HEARING RESUMES ON 16 AUGUST 2012 AT 9.30 AM

JUSTICE COOPER ADDRESSES MR MILLS AND MR RENNIE – ORDER OF HEARING AND DR MANDER'S EVIDENCE

MR RENNIE CALLS

JOHN BARRIE MANDER (SWORN)

Q. Now your full name is John Barrie Mander?

A. Yes.

Q. And you have in front of you the third statement of evidence which you have prepared for the Commission?

A. I have yes.

WITNESS REFERRED TO STATEMENT

Q. And can you confirm on oath that that is a true and correct statement?

A. It is.

Q. Of the evidence that you wish to give in respect of the matters contained in that?

A. Yes sir it is.

Q. Now I understand that in relation to figure 3 on page 6 you would like to just comment or explain that figure in terms of its significance in relation to your findings?

A. Well actually I, I would prefer if I go through each of the figures very briefly because they –

Q. I will take you through each of the figures –

A. – are such a continuum.

Q. – very briefly as a continuum?

A. As a continuum of ideas that come from the three figures.

Q. Right so the first figure logically being called figure number 1 is found on page 3.

WITNESS REFERRED TO FIGURE 1

A. So if we could have that up.

Q. Can we have that up, that's WIT.MANDER.0003.4, then if we just go to the figures I think.

A. So as mentioned yesterday we did the large scale column tests of the 400 millimetre diameter columns. These were selected by myself in collaboration with Mr Christopher Urmson and Doug Latham at the Burwood fill site. Later on that was they, they extracted those under the dutiful watch of Dr MacKechnie who we saw here yesterday and then they were sent to the University of Canterbury labs, the columns were tested in a manner similar to the work that I had done many years ago for my own PhD because back in those days we tested several, well a lot actually 1500 millimetre long, 500 millimetre diameter circular columns and this was specifically more specifically to look at confinement was one of the early full scale studies on confinement of concrete and so what the aim was here was to, given that these columns were of a similar dimension, was to test them under more or less the same circumstances.

So we did that and what you'll see on the top left, well on the left column of the graphs are the test results from the three specimens and the, on the left-hand axis you have axial load. The upper graph on the left is the upper portion of the column. The middle graph is the lower portion of column C5 and then the low graph is, on the left, is the results for what I talked about yesterday that was the clearly damaged column C13. And you'll notice if you just want to pick off some results the result of, of the upper column is about 3500 or 600 kilonewtons, the second one is a little bit higher, it's about 3800. This difference is attributed to the fact that there is a diff- there's to be, remembering that these are both from the same column, there is to be expected a difference between the upper and lower portions of the results because of the moisture rise during the curing of the concrete and the placement of it it tends to weaken the cement, water or water ratio, water cement ratio leading to slightly weaker concrete so that, that's not, no surprise there and then the lower column obviously has a lesser result. We really don't know what concrete that was likely to be made of although it was very clear that the upper concrete, the other specimen was from the upper column so that was clearly 25 megapascal concrete.

So what, what I then did and this took quite a while I had to write a programme to do this but we modelled the actual results so on the right-hand column you'll see the modelled results based on modelling the effects of the, the reinforcing steel and now the reinforcing steel did buckle and that's been accounted for in the modelling. That's why you see it going up on a diagonal line and then it's kind of concaved downwards to the right of a strain of .002 and then the blue dashed line is the cover concrete contribution. And then the, the red dashed line is the core concrete contribution. Now that hangs on a little longer simply because the spiral reinforcement even though it's very meagre it does help somewhat in binding that (inaudible 09:39:43) core together. So those are the results and you'll see that, and as, as far as most engineers would be concerned this is pretty decent agreement between the experimental results and the modelled results.

Q. Yep.

A. Now the method of modelling was an inverse type of modelling where you have to assume the parameters and then they are on the next –

Q. They are on page 4 in table 1.

A. Let's just have the next page will do fine thank you.

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Q. Page 4 table 1 and figure 1, figure 2.

WITNESS REFERRED TO SLIDE

A. So the upper column had 25 megapascals, the lower portion of column C5 had 27 megapascals and the damaged column was 19. Clearly below strength. Now the other point to note is that the Young's Modulus which is the E sub C value in the second or third column, that is quite a bit less than what you would normally expect to see. Normally you would expect that to be about 25,000 for both of those and that is ascribed to the fact that the material itself has been damaged. The next one, epsilon C nought, that is the strain at peak stress that you will notice in the graph below. That value is less also than .002 and that is because the column has been tested dynamically. So things in some respects stiffen up and then there's spalling strain when you test an

axial compression. It's a bit of a crap shoot as to what the outcomes are. So essentially you've got to choose a value that models a result reasonably well. Now for the steel I ended up putting a number in there that's just a specified strength. It really doesn't make a whole lot of difference because the analysis showed that the steel would buckle a little bit before that at a strain of about roughly about .002. Okay so if we have –

Q. We now move forward to figure 3?

A. So as mentioned in my write up that it was somewhat of a surprise that the numbers came out to be so low. So I had to scratch my hair a little bit and I guess I lost some over that, some more. But the point being that the only way that these differences between the cores that we heard about yesterday that Mr Haavik I believe in a very faithful way to the codes and to best practice and to, you know and a very, very high level, did a very thorough job in getting some reliable results. So one would expect, given that this was more or less the same sort of concrete to have the results in that ball park.

So we then have to ask ourselves why there are differences? Well, very simply I believe it's due to cyclic loading. So again I thought, mmm, we've done this before some time or other, ah, it's actually in my thesis. So this albeit for a highly confined specimen shows what happens when you have a column under extreme cyclic loading and pushed out to a very far distance. The dash line is the analytic monotonic. That's the result that you would expect to see in that particular experiment if there was no cyclic loading. So you'll know at the peak of the curve there, it is at about 50 megapascals there is a drop. A drop of about 5% or 10% of the actual observed stress, and then there is a bit of a difference between the two out to a strain of about .003. Now that drop, again as I mentioned is ascribed to cyclic loading effects and perhaps the more important, more significant thing is this.

Here we go, okay so this, what is important to note is that the slope up here, the initial slope, this, that slope in there is called Young's Modulus and as I mentioned, one would expect that for the concrete that we

tested to be about 25,000 or higher megapascals and then this slope in here is a slightly lesser slope due to unloading, and then when it reloads again, because of the pre-damage that's been caused, on every curve you get a little bit of history so that means the area inside the loop down compared with the loop back up again and that is significant of, or that is symptomatic of damage and that damage leads to a lesser strength and also the slope in here is less so if you were test the modulus again in here it would show less. Now to me this explains two things, first of all it explains that there has been damage from the observed results but it also explains why when Opus went to use, to do the Schmidt hammer testing it actually signalled weaker concrete than was really perhaps there. They were measuring this weakened state rather than this virgin state out here.

So I guess in many respects this is what, this is the conclusion of this here and as I have mentioned in my write up there is quite a significant percentage drop as measured. If anybody was, any Commissioners were wanting to pursue this or this further, if you refer to my thesis you will see there is another graph underneath this which almost looks the same and that is totally modelled. So in other words you can, given the right loading regime, if you know what the loading path was, you can model the force response to that and of course all the earthquakes that took place on the CTV we don't know what the previous loading history was so that is really a major problem.

Q. Now, if we can move from that to the written questions that Professor Fenwick has posed to expert witnesses. Do you have those available?

A. I actually don't have them here but I think I remember them.

JUSTICE COOPER:

Is this the minute?

MR RENNIE:

That is correct Sir. Minute of 22nd June.

JUSTICE COOPER:

BUI.MAD249.0506.

MR RENNIE:

And the associated diagram is 0493. If you would like to have a hard copy I can hand you mine Sir.

JUSTICE COOPER:

Well that might facilitate things mightn't it.

MR RENNIE:

That is what I was thinking Sir and no Sir they don't have any writing on them.

JUSTICE COOPER:

Professor Mander will be deprived of the benefit of your expertise on these matters Mr Rennie.

MR RENNIE:

I think that is likely to be to his benefit Sir.

EXAMINATION CONTINUES: MR RENNIE

Q. If you would just like to address them in your own time and in your own manner Professor?

A. I thought I had been through quite a few of these before.

Q. Yes you did you went through the first section I think but there was some matters on which in...

JUSTICE COOPER:

Well it may be preferred, Commissioner Fenwick?

MR RENNIE:

I was going to say Sir it may be better if it is made clear by Professor Fenwick Sir.

COMMISSIONER FENWICK:

Q. We went through the first one on the south wall and I think your comment was, yes, if I have got to remember this correctly, the floor would interfere with the coupled beams?

A. Mmm.

Q. Providing restraint. I can't remember now offhand I would have to check the transcript whether you said the coupled wall would act as a coupled wall or act as a unit?

A. Well as I recall I mentioned that the floor provides some additional bending moment. If you were to draw the bending moment diagram you would get a triangular shape from the floor so there would be an additional component that would have not been considered in design so this will be an over strength and when you add all those, if you take a cut down there and added up the shears accordingly then you would end up with sufficiently a large shear that would have to be taken by tension in the tension side wall.

Q. Now, the critical question is, did you do that sum?

A. Very roughly by just simply adding up the reinforcing steel all the way through.

Q. And your conclusion?

A. My conclusion is that the wall would be more likely to behave, it would, you would get some deformation so it wouldn't be 100% solely just like a cantilever wall but it would behave initially as a cantilever wall in terms of the stiffness and then it would uplift or try to uplift because of the over strength effect. The thing however that was more worrying to me in this and you'll understand what I am saying here Commissioner Fenwick, because – if the wall is trying to tilt on the windward side, that would be the tension side, you are getting uplift of the floor at that point and possibly pushing down on the other side so the floor slab through there would not be level and there would be a kink at the approach to that. Now you remember I am sure the experiments we did in the lab at Canterbury and this is very reminiscent of that and you will remember

that that happened in that central column of that super assemblage specimen where the column itself was only 500 or 550 millimetres wide as I recall. Now if it can happen and we can break the slab on that which was only 75 millimetres thick but it had more or less the same reinforcing steel in there. This is the main thing like – that is one of the reasons I didn't do too many calculations before because I knew intuitively this, from those experiments that was really the Achilles' heel of that site and also probably the same on the north side as well under east-west motion. So that was – my major concern is that the drag bars obviously helped the –

Q. Hang on we are still on the south wall?

A. Oh, okay sorry.

Q. If we can just finish the south wall I have just got one more point to put to you about the south wall, I mean I think you conclusions are pretty well lining up with ones we've had from other people and the ones I have done myself as well but there is one aspect which did cross my mind a few days ago I would like your comment on and that is, when you look at the non-linear time history analysis you see that inter-storey drifts in the north-south direction get to about 60 plus millimetres per storey?

A. Yes.

Q. Quite high, now if you take 60 millimetres and apply that to a inter-storey height of just over three metres and you look at a slab which is 200 millimetres deep, my calculations in any rate, that is 60 divided by 3000, multiplied by your inter-storey drift, multiplied by 200, tells me I am getting a crack width of the order of four or five millimetres at the interface –

A. Mmm.

Q. – of the wall, does that sound reasonable to you?

A. It does and –

Q. And what would that do to the mesh do you think?

A. Well it is obviously going to fracture it but it may not be right at the wall too because again we were doing that similar type of experiment as you recall?

Q. Yep.

A. And it broke out at the end of the saddle bars?

Q. Mmm?

A. So it may well be a little bit offset from there. However having said that, as I recall from the photographs it showed a fairly clean break all the way down through.

Q. That's right, yep.

A. So I suspect that might be more to do with the insufficient anchorage of the slab steel and anything else that was there into the wall.

Q. Yep, so when one looked at the Frost picture of that, taken through that gap, you could see the broken –

A. Yes.

Q. – snap bars?

A. Yes, that is right.

Q. Not the 12 millimetre but the mesh?

A. Well they were fractured and yes, in fact the other bars that are there helped to provide some restraint but, and permit a much longer crack because you are going to get surrounding debonding on that steel and that facilitates a very high strain on the mesh bars which of course are anchored quite well largely because of the cross wires that are welded to it.

Q. That is right, yes. If we can look at the north wall, do you want one of the pictures to go with it?

A. I have them here Sir.

Q. Do you.

JUSTICE COOPER:

Q. Just announce the number though so others can see.

A. 0493.1.

COMMISSIONER FENWICK:

Q. That is right, BUI.MAD yep 249. Point 1 is, yeah point yep, point 1 is, yeah quite right that is the north wall in plan, left-hand side, that is fine. Now did you look at the actions, particularly the actions I was concerned about there were the actions in that wall between C and CD, that is the first bay, that is the toilet bay there?

A. Mmm.

0955

Q. And I guess quite a few people have talked about this and the actions I am particularly interested in there are really can that moment in that shear at line 4 be resisted?

A. I would say no because that moment has shown you would decompose into a force couple with the eccentricity being the distance between the two walls and that is going to add to any forces in the drag bars if they're there and if there are no drag bars there it's probably going to add any insult to injury that was being also put on by north-south motion so you have to remember of course that these motions are not uncoupled they're coupled.

Q. That's right. Yep.

A. And, and so adding the two actions together would be really what causes the problem and of course any design is pretty much really only looking at one direction at a time and even if over strength was taken into account which evidently it may not have been but even if over, over strength was taken into account with one direction only it may still be insufficient to deal with the problem.

Q. Yes.

A. Because of this coupling effect.

Q. Yes the actual from memory the actual forces predicted in the time history analysis the shears were the order of two to three times the design parts and portions?

A. Yes.

Q. Assessment.

A. Yes.

Q. Yeah. So okay you have not done any calculations to –

A. No, no I haven't, no.

Q. Okay all right. Thank you. Now can we go back to your, your statement now I've quite a few questions, I've got quite a few questions I'd like to go through that statement?

A. Sure.

Q. To get some clarification from you and I would also like to get you to comment on some of the details in the, in the structure?

A. Right.

Q. Should we, well we'll start with your statement or, that all right?

A. Yes, yes. First statement?

Q. This is the, the statement yeah, it's the first one. Alternative Collapse Scenario is what it's headed up?

A. Yep.

WITNESS REFERRED TO FIRST STATEMENT

Q. So when we build up a design code, you know the design actions that we put in or the intracode are based on analytical work and on experimental work, so just looking at the basis of the design so if we, we look at the, the tests 1970s and 1980s we would take a, a specimen and the code specified four cycles of design displacement ductility but we didn't do that we did something which is equivalent to it, we think was equivalent to it. So what we did is we'd take our, our specimen and it would be pushed backwards and forwards to something which we considered was equivalent to four cycles of the design displacement. When we came to the design code that, that told us our ductility and the, the strength. When we came to the design code of course we determined the strength, the design strength as based on what are now called lower characteristic strengths and then we didn't quite use that term we used design strength to the reinforcement for instance the two 75 reinforcement we used then was typically went at about three 20, three 30 megapascals so there was a 20% gap at that stage between the performance of that steel and roughly the same gap with the three 80 steel before we really got on to the upper and lower strength

characteristic. And then when we determined the design strength we took the, the theoretical strength what we now call the nominal strength and multiplied by .9 which meant if you take those calculations into account that on average the design strength was 75% of the average strength, about right?

A. Actually I remember this very well and if I may just give you my recollection because as you well know Professor Fenwick one could never forget Professor Paulay's accent and the quaint way he would explain things and so as I recall the number that sticks in my head very clearly for grade two 75 steel was 1.39 and that came from a product of 1.25 divided by .9 and so I always felt that that was a little bit of an anomaly because I think you explained it based on today's understanding, not the current, the understanding at the time.

Q. That's right, yeah.

A. And the difference is that you are now distinguishing between the specified strength which back in those days we called the ideal strength.

Q. Yes.

A. And the, the, the probable strength that we're now using actually.

Q. Mhm.

A. So and by the way the Americans still use the same approach. So the 1.39 was used on the assumption that if there was going to be a difference between probable strength and the specified strength that, that would be as you say it's probably about a 15, 20% maybe more difference between the probable –

Q. Yeah.

A. – strength and the specified strength but everything was going to be inflated by a similar amount.

Q. Yes. Now I'm, I'm leaving out strain hardening and all the rest of it?

A. Yes.

Q. But I think your figures aren't too far out from mine?

A. Right.

Q. I think there's roughly, roughly about the same –

A. Yes.

Q. – order?

A. That is what was used at the time.

Q. Yeah. Now if, if one looks at the, the ductility demand then and you can do this in terms of displacement or strength and it comes to roughly the same figure, you find that of course the, when, if you've got something which is 75% of the strength then roughly your ductility demand going to the same displacement same stiffness is going out by a factor of about 1.33 so your average ductility would be about 1.33 times your design ductility?

A. Yes.

Q. And these are built into the standards. Now if we look at a multi-storey building or even a one storey building we then apply an eccentricity to it of .1b in one direction to allow for torsion and .1b in the other direction to allow for torsion of course there's no real no effect on the torsion at all but what it does do it ups the strength by somewhere between 10 and 20%?

A. Mhm.

Q. You go to the CTV building as 20% two walls they go up 20% and there's no, you wouldn't on average expect that eccentricity would you, you might get it but you wouldn't expect that natural eccentricity due to the twisting of the ground allow for it, you wouldn't on average expect it?

A. No not from twisting from the ground –

Q. Yes, yes.

A. – but it, my understanding is that that, those numbers are put in there in the code simply because for example we don't have any jurisdiction over how a building is used after it's constructed and so on one floor you might have a medical centre with some desks and some stethoscopes –

Q. That's right.

A. – and some people.

Q. Yep.

A. And then the next floor you might have a library with books stacked around one wall.

Q. That's right.

A. And it's going to totally throw the eccentricity off.

Q. Yeah but given the weight of the live load compared with the dead load and of course there's, it also allows for the fact that one wall might not be quite as stiff as the other for -

A. Yes.

Q. - endless number of reasons? So those are sort of in there but on average you wouldn't expect to, the whole .1. Now my, my comment really comes down to there are a whole lot of factors of safety are built in.

A. Yes.

Q. And what you'd expect when you apply all these factors and I've done it on two or three buildings now around here. Design displacement ductility of six actually cranks down to about a design displacement of about three in there?

A. Mhm.

Q. So, and of course that's true for buildings and you agree that's a reasonable sort of estimate it might be four perhaps but it sorts – seems to be in that range as far as I can see on the few buildings I've checked it out on?

A. No I do and in fact that's one of the things that when I first went to Buffalo back in the late '80s and early '90s where you had a large research initiative on this very topic.

