concrete beams and columns resisting gravity loads and composite concrete topping and steel tray deck floors. I did not have any information about the foundations. I would have expected however that they were concrete strip and pad type. The drawings included in the DBH report show construction as described above. I observed that there was some plan irregularity eccentricity to the building. I understood that the concrete block infill panels on the west wall were not intended to play any part in lateral load resistance since these panels were isolated from the surrounding concrete frame. This meant that for loads in the north-south direction, the centre of stiffness was in line with the finger walls in the north shear tower and the centre of mass was some distance to the west, nearer the centre of the building. This difference between the centre of stiffness and the centre of mass introduced some eccentricity. The loads in the east-west direction were resisted by the north shear tower and the south side coupled shear walls. The north shear tower was stiffer than the south side coupled walls and this also introduced some eccentricity. Because eccentricities apply torsion, twisting loads to the structure, it is ideal to minimise these. However, it is unusual to have buildings with no eccentricities at all. Indeed Codes typically require designers to allow for some eccentricities. I did not do any calculations to assess the extent of the eccentricity in the CTV building but I was not alarmed by the amount of eccentricity that I perceived when inspecting the building.

The two car lift shaft stairwell and bathrooms projecting from the north side of the building, about half way along the north wall, projected, sorry; a concrete shear wall extended across the north side of these facilities. Finger walls projected at right angles to the north side wall at each end and between the facilities so there was four finger walls in total. The connection between the floor slabs and the north side shear walls was essential to the stability of the building. I understand it has been postulated that the retrofitted drag-bars connecting some of the floors to the north shear walls failed in the February aftershock or, indeed, possibly failed in the September earthquake. Although I was, at the time of my inspection in late September 2010, unaware of either the original or the retrofit detail, I was aware of the importance of connection of the floor slabs to the shear walls. Any separation of the floors from the shear walls would have caused significant cracking, separation that would have been apparent. As I now explain I expressly looked for such cracking. With respect to the north core shear wall and the areas of connection between it and the floors; I looked for cracking in the shear walls and signs of separation between the floors and the shear walls. On the inside of the building I made observations from the bathrooms, the stairwells and the lift lobby, on each floor, as well as in the tank room and plant rooms. From the exterior of the building I observed the north shear wall from the ground and from the roof. I looked at the floors of the bathrooms where they extended out into the main part of the building. Had there been separation of the horizontal floor slab at this point it would have shown up as a crack in the floor that I would have expected to see reflecting in floor coverings, or as a separation of the floor covering from the skirtings. I did not observe any of these signs. In the stairwell, in the bathrooms, in the tank room and the plant room, I was looking for cracking or misalignment in the walls. In the tank room I observed minor cracking in the north and west walls. Some of these cracks showed efflorescence indicating that they had been there for some time and certainly pre-dated the September earthquake. None of

them was structurally significant. The same was true for the plant room. At most levels there were some diagonal shear cracks in the walls around the bathrooms and stairwell, for the most part measuring less than 0.2 millimetres in width, but with three measuring up to 0.3 millimetres. For example, in the toilets in the north shear tower on the fifth floor I saw a single fine diagonal crack on each of the east and west walls. None of the cracks I observed in these areas was large enough to indicate failure or yielding of the wall. Except for a thin gypsum plaster coat applied directly to the concrete the stairwell walls were unlined. The stair flights were of pre-cast concrete treads on steel stringers bolted under the landings. Am I allowed to make a correction here?

JUSTICE COOPER:

Q. Yes, corrections are encouraged.

A. I don't believe the treads on the stairs were in fact pre-cast concrete, I believe they were timber.

Q. So how should we recast this - the stairwells where timber treads on steel stringers?

A. Yes.

EXAMINATION CONTINUES: MR WESTON

A. The mid-height landings were in situ concrete slabs cast against the shear walls. The floor level landings were part of the main floors of the buildings. There were construction joints in the walls immediately above and below each floor level. From the stairwell, facing the wall that separates the stairwell from the bathroom, the construction joints were above and below the bathroom floor slab. For the most part, however, these were not visible because of the gypsum plaster coating. I was looking to see if the construction joints had opened up or if there was any misalignment in the plane of the wall or at right angles to the plane of the wall that would have been indicative of shear sliding failure. I observed minor cracking along part of the length of the construction

joints in the walls and stairwells at several floor levels. However these cracks measured generally less than 0.2 millimetres in width but with a few up to 0.35 millimetres in width. While this constituted minor structural damage, once again, it was not of an order that would signify yielding of the shear wall. I observed minor cracking in the stairwell walls at most levels. For example, I saw horizontal cracking in three of the walls of the stairwell between the fourth and fifth floors. There was also a minor diagonal crack in the northern wall approximately 500 millimetres below the roof level. Although the cracking that I observed was indicative of minor structural damage, because the cracks were very fine I consider that the reinforcing steel had not yielded, that the aggregate in the concrete was still interlocking and that the general integrity of the concrete walls was not compromised. From the ground and from the roof, I looked at the outside of the shear walls. I was looking for misalignment or separation of shear walls from the rest of the structure and for separations of windows or cladding materials from the underlying structure. I saw no signs of any such damage. In summary, none of the damage that I observed indicated yielding or other failure of the north shear wall or separation of the floor slab from the shear wall. I summarised these findings at page 4 of my report. The CTV building had circular and square columns of reinforced concrete. The function of the columns and beams was primarily to support gravity vertical loads rather than to resist lateral horizontal loads. However they did have some stiffness and when the building moved horizontally would attract some load. In response to the lateral loads of the earthquake I was looking for shear and/or flexural bending cracking in the concrete at beam column joints or in the columns and beams themselves. The size of any cracking would reveal whether it indicated elastic or inelastic movement. I was also looking for signs of compression failure in the columns as a result of vertical loading. I examined some columns on all floors. With a few exceptions, I observed very little damage. My findings are summarised on page 4 of my report. I now expand on those findings. Maybe another clarification on that point 54, I'd said

there that I examined some columns on all floors but in reality I believe I saw every column on every floor.

QUESTIONS JUSTICE COOPER:

Q. Did you say, "I *saw* every column on every floor"?

A. Yes.

Q. And are you contrasting that with examining them?

A. Um, I guess I meant the same thing, um, you know I was standing within a metre of each of these columns and was able to see if there was any damage to them.

WITNESS CONTINUES READING BRIEF OF EVIDENCE AT PARAGRAPH 55

A. "The north-east corner column immediately above the third floor spandrel exhibited some very fine, minor cracking. Similar hairline flexural cracking was evident in the north-east column above the fourth floor spandrel panel. As a result of observing this damage, I further inspected the column in the north east corner at other floors but observed no damage. At the top storey, the first column west of the north-east corner of the building exhibited some cracking, the appearance of which was accentuated because the paint had chipped off at the cracks. I did not record the width of these cracks, but my recollection is that they were less than 0.2mm. I took photographs of the column and the cracks. The first column in from the south west corner on the south side of the building at the top storey also exhibited some fine cracking. I recall these also as being less than 0.2mm and, again, I took photographs of the column and cracks. In a number of places I observed gaps of approximately 7-8mm at ceiling level between the plasterboard wall and structural columns. At the floor level however there was no gap. The movement of the plasterboard was, in my view, caused by building sway. At floor level the plasterboard was fixed to the floor slab, which was fixed to the column. When the column leaned during the earthquake it pushed on the plasterboard wall, causing the

gaps that I saw at ceiling level. Similar effects but to a lesser extent were evident where partition walls adjoined the shear walls. This was not evidence of structural damage. The first floor beam on the north face of the building in the span between the north east column of the building and the adjacent column had two fine diagonal cracks. Because these were so fine I did not consider yielding had taken place. The interior beam column joints were for the most part, behind the suspended ceilings. However, as I shall explain later in my evidence, I removed ceiling tiles from several locations and could observe the joints in areas where there was no suspended ceiling. The underside of the beam column joints around the perimeter of the building were visible from the ground and from the building, through the windows. I did not see any signs of distress in the beam column joints that I observed. In short, I saw no evidence of anything other than occasional minor structural damage to the columns and beams. This indicated to me that the steel in the columns and beams had not yielded and that the integrity of the beams and columns had not been compromised. The south elevation contained a coupled shear wall. It had door holes in the middle of the wall at each storey providing access to the external fire escape. Beams across the door heads coupled the walls on each side of the doors together. Coupled shear walls are designed to yield in the beams over the door-heads. I was accordingly looking for cracks in the coupling beams. I found no evidence of this. I examined the southern shear wall from the ground floor and from the external fire escape at every other floor. The inside face of the south shear wall was finished with a thin coating of gypsum plaster at all levels except the ground floor. At the ground floor the wall was lined with plasterboard. That is, it was on a timber frame, plasterboard on a timber frame. The exterior of the shear wall was finished in a plaster splash. The plaster splash surface of the exterior wall made fine cracking less obvious than on the gypsum plaster interior walls. However, in spite of the plaster splash, in my opinion cracks in the concrete wall that might have indicated yielding would have been visible. I did not see any. During my inspection I

observed very fine diagonal hairline cracking in the gypsum plaster on the inside of the south shear wall at the first floor level of the building. At the ground floor I saw significant cracks in the plasterboard lining. I was also able to identify a fine diagonal crack on the outside of the south shear wall at the ground storey. This crack was quite fine so I did not consider it to indicate structural yielding. Given that the only crack I observed on the outside of the wall was of no structural significance, I considered it unlikely that the south shear wall behind the linings had been compromised. However, I considered it prudent to remove a ceiling tile from the ground storey so as to inspect a portion of the inside of the shear wall itself. This also enabled me to inspect the first floor connections to the shear wall at that location. These areas revealed no signs of distress. Secondly, I recommended that the ground storey plasterboard linings be removed to provide further confirmation as to whether there had been any damage to the structural shear wall. I anticipated that, if there were any cracks in the structural wall, these would be similar to the cracks on the inside of the shear wall at the first floor and to the single exterior crack I had observed on the outside of the wall at ground level, which were of no structural significance. I do not specifically remember discussing my recommendations to remove the linings with Mr Drew or any other representative of the building owner but I think it likely that I did. It was included in my report at page 3 in my discussion of the south elevation shear wall. I do not know whether my recommendation was followed and if so what the results were. In the CTV building the floor construction consisted of composite concrete topping and a steel tray deck system spanning north to south between concrete beams. Because these types of floor systems are relatively light and flexible, it is common for them to exhibit some deflection and indeed most of the floors in the CTV building had high points over the supporting beams and sags in between. This was not earthquake damage but was a fairly normal and acceptable effect of this type of construction. As I have previously mentioned, I remember talking with some of the staff at Kings Education about the deflections in

the floor and walking over the floor to see what they were talking about. I noticed the high points over the beams and the sags in between but I would have expected to have seen more significant deflections if the floor had yielded. For the reasons I have just mentioned, I removed a ceiling tile from the ground floor ceiling adjacent to the south side coupled shear wall which revealed no damage above the ceiling lining, ah, above the suspended ceiling. In addition I removed a ceiling tile from the ground storey ceiling in the CTV store room adjacent to the stair lobby. I did this in order to view the underside of the first floor and its support beams and beam/column joints to check for damage. I observed no structural damage. I was also able to observe the underside of the first floor slab, the support beams and the beam column joints from the ground floor CTV studio and from the garage, neither of which had a suspended ceiling lining. Again I saw no structural damage. I also removed a ceiling tile from the second floor ceiling. I believe this was in the lift lobby. I did this for the purpose of viewing the underside of the third floor and its support beams and beam/column joints to check for any damage. Again, I observed no structural damage. I note that when providing responses to questions from the Royal Commission last year I mistakenly identified this tile as having come from the first floor ceiling. That was an error. I did not remove ceiling tiles from any additional locations in the building. This was a judgment call on my part. In the elements that were visible without removing ceiling tiles, e.g. columns, structural walls, non-structural walls and floors, I saw no evidence that the damage to the upper levels was any worse than that at lower levels. In addition I closely looked at the tops of columns at ceiling level and saw no evidence of damage. In addition to the structural elements described above, I also observed the spandrel panels, the non-loading bearing concrete block walls, the internal framing and linings and the windows. Details of my inspection of these areas are set out at pages 4-6 in my report. Spandrel panels were on the north, east and south faces of the building and weatherproofed the building under the windows. I observed

the panels from the ground, from the fire escape and through the windows on each level. I could not observe the connection of the panels to the structure since this was obscured from sight behind the panels themselves. There were only two areas where I observed any damage to the panels. First, at each side of the south shear wall the ends of the panels had been plastered. The plaster was spalling off due to differential movement in the earthquake. Since this was a hazard to people below I recommended that the spalling plaster be removed and a strong bonding epoxy plaster reapplied." I think I need to make a correction here as well. On looking at the photographs, my photographs since preparing this brief, I believe that the plaster was actually on the ends of the beams rather than on the spandrel panels.

Q. Does that otherwise alter the burden of your evidence?

A. No.

Q. Thank you, right, so that's all you want to say about that?

A. Yes.

Q. Right, 81?

WITNESS CONTINUES READING BRIEF OF EVIDENCE AT PARAGRAPH 81

A. "Secondly, at the 5th floor level the end of the spandrel panel on the north elevation adjacent to the lift lobby showed signs of corrosion of the reinforcement. While this was not a structural problem (the spandrel panels were not structural elements) and had not been caused by the earthquake." Sorry, I've just lost the context of this little bit, I'll read it again. "While this was not a structural problem (the spandrel panels were not structural elements) and had not been caused by the earthquake, I recommended that it be treated. Apart from what I have just said I observed no damage to the spandrel panels. I understand there is some suggestion that the columns may have impacted the spandrel panels at some locations. If this had occurred I would have expected to see chipping at the corners and edges of the spandrel panels. I saw no evidence of this. The west wall at the ground, first and second floors had concrete block in-fill panels between the concrete

beam and column frames. As observed from inside the garage, there generally was a gap of approximately 30 millimetres between the columns and the ends of the block panels. The back of this gap (recessed into the joint) appeared to be filled with sealant or possibly foam. I do not believe there was a significant gap (if any) between the top of the block in-fill panels and the underside of the concrete floor beam above." Can I go back to my comment about the plaster and the spandrel panels and the beam?

Q. So this is going back to paragraph 80?

A. Yes.

Q. What do you want to say?

A. I'm trying to describe how this looked. In general the spandrel panels had a sloping top surface that was at the windowsill level and the outer face of the spandrel panel came down the front of the building and lapped over the beams, the floor beams.

JUSTICE COOPER:

Q. I wonder if in this case we might be assisted by the display of photograph 52, which is the one referred to in paragraph 80?

A. Yes.

Q. And that is WIT.COATSWORTH.01D.12

WITNESS REFERRED TO PHOTOGRAPH 52

EXAMINATION CONTINUES: MR WESTON

Q. By reference to this photo Mr Coatsworth perhaps you could –

A. Yes. So you can see that the sloping top of the spandrel came along there and down the face of the building, right? Now in here you can see the end of the concrete beam and this portion down here is a narrow skirt on the bottom of the spandrel panel. Now what I believe is that the end of the concrete beam didn't line up perfectly with the end of the spandrel panel and so the builder had plastered this end of the beam to match the alignment of the end of the spandrel panel and, as you can see in this photograph, the plaster is spalling off at the intersection of the spandrel and the beam, and I believe that the reason for the plaster

falling off was minor interaction going on between the beam and the panel.

Q. Just for clarification Mr Coatsworth, all of what you have just said relates to paragraph 80. You'd jumped back to that from paragraph 83. There is nothing of significance in 83 that relates to this additional explanation you've just given us, is there?

A. No, it was just my recollection going on in my head while I was continuing to read.

Q. All right. So now we've cleared away all of those?

A. Yes.

JUSTICE COOPER:

Q. Just to make it plain Mr Coatsworth, that if there is any part of your evidence where you do really think there would be assisted in explaining the position by reference to a photograph just say so and we'll get it displayed, all right?

A. Yes.

EXAMINATION CONTINUES: MR WESTON

Q. So I think we've got to the end of 83 Mr Coatsworth so if you could start now at 84?

WITNESS CONTINUES READING BRIEF OF EVIDENCE AT PARAGRAPH 84

A. "I understand there is evidence from workers who observed the exterior of the building once the adjacent building had been taken down," this we're talking about the west wall of the CTV building now, "that mortar rather than sealant filled the gap between the panels to the columns and horizontal beams. I have rechecked my photograph taken from inside the garage and it still appears to me to show sealant or foam. However my view was limited since at the time of my inspection there was an old brick building against the west wall so I was not able to see the block work from the outside. As noted, I observed the block panels from inside the garage. If they had impacted the columns to any extent I would have expected to see some damage at the top corners of the

block panels. I saw no evidence of this. I also had some limited observation of the block panel separation from the north-west corner concrete column at the first floor. There was a gap between the internal framing/lining and the column at this point through which it was possible to see daylight. It appeared that whatever had been used to fill in the separation between the block and the concrete column (I believed sealant) had fallen out. I saw no evidence of impacting between the block panel and the column, although my notes reflect that in this location there was only an 8 millimetre space between the column and the panel, so my view was limited. Because I had only a very limited view of this area I advised that it needed further investigation (which would have entailed removing internal linings). I also advised that the gap needed to be repaired. That's the gap between the block wall and the concrete column. The non-load bearing at ground storey in the stairwell exhibited some non-structural damage. Differential movements between the block wall and the structure had peeled off the gypsum plaster lining on the block wall. There was damage to internal framing and linings on all floors which varied from minor cracking in joints between plasterboard sheets to diagonal cracks in the sheets. There was one broken window on the east wall at the third floor most likely due to the earthquake, and the rubber seal had come loose on another east wall window at the ground floor. I observed no other damage to the windows. None of the damage to the spandrel panels, the concrete block panels, the internal framing and lining or the windows was of structural significance. Following my inspection I made some further notes to myself concerning my observations and preliminary thoughts. A copy of these is annexed as attachment 5. On, or about the 1st of October 2010, I telephoned John Drew and advised him that a security fence should be erected around the bottom of the fire stairs on the south face of the building to prevent injury to people walking beneath the stairs should any of the plaster fall away from the damaged spandrel panels." Which should probably now read, “beam-end.”

JUSTICE COOPER:

Q. What do you want that to say? Damaged?

A. Beam, um, (inaudible 10:36:50).

Q. Beam-end?

A. Well the beam-end wasn't damaged it was just the plaster that was...

EXAMINATION CONTINUES: MR WESTON

Q. Well, can we cross reference it Your Honour just back to his description in paragraph 80. So perhaps to recast this, from the damage discussed in paragraph 80 above, would that be an easier shorthand? Would that be satisfactory Mr Coatsworth?

A. Sorry?

Q. Well you wanted to make a change in 93?

A. Yes.

Q. And that change relates back to the description you gave us back in paragraph 80 in the additional description by reference to paragraph 80. You understand that?

A. Mmm, oh, I was going to suggest that it might be just as simple to amend a couple of words in that sentence and just say, "To prevent injury to people walking beneath the stairs should any of the plaster fall away from the beam-ends." Not damage beam-ends but just from the beam-ends.

Q. And we are to understand from that, that that is the damage you are talking about in paragraph 80?

A. Yes.

JUSTICE COOPER:

Q. So we omit the words, "spandrel panels," there?

A. And, "damaged."

Q. Yeah.

EXAMINATION CONTINUES: MR WESTON

Q. All right, 94?

A. I do not know whether this was undertaken. On the 6th of October I returned to the CTV building in order to complete elevation sketches of the inside of the north shear tower walls as I did not complete a full sketch during my initial inspection. A copy of these seven sketches are included in the diagrams at attachment 2. I also re-checked the width of the cracking in the shear walls. It is my normal practice to discuss –

MR WESTON ADDRESSES JUSTICE COOPER – RE: ATTACHMENT

JUSTICE COOPER:

Q. Something is being displayed. Can you see that on the screen in front of you Mr Coatsworth; is that what we are talking about?

A. That is the key plan that I prepared. It is the key to the wall elevations that I also prepared, so you can see there, see the main northern side wall, northern wall of the shear towers is on grid A as I have nominated it there and the finger walls are on grids 1, 2, 3 and 4. So that is a plan.

EXAMINATION CONTINUES: MR WESTON

Q. And indeed that's the first of the seven sketches that you mention in your paragraph 94?

A. Yes.

JUSTICE COOPER ADDRESSES MR WESTON

EXAMINATION CONTINUES: MR WESTON

Q. So we are back to 95, Mr Coatsworth?

A. Yes.

Q. You can keep reading.

A. "It is my normal practice to discuss my preliminary conclusions from an inspection with colleagues or other specialists in related fields. This form of peer review is useful in checking my own opinions and is a matter of risk mitigation. This is common across most engineering practices. With respect to my review of the CTV building I consulted a

number of people in particular on the 1st of October 2010 I telephoned Dene Cook of Firth Concrete. Mr Cook is an expert in concrete performance. I described the general level of cracking that I had seen in the shear walls. My notes of that conversation reflect that Mr Cook confirmed that, at 0.2 millimetre crack width the steel would not have yielded and the walls should be good for the same earthquake again. He also agreed that their stiffness might however be lower – that is, during a seismic event the deflections would be greater in the pre-cracked section and the period of vibration might be a little longer than previously. A copy of my record of the telephone conversation with Dene Cook is annexed at attachment 6. On 6 October 2010 I telephoned Des Bull. Des Bull is a senior structural engineer" and, another correction I would like to make here he is a lecturer at the University of Canterbury but that reference should have read, "Holmes Consulting Group."

Q. So where do we put Holmes Consulting Group in?

A. Just instead of, "A lecturer at the University of Canterbury," will be fine.

Q. So we delete the words, "A lecturer at the University of Canterbury," and put, "He is a..." –

A. "Senior structural engineer at Holmes," –

Q. So the word and also is deleted?

A. Yes.

JUSTICE COOPER ADDRESSES MR WESTON

EXAMINATION CONTINUES: MR WESTON

Q. And just by way of explanation, may I please the Commission, this change has been made at his expressed request to reflect the fact that the capacity in which he believes he gave this advice to Mr Coatsworth –

A. Was as a –

Q. Member of Holmes.

A. A member of Holmes.

Q. Okay, next sentence thanks Mr Coatsworth.

A. "He is also a key member of the civil defence response team in the Christchurch earthquakes. During this telephone call I discussed with Mr Bull my observations of the cracking present within the CTV building and in particular the diagonal shear cracks in the order of 0.05 millimetres to 0.35 millimetres as well as the cracking in the horizontal construction joints above and below floor slabs. Mr Bull advised that cracks of less than 0.4 millimetres still retain aggregate interlock within the concrete and observed that code designs allow for some cracking. He was not surprised that there was cracking at the construction joints. He said he thought that cracks of the type I had described should be fine but agreed that for peace of mind cracks larger than 0.2 millimetres should be injected with an epoxy resin. A copy of my note of this telephone conversation is annexed at attachment 7. I also telephoned Peter Higgins of Construction Techniques. The purpose of my call was to discuss injection of epoxy resin into the concrete cracks. Mr Higgins said that he thought that the smallest cracks that could be effectively filled would be approximately 0.1 millimetres. A copy of my note of my conversation with Mr Higgins is annexed at attachment 8. I discussed the matter with Jerry Kearney, a structural engineer in CPG's Dunedin office. Jerry recommended that I also speak with Steven Moody, of Adhesion Sealing, who were also experts in epoxy injection of cracks in concrete. I accordingly telephoned Mr Moody. He too confirmed that epoxy injection repair of these cracks was appropriate but said that anything less than 0.1 millimetre could not effectively be filled. A copy of my note of my conversation with Mr Moody is annexed at attachment 8. I also generally discussed the damage I had observed in the CTV building and its effect on the structural integrity of the building with Jerry, as well as with Tony Crang, who is a senior structural engineer in CPG's Auckland office. I sent an email to both Tony and Jerry on the afternoon of the 6th of October 2010 in which I summarised the opinions of both Dene Cook and Des Bull, which confirmed my own views. This email is annexed at Attachment 9. I started writing my report on or about the 6th

of October. The report was emailed to John Drew on the 8th of October 2010. Accepted design practice requires that buildings remain standing after a design event but it is expected that some damage will be inflicted. The CTV building showed noticeable damage to non-structural elements such as linings and finishes. It demonstrated some minor structural damage, as already outlined, but no evidence of structural failure. Based on my own knowledge and experience as an engineer as well as the checking I had done with other specialists, I concluded that the fine cracking I had observed was not indicative of yielding of the reinforcement in the shear walls or in the columns. I also do not believe that there was any evidence of separation of the floor slabs from the north or south shear walls. However, the effect of the cracking would be to reduce the overall stiffness of the building slightly. I accordingly recommended that cracks with more than a width of 0.2 millimetres should be repaired by epoxy injection. In some places this would also assist in weatherproofing the building. On the 19th of October 2010 there was an aftershock of magnitude 5.0. The aftershock was quite shallow being 9 kilometres deep and at 10 kilometres south-west of Christchurch —was quite close to the city. The day it happened, John Drew telephoned and asked me to take another look at the building that same afternoon, which I did. Starting on the ground floor I had a general look around the building including walking up the stairs in the north shear tower. Peter Brown accompanied me on my inspection of the ground floor. I also spoke with the receptionists on the 5th floor. Apart from the two cracks in the north stairwell shear walls being possibly slightly larger, I saw no additional damage to the building. I drew a sketch that reflected the damage I observed in the north shear tower, a copy of which is annexed at attachment 10. In addition, I took nine more photographs which I have numbered 19Oct10 001-009, a copy of which are annexed at attachment 11. Included among these is the fifth floor column in the lift lobby that I had photographed during my initial inspection. As far as I could tell the cracks in this column had not increased in size."

JUSTICE COOPER REQUESTS PHOTOGRAPHS TO BE DISPLAYED

EXAMINATION CONTINUES: MR WESTON

A. The one that is showing on the screen now is correct. It is the correct column and it is the photograph I took on the 29th of September.

JUSTICE COOPER:

Q. What is the —I can't see the red number?

A. 087 5th floor lobby column.

Q. The numbering of the photographs is consecutive from September and the October sequence starts –

A. Starts from 1 again but it's prescripted with the date.

THE COURT ADDRESSES MR WESTON – SEQUENTIAL PHOTOGRAPHS

COMMISSIONER FENWICK TO THE WITNESS:

Q. What we see there is mainly chipping, the plaster having chipped off the column?

A. Yes.

Q. Which is around about a centimetre in width but it doesn't represent a crack going into -- it represents a crack but the crack will be very fine in the concrete?

A. Correct.

Q. Thank you, I'm just raising that because it arose in earlier issues where people were saying they saw cracks of about a centimetre in width.

A. Yes. If you zoom in on that photograph because it's a high resolution photograph you can actually see the crack and it's only a small fraction of the, of the grey surface that you're seeing on the face of the column.

JUSTICE COOPER TO MR WESTON:

Q. Now these photographs are the October photographs, not the September photographs?

A. No, no, Your Honour, these are the September ones that we've got here now.

Q. Well then, I am confused because they've got the numbers 87 and 88 and if you have a look at paragraph 102 of the witnesses' evidence he says –

A. There's a comparison intended in the reference in the third and fourth lines, Your Honour, so refer paragraphs 87 and 88, that's from September and then the photograph –

Q. Yes but the numbers referred to say 1F.7-8?

A. That's right Your Honour because that's from September so he's comparing those numbered 87 and 88 using his numbering sequence –

Q. Yes.

A. – with which he did in September, with what he then did when he came back in October, which is the next photograph if Your Honour wants that one shown on the screen, 1H.34.

Q. So is there only one – I've got it, I think if you look at the white writing. Maybe what has confused me is it talks about similar September '10 photo 088 and I've just gone to the end of that line rather than reading the whole thing. So sorry about that.

QUESTIONS FROM JUSTICE COOPER:

Q. So we're now looking at the photo with the suffix IH.34 which is the 19th of October photograph of the same column?

A. Correct.

Q. So would it be useful if we – Commissioner Fenwick's questions about the nature of that crack, that's true on the 19th of October as well?

A. Yes.

EXAMINATION CONTINUES: MR WESTON

Q. All right, that's enough on that Mr Coatsworth. If you go back to your writing statement of evidence at paragraph 103.

WITNESS CONTINUES READING BRIEF OF EVIDENCE AT PARAGRAPH 103

A. "I emailed John Drew that afternoon confirming my findings and my view that the CTV building remained structurally sound. By this I meant that the capacity of the building to resist gravity and lateral loads had not been significantly reduced. I emphasised, however, that it was inevitable that where cracks had been opened by the initial earthquake, subsequent shocks would work the joints and open them further. I accordingly recommended that arrangements to repair the walls by epoxy injection be made as soon as practical. A copy of this email is annexed at attachment 12. Following my inspection on the 19th of October 2010 I had no further contact with John Drew. I was not requested to provide any further inspections of the building and did not provide any further inspections. So far as I am aware, I had no further contact with anyone in relation to the CTV building prior to the 22nd of February 2011 aftershock. I have been asked to address whether my instructions included a request for any advice on whether the CTV building was safe to occupy and whether or not my inspection amounted to stating this, nevertheless. The answer to the first question is no. To the best of my recollection I was not asked if the building was safe to occupy. However I did state in my report that there were no obvious structural failures. In my email to John Drew, dated the 19th of October 2010, I said that the building was still structurally sound. I did not in either my report or my email recommend that it be vacated. I saw no reason to do so. I considered that with the limited damage observed, the capacity of the building to resist gravity and lateral loads had not been significantly reduced. In my opinion the building performed well in the September earthquake, sustaining only minor structural damage. As an engineer, however, I do not use the term 'safe' because it is too broad and imprecise. It is simply not possible to say a building will be safe under all circumstances. While I understand that a concern has been raised during the Royal Commission's hearings that a layperson might misconstrue a finding that a building had not been damaged as

meaning that the building was safe in this broad sense, it was not my intention to imply this. I have been asked whether in inspecting the building and coming to my conclusions I gave any consideration to: (a) the impact of the September earthquake and any subsequent aftershocks on the structural integrity of the building and, in particular, whether the building's capacity to withstand future aftershocks was diminished as a result, and (b) that in the aftershock sequence there could well be an aftershock of approximately one magnitude less than the September earthquake, that is approximately magnitude 6.1, and the effect that might have on the structural integrity of the building. With respect to part (a) of this question, I did consider the impact of the September earthquake and the aftershocks that had occurred as of the date of my inspections on the CTV building, including the aftershock that occurred on the 19th of October 2010, after my report was submitted. As I have said I submitted a follow up email report to cover my considerations relating to that event. I also considered the effect of future aftershocks as evidenced by my discussion with Dene Cook whose conclusion with respect to the cracks in the shear wall was the same as my own - that the walls should be good for the same earthquake again, although their stiffness might be reduced, leading to a longer period of vibration to the building. It was in part to remedy this reduced stiffness that I recommended the epoxy injections. Given the limited amount of minor structural damage resulting from the September earthquake and given the minimal additional damage that resulted from the subsequent aftershocks up to the time of my final inspection on the 19th of October 2010, I concluded that the capacity of the building at that stage had not been significantly diminished. With respect to part (b) of the above question, I did expect that there would be aftershocks and that one of these might have a magnitude of one less than the September earthquake. What I did not expect (and I do not believe that anyone including the specialist seismologists expected) was an earthquake with the accelerations and resulting forces that accompanied the 22 February aftershock, which were substantially

greater than those of the September event. Having not done any calculations or structural analysis I had no way of knowing how the CTV building would perform in an earthquake or aftershock which exceeded the accelerations of the September earthquake. I have been asked to comment on whether in inspecting the building and reaching my conclusions, I gave any consideration to the following: (a) Any information from GNS or any other source about the likelihood, location and extent of further aftershocks? I was aware that aftershocks were likely. I did not, however, seek out information from GNS or others concerning the likelihood, location or anticipated extent of further aftershocks. As I have said, although I expected aftershocks to occur, I did not expect (and I don't believe other engineers or seismologists expected) an aftershock to have the accelerations of the 22 February 2011 event. (b) Any information from the Christchurch City Council relating to building standards or the inspection of buildings following an earthquake. If so, please provide details of this information. Save for the fact that the CTV building was green stickered, I do not recall having any other information from the Christchurch City Council at the time of my initial or follow up inspections of the building. And (c) Any information from any other party relating to building standards and the inspection of buildings following an earthquake. I was aware of the requirements of the New Zealand Building Code and the various associated designs and materials standards. I was also familiar with the New Zealand Society of Earthquake Engineering document "*Assessment and Improvement of the Structural Performance of Buildings in Earthquakes".* And (d) Whether there had been any structural modifications or alterations to the building since its construction. I was unaware of whether there had been any structural modifications or alterations to the building since its construction. I, along with everyone in Christchurch, live with the consequences of the February 2011 aftershock every day. It would be fair to say that I have re-lived the inspection that I did of the CTV building over and over in my mind wondering whether there was anything I missed or misinterpreted.

I have examined and re-examined the 120 photographs that I took and read and re-read my notes and my report. I have asked myself whether there was anything that I could or should have done differently that might have changed the outcome. In the end, I have to fall back on my professional judgement as an engineer. I have told you what I did, the conclusions I came to and the reasons for those conclusions. In closing my evidence I'd like to offer my sincere sympathies to the families of the people who died in the CTV building that day."

EXAMINATION CONTINUES: MR WESTON

Q. Now Mr Coatsworth, two matters that have come out from the evidence of other people. As I mentioned at the outset we would now need to attend to, and one of these concerns evidence that Mr Drew gave and Your Honour, Commissioners, this can be found in the draft transcript from day 51 at page 62. It may of course change, but at the moment at line, about 9, Mr Drew said that he had a conversation with you on the phone in relation to the demolition of the building to the west of the CTV building. Now you were not present in the hearing when that evidence was given but it's been mentioned to you subsequently that Mr Drew gave that evidence hasn't it?

A. Yes.

Q. And your position in relation to whether you had such a telephone conversation with Mr Drew is what?

A. I do not recall any discussion regarding the demolition of the building next door. In fact, I don't believe I was aware that it was going to be demolished.

Q. And the second and final matter; there was evidence given by a witness about cracking in the lift shaft, and as you have said already you did not get into the lift shaft yourself, so you have not given any evidence thus far about what, or was not, in the lift shaft have you?

A. No.

Q. No. Now having learned that that evidence was given, however, you have since looked at some photographs that you took subsequent to the demolition of the building and up till now these photographs have not been made available to the Commission because you didn't understand what –

JUSTICE COOPER:

Subject to the demolition of?

MR WESTON:

The CTV building, sorry, Your Honour. So the lift well's still standing but the building has otherwise been removed. This is a photograph

JUSTICE COOPER:

The word "demolition" is an interesting one to use but anyway I am with you now, yes.

EXAMINATION CONTINUES: MR WESTON

Q. Now, you took a photo subsequent to the partial demolition of the CTV building didn't you?

A. I did, yes.

Q. And it shows the lift well still standing doesn't it?

A. Yes.

Q. And a copy this morning was given to Mr Zarifeh, and will need to be entered into the Commission's records properly, but in front of you Mr Coatsworth is a copy of this photograph and on it you have hand marked with arrows what you believe to be the two cracks that could be observed, the one on the right-hand side running more or less right up the length of the lift shaft, and then one on the left up near the top of the lift shaft?

WITNESS REFERRED TO PHOTOGRAPH

A. Yes.

Q. That's a quick summary?

A. Yes.

Q. And your opinion of what these cracks might be is what?

A. I believe they're something to do with the construction of the building. You can, um, on the line that actually -- and I wouldn't describe it as a crack, um, cracks don't form in a straight line like this, um, but on the photograph you can actually see little black marks, little black dots all the way up the line, um, which I interpret as being she-bolt holes which were used with the -- for the holding the formwork in place during the construction of the building.

JUSTICE COOPER:

We can't make much of this, I'm sorry Mr Weston. We can't really see it.

MR WESTON:

No, and indeed Your Honour, I'm not quite – presumably you've just been given the one Mr Zarifeh had have you?

JUSTICE COOPER:

We have just been given something which looks like this but as to discerning, well, I am speaking for myself, I am simply not following this evidence.

MR WESTON:

Perhaps, and this may be simplified if the copies of the photographs in front of Mr Coatsworth could now given to the Commission as the handwritten arrows appear on those and they may not appear on the one that Your Honour has.

JUSTICE COOPER:

Well, I have something that looks like, no; there is nothing that really fits the description of a handwritten arrow on this.

MR WESTON:

Well hopefully this may now clarify. The first photo should be a copy the same photograph that Your Honour, Commissioner Fenwick, will have had and then the second one is an enlarged version of a portion of that.

JUSTICE COOPER:

There are three? How many photos are there?

MR WESTON:

There are two. Mr Zarifeh, Your Honour, had a copy of one which is the large scale version if I can call it that. And then there is a second one which is an extract, as it were, of the same photo but an enlarged version taken near where the lift car can be seen with the counter balance on it.

COMMISSIONER FENWICK:

Well my understanding was those cracks were measured at 0.3 to 0.5 millimetres in width. I think it was – trying to remember. Was it Graeme Smith who measured, went in and measured them?

MR WESTON:

I understand it was Mr Smith, Sir, yes.

QUESTIONS FROM COMMISSIONER FENWICK:

Q. And he tracked them the whole way up the tiles. I am still wondering if you think that lines up with your theory of attachment to boxing? He was very definite and he was looking at this in terms of the cost of sealing them, so he would need to have some idea of the width. He was quite definite. He went up and measured in, in the lift.

A. My concern was that the picture was painted of this crack running all the way up the height of the shear wall, um, in my experience a crack formed by, well I don't think earthquake loads would form a crack like that anyway, but if it had been by some outside chance the result of

earthquake loading. It I, you know, it just would not have formed in a straight line like this.

Q. You are familiar with the general shape of the core outside the building and the fact that the toilet area was where the shear can be transferred into that core?

A. Yes.

Q. So do you consider this could have been a sort of warping of that core due to the eccentric nature of the loading going into it?

A. I don't believe it would have failed in a dead straight line. That was what he described I think, wasn't it? He talked about it being a metre out –

Q. Yes.

A. – from it, in fact, two cracks –

Q. Two cracks, one (inaudible 11:12:07)

A. – being a metre out from the wall and another one a metre and a half out from the wall.

Q. That's correct.

A. My interpretation is that they would've been construction joints or some blemish in the formwork as it was lifted up each storey. But having said that, I didn't go inside the lift shaft.

JUSTICE COOPER ADDRESSES MR WESTON – ELECTRONIC VERSIONS OF PHOTOS INCLUDING ARROWS

MR WESTON:

I wonder Sir whether it would be sensible whether we can perhaps just have the two photos that are, as it were, are the official set. Call one A and the other B. B will be the blown up version of the segment. I will write that on it. Other than attending to that homework that would be substantially what I was intending to cover with Mr Coatsworth. Can I make one clarification which led to the confusion over paragraph 94 where I said the reference here, which is written in as attachment 2, should be attachment 3. The reason I confused myself Sir is the version that up till yesterday was the one in front of the Commission had it the other way round, so when I said to you at the outset

that the only changes that had been introduced by this new version of Mr Coatsworth's brief were to put in the references was not strictly true. The error that was there also got tidied up and I hadn't –

JUSTICE COOPER:

Which paragraph?

MR WESTON:

In 94, Your Honour. You may recall you said to me that was the one I tried to clarify and it turned out that I was making the hole bigger. The reason I had made the hole bigger was the change had already been made and I hadn't caught up with that.

1115

CROSS-EXAMINATION: MS FRAMPTON – NIL

CROSS-EXAMINATION: MR REID – NIL

CROSS-EXAMINATION: MR PALMER

Q. Mr Coatsworth, as I understand it, you were out of New Zealand on the 4 September earthquake?

A. Yes.

Q. And you didn't return until the 19th of September did you?

A. Correct.

Q. During that period there were several magnitude 5.0 and above earthquakes, of course you missed them all by not being here. As I understand it from the records that are going to be introduced into evidence by either Mr Rogers or Mr Mander, after your return from overseas, in the period up until when you did the inspection on the 29th of September, there were no magnitude 5.0 or above earthquakes in the CBD or in Christchurch at that time. Would you accept that from me or would you like me to show you the records?

A. Well, I don't know the answer but I accept it from you.

Q. So when you came to inspect the building on the 29th of September you had really not experienced the nature of the shaking experienced in Christchurch up until that period had you? You hadn't personally experienced it?

A. I can't remember. I presumed there were earthquakes between the time I returned and my inspection of the 29th of September. Is that, is that correct? There were earthquakes?

Q. Yes there were earthquakes but not significant ones.

A. Okay.

Q. You're employed by CPG, that's as I understand it a part of a Downer EDI, a global firm with some 3500 employees and the CPG subsidiary is a multi-disciplinary practice as I think you've said in your evidence with a range of engineering and other disciplines?

A. Correct.

Q. And, indeed, you've just said in evidence that you discussed many of the issues with your colleagues in Auckland and Dunedin before you completed your report. I'm interested in how you came to inspect the CTV building. Had you worked for the CTV owners before?

A. No.

Q. When you returned from overseas on the 19th of September were you directed in some way by your employers to make proposals to parties in relation to earthquake assessment and repair work?

A. Yes we were offering services, yes.

Q. So can I take it from that that you made it your business to approach the CTV building manager and/or owners and others with a view to offering your services?

A. I can't remember that, I do not know the answer but another option, another alternative, might have been that somebody from the CTV building or ownership or tenants or whatever had contacted our office and the enquiry had come to me. That line of approach wasn't uncommon.

Q. It's just that your evidence talks about speaking with Mr Drew at the outset but, it – you don't make it clear about whether he called you or you called him and I was just wondering how that came about?

A. I don't know the answer to that.

Q. You certainly hadn't worked for the CTV owners before had you?

A. No.

Q. Now having spoken to Mr Drew you then followed that up with a proposal, a possible damage inspection which you called a proposal and that's your email of the 24th of September isn't it?

A. Yes.

Q. Now if you could just please bring that email up? It's document 1A, there it is there on the screen. The language that's used in this is interesting. I note that you start off by referring to Mr Drew's interest in an independent structural assessment in the first paragraph which will involve I think in the fifth paragraph, what you call a thorough inspection of the building. In that same paragraph you go on to mention that structural and architectural drawings of the building would be very helpful for an understanding of the structural systems within the building. You would say that you would then consider the information obtained to determine if there were any patterns to the damage observed that might explain any deficiencies in the performance of the building. However what's missing here is the scope of the report that you're proposing here in your email of the 24th of September. It doesn't appear to include and, it specifically doesn't include, any analysis of the structure although I accept you noted that if significant structural damage was found it would ultimately be necessary to carry out structural analysis to determine strengthening and repair work, and for that you estimated some $3000 plus GST which you considered would be a reasonably detailed inspection and you would prepare a report which would be useful to the owners.