Q. Yep.

A. And the work that you'll see they've done on that covers, where, my personal work didn't cover all of that. I did have some students working –

Q. Mhm.

A. – on this very topic.

Q. Yep. I mean that, that's a necessary stage isn't it to give you confidence that you're going to reach your design criteria of a high level of certainty, I mean –

A. Yes.

Q. But we have built in big factors of safety. Now the reason I'm saying this, it's several places in your text you have indicated and I can bring them up if you wish, you've indicated that this building, the CTV building sustained the Darfield earthquake which was close to a design event and therefore it was a successful design. Now I'm, I'm just questioning that do you wish to maintain that or do you wish to back away from that. You're on record of saying it –

A. Yeah.

Q. – in three or four places.

A. My –

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Q. In fact and I'm giving you the opportunity now to say now do you accept that or do you think in fact because of the factors of safety, I mean certainly I know that Professor Paulay was very keen when he writing that the building's design criterias used would sustain more than just the design level earthquake without collapse but I just wondered whether you wanted the opportunity to change that stance or whether you feel you still want to stick by that stance.

A. I'll stick by it and I'll give you the reasons I'll stick by it. The reason I'll stick by it is because it is true, everything you say is true and I agree, I don't take anything back from that. However, the main point being is that the building was built in a way that we would now consider it to be an anomaly. I don't think it was ever the intention that buildings, you know, from the code writers that buildings be built like that. It just so happens that there must have been a permissible loophole, shall we call it, that was in the Code that permitted to have this kind of dual system whereby one could use ductile walls and non-ductile frames tied back to those.

Now my belief is that if that's in the Code that's, and people can legitimately do that and the Council signs off on it, then that may not be good practice but it's permissible and the CTV building was designed in that permissible way, albeit with, as we've discovered, some additional faults that didn't even stick to that kind of dual system. And I think those additional faults was that perhaps the eccentricity wasn't handled

correctly because let's suppose now that Mr Harding did do the check and tied together the fact that there was a lateral torsional coupling and that apparently was missed because he took the centre of mass displacement it would appear. Supposing he had caught that and also suppose that the drift was still in a permissible range then what probably would have happened is that the building would have survived the Darfield earthquake without any, without even any yielding in the Darfield earthquake. But because he did not do that then what was happening was that the response was eating into these reserve capacities that you've rightly pointed out and that was the sign of these initial damages that were being shown up, albeit, you know, both the second, not so much the first but the second time history analysis has clearly shown that there is damage and, of course, again I believe a lot of this is due to this lateral torsional coupling effect that was inevitably taking place. The response nevertheless was not excessive in that it didn't lead to the demise of the building at that time. So that's my position and the reason that I will stick by that.

Q. Okay well you're entitled to do that. I think if you'd actually put some stress calculations on that junction on the north wall you might have decided that that north wall connection did not satisfy the standard at the time. Of course then it was subject to much higher loading so you would have got tearing –

A. Well I did put that caveat on, that there were some inherent faults there.

Q. Yeah and there were also, I think, a failure actually to check the deformation on the columns.

A. Yes.

Q. I mean that type of building is no longer permitted.

A. Right.

Q. And that's quite right too but, of course, there are quite a few buildings in Christchurch of that type which survived and performed well.

A. Yes and maybe that's the reason that they did because those other extraneous –

Q. It didn't have the other faults in them to accentuate it.

A. Yes.

WITNESS REFERRED TO WIT.MANDER.0001.46

Q. And if we go to the paragraph immediately above 1.2 please and you've got the comment there:

"What is concerning is that following the Darfield earthquake eye witnesses reported on numerous occasions that the CTV building was uncomfortably lively".

This raises a problem when you've gone through an earthquake you become very aware of the dynamics of the structure, I mean that's, I know having gone through several earthquakes I can now specify that's the case. So the problem here is what are the observations on the liveliness of this floor before the earthquake and compounding that is the problem, when you look at the design, you find the design for that particular span exceeded the manufacturers' recommendations quite appreciably. So would you like to comment. I don't know how one allows this sort of, 'cos, you know, you can see that it would have been a very lively floor. You might like to comment on that.

A. Well I think I made the comment at the time, if I'm not mistaken, that it is true in an absolute sense one is, one's senses are heightened after an earthquake but having been in Christchurch and you listen to people, and I do the same myself going back over the last couple of years, is they all play a game now and they say oh how big was that earthquake and you'd be surprised how accurate people can predict what they are because the point I'm making is that it's possible, and I made this point earlier, that the human body is a wonderful motion sensor and although it may not be possible to accurately predict the magnitude of the excitation it is very capable of understanding relative differences. You know, this one is bigger than that one and so forth. And so if there was a Christmas Eve party in the CTV building and people are jumping up and down I'm sure you're absolutely right, those spans were long and the floor would have been felt somewhat lively due to that effect. But if there was an earthquake in the midst of it people would probably notice that more but then when they go back to work, and this apparently

happened, after Boxing Day because the Boxing Day earthquake was literally more or less right under Cashel Street area there, it evidently must have caused more damage and so people would notice this, that the building was even more lively subsequent to the Boxing Day event than beforehand, and all I'm saying is that these serve to provide additional evidence and should have rung alarm bells but apparently these alarm bells that people were raising fell on deaf ears and nothing was done about it.

JUSTICE COOPER:

Q. Is that, can we just make it clear, the way you've put that seems to me to be focused on Boxing Day rather than any earlier event.

A. Well I'm, my contention is that it would have started with the Darfield event and there were a number of earthquakes immediately after Darfield and I've mentioned those in my second brief. There were about five big ones and they will have all added a little bit, each a little bit at a time. But, by the time you got to the Boxing Day event that would have made probably a noticeable difference, simply because that earthquake, compared with the others, would have had demonstrably larger vertical ground motions in the frequency band, 2–5 Hz frequency band, which is the one that would be felt by humans and the one that excites the floor modes.

COMMISSIONER FENWICK:

Q. You've got no direct evidence of the liveliness of the floor before the earthquakes.

A. No, no, of course none of us do, but I agree with you you can do by calculation that's going to be moderately lively.

Q. I think people said it was lively when someone walked past.

A. Yeah.

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Q. One of the witnesses said that. I mean they were commenting, I mean the whole time, of course, there was, well later on there was the

demolition going on next door and that was shaking the building and they were commenting that when trucks went past but whether that was because they were tense because of the demolition and, or whether it really was earthquake damage there's always going to be some doubt isn't there?

A. Yes.

Q. Can we go to 47 in the same series please, page, number 47?

WITNESS REFERRED TO DOCUMENT

Q. If we look at the bottom portion below the heading there. I'm talking about the floor and the second sentence there, "There's the relatively high vertical vibration from the earthquake prior to the Christchurch earthquake…" we're talking about Darfield, it's the other one on Boxing Day, "…essentially would have broken the flex end to make the slabs function more like individual units." Now what do you mean by "broken"?

A. Well simply the fixed end moment which would be there previously was unable to be sustained. So essentially it comes, goes from a fully fixed condition to a pin condition. There's a number of ways to explain that. I, obviously if the steel had yielded there then you're going to get the shake down phenomenon taking place which generally means that it ends up in a pin condition anyway. But I think it was more than that. I believe the vertical motion would've separated the, the fixity in terms of the, where the steel would've been, steel tray deck was pressed in against the concrete at the bottom. That whole area would've possibly led to crushing and then again that would reduce the moment capacity. Now it's not going to go, it's not going to go from a sizeable fixing moment, albeit very meagre anyway, down to zero in one cycle. It's going to take a number of cycles to do that and I would consider that, again this is part of this progressive damage that over time it would've gone from a full fixed end moment down to well it'd tend towards zero and my sense is that it would be much closer to zero after the Boxing Day earthquake.

Q. Can we have BUI.MAD249.0531B.22 please?

WITNESS REFERRED TO SLIDE

Q. So you're predicting it would flick round the top of that, is that it?

A. In fact I believe there would be a fracture zone entirely where that red line is drawn.

Q. Can we have in the same series .351B.18 please?

WITNESS REFERRED TO SLIDE

Q. And the right-hand side, enlarge that, that's the first floor response factor, 5% damped. Now I've sat down and tried to calculate what the fundamental periods of that floor slab would be and of course you can get different values depending on what I gross you tend to use in this. So I've gone from I gross to .1 I gross in this. If one takes it as a simple support which would be if it was going up, it's broken like the way you've got or even part of the way, then the fundamental period for I gross would be .3 of a second. The .5 I gross would be .4 of a second and .1 I gross would be .9 of a second. Now if you look at that response spectra you would have to exceed 1 G upwards to actually break that support wouldn't you, to remove the gravity load effectively from it? I don't see .3 or .4 or .9 as exceeding 1 G.

A. No it's got –

1020

Q. I don't see that could have broken unless the acceleration vertical accelerations are especially higher than were actually measuring?

A. The, in your calculations did you take into account the stiffening effect of the tray deck?

Q. Yes.

A. Okay.

Q. Now if one now takes the, the built in support coming down if it's fixed at the ends you've got .12, .19 and .4 period coming up here but of course for it to be built in that would only apply for downward loading wouldn't it?

A. Yes.

Q. Going up is always going to be simply supported?

A. Right.

Q. And the downward load of course there's a, a ton of surplus strength there you'd find -

A. Yeah.

Q. – at 1.4g and 1.7 live with a strength reduction factor of .9 and what you do with the checks you find actually the strength was quite a lot higher than that, so I have a little problem with this "broken" concept because I can't see where the actions would come, can you explain to me or do you think it's just progressive factor due to fatigue or something?

A. No, I, I think that when I wrote this I was being guided mostly by the first phase of the Compusoftt analysis. I don't have the graph in front of me but there's, there's one classic graph we've seen several times where it plots both the horizontal and the vertical response and in that you can see the, you just do the pig picking and calculate the frequency so the, as I recall the Compusoftt was predicting a frequency of about 3 hertz or .3 of a second –

Q. Yes.

A. – maybe a little less.

Q. I, I –

A. And it, and when you look at this particular graph you, I would concede that it's not going necessarily above .1g but –

Q. Yep.

A. – it is a dynamic response of the slab. Now those, those responses that we were seeing in the Compusoftt analysis were pretty violent like you're getting more or less in, in some cases going down to almost zero and then going up to almost double their static –

Q. Yes.

A. Case.

Q. I would like your comment on this. I have a concern they used elastic springs in the soil which is all they could do but there's suspicion that the peak elastic response in the (inaudible 10:22:38) period might have been more a function of the elastic springs in the soil rather than a realistic soil representation but would you like to comment on that?

A. Well it is true that you're likely to get more damping than what they modelled.

Q. Yep.

A. In the foundations and so I see your point that it may little, be a little unconservative and I do know that when the first Compusoft analysis was done the liveliness that was exhibited and I must say this, as you know, this was really coming as signalled by the columns but most of it's coming from the slab anyway so on that initial run I think from memory the, using the rally damping the damping in the floor slab would be quite low and rightly so probably in the order of 1% -

Q. Mhm.

A. And sometimes I've got a feeling that these Hi-Bond floors being steel they're going to be more integral therefore they'll be even livelier.

Q. Mhm.

A. They may even be only a half a percent damping in their pristine state. The later analysis, the phase two analysis done by Compusoft the damping, the rally damping was adjusted not because of this but for some other reasons and I think what it, the unintended consequence of that adjustment was that the floors would in the analysis be lef- less lively from the get go so the violent swings in the vertical axial loads weren't quite as bad partly because of that. Now who's to know what that damping factor is. The reality is it's changing all the time because it was never properly modelled as an elastic system anyway and, and it's going to, the damping well start off being very low and then it'll increase and it'll probably get out to five or 8% in the slabs themselves.

Q. Yep. Clearly a case for a good PhD student -

A. It is.

Q. – to put his ticket on (inaudible 10:24:48). Now the next page we go to 48 please in the point Mander series, .0001 series.

WITNESS REFERRED TO MANDER SERIES

Q. And you, when this one comes up you're talking about the vertical excitation at the top. "In the light of these exception demands on the CTV building it is quite surprising the point had not received more

attention. For example if we were to run this analysis as graduate student project, the students would be instructed to analyse the effect of vertical ground motion alone (without horizontal ground motion) to the best effect". Now I want to know what was the point of that statement?

A. I am basically saying how I would do it.

Q. Yes.

A. And I concede that in practice this may not be done because it's very expensive doing these analyses, so the point is that it's highly desirable to uncouple all these motions and to get an understanding of what each of the directions are doing.

Q. Yes Professor Mander I thoroughly agree with you but that's precisely what Compusoft did so I wondered why you put it in?

A. I didn't notice that they plotted the results clearly to me.

Q. Do you want me to bring it up for you?

A. For the vertical alone? Yes that would be good.

Q. Yes. ENG.COM.0001.76 and .77, .76 will do.

WITNESS REFERRED TO ENG.COM.0001.76

Q. Probably one page of results will be enough. Vertical earthquake effects. So just put the vertical earthquake in by itself and measure the effects and on .77 there's a second page of results as well there in their first series of analyses. So I just wondered well did you actually read that?

A. I did but I, I missed the only word and because I, I looked at those graphs and then I reconciled them with the, the lateral ones as well and the graphs that they have shown show that they're pretty much the same.

Q. Yes. It's sort of a rather negative comment isn't it about Compusoft which perhaps –

A. No I wasn't intending to be negative. All I was trying to point out was that the –

Q. Well I think, think on record perhaps it's an unfortunate comment but I can see you just made an error forgetting about that particular part but

it's sort of a little unfortunate to make it implying that your students would do a better job than Compusoft would do?

A. No that wasn't the intent Sir like as I've said the intent was to say that you would try and understand by starting out with a very simple model –

Q. Yes I know what you –

A. Yeah.

Q. I know what your intention was I'm just saying it's an unfortunate reflection to pass on?

A. Okay.

Q. Now if we can go to page 49 please?

WITNESS REFERRED TO PAGE 49

Q. And this is, really leads into something we've looked at before so I'd like your additional comments on it but you're, you're saying, talking about the columns and this is the, it's about one third of the way down, oops, .49, why is your?

A. That's the Compusoft report.

Q. Oh yeah, sorry, no –

JUSTICE COOPER:

WIT.MANDER.

QUESTIONS FROM COMMISSIONER FENWICK CONTINUE:

Q. Go back to WIT.MANDER.00149 sorry about that.

WITNESS REFERRED TO WIT.MANDER DOCUMENT

Q. So if you look at the sort of first full paragraph that's about 10 lines down and your commenting there the columns were not the cause of, of failure. You say "if they had been the cause of failure there would have been clear evidence of those columns having failed in the way of extensive spalling of concrete". Now, so if plastic hinge is going to form, if it's going to form at the top of the column you would expect and is a very lightly confined column, in fact I find it hard to find a more lightly confined column that's ever been tested, and I'll question you about that later, but if a plastic hinge formed where would spalling start?

A. It would start immediately at the soffit of a beam –

Q. Yes.

A. – column junction.

1030

Q. Yes, and now if it was a highly confined concrete then confined concrete can take a very much higher strain, and the stress and the reinforcement can be very much higher. The strain in the reinforcing can be very much higher couldn't it?

A. Yes.

Q. And if there are closely spaced spirals or laps down there this will actually encourage spalling won't it, because it gives you a weak plane around the outside?

A. Yeah.

Q. But this was not this case was it?

A. No.

Q. Because it's very lightly confined and it's going to start to lose its lateral strength at any rate and spall concrete at relatively small strain displacement isn't it?

A. Yes.

Q. So would we expect extensive spalling of the concrete?

A. No.

Q. Right, so that's a little bit misleading saying, "But of course the column can still act as a prop," it's lost its lateral strength, you've lost some strength.

A. Yeah.

Q. Now let's now just go back to something we looked at before. I've wanted to follow this up with you. It's a different failure mechanism we've briefly talked about. If we go to WIT.FROST.0001.60 please?

WITNESS REFERRED TO SLIDE

Q. And this is to do with the observation that Frost made. I must say I didn't pay much attention to it initially but the more I think about it, I'd like your opinion on this. He observed that in all the log beams he could find, that the, what he called the "wings" that's the bit round the outside

A. I did the same.

Q. – was across that and, you've seen it. I probably don't need to bring the photographs up but I could if you want? Now his comment was, you know, that you put positive or negative, a positive moment on that then those wings would break off and every one I saw had those wings broken off and he commented he couldn't find any about them. Now those precast beams were sitting on 25 millimetres of cover concrete with a weak plane on the inside that could not transfer shear. So vertical shear transfer from the beam to that column would have depended upon the in situ concrete at the top, 200 millimetres of it, well somewhere between 150 and 200 because of the decking shape, and the bars, bottom bars acting as dowel bars. Now running through that zone between the cracks of course you've got top steel of four 28 millimetre bars going through. So if one now puts a small positive moment on that you're going to get a crack forming and opening up round that unroughened interface, do you agree?

A. Yes, however there's going to be a diagonal strut coming down from the – because of the reversing nature of the column moments above and below there will be a diagonal strut that will come down and it'll be forced into that turn-up in the bottom bars.

Q. Let's get back to that one later on?

A. Okay.

Q. Okay, so that's not going to cross, that diagonal strut's not going to cross that plane I talked about is it?

A. No, but I think there's another reason Sir why this has failed and…

Q. Do you want to go ahead or do you want to?

A. Well yeah, if I may, like as you know you're plagued with a lot of tension in the longitudinal bars through the joint. It wants to be in tension if it can, more or less the whole distance, and but then when it reverses it

has to go through into compression and in the process it, there's basically no transverse reinforcement in there that's going to do any restraint let alone provide shear resistance. It's not going to restrain those longitudinal bars from buckling and so the bars in fact if you look at it, if I'm not mistaken the bars, you look at the top, I can use the pointer here.

1035

Q. Professor Mander I think we'll just carry on the way I'm going because I think you're going on a different track and I'd like to follow through my track. We'll come back to yours later on if you still want to.

A. Okay.

Q. So we've put a positive moment on that interface, small positive moment, it's going to crack round that surface. We've said there's no transfer across it, there's only dowel action at the bars, but that positive moment transfer is actually going to drag against the top of your column isn't it?

A. Yes.

Q. So it's actually going to try to tear the cover concrete off the column.

A. Yes.

Q. And that's where you're providing your gravity support. Now if that cover concrete goes you've now got the two 28mm bottom bars that can act as a dowel bar but to develop dowel displacements you have to have an appreciable vertical deflection.

A. Mmm.

Q. Or you've got tension in the concrete above in the in situ concrete.

A. Yes.

Q. Now the problem with the tension in the in situ concrete, exactly as I think you started to state, you've got longitudinal bars going through there which weaken that section.

A. Right.

Q. If you just take out the diameter of those bars, and I believe it would be more than that, take out the diameter of those bars and to assume a 45

degree angle crack for your tension if you get stresses to the order of 3 megapascals, ignoring any vertical excitation on that concrete.

A. Right.

Q. Now do those figures seem reasonable to you?

A. They do, very reasonable. I did some rough sums, back of the envelope sums on that and that's similar, like as you know you kind of check it back to 0.17 root f'(c) and see how it compares and it just doesn't wash up.

Q. Yeah, in fact vertical excitation in my calculation was about 5 megapascals.

A. Right.

Q. Rising there which means it's going to fail doesn't it?

A. Mhm.

Q. And now you've only got the dowel bars. I don't think, I think they're just going to pull out of the concrete aren't they?

A. Well…

Q. That concrete's already been weakened 'cos it's acting as a diagonal structure, the joint zone and so on.

A. Yeah but I think the load path, you've got to remember the slab's still above and that's pretty decent, pretty strong.

Q. You've taken out the support beam so how is the slab going to transfer any load?

A. No I'm talking about the shear that's necessary on the positive moment site, is that what you mean?

Q. Well I don't know, the only shear that can come from the beam into it is via friction across that interface which is, we've accepted, under positive moment, it's cracked and open. It was a highly polished surface as far as I could tell on that interface. Now the only shear transfer I can see is either by dowel action or by tension through the top concrete.

A. The top concrete being?

Q. The in situ concrete, the floor, the slab.

A. Yes that's what I was meaning, yes.

Q. But it's a direct tension on that to support that beam so I don't think there's any support left for that beam.

A. I'm struggling with this verbal description now. Can we have a site elevation to discuss this please. Excuse me, Professor Fenwick, can I just go back to my point before we go to the site elevation.

Q. Right, yep.

A. Like what I was going to say is that the bar is going to be roughly, it's what is it 30 degrees on this vertical so it's going to be roughly around here, which is pretty close and what it's going to do is provide an outward force if it tries to buckle under the compression cycle so it's quite in keeping that that's exactly where it would break off as shown and I do remember doing some experiments on essentially an unreinforced joint and this is exactly what happened because the American style on the ACI Code that's permitted under gravity load design is very similar to what we described but, of course, it's all in situ and we just have the bottom bars going six inches into the joint without a turn up at all and there's no, if it's only a two way system then the longitudinal bars have nothing to restrain them and they'll buckle out and pop off the end cover concrete that is here. In this case it's going to pop this whole wing off.

Q. Well whether it's the wings needed to be pushed by buckling bars or whether this action itself was enough I think's a matter of contention.

A. Right, right.

Q. I would have thought the straight radial pressure going through there, the fact that the co-efficient of friction was so low, but maybe you're right maybe it had to be buckling bar which did it.

A. Well I think it's possibly both because the radial pressure will be on the bars as well.

WITNESS REFERRED TO BUI.MAD249.0493.3

Q. Not a perfect vertical elevation but it shows the beam column joint actions I guess and you can see the top, I haven't marked in where the top slab comes but you can see where the four 28mm bars go. Is that enough for your vertical elevation?

A. Yes, no that's good.

JUSTICE COOPER:

Q. You'll appreciate this is Commissioner Fenwick's drawing.

A. I think it's a good drawing.

Q. That was a good answer.

COMMISSIONER FENWICK:

Q. So that's actually shown, the right-hand one's shown, of course, with a negative moment.

A. Yes.

Q. Where I would have gone to a positive moment, so if you want to look at that you've got to look at the left-hand side one.

A. Yes, yes.

Q. Now you wanted to see that to make some comments?

A. Well yes. So I've done this analysis but, of course, this is something that Professor Park and Professor Paulay always used to argue about so one of them put the forces from the left and the other would put the forces from the right and now I've got to kind of mentally turn it around. So and my ones, of course, around the other way than yours but on the left-hand side there with the positive moment you show the crack coming up and that's the outer bar so I presume that crack is symbolic of what's going on in the middle of the column, right?

Q. Yes that's right, a vertical crack in the beam will always whip up by the column steel and reduce the bond on the column steel yep.

A. And there will be another vertical crack basically just to the left-hand side of the second bar in, more or less on the edge of the crank of the bottom bar that we see there.

Q. Could, very likely.

A. And that's the one that's going to pop that wing out, right. So the shear has to be transmitted in the concrete compression block at the top. That's the only place you can transmit that.

Q. Yes but that's on the other side of the beam. So if you're looking at the –

A. No, no –

Q. Okay yeah you're saying right the shear's transferred through there.

A. That's the shear for the beam.

Q. Yes, yep.

A. And the shear on the right-hand beam, which is going to be a diagonal strut coming down, if I use the, there'll be a diagonal strut coming down here and if this moment was large, all right, then there will be a diagonal strut coming down here as well. Now I've done this but the curious thing is that if the moment is very small that diagonal strut will be out in here. See normally under gravity load that strut would want to be here, right, and it's going to fade out and then if the moment got large, if it was possible to get large, then it would be in here. So I think this is part of the problem that we've got with this whole –

Q. So you're proposal is that that compression force is going to reduce the diagonal tension is it that I'm talking about? The tension necessary to hold it up?

A. Yes, yeah absolutely.

Q. Even though the bending moment is going to be low –

A. Yeah.

Q. – it's only the bars that's just in tension, the bending moment's going to be, 'cause you've got negative moments, use gravity load and then we've got bending moments going to this which actually come from the column, the seismic actions, so the actual compression at the top you've got is going to be quite small. Those bars are only going to be in small tension when the shear transfer's occurring and so you're postulate is that the compression force through that block two hundred millimetres deep is going to be sufficient to suppress a tensile stress of about 5 megapascals.

A. Well it's not going to be very possible to do that and it'll go searching for a load path.

1045

Q. Yes.

A. I think the next thing that one would want to do is look at this, and I haven't done this, but look at this in a plan view and then treat it more like a slab system where you kind of neglect the beam here given that it's incapable really of doing anything for you and then look at if there is a yield line pattern around the slab out on the free part of it –

Q. But we already know that the connection between the slab and the beam is tenuous because there is no continuity steel in there?

A. Yes, it's true.

Q. Would you accept that is a possible mechanism of failure?

A. I do actually and in fact was, I think Mr Frost was it, or was it, no Mr Holmes had a view of that where he showed the, like he was basically drawing a picture of the next stage beyond this where the beam more or less came off its seat and it brings back memories and I am sure I don't have to remind you of this Commissioner Fenwick of a few years ago in the labs, this is very similar to the seating of a hollow core problem isn't it?

Q. Yep, yep that is right. Just while we are on that and I am not quite sure where it is I am trying to skip to of what – (inaudible 10:46:18) questions but somewhere you say you have got calculations which show that the joints zone is 70% of the strength of the column?

A. Yes, I didn't bring those with me I am sorry.

Q. No I was wondering whether you could –

A. I can forward them to you though.

Q. If you could I'd appreciate them and I did a very simplistic analysis here and came back to a figure of 80%?

A. Well what we have been doing a lot of research on this very topic to do with bridge joints in Texas.

JUSTICE COOPER:

Q. So what are the calculations that you are going to forward?

A. They are the calculations to show the weakened state of the concrete in the beam column joint and this is because one gets transverse tensions

and if one is to use a strut and tie model the ACI code is silent on how you do this analysis but if you look at the AASHTO Bridge Code there is a formula in there that indicates how one should reduce the concrete strength in the beam column joint using a strut and tie model and if you apply that because knowing that the steel in the corner of, the tension corners of the joint is going to be yielding, if you just even put in the yield strain of the steel that is going to markedly reduce the concrete strength.

Q. Just quickly, I mean, my argument was you balance the forces out, you suddenly find the force due to the hook is probably further in if you could sum it up, the moments reduced by 20% but that would be a valid approach as well?

A. Ah, yes, yes, very much.

Q. Now just quickly, you've got a description of beam column joint in there and I can pull it up or perhaps we can do without it, you show the typical shear for BUI.MAD249.0531A.26. Yes there we are, beam column joint. Now again this is on the – in your statement here, now what you have got is, you have go the joint, what you say is the area of joint zone reinforcement you would normally need in there is roughly equal to the area of the top and bottom steel in the beam?

A. That is if you were to ignore the concrete contribution.

Q. If you ignore concrete contribution, you don't actually make that comment in there but hang on a second that is not the question –

A. Okay.

Q. Now that is what I believe what you have got there is correct, give or take a V col which is missed out but that would give you about a 20% reduction if you are taking all the shear on joint shear reinforcement but what you have drawn is the case for a typical beam column joint where C2 is equal to T2 is equal to the area of steel times the stress in that steel?

A. Yeah.

Q. Forming a plastic hinge?

A. Right.

Q. So it is yield or strain hardened, and the same on the other side?

A. Yeah.

Q. That is not really the case for this column is it?

A. No, however the point is actually that you can't – it is not driven by the column, sorry it is not driven by the beam forces or moments rather than the column so the moments come from the column which then have to go into the beam.

Q. Yes?

A. Which then have to go into the joints, so it is true that you can reduce one of those particularly as we have been discussing, you can reduce the positive moment so the T2 there could be reduced.

Q. Can we have –

A. And then the T1 will increase because I did the calculation assuming that that the positive moment would be zero and the case that is has partially failed and there is sufficient beam steel there plus the fact that you'd also have a slab at the top with that slab steel that would be sufficient to provide the maximum moment that can be squeezed out from the columns.

Q. I mean okay, the point is that the joint zone – that is not representative of what is happening in the CTV building because it is the columns which were indicated and if you want to calculate the shear of columns then you'd have to look at the interaction, the input from the columns, wouldn't you?

A. Yeah, no, but that is what I have tried to do here.

Q. Right well if we go to BUI.MAD249.0493.4. I hope. And that's my estimate of what comes in of one of those columns ignoring vertical excitation and so on, you get a diagonal compression force coming from the top left down to the bottom right across there that is due to the axial load. You have shear and that transfers it, a major part of the, at the joint shear and then you have the tension forces and the reinforcement which generates bond which you have to tie up for your joint zone shear so it is bit like a, putting it around to 90 degrees to look like a typical beam which is pre-stressed isn't it?

A. Yes.

Q. Which reduces the shear, okay, that actually – when I did that calculation I got a shear stress of 7 megapascals which gave me a principal tensile stress of 2.5 tension which given all the other effects probably would lead to cracking and degradation?

A. That is correct and that will lead to cracking and that is possible on the first pulse and then beyond that the different mechanisms have to take place and it is when your diagonal struts to kick in more and provide the resistance.

Q. And that of course ignores the fact you have got the hooks coming in which pull the force into the centre?

A. Right.

Q. Right.

A. By the way though, given that in spite of that Professor Fenwick, in the lower columns where the axial loads are much more intense the – I think you did this for a second or third storey up?

Q. It is about second floor, second storey up, yep.

A. I think if you go down a floor lower it gets more dire in that, but curiously in a strange way you can probably take a little more shear because the eccentric force from the compression side of a column is closer to the central axis of the column and it actually pokes into that hook.

Q. Right yep?

A. So it kind of, in a perverse way helps you out?

Q. Yep, no my feeling was, it was the second or third that was critical not the bottom one?

A. Right.

Q. And I think you are probably right there. Can we go to, back to WIT.MANDER again please, 67, .67. Now these are, I assume they are push over curves are they?

A. They are of, half height columns.

Q. Of?

A. Half height columns so it is just –

Q. Half height, yes?

A. Yes, so that the shear span is the same as what you would see –

1055

Q. Yep right and just the column or the column and the beam?

A. No just the column alone, so you need to add the beam rotation into this.

Q. So my first question is, how would these relate to cyclic loading?

A. They will provide the initial envelope, and then under cyclic loading it's going to be well within that and it will degrade very quickly and who knows? That may have, that may have happened momentarily even on the first earthquake and not shown up, and of course certainly even if it didn't, certainly in the February 22nd earthquake this would've taken a big lurch in one direction. It would've seen this. Subsequent cycles it would never see this again, so I concede that, yes.

Q. I don't know, my observation looking at a whole series of beams and so on is that the ductility displacements you can go to in one direction is more a measure of where you've come from rather than just the absolute magnitude. So I would anticipate that under cyclic conditions your peak value would actually reduce compared with your monotonic –

A. Yes.

Q. – but not the alternate but the peak you go to. But that's probably an issue one needs to follow up more in terms of tests and so on that you haven't done. What was the basis of these? I mean you're going through here and you're showing the lateral load capacity, and of course the axial load hangs on quite a lot longer doesn't it?

A. Yes, yes.

Q. And this is, I guess, one of the problems I have with the, the analysis from the DBH that they are taking the failure at where the lateral load starts to drop away, most of the criteria which had developed I think assumed that you've got failure when you've lost 20% of your lateral strength but you wouldn't necessarily have lost any of your axial load strength would you?

A. That's true. I don't believe in the, no I don't believe in the second analysis that was the case. In the first, in the first analysis they were

basically silent on this matter because what they did was they sized the moments based on the static level of loading, and that was my objection to that column interaction diagram where they had plotted a whole lot of dots outside the –

Q. Let's come back to that?

A. Yep, but on the second analysis I believe what they did was they used full stress strain curves, very similar to the ones that I'd used in my presentation this morning. They used the same model.

Q. So what predicted, I mean the things I've got there, what was the basis of these calculations? Do you, were you assuming an effective plastic hinge length or what were you assuming?

A. No, no, if you go back to the Mander '83 thesis you'll, it's the same as what's done in there so this is a spread plasticity that's variable and increases until the maximum moment and then it doesn't increase any more. It is not a rectangular plastic hinge length that's assumed, often wrongly in, in quirky circumstances like in this building you cannot assume that. Particularly in the lap splice zone you possibly can get away with it right at the bottom. It'll be a very short plastic hinge but in the, in the soffitt, column soffitt region you have to use this spread plasticity model that's variable under increasing load, and that's been done here including the effects of shear deformation.

Q. So not using the Priestley formulation is probably not that right.

A. No, no definitely not.

Q. Okay, good well that's (inaudible 10:58:46)

A. So if you want to refer to, well you refer to the thesis and then there's the paper by a Arcady, Mander and Reinhorn, published in ACI Structural Journal around about '94.

Q. Have you got that reference in the?

A. It's in my resumé.

Q. Right I can find it then.

A. I can give you the number if you would like?

Q. All right if you can do it quickly?

A. I can. The number for that is in the journal articles, number 7.

Q. Number 7, good thanks. Now when I look at those results and I think Professor Priestley had a few comments about these as well so I apologise if I'm repeating on his but the strain level in the steel where you've got left-hand side at level 5, you've got a rotation of 23 -

A. Twenty three percent yeah. No I did comment on that. Like, as I said –

1100

Q. I mean that to me took the concrete strain to about 30 times what I would have expected and the steel strained to about four times the value which would have snapped but I would be interested in your comments.

A. Well there's no reason we should restrain the concrete strain. Like it can go way beyond the spalling strain. There's no reason to stop at anything less than that.

Q. You're relying on the confinement of the concrete around it.

A. No it's not confined so it's getting its capacity by virtue of having a low level of axial load and the concrete stress block is going to propagate back in and basically what this is saying is that this is a very high level but all it's doing is you can rely on it to be a pin column for out to that level of drift to carry axial load. So a lot of, and I believe Mr Holmes of California made the comment that in the United States they no longer use this artificial 20 percent reduction criteria so you just run it out and see how far it can go. That was the intention here and I can see that it's impractical and you wouldn't really go that far. The point is that the contrast is that in spite of the fact that there's no transverse reinforcing if the axial load levels are low then you can have almost limitless ductility out to some sort of practical limit based on some other criteria.

Q. Until (inaudible 11.01.48)

A. In contrast with that the lower storey columns like one, two and three, you can see that everything drops off quite quickly.

Q. When you increase the concrete strength, the same axial load level, it drops from 14.99 to 6.7 percent.

A. Which, which diagrams are you referring to?

Q. Level 5, left-hand side, FT–+2.5 megapascals, 23 percent. Right-hand side 1.5FC– increase in concrete strength would one wouldn't normally anticipate, so you'd increase the ductility, you're limited now to 6.71 percent reduction of a factor of three due to increase in the concrete strength while intuitively one would think it would go the other way round.

A. Oh I see. Yeah like we wrote the program. I didn't interrogate those results out that far. Like I felt that five percent drift was a practical limit anyway.

Q. So there's something strange, I would have said, with both those results. If we can go now to –

JUSTICE COOPER:

Q. Well do you accept that?

A. It is but that wasn't the intention. That number was really intended to be used for the lower levels.

QUESTIONS FROM COMMISSIONER FENWICK CONTINUED:

Q. If we can go to 0.70 now please. And these curves are the things suspended, knocked off the bottom but these are for gravity plus seismic axial loads so I assume that the axial load's been increased by 60 or 70 percent or 80 percent possibly.

A. No I took the actual values off those graphs that you showed me before, the bar graphs.

Q. They're higher.

A. The axial loads were taken from there.

Q. So quite appreciably higher.

A. Yes, roughly some of them are almost double.

Q. And if one looks at the level there we find that the 6.71 percent, when you add an axial load on, becomes 14.99 percent, that's level 5. So increasing the axial load in that case has increased the deformation.

A. I don't think we should be looking at that particular value. Like it should have had a cap on it just, it's outside the practical range as you know. It's kind of irrelevant.

Q. I agree but the numbers come up and they give one a disquiet about whether one can rely on the remainder of them.

A. Well okay, fair comment. I stand by the rest of it though.

Q. If we can go to 67.69 please. Same series.

JUSTICE COOPER:

Point 69, 1.69.

QUESTIONS FROM COMMISSIONER FENWICK CONTINUED:

Q. Yes now you're talking here about, this is about one-third of the way down the page and I can summarise what's there. You're really talking about the need to model the columns more accurately in the ASDEC time history analysis. Initially Compusoft put in elastic columns and I understand the basis of this was that, first of all, it simplified the analysis but the force carried by the columns really was not going to influence the drifts because the column contributions are very small in terms of lateral displacements and then the whole process was reduced and a new model of the column was put in and the beam column joint which would allow for some degradation and so on of the joint zone, is that right, in the column?

A. Yes, yes.

Q. Now I've just questioned why, I mean these analyses ran for quite a long time and I just question why that process was necessary because would it not have been better to have had a more refined model of the beam and the joint zone and the column which couldn't have been used, at any rate, with this because it would have made the analyses run for too long a period. Wouldn't it have been better to have had a more refined joint zone and beam and column and then apply the imposed displacements on that. Would that not have given you a better feel for what's happening in the zone?