JUSTICE COOPER:

You are coming to a question are you Mr Palmer?

MR PALMER:

I am just putting, the question is about to come.

CROSS-EXAMINATION CONTINUES: MR PALMER

Q. So with all of that, and, am I correct that you were very careful not to pitch this work as the performance of a structural analysis?

A. Yes.

Q. If it wasn't going to be a structural analysis would you have used the drawings solely to, if you had them, the drawings and plans, solely to orientate, orientate yourself to the building in terms of its structural elements?

A. Yes.

Q. Now you've said that those plans were not made available by Mr Drew and you couldn't, on your enquiries, get them from the City Council? Did you consider approaching the design engineers?

A. I didn't know who the design engineer was.

Q. Did you ask Mr Drew?

A. I believe I did.

Q. And he didn't know either?

A. No.

Q. Did he make his files available to you?

A. No.

Q. You gained an understanding of the structural elements of the building and you've given evidence about that. Are you confident that your understanding of the structural elements was as good as it could be had you had the structural plans available to you?

A. By my inspection I gained a general understanding of the structural systems of the building. I didn't have any details.

Q. Did you make any enquiries about alterations that had been made to the building?

A. I don't recall.

Q. Did you make any enquiries about the loadings of the building relevant to its occupancy?

A. What do you mean by that?

Q. Well did you make an assessment of where the heavy loads in the building were located?

A. To my knowledge this was an office building and it had, I don't believe it had any significant floor loadings in any particular area.

Q. You're aware that there was a language school in the building?

A. Yes.

Q. Did you ask how many people would be in that, on that floor at any one time?

A. No.

Q. So, as I understand it and correct me if I'm wrong, what you were proposing was an independent structural inspection but without any analysis of the structure? Is that correct?

A. Yes.

Q. Now there was no, you've said there was no letter of engagement other than the 24 September email? So it must be correct then that the work that you did was really governed by what you proposed to do rather than what you were asked to do?

A. I suppose that's fair comment.

1125

Q. And the parameters that you were working to, were those set out in your 24 September email that we have just looked at?

A. Yes.

Q. Now when Mr Drew gave evidence on Monday, he said that he told you, well, he said that it was incredulous to him if it wasn't part of the discussion that he might have had with you, and this is at day 51, page 14 at lines 8 and following, he said it would be incredulous to him that he did not ask you to give a report that would ensure that the building was safe to occupy. Do you recall a discussion about that?

A. I don't recall being asked if the building was safe at any time.

Q. Could he have said that to you?

A. I don't know if he did. I would have said, well, I would have gone through what I have said in my brief of evidence that, you know, that as an engineer, I wouldn't say it was safe.

Q. I think he added that he asked you also to identify for him what repairs and investigations were required as part of that objective?

A. Mmm.

Q. Can you recall that discussion?

A. Well I made the offer in my proposal to briefly outline what repairs I thought were appropriate and Mr Pagan who, from the quantity surveyors who accompanied me around the building, was to schedule those works and I believe to get an estimate of cost.

Q. So in effect you gave a report which identified repairs that considered necessary, but you did so without undertaking or performing a structural analysis. Is that correct?

A. These were damage repairs I was talking about, not strengthening of the building works.

Q. In your evidence you then – when you went about the task you say that the building was green stickered, you don't in paragraphs 25 and 26 of your evidence, when you say that right at the end of 25 and at the beginning of 26, you don't say whether you were aware at the time that the building was green stickered. Can we just clarify that, were you aware at the time that the building was green stickered?

A. I believe so.

Q. What are the grounds for that belief?

A. Um, I may have seen the sticker on the building, I do not recall.

Q. So you don't recall whether you did or you didn't?

A. No.

Q. And would that apply to both level 1 and level 2 assessment stickers. You don't know whether you did or didn't see them?

A. I don't know.

Q. If the building had been red stickered would your approach to your investigation have been different?

A. If it had been red stickered?

Q. Yeah, if you are aware that it had been red stickered?

A. I believe so, yes.

Q. Would you have been more careful?

A. I don't think careful is the right word for it. It would have been a different investigation. I would have known that that building had been seriously damaged if it was red stickered and so it would have warranted a different type of investigation.

Q. Would you then have proposed or recommended that you carry out a structural analysis?

A. Yes.

Q. When you spoke to the tenants as part of your inspection, do you recall how many tenants you spoke to?

A. Not specifically.

Q. Do you recall – you don't recall any conversations either do you with them?

A. I recall the lady on the top floor making the comment that the building moved quite a bit and I recall not the exact words but the essence of what the Kings Education people were talking about with regards to floor deflection.

Q. Did Mr Drew –

A. And Mr Brown of course who as tenant was with me and John Drew and Leonard Pagan –

Q. I was going to ask –

A. Around the first floors and second floors.

Q. – was Mr Drew with you throughout the inspection?

A. Basically, yes.

Q. So you walked around as a group of four did you?

A. Um, I think Leonard Pagan made a comment in his evidence that I had been off looking at something somewhere but primarily John Drew stayed with me virtually all the time.

Q. What were your expectations of Mr Drew once you had completed your inspection and provided your report? Did you expect he would action it?

A. Ah, yes.

Q. Did you have any – did you find him somebody that was knowledgeable about the engineering issues that you were considering?

A. Um, he – I believe he understood what I was saying.

Q. Your report doesn't specify any timing for the carrying out of the repairs but did you have any discussion with Mr Drew about the timing of the repairs that you were recommending?

A. Well my understanding was that Mr Pagan was going to prepare the schedule of damage because my report only talks generally about damage, it doesn't actually quantify or, you know, the actual length of cracking or the quantity of plasterboard that needed to be replaced or the length, the total length of an epoxy injection that was required and he was going to do that and I believe provide an estimate of cost, which would then have led to requests for contract prices.

Q. So as you went about your inspection without – and making it very clear at the outset that you weren't undertaking a structural analysis – is it fair to say what you were really looking for was damage requiring repair?

A. Yes.

Q. So you set the parameters to look for the sort of things that you have identified in your evidence and I think you have mentioned cracking in the structural concrete and other surfaces, evidence of alignment divergence, settlement separations between the structural elements and so on. Considering those issues that you were looking, which is really an observation inspection, is it fair to say that you really weren't able to observe the building with the sophistication that you might have had if you'd had the structural drawings?

A. I think, as I said, I was able to identify the elements of the building but I didn't have knowledge of the details of – hidden details.

Q. And equally same question, would your inspection have had more sophistication if you had knowledge of the Council file as regards consents given to the building and other work that might have been carried out on it in the period since its design and construction?

A. Sorry, I am not aware of work being carried out?

Q. Well you didn't have the Council file, did you?

A. No.

Q. You weren't aware of any consents that were given for the occupation of the building, were you, or for any repair work?

A. No.

Q. If you had that material would you have approached your task differently?

A. I believe that what I saw was a good representative, representation of the structural elements in the building.

COMMISSION ADJOURNS: 11.35 AM

COMMISSION RESUMES: 11.51 AM

CROSS-EXAMINATION CONTINUES: MR PALMER

Q. Mr Coatsworth, what do you recall of the occupancy of the various levels when you did your inspection? Can you just run through each level as to what you observed the tenancies to be?

A. Ground storey and the first floor were CTV.

Q. Was that fully occupied?

A. I think it was reasonably fully occupied.

Q. Second floor or the third floor rather, level 3?

A. Bit confusing the difference in –

Q. I think we've been using ground floor as level 1, top floor as level 6, so if levels 1 and 2 were occupied by level, by CTV, level 3 should have been the vacant floor. Is that your understanding?

A. Possibly, I couldn't say that categorically.

Q. You went in –

A. And I think Kings Education was on the next floor up.

Q. Yes.

A. And –

Q. What did you find on level 5?

A. That's Kings Education level as you're describing it is it?

Q. I think that would be the 4th floor or level 5 would be Kings, above that would you have found Mr Drew's office? On level 5?

A. I don't believe I knew that Mr Drew had an office there.

Q. What did you, what was the tenancy in level 5?

A. I can't remember.

Q. And level 6, you'll recall that was the Relationship Services? The top level.

A. Yes.

Q. And some of it was vacant, do you recall that?

A. I think that's right.

Q. Did you have access to the entire building? Did you go through all the tenancies?

A. I believe so.

Q. Your evidence says that you didn't look at any GNS records. Did you look at any other seismic records as part of your inspection?

A. With regard to?

Q. To the accelerations that might have been experienced on the CTV site?

A. I don't recall.

Q. When you went about your – just, this is drawing upon evidence given by others in the hearing – when you went about your inspection did you see any holes drilled in the beams or the floors for services or otherwise?

A. Possibly, but I don't specifically remember.

Q. Did you see any indication of concrete that you might have during your inspection have considered to be substandard?

A. No.

Q. Now I'm going to ask you a few questions about the extent of your inspections and I'm going to refer you to a few photographs relating to various aspects of the building. I'm going to start with the columns. You say, I think now in your evidence you've clarified that you saw every column on every floor?

A. I think that's true.

Q. So that implies that you had full access to the entire building doesn't it?

A. Yes.

Q. As to the beams you only mention, as I read your evidence at paragraph 58, you really only mention one beam specifically and you say that that beam required an epoxy injection on the 1st floor, level, which is level 2? I just want to ask you what other beams were inspected by you, that you can recall?

A. I was able to see the interior beams under the 1st floor, under level 2.

Q. There was no ceiling panels there were there?

A. Correct. In the studio and in the garage, and I was able to see the perimeter beams around the perimeter of the building at every level.

Q. And on, above, on other floors, do I take it that you didn't make a comprehensive inspection of the beams and you said you did with the columns?

A. Apart from the ceiling tile that I removed from the 2nd or 3rd floor lobby, depending on which system you're talking about, lift lobby.

Q. So would it be fair to say from that that apart from the areas that you've described on the accessible on the areas where beams were readily accessible you looked at a very, very few beams?

A. I think when you, if you add it up, it's probably half of the beams on every floor and more than that on the, on level 2.

Q. So that again implies, and correct me if I'm wrong, that if you looked at half the beams on every floor you must have gone into the ceiling on many, many occasions on the levels above level 2?

A. Must have, sorry?

Q. You must have gone into the ceiling panels to inspect the beams on levels 3, 4, 5 and 6 on 30 or 40 occasions?

A. No, the reason I make that statement is that the perimeter beams were visible.

Q. Ah, but what about the internal beams?

A. Not visible.

Q. So –

A. Without removing the ceiling panels.

Q. So you needed to remove ceiling panels to see the internal beams. Can you give us an approximation of how many times you did that on levels 3, 4, 5 and 6?

A. Just the once at the lift lobby on level 2 or 3.

Q. On level 2?

A. Mmm.

Q. And that beam that you looked at you saw required epoxy injection for the cracking?

A. No, that was a different beam.

Q. Different beam? And where was that other one that required the injection?

A. It was on the north side at level 2.

Q. So just to be clear, above level 2 you looked at one beam? You went into the ceiling panel to look at one beam, as I understand it?

A. In the internal –

Q. In the interior?

A. – in the interior of the building, yeah.

Q. In your evidence at paragraphs 72 and 73 you make reference to the removal of three ceiling panels to inspect the floor beam connections and also at paragraph 75 in relation to the level 3 lift lobby. Can I take it that that really was the extent of your review of the floor beam connections above on level 3 and above? In the internal beam floor connections?

A. Can you repeat the question?

Q. Well, you've told us that you didn't inspect the beams with one exception, on the internal, in the internal area of the building on levels 3, 4, 5 and 6. I'm assuming from that that equally you didn't inspect the beam, the floor beam connections in that same area internally, levels 3, 4, 5 and 6? That's correct?

A. Correct.

Q. For those floor beam connections that you did see, did you see any delamination of the steel deck trays from the concrete which sat on it?

A. No.

Q. Could I take you please to one of your photographs? I think it's photograph number 30, which is COATSWORTH1.C10. This is in the 2nd floor lift lobby. The photograph's on the screen in front of you.

A. Yes.

1201

Q. Who made the hole in the gib above the ceiling panels? Was that you so that you could undertake the inspection?

A. No.

Q. That was already there?

A. Yes.

Q. And looking through that hole there's an arrow which appears to be in pencil or something like that. Did you make that mark?

A. No.

Q. Just while I'm asking you, you refer throughout your evidence to gypsum plaster. Is that what we would commonly refer to as gib board?

A. In this photo it's gib board? What I would call gib board.

Q. So what's the difference between gib board and gypsum plaster?

A. The gypsum plaster was a reference to the lining in the stairwell which was a thin coat of gypsum plaster that was plastered on, trowelled onto the concrete, straight onto the concrete.

Q. Right, and in that photograph just while we have it, the arrow appears to be pointing to something. It looks to me like a wavy crack. Can you recall what you saw when you looked into that cavity?

A. Not specifically but I thought it was grout from the, um, concrete topping on the slab that had, um...

Q. Did you get up on a ladder to have a close look?

A. Um, I believe I was on a ladder.

Q. If I could just now turn to beam column joints. In paragraph 59 of your evidence you say that you removed ceiling tiles from several locations and could observe the joints in areas where there was no suspended ceiling. I just want to be clear about what you looked at. Given you've told me that you really only looked at one beam floor connection in the levels above level 2, that's on levels 3, 4, 5 and 6?

A. One internal –

Q. On the internal area of the building, not the perimeter. Am I also correct in my assumption that in that area you looked at no more than one beam column joint?

A. Ah, yes.

Q. For the rest of the building where you could see the beam column joints and here I assume we're talking primarily about levels 1 and 2 occupied by CTV and possibly the perimeter although I'm not sure, approximately how many beam column joints did you look at?

A. Well it did include all of the perimeter joints.

Q. Did it include all of the beam column joints on levels 1 and 2?

A. Virtually, um, virtually all of them on level 1 yes, ah, on level 2 yes, sorry. The total number of joints that I saw, um, -

Q. It might help if document 486 -

QUESTIONS FROM JUSTICE COOPER:

Q. Are you in the middle of composing an answer?

A. Yes.

Q. Just let him answer.

CROSS-EXAMINATION CONTINUES: MR PALMER

A. I would say in the order of 70 joints.

Q. That you would have looked at and probably about 50 that you didn't?

A. I haven't counted those, but maybe.

Q. And your evidence has been that you noticed no significant damage. What did you anticipate the internal structure of the beam column joints to be, given that you didn't have any plans?

A. I assumed it would be a standard type of connection with, um, reinforcing steel continuous through the column, top and bottom of the beam and with shear reinforcement in the column joint.

Q. In paragraph 60 of your evidence if I could just take you to that. You say here that you saw no evidence of anything other than occasional minor structural damage to the columns and beams, indicating that the steel in the columns and beams had not yielded and that the integrity of the beams and columns had not been compromised. Could I now just take you to some photographs. Could you please bring up the Coatsworth photos 1F, 7 and 8. Now we've seen those photographs before when Mr Weston was leading your evidence. My understanding, and if you could just please confirm, these are the photographs that you took during your initial inspection on the 29th of September. Is that correct?

A. Yes.

Q. And that's a photograph, as I understand it, of column 18 on the top floor?

A. On the top floor in the lift lobby.

Q. In the lift lobby on the eastern side. Is that correct?

A. Yes.

Q. Now when you took those photographs you'll note if you look at the photograph on the left on the beam that joins the column you can see some minor cracking just immediately above the column to the left on the beam?

A. Yes.

Q. Would I be correct in assuming that if there had been significant additional cracking on that beam you would have taken a photograph of it?

A. Yes.

Q. If you could bring up now please photograph 1H34 and, likewise, this is, as I understand it, your photograph taken on 19 October, correct?

A. Yes.

Q. And again, if you'd noticed significant cracking in the beam would you have taken a photograph of it?

A. I believe so.

Q. Now could you please refer to photograph MAD2490454. Now I'm focusing here on the photograph on the right. This photograph of the evidence has been that this photograph was taken by Mr Higgins when he went to the building in February 2011 and you'll see the circled area which I think is his circle. He's circling a crack in the beam. Can you see that there?

A. Yes.

Q. Did you see that crack in the beam when you were inspecting the building?

A. No.

Q. If it had been there can you make an observation about whether you would have taken a photograph?

A. I believe I would have.

Q. Now turning to the south shear wall which you deal with at paragraph 60 –

A. Excuse me. I think in that same photo you can also see the original damage that I photographed.

Q. Yes you can, and I think your evidence has been that was observed by you. So is that the case? You saw that original cracking and you considered that there was no significance to it?

A. Yes.

1211

Q. Now at paragraph 61 and following you deal with the south shear wall. In paragraph 62 you say what you're looking for, which is cracks in the coupling beams and you say that you found no evidence of this. At 66 of your evidence you say you noticed fine diagonal cracking in the gypsum plaster on the inside of the first floor. Just to be clear, is that what we would call level 2?

A. No. Well I don't think so. Which – you're talking item 66 are you?

Q. Well paragraph 66 you say that you found some fine diagonal hairline cracking on the inside of the south shear wall at the first floor level of the building and I just want to be clear?

A. And it's not the ground storey, that's the storey above.

Q. So that would be what we would refer to as level 2?

A. Yes.

Q. And also you found cracking on the ground floor in the plasterboard lining, that is also what you say in paragraph 66?

A. Yes.

Q. When you refer to "plasterboard lining" do you mean what I was referring to before, gib board?

A. Yes.

Q. Like we saw in the photo? How many floors did you inspect internally for damage on the south shear wall coupling joints?

A. Just one I believe.

Q. Well you've referred to two here?

A. Oh, yeah.

Q. So you're referring to levels, the ground floor level, level 1 and level 2?

A. The ground storey and the one above, yes.

Q. And you didn't inspect the coupling joints on the floors above?

A. Yes.

Q. You did?

A. Yes.

Q. Sorry, you said before you didn't but -- so you went to each coupling joint on each floor and inspected it. Were they all covered by plasterboard?

A. The ground storey was the only one that had plasterboard across it. All the other storeys had the gypsum plaster, a thin skimmed coat of gypsum plaster.

A. And on those other floors, presumably because you haven't mentioned it, you didn't notice any damage?

Q. Correct.

A. I take you now to photograph 75 which is 1E15?

WITNESS REFERRED TO PHOTOGRAPH 75

Q. Now this is identified as being the third floor fire escape. That would be the level 4 fire escape in the hearing language, would you agree with that?

A. I guess so.

Q. So that crack that's under somebody's foot, that's on the inside face of the south shear wall isn't it?

A. Almost.

Q. And is that crack immediately above the coupling beam for the level 4 floor?

A. Yes.

Q. Now I'm only referring this to you because the evidence has been from Mr Frost and Mr Heywood that, and I don't know whether this is right or not, but there has been a suggestion that the floors might've separated from the south shear wall before the south shear wall fell on them. Could this crack be significant to such a scenario?

A. This sill, so to speak, outside the door was plastered, um, so I believe it was a crack in the plaster, um, I also think that if there was separation going to be going on it would be at the line of the inside of the shear wall not part way up through the thickness of the shear wall.

Q. You mean by that, I assume, that you would expect to see a crack, if you could see it under the carpet rather than on the exterior, is that right?

A. Um, yeah, or along the line of the frame.

Q. You didn't look under any carpet did you?

A. No.

Q. Is there anything else you would like to say about that before we leave it?

A. I think that if there was separations going on here that there would've been other telltale signs as well. Um, you know, like skirtings would've been separated from the walls, um, door frames butting into the, into the back of the shear wall would've been separated.

Q. But you didn't notice any of that?

A. No.

Q. Anything else before you leave it?

A. Not that I can think of.

Q. I'd now like to turn to the north shear wall. In summary of that evidence my understanding is that you saw some cracking but none of that cracking indicated to you any structural failure. Is that correct?

A. Yes.

Q. You refer at paragraph 45 of your evidence to cracks in the bathroom of somewhere between 0.2 millimetres and 0.3 millimetres in the gypsum plaster. Do you recall that evidence?

A. Yes.

Q. If these cracks had opened up during the 4 September earthquake or any aftershocks, is it possible that the heavy load of the building could've closed the cracks up again so that they were relatively small?

A. This is the cracks in the shear walls you're talking about?

Q. Yes?

A. I think that's unlikely.

Q. What about more generally, any other cracks that you saw that might've been opened and closed due to the weight of the building, would you accept that that's a possibility?

A. I think you would see more damage.

Q. Dealing with both shear cores, if I could just bring up photograph 1C.5? I think this is photograph 25.

WITNESS REFERRED TO PHOTOGRAPH 25

Q. You can see there some cracking between the columns and the plasterboard wall. I think your evidence at paragraph 57 if you want to check it talked about distortion of the internal wall linings of some seven to eight millimetres?

A. What paragraph?

Q. Five seven, 57. "In a number of places I observed gaps of approximately seven to eight millimetres at ceiling level between the plasterboard wall and structural columns." My first question is, is this photograph showing the sort of cracking that you're referring to there in your evidence?

A. Yes.

Q. Would you accept from me that to see cracking of that dimension, that that would indicate inter-storey drifts of the building of at least some 10 millimetres?