A. It would have and I agree but I didn't have time to do that.

Q. Okay so that's a work in progress for the PhD student.

A. Yes indeed, indeed.

Q. All right.

A. But I might say though that I have had a student since work on, not doing a (inaudible 11.07.36) type model because I think it's not really very helpful because it cannot be used through the beam column joint so there is a work in progress going on right now on this very topic looking at using strut and tie models which we've developed a lot of with this Texas Department of Transportation study and we're using that to look at what's going on in the beam column joints, specifically because it's a more capable way of looking at the interaction between the columns, the beams and specifically the joint.

Q. Yeah I've come to my other question (inaudible 11.08.19). Could we have the calculation to show the 70 percent but we've done that one, you've given that to, you're going to forward those to me so that's good. Right point 79, same series.

WITNESS REFERRED TO .0001.79

Q. And we're looking at the paragraph which starts, oh it's the second paragraph down. Here you're talking about, I think we can probably skip this one, here you're talking about the high vertical accelerations but I think we've actually covered that in a previous one so we'll skip that. Point 81 in the same series.

WITNESS REFERRED TO .0001.81

Q. So 0.81 you're talking about the, this is the second paragraph, you're talking about the excitation in the north-south direction and the action on the floor slabs and you've said that in the north-south excitation towards the north could buckle the slabs downwards. That's my interpretation of that. If you read from the third sentence down: "It will be hypothesised however that the opposite action is also likely, that's under northward inertial forces the floors may crumple up (in technical terms buckle downwards)."

A. I think there's a diagram of that somewhere.

1110

Q. "This leaves sufficient room for the floor slabs et cetera," so you talk about the slabs buckling downwards. Now I don't know. I'm just wondering how you arrived at that conclusion?

A. I did do some calculations on that, very rough, but it was on the assumption that the tray deck by this time will have essentially separated because the seats between, either due to elongation in the bay or whatever the removal of the wall, particularly on the lower levels.

Q. So you're assuming the tray decks dropped away? Sorry, the Hi-Bond has dropped away?

A. Yes.

Q. But you, okay, I mean that's, I can only accept if vertical acceleration was going to actually break it up but the vertical acceleration on my estimate was not high enough to break it up. But you say that's wrong?

A. No, if you look at. Well perhaps can we go to the diagram on 1.87? So if you look at the lower diagram first and you could say on a previous shunt towards the south, if there was a separation then that alone is going to be sufficient to create a gap whereby the tray deck is going to be at least unseated on one end.

Q. The problem I have with that is that I would've thought the floor slabs would've actually restrained that lateral displacement. I couldn't see how that displacement could occur if the floor slab was still there?

A. Which one are you talking about?

Q. Well you're putting the lower diagram there and –

A. I'm just using that as a vehicle to explain. If there's an unseating or if there's a complete disengagement of the such that the tray decks break free, and there was a lot of forensic evidence to say that, none of them were intact. They were always separated.

Q. Well they dropped quite a few metres so it's not surprising is it?

A. Well that's true and we don't know if that was part of an artefact of the collapse itself or if it was happened before that. But if, and I concede that this can only happen if the tray deck is not there, otherwise the tray deck itself would provide sufficient stiffness to inhibit that. All I was

pointing out is that there is several possibilities whereby things can move around sufficiently to allow this buckling mode to occur.

Q. So the tray deck would've had to have fallen off first?

A. Yes, dislodge at least.

Q. Okay, I was going to say I couldn't get it buckled, I got it up to –

A. No, no the tray deck won't buckle, no. This would be, and so you end up with a piece of slab that's quite flimsy.

Q. Have to be very flimsy wouldn't it, yeah. All right. Now there are just a few more things I'd like you to look at and so if we can have BUI.MAD249.0284.20?

1115

WITNESS REFERRED TO SLIDE

Q. I just wanted you to comment on some of these details. So if we look at the detail labelled 3 and 4 and I think you've already indicated there at the top of the page towards the middle, slightly to the right, those are the two there. There seems to me to be a lack of continuity steel there. There is steel sticking out of those precast beams on the outside, 12 millimetre bars come out and go into the slab. They're either at 400 or a 600 centres, but would you like to comment on that detail?

A. Yes well as you know this is like a forerunner of the hollow core problem that we had in the last decade and what doesn't help is that this is essentially the same detail that has been used on seating it on a member that's 100 millimetres smaller than the columns and yet it is using the same more or less the same detail and so the wrap around part of the hook bars that are coming in that are expected to provide some negative and positive moment capacity certainly really needs a positive moment, I am sure the designer had in mind because, a negative moment because that is what would be normally needed for this gravity load alone. That would be insufficient to take a substantial overload moment because the hooks don't go and as you – on your beam column joint with the green arrows, as you rightly pointed out, it has got nowhere for that strut to push into the bars to make it stay in place.

Q. Would you agree the moment capacity is depended entirely on the tensile strength of concrete which almost certainly would have been cracked by gravity loadings?

A. Yes and in fact I think again it comes down to the goodness and the integrity of the infill concrete there and if that breaks down which it will do, then it is going to be the seating, 20 millimetre seating width on the sill which will probably crush that off and then the whole thing will come down.

Q. Can we look also please at the two to the left of that, that is 1 and 2. So if we can highlight those two on the top left. Now you will notice in that one that there is no continuity of looking at 2 or looking at 1, but looking at 2, there is no continuity bottom reinforcement going through that joint zone, those two bars actually, coming out of that beam actually bend up, so there is no continuity reinforcement through that and would you like to comment on that detail?

A. Well clearly that failed because there is that classic photograph taken form the street side looking across at the building with the column sticking up and there is no reinforcement in the joint, and so it possibly didn't fail absolutely immediately because if it did it would have perhaps left the backside outside face, face of concrete there.

Q. Would you describe that detailing as appalling?

A. Well it is certainly unacceptable. I don't know if I would use the superlative of appalling.

Q. Now look at the one on the left-hand side, that is the corner column, two bars going in?

A. Oh, sorry I was actually looking at that, I mistook – you wanted the interior one?

Q. Well I wanted the interior one and then the corner one -

A. Yeah, the interior one I wouldn't go as far as appalling, it is not good – it is certainly not good and to me it is unacceptable, the other one I think you could probably use a stronger adjective but again I don't think I would quite go as far as appalling.

Q. Slightly more unacceptable?

A. No, grossly unacceptable.

JUSTICE COOPER:

Grossly unacceptable.

QUESTIONS FROM COMMISSIONER FENWICK CONTINUED:

Q. Now can we go now to the bottom of that page, it is 12, it is slightly to the right of centre and is the junction at the, if we can concentrate on the bottom that one under .12, it is near the middle of the page at the bottom, that is it. That one shows a junction of the columns on line A outside. You see the column steel going down, you see the pre-cast units coming in which have been filled with concrete and at the top level there are three 24 millimetre bars going through right by the column zone?

A. Mmm.

Q. There is no bottom continuous steel. The continuous steel is bent up so there is a lack of steel between the two. Sorry line F, not line A, line F?

A. Yes.

Q. So there is no continuous steel at the bottom. The beams are .55 metres deep and close to a metre in width so I might anticipate there would have been thermal problems, head hydration problems in casting those which probably would have caused a certain amount of flexing to occur. So almost certainly with that and shrinkage you would have anticipated cracks through the bottom of that unit and possibly through the top. Would you like to comment on what you feel about that detail?

A. Well I wasn't – first of all for clarification I wasn't sure if your comments or what you wanted to have a comment on, is the up down motion or the sideways motion?

Q. The detail used there. This is a column which is going to have moments induced into it due to the lack or sway of the structure and the whole detail which is working there?

A. Well either way I guess either it be the transverse – where it's an interior joint for the sideways movement in the – let me say how I've tested

connections like this and, in the United States and they hold up surprisingly well and the reason that they hold up surprisingly well is if you have columns that were sized based on the old architect's way of sizing columns they would work out the weights and it was all based on the days of allowable strength and basically the gravity load was either .1 or at point, at most I would say .2 $F'_C A_G$, so you would get a much larger column and they can hang on quite well but when you make the column smaller the shear stresses obviously in the joint can actually become more, considerably more intense and by the way that paper I mentioned Arcady, Mander and Reinhorn, that is actually the subject of this and is in this as well but in the – now in the US the ACI detailing always required for an exterior connection so in other words in the up, down direction it was like prescriptive requirement in the code, you would always have to have at least two hoops in the beam column joint. Now these would be typically like most of the details were for rectangular columns and in fact there was a lot of buildings that only have 12 inch by 12 inch columns and then they would require two number four hoops in the joint, so 12 millimetre bars in the joint and that is to improve the help, provide some of the anchorage. The hook bars are actually hooked inside that but the distance – because the columns are bigger again they have got a little bit more room to provide some bond and anchorage around the hook. Now it comes down to this, again because everything becomes smaller those shears are more intense, the hooks are not – you are going to have to rely on a measure of bond across the joint and you will very quickly lose your moment capacity and it will turn into essentially just a pin connection. Then it comes down to your proposition earlier is what is there to hold the shear or permit the shear to work for you and as you rightly point out because of the differences in the concrete, it is likely that the column head, that concrete if the beams of concrete was quite strong will spall off, then you are relying on the bottom bars to in dowel action and the sum total is that it's an unacceptable performance. So in terms of design it is not really acceptable I don't think to –

Q. I think we can accept that it is basically an unacceptable detail –

A. Yes.

QUESTIONS ARISING: MR REID – NIL

QUESTIONS ARISING: MR MILLS – NIL

QUESTIONS ARISING: MR ELLIOTT – NIL

COMMISSIONER CARTER:

I would like to say thank you for the effort you have put in to giving those detailed responses. They are helpful, thank you.

1125

MR RENNIE:

Sir I think that only leaves me with that matter of record that the Professor wanted on record and I might just lead him on the facts.

RE-EXAMINATION: MR RENNIE

Q. Professor, you will have heard His Honour clarify the Commission's earlier question about 22 February 2011 and whether you came to New Zealand. And just for the record my understanding is that at that time your immigration status in the States was not resolved and you weren't immediately able to come yourself, but that you located a robotics team and a fire rescue team from the States who were willing to come, but that proposal was not in fact taken up here in terms of the resources that were required. That's it in short order?

A. Yes, but if I may could I put that in my own words please?

Q. Oh, I thought I'd done a good job of doing it for you?

A. You're very close but I'd like to elaborate on a couple of points.

Q. His Honour is nodding.

JUSTICE COOPER:

Q. Just so long as you don't feel the need to elaborate on the basis that there was anything critical behind the question. We were merely, or whoever asked it was merely wanting to ascertain how familiar you were with the situation which applied immediately after the 22nd of February earthquake in terms of the inspection of buildings, that's all.

A. Yes, well Your Honour I respect that and I thank you for that. I was very, very, and on your point about awareness I was very, very aware of what was going on because I, as you know we live in a wired world these days and I was spending almost 24/seven for those first time collecting information as much as I could. However, at Texas A&M University we're a very big university and we have a very diverse body of all sorts of things that go on there, including TEEX which stands for Texas Engineering Extension. That's a part of a fire school as Mr Rennie pointed out and it's also, I've been doing a lot of work with a colleague in computer science who does rescue robots and one of the things that we, is well known is that immediately after an earthquake you, or any disaster for that matter, if people are trapped and in peril then you, there is a window, a golden window of no more than 72 hours available for rescue. And so my colleague, Professor Robyn Murphy, she's in the Department of Computer Science and Engineering and her area is in rescue robots along with artificial intelligence has been a long time responder to a lot of big disasters and we do work together on some of these matters.

Q. Professor I'm going to have to stop you there because although you won't be aware of it you're in danger of going outside the terms of reference.

A. Okay, well –

Q. So can you simply confirm that you did take initiatives in that respect at the time as part of your consideration of the situation in Christchurch?

A. Right, right, well we were trying to, in short then, we were trying to come with, in response to the TEEX which is Texas Taskforce 1 and that, and in the end, and if that was possible my immigration problems would've been resolved because that's all, an invitation is handled through the

State Department, that didn't happen because California was invited instead. So that's basically why I wasn't able to come.

MR RENNIE:

I apprehend that Professor Mander's now completed his various responsibilities other than the provision of the calculation that Professor Fenwick requested which we have noted and will follow through on.

JUSTICE COOPER:

Calculations to show the weakened state of concrete in the beam column joints.

HEARING ADJOURNS: 11.29 AM

HEARING RESUMES: 11.46 AM

SORTING OF PAPERS

MR HANNAN & MS EVANS APPEAR FOR MR HARE
MR BIERRE APPEARS FOR MR WILKINSON
MS SMITH APPEARS FOR MR BANKS

MR HANNAN CALLS
HENRY JOHN HARE (AFFIRMED)

Q. Is your name Henry John Hare? Are you a director of Holmes Consulting Group?

A. I am.

Q. Mr Hare I'll get you to read your brief of evidence. There will be a few points at which I'll pause and take you to some of the documents referred and I do have a few supplementary questions for you at the

end. If you'd begin reading your brief of evidence at paragraph 2 please.

WITNESS READS BRIEF OF EVIDENCE

A. I am a director of Holmes Consulting Group Limited, HCG. I have a Bachelor of Engineering (Civil) with Honours and am a Chartered Professional Engineer. I hold professional memberships with the Institution of Professional Engineers, the Structural Engineering Society (of which I am the current president) and the New Zealand Society of Earthquake Engineering. In addition I am a licensed professional engineer in California.

I have over 25 years of experience in structural engineering in New Zealand, England, Hong Kong and the United States where I was resident from 2000 to 2005.

I spent over four years resident in California from 2000 to 2004. Previously I had worked on assessment of buildings after the 1994 Northridge earthquake. Whilst resident I took the additional examinations required to be licensed in California. This included a seismic specific examination. Much of the work I carried out involved retrofitting and strengthening buildings to upgrade their seismic capacity.

The majority of my professional career has been with HGC where I have worked at various times in Auckland, New Plymouth and Christchurch. My project experience has been mainly in buildings with a combination of both new building design and evaluation and strengthening of existing buildings. I am currently seconded for the majority of my time to CERA where I am the Acting Principal Engineering Advisor.

This brief of evidence sets out my involvement, whilst employed by HCG, and the preparation of a report for a prospective purchaser of an office building development located at 249 Madras Street, subsequently known as the CTV building.

On 24th of January 1990 HCG was engaged by Buddle Findlay Limited and Schulz Knight Consultants Limited to prepare a pre-purchase report on the CTV building. HCG was advised that Buddle Findlay Limited and

Schulz Knight Consultants Limited were acting on behalf of a potential purchaser of the CTV building.

Initially HCG was unaware of the identity of the potential purchaser. HCG subsequently became aware that the potential purchaser was the Canterbury Regional Council.

At the request of our client HCG's review of the CTV building included a site inspection of all areas that were readily accessible, a review of available documents and carrying out approximate calculations. The report was intended for a potential purchaser. The time frame given by the purchaser was limited so the report was never intended to be a full peer review of the design of the building. The draft report subsequently produced by HCG confirmed that "Due to the limited time available for the report our review has been limited".

I drafted the report and carried out the approximate calculations. The calculations were approximate calculations in accordance with our brief and because the client requested HCG stop work and produce a report based on the information HCG had collated at that time as I will explain later in my evidence.

My work was supervised by Grant Wilkinson who, at the time, was a project director for HCG and senior to me. My position at the time was Senior Engineer for HCG.

The draft report subsequently produced by HCG is dated January 1990.

Copies of the architectural drawings and some of the structural drawings were obtained from Alan Wilkie Architects, the architects for the building.

From these drawings I was able to carry out an approximately seismic analysis on 25 January 1990. In the course of preparing my evidence it has been brought to my attention that my calculations carried out on this date appear to be dated 20th of September 1990. They were definitely carried out in January 1990.

WITNESS REFERRED TO WIT.HARE.0001.28

Q. Just have a look at that. Are those the analyses and calculations to which you are referring?

A. Those are the calculations yes.

Q. Just read on please.

WITNESS CONTINUES READING BRIEF OF EVIDENCE

A. The relevant standards at the time were: the loading standard NZS4203:1984 and Derivation Of The Demand Loads; and the Concrete Standard NZS3101 1982 for the design of the elements.

My first task was to review the primary load paths.

Having reviewed the structural drawings and carried out initial calculations I identified that there appeared to be an area of non-compliance with the Code of the day with respect to the tying of the floors to the shear walls, specifically to the north core walls. I picked this up fairly quickly as there appeared to be no connection detailed for the walls on either side of the lift shaft.

Q. I'll just pause you there. If we could move on please in the same document to point 38. If you read on please at paragraph 18 of your brief.

WITNESS CONTINUES READING BRIEF OF EVIDENCE

A. My calculations noted the following:

"Gridline one (south wall) – probably okay;

Line four plus (north wall) – marginal;

Gridline C (west toilet wall) – okay;

Line C/D (east wall toilet/west stair) – probably okay;

Line D (lift shaft stairwell) – no steel shown or not much; and

Gridline D/E (east lift shaft) – no steel?"

Q. Just pausing you there the document now on screen that's your summary which you've just referred to, is that correct?

A. It is yes.

Q. And read on please paragraph 19.

1156

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 19

A. In the summary of my approximate seismic analysis, I noted "entire shear core slightly dubious". This comment related to the connections of the north shear core as a whole to the floor diaphragms. The connections in particular seemed tenuous and in need of further verification.

Q. Thank you we don't need that document up any more.

A. The floor diaphragm of the CTV building adjacent to the north shear core was punctured by the lift, stair and service risers. The result was that there were relatively few direct connections from the floor diaphragm to the north shear walls and there appeared to be insufficient reinforcement tying the floors and shear core together.

On 25th January 1990 I also telephoned the offices of Alan Reay Consultants Limited, ARC, the structural engineers for the building to arrange for an inspection of their documentation. I believe I spoke to Alan Reay directly. Given the passage of time I do not recall the content of the discussion in detail but I wanted to arrange to see ARC's documentation to check that the drawings I was working from were the most up to date and to see whether a site instruction may have been given that would have dealt with the connection of the floor to the walls. My attendant note confirms that I was told I could inspect ARC's documents at any time.

In the course of preparing my evidence it has been brought to my attention that my attendance note of this telephone call appears to be dated 25th September 1990. I must have written the wrong date because I attended the ARC offices on 26th January 1990 and made a note of this attendance which is dated 26 January 1990.

JUSTICE COOPER:

Q. So do you infer that the telephone call was on the 25th of January?

A. Yes I think it would have been at the same time as the other wrong date.

EXAMINATION CONTINUES: MR HANNAN

A. When I attended the offices of ARC on 26 January 1990 I reviewed ARC's design documentation, soils investigation and a complete set of drawings. I cannot recall who met me when I arrived at ARC's offices but I recall seeing both Alan Reay and Geoff Banks at some stage during my visit. I believe I discussed my concern in relation to the floor diaphragms with either Alan Reay or Geoff Banks during my visit. ARC indicated that there may have been some provision made for this during construction and that enquiries would be made.

I recall someone at ARC suggesting they would use a reinforcement cover meter or bar finder to determine whether there was in fact some reinforcement in the locations in question.

I was informed by either Alan Reay or Geoff Banks, I cannot recall who, that the original design engineer was David Harding. He was unavailable for comment as he had left ARC but I was told that Geoff Banks was available for comment on aspects of the design.

I conducted a review of the documents and made notes on matters of interest from the calculations and drawings whilst at the office of ARC. These notes are on my attendance note.

Q. And I'll just pause you there and if we could go to HARE.0001.43 please.

WITNESS REFERRED TO HARE.0001.43

Q. And just looking at that and if we could page through the next three pages, are those the attendance notes that you made?

A. Yes, yes they are.

Q. Thank you. If you can read on paragraph 27 please.

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 27

A. The ARC design calculations included two pages (pages S56 and S57) which considered the slab diaphragm and connection to shear walls. The ARC calculations failed to address the tie force to the walls in question (although they did consider the shear calculations for the orthogonal walls including the south wall, and the north wall through the

shear in the slab). That is the calculations on this aspect of the design addressed earthquake in the east-west direction only. The calculations for this aspect of the design appeared to omit consideration of an earthquake in the north-south direction.

On 29th January 1990 I spoke with Bryan Bluck who was then the building's control manager at Christchurch City Council. My attendance note suggested, suggests I contacted him at approximately 2.15 PM that day. The purpose of the call was to enquire whether the Council had identified any issues during the building permit and construction process of the building.

Q. Just pause there if we can go to HARE.0001.47 please.

WITNESS REFERRED TO HARE.0001.47

Q. And is that your note of your conversation with Mr Bluck?

A. Yes it is.

Q. Thank you please just read on.

WITNESS CONTINUES READING BRIEF OF EVIDENCE

A. I mainly spoke to Bryan Bluck about issues concerning the egress stair which was hanging over the boundary. I do not recall any structural issues being raised nor do I recall any concerns being raised about the building permit process.

I do not recall discussing the diaphragm/shear wall connections with Mr Bluck. I suspect the reason this wasn't raised by me was because ARC had previously suggested that there might be some ties and that this was to be verified with the use of the bar finder. At that time I did not know if I had been supplied with the most recent drawings. Updated drawings might have addressed the diaphragm/shear wall connection position. Also I did not know whether the position had been addressed during the construction phase. This was still being investigated by ARC.

I inspected the CTV building on 30th of January 1990 and was met on site by Geoff Banks. He brought a bar finder with him which he had hired so as to determine whether reinforcement had in fact been added during the construction process. Apparently ARC had been unable to

locate any documentation to confirm whether provision had been made for the floor diaphragm attachment issue during construction.

Geoff Banks tested the slab in the areas concerned with the bar finder. I did not stay with Geoff Banks throughout the testing. However whilst I was with him no significant reinforcement was found.

The HCG draft report records that level 1 and level 4 were unavailable for inspection. These levels were occupied at the time. The remaining floors were accessible and were taken as representative. Geoff Banks and I were also able to gain access to the lift machine room, the cooling tower and on to the roof.

Q. Now I just pause you there. On this question of whether levels 1 and 4 were occupied at the time, there appears to be other evidence notably an article in *The Press* from the 4th of February 1991 which said that the building had been vacant since its construction so I'm just inviting you to recall whether, whether it is in fact the case that so far as you could see those floors were occupied or there is some other reason why you weren't able to gain access?

A. I cannot recall with certainty, it's my recollection that it was because they were occupied but there may have been another reason why we couldn't get access to those levels.

Q. Thank you please read on.

WITNESS CONTINUES READING BRIEF OF EVIDENCE

A. On or about 31st January 1990, HCG was asked to supply a copy of HCG's report as it stood at that time to our client's representative. I cannot recall how this request was communicated but assume the request was made through Grant Wilkinson by Robin Schulz of Schulz Knight Construction Limited. A draft report was produced based on the information that had been collated to that date. I faxed the HCG draft report to Robin Schulz of Schulz Knight Consultants Limited on 31st January 1990. The fax cover sheet confirms that I was sending quote "a draft copy of our report".

Q. And I'll just pause you there if we could go to that document HARE.0001.48, just have a look at that.

WITNESS REFERRED TO HARE.0001.48

Q. That's the fax cover of the fax you sent sending that draft report?

A. Yes.

Q. And if we can go now please to HARE.0001.22

WITNESS REFERRED TO HARE.0001.22

Q. Which is the conclusions portion of your report at paragraph 3 if you'd read paragraph 35 of your evidence please.

WITNESS READS PARAGRAPH 35 OF EVIDENCE

A. Yes. At paragraph 3.0 the HCG draft report stated:

Item 3. A vital area of non-compliance with current design codes, seen in the documents, is in the tying of the floors to some of the shear walls. This item is under review with the original consultants, but if confirmed will require potentially expensive remedial work. However, this cost is a matter for discussion between the current owner and their consultants.

Q. And just one supplementary question on that if you go up to the head of that paragraph under conclusions we've got the reference to the limited time available for the report stating the review was limited to a brief inspection of the building and documents and approximate calculations, that's the passage you were referring to earlier in your evidence?

A. It is yes.

Q. Yes. So please read on at paragraph 36 and if we can go to 0001.25.

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 35

WITNESS REFERS TO DOCUMENT 0001.25

A. At paragraph 6.3 the HCG draft report stated:

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

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

Q. And if we could just pause there, possibly we could just have those last two paragraphs, last two paragraphs on that page enlarged and those are the paragraphs you've just referred to?

A. Yes they are.

1206

Q. Please carry on at paragraph 37.

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 37

A. My view was that it appeared that more reinforcing or other connection was required in those areas of the floors that connected to the north shear core along gridlines D and D/E.

I communicated this issue to ARC at the time of my first to ARC's offices. It was later confirmed by their own testing on site. Our understanding (which was confirmed by the letter from ARC dated 2nd of February 1990) was that ARC had acknowledged there was an issue and it was taking the necessary steps to resolve the issue. Any modification to the design of the building would have had to have been approved by the Council through the permitting process.

The CRC, or at least its representatives had asked HCG to advise on the likely cost of fixing any defects we found. I cannot recall how or when CRC requested advice on the likely cost of fixing any defects in the CTV building as identified in the draft report. It may have been a verbal request from Warren and Mahoney (who were acting as principal consultant between HCG and Schulz Knight Consultants Limited).

I developed a possible remedial detail on 31st January 1990 to give a preliminary estimate of the cost of establishing a connection between the north core and the floors.

Q. Now just pause there and look at the document now shown on screen.

WITNESS REFERRED TO SLIDE

Q. Is that the detail that you had developed?

A. Yes it is.

Q. And there are a couple of pages to that I think we can just go on. And I think there were in fact four pages. I'm not sure if they're part of this particular sequence, if we can just run onto the next page in that document.

A. Yes, no, there should've been three I think at least.

Q. We'll come back to that as we need to. So if you can please read on at paragraph 41?

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 41

A. My draft remedial detail involved:

(i) The insertion of steel diaphragm strengthening members (drag bars) on levels 1 to 5 of the CTV building. By levels 1 to 5 I was referring to all levels above the ground floor carpark. In my calculations, and in the HCG draft report, HCG refers to the floors in the CTV building as the ground floor and then levels 1 to 5 above the ground floor. In contrast ARC refers to the ground floor as level 1 and the floors above the ground floor as levels 2 to 6.

(ii) A piece of steel angle being cut to shape and fixed to the lift walls and the underside of the slab, with drilled and epoxied anchors. There were to be two such ties per floor to the wall on grid D and the east wall part way between grids D and E. In my view such a detail was required to improve the connection between the floor slabs and the walls of the north core.

(iii) Consideration of the specifics of fixing to a thin wall and a thin slab. I recommended the use of 12 millimetre diameter mild steel rods for connection to the wall, being the largest diameter reinforcement that could be practically developed into the 300 millimetre wall. Likewise I limited the size of the connections into the underside of the slab and recommended coring and grouting

from above, due to concerns I had with overhead expoxying and grouting.

My draft remedial detail was developed solely for the purpose of determining the approximate cost of any remedial work as part of HCG's report to the prospective purchaser. My draft remedial detail was not developed to a final design stage.

On or about 31st January 1990, HCG was instructed to cease any further work and our engagement ceased. I think HCG was advised of the identity of the potential purchaser at the time we were asked to supply our draft report.

On 1st of February 1990, Grant Wilkinson sent a memo to Kerry Mason of Warren & Mahoney with details of the quote we had received for the proposed remedial works. I supplied the sketch for the quote but don't remember any further involvement beyond that.

Q. Yes if you just look at the documents now on screen. Does that appear to be the memo that Mr Wilkinson sent to Mr Mason of Warren & Mahoney?

WITNESS REFERRED TO SLIDE – MEMO

A. Yes.

Q. It would be correct that's the document on the left-hand side of the screen. Please read on?

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 45

A. The quote came from Martin Charles, a quantity surveyor with Russell Drysdale and Thomas. He advised that the cost to carry out the HCG draft remedial detail would be approximately $14,000 plus GST. In his memo to Warren & Mahoney, Grant Wilkinson asked Kerry Mason, "Do you need anything else from us on this job?" I do not know whether Kerry Mason had any further contact with Grant Wilkinson about the building after this.

HCG was subsequently advised that CRC had decided not to proceed with the potential purchase of the CTV building. I don't know exactly

when we were told this or why the CRC had decided not to proceed with the purchase.

In the documentation that has subsequently been made available through the Commission's process, I have been made aware of a letter from ARC to its insurers dated 1st of February 1990.

Q. I'll just pause you there, we'll look at that letter that's HARE.0001.55.

WITNESS REFERRED TO SLIDE

Q. And if you'll just read on please?

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 47

A. In the letter ARC says that CRC has an option to purchase until 28th of February 1990 and that CRC's solicitor has requested a two month delay in settlement to give time to carry out the remedial work. I was not aware in January or February 1990 of any option to purchase or any request for a delay in settlement.

Q. Just to clarify that a little further, were you aware at any time through January or February that Alan Reay Consultants had involved its insurers?

A. I don't believe so, no.

Q. Please continue at paragraph 48.

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 48

A. Geoff Banks faxed a letter to Grant Wilkinson dated 2nd of February 1990 in which ARC set out their understanding of the scope of the possible non-compliance referred to in the HCG draft report.

Q. Just pause there, we'll get that document up, that's doc 57. Just carry on please.

A. In the letter ARC suggested:

(i) "the scope of the possible non-compliance" related to "the connections between the walls on gridlines D and D/E as shown on the attached sketch SK1 from levels 2 to 6 inclusive (level 1 being the ground floor carpark)";

(ii) "The proposed remedial work, if required, would consist of a total of two ties per floor, tying the walls to floor diaphragm";

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

HCG was asked to contact the office of ARC "today" if HCG's understanding of the situation was not as outlined in the letter.

I cannot recall whether I was shown this letter at the time. I have seen it whilst preparing my evidence for the Commission. I can't recall whether I discussed the content of the letter with Grant Wilkinson and/or ARC.

Geoff Banks called me by telephone on 14th of February 1990. He wanted to discuss the design issue with me and I had a short discussion with him. I did this without a fee being rendered.

I believe I discussed the content of the telephone discussion afterwards with Grant Wilkinson.

In the document that has subsequently been made available through the Commission's process, it appears ARC was told by the receivers KPMG Peat Marwick, by letter dated 2nd of February 1990 to agree the level of work required.

Q. Just pause there, we'll get that document up, that's .58 please?

A. It also appears that ARC was given approval by its insurers, by letter dated 12th of February 1990, to agree the precise scope of the work HCG considered to be inadequate.

Q. Just pause there, we might just pause a moment on the letter from the receivers. Now firstly these were the receivers of the building owner so far as you're aware?

A. Yes.

1215

Q. But were you aware at the time that you were having these interactions with Alan Reay Consultants and doing your work with respect to the building for the Canterbury Regional Council, of this communication from the receivers?

A. No.

Q. No. And were you aware that Alan Reay Consultants had been told by the receivers to agree the level of work required with Holmes Consulting Group?

A. I was not aware of that no.

Q. Now you have just read the sentence in relation to the approval by the insurers, if we could have that document, that's Dot 60. If we just have the first two paragraphs of that letter enlarged. Now firstly were you aware of this letter from Alan Reay Consultants' insurance?

A. Not at the time, no.

Q. And was – in Alan Reay Consulting's communication with you was there any suggestion that such communications were being undertaken on a without prejudice basis with no admission of liability?

A. None that I recall.

Q. So you really didn't know anything about this?

A. No.

Q. Thank you and I think you are at the last sentence at paragraph 53.

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 53

A. Yes. As far as I am aware none of this was communicated to HCG at the time.

I have recently been shown a copy of the file note made by Geoff Banks dated 14th February 1990.

Q. Just pause and we will get that up, Dot 61 please?

A. The file note suggests we:

(i) "agreed loads" applicable to each level of the CTV building as follows:

(a) Level 5: 300 kilonewtons.

(b) Level 4: 240 kilonewtons.

(c) Levels 1, 2 and 3: 184 kilonewtons.

(ii) "Confirmed tie only system okay", but the note makes reference to "possible pretension via nuts".

(iii) "Confirmed reduced connection at level 1 maybe okay (could compensate at level 2 if necessary)".

However my recollection differs from Geoff Banks' recollection of the matters discussed during this telephone discussion. I recall that we discussed:

(i) the loads referred to in his note in the context of Geoff indicating he had carried out his own calculations and had arrived at these figures. I indicated they appeared to be around the right figures but it was over to Geoff to check and finalise.

(ii) Geoff's suggestion that the loads could be reduced at any level in light of the suggestion that some steel existed at the applicable level. I indicated that if this were the case then the loads could potentially be reduced but it was over to Geoff to check and finalise.

(iii) Geoff's suggestion that he used a reduced connection at level 1 which was to be compensated for at level 2 if necessary. I indicated that Geoff would have to check whether this was possibly by investigating other mechanisms that would be required to make up any shortfall. I expressed the view that caution should be exercised if it were ARC's intention to reduce the load at level 1. I certainly did not agree to this.

The discussion was a general discussion and centred entirely on the Loading Standards NZS4203:1984 for derivation of the demand loads.

I wouldn't describe us reaching agreement. In relation to all matters it was clearly understood that it was over to ARC to progress.

The file note of the telephone discussion as recorded by Geoff Banks says, "Will confirm if work proceeds." I do not recall any suggestion during our telephone discussion that ARC was to confirm anything with me. HCG thought its involvement was over. We assumed ARC was sorting out the design issue and I did not expect to hear from Geoff Banks again.

Following my discussion with Geoff Banks my understanding was still that ARC had accepted responsibility for dealing with the matter and

that they intended to take the necessary steps to remedy the issue. I had no further involvement with the CTV building post February 1990.

I understand that Alan Reay and Geoff Banks may now be asserting that HCG had some level of responsibility for the ARC design of the remedial work that ARC ultimately carried out for the CTV building. This is not correct.

HCG was engaged by a prospective purchaser to prepare a pre-purchase report. I contacted ARC and notified them of the potential problem I had identified during that process. I also discussed the issue with Geoff Banks. I had not carried out detailed calculations nor had I finalised the design for the draft HCG remedial detail. I was not instructed to do so. I understood that ARC as the designer of the building had accepted sole responsibility for rectification of the issue.

The ARC remedial work which appears to have been carried out to the CTV building by ARC in 1991 did not in any event accord with the draft HCG remedial detail which I have produced for the prospective purchaser of the CTV building.

I did not give ARC a copy of the drawings or calculations for that draft detail or a copy of the draft HCG report.

I have been requested by Counsel assisting the Commission to review ARC's calculations in respect of the ARC remedial work which was designed by ARC and carried out to the CTV building under ARC's supervision.

It appears that initial calculations were carried out by ARC on 29th of January 1990 and 1st of February 1990. Further calculations appear to have been carried out on 10th of October 1991 (some 20 months after my discussions with Geoff Banks).

The calculations dated 10th of October 1991 include calculations (at pages 12A to 14A) for the transfer of loads from levels 1 and 2. It appears those calculations were carried out by ARC to "check whether loads and diaphragms at these levels can be transferred to walls 5 and 7, (lines C and CD)". The ARC calculations conclude that the additional

load on the other walls (lines C and CD) would be acceptable as those walls had excess capacity but the calculations do not appear to include any additional analysis of the building's global performance.

The calculations do not appear to have considered the impact of any torsional behaviour at levels 1 and 2. Without specific analysis this would be difficult to estimate but there is a possibility that there could have been additional rotation of the floor plate due to the eccentricity of the connection. By this I mean the whole of the floor plate appears to have been left eccentrically connected to the wall system on the north side. Therefore the floors that were not connected could tend to behave differently in the event of shaking, potentially imposing greater displacements to the gravity structure and greater stresses in the connecting elements at the level above. A detailed computer analysis would probably have been required to verify the impact of this.

The ARC remedial detail as designed by ARC adopted the same concept (a tie system) that I had proposed in the draft HCG remedial detail for the prospective purchasers of the CTV building. However, the ARC remedial detail differed from the draft HCG remedial detail in several ways.

I have identified some of the differences as follows:

(i) ARC uses a 152x152x10 angle. The draft HCG detail recommended a 200x200x10 angle.

(ii) ARC used 262kN as a maximum load. The draft HCG detail recommended 300kN.

Q. Just pause you there, with regard to paragraph 7.3 in your written brief, I understand you don't wish to give the evidence in the first sentence of that paragraph. What do you wish to say about the contents of that paragraph?

A. No in the course of doing this piece of work I was going through the calculations. I realised later I looked at the calculation which was done at the earlier date which didn't in fact reflect the final detail that was used as I did not see a calculation for that.

Q. So let's just get clear about that, when you said you looked at the calculation from the earlier date, you are referring to calculations that Alan Reay did –

A. Yes.

Q. – in possibly the end of January 1990?

A. Yes, there was one calculation for tension capacity of an element there which was the only one that I saw but that referred to a detail not in fact used.