A. I don't know about the amount.

Q. You also refer to unrelated to this photograph, that there was cracking in the ground floor southern shear wall and you recommended inspection of that. What did you anticipate was the cause of the cracking?

A. In the shear walls?

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Q. Mmm?

A. Earthquake loads on the structure.

Q. You recommended further inspection but you never undertook that further inspection did you?

A. No.

Q. Are you aware of whether anyone else did?

A. No.

Q. In paragraph 90 of your evidence dealing with a different topic, windows, you say that you observed there was one broken window

on the east wall of the third floor, most likely due to the earthquake and the rubber seal had come loose on another east wall window at the ground floor and then you say, "I observed no other damage to the windows." Now if I could just refer you please to Mr Reynish's evidence and if you could please bring up the Reynish witness statement, he is a painter at -- it is REYNISH.0001 at page 3.

WITNESS REFERRED TO REYNISH.0001 PAGE 3

Q. Now Mr Reynish's evidence the he went to the building in mid February and under that heading of, "Windows," if you just read to yourself those paragraphs 9 through 11?

A. Yes.

Q. Now if you also - now could you please bring up photograph 5 and 6 if that is possible to do both together or pages 5 and 6.

WITNESS REFERRED TO PAGES 5, 6

Q. Here Mr Coatsworth, Mr Reynish's evidence was that the cracking he observed in the windows is where he has marked the X's on level 6 on the eastern side of the building and he has given a diagram figure 1 on the right-hand side showing the movement between five and 10 millimetres at the bottom and 20 millimetres at the top of the window. Firstly, did you make an inspection of these window areas on level 6?

A. Yes, I believe I did.

Q. And given what you have read about his evidence that he saw these gaps opening up between the windows, window frames and the columns, do you recall seeing something similar or anything similar when you inspected the building on 29 September or 19 October?

A. No. Can I add something to that?

Q. Yes?

A. I do not understand Mr Reynish's evidence. He talks about the windows being in the concrete frame of the building, in fact, the windows were inside the concrete frame, they were – the columns were outside the line of the window so the column to the windows did not abut against the columns at all.

Q. Okay, thank you for that. Is there anything else you want to add?

A. No.

Q. In summary, given the way you approached the inspection in particular of the beams, the beam floor connections, the columns, the beam column joints, would you accept from me that you inspection was really primarily focused on what you could easily see on levels 1 and 2 where there were no, where an absence of ceiling panels and around the parameter of the building?

A. No I wouldn't accept that.

Q. But you didn't go into the beam column joints and the beam floor connections or the beams in the internal areas of the building, did you?

A. With the exception of that one tile that I lifted.

Q. So you didn't while you looked – you say, your evidence has been that you looked every column, you didn't look at every beam column joint or every beam, did you?

A. No.

Q. If you had, what do you think -- what do you now think might have been there to be observed that you might have missed?

A. I don't think there would have been any significant damage.

Q. That deals with your inspection, I am now going to deal with your report, and we have established that you were essentially preparing an engineer's observation of damage report, in fact it's – you'd accept that wouldn't you?

A. No, I probably said the wrong thing when I agreed to your statement earlier on. It wasn't a damage inspection this was an assessment of the building.

Q. It wasn't a structural –

A. The damage -

Q. - analysis was it?

A. No it wasn't a structural analysis, but it was an assessment of the building and the damage report was a part of that.

Q. What did you expect the outcome of your work to be?

A. The outcome?

Q. Yeah, what did you expect would happen with your report?

A. I expected that Mr Pagan would have quantified the damage that I reported and that he would have – and the contracts would have been arranged to repair it.

Q. Did you expect to be involved in that repair work as engineer?

A. Yes, yes I did.

Q. Would it be fair to say that prior to doing your report you didn't expect that to be the end point of your engagement?

A. Prior to doing my report?

Q. Yeah?

A. I guess that's hard to answer because I didn't know what my report was going to say prior to repairing it.

Q. Did you expect that you might be called back for further inspections if there were any further aftershocks?

A. Well I was, in fact, called back for one.

Q. Yeah. But did you expect that when you prepared your report?

A. It didn't come as a surprise.

Q. Did you ever contemplate before, during or after your investigation and report that the result of your work might result in closure of the building?

A. Um, I don't know that I speculated on that at all but if I had seen anything to warrant it I would have closed the building, yes.

Q. Before you did your inspection and report did you expect that that was a likely outcome?

A. Before I did my inspection and report?

Q. Yes?

A. I don't think I had any expectation.

Q. Well, didn't you expect it to be a damage report which, indeed, it ultimately proved to be?

A. Sorry, say that again?

Q. Didn't – wasn't your expectation that you were going to give a report on the damage the building had suffered?

A. No.

Q. Well that is what you said you were going to do in your proposal, that's, what you did, isn't it, you prepared a damage report?

A. Yeah it was an assessment of the building that included reporting damage.

Q. Now in your report you made a few repair recommendations, you recall those?

A. Yes.

Q. You recall, and I won't go through them all, but there was the injection of epoxy in certain areas, removal of spalling plaster which we've discussed this morning already. There was some treatment of steel corrosion on the north-west corner and there was some investigation and repair suggested for the western wall, for the sealant. After you gave your report to Mr Drew on the 8th of October and before you returned to the building on the 19th, did you follow up with him in any way as to how your recommendations were to be carried out?

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A. I don't have a specific recollection of it but I believe that he was reported as saying that I talked to him about concrete repair people and it's possible.

Q. Okay, so to answer my question, are you saying that you don't have any specific recollection of any contact with Mr Drew in relation to your recommendations?

A. I can only say I think it's likely.

Q. But you don't have any recollection, is that right? It's not a hard question. You either have the recollection or you don't.

A. Mmm, I'm just trying to remember whether I did or didn't. What were the dates you mentioned after the report?

Q. After your report until the 19th of October. If I just put it in context, you've told us very clearly in your evidence that after the 19th of October you didn't have anything more to do with the building, I'm just wondering what you might have done in relation to the building

A. Well I accept that I probably discussed with John Drew the repair, the names of the repair people.

Q. I don't want to labour this. I'm not putting any proposition to you. I'm asking a very open question, did you or did you, do you or do you not recall having had any further involvement with the building between the 29th, between the 8th of October and the 19th of October? Don't feel you have to give me an answer that you're not comfortable with, either you did, or you do or you don't recall?

A. I think to answer that question I'd want to look back on my diary and so on.

Q. So, just to round this off, can we take it that you can't recall anything specific, but if you looked at your diary you might remember something?

A. Possibly.

Q. Before you completed your report your evidence at, I think paragraphs 95 and 96, is that you spoke to several people about your report?

A. Yes.

Q. Several people about many aspects of your report? You said that you did that by way of peer review but it wasn't really a peer review was it? In the conventional sense? Correct?

A. I believe it was.

Q. Well really what you were doing here is seeking guidance wasn't it as to the tentative conclusions that you'd come to?

A. Is that not a peer review?

Q. Well –

JUSTICE COOPER ADDRESSES MR PALMER:

Q. I'm not sure we're going to be concerned about whether it fits some precise definition of peer review, are we?

A. No, we're not.

Q. Because what he says in paragraph 95 is, “This form of peer review is useful.” So he regarded it as a form of peer review.

A. I'll side-step this.

CROSS-EXAMINATION CONTINUES: MR PALMER

Q. What is what you call a peer review? I'm just wondering why you felt the need to go to so many people before you concluded your report and, perhaps it appears to me, and you correct me if I'm wrong, that you did so because those aspects of your report you weren't entirely comfortable with without speaking to somebody with further knowledge, is that correct?

A. I wouldn't say that, no.

Q. When you completed your report you were working on the general observations that you had about the nature of the building, whatever information you did have access to about the 4 September earthquake but not including seismic records and your report then deals specifically with your observations and repair recommendations. Why didn't you include cautions about the limitations of your report, in particular about not having – about the value of your report without having sighted structural plans?

A. Well I thought I did say that.

Q. You didn't include a recommendation to carry out further investigations when the structural plans might become available did you? Did you have a discussion with Mr Drew about the desirability of doing so?

A. I had no expectation about when the drawings would be available. I think the answer, sorry, repeat your question?

Q. Well, did you have a discussion with Mr Drew about the desirability of carrying out further assessment when the structural plans became available because I don't see it in your report?

A. No I don't think I did.

Q. What about if there were to be further earthquakes or aftershocks did you give any recommendations about the action that Mr Drew or

the owners should take? I don't see it in your report so did you do it in some other way?

A. No.

Q. Your report is what it is which is a damage report, it's not a structural analysis. Did you, it's not included in your report so did you suggest to Mr Drew that a full and proper structural analysis should be undertaken in the period following provision of your report? Did you make that suggestion?

A. I made that suggestion in my proposal.

Q. Okay, but not in your report?

A. No.

Q. Did you speak with Mr Drew or the owners about – again, it's not in your report, the timing of the repair work that you'd recommended? Did you give it any urgency or priority?

A. I think I said as soon as possible.

Q. Did you, it's not in your report, did you say that to Mr Drew?

A. I actually said as soon as practical.

JUSTICE COOPER:

Q. In the report?

A. In my email of the 19th of October.

CROSS-EXAMINATION CONTINUES: MR PALMER

Q. In paragraph 107 you make it clear that you weren't asked to consider whether the building was safe to occupy, you say, "To the best of my recollection I was not asked if the building was safe to occupy." Now as I understand your report you don't make any comment specifically about its safety for occupation, do you?

A. No. I think that's right.

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Q. But instead you use language that might suggest it's safe to occupy. You say, as I read your report that it had no obvious structural failures and performed reasonably well. Do you recall those aspects of your report, on page H5. "There is also some minor

structural damage but there are no obvious structural failures. In that respect we believe that the building has performed reasonably well." Effectively the second page of your report. Do you recall saying that?

A. Um, if I wrote it here then I must have said it.

Q. Well it's in the second paragraph there under the heading "Seismic Performance of the Building". It's on the screen in front of you.

A. So what is your question?

Q. I didn't hear that, I'm sorry?

A. So what is your question?

Q. My question is, having said that, is this code for your view that the building was safe to occupy in your view at the time?

A. Yes.

Q. Could you be completely certain about any of those conclusions when you didn't perform a structural analysis?

A. I think if a building goes through a design level earthquake with limited damage.

Q. So your answer is that you were confident. Is that right?

A. Yes.

Q. And on that basis the building was safe to occupy in your view at the time. Is that correct?

A. I didn't say that and the word 'safe' is a relative word.

Q. In normal circumstances?

A. What I was saying was that the capacity of the building hadn't been significantly reduced.

Q. You're aware of the New Zealand Society of Earthquake Engineering document I think you refer to this at page 115 c. of your evidence – "*Assessment and Improvement of the Structural Performance of Buildings in Earthquakes".* You've mentioned that specifically. Were you also aware of the NZSEE Guidelines for Territorial Authorities?

A. Not in any detail although the rapid assessment forms come out of that document.

Q. Yes, but when you did your inspection were you aware of that document and what it was suggesting should be followed in terms of a process post-earthquake?

A. Um, my understanding of that document is that it's aimed at territorial authorities and that the, um, and the way that they carry out their duties.

Q. Well my question was, were you aware of this document at the time you did your inspection?

A. I wasn't familiar with the document apart from the fact that I'd seen the rapid assessment form.

Q. Did you know anything more about the rapid assessment forms other than what you'd seen on the forms themselves stuck to the buildings?

A. I'm not sure.

Q. Well, did you make it your business to understand what they meant, what their limitations were, what they were intended to achieve. Did you understand that?

A. The forms?

Q. Well the level 1, level 2 assessments?

A. Basically, yes.

Q. And where did you get that information from?

A. I can't remember specifically. I talked with other engineers and I did attend some of the, um, well they're not seminars, the meetings they had at the Emergency Centre.

Q. Were you aware that any detailed engineering evaluations that followed a level 1 and 2 assessment process was intended to ascertain the extent of structural damage. Were you aware of that?

A. Um, I believe that's what I did in my assessment.

Q. You mentioned before the fact that the building had at least undergone a design event and I think that's your evidence anyway. You've made it very clear in both your report and in your evidence that you were aware of that fact. Do you recall that?

A. Yes.

Q. And by design event in paragraph 14 of your evidence you've clarified that to mean generating seismic loads that reach design loads for many structures. In your report you note that the 4 September earthquake produced ground accelerations in Christchurch similar to those required for current design of new buildings and you also state that the 1980s design code for the CTV building was similar or lower than current requirements. So, do I take it from all of that that when you wrote your report you had come to a conclusion that the CTV building had been through a magnitude of earthquake that it was designed for?

A. Basically or thereabouts.

Q. So when you went to inspect it you expected to see damage?

A. Yes.

Q. And in fact that's what you found; you observed considerable damage to the linings and finishings?

A. Yes.

Q. And as we've just looked at before you noted minor structural damage, albeit that you didn't see any obvious structural failures?

A. Yes.

Q. You were also aware of, and you were aware that the building had performed reasonably well, and you had also mentioned in your report that you anticipated aftershocks as well?

A. (no audible answer 12:48:46)

Q. Taking into account those facts did you give any technical consideration to the internal effects of the 4 September earthquake and subsequent aftershocks?

A. What do you mean by "internal effects"?

Q. Well, did you consider the possibility of the building having suffered low cycle fatigue or cumulative damage? Did you consider those effects?

A. Repeat your question please.

Q. Did you make a technical assessment of the effects of the 4 September earthquake and subsequent aftershocks? For

example, did you consider the effects of low cycle fatigue or cumulative damage?

A. I didn't do any calculations, um, if that's what you mean by technical.

Q. Well just to cut through this, is it correct that you from what you observed you intuitively felt that the building had survived the earthquake and still had code level strength?

A. More or less, yes.

Q. Did you consider that there may have been damage within the building, not only not observed by you but not capable of being observed without significant investigative tools? Did you consider that fact?

A. Um, yes.

Q. Were you aware that not only had the building been through a design level earthquake on the 4th of September but in the period when you were out of the country before you did your inspection there was another earthquake experienced at the site of similar magnitude? Were you aware of that?

DOCUMENT MAD2490502 DISPLAYED

Q. Now this is new evidence. It's going to be presented by Professor Mander and/or Mr Rogers who has prepared this material. If you just orientate yourself to the document at the moment, helpfully the person that's prepared it has put some lines in red which I'm going to refer you to?

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WITNESS REFERRED TO DOCUMENT

Q. This document is a record of accelerations experienced on the four CBD sites currently being considered by the experts. On the right-hand column there is a column headed CTV, this is the CTV distance, this is the distance that each of these earthquakes listed is from the CTV building and the second column from the left shows the dates of each earthquake and in the columns the magnitude of the earthquake is shown under the heading magnitude or mag. and there are the four columns; the CBGS site, the cathedral,

Christchurch hospital and the Westhaven Rest Centre showing the accelerations, peak horizontal accelerations from either orthogonal direction, that's transverse. So if you look at that table and if you accept that this table is an accurate record of the accelerations experienced at the CBD sites you'll see that in the first line on the 4th of September at 4.35 in the magnitude 7.1 earthquake, at the four recording sites the horizontal accelerations were recorded as 18.86, 23.81, 21.38 and 26.28. If you go down and find the GeoNet reference for 3368445 for the 8th of September you'll note that the accelerations recorded here from an earthquake not 38 kilometres from the CTV site but only 6.5 kilometres were in a similar range of magnitude at 15.79, 25.40, 24.57 and 13.53. And if you go further down the table three lines down, you'll also see the October 19 aftershock which you inspected the building after, which shows again in red, higher, high, but somewhat lesser magnitudes than those two that we just looked at, and you'll note that the next column in red is the Boxing Day earthquake with again similar accelerations for those experienced on the 4th of September and finally, the unfortunate 22 February earthquake with markedly higher accelerations. These, this list, with the exception of the Boxing Day earthquake which was only 4.9 but 1.9 kilometres away from the CTV building shows all of the magnitude five or above earthquakes experienced and recorded by GNS sites. Having given you that quite long introduction you can see that on 8 September there was a near earthquake with magnitudes possibly exceeding, possibly not, the 4 September earthquake in terms of where the CTV building is located. If you accept all this is correct. When you came to inspect on the 19th of September, sorry, on the 29th of September, the building had in fact undergone at least two design level earthquakes, how would your conclusions change if you had that fact at your disposal?

A. As I said before I haven't done any, I didn't do any calculations on the building I didn't know what its capacity was. Um, clearly it's obviously

been able to withstand these two design earthquakes. Um, I based my assessment on what I saw at my inspection and, um, I believe that it had not been significantly damaged at that stage.

Q. Now you didn't do any calculations –

JUSTICE COOPER:

Mr Palmer, Mr Fenwick just has a few questions that he would like to clarify if you don't mind about this data we have just been presented.

COMMISSIONER FENWICK:

To judge the intensity of the earthquake, of course we need to know how it influenced the ground which is very dependent on the duration of the earthquake. So in judging whether this earthquake was significant or not one would need to see a response spectra from that earthquake. You can't just judge it from the peak ground acceleration because the way that peak ground acceleration will influence the building depends on other factors as well, so we'd need the response spectra to make the judgements you're asking Mr Coatsworth for.

MR PALMER:

I fully appreciate that this is a technical issue and I fully appreciate that I am not qualified to deal with it, but I think we can proceed with the questioning on the basis of an assumption that if it were a second design level earthquake, leaving that issue to be resolved by others much more knowledgeable than I on the subject –

COMMISSIONER FENWICK:

So long as you do not expect someone to answer the question on whether it would influence that building or not, I say, because you have not given them the information that they can see to determine whether it would have had an influence on the building. That's all I'm saying. (inaudible 12:57:53) a logical point of view, your question does not make much sense in terms of structural performance without giving additional information which we have not got here.

MR PALMER:

Well unfortunately this information has only come to me yesterday, quite late in the piece as well, so there's a limit to how far I could –

JUSTICE COOPER:

Well is this all the information, there aren't response spectra available?

MR PALMER:

My understanding is that there, that they will be part of the evidence that will be produced.

JUSTICE COOPER:

Well when is it going to be made available to everyone else?

MR PALMER:

It's being worked on at the moment Sir. I'm doing the best I can with the information I have but I think it's a reasonable question. If the response spectra evidence ultimately comes to sustain what I'm putting to you, then I think it's – hypothetically – and if I put the question to the witness on this basis.

JUSTICE COOPER:

You are going to put to him that there was an event of equivalent or near equivalent force –

MR PALMER:

Yes.

JUSTICE COOPER:

– to September the 4th earthquake that occurred on the 8th of September, is that right?

MR PALMER:

Well yes, and also the 19th of October readings are significant. If –

JUSTICE COOPER:

Well that's after his inspection, I thought you were dealing with his –

MR PALMER:

Well that's what I'm going to put. If an event of exerting force on the CTV site occurred prior to the inspection and that was public knowledge and/or certainly within the knowledge of Mr Coatsworth inspecting the building, in other words it had gone through design events, would that have made a difference to his conclusions?

JUSTICE COOPER:

Mr Palmer, I think once you start bringing public knowledge into it, it gets more difficult. You want to put to him, as I have understood it, a hypothetical because of the issues that Commissioner Fenwick is raising, it can only be of hypothetical given the current state of our knowledge, so you are asking him to assume the hypothesis that there had been an event of similar intensity to the 4 September earthquake on the 8th of September, that is the first part of your question then you want to do the same thing in respect of the, event of the 19th of October, is that right.

MR PALMER:

I couldn't have put it better.

JUSTICE COOPER:

Well now on that assumption, what is the question? First of all in relation to the September event.

MR PALMER:

Well do you want me to take –

JUSTICE COOPER:

Yes.

CROSS-EXAMINATION CONTINUES: MR PALMER

Q. Your evidence is clear about the building having experienced in your view a design level event, hypothetically, if it had in fact experienced two design level events prior to your inspection would your approach to your investigation and report have been any different?

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A. I don't know the answer to that question given that it is a hypothetical proposal I don't know what my approach would have been.

Q. Well perhaps if I ask a follow on question to that and that is, noting that you didn't do any calculations or structural analysis, you – is it correct that you had no way of knowing how the CTV building would perform in an earthquake or aftershock that exceeded the accelerations of the September earthquake?

A. I think I actually said something to that effect in my evidence that was one of the questions that the Commission asked.

Q. Well I think at paragraph 114, "Having not done any calculations or structural analysis I have no way of knowing how the CTV building would perform in an earthquake or aftershock which exceeded the accelerations of the September earthquake." Well, without having that level of analysis available to you, how did you know in paragraph 112 with respect to the cracks in the shear walls, that the walls should be good for the same earthquake again? How did you know that?

A. I didn't do any calculations and I didn't offer to do any calculations and that was the understanding of the arrangement, the agreement. How did I know that it was good for another earthquake the same magnitude or similar was based on the limited amount of damage that had occurred?

Q. Well –

A. The structure hadn't yielded.

Q. Equally in paragraph 113 you concluded, "That the capacity of the building at that stage had not been significantly diminished." Is that what you are saying, the building hadn't yielded –

A. That's what I said, yeah.

Q. I simply want to know how you could make that assessment without having done calculations and without having obtained seismic records?

A. I don't think I needed to have seismic records to make that statement. I wasn't trying to compare it to any record of seismic history.

Q. Well it falls back into paragraph 114, without having those records and having done that analysis, how could you be sure that the building would indeed be safe or not yield in an earthquake or aftershock that did not exceed the accelerations of the September earthquake, how could you say any of that without having done the analysis?