Q. So essentially where we get to is that you don't want to say anything about the ratio of area supplied to area required fixed by Alan Reay Consultants?

A. No.

JUSTICE COOPER:

Shall we put a line through 70.3.

EXAMINATION CONTINUES: MR HANNAN

A. (iv) ARC used fewer but larger connections comprising M24 chemsets to the wall, with M20 chemsets to the underside of the slab. The draft HCG detail recommended smaller connections to ensure the anchors had sufficient anchorage to develop the full capacity of the anchors given the thickness of the elements being fixed to. The draft HCG detail recommended epoxied bars rather than chemsets as I had concerns about the chemset adhesive (which I felt was best used on light duty applications).

(iv) The draft HCG detail recommended coring and grouting from above to attach the angles to the floors, due to the concerns with overhead epoxying and grouting.

1225

I was not confident at the time that Chemset anchors were suitable for overhead application having had several experiences of Chemsets not curing properly and of the Chemset adhesive running out of the horizontal holes.

(v) The slab thickness was 200mm overall but the Hi-Bond, taking into account the trough depth of 50mm, this left 150mm. The slab thickness is less than the minimal acceptable depth of fixing at the time for M20 anchors, therefore prone to pullout failure. To address this the draft HCG detail recommended a headed anchor instead. The holes to be cored from above over the entire depth, the sides roughened and then filled with non-shrink high strength grout. In this way the detail would have approximated a conventional in situ connection.

(vi) The angle used by ARC was slightly shorter with the spacing of bolts adjusted to suit. The draft HCG detail recommended the angle be extended as far as possible in order to connect into as great an area of slab as possible. I have not attempted to minimise its length to suit minimum anchor spacings.

(vii) ARC inserted drag bars at the top three levels only. The draft HCG detail recommending drag bars at each floor level above the ground floor.

The draft HCG remedial detail was very different to the ARC remedial detail. For the reasons as set out above I would not have agreed to the ARC remedial detail had I been consulted about it at the time.

Remedial detail used in the CTV building was designed by ARC without any reference to HCG and was never approved by HCG. Geoff Banks, on ARC's behalf, carried out independent calculations. ARC's decision to leave out the ties at levels 1 and 2 was a decision taken by ARC long after my discussions with Geoff Banks.

In any routine review situation the original designer remains responsible for the design. HCG identified a potential design issue and this was referred back to ARC, the original designer. Any required modification to the design of the building would have had to have been referred by ARC to the Council for approval through the permitting process.

As a result of discussions with ARC and ARC's letter dated 2nd of February 1990 HCG had a clear understanding that ARC had accepted responsibility for the design issue and was taking steps to remedy it.

HCG was satisfied that this is what ARC intended to do. That was the end of the matter as far as HCG was aware.

Q. Yes, thank you, now I have one or two supplementary questions.

WITNESS REFERRED TO BUI.MAD249.0528.1

Q. Now this is not something obviously you would have been aware of at the time. It's a letter from Wynn Williams Lawyers for the Canterbury Regional Council dated 12 July 2012 to counsel assisting the Commission and it's about CRC's decision not to proceed with a potential purchase of the Madras Street building, the CTV building.

If we could go please to the second page of this letter and enlarge the third full paragraph please and I'm just going to ask whether you knew any of this back in late January 1990, early February 1990. Now, first of all, Mr Stock who was the solicitor for the CRC, about halfway through the paragraph, "Mr Stock's recollection is that although Madras Street was to be considered as a possibility this was more to ensure the Council had some leverage in negotiations over 58 Kilmore Street". Just looking at that.

Then if we can go back down the document and to the second paragraph from the bottom, if that could be enlarged please. There are also minutes of a special meeting of the CRC on 9 February 1990 and then just at the last sentence of that paragraph "The Council resolved to purchase Kilmore Street subject to satisfactory negotiation by the subcommittee". Now my question is simply were you aware that CRC was, firstly, considering another property, and, secondly, of the timing of its decision in this way?

A I don't recall being made aware of any of that at the time. That all happened, we all found out about that later.

Q. Now just coming back to your discussion with Mr Banks on the 14th of February and really it may not have emerged as clearly as it might have done in your evidence so far but was there any discussion, any suggestion by Mr Banks, so far as you can recall, that tie bars might be omitted at levels 1 and 2 and by 1 and 2 I'm referring to the two levels above the ground floor, using that nomenclature?

A No the way I recall it there was discussion about the possibility of leaving the tie bars out at the lower level only.

Q. When you say at the lower level only what level are you referring to?

A I'm referring to the first floor as I would think of it, the first suspended level above the ground floor.

Q. All right so some discussion about possibly omitting a tie bar at level 1 but no discussion about omitting a tie bar at level 2.

A None that I recall.

Q. Now I'm just coming to the evidence of Mr Harding – Commissioners, Your Honour, I'm referring to Mr Harding's evidence at transcript 20120731.11. I don't need to get it up on screen but I'll give you that reference. Mr Harding in his evidence at that portion of the transcript suggested that Dr Reay had told him that Grant Wilkinson, then of Holmes, had suggested to Mr Harding that Holmes had had drag tie issues with some of its own buildings or its own jobs prior to the contact which you had with ARC consultants in late January 1990. Have you got any comment on that? Obviously you weren't part of that conversation and you can't comment on what Mr Wilkinson may or may not have told Dr Reay but what about the bit about Holmes having had issues with drag ties?

A No I guess my comment would be that I have no idea where that came from. As the person doing the review I certainly didn't relate that to any issues that we may or may not have had with drag ties. It was simply something that was immediately evident as having been omitted. So nothing to do with any prior designs in that sense.

Q. Now Mr Banks also gave evidence. I'm sorry no Mr Banks hasn't given evidence yet. Mr Banks brief of evidence, and this is at, I don't need the document up I'll just simply give the reference – WIT.BANKS.0001.15 – suggests that he may have thought that the City Council was aware of this problem of the connection of the diaphragm or the walls to the shear core because of something that had arisen in discussions with either yourself or Mr Wilkinson. Are you able to comment on whether, so far as you were aware, the Council was told of this problem?

A Certainly not by me. At the stage when I was talking to the Council about this I wasn't, it hadn't been confirmed that it was, in fact, a problem. We were still waiting to see about the bar testing on site so it wasn't raised with them. So I don't believe that anyone at HCG had communicated with the Council about it at all.

CROSS-EXAMINATION: MR BIERRE – NIL

CROSS-EXAMINATION: MS SMITH

Q. Mr Hare I just wanted to clarify some aspects of your evidence if I could. You've indicated that your first task when looking at this building was to review the primary load paths. And that was across the entire building, is that correct.

A I think I would have said concentrating initially on the lateral load resisting systems, but yes.

Q. And as a result of that review, however, you, the issue that you raised with ARC and with Mr Banks was only that issue in relation to lines D and D/E, wasn't it?

A That was the main point where we saw there was an absence of a load path so we were looking for the missing link as it were. So that was certainly the primary thing I was talking to him about at this stage.

Q. It actually went further than that though didn't it Mr Hare because that was the only thing that you actually spoke to Mr Banks about?

A It was because, as we said, we were called to stop work shortly after that and so that was all we discussed yes.

1235

Q. And as a result of those discussions that he had had with Mr Wilkinson I think it was at that time and potentially with you when you came to visit on the 26th of January at ARC's offices he wrote to you and sought clarification that his understanding of what the issue was was correct, is that right?

A I can't remember the exact wording of the letter at this point but yes I think on the face of it yes.

Q. And if I can bring up that letter just so we're clear on this point.

WITNESS REFERRED TO BUI.MAD249.0005.2

Q. So this is the letter of the 2nd of February 1990 in which Mr Banks is seeking clarification that is understanding of the issue is correct, is that right?

A Yes.

Q. And my understanding, Mr Hare, is that that was faxed to your offices but it was also sent by post and you'll see there in the top right-hand corner there's a received stamp.

A Yes.

Q. And that shows that those initials RGW are presumably Mr Wilkinson's initials.

A Yes.

Q. And HJH are your initials?

A Yes.

Q. And the arrow there shows that or suggests that that letter was sent to you also internally?

A Yes that was the customary way that would have been handled.

Q. Now I know that you've said that you can't recall whether you saw that but it suggests that you had received it and if you had and you're understanding was different from as expressed in that letter you would have got back in touch with Mr Banks to clarify any issues of concern wouldn't you?

A Yes certainly.

Q. And you didn't do that at that time?

A No I don't recall the timing but we heard from Geoff at some later date, remember we'd been asked to stop work at that point so.

Q. And when you first went to the offices of ARC and you've indicated, which is understandable that you can't remember who you spoke to and it may have been Mr Banks or Dr Reay but you were aware, were you, at that time that Mr Banks had no involvement in the original design of this building or through construction?

A Yes.

Q. Now as a result of producing the report that you did and you sent that to your client and you've referred in your evidence to paragraph 3 of that report which indicates that if the issues confirmed essentially that it's going to require potentially expensive remedial work.

A Yes.

Q. Do you recall that? So they obviously came back to you as a result of that comment and asked you for an indication of cost.

A. I can't recall when that quick request was made, certainly it was at the time we had informed them about that informally.

Q. But you've given evidence that that was the purpose of your design that was spoken about this morning.

A Purely for cost yes.

Q. And that design simply focused on the areas around lines D and D/E.

A Yes.

Q. So you've described it as a possible remedial detail and you didn't do any detail calculations in support of that detail?

A There was sufficient calculations done I guess in support of the detail to say that that was something that would meet or exceed that load that we'd used as an approximate check, yes.

Q. But what you were doing weren't you is that you were actually using the higher floor where the highest loads would be on the building.

A Yes.

Q. And therefore the greatest amount of work would be required at that level.

A Yes.

Q. And you prepared the detail on that basis didn't you?

A That's correct.

Q. And then you simply just applied it down the rest of the building?

A Yes, as I said, I was a preliminary detail to establish costs so it wasn't being refined at all.

Q. And we'll come back to the detail, I guess, of the calculations shortly but you've spoken about a discussion that you and Mr Banks had on the 14th of February.

A Yes.

1240

Q. And you've described that as a short conversation that you had with him?

A To the extent I can remember yes.

Q. And that's understandable because it is 22 years ago that we're talking about. You don't have a file note of that conversation at all?

A No I don't.

Q. So you've suggested that Mr Banks file note of that conversation is wrong in a few respects?

A I think wrong would perhaps be too strong a term for it. I think a better way of saying that would be I didn't agree on appear to be interpretation of some parts of it.

Q. Do you accept that your interpretation of that might be affected by hindsight somewhat?

A I think after 22 years anyone's interpretation would be affected by hindsight.

Q. So if we look at one aspect of that. You've indicated and clarified that with us this morning that you spoke about redistribution of loads in that conversation?

A Yes.

Q. And you thought that at level 1, which is the first elevated level, that might actually be acceptable?

A I recall the discussion and I guess acceptable would be one word for it. I don't recall being immediately, it would, isn't something that I would think would be obviously what you would do. I would've said that the absence of a tie meant that a tie should be put in there. And so I would've been reluctant to agree to any transfer of load vertically in the building when it would be just as easy in my view to put a tie in.

Q. But you hadn't done the detailed calculations that Mr Banks later did to actually work that through to see whether that was right, did you?

A Quite clearly not.

Q. And it would be expected that if you were saying to somebody that you need to be careful here, you need to exercise caution, that that would actually be recorded in the file note that was taken of that conversation?

A Well not necessarily, it depends on how the file note's recorded, I couldn't say.

Q. Mr Banks' evidence will be that had you expressed that he would quite clearly have recorded that in his conversation – in his file note of that conversation. Do you have any comment to make about that?

A Well only that if my reading of the file note on the first two items it said I agree and I think the last one said something less than agreed, and so I think that there was certainly if not a note of reluctance, certainly not the same note of acceptance.

Q. I think if we actually look at the file note though it doesn't say that you had agreed. If we're talking about the load at level 5 which is 300 kilonewtons, it doesn't actually say that you had agreed that. But that those were agreed loads. Is that right?

A Well it would be useful to see the file note in front of me but yes that's generally the course of my agreement, my memory yes.

Q. BUI.MAD249.0130.14. So in relation to the 300, were you aware at this time that Mr Banks had had a discussion with Mr Wilkinson in which Mr Banks had indicated that the load he had calculated was lower than 300 but had agreed with Mr Wilkinson that he would use the higher load of 300 for the design?

A I'm not aware of the, any discussion about a lower load than that, but I'm certainly aware through the letter that you brought up earlier that there had been discussion about reducing loads which is consistent with the standard.

Q. So if we can just have a look in a little bit more detail about the comparisons that you have made between your possible remedial detail and the detail that Mr Banks had produced. You've indicated that they didn't accord with each other?

A Mhm.

Q. It's not surprising though is it because of the purpose for which yours was prepared and that you hadn't done those detailed calculations?

A In some respects yes, obviously someone working through that in more detail would be able to refine it further.

Q. And so the impression that one might get when reading or hearing your evidence on those comparisons, is that you're actually comparing like for like when in actual fact you're comparing something that's quite different. What I'm putting to you is that you're actually making an unfair comparison aren't you?

A I take your point. We were responding to the request made by the Commission in doing so.

1245

Q. I understand. Now you've identified some differences and one of those you have changed your view on since preparing your statement. I just want to take you through some of the other differences that you've identified between the two details if I may? The first one is in 70.1 of your statement where you're referring to ARC having used a 152 x 152 x 10 angle and you say that the draft detail you prepared recommended 200 x 200 x 10 angle.

A Yes.

WITNESS REFERRED TO BUI.MAD249.0005.19 & 20

Q. So if we accept that the dimensions are as you have stated them the difference between the design load is the fact that there's actually more steel in the ARC design. Do you accept that? And I'll take you to that shortly.

A I do actually and that was the whole purpose of withdrawing that note 70.3 because I realised when I looked at it again that the flange of the angle hadn't been stripped back fully in the ARC detail as used.

Q. So just to provide some clarity around that this is your detail on the screen in front of you and what that shows in the area beside the lift shaft it has been cut back completely.

A Yes.

Q. And if we move over to 20 in that same series. That shows there that at that top angle has actually been cut back because of working in the lift shaft.

A Yep.

WITNESS REFERRED TO BUI.MAD249.0130.35

Q. And this is the issue that you've identified now since preparing your evidence that at the bottom there it shows that 80mm of that angle is actually still left in the ARC detail.

A That's correct

Q. The second point that you have raised is that ARC used 262 kilonewtons as a maximum load and your detail recommended 300 kilonewtons. Do you still maintain that that's the position?

A That's as I was able to ascertain it from the calculations, yes.

WITNESS REFERRED TO BUI.MAD249.0130.21

Q. These are the calculations that Mr Banks prepared in October 1991 and you'll see down the right-hand side he's got a reference there to 300 kilonewtons as being the load that's used.

A Yes.

Q. So it's clear that he used 300 as the maximum load as had been agreed earlier with Mr Wilkinson, not 262 as you suggest.

A Yes but what I can't see on this page, and I can't tell you exactly where it is, is that there was a reduction in the design load for the angle I think for the area of steel which was ascertained might have been in the slab.

Q. I'll get Mr Banks to address that when he gives evidence. I'm not sure which aspect that you're referring to.

A Yeah I'm sorry I can't remember where it is.

Q. The next point is that you, the ARC used fewer but larger connections and your detail recommended smaller connections to ensure the anchors had sufficient anchorage to develop the full capacity of the anchors.

A Correct.

Q. If I can just get you to look at your detail SKO3 which is BUI.MAD249.0005.21

WITNESS REFERRED TO BUI.MAD249.0005.21

1250

Q. Now the drawing that is on that detail there, you have actually – there's a, hard to see, but there is a dotted line that is running along the middle of that portion. Can you see that?

A Yes.

Q. And that's to indicate the HiBond, is that right?

A Yes, correct.

Q. Do you accept that you have actually got that running in the wrong direction?

A It would be for that particular span that we would be having to grout along the top of the angle to get the connection.

Q. Sorry?

A I said, yes you are right but we would have had to have, which is there indicating the fact there is HiBond, we would have to have grouted the gap between the flange and the under side –

Q. So the more accurate representation would be the one in ARC's detail which is BUI.MAD249.0130.30. So that's the direction that the HiBond are running?

A That is correct, yes.

Q. So in terms of your detail if you are bolting through that, how would the grouting work to provide you with sufficient anchorage?

A Well, once again as you pointed out, we did a preliminary design we would have to have done a final design to have gotten to that point, so equally I think you'd say that the preliminary detail and for the purposes pricing wasn't going to be complete in every respect.

Q. Now another aspect is that your detail called for, sorry 80 millimetre diameter holes to be drilled through the floor slab at 100 mm centres, is that correct. Do you want to refer to your –

A No I don't think we need to, no I think that sounds right, yes.

Q. But that – if that had been constructed would have cut away much of the floor strength, wouldn't it?

A Which was the purpose of staggering those so they would in fact align but I agree any detail was going to have to address that issue.

Q. But if you were staggering them the number that were there and given the width of the angle that you were talking about, you are effectively slotting slab aren't you?

A Not quite slotting, it is certainly not great, but again it was all subject to further development.

Q. So just in comparison to that, if it is an accurate comparison, the ARC holes were only 24 mm in diameter and spaced every 170 mm which would have a less detrimental effect wouldn't it?

A Yes I'd agree with that. It is a matter of balancing the one against the other.

Q. Now you've indicated that you thought Chemset anchors or you had a concern about using chemset anchors for an overhead application?

A Yes.

Q. It has been difficult to obtain the relevant technical data at the time as you might understand but the Beca report CTV building drag bar capacity assessment, at 2 of that report has indicated that Ramset, sorry Ramset Chemset capsules were used and the similar bond properties to those implied in the current manual are applicable and that discussion with that manager had indicated that the latter was a reasonable assumption. So what I am putting to you Mr Hare is that first of all relying on manufacturer's specifications would be appropriate 22 years ago and now?

A You could say that. I was simply saying what I said based on my experience at the time which hadn't been favourable with Chemsets.

Q. But they were designed and intended to be used for just this application in an overhead application, had they?

A Yes but my comment stands, I'd certainly had previous bad experience with them.

Q. And you have indicated as well then that you thought that there was a potential for pullout failure?

A Yes.

Q. So you accept wouldn't you that the slab thickness was 200 mm over all?

A Yes.

Q. And then with the HiBond taken into account it brings it down to 150 mm?

A Yes.

Q. So if we look at the ARC design which was recommending an M20 anchor for a start, the manufacturer's recommendations provided that so long as it was embedded by six diameters then pull out or pry out would not govern, so for a M20 anchor that means an embedment of 120 mm you accept that?