A. Well why would it not survive another – if it hadn't been damaged significantly by a certain level of loading, why would it be damaged by reapplying that load, at the same level of loading?

Q. I am not able to answer your questions. You must answer mine. Would that be a convenient place?

COMMISSION ADJOURNS: 1.05 PM

COMMISSION RESUMES: 2.19 PM

CROSS-EXAMINATION CONTINUES: MR PALMER

Q. Mr Coatsworth I'd just like to take you now to what happened after you delivered your report and I'll just go first to the 19th of October. Your evidence was at paragraph 102 that you inspected the building again after the 19 October aftershock at John Drew's request. I just want to clarify something arising in the evidence that the Commission has already heard. Mr Drew in his witness' statement at paragraph 29 said that you inspected the building after the 19 October earthquake of your

own volition. To assist you, your email would seem to suggest that Mr Drew called you but I just wanted to put all that to you so that you know what Mr Drew has said and just to get a clarification from you as to your position. So did he call you or did you inspect the building of your own volition?

A. I believe he called me.

Q. And that would seem to be confirmed in your email wouldn't it?

A. Yes, which was written on the same day.

Q. Yes. How long did your inspection which started at 2.30 pm take?

A. I don't remember specifically. I certainly wasn't there as long as the four hour inspection the first time.

Q. Right. I think the email was dated 4.24 so it was obviously a period of less than two hours between 2.30 and 4.24?

A. Yes.

Q. You can't recall?

A. No.

Q. Subsequent to the 19th of October your evidence at 105 is that you were not involved with the CTV building at all. I'd just like to clarify that proposition. After the Boxing Day earthquake presumably it is the case that there was no request, that you can recall anyway, from Mr Drew to inspect the building. Is that correct?

A. That's correct. As far as I'm aware there was none. I was on leave at that time and for some time afterwards.

Q. Well Mr Drew says that he called CPGs' offices and he can't recall, I think he might have thought that he left a message. Do you recall ever getting a message from him?

A. No.

Q. By this stage I image that you were busy enough without having to be concerned about chasing up past issues that you'd worked on?

A. I don't think that's a fair comment.

Q. I'm just suggesting that your evidence was that you undertook dozens of inspections of other buildings and my assumption was that during this period you were probably quite busy but if that's not right please clarify?

A. Well that's true. We were quite busy but, um, I would have had time to follow up on a job that I'd already been involved with.

Q. Did you do so?

A. Um, no. I think the principal reason for that was that, well the process of going through the quantity surveyor, you know, and scheduling works and so on, I assume hadn't been completed.

Q. Well, did anyone else at CPG follow up with either Mr Drew or Mr Rawlinson as to whether the repairs that you'd identified and recommended had been carried out?

A. Not to my knowledge.

Q. Did you or anyone else within CPG know the status of the recommended repairs as at the 22nd February earthquake?

A. Sorry, repeat the question.

Q. Did you or anyone else at CPG have a knowledge of the status of the repairs that you'd recommended to the CTV building as at the date of the 22nd of February earthquake?

A. I don't believe so.

CROSS-EXAMINATION: MR ZARIFEH

Q. Mr Coatsworth I just want to follow up on some topics, some of which have been addressed with you by Mr Palmer and the main one I want to talk to you about is the level of inspection that you carried out of the CTV and this issue of the drawings and whether there could have been a more invasive inspection, talking about looking behind or lifting floor coverings and looking behind linings. Were you involved in the voluntary civil emergency effort? You wouldn't have been in the days that followed the September earthquake but I think you were following the February earthquake?

A. No I wasn't part of the volun..., some of our staff were but I wasn't personally.

Q. Right, well how did you decide on what approach to take to the CTV building, what level or what tests to apply?

A. I think the logical approach to this and the accepted approach was to, um, make an inspection first, an assessment by inspection, um, and, depending on what was found, um, proceed accordingly.

Q. Right, and in some of the other hearings that the Royal Commission has held, we've heard reference to a damage-based test. Is that something you've heard before?

A. By that you mean?

Q. Looking at damage to a building and making an assessment from that, a visual assessment of the damage. Is that essentially what you conducted?

A. Um, yes I was looking at the performance of the building and assessing it on the basis of, um, of the damage and how well it had survived.

Q. And are you aware of Level 2 Rapid Assessments and what they entailed?

A. Basically.

Q. How would you describe your assessment in comparison to a Level 2 Rapid Assessment?

A. Um, probably more detailed.

Q. But similar in the sense of a visual inspection of damage?

A. Ah yes. In that, there was no calculations or anything carried out.

Q. Another thing that has come up in other hearings is a possible miscommunication or misunderstanding between owners and occupiers and engineers over the level of the test or the level of inspection rather, and I just want to ask you about that in this case. You were aware you said that the building had been green stickered?

A. Yes.

Q. And were you aware that those green placards recommended to owners that they get their own engineer to do an assessment?

A. I believe I was.

Q. And Mr Drew said that, in part, that's what motivated him that, he, I think he said he heard in the media that there was a recommendation, even if you're green placarded, to get an inspection done by your own engineer. Do you accept that he, like other occupiers/owners, would

have been interested in knowing whether it was okay to be in the building following the September earthquake?

A. Yes.

Q. And whatever the terminology that in effect was going to be one issue that your assessment would resolve?

A. Yes.

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Q. You said that you didn't do a structural analysis but you did do a structural assessment. Did you explain to Mr Drew what the difference was?

A. Well I think he certainly knew I wasn't going to do, um, structural analysis calculations, I mean that was fairly clear in my –

Q. In your email?

A. – conversations with him and my email.

Q. Right.

A. So –

Q. And Mr Drew's not a civil engineer or a structural engineer so would you have explained to him the distinction and what might follow from not doing a structural analysis? Or not?

A. What might follow from not doing a structural analysis?

Q. Well you said that you –

A. I think –

Q. – explained that you weren't going to do calculations? Calculations would have been –

A. Unless I found significant damage that warranted it.

Q. Right, and I think you said to Mr Palmer that essentially you dictated the level of inspection because you sent your proposal and he was presumably happy with what you proposed?

A. Well I certainly suggested what we were going to do to him and he accepted. I don't know that 'dictate' is the correct word.

Q. Okay, the – you said that the fact, if it had been red placarded rather than green that might have made a difference to how you approached the building?

A. Yes.

Q. What do you mean by that?

A. Well if the building had been red placarded for a starter there wouldn't have been anybody in it and it would presumably have had some significant damage that would indicate that it required strengthening.

Q. Right, and –

A. So it would be a different approach.

Q. And how would your approach differ though in what you actually did? Would you do a structural analysis then?

A. A calculation, yes, I would have recommended that.

Q. Because damage would be apparent, is that what you're saying? Or presumably apparent for it to be red placarded?

A. There would have been obvious deficiencies in the building which required investigation by more detailed assessment.

Q. You said that you asked for the plans or the drawings, the structural drawings, you said that you weren't going to do any calculations though unless it followed from your inspection that that might be required?

A. Mm.

Q. What were you going to use the, what would you have used the plans for then?

A. Well it was basically like I said in my proposal; it was to help identify the structural systems in the building.

Q. Right. In your email of 24 September, the proposal, you set out a little detail about the building and your understanding of it and in your brief you talk about the structure of the building and in particular the north shear wall and the south shear wall and the difference between them, the eccentricity, things like that? Presumably you got all of that understanding without having to look at the structural plans?

A. Yes.

Q. You could see that from your inspection?

A. Yes.

Q. So how were the plans going to add to that?

A. As it turned out they probably wouldn't have added anything in terms of my understanding of the basic layout of the structure. I was able to determine that from the inspection.

Q. So is that why you didn't, when you found out that the plans weren't available at that time from the council and Mr Drew didn't have any, is that why you didn't take it any further?

A. Basically I believe so. I didn't, I had identified the elements, I didn't see any damage, um –.

Q. Mr Palmer I think suggested that you could have gone to the, or tried to find out who the original design engineer was and I imagine that if you'd really wanted the plans you could have done that? Could have made enquiries? Or got Mr Drew to make enquiries?

A. (inaudible 14:34:13)

Q. Just trying to understand the –

A. Yeah.

Q. – I take you didn't really need them for the purposes of the level of inspection you were conducting? Is that fair?

A. I think in the long run yes that's fair. If I'd have had difficulty identifying the structural systems in the building, I mean this is speculation, but yes maybe I would have followed it up further.

Q. Do you not need the structural drawings to be able to conclude that a building is structurally sound? As an engineer doing an assessment of a building?

A. I think that if a building has gone through a design event and has, has, and shows very limited damage then that's reasonable grounds to assume that it's performed reasonably well and is still structurally sound.

Q. Right.

A. As good as it was before or more or less as good as it was before.

Q. And is that essentially what you conveyed, do you think, to Mr Drew that that was your conclusion?

A. I think in a couple of places both in my October, 19th of October email and in my report I did say that it, there was no significant loss of capacity of – words to that sort of effect.

Q. If you did have the structural drawings though of a building, such as the CTV, you'd see how the various elements were tied together?

A. Yes.

Q. Correct? You mentioned earlier that you assumed that the beams would have the usual reinforcing and shear reinforcing and that it would go through, right through the beam and the beam column joint?

A. Yes.

Q. Correct?

A. Yes.

Q. And if you got the drawings you'd be able to check something like that?

A. Yes.

Q. Or you would see if that was correct?

A. Yes.

Q. And if that wasn't correct and you saw it in the drawings what effect might that have on your assessment?

A. If I'd have had the drawings I would have known who the designer was, I think I would have been tempted to enquire about, about those matters.

Q. Because they would be a concern given what you were doing? You're looking after, looking at the building after a big earthquake in an aftershock zone?

A. Yes it would have been a concern to me.

Q. You said in paragraph 41 that the connection between the floor slab and the north side shear walls was essential to the stability of the building?

A. Yes.

Q. That was something that was obvious to you from the layout of the building and the structure of it?

A. It, the north shear tower and the south shear walls, coupled shear walls, provided all the lateral stability for this building so the floors had to be connected to that otherwise there's a real issue.

Q. Again as you did in relation to the beams and the beam column joints presumably you would have assumed that they were properly tied in and connected?

A. I expected they would have been but I did recognise that it was an important issue and I did go looking for any signs of disconnect there.

Q. And if a building has structural weaknesses or critical structural weakness or weaknesses that might only be detectable by looking at the plans, would you accept that?

A. In relation to this building every component of a building has a different capacity and I'm just questioning whether, whether you would call it a critical structural weakness because it did survive a design level earthquake. But it, but it, I don't know, in the long run something, some element in this building did not have sufficient capacity to, to survive the February earthquake.

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Q. February earthquake.

A. And so some component, I wouldn't speculate on which component that was but some component did, didn't have sufficient capacity.

Q. Just on that, you were asked about the comments you'd made about being, September being a design level earthquake and I don't want to go into those issues the hypothetical issue of the one the week after or the following week, but obviously as you say in your report your view was that the September earthquake was either at or close to design level, is that fair?

A. That was my understanding.

Q. Right. And yet, knowing that the building had been through that, through that level earthquake, what did you expect to find in terms of the resilience of the building? Knowing that it was the age it was and the construction?

A. I don't know that I had any expectation whatsoever I knew that it was still green stickered but, but I believe I went looking for any, any, any signs of issues with a, with an open mind.

Q. Right. Do you think as an engineer do you think that if a building such as the CTV building has experienced a design level earthquake that that's all it's designed to do, and that it's going to have significant damage whether you can observe it or not?

A. No I don't believe that's correct; there were many buildings in Christchurch that survived the September earthquake without any significant damage.

Q. And I'm not questioning that but are you saying that from your own inspections or your own experience?

A. I think it's just a fact.

Q. Okay.

JUSTICE COOPER:

Q. I suppose the question is how do you know it's a fact?

A. Well that they're still standing and that they haven't been demolished and that they are still functioning.

Q. Right.

A. And other engineers have inspected them and, and approved them and…

CROSS-EXAMINATION CONTINUES: MR ZARIFEH

Q. Have you read Professor Mander's evidence, any of his evidence?

A. Yes I have.

Q. And did you see his comments to the effect that because it had been a design level earthquake in September that there would have been damage that was not, might not have been observable, hidden damage if you like, to the building and it should have been red stickered if you like. I think he even goes as far to say it should have been red stickered without even an inspection?

A. I think he actually suggested that every building in Christchurch should be red stickered because they'd been through a design level earthquake.

Q. Well I don't think he was saying that but is that what you're saying would follow?

A. Well that was what I read from his report but he also said things like, and he didn't actually state it as a possibility, he stated it as an inevitability that the west wall of the building was damaged, badly

damaged but photographs and subsequent evidence have shown that that's not true.

Q. Well that's something I wanted to ask you about so let's just down with that now. You gave evidence, I don't want to go over it, you have taken a photo I think from in the first level or ground floor looking at the west wall or part of it, you recall that?

A. Sorry which?

Q. You took a photo from the, on the ground floor looking at the west wall and –

A. From inside the garage?

Q. – the carpark? Yes.

A. Yes.

Q. And you commented that there was a gap between the block work and the columns?

A. Yes.

Q. Right, so can you just tell us any more about that than is in your report your or brief. How sure are you from your inspection that there was this gap and that it had sealant in it or something of that?

A. I'm absolutely positive that the gap was there, I took photographs of it. With regards to the filler, filling material that was in it, I concluded that it was sealant because that's what, what I would normally have done. The reason for these gaps is to separate the block walls which are very stiff from the frame the concrete beam and column frame that can move.

Q. Right.

A. And, and so to keep the water, to keep it waterproof the joint waterproof, you need to put something in it that's flexible and so you put sealant in it. That was what I assume, well that's what I concluded it was but it was recessed, it wasn't right on the surface of the block work in the garage. It was recessed back in the joint and those, those walls were 150 ml, 140 millimetres thick block work.

Q. Right.

A. So, so it was difficult to see in the back. I understand that there's been evidence given subsequently that it was actually a mortar fill that was in the joint and I'm not in a position to refute that.

Q. Well we had evidence from two workmen who were working on the outside of that west, western wall at the time of the February earthquake in fact.

A. Yeah.

Q. And they spoke of observing mortar between the block work and the columns?

A. Columns. Yeah.

Q. You wouldn't have seen that of course because the building was, the next door building was still up when you inspected?

A. No but what I was seeing was the other side of that fill.

Q. Right, well I was going to ask you is there a difference visually between mortar and sealant and a flexible sealant?

A. Hard to tell, if it was a sealant I don't know it was, yeah, you've got to –

Q. What colour, was it a coloured sealant that you saw?

A. It was a dark colour that I saw.

Q. Right, so you couldn't tell if in fact it was mortar or there was mortar on the other side?

A. No I accept that.

Q. All right and what about between the top of the block work and the underside of the beam?

A. There was virtually no clearance whatsoever there.

Q. Right and any sealant or mortar or anything like that? That you could observe?

A. I don't believe so.

Q. And just on –

A. But, but you have to you know in terms of the, the block walls and the, and the columns you know you have to allow for this sort of movement going on but the beam across the top of the block wall all it does when the building moves is slide so it's not like you need a great clearance there.

Q. Right. You need the vertical clearance?

A. Yes.

Q. Right, and from what you could see there was a clearance?

A. At the side, at the sides?

Q. Yes.

A. Yes.

Q. Right. You mentioned too that Professor Mander said that the western wall was badly damaged, can you comment on that? Do you agree with that or not?

A. No, I, I – he made that statement but I disagree with it.

Q. And just tell us why?

A. Because I didn't see any damage.

Q. He might have been referring to the cracks in the plasterboard lining on the west wall on level 2, the first floor? Do you recall in the, we've had comments from people that were in the building that there were cracks particularly on the north side; you could see daylight through some of them?

A. Well I reported daylight in my report.

Q. You did yes.

A. In one place.

Q. Well perhaps he's talking about that?

A. And I understand that two, somebody else reported daylight visible through the wall in two other places. I suspect that that was after the building next door had been demolished because those two positions that they indicated were along the, you know, the interior – the intermediate points on the, on the wall not at the, not at the corner where I saw it. But there were, these block walls were actually between two columns, there wasn't just a single panel of block wall there were, those, those block walls were actually made up of three panels.

Q. Right.

A. And for, presumably for, for shrinkage control and, and there was a gap between each of those panels that was, that I'm aware of now was shown on the drawings as being filled with sealant and I believe that

whoever saw daylight through those or through that wall in those two positions it just happened that the, the damage to the gib lining lined up with one of those control joints.

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Q. Okay, well just going back to this comment by Professor Mander about the damage to that wall, he might have been talking about the cracks in the daylight that could be seen in the plasterboard, through the plasterboard cracks, and which I think you referred to and said should be (a) "Investigated further and repaired." Do you recall that in your report?

A. I'm, as far as what I was referring to, um, in that north-west corner where I could see daylight, um, it was, it was a fairly, a fairly narrow gap that I was looking through and, um, and so I wanted to see if there was any damage to the block wall behind it.

Q. Right, so what were you?

A. That was why I recommended removing those linings in that position. But I'm not too sure that I said "remove the linings", I said "investigate further".

Q. You said, "Investigate further and repair," I think. The repair was to what, the plasterboard then?

A. Did I say "repair"?

Q. It's under the heading, "Non bearing concrete block walls," and it's the second paragraph. Have you got that, the last sentence?

A. Yes.

Q. "This needs further investigation and repair"?

A. I think by the "repair" I was meaning that there was a gap there in between the block and the concrete and it needed to be waterproof.

Q. And that's the damage that you were referring to?

A. Yes, but –

Q. The damage to that western wall?

A. Yes. But I did recommend that, I mean virtually apart from the, um, whatever the fill was in the joints having fallen out, um, I didn't believe there was any other damage to the wall.

Q. Just going back to this issue of the plans, have you read the evidence of a Mr Mitchell from Opus?

A. I can't remember.

Q. Well I'll just quickly refer you to that. He was or is an engineer from Opus and Opus was looking at leasing the building back in 1998 or 1999 and he was asked to do a desktop review of the CTV building?

A. Okay, I wasn't aware of that.

Q. One of the ones that was being considered, and he says in his brief that he was provided with structural drawings of the building and he carried out a desktop review. He says, "I cannot recall the exact time this review took but it would've been hours not days." And he says, "A desktop review involves a qualitative assessment of the robustness of the building, it also involves a consideration of the likely modes of failure of the building if the building was subjected to a seismic load greater than its design capacity," and he concluded that, "The interconnections between the floor diaphragm and the shear core wall were not as strong as I considered they should have been for an asymmetrical design such as this." He also went onto say, "The building also lacked structural redundancy meaning there was no alternative load paths available in the event that the primary load path failed." And he said, that he, "Would characterise the building as having an actual critical structural weakness under seismic load in relation to those floor connections." And he went even further to say, "Again looking back as best I can, my view was that there was a significant risk that the building would be subject to premature and catastrophic collapse in a moderate earthquake." And a similar, similar sentiments were expressed by Holmes Consulting Group in 1991 prior to the Mitchell review, but looking at the same plans. And you mentioned in your brief the drag bars that were retrofitted. The drag bars were as a result, effectively, of that Holmes report, and the Holmes assessment. I won't take you to the Holmes assessment but it essentially came to the same conclusion that Mr Mitchell had come, again based on the same structural drawings which Mr Mitchell, when he looked at them, didn't have a reference to

the drag bars because no permit was obtained for the drag bars when they were put in, in 1991. But my point is, and what I want to put to you is that that's something, albeit peculiar perhaps to this building, something that would've been apparent from a perusal, assessment, whatever of the structural drawings, do you accept that?

A. Ah, yes.

Q. There's no reason to think that an experienced engineer like yourself wouldn't have, would have come to a different view from the engineers from Holmes and from Opus that looked at it, at the plans?

A. I would like to think that I would've identified that problem, yes.

Q. So do you agree with me, and I'm not trying to be critical of what you did, I'm looking more to the future –

A. Yes.

Q. – and trying to learn lessons in hindsight if you like, particularly with what happened in September and then in February. Do you agree with me that in an assessment following a large earthquake like September, the ideal would be to have access to structural drawings?

A. I think it'd be desirable, yes.

Q. Because if there were critical structural weaknesses such as the floor slab connections, that would have an impact on the structural assessment wouldn't it?

A. Yes.

Q. Do you agree with me that one way to get around the problem that you faced, albeit as we've heard it was temporary, and talking about the access to the plans, would be to have structural drawings held electronically?

A. Yes.

Q. And do you think then that in a similar situation, if that was the case that you would as a matter of course go to structural drawings?

A. Yes I would, I would've asked for drawings if they'd, or I would've accepted, I would've wanted them if they were available, yes.

Q. You said that because you knew the floor slab connections to the north core wall were important, that you took some time and some care to look for any signs of disconnection or cracking?

A. Yes.

Q. Again without knowing, not having access to the structural drawings, not knowing where potential weak points were, you were simply looking in the general area of the sheer core, the floors and the, presumably the floor slabs where they met the shear core?

A. Yes and down the external walls and the internal walls.

Q. And, as I understand it you didn't lift any floor linings?

A. No.

Q. So were you able to look, other than on the surface, at where the floor slabs met the north core?

A. Um, and out on the outside walls of the building as well.

Q. Yes I'm just talking about where the connection actually was, were you able to look at that connection and where it might've, if there had been a disconnection or a compromise of it, where there might be a sign of that?

A. Well it's not just the floors that, um, that would show any sign of disconnect. There are other elements that would show that disconnect as well.

Q. Such as?

A. Well on that, um, east side of the shear tower, um, you could see the shear wall quite clearly. I viewed that from out, from down on the street outside, and I also viewed it from up on the roof, um, in fact both sides of the shear, the east and the west walls, um, and you could see where the floor slabs and there were, um, when I say spandrel panels, under that win – you know the window outside the lift lobby, um, it wasn't a concrete spandrel it was a frame, I believe it was steel framed with gib linings on the inside and, um, some sort of a, a cement fibre board on the outside, um, but that material butted up against the shear wall, the concrete shear wall, the structural wall and, you know, if there'd been any disconnect that would've shown a gap between the two.

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Q. What if the mesh that was in the floor, in the floor slab?

A. Mhm.

Q. What if that had cracked or broken in the September earthquake, do you think that that would have been apparent?

A. Well I didn't know it was mesh at that stage, I didn't know what the floors were reinforced with and if they –

Q. If you had plans would you –

A. – and in fact I think there was other reinforcement in that area besides the mesh.

Q. There was some bars to the west side of the north core and to the east side, that was where the particular problem that I referred to earlier was highlighted in 1991?

A. Yes.

Q. And the drag bars were put in on that eastern side where the lift well is?

A. Yep.

Q. But you weren't aware of any of that?

A. No.

Q. No, or as you say in fact not aware of mesh being in the floor slab. I am sorry you might have answered this but do you think that you would have seen it if the mesh had been compromised in the September earthquake?

A. Would have seen signs of –

Q. Yes.

A. – that having been compromised?

Q. Yes?

A. I think that – I mean mesh is proven to be, that mesh that was used in those buildings is proven subsequently to be quite a brittle material and yes I think it would have been obvious.

Q. Obvious how, how would it have shown itself?

A. Cracking in the floors.

Q. Visible –

A. Separation.

Q. Visible on, without having to look under linings?

A. Um, yep I believe so,

Q. Professor –

A. I can't remember what the linings were in the lift lobby.'

Q. Were they not lino, is that right?

A. I think that is right and I think lino – I mean you know vinyl or whatever reflects all sorts of minor defects.

Q. And carpet I think in the main or lino as well on the other sides, on the floor slab side?

A. Yes there was carpet somewhere.

Q. Professor Nigel Priestley, do you know of him?

A. I know of him, yes.

Q. Have you read any of his evidence in this; that will be on the secure website?

A. Yes.

Q. I just wanted to refer quickly to part of one of his briefs, it is WIT.PRIESTLEY.0001.24.

WITNESS REFERRED TO BRIEF WIT.PRIESTLEY.0001.24

Q. And he has got a heading and it will come up on the screen in a moment but I will just start reading it to you, "The state of the CTV building following the 4 September earthquake." Paragraph 79, he says, I will quickly read it, "It is entirely possible that a partial floor diaphragm north core connection failure could have occurred in September 2010. The NTHA results indicate the possibility of drag bar floor diaphragm failure under the 4 September earthquake. The displacements the building experienced in September 2010 earthquake would not have been sufficient to cause complete failure of the building. Because the Hi-Bond trays and the east west support beams would have continued to support the floor, it is conceivable that separation did occur but it was not picked up in the post-earthquake inspections and it was the reason for the increased flexibility of the building that was noted by many of the occupants. This separation might have been difficult to observe during the post-September 4 inspections. The investigators would probably not

have known about the drag bar installation, and hence would not have paid them attention. If fracture of HRC mesh in the floor had occurred, this might not have been visible because of floor coverings, or may have been construed as shrinkage cracking, as crack widths of only 2 millimetres are required to induce mesh fracture." So, can I just ask you about that?

A. Mmm.

Q. If Professor Priestley is right in that a crack would width of only 2 millimetres might be required to induce mesh fracture, that might well not be visibility he says without an invasive investigation, would you accept that?

A. I think that the issue of separation is not just one of looking at the floors as I explained before, you know you have these cement fibre panels on the outside that didn't show any separation from the walls, from the structural walls. There were other things like in the lift lobby there was a wall that extended out from the finger wall as I have described it on the west side of the lift shaft and there were signs where the structural wall had pushed against the partition wall and left it open and a small gap, you know, typical of a lot of the photographs that I had in my report, but the important thing with that is that there was, it was open at the top, you know, at the ceiling, where there was no connection between the top of the wall and the floor above but at the bottom it was tight, you know –

Q. So disconnected –

A. So indicating that the floor is still connected to the structure.

Q. But are you confident that that meant or would have meant that the mesh hadn't been compromised?

A. I believe that was the case at the time that I saw the building.

Q. How do you know that, that it must follow that the mesh hadn't been compromised, are you saying from experience of seeing mesh and what affects it produces?

A. My comment about that would be that if it was damaged in the September earth – if this mesh was compromised in the September

earthquake and we'd had a number of earthquakes after that, that I would have expected that it didn't just remain broken but hard up against the structure. The floor slabs, what I am saying is that you know, the floor slabs didn't just remain hard up against, yeah if it had been broken in September, I am sure subsequent earthquakes would have moved this and you would have seen signs of it.

Q. And what about his comment there that might have, some separation or compromise in the connection might have accounted for some of the comments by people, it has been termed 'liveliness', I think that's, an engineer has put that word on it, more movement and more vibration?

A. I think those sort of comments are very hard to assess, people's impression of movement after an earthquake I think became much more heightened.

Q. When you heard comments that you did in this building when you did the inspection, did they cause you any concern or not?

A. Well, like I said with regards to the vibrations and deflections in the floor slabs I was there for four hours and people were walking around, heavy traffic was running past and I didn't notice anything that I thought was unusual. With regards to earthquake movement of the building, I wasn't in the building during an earthquake so I find it hard to comment on that, but there was that one lady in the top floor who said that the building moved quite a bit in the earthquake but, you know, that doesn't surprise me, all buildings move quite a lot in an earthquake.

Q. So with comments from occupants ever have any bearing on what you do or what conclusions you come to?

A. Um, yes, I believe so. I believe engineers should listen to what comments people make that are working in the building.

Q. Do engineers seek them out for that purpose or not, in your experience?

A. I asked some of the people in the building what damage they'd noticed. I don't know that I specifically asked them about response but it was implicit I guess, you know, if I had asked them, you know, what do you think about the damage, you know. I would have hoped that had imparted that information.

Q. So that was the reason you were asking?

A. One of the reasons, yes.

Q. Just still in that north core area, you had reference to that photo, Mr Higgins took. Do you remember that of the lintel or the –

A. Oh, yes with the –

Q. (inaudible 15:08:34) above the column –

A. The window?

Q. It is called C18 but it is the column as you come out of the lift on your lift?

A. Yes.

Q. You referred to a crack that was nearer the column?

A. Yes.

1509

Q. At the time you inspected it, I'll just get a photo brought up under reference, Mr Pagan's photo. It's WITPAGAN0001.45, top left photo. I'm just going to show you a photo Mr Pagan took at the time of your 29th inspection. I think it's a bit clearer than the one you had, the top left we'll get focused on. You can see that cracking about half a metre or so from the column, maybe more?

A. Half a metre from the column?

Q. It's my measuring but you can see the crack I'm talking about.

A. Well the columns are 400 diameter so that gives you some idea of how close it was to the column.

Q. All right, you can see the crack I'm talking about though?

A. Yes.

Q. Right, now that's the crack that we saw in the photo taken by Mr Higgins was further along away from the beam?

A. Yes.

Q. From the column rather, and appeared to be more extensive?

A. Yes.

Q. What area is that cracking in, what is that, as part of the structure, do you know?

A. It's a part of the wall.

Q. Because it's running back towards the lift isn't it?

A. Yes.

Q. So it's running north from the column?

A. North/south, yes. Yeah, north from the column, yes.

Q. And so is that part of the structure of the north core?

A. Ah, it's a cantilever portion of the core walls that supports the lift machine room up above but the lift machine room's not just right there. It's quite a long way up above. That was quite a big piece of wall.

Q. All right, so did that crack concern you?

A. Um, I considered it was, ah, a result of interaction between the column and the wall but I felt it was relatively minor.

Q. All right, and I appreciate you only saw a photo of it, the one taken later in time I think on 14 February the Higgins' photo, I'll get that brought up. I think it's 454. See that on the right?

A. Yeah.

Q. And it's obviously bigger or peeled off more surface because you can see it and in that photo you can't see the other crack that well. So did that –

JUSTICE COOPER ADDRESSES MR ZARIFEH

I'm not quite following that.

MR ZARIFEH:

The photo on the right, the one with circles, the Higgins crack, if I can put it that way. Sir.

JUSTICE COOPER:

That's not the damage we can see in the left-hand side photo though is it?

MR ZARIFEH:

No, no, I'm saying the damage you can see on the left-hand side you can hardly see on the Higgins' photo. You can just see it.

CROSS-EXAMINATION CONTINUES: MR ZARIFEH

Q. So looking at the damage that's circled on that lintel, if that's the right word, does that, did that concern you looking at that. I appreciate you're only looking at a photo?

A. Um, yes it's more substantial.

Q. And why does it concern you compared to the other crack, apart from being more substantial?

A. Um, I guess it's away from the influence, the direct influence of the column and any bending effects that there might have been just at the top of the column, you know, the original crack that I saw that's close to the column, um, um, I interpreted to be an effect of that, of rotations or displacements that had gone on there and that had not only caused that crack but also the cracks in the column, but the one that you're looking at here now, this one under the circle, is something different.

Q. What, you're unsure of what the mechanism might be?

A. Well...

Q. Is that what you're saying?

A. We know now from the photos of the building after collapse that that corner of the wall actually pulled out of the wall.

Q. Right, but if you'd seen that in an inspection –

A. The circled damage?

Q. Yes. What would you have concluded do you think?

A. Um, I would have been looking on the outside of the wall above the window to see if it was apparent there and whether it was more extensive than just on the soffit of that piece of wall.

Q. Okay, but not so in relation to the crack you saw?

A. No, I believe that the crack that I saw was relatively minor.

Q. And just going back if we can to the Pagan photo, do you recall the discolouration in the tiles. Can you see that. Did that concern you at all?

A. That's a water leak. That's watermarks in the tiles. This building obviously had water leak problems. That wasn't the only place where there was water leaks.

Q. Right, the pre 4 September you thought?

A. Yes.

Q. So that wasn't a concern to you?

A. No. It wasn't a structural concern.

Q. The recommendations you made in your report firstly to remove the plasterboard on the ground floor of the south coupled shear wall and we talked before about the western wall – investigate and repair – you said that you didn't follow that up so you're not aware of whether anything was done. We heard from Mr Drew that, that plasterboard on the south wall wasn't removed and in relation to the western wall he was having it re-clad once that building next door had been demolished and, as I said before, it was happening on 22 February and he was going to repair that if you like in that process but I presume that, that further investigation in particular in relation to the south wall that wasn't vital in terms of your conclusions?

A. I assumed that those things would have been investigated in time. The gib board was damaged, you know, and to repair their building to put it back to the cosmetic effects I'm talking about, the cosmetic linings, to put them back to original condition you know would have required those, um, those linings to be removed anyway and I expected that I would have been advised when that had happened, um, so that I could follow up with my inspection but, um, there's two things attached to that. I didn't expect the damage to be significant for a starter and the other thing is that the delay in doing that work, um, didn't surprise me because you have to recognise that at this time there was a lot of damage to buildings and getting people to do repair work, it wasn't easy.

Q. Okay and presumably the fact that you couldn't at that point look behind that plasterboard wall lining that didn't prevent you from coming to the conclusions that you did in your report and in the email of 19th of October. Is that fair?

A. I think if I'd have suspected there was serious damage there I would have got my boot or my hammer and knocked it off myself.

Q. Right.

A. Espec – I mean in relation to the south wall I was able to see the outside of that wall and I looked pretty close at it and I found one very minor crack. There likely was other minor cracks but certainly nothing significant.

Q. The cracking that Graeme Smith, the concrete repair engineer talked about, you weren't aware of that at the time were you because you didn't go into the lift shaft?

A. This is inside the lift shaft?

Q. Yes.

A. No.

Q. And you hadn't seen any evidence of that on the outside of the north wall had you?

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A. No.

Q. Right.

A. And I believe he said it wasn't visible on the outside.

Q. No, but if that's right –

A. In fact –

Q. – yeah.

A. – in fact I think he made the comment that, that none of the cracking was visible on the outside but in fact that's not correct because I've got photos that did reflect some cracking on the outside.

Q. And I think as you said and he might have too that there was a bit of a coating on the outside which made it difficult to sometimes to see cracks?

A. Yeah, it wasn't as obvious as it was on the gypsum plaster skim coat on the inside.

Q. But that crack that he saw would that have concerned you if you'd seen it? If you'd inspected the lift shaft? You think it's a construction crack or possibly?

A. Yeah, I do not believe it's the result of earthquake.

Q. That's –

A. I, I even question whether it was a crack.

Q. Okay, and –

A. I would assume that somebody took some, I think the, my photograph that I took from a distance of that wall was presented earlier on, but I assume there are photographs, better photographs than that in existence after the collapse of the building showing the inside of that lift shaft that would give us a better idea of exactly what that was.

Q. Right. What was the largest crack, the widest crack if you like that you saw in that north core shear wall? Was it the –

A. I think in the end I said between 0.4 and 0.5 on one of my sketches.

Q. Right, so that was the – it went up to that much?

A. Yes.

Q. The other thing I wanted to ask you was when you looked at the columns on the perimeter of the building; you were presumably looking from the inside?

A. Yes.

Q. In the upper levels anyway?

A. Except that they were visible from the fire escape as well.

Q. Right, what I wanted to ask you is can you recall the, whether there was a gap between the spandrel panels and the columns, and whether that gap that was there was the same or not in respect of the three elevations that there were columns and spandrel panels?

A. I can't tell you what the clearance was but I know I looked out those windows at all those columns and I didn't see any damage. If they'd have impacted at the time that I was inspecting the building I would have expected to have seen, well, you know, you're talking about a round column and a flat piece of concrete and if the panel, if the column had impacted on it this panels got a square corner on it and I would have expected to have seen the corner knocked off or a gouge in the side of the column or something to that effect and I didn't see either of those.

Q. Right, what about a variance or a marked variance between gaps that you did see? Do you recall any variation or did it appear to be a similar gap?

A. I honestly don't recall.

Q. Okay.

A. I think Nigel Priestley summed this up fairly well in his evidence and he said that even if the, if the spandrels had contacted, impacted on the, on the columns that the capacity of the column was way in excess of the panel and that it wouldn't have affected the strength of the column.

Q. Right, and do you agree with –

A. And I agree with that, yeah.

Q. Just finally I want to come back to lessons that we can learn from this building and from your inspection and as I said before I understand that you were carrying out this visual damage inspection if you like?

A. Assessment. Visual assessment.

Q. Assessment, yes, and perhaps the general population know a bit more about that now than obviously they would have at the time, but do you agree with me that perhaps in future something more is required when an engineer is engaged by an owner/occupier to do an assessment when there's been something like a design level earthquake?

A. You mean in terms of the communication with the public or the tenants or whatever?

Q. Well firstly the level of inspection?

A. I think you have to start somewhere with an assessment of a building and I believe that what I proposed and what I did was a reasonable starting point and that if you find issues from that starting point or that initial assessment then you progress to whatever is required.

Q. Do you think then that it should involve at least say access to structural drawings then?

A. I think it's highly desirable to have structural drawings, yes.

Q. And what about the level of invasive inspection then?

A. I think that depends on what you find.

Q. And do you think then, you brought up, or mentioned communication, do you think that perhaps work needs to be done on that in terms of what the owner/occupier might understand because Mr Drew, I imagine, one of the things he was wanting to know, and obviously his tenants, was that they were all right to be in there and that is in effect what you concluded isn't it?

A. Yes.

Q. Even if you didn't use words like 'safe' but they may well not have understood the qualifications, if you like, that you would have to put on it if you were asked to say was it safe or not?

A. I think communication is great and you know we should improve it by all means.

Q. Just one minor point, you were asked about Mr Drew ringing or you were told Mr Drew gave evidence that he rang, said he rang your firm CPG, not sure he gave a date but it was some time early in January 2011 and I think he said that, I don't think he said he left a message but he said that he got an answer phone because it was closed?

A. Holiday time.

Q. What dates would it have been closed? The office with an answering phone on?

A. I'm not sure exactly but you know it wasn't uncommon for our office to be closed through till the, you know, the Monday in the New Year that would have been around about the 10th or the 12th or something like that.

CROSS-EXAMINATION: MR ELLIOTT

Q. Mr Coatsworth, my role is to represent the interests of the families of those who died and the people who were injured in the collapse of the building and firstly on their behalf I'd like to acknowledge and thank you for the condolences that you expressed earlier on when giving evidence. Virtually all of the questions I had have been covered by others so I don't have many more questions and they're really just to clarify one or two points for those watching who are trying to understand what

happened and to raise one or two points as well. It's implicit, in fact you've already said, that in carrying out these assessments of the building you were considering whether the building should be occupied during that period of ongoing aftershocks.Is that right?

A. Yes.

Q. And you were obviously conscious of that consideration when you were making your decisions in providing your report?

A. Yes.

Q. And you took care in carrying out your assessment keeping in mind that you were giving advice effectively about ongoing occupation?

A. Yes.

Q. The evidence you've given in response from questions from Mr Zarifeh and Mr Palmer in particular drew out this distinction that the Royal Commission is well aware of. You've used the words 'diminished capacity' and on the other hand we have the words that Mr Kehoe uses I think of 'actual capacity' or 'seismic capacity of the building'. Now they are two different things aren't they? Firstly, diminished capacity involves a consideration of whether or not the building is any worse than it was before the earthquake is that right?

A. Yes.

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Q. And that assessment is carried out by identifying damage to the building, is that correct?

A. Yeah, or lack thereof.

Q. Or lack thereof, and on the other hand an assessment of the seismic capacity of the building involves asking what would be the capacity of this building to withstand earthquake forces in future, is that right?

A. Yeah.

Q. And it's the former of those two tests, if you like, that you were applying in your assessment and not the latter?

A. Correct.

Q. And in fairness to you, that approach seems to be consistent with that of virtually every other engineer who was carrying out post-earthquake

A. Some of them were hidden, yes. Not all of them.

Q. And I think you've already agreed that drawings would put one in a better position to consider the location and consequences of damage to hidden structural elements, is that right?

A. Say it again, sorry?

Q. I think you've agreed that drawings would put one in a better position to consider the location of structural elements that are hidden and the consequences of damage to those hidden elements?

A. I think having, having structural drawings is very helpful, yes. But in this case I believe I was able to identify the main elements of the structure.

Q. Yes. Is it right to say do you think that cracks that one can see on the exterior of a structural member don't necessarily tell the whole story about what the damage to that member might be?

A. Um, I think they give you a pretty good indication.

Q. I'll ask Mr Kehoe about this, but FEMA 306, which he refers to in his evidence, refers to equipment that engineers can use to assess the extent of reinforcing steel present, and the size and location of cracks in a member such as rebar detectors, impact echo, ultrasonic pulse velocity and radiography. Would those have been things which

would've assisted you in working out the extent of hidden damage to structural members?

A. Um, I'm sure they would've been if I had, um, found any hidden damage but I didn't actually find any hidden damage.

Q. Are you saying it was possible to find hidden damage just by visual assessment, were you?

A. Well I looked at a lot of beams and a lot of columns and a lot of joints, and, um, and I did see some damage but it wasn't hidden.

Q. For example, it may not be possible to see from the outside whether reinforcing steel has been fractured or bent in some way?

A. There's always consequences of something like that, you know, things move, if you have a failure of an anchorage of a bar or a bar itself breaking, um, there's always consequences of that.

Q. And by that are you referring to cracks that would've been evident to you?

A. Yes, that show up on the structure, yes.

Q. Mr Coatsworth, would you agree that if the objective was to assess whether the building should continue to be occupied, which I think it was you've said, that the more information one has the better?

A. Um, yes I couldn't argue with that.

Q. And assessing seismic capacity of the building requires the gathering and consideration of more information than just assessing diminished capacity, is that right?

A. Yes.

Q. So in light of that would you agree that rather than using a test of diminished capacity to determine whether a building should be occupied after a major earthquake, it would be better to determine the building's actual seismic capacity?

A. Um, full assessments, um, are great I'm sure. Um, but you know there are a number of other considerations here. You know resources, um, if every building in Christchurch had had a full assessment, um, there was no way you'd have had enough engineers to do that. There weren't

even enough engineers to do the assessments that we did do. Um, and I had another point, what was your question again?

Q. If you've got another point to make feel free to make it?

A. But what was your question again though?

Q. Well my question was just, given that the seismic assessment of seismic capacity involves gathering and assessing more information which you've agreed is something which is desirable when concerning occupancy, isn't that a better test to apply?

A. The other matter that I was going to suggest was that a, um, you know the sort of full assessment that you're talking about is quite an expensive procedure as well and, um, you know you have to weigh the justification, um, if you don't see any damage, any significant damage well then, you know, how do you justify having a building owner or a client spend all that money on an assessment?

Q. Would you agree that is something though you could've perhaps discussed with Mr Drew, and said to them, "Well we've got this option of a more detailed assessment if you want it?" So they could decide whether to spend the money?