A I accept that is what the manufacturer says, yes.

Q. So that is readily achievable within a slab of 150 mm isn't it?

A Again I would just go with my own feeling on that, that a smaller anchor is better into a shallower hole simply as matter of course but I accept that the manufacturer's data says that.

Q. So another point that you have raised is that the angle used by ARC was slightly shorter?

A Yes.

Q. And that your detail recommended that the angle be extended as far as possible. So if we can have a look at your detail SK01 again which is BUI.MAD249.0005.19. So this shows the line, horizontal line in the middle is the area where there is overlapping between the lift shaft and the slab?

A Yes.

Q. And if you actually take your measurements on that, what appears at the bottom of that detail, you've actually only got an overlap of 1350 mm haven't you?

A I seem to remember the length was specified on the other sketch.

Q. Well it is specified as, you were using a 3000 mm angle, but what is shown on this detail if you use the –

A Oh, beg your pardon, sorry yes you are quite right.

Q. So if you are looking at the bottom there it is 1350 mm overlap isn't it?

A That would appear to be the case yes.

Q. And on the ARC sketches the angle actually overlaps by 1700 mm?

A I may be looking for another note in our drawings but I think there'd be an instruction at some stage perhaps to the QS to extend that all the way to the beam, so obviously that is not what it says there I accept that.

Q. Sorry whose instruction to the engineer?

A So – our instruction to the QS when he was pricing it.

Q. Right. I haven't seen that so perhaps we can have a look at that a bit later. Then of course the final point which we've already touched on a little is in relation to the drag bars at the top three levels only on the ARC design, but when you've prepared your detail you did so on the 31st of January 1990, is that correct?

A Correct.

Q. And so at the time that you prepared this you hadn't had the opportunity to take into account the discussions that Mr Banks had had with Mr Wilkinson on the 2nd of February?

A No I hadn't.

Q. And you also hadn't had, hadn't taken into account the discussion that you had yourself with Mr Banks on the 14th of February?

A No I hadn't.

Q. And in that discussion you had spoken about the ability to redistribute loads and so on at that lower level, level 1?

A It was discussed. It wasn't raised by me or agreed by me.

Q. Or you can't be sure that it wasn't raised by you though can you Mr Hare?

A I can, excuse me, I can be fairly sure it wasn't raised by me. I can't tell you the exact words that were used.

Q. But what is clear from your evidence is that you haven't produced a detailed, you haven't produced detailed calculations or a detailed design?

A I agree.

Q. And so it is difficult to – when giving your evidence, to devoid yourself from the 22 years of knowledge and experience that we all now have in design?

A I agree with that.

Q. And it is perhaps inappropriate therefore to compare those two designs when as we said before, it is not in fact comparing like with like, is it?

A Yes it is, as I said I was asked to comment by the Commission and have done so.

HEARING ADJOURNS: 1.00 PM

HEARING RESUMES: 2.15 PM

CROSS-EXAMINATION: MR RENNIE

Q. Mr Hare at paragraph 7 of your brief of evidence you say that your firm was engaged on the 24th of January 1990 to prepare a pre-purchase report. Do you see that?

A. Yes.

Q. And we know that the pre-purchase report reached a draft stage as you say in paragraph 12 and it says on the face of it that it was for the Canterbury Regional Council doesn't it?

A. On the face of the report sorry?

Q. Yes.

A. Yes.

Q. Do you know when and where you got that information from?

A. I presume it came at that stage.

Q. Yes.

A. I can't remember.

Q. You haven't produced a letter of instructions or other brief so how on the 24th of January did you know that this work was required?

A. My understanding is that it was a conversation over the telephone, one of Robin Schulz or – I'm not sure who it was, someone from Buddle Findlay may have called, David Stock perhaps.

Q. And pre-purchase report then would be a standard concept, something that you provided in your firm?

A. I wouldn't say it was something we did a lot of. It was an occasional request. I couldn't say that it was a clearly defined brief as such.

Q. But a phone call asking for a pre-purchase report, you'd either have to know what it was going to be or the terms of it would have to be defined wouldn't it?

A. Yes that's reasonable.

Q. And I take it that a pre-purchase report from an engineer would be a report as to whether the building had been constructed to code requirements. You'd agree with that?

A. It may have been. I can't tell you what was discussed.

Q. Well in the draft report you actually address the question of whether it's been constructed in accordance with code don't you?

A. Yes I think I put in the opening paragraph of that what it was that we thought we were doing.

Q. Yes and in addition to compliance in that sense the report would also seek to identify any engineering defects of any kind in the building whether at construction or later in time. Do you agree with that?

A. To the extent that we were able to put that time in to do it, yes.

Q. I'm still talking generically about pre-purchase reports. Forget about time for a moment. Would you agree that a pre-purchase report would seek to identify engineering defects in the building whether at construction or arising later?

A. I would say generally the case, still dependent on the discussion or the briefing given at the time.

Q. Yes well we don't have a written brief and on your account of it we have an oral request for a pre-purchase report, not as I understand it further defined. Do you agree?

A. I agree yes.

Q. So can we take it that when the work was assigned to you, you commenced to check code compliance in respect of the building?

A. To the extent that we were able to do so, structurally, yes.

Q. And you were also looking for design defects and you found one.

A. Yes.

Q. And you were looking for other defects in the building. It would seem you found none. Is that correct?

A. In the time available, yes, it is.

Q. Well I understand you keep saying in the time available but the purpose of the report is matched by the actual report as it was sent on the 31st of January wasn't it?

A. I'm not sure I understand your question.

Q. Well what you set out to do is what you wrote and sent on the 31st of January.

A. That was the state of the report at the time that we sent it.

Q. Yes.

A. As I said we'd been asked to stop work at that time so it was as it was.

Q. Were you actually asked to stop in the sense that your engagement was terminated or were you simply asked to suspend work in the meantime?

A. I couldn't tell you either way. I'd assume stop.

Q. You see I notice that you say on I think it's the 15th of February you had a conversation with Mr Banks. Do you recall referring to that?

A. Yes I do.

Q. You say in that that you didn't render a fee note in relation to that conversation. If you had rendered one where would you have sent it?

A. I think that's precisely the point. We wouldn't have had anywhere to send it to because we had no client as it were at that point.

Q. So in that sense are you saying that on that date you told Mr Banks that you were no longer engaged in relation to the Canterbury Regional Council or the building?

A. I'm not sure if I said that but that certainly would have been my understanding.

Q. The reality is that at no point in time is there any record of your telling, you or your firm telling Alan Reay Consultants Limited that you were no longer engaged or retained in this matter. Do you agree?

A. I would have to, yes.

Q. Yes. In that sense Mr Banks was aware on the 15th of February or thereabouts that your work had included identifying remedial measures and the first stage of the design of those remedial measures. Do you agree?

A. Not necessarily. I can't talk for his understanding though of what we thought the situation was.

Q. Well you can't either point to telling Mr Banks or Alan Reay Consultants Limited that your work on remedial measures was suspended and would not be continued. You didn't do that did you?

A. I don't think I would have felt we needed to as we'd had the acknowledgement that the problem had been accepted, if you were, by ARC and having been told to stop work we thought that was the end of it from our perspective.

Q. So are you saying that just because the engineer knew about it, that is to say the engineer responsible for the design of the building knew about it that your understanding was you had no ongoing responsibility from that point?

A. The latter part is correct. I think on the former part the letter we'd had basically, to us anyway, appeared to acknowledge the problem and that to the extent that it was confirmed that it was a problem they would take it from there.

Q. But again you have no evidence of Alan Reay Consultants Limited agreeing to do that as opposed to saying that they were looking at it. Do you agree?

A. I think that would be a matter of interpretation of the letter but it certainly wasn't the way that I saw it at the time.

Q. At paragraph 10 of your brief you say that the calculations were approximate calculations done in accordance with your brief. Do you recall saying that?

A. Yes.

Q. Are you saying that your brief was that you need only do approximate calculations?

A. That was my understanding, yes.

Q. And why would that lesser standard of calculation be done as you understand it?

A. Because as I understood at the time we'd been given a relatively short time to have a general look at the building and I wouldn't say it was an instruction but we could not possibly have sat down and re-analysed it. It was in the nature of a pre-purchase review not a full peer review that we were doing.

Q. It, you've referred frequently to the matter of time but you have not at any stage indicated what the time period was that you were specifically given. What was it?

A. I do not recall.

Q. On the 31st of January when you sent the draft report to Buddle Findlay and to Schulz Knight Consultants and presumably to the Canterbury Regional Council do you agree that neither your covering letter nor the document indicated that you needed more time or were asking for more time?

A. No because at that stage we'd been told to stop and send through the report as it was. So it was, it was academic.

Q. But there's no reference to that in the report or the accompanying letter is there?

A. No there's not.

Q. The letter on its face simply says, "Here is the draft report," which might reasonably be taken to mean the report which we were asked to provide when we were instructed.

A. Well in the sense that we were supplying it to Robin Schulz who had asked us to stop work and send what we had. I guess we didn't see the need to take that reference any further.

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Q. So you're now saying that there was a specific communication from Robin Schulz to stop or suspend work and to submit the report?

A. I believe so, that was a phone call which I didn't take. It was relayed to me.

Q. So that's your understanding of what may have been said to somebody else?

A. Yes.

Q. Now again I say, in the report there's nothing to indicate that it's, in the report itself that it is interim or incomplete in any way. Do you agree?

A. I agree.

Q. And to the contrary do you accept that it makes clear positive statements in respect of compliance except in respect of a single issue you identified?

A. I agree that's a statement but again it was because it was passed over as it was as opposed to with intent to being a draft as such.

Q. You indicated when you were giving evidence this morning that you were not aware of any option to purchase or any arrangement of that kind held by the Canterbury Regional Council?

A. No I was not.

Q. So in fact at the point in time that the report went on the 31st of January, for all you knew it was actually going to be used and relied on in proceeding with the purchase. Do you agree?

A. No, because it was our understanding it was incomplete. We'd been - because we'd been told to stop work on it and therefore we assumed that that was, the sale wouldn't be going ahead, or the purchase wouldn't be going ahead sorry.

Q. But to the contrary it's apparent from the Wynn Williams letter that you were taken to this morning that in fact as late as 9 February the

Canterbury Regional Council had not yet decided which building to purchase. Do you agree?

A. I agree but we didn't see that letter until recently.

Q. So on the face of the structural report, I'll put it to you again that was a structural report which for all you knew could be going forward to the Canterbury Regional Council for possible use in a purchase or a negotiation for a purchase?

A. No that was not our understanding because we'd been told to stop work as I said.

Q. Well can we take the "our" out of it and just make it "you"? You're saying that was not your understanding?

A. Yes.

Q. And who told you that?

A. Grant Wilkinson.

Q. Now in – if we could have Mr Hare's brief at 1.38. This is part of your calculations and is a summary of your calculations which was set out in your brief of evidence, you recall that?

A. Mhm.

Q. Do you agree that the calculations assessment which you're summarising there did not include calculations in relation to the columns of the building?

A. I agree.

Q. And so on what was the basis for your assessment of compliance in relation to the columns?

A. I couldn't tell you if at the stage the report was issued I'd even looked at the columns, I don't recall that.

Q. In the sense of not looking at the columns, you would have looked at the plans, the Alan Reay Consultants Limited calculations and the columns as constructed on site. You agree?

A. I agree I may have them.

Q. Well let's take it one by one, you say in your – you wrote the report I take it?

A. I did yes.

Q. And you say in the report that you had looked at the building on site on four of the six levels. Do you agree?

A. Yes.

Q. So you must at that stage have looked at the columns?

A. Well I had physically seen the columns. That's not quite the same as looking at the design in detail.

Q. But I was coming to that, but surely the purpose of your inspecting the building was to actually do more than appreciate its aesthetic beauty and actually have a look at what the engineering issues were as found on site?

A. Yes and I could say as found on site I didn't see anything to make me suspicious of the columns but as I say, I can't tell you if I'd reviewed the design in detail.

Q. Now you separately say in the report that you accessed the plans and the calculations of Alan Reay Consultants Limited?

A. Yes.

Q. And on the face of that therefore you did look at those as part of your exercise of forming the views in the report?

A. Yes but I can't tell you exactly what I'd seen while I was there.

Q. The report as you wrote it, does that actually contain input review or content from any other person at Holmes Consulting Group?

A. Probably not.

Q. Now if we can have 1.47 please. Now this is your note of your discussion with Mr Bluck, you see that?

A. Yes.

Q. And alongside his name you've written 2.15?

A. Yes.

Q. Does that suggest that you may in fact have called on Mr Bluck rather than phoned him?

A. I believe I did yes.

Q. Visit him?

A. Yes.

Q. Can you recall how long your visit to Mr Bluck was?

A. No I can't.

Q. And was the purpose of visiting Mr Bluck to identify what knowledge the Council had in relation to the state of the building and its code compliance?

A. Yes it was.

Q. And did Mr Bluck know the building you were talking about?

A. Well I presume he knew of it because we had a discussion of aspects of it.

Q. Do I take it that the three matters in your note are three matters that Mr Bluck identified to you, as matters you should look at?

A. I can't tell you that in detail. They were matters we discussed. I can't tell you how they were raised.

Q. The first relates to the possibility that an easement may or may not have been created. Is that correct?

A. Yes.

Q. And the second relates to issues in respect of the quality of construction of the fire escape?

A. Yes.

Q. Do you recall identifying that as an issue when you visited the building?

A. I believe that's something that Mr Bluck raised with me. I don't recall specifically looking at it when I went to site, I may have done.

JUSTICE COOPER:

Q. What's the first word there, is that “dubious”?

A. Dubious, yes.

CROSS-EXAMINATION CONTINUES: MR RENNIE

Q. And in fact, and the last statement which relates to, if I've got it correct a “terrible elevation, check vehicle clearance”, do you see that?

A. Yes.

Q. And what does that mean to you?

A. Well again I'm trying to recall, I think that was obviously Mr Bluck’s words, not mine, but he was referring I think to something around the

vehicle entry that he didn't think would have worked very well, suggesting I have a look at it.

JUSTICE COOPER:

Q. I can't read the previous paragraph either. Is that, what's the – something very bad.

A. Some welding very bad in 10 years.

Q. In 10 years' time will have –

A. Will have construction faults. I apologise for my bad writing Sir.

CROSS-EXAMINATION CONTINUES: MR RENNIE

Q. So those being matters that Mr Bluck identified to you, do I take it that as none of them appear in your report two days later, you had satisfactorily resolved those issues in the meantime?

A. I presume I must have.

Q. And do you now recall how you resolved those issues?

A. I imagine they were things I had a look at while I was on site.

Q. Now can you recall the length of time you spent with Mr Bluck?

A. No I can't.

Q. And did Mr Bluck to your recollection have with him the Council files in respect to this building?

A. Not that I recall.

Q. Did you separately inspect the Council files in respect of this building?

A. No.

Q. Was there a reason for that?

A. Well again largely one of time constraints I imagine. We were trying to get around and see as much as we could in the short time that we were given.

Q. Well I don't wish to be difficult about it but if you've gone from your office to Mr Bluck's office to talk to him, can you explain the time constraint on having a look at the Council file on the way in or the way out?

A. Well in my experience it's usually not quite as straightforward as dropping by the desk to look at a Council file. It takes some time to

retrieve it, so I imagine if I went in there it was probably on the way to somewhere else I stopped, for the amount of time I had.

Q. But it looks from the 2.15 reference as if you made an actual arrangement to visit Mr Bluck. Do you agree?

A. Yes.

Q. So in essence you were relying on Mr Bluck's recollection of the building for information as to the Council's position on it?

A. Yes.

Q. And you knew Mr Bluck?

A. Yes.

Q. He was a precise and thorough person was he not?

A. I would think him that way, yes.

Q. Highly respected as an engineer?

A. Yes.

Q. You had confidence that what he told you would be all that there was to be known as to the Council's knowledge of any problems with the building?

A. Well that on top of it having been awarded a building permit and being constructed, yes.

1435

Q. Now, I know this is probably an impossible question to answer but a couple of days later you sent off your draft report as we have been discussing. Do you know whether you sent that and were then told not to take it further or was it the other way around?

A. To the extent I can remember, I think it was the other way round.

Q. So having sent off your draft report, what did you next expect to have to do in relation to this project?

A. I don't think I expected to have to do anything. We were waiting only for the price, the number back I guess on the ties.

Q. At some point in time you would have drawn up a fee note and sent it to either or both of the instructing consultants?

A. Ah, no that wasn't my responsibility.

Q. Well at some point in time I take it you would have marked the job off as complete so that that process could be done?

A. Well again the project director would have done that.

Q. So once you'd sent that off is it your position that the responsibility for the file moved to somebody other than yourself?

A. I am not sure I'd say the responsibility for the file move but I guess we would all have considered that the project was completed as far as we were concerned.

Q. But at some point in time – I presume that at some point in time Holmes Consulting Group sent a bill?

A. I would assume so yes.

Q. But you don't know when?

A. I don't know when.

Q. And you haven't seen that bill?

A. No I haven't.

Q. But you normally expect to send a narrated bill as to the work that was actually done and the outcome of it?

A. Yes but as I say I can't tell you what was done for this one.

Q. If you have a look at paragraph 62 of your brief you will see that you referred to work that you had still to do and you speak of calculations and design not being finalised. Do you recall that? Have a look at paragraph 62.

A. Yes.

Q. The reference to work still to be done relates to finalisation of the design work for the remedial matters, doesn't it?

A. Yes.

Q. It does not say that you had any work remaining to do on the report itself?

A. No I think it is more by way of saying that, to the extent that if, that remedial detail have been instructed, if we had been instructed to carry that out we would have had to do that.

Q. So in fact there is nothing in your evidence to indicate that any part of your draft report was incomplete or deferred, do you agree?

A. No. No the report was a draft report. It was – we stopped work at that time and sent it on as such, it was intended if you like a, I guess this is where we got to. It wasn't intended to have been signifying it was complete.

Q. The document itself is not marked as draft is it?

A. I realise that.

Q. So I put it to you again there is nothing still to be done in relation to the description of work in the report in the contents of the report itself. Do you agree?

A. No, as I say it was incomplete. It was sent through as it was before the report would have been finalised there would have been, there may have been elements and work leftover and it would have been checked and reviewed prior to being amended and going out.