A. I, I did say to him that, um, that we would recommend a full assessment if it was, if we found significant damage, but, um, ah, yes I take your point. I guess he might've chosen to follow that route.

COMMISSION ADJOURNS: 3.37 PM

COMMISSION RESUMES: 3.55 PM

CROSS-EXAMINATION CONTINUES: MR ELLIOTT

Q. Mr Coatsworth when you were inspecting the CTV building and deciding whether it should continue to be occupied, is it correct to say that one of the important considerations, or assumptions that you made about it was that the design engineers, which we now know to be Dr Alan Reay's firm, had designed the building in accordance with applicable codes?

A. Was it my assumption that they had done that?

Q. Yes.

A. Yes, I had no reason to believe that it didn't comply.

RE-EXAMINATION: MR WESTON

Q. First and perhaps most conveniently addressed by reference to Mr Elliott's questioning of you Mr Coatsworth, first of the two, this expression "hidden damage" was used by you, you may recall that?

A. Yes.

Q. And you said that if there was hidden damage that there would almost always been consequences of that, again you recall saying that?

A. Yes.

Q. And while I think it's implicit in what you say I'd like to make it explicit. When you say there would almost always be consequences of that are you referring to consequences that you would be able to see visually?

A. Yes.

Q. Okay, first topic, second topic the question of cost was raised as between an assessment of diminished capacity which was what you undertook and cost $3000, do you understand that?

A. Yes.

Q. And the full assessment for seismic capacity and you said that that would be much more expensive, you recall saying that?

A. Yes.

Q. Can you give some sort of estimate from your knowledge of the CTV building of the sort of figure that you would estimate it might cost to undertake the full assessment of that building?

A. I would be guessing but it would be many times what my fee was to do what I did.

Q. Are you able, and recognising that it may only be a line in the sand, are you able to put some sort of figure on it or not?

A. I don't know. I would guess it would be upward of $25,000 anyway.

Q. And how long do you think it might take?

A. I guess it depends on how many people you had to apply to it.

Q. Assuming it was just you again to give us a line in the sand, can you, can you help us with how long it might take?

A. I don't know, a month or more.

QUESTIONS FROM COMMISSIONER FENWICK:

Q. Yes just point I'd like to check up with you, you went to the inside of the western wall and noted that there was no damage to the wall and your belief was that there was sealant on the, in the gaps between the different blocks and to the columns. The workmen on the outside of the wall were quite sure there was mortar in the junction but they reported no damage to the block work. Can you draw some conclusions from that please? I mean you were looking for cracks in the block work and the corner where it impacted, they reported nothing of this. Do you draw any conclusions from that for me please?

A. I suppose the inference is that the displacements weren't very high and that, that the mortar wasn't damaged.

Q. Is it just possible that the amount of dust you got there would have hidden the different colour between the sealant and the mortar? Is that possible?

A. Sorry, on the outside?

Q. On the outside?

A. What are you saying that it was actually, you're suggesting that it might have actually been sealant?

Q. I don't know, I'm wondering whether it was sealant and they mistook this, they didn't realise it was sealant but that, I'm wondering whether they could actually see the difference in colour because that would have been outside and there would have been a lot of dust around. I'm trying just to work out you know whether those blocks really, the walls were isolated from the structure or not. So your evidence on the inside it quite clear it was isolated now I'm trying to transfer that now to the outside and what deduction we can make from this?

A. Well I certainly didn't see any damage to the block work and I think that if it had, it had impacted it would've damaged the block work and I've, I

mean I've learnt subsequent to my inspection that the top course on the block work wasn't filled with concrete so it probably would have slid along the, the joint –

Q. Yes.

A. – quite readily.

Q. Yep.

A. But I didn't see any signs of that, but how you would relate it to the outside of the building I don't know I've seen some photos of the outside of the building but they weren't very good quality photos.

Q. The workmen we did question them about it and they didn't report any damage?

A. No.

Q. To the wall there.

A. Well, I, I would've certainly have been surprised if there had been mortar in those joints and it was perfectly undamaged.

QUESTIONS FROM COMMISSIONER CARTER:

Q. Yes just one question that still puzzles me I must say is that column C18?

A. Mmm.

Q. Continues to show more damage than other columns as far as the evidence we've been shown and indeed maybe after the Boxing Day event it was damaged even more than it was when you saw it judging by the photographs at that time. Can you think of any circumstance that would be pulling that cable, that column differently to, to others? I mean was the plant room involved or was there any other situation that you're familiar with that pertained to that column?

A. Yes one would have expected that, you know, all of the columns are tied through the floor slabs to the shear walls and that they should have at least columns in proximity to each other should have undergone the same sort of displacements but why that particular column did that I'm not sure it was, it was obviously directly connected to the, to the wall above.

Q. Yes.

A. And I think there was some interaction going on there; I'm not sure exactly what it was.

Q. Was that a stub wall that sort of was canterlevering out from the side wall of the lift shaft?

A. It was, yes.

Q. Yes. I think I understand the physical nature of it so we'll have to ponder further on why that might be.

A. Yes.

QUESTIONS FROM JUSTICE COOPER – NIL

JUSTICE COOPER:

I have no questions but Mr Weston there's a loose end so far as I am concerned and those photographs that we couldn't make much of and I'm just wondering how that's been resolved, has there been any discussion between counsel about it?

MR WESTON:

Checking with Ms Bryant because those arrangements were to be made and I hadn't quite caught up as to where got to.

JUSTICE COOPER:

Right.

MR WESTON:

Give me just a second. The photos are on a disk, the disk's to be provided directly, that hasn't yet occurred for various reasons I won't bore you with but will occur very shortly. The next ten minutes.

JUSTICE COOPER:

And what about what we are to make of them when that's happened, is there some agreed position.

MR WESTON:

We didn't put them forward, Sir, for any contentious reason at all and it may be that at the end they are of no moment whatsoever.

JUSTICE COOPER:

Well what do you want us to do? Are you just leaving them to us for us to –?

MR WESTON:

Yes –

JUSTICE COOPER:

Make what we will of them?

MR WESTON:

The context is this Sir, the, there was evidence about them. Mr Coatsworth reflected on the photos that he had taken, was concerned that he was properly assisting the Commission.

JUSTICE COOPER:

Yes.

MR WESTON:

And in case it was of assistance thought he should draw that photo to your attention.

JUSTICE COOPER:

All right.

MR WESTON:

And so there was nothing more behind the motivation than that.

JUSTICE COOPER:

Well will Counsel Assisting be told when these documents are in uploadable form?

MR WESTON:

The short answer is yes.

JUSTICE COOPER:

So Mr Zarifeh you'll tell us what the position is when it's resolved. Thank you.

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WITNESS EXCUSED

MR WESTON CALLS

BRIAN EDWARD KEHOE (SWORN)

Q. Mr Kehoe, your full name is Brian Edward Kehoe?

A. Yes.

Q. You live in California?

A. Yes.

Q. And you are a professional engineer?

A. Yes.

Q. Now you have in front of you a statement that you prepared together with one of your colleagues?

A. That is correct.

Q. And you are going to give the evidence that you have jointly prepared with him?

A. Yes.

Q. And as you mention in the course of this witness statement of yours indeed you sought assistance from a third colleague and you mention the detail of that in this witness statement, don't you?

A. Yes.

Q. So subject to that if you would be good enough to start at paragraph 1.1 and read this through please?

A. Yes. Our full names are Brian Edward Kehoe and Terrence F Paret. We live in California and are, respectively, Associate Principal and Senior Principal of Wiss, Janney, Elstner Associates Inc, a US firm of structural engineers, architects and materials scientists. Copies of our curricula vitae are attached to this statement of evidence. WJE undertakes earthquake damage and seismic risk assessments around the world. Its expertise and our experience include emergency assessments of reinforced concrete and other structures undertaken in the aftermath of earthquakes both in the United States and other jurisdictions, including Turkey, Greece, Haiti, Algeria, Japan, China, El Salvador, Taiwan, India and Guam. Notable reinforced concrete structures that we have assessed include the San Francisco Airport Hyatt Regency Hotel, the Mauna Kea Beach Resort, the Royal Palm

Hotel, and the Los Angeles County Civic Centre. WJE is contracted by the US Department of State to undertake seismic assessment and strengthening designs for its embassies and residential facilities worldwide and its team of earthquake engineers of which we are part provides consulting services to the Federal Emergency Management Agency and the US National Park Service. Subsequent to the August 2011 Mineral earthquake in Virginia, WJE was engaged to performed damage assessment and emergency hazard mitigation for NPS buildings and other buildings in Washington DC including the Washington Monument, Jefferson Memorial, Lincoln Memorial and the National Cathedral. We have developed construction drawings for repair of the Washington Monument and have just completed a performance-based nonlinear assessment of seismic safety for the Monument for a 2,475 year earthquake. I participated in the initial damage assessment of the Washington Monument and the Lincoln Memorial and Mr Paret is supervising the seismic assessment of the Washington Monument. WJE's engineers have developed or contributed to the development of many of the earthquake engineering investigation and analysis procedures in common use today. These include, WJE engineers were part of the project engineering panel that provided overall reviewing guidance for the development of ATC-20 post-earthquake assessment protocols and developed the ATC-20 training materials used to train engineers to conduct post-earthquake safety evaluations throughout the United States. As we discuss below, the New Zealand guidelines for post-earthquake safety procedures are based on ATC-20. WJE engineers including myself are regularly engaged by ATC and FEMA as instructors. WJE engineers are credited with developing the Capacity Spectrum Method, a seismic analysis technique that is the source of the nonlinear static pushover analysis methods prescribed by ATC-40, FEMA 356, and ASCE-41. CSM and nonlinear static pushover methods are recognised as innovative methods for the seismic analysis of buildings. WJE engineers developed the acceleration-displacement response spectrum for application in nonlinear static analysis, ADRS.

ADRS is used worldwide, including in New Zealand. Myself and Mr Paret were primary participants in the development of the ADRS. WJE engineers have contributed to the following projects: FEMA 306, 307 and 308 Evaluation and Repair of Earthquake Damaged Concrete and Masonry Wall Buildings; FEMA 310 Handbook for the Seismic Evaluation of Buildings: a pre-standard, FEMA 356 pre-standard and Commentary for the Seismic Rehabilitation of Buildings, ATC-20-2 addendum to the ATC-20 post-earthquake Building Safety Evaluation Procedures, ATC-40 seismic Evaluation and Retrofit of Concrete Buildings, SAC Steel Moment Frame project; CUREE-Caltech Woodframe Project, ASCE-31 Seismic Evaluation of Existing Buildings and ASCE-41 Seismic Rehabilitation of Existing Buildings. Seminal resource documents that were prepared by WJE engineers include three Naval Facilities Engineering Command seismic technical manuals, Seismic Design for Buildings; Seismic Design Guidelines for Essential Buildings; and Seismic Design Guidelines for Upgrading Existing Buildings; TM5-809-10, TM5-809-10-1 and TM5-809-10-2, respectively. WJE was requested by CPG New Zealand Ltd to review the damage assessment performed by David Coatsworth on the building at 249 Madras St, the CTV building, after the 4th of September 2010 earthquake and to provide an expert opinion on, a) whether the assessment undertaken by Mr Coatsworth was appropriate; and (b) whether, based on his findings from that assessment, his conclusions and recommendations were properly made. In relation to the first question, WJE was specifically asked to consider whether Mr Coatsworth should have undertaken a seismic analysis of the as-built condition of the building. We undertook this review in conjunction with a principal from our Chicago office, Conrad Paulson. A copy of Mr Paulson's curriculum vitae is also attached to this statement of evidence. While I will attend the inquiry to present this statement to the Royal Commission, the other members of the team are able to attend the hearing by video link if it would be helpful to the Commission for us to do so. I was a member of the American Society of Civil Engineers reconnaissance team which

visited Christchurch after the 4th of September 2010 Darfield earthquake and again after the 22nd of February 2011 event. The team was tasked by the ASCE with assessing the performance of buildings for the purpose of improving procedures for evaluating the seismic performance of existing buildings and met with professors from the University of Canterbury and local structural engineers. After the February event, I accompanied building damage assessment teams conducting follow-up post-earthquake safety evaluations of buildings and attended briefs for local structural engineers at the emergency operations centre. I am a steering committee member of ASCE-41 (Seismic Evaluation and Rehabilitation of Existing Buildings) and sat on the American Concrete Institute's Committee ACI-374 for Performance-Based Seismic Design of Concrete Buildings (among other committees). I've developed training courses and given numerous presentations for FEMA regarding seismic design and evaluation of buildings and non-structural components throughout the United States and I'm also an instructor for ATC-20 which is discussed in more detail below. We have been provided with and have read a copy of the Code of Conduct for Expert Witnesses set out in Schedule 4 of the High Court Rules and agreed to comply with the same. We have reviewed the brief of evidence of David Coatsworth and the documents to which he refers, including Mr Coatsworth's email of the 24th of September 2010 setting out CPG's proposal for the building assessment; Mr Coatsworth notes, diagrams and photographs concerning the assessment he undertook, his report of his findings and conclusions and his email concerning his subsequent inspection on the 19th of October 2010. We have also reviewed materials on the secure document access system and the public database set up by the Royal Commission relating to the CTV building collapse. In this statement I refer to other materials including research and reference materials that we have considered in forming our opinions. As outlined above, WJE engineers have undertaken post-earthquake damage assessments in various jurisdictions and have been directly involved in the development of, and provided training for, commonly used

post-earthquake procedures. There are a variety of assessment methodologies that can be used. The type of assessment that is performed will depend on a number of factors, which are explained in more detail below. Typically, assessments fall into two categories: (a) basic rapid assessments conducted by the local jurisdiction (territorial authority), (b) engineering evaluations undertaken by an engineer engaged by the building owner. In some circumstances that evaluation may include an assessment of the building seismic capacity as designed or constructed. The basic rapid assessment process is initiated by the territorial authority immediately following a significant earthquake. It is a triage process used to establish whether a subsequent damage assessment should be performed. The triage process helps to prioritise buildings that require subsequent damage assessments so that the available resources are best utilised. In New Zealand the primary resource document available in September 2010 to guide the performance of these rapid assessments was the document titled *"Building Safety Evaluation During a State of Emergency – Guidelines for Territorial Authorities"* prepared by the New Zealand Society for Earthquake Engineering (NZSEE) and dated August 2009 (the NZSEE Guidelines). The NZSEE Guidelines is an update of the first edition produced in 1998 based on post-earthquake experience gained in both New Zealand and the United States, and draws heavily from the document "*ATC-20: Procedures for Post-earthquake Safety Evaluation of Buildings"* by the Applied Technology Council. The ATC is a non-profit corporation that was founded in 1973 as an initiative of the Structural Engineers Association of California. ATC develops and promotes engineering resources and applications for mitigating the effects of natural and other hazards on the built environment, primarily as they relate to earthquakes. Mr Robert Bruce, who is currently employed by WJE was a contributor to the development of the ATC-20 series of documents. Myself, Robert Bruce and others at WJE are instructors for ATC-20. Under the NZSEE Guidelines the initial assessment of a building is referred to as a Level 1 Rapid Assessment. Generally, the

Level 1 Rapid Assessment is performed by a building official or volunteer engineer or architect without interior access to the building and this assessment takes on the order of 10 to 20 minutes per building. The purpose of this initial assessment, the initial rapid assessment, is to identify buildings with obvious visible indications of severe damage that may present the life safety hazard to the public. The result of this initial assessment is typically a coloured placard placed on the building (also referred to as 'tagging') indicating that the building is either green (safe to occupy), yellow (restricted use) or red (unsafe). In the ATC-20 document the initial assessment is termed a rapid assessment which corresponds to the level 1 assessment from the NZSEE Guidelines. A subsequent evaluation may be performed by the territorial authority to verify the findings from the initial rapid assessment. This subsequent evaluation is termed a Level 2 Rapid Assessment in the NZSEE Guidelines or a detailed assessment using the ATC-20 procedure. This evaluation, performed subsequent to the level 1 evaluation, typically includes visual observations of the accessible interior and exterior portions of the building. In the ATC-20 Guidelines the detailed assessment is described as a visual observation of the inside and outside of the structure. These assessments typically last from one to four hours. The criteria used in Christchurch to determine the prioritisation of the Level 2 inspections were: (a) all buildings which had received red or yellow placard in the Level 1 Assessment, (b) all green placarded buildings with more than four levels, (c) all green placarded buildings with high occupancy levels, and (d) all green placarded buildings where the Level 1 Rapid Assessment form recommended that a Level 2 assessment be carried out. The third level of post-earthquake evaluation is termed a detailed engineering evaluation by the NZSEE Guidelines. The ATC-20 document refers to this level of evaluation as an engineering evaluation. In both documents this level of valuation is one, is described as one in which an engineer is engaged by the building owner. The NZSEE Guidelines in Figure 2 anticipate that the buildings receiving yellow and red placards will require a detailed engineering

evaluation. However, the NZSEE Guidelines do not require green placarded buildings to receive a detailed engineering evaluation. With respect to the green placarded buildings this same figure indicates only that they "...may need further inspection or repairs ([by the] owner's engineer)". A copy of Figure 2 is included below."

Q. Just pause there Mr Kehoe.

MR WESTON ADDRESSES THE COMMISSION:

Your Honour, Commissioners, I know you've had an opportunity to see this before, do you want Mr Kehoe to talk you through this or -?

JUSTICE COOPER:

I don't think so. We're quite familiar with this by now.

EXAMINATION CONTINUES: MR WESTON

Q. Paragraph 3.11 Mr Kehoe?

WITNESS CONTINUES READING BRIEF OF EVIDENCE AT PARAGRAPH 3.11

A. "We understand that buildings that received yellow or red placards following the September 2010 Darfield earthquake were considered by the Christchurch City Council to be earthquake-prone buildings under s122 of the Building Act 2004 once the State of Emergency expired on September 16, 2010. These buildings were required to have a detailed engineering evaluation and possibly remedial work prior to resuming unrestricted occupancy. Buildings such as the CTV building that received green placards did not require any further action by the Christchurch City Council and the green placard could remain on the building at the discretion of the owner. In our experience, there can be a number of reasons why an owner engages an engineer, such as Mr Coatsworth, to perform a visual assessment of a building which has been given a green placard under the basic rapid assessment process and which, accordingly, does not require further assessment under the NZSEE Guidelines. These reasons include, among others:
(a) confirming or refuting the post-earthquake posting of the building

performed by the territorial authority, (b) developing estimates for repair costs for insurance claims, (c) providing an initial assessment of the condition of the building for the purpose of determining the need for follow-up damage assessments, and (d) designing repairs or other remedial measures. Following an earthquake building owners and tenants often have heightened awareness of the condition of the building. Engineers are engaged to assess visually the conditions identified by building owners and tenants to help distinguish cosmetic damage from structural damage. This may be needed when the building owner or tenant perceives the observable damage to be more significant than indicated by the post-earthquake rapid assessments performed by the territorial authority. The NZSEE Guidelines do not provide detailed guidance for the implementation of the detailed engineering evaluation of red and yellow placarded buildings or for any further inspection of green placarded buildings outside the scope of the NZSEE Guidelines. The ATC-20 document also does not provide guidance regarding the scope or implementation of the engineering evaluation. The specifics of the Detailed Engineering Evaluation of a yellow or red placarded building or further inspection of a green placarded building would be expected to vary depending on the type of damage and the type of building. The decision on the specifics of the evaluation is usually made based on agreement between the engineer and the building owner, typically with consideration given to the amount of effort required and the cost associated with the evaluation compared to the perceived need for the evaluation. An evaluation of the Green placarded building (that is, a building that has not been identified in the Level 1 and Level 2 Rapid Assessment process as being hazardous or unsafe will always involve a visual inspection, at least in the first instance. Implicit in the methodology of post-earthquake safety evaluations is that imminent hazards and unsafe conditions are visible physical conditions as opposed to numerically calculated conditions, particularly with respect to reinforced concrete buildings, structural damage significant enough to compromise safety is normally expected to be visible. This is the case

because the concrete has to crack before the strength of the steel reinforcing embedded within the structural concrete members can be mobilised and full mobilisation of the steel reinforcing normally necessitates the formation of wide cracks. By way of clarification in a post-earthquake environment a finding that an imminent hazard or unsafe condition exists is generally indicated when a part or portion of a building might fall or collapse, either spontaneously or in the event of an aftershock, where aftershocks are commonly understood to be smaller than the main shock. The 22nd of February 2011 aftershock was unusual. Although it was a lesser magnitude on the Richter Scale than the 4th of September 2010 event, the depth and the proximity of its epicentre relative to the Central Business District meant that the seismic demands experienced in the centre of Christchurch exceeded both those of the main 4th of September 2010 earthquake shock and the theoretical 475 year design event that new commercial office buildings must be designed to withstand. In our opinion, the occurrence of an aftershock with an intensity meeting or exceeding a 1 in 2475 year event (such as the 22 February 2011 event) would not have been anticipated by engineers undertaking assessments in the aftermath of the 4 September 2010 earthquake. While ATC-20 and the NZSEE Guidelines are intended to guide post-earthquake assessments by professional volunteers as organised by a territorial authority, or by qualified employees of the territorial authority itself, the conceptual framework established in these documents for recognising imminent hazards and unsafe conditions is generally also applicable to post-earthquake assessments conducted by engineers under contract to an owner. This applies both to Detailed Engineering Examinations required under the NZSEE Guidelines and to the assessment of Green placarded buildings, which are not required under those guidelines. An engineer conducting a post-earthquake assessment under contract to an owner would normally focus more on-site attention on the structure of interest than would volunteers or civil authorities using either the NZSEE Guidelines or ATC-20. Examples of examinations that might be

done by an engineer engaged by a building owner beyond that done during the Level 2 Evaluation are: (a) mapping the location of cracks, (b) measuring the width of cracks, (c) observing concealed conditions, such as by removing ceiling tiles at strategic locations, and (d) measuring selected dimensions of the building and structural elements. Engineers have recourse to a limited number of available documents for guidance with respect to assessing the condition of a building affected by an earthquake. The selection of the documents that are relied upon is at the judgement of the engineer performing the evaluation. One document that provides a detailed procedure for quantitatively evaluating buildings constructed with concrete or masonry walls for seismic lateral resistance is FEMA 306 *"Evaluation of Earthquake Damaged Concrete and Masonry Wall Buildings"*. This document provides guidance for the evaluation of earthquake damage to concrete and masonry shear walls in terms of the effect of the observed damaged on the future performance of the building. FEMA 306 includes component classification guides that provide recommendations for the characterisation of various types of damage to the lateral force resisting elements of the building. FEMA 306 guides can be used to evaluate the structural significance of cracks of various widths in concrete shear walls. However, FEMA 306 does not provide guidance for the evaluation of the other structural elements in a building such as the gravity load framing. Other general guidance about what may or may not constitute structural damage can be obtained from structural engineering textbooks and available professional papers. We note, however, that documents published in New Zealand following the February 2011 earthquake point out the lack of guidance for engineers performing post-earthquake assessments and provide some additional guidelines. There is no post-earthquake evaluation standard of which I am aware that requires the review of design drawings as part of the post-earthquake damage assessment. The NZSEE Guidelines indicate only under the category "Detailed Engineering Evaluation and Remedial Work" that such evaluations "are likely to involve review of construction

documentation..." As outlined above, a Detailed Engineering Evaluation is only required if a building has already been inspected and identified as hazardous during the basic rapid assessment process. It is sensible for an engineer to request the design drawings to obtain information about the building structure. In reality, however, post-earthquake damage assessments, including further assessments and Detailed Engineering Evaluations carried out by engineers engaged by the owner are often performed for older buildings for which original structural design drawings are no longer in existence and so the drawings are not available. Where original design drawings are not available, an engineer performing a post-earthquake evaluation may obtain architectural floor plan that shows the general layout of the permanent building elements, or the engineer may create such a floor plan. This type of plan may enable the engineer to understand the location and quantity of the structural elements of the lateral force resisting system, such as concrete shear walls, among other elements. The general information about the layout of the structural elements can be used by the engineer to attempt to identify the location of the elements that would be more likely to have been damaged by the earthquake. This information could be used by the engineer performing an engineering evaluation to direct the engineer's efforts toward potentially important structural elements. For buildings that were previously identified as earthquake-prone or are suspected to be earthquake-prone following an assessment of their seismic capacity using a simplified calculation process such as the Initial Evaluation Procedure, it would be reasonable for an engineer to review the structural drawings, if they exist, to make an assessment of whether the damage to the building has affected the critical deficiencies identified by the IEP. An engineer would also generally recommend reviewing available drawings for buildings that have unusual configurations or that have structural framing that is not readily observable. This would provide the engineer with confidence that the important structural details would be identified and observed in detail if warranted by the available evidence of damage. If the engineer

feels that the pattern and extent of damage to the building are not consistent with the engineer's expectations, based on knowledge of the age of the building, ground motion at the site, and damage to nearby buildings, then the engineer may review drawings or perform in situ testing to explain the observed damage. An engineer would generally not obtain and review structural drawings (or undertake an IEP) for modern buildings that do not exhibit unusual or excessive structural damage. This is because modern buildings are generally considered to be designed to current earthquake design standards. In the City of San Francisco, for example, code triggers that require strengthening of existing buildings are not applicable to buildings designed after the 21st May 1973 when the first San Francisco code which incorporated significant improvements to ensure ductile response of reinforced concrete structures was adopted. Similarly, ASCE-31 *"Seismic Evaluation of Existing Buildings"* includes an explicit definition of "benchmark buildings" which sets forth that a seismic evaluation need not be performed when the design and construction of the buildings is in accordance with modern building code provisions identified as benchmark provisions. These modern buildings would generally be expected to perform well during a design earthquake, even though the building codes have evolved and become more stringent since that time. A similar philosophy exists within the New Zealand earthquake engineering profession, where post-1976 buildings are credited with superior seismic resistance by virtue of their design date. The primary goal of a post-earthquake assessment is to identify if the building exhibits visible physical evidence of having its capacity diminished by the earthquake. In the absence of such evidence, the building can be assumed to be capable of withstanding another earthquake of equivalent force to the earthquake that resulted in the inspection taking place. Under the circumstances discussed below, an engineer conducting a post-earthquake assessment under contract with an owner might determine (that is, numerically calculate) the expected seismic capacity of a building as designed, or as constructed, or both.

Generally, such a determination, if it were to be done, would be done with the authorisation of the owner of the building who would have agreed in advance to the scope and cost of this kind of assessment. An engineering recommendation to make a determination of expected capacity of a building would not normally be made prior to the completion of an on-site post-earthquake visual assessment. Only after determining during the on-site assessment that the building exhibits visible physical evidence of its capacity having been diminished by the earthquake would an engineer conducting a post-earthquake assessment normally recommend that calculation of expected capacity of the building as designed, as constructed, or both, and calculation of diminution of capacity, be performed. In the absence of visible physical evidence of some diminution of capacity, there would not normally be cause to recommend calculation of expected capacity as part of a post-earthquake assessment. The absence of visible physical evidence of some diminution of capacity would be all the more significant if the intensity of earthquake shaking that prompted the assessment was near that of a design level event (such as the 4th of September 2010 earthquake), because exposure to actual earthquake shaking at design-level intensity is a better test of capacity than any calculation or analysis. Determination of the expected capacity of a building can be done in a multitude of ways and with varying levels of accuracy. The extent of professional services involved in making such determinations might vary from approximate calculations (such as the IEP) to highly complex computer simulations. The level of effort involved would normally be the subject of discussion and negotiation between the engineer and the building owner, and based on the physical evidence of damage exhibited by the building after the earthquake. Lack of visually significant damage would not warrant further analysis since the extent of professional services undertaken should be commensurate with the damage observed. Without available drawings, a 'back of the envelope' type of determination would likely be of limited utility. For example, without structural drawings, the strength of a shear wall building might

be relatively easy to approximate using the 'back of the envelope' approach, but the vulnerability of the associated beam and column framing to go undergo significant lateral displacements without being structurally compromised would not be readily assessable in this manner. Under appropriate circumstances, it would be prudent and generally accepted practice for an engineer to recommend closure of the whole or part of a building while at the site in response to conditions observed when conducting a post-earthquake damage assessment. In particular, it would be prudent and generally accepted practice for an engineer to recommend closure of the whole or part of a building which exhibits an imminent hazard or unsafe condition that jeopardises the safety of either occupants or passersby. It is not prudent or generally accepted practice to close parts or all of a structure that do not exhibit an imminent hazard or unsafe condition, although closures for inappropriate reasons do occur. Guidance set forth within the NZSEE Guidelines and ATC-20, and also within other documents, explains that improper closures are unduly burdensome to building owners and to the community as a whole and should therefore be avoided. Prudence does not therefore justify being overly conservative and closing buildings unduly. All buildings affected by an earthquake and that have been given green, yellow, or red placards need to be re-evaluated following any significant aftershock using the same triage procedure with Level 1 Rapid Assessments to assess changes in the condition of the building. This is because the conditions may have changed during subsequent events, such as the Boxing Day earthquake of 26th of December 2010. Any evaluation made following an aftershock supersedes the evaluations made prior to that event. We have reviewed the statement of evidence of David Coatsworth and the supporting documents referred to in that statement. The opinions I express are based on those materials. Mr Coatsworth of CPG conducted a post-earthquake assessment at the request and under agreement with the owner of the property. Mr Coatsworth's proposal was drafted, as is usual and customary, at a time when he had only a

limited understanding of the conditions at the building, and as such was general in nature. At the time of Mr Coatsworth's instruction, Level 1 and Level 2 Rapid Assessments had already been conducted by post-earthquake inspection teams operating under the direction of the Christchurch City Council. Since the CTV building was not placarded as either yellow or red by a Level 2 Rapid Assessment, a detailed engineering evaluation was not required by the NZSEE Guidelines. Nonetheless, the owner of the building appears to have decided to obtain a separate evaluation. In his proposal, Mr Coatsworth appropriately requested both the structural and architectural drawings as having such drawings would assist in his developing an understanding of the structural systems in the building. We understand that his evidence is that he was informed that they were not available. Mr Coatsworth proceeded with the post-earthquake assessment without benefit of the information that the original structural drawings might have provided. As we have explained above, this is usual and customary when drawings are not available. In lieu of original drawings for the building, Mr Coatsworth made use of interior layout plans for the first and second floors (also known as the ground floor and first floor) provided to him by the tenant of those floors, CTV. Use of such plans, where original drawings are unavailable, is accepted engineering practice. Mr Coatsworth's proposal explains that his recommendation is to examine the exterior of the building from whatever vantage points are available and to inspect all visible interior finishes. In addition, he proposes to look selectively above ceiling tiles, but reserves judgment on removing wall finishes until the condition of those finishes is examined. We agree with his recommended scope of work. To recommend more on-site activity at the time the proposal was written would not have been appropriate prior to viewing the condition of the building. Mr Coatsworth's proposal states that at the time the proposal was written he was not including either analysis or development of repairs in his recommended scope of work. Importantly, and, in our view, quite correctly, his proposal indicates that analysis of the structure

might ultimately be necessary if significant structural damage is identified. This is the correct hierarchy in which to place analysis in a post-earthquake inspection. As I have explained at paragraphs 3.32-3.33 above, it is usual and customary to conduct the on-site assessment first to determine if significant structural damage is exhibited, and then, if called for by the presence of damage, recommend that structural analysis be performed. I understand that Mr Coatsworth's evidence is that on the 29th of September 2010 he spent approximately four hours performing visual observations at the CTV building. His field notes from this site inspection include visual observations undertaken at every level of the interior, including the mechanical plant room at the top of the building, and also visual observations of the building exterior. He includes sketches of cracking on the walls of the north core stairwell and the WC room, and on the south shear wall. He took photographs of numerous conditions at the interior and exterior of the building, including photographs taken at locations appearing to be above the ceiling, presumably accessed by lifting up of some the ceiling tiles. For the size of the CTV building and its type of construction, the actions of Mr Coatsworth are consistent with our understanding of accepted engineering practice. His field notes also indicate that Mr Coatsworth systematically examined and then documented locations of readily observed cracks in all of the readily accessible reinforced concrete shear walls in the building. We understand that Mr Coatsworth's evidence is that he made numbered notes during his inspection and then, on October 6, returned to the building and made a more detailed record of crack width measurements. This kind of record is what we would expect to see in an assessment of this nature. The largest crack width measurement recorded by Mr Coatsworth as of October 6, 2010 was 0.30 millimetres for inclined or diagonal cracks, and 0.35 millimetres for horizontal cracks. Based on our own review of Mr Coatsworth's crack measurements, field notes and previous experience in evaluating concrete buildings, we would interpret the vast majority of the horizontal cracks to be movement along construction

joints that in all likelihood would have already existed as open cracks before the earthquake of 4 September 2010. Mr Coatsworth characterises these cracks as minor structural damage and did not raise any alarm, immediate or delayed, concerning these cracks. I agree with his assessment in that we consider these cracks to be damage to a structural element that is not of structural consequence. Cracks of this size may be considered minor damage to a structural element, damage of a cosmetic nature. Mr Coatsworth's records indicate that, while preparing his report, Mr Coatsworth sought the opinion of his colleagues and others in the engineering profession regarding the size of the cracks in the concrete shear walls and what, if anything should be done about them. Seeking counsel from peers is not unusual in the engineering profession and, in our opinion, amounts to good practice. In many engineering firms, this type of action is encouraged. Mr Coatsworth did not undertake any numerical calculation of the expected seismic capacity of the building. This is consistent with his proposal to the building owner. As I have explained, we would not expect any such calculations to be done in the absence of any indication that significant structural damage had occurred. Such damage ought to be apparent on a visual inspection of the building. Following the aftershock of 19 October 2010, Mr Coatsworth says that he returned to the CTV building that same day to re-examine the building. He spoke with several building occupants and re-examined distressed areas he previously observed. His only notable observation was the possibility that two horizontal cracks in the shear walls, likely pre-existing construction joints, may have enlarged slightly, with the maximum horizontal crack width now reported as 0.4 to 0.5 millimetres. According to his records, diagonal cracks did not increase in width. In my opinion, the cracks of this size in a modern reinforced concrete structural element do not constitute structurally substantive damage to the structure, whether or not they are at construction joints. In summary, it is our opinion that Mr Coatsworth's inspection is consistent with what we would expect an engineer to do when assessing a building like the CTV building for post-

which repairs may be necessary for restoration of non-structural characteristics. Mr Coatsworth's largest recorded crack size of 0.4 to 0.5 millimetres clearly qualifies as insignificant damage according to the FEMA 306 criteria. In Mr Coatsworth's notes and in his emails, he indicates that he has based his opinion upon discussions he had with his colleagues at CPG and with others in the engineering profession regarding the observed size of the cracks in the concrete shear walls. In our view, seeking a second opinion is consistent with good engineering practice. I agree with the advice that he received. In his report, Mr Coatsworth advises that cracks larger than 0.2 millimetres be repaired by epoxy injection. In his notes and emails summarising his consultations with others, it appears that the basis of this specific recommendation is "for peace of mind and weathering." There is also discussion that some of the stiffness of the wall may be restored by the recommended repairs. His recommendation to repair these cracks is, in our opinion, appropriate not only as a measure against the weather but also for partial restoration of stiffness of the wall, and is in accordance with accepted engineering practice. In his report, Mr Coatsworth also comments on other damage he observed, in addition to the cracking damage in the concrete shear walls. The described damage is itemised under the following categories: Columns, Beams and Spandrel Panels; Flooring; Non-Load Bearing Concrete Block Walls; Internal Framing and Linings; and Windows. From a structural perspective, all of the damage described under these added observations is characterised as minor damage at worst, for the most part not indicating structural damage and not warranting structural repairs. However, several repairs for protection against weather intrusion are again recommended. Additionally, loose plaster on the exterior of the building is identified as a falling hazard, and Mr Coatsworth recommends taking measures to mitigate this. I agree with Mr Coatsworth's conclusions on these added observations and his recommendations for repair or mitigation. Finally, in his email dated 19th of October 2010, recounting his follow-up visual inspection of the CTV building following the aftershock in the morning of

that day, Mr Coatsworth concluded that the building was "still structurally sound". To an engineer, the use of the phrase "structurally sound" in the context of a post-earthquake assessment means that the building had not been structurally compromised and would be capable of withstanding another earthquake of equivalent intensity, including such considerations as the acceleration, velocity, and displacement caused by the shaking. On the basis of the observations noted in Mr Coatsworth's email we agree with the assessment that the condition of the structure had not deteriorated as a result of the 19th of October aftershock.

CROSS-EXAMINATION: MS FRAMPTON – NIL

CROSS-EXAMINATION: MR REID – NIL

1655

CROSS-EXAMINATION: MR PALMER

Q. With reference to your paragraph 3.18 Mr Kehoe you, you're referring here to a conceptual framework established in the documents ATC20 and NZSEE Guidelines, would that include ascertainment of the extent of structural damage?

A. Yes it would.

Q. And in the paragraph that follows you refer to some examples of things that might be done by an engineer engaged by a building owner and of course you'd have to add to that list wouldn't you obtaining structural plans and drawings if they were available?

A. Yes. That, that was not part of what this paragraph was talking about but that would be another consideration.

Q. Well it's just you talk about examples of examinations that might be done so an examination of the plans and drawings would be one such thing that might be done?

A. Right.

Q. Yes. In 3.22 you say that FEMA 306 does not provide guidance for the evaluation of the other structural elements in a building such as the gravity load framing. Does that mean that out – effectively outside of the shear walls where FEMA 306 does apply, it doesn't provide guidance for cracking in, for example, beams or column joints?

A. Not directly there's no, none of the component guidelines that are covered in the FEMA 306 document covered those other elements but the general procedure in FEMA 306 looks at the total capacity of the building, which would include considerations such as the gravity load framing.

Q. I think you went on and said that there weren't really any guidelines to deal with those issues outside of FEMA 306 and the engineers were effectively left without an international standard ,or any other standard to, to guide them on those matters, is that how, is that, is my understanding correct?

A. Yes.

Q. So, does that mean that relatively fine cracks could be observed on an inspection in non-shear wall components or elements of a building such as columns and joints, but there's no guidance as to how the inspecting engineers should treat their significance?

A. There's nothing that specifically considers that effect but there are guidelines such as ASE41 which talks about evaluating existing structures, which does take into account pre-existing damage to those elements.

Q. So it’s really up to an individual engineer inspecting on the day to make an assessment within his or her judgement as to the significance or otherwise of any such cracks that might be observed outside of the shear walls, of course?

A. That's correct.

Q. And it is, is it the case that while we might look at a crack as it, as it stands on, on the day of inspection that crack may have widened considerably during an earthquake event and then closed under the load of the building or otherwise?

A. Well most cracks will during the earthquake be larger than what is visible at the, after the end of the earthquake. All of the damage assessments guidelines are based on the appearance of the crack after the event and so that is already taken into account.

Q. So there's, by, by looking basically, by looking at a crack in one of those non-shear wall elements given that capacity for opening and closing of a, of a crack it's really impossible to say how far they may have opened during the earthquake event?

A. Well, I wouldn't say it's impossible, there are, there's a lot of research that has been done on the difference between the crack widths during an earthquake or during testing of an element for earthquake loads and what that crack width is at the end of the event. There, there would not be a very large change in the crack widths, there are obviously some changes in the crack widths that occur after the event but it's not, a crack is not going to open up three to four centimetres during the earthquake and close to where you can't see it; that does not happen.

Q. But an earthquake engineer inspecting, such as Mr Coatsworth, he really wouldn't know how far they opened or not?

A. Well you would be able to tell in most cases by looking at the finishes and other indications around that particular crack to see if they also look they, there was indication of a, of an opening of that crack. So the crack itself may not be indicative but there would be outward signs of areas around that element that would give an indication of how wide that crack had opened.

Q. Okay. Moving on at paragraph 3.25 you say it's sensible for an engineer to request the design drawings to obtain information about the building structure and we know, of course, that Mr Coatsworth did request and wasn't able to locate them. Would that request that you're referring to there extend to seeking the seeking the drawings off the design engineer?

A. Well as Mr Coatsworth said in his evidence most of the time you would not know who the design engineer is if you don't have a copy of the drawings.

Q. Would you make enquiries?

A. In a large community the, you'd have to call a lot of engineers to figure out who the designer would be and it would not be, you know, very prudent to do so.

Q. And in a small community?

A. In a small community when you know that there may only be three or four, or five large firms that might be designing buildings of that type it might be more reasonable to make, ah, make a couple of enquiries.

Q. Okay. At 3.29 you say that an engineer would generally not obtain and review structural drawings for modern buildings and you go on to explain that that's because of the higher design codes for seismicity. Mr Coatsworth did say that the drawings would be very helpful. I assume that even for modern buildings if you can get the drawings you should try and do so, is that correct?

A. That's correct, yeah, I would agree that any time you can have the drawings they would certainly be useful.

Q. At 3.33 you draw together a number of evidential threads here and say that, "the absence of visible physical evidence of some diminution of capacity would be all the more significant if the intensity of earthquake shaking that prompted the assessment was near that of a design level event, such as the 4 September earthquake, because exposure to actual earthquake shaking at design level intensity is a better test of capacity than any calculation or analysis". Do I take it from that that you're saying that if a building is, has weathered the storm so to speak or gone through the, the earthquake that you're referring to here than the fact that visible design is not present is a good indication that the building is structurally sound?

A. Yeah that's the, the implication here is that if the building has gone through its design level event, we can assume that it would good for its design level event and would not need to do any calculations to verify that.

Q. Bearing in mind that we've all experienced significant aftershocks since the 4th of September including unfortunately the Boxing Day earthquake

A. Yes.

Q. What about the phenomenon of low, low cycle fatigue and its effect on, on the reinforcing in such buildings?

A. Well there's been studies done as part of the FEMA 306, 307, 308 process of which Dr Mander was a part which studied this exact condition, whether a previous earthquake damage would affect a building's ability to resist further earthquakes and the conclusion based on thousands of numerical analyses of buildings concluded that previous earthquake experience of a building did not significantly affect its ability to affect a future earthquake.

Q. It's almost impossible for a lay person like myself to conceive that the, that a strong earthquake exhibiting force to a building could not have an effect on the strength or the capacity of a building to withstand further earthquakes. It's been likened by some of the experts that I've spoken to as something like a slow cancer taking hold, which with the building's capacity being used up in the process. Are you saying that the 4 September and subsequent aftershocks up to the time of inspection on the 29th of September would have had no or nil effect on the capacity of the building?

A. That's what I'm saying, yes.

COMMISSION ADJOURNS: 5.05 PM

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