Q. So are you saying that no person other than you reviewed or checked the draft report?

A. That's right. I have already said that, yes.

Q. Can you recall when you went to see Mr Bluck where his office was then located?

A. Oh, I don't remember precisely. On the third floor I think it was at the civic offices.

Q. And in relation to the building files I was asking you about, where were they located at that time, 1990, January?

A. I have no idea.

Q. Same floor I suggest?

A. Quite possibly I don't know.

CROSS-EXAMINATION: MR REID

Q. Mr Hare, from what you say do I take it that you had carried out a reasonably extensive review of the building prior to writing your report?

A. I wouldn't call it extensive, no.

Q. How complete do you say it was?

A. Oh, I didn't attempt to put a number on that at the time, I am not sure I could now. We were working through, progressing a lot of things and so when we got told to stop we stopped.

Q. What matters do you say were outstanding at the time you were told to stop?

A. Well certainly the report hadn't been reviewed. We were still in the process of determining I guess whether the – exactly what the situation was with the missing ties. I can't be –

Q. Sorry with the missing ties did you say?

A. Yes.

Q. So that is the north core issue you are talking about?

A. Yes.

Q. So exactly what the position was with the north core, ties were outstanding?

A. Yes I think as I said in the report it was, apparently it was missing and it was still in the process of being confirmed whether there was actually anything installed during construction.

Q. What other matters do you say were outstanding at the time you submitted the draft report?

A. Oh, sorry I don't remember but it hadn't been reviewed internally and so that, the very least would have happened before it went out.

Q. Yes, was that the principal matter that was outstanding?

A. No as I say I don't recall.

Q. But at the time that you wrote and submitted the draft report, by that stage at least you had reviewed the plans, correct?

A. To some degree, yes. We had a few plans. I had seen more in the Alan Reay office I couldn't tell you if I had seen all of them or not.

Q. In order to form the view that you did even in draft, surely you would have had to had a reasonably thorough review of the plans. Do you accept that?

A. Well, again as thorough as it could have been in the timeframe that we had to do it, it was always intended as a pre-purchase review not a full on peer review so.

Q. Yes but in order to form the view as you do on page 3 of the report that the layout and design of the building was quite simple and straightforward and generally complies with the current design codes and material codes, you would have needed to have carried out a review I suggest of the plans and calculations. Isn't that correct?

A. Within the limitations as noted above that, that we'd only be able to carry out a certain amount of review and I certainly hadn't gone through a line by line review of the calculations and nor could I have had in that timeframe.

Q. No, when you reviewed the plans though did you note the general approach to design was of that a gravity frame protected by a stiff, by stiff shear walls?

A. There were two independent systems one for the lateral load resistance and one for gravity, yes.

Q. And was that general approach to design, that of a gravity frame with stiff shear walls, was that a general approach that you were familiar with?

A. Yes.

Q. Had you encountered that approach before?

A. Yep.

Q. And that approach in itself didn't give rise to any concerns on your part?

A. Not as a matter of principle, no.

Q. There has been evidence, well have you had the opportunity to study the evidence concerning the non-compliances that have been identified with the building?

A. I have had limited opportunity, I have seen some of it but by no means all of it.

Q. But you aware in general terms of the nature of the non-compliances that have been identified?

A. Some of them, yes.

Q. You are aware that there are alleged to be significant non-compliances with respect to the columns?

A. Yes.

Q. What sort of review do you think would have been necessary for you undertaking or to identify those non-compliances with the columns?

A. Well it is always easy to look at it a long time later knowing what the outcome was. I would personally feel that in order to get down to that level of detail you have to conduct a full detailed analysis of the building.

Q. Effectively a full peer review?

A. Yes.

Q. And you agree with me that whether the columns were able to be detailed as gravity or needed to be detailed as seismic was dependent on the outcome of the computer analysis that was undertaken at the time?

A. You would need a computer analysis or something of that order to be able to establish the drifts that might be imposed on the gravity structure, yes.

Q. So in order to carry out the kind of peer review that you are talking about, would it have been necessary to redo that computer analysis?

A. Most probably yes. You may have been able to look at, as I say, a line by line calculation and see all that but a full peer review would really require independent analysis I would think.

1445

CROSS-EXAMINATION: MR MILLS

Q. Just a couple of questions, just to pick up on a couple of things that have come out in the course of your evidence. The first one, I just want to ask you a further question about your paragraph 23, and so if you could just have that in front of you that'll make it easier for both of us.

WITNESS REFERRED TO BRIEF OF EVIDENCE

Q. You'll see that you say there that you attended the offices of ARC on 26 January 1990 and you say you recall seeing both Alan Reay and Geoff Banks at some stage during your visit. You believe you discussed or to put in your terminology, "I believe I discussed my concern in relation to floor diaphragms with either Alan Reay or Geoff Banks during my visit." I think you were aware then, were you not, that Geoff Banks

had not had any involvement with the original work on the CTV building back in '85/'86?

A. Yes definitely.

Q. Did you understand that Alan Reay had?

A. I probably assumed that to be the case. I did know that the original designer had left the company. I think I learned that on our visit.

Q. Yes. Now you were told, according to your evidence, in that discussion it was indicated there may have been some provision made for the issue that you had identified during construction and that inquiries would be made. It would be likely, wouldn't it, given that Mr Banks had had no involvement in the original design, Dr Reay at least had been there, that the source of that advice to you would've come from Dr Reay?

A. Look I don't recall exactly who I discussed that part of it with.

Q. You don't remember. Do you remember anything from that discussion about Dr Reay indicating any knowledge of that building?

A. Look no, I'm sorry I don't.

Q. You just can't remember?

A. No.

Q. All right. Paragraph 31 of your evidence, just a very small point on that. This is an inspection on site that you say you were engaged in on 30th of January where you met Mr Banks on site and you say there in the third to last line, "Apparently ARC had been unable to locate any documentation to confirm whether provision had been made for the floor diaphragm et cetera." It's just the reference to "apparently" that I'm trying to get a lit bit more clarity around. Did Mr Banks tell you that, as best as you recall?

A. Yeah, to the best of my recollection.

Q. Yes.

A. It may not have been then but I certainly had been made aware I think at some point they hadn't been able to find anything.

Q. But again you can't, it's just the way it's put here, it seems as though that must've been said on that date on that site visit, but I take it that you're not sure of that now?

A. Not at this time, no.

CROSS-EXAMINATION: MR ELLIOTT – NIL

RE-EXAMINATION: MR HANNAN

Q. Yes two small points, but first could we have please document BUI.MAD249.0005.19?

WITNESS REFERRED TO SLIDE

Q. And if we could just page through that so Mr Hare can look through it please? Now Mr Hare, for whatever reason it seems that not all of those pages were appended to your brief of evidence but can I invite you to tell the Commission whether those are the complete set of calculations and drawings you did with respect to the draft remedial work in relation to drag bars that you did?

A. The first four pages of that were, yes.

Q. Yes. And just thinking about the calculations that you did, or the review that you did when you did your initial assessment of the building, did you look at anything other than the seismic capacity of the building?

A. I didn't perform any calculations for anything other than that. So beyond that I can't remember exactly what I looked at in detail.

Q. Yes, it might be useful just for you to page through the relevant calculations and perhaps just tell the Commission what each page relates to. This would be HARE.0001.28. I'm sure the engineering Commissioners will fully understand this but it may be useful for some of us?

A. Well just –

Q. Very briefly each page?

A. The first page is simply a very approximate weigh up of the building and to establish what loads may have been used for seismic analysis.

Q. Next page?

A. Second page is a derivation of the seismic loads appropriate to the building and then a vertical distribution of those loads over the height of the building to use the detail with the more detailed analysis of walls and

the bottom of the page is a calculation, just a quick derivation of the coefficient you use for the diaphragm connection check.

Q. The next page?

A. This is just a very quick rough and ready check on the shear that was going through the small piece of diaphragm by the looks, connecting to the north wall. And just a calculation to decide if there was sufficient capacity there.

Q. Next page?

A. And this likewise looks to be a check of still a continuation of that.

Q. Next page?

A. A quick verification of the capacity of the shear walls as I saw them.

Q. And the next page is the same by the look of it?

A. Yep.

Q. So coming onto the page after that?

A. Same again.

Q. The next page?

A. This is basically the summation of the capacities of all the walls in overturning with a view to comparing that to the total demand on the building. So at that point I concluded it was, looked like it was close to being enough and then looking at the question of torsion on the walls to see if, to see how the, whether it would actually behave itself properly or could behave itself properly.

Q. Next page?

A. And this is where I came back and looked into the diaphragms. A little more concern about what was connecting the walls to the floors.

Q. So that's, there's that page, the next page .37 you've got your summary at .38, we've already looked at that?

A. Yep.

Q. We've got .39, again same topic?

A. Yes that was looking at the capacity of, even assuming that those walls were tied to the slab, whether that entire piece of slab could just peel off the side of the building.

Q. Yes, and then we've got .40 and .41 and here you seem to be looking at the roof?

A. Yes there was just a quick check of some of the, what was going on with the steel work at the roof, it looked quite flexible I think.

Q. So having done this work, having then been to visit Alan Reay Consultants and looked at the drawings that they had there, having spoken to Mr Bluck, you were then told to cease work, at that point you sent out the draft report, is that correct?

A. As it was at the time, yes.

QUESTIONS FROM COMMISSIONER FENWICK:

Q. The design approach of using shear walls limit deflections and using gravity loaded frame which were protected against excessive deformation?

A. Yes.

Q. That was fairly common in Christchurch?

A. I believe so, yes.

Q. Yes, and you would've had some experience in checking that or overseeing those buildings or at least being involved in the design of some of those buildings?

A. Yes.

Q. And to your knowledge those other buildings, it was fairly usual was it for the columns not to be closely confined?

A. Um, well it depends on how you look at that. My experience would be that they may be treated as gravity elements and therefore not required to have the full review of confinement, be treated as seismic elements but certainly after that how much steel went into them is the question.

Q. So it wouldn't have been unusual when you got to the CTV building to see these column lightly confined knowing that the shear walls would take the lateral load. Was that, that be the case, in your sort of experience of what else was going on in Christchurch?

A. It wouldn't be unusual that they wouldn't be designed specifically for seismic and therefore have for heavy confinement.

Q. Yes, okay. Thank you.

1455

QUESTIONS FROM COMMISSIONER CARTER – NIL

WITNESS EXCUSED

MR BIERRE:

I just have one supplementary piece of evidence that I'm going to adduce out of Mr Wilkinson Your Honour. That simply relates to his experience in the structural design profession before he qualified as an engineer in 1984. So I'll just ask him to give evidence about that at an appropriate point.

MR BIERRE CALLS

RONALD GRANT WILKINSON (AFFIRMED)

Q. Mr Wilkinson is your full name Ronald Grant Wilkinson?

A. That is correct.

Q. You live in Christchurch and you're the managing director of Ruamoko Solutions Limited an engineering firm?

A. That is correct.

Q. Mr Wilkinson could I just get you to commence reading your brief please from paragraph 2.

A. Okay. I am a Fellow of the Institute of Professional Engineers of New Zealand and a Chartered Professional Engineer. I am a member of the New Zealand Society for Earthquake Engineering, the Canterbury Structural Group and the Timber Design Society.

I have a Bachelor of Engineering (Hons) (Civil) from the University of Canterbury and I have worked as a consulting structural engineer since 1984.

Q. If you just pause there Mr Wilkinson. Could you just tell the Commissioners please about your experience in the structural design professions prior to qualifying as an engineer in 1984.

A. In 1973 I joined Arthur Tyndall, structural, consulting structural engineer in Christchurch as a structural draftsman and I continued to work for him and then in late, from the late 1970s to 1982 I had a contract drafting business called Wilhart Drafting. My partners were consulting engineers Arthur Tyndall and Noel Hanham. From 1981 to 1983 I was at the University of Canterbury to complete a Bachelor of Engineering and 1984 I joined Holmes Consulting Group.

Q. Thank you Mr Wilkinson. Would you just resume reading your brief please from paragraph 4.

A. Between 1984 and 1987 I was a structural engineer with Holmes Wood Poole and Johnstone Limited in both Christchurch and Auckland. This is a predecessor firm of Holmes Consulting Group (Holmes).

From 1987 to 2004 I was a director of Holmes and the manager of the Christchurch office from approximately 1992 to 2004. From 2005 to

2006 I was a project director for Holmes in Christchurch and in July 2006 I established a consulting engineering firm in Christchurch, Ruamoko Solutions Limited.

Now in referring to the 1990 Holmes Report on the CTV Building. In January 1990 Holmes was engaged by Buddle Findlay and Schulz Knight Consultants to prepare a structural report on the office development located at 249 Madras Street, subsequently known as the CTV building. The engagement was on behalf of a potential purchase of the building, the Canterbury Regional Council (CRC).

The terms of the engagement required Holmes to carry out a general structural assessment of the building and to provide a structural report. This was part of the due diligence that CRC was carrying out.

I was the project director for this assignment and the preparation of the structural calculations and report was done by Holmes' structural engineer John Hare who reported to me at that time. My involvement was primarily to review Mr Hare's assessment and report.

The Holmes report is incomplete insofar as it doesn't state the author or the reviewer. It is unsigned and it doesn't contain the limitation clause that was standard for all final Holmes reports at that time.

Section 3 of the report records that the review was limited to a brief inspection of the building and documents and approximate calculations. The inspection and calculations were undertaken/prepared by Mr Hare. Physical inspection was limited to areas that were readily accessible. Section 4 of that report summarises the investigations undertaken. John Hare reviewed a complete set of structural drawings and other related documentation at the offices of Alan Reay Consultants (ARC). The original design engineer for the building had left ARC and John Hare met instead with Mr Geoff Banks to discuss the building design. John also discussed building permit and construction issues with Mr Bryan Bluck, the building control engineer at Christchurch City Council.

Mr Hare identified an area of serious concern with the connections of the structural floor diaphragm to the shear walls at the north face of the

building. The problem was identified from the drawings by Mr Hare and he reported it to me. I agreed with his assessment.

The structural drawings showed that the connections of the floors to the walls at the north face of the building were tenuous. Both John and I were concerned that in the event of an earthquake the building would effectively separate from the shear walls well before the shear walls themselves could reach their full design strength.

There was a professional obligation under our code of ethics to notify ARC when reviewing their work that we'd identified an area of serious non-compliance with the design codes. Mr Banks at ARC was alerted to this issue (see paragraph 3, item 3 and 6.3 of the report).

Holmes provided a work-to-date copy of the report to Schulz Knight on 31st of January 1990. We got instructions to consider in a preliminary way the estimated cost to remedy the lack of adequate connections between the walls and shear walls.

John Hare did some calculations and sketches for remedial ties for the purpose of establishing a budget cost for remediation work so that the client could have a rough estimate of cost of that work. Mr Hare's sketch allowed for the insertion of a steel connecting angle at both of the affected walls at levels 2 to 6 in the building, a total of 10 angle ties. Mr Hare's sketches were not intended to be for construction.

On the 1st of February 1990 I sent a file note to Kerry Mason at Warren and Mahoney, CRC's architect. I reported that Martin Charles, a quantity surveyor with Russell Drysdale & Thomas advised that the cost to carry out the remedial structural work would be approximately $14,000 plus GST. (I had provided a scope of work to Mr Charles. My file note refers). I asked if Kerry Mason needed anything else from us on this job. I don't recall his answer, if he gave one.

My recollection is that Holmes' engagement was terminated after sending the memo to Kerry Mason at Warren & Mahoney.

On the 2nd of February 1990 Geoff Banks at ARC and I discussed the serious issue that Holmes had found. I can't be absolutely sure, but I think my discussion with Mr Banks followed the instruction from one of

CRC's agents that Holmes were to proceed no further with the due diligence assessment and report.

The discussion with Mr Banks is referred to in a letter he wrote to me, dated 2nd of February 1990. I note that the letter is stamped as being received in the Holmes office on the 7th of February 1990 but the facsimile cover sheet that refers to that letter is dated the 2nd of February 1990. I have no explanation for the difference in those dates except that the letter and accompanying sketch may have been posed and received after the facsimile was sent.

Mr Banks' letter and sketch confirmed the two shear wall lines that Holmes had identified as having possible non-complying connections to the floor diaphragm, the floor levels affected by that non-compliance, and that the remedial work, if required, would consist of two ties per floor level, the maximum load per tie, and it made reference to the relevant loading standard, NZS 4203:1984.

I don't recall the specific details of the conversation that I had with Mr Banks on the morning of the 2nd of February 1990 but the letter asked that I contact ARC if my understanding was different from what was outlined in the letter. I don't believe I replied to that 2nd of February letter. I would have seen no need to reply because it was clear from the letter that Mr Banks understood the serious issue Holmes had identified.

Once I've advised a fellow professional engineer of a serious issue of non-compliance, as the building designer I consider that it is their professional obligation to take out any and all actions necessary to check that issue thoroughly and action any remedial works that may be necessary.

I heard nothing further from Mr Banks.

1505

CROSS-EXAMINATION: MR HANNAN – NIL

CROSS-EXAMINATION: MS SMITH

Q. Mr Wilkinson just to be clear, the discussion that you had with Mr Banks on the 2nd of February, the only issue that you discussed with him was the non-compliance on lines D and DE is that correct?

A. I can't recall the specifics of the discussion, but judging by the letter that Mr Banks wrote to me, that was the prime issue that we discussed.

Q. Well the only thing that he refers to in the letter of the 2nd of February to you is that correct?

A. That is correct.

Q. And so, and that letter asks you to contact him if your understanding of that was incorrect in any way?

A. Correct.

Q. And you didn't do that did you?

A. No I didn't.

Q. So if there had been anything else that you had discussed with him on the 2nd of February that wasn't addressed in this letter you would have then made contact with him to clarify that would you?

A. I would have.

Q. Now you've said and pointed out quite correctly that the letter refers to the relevant standard NZS4203 and the letter makes particular reference does it not to the Parts and Portions aspect of that standard?

A. Correct.

Q. And there is a specific reference to the load being reduced on the lower floors in accordance with that standard, is that correct?

A. That is correct.

Q. And again if that was not your understanding of how that might operate again you would have contacted Mr Banks to clarify that would you not?

A. Yes I mean it's clear in the standard as to how you derive those loads and I would have, would have expected Mr Banks to have derived the loads himself to that standard.

CROSS-EXAMINATION: MR RENNIE

Q. Mr Wilkinson in relation to your paragraph 19 it may assist you to know that the 2nd of February 1990 was a Friday?

A. Yes.

Q. It may assist you to recall that that year was the 150th anniversary of the foundation of New Zealand?

A. I wasn't aware of that thank you.

Q. And that the 6th of February was Waitangi Day?

A. It would be yes.

Q. So does that now suggest to you that whatever happened on the 2nd of February it was not until the 7th of February that your firm really turned attention to the letter to which you refer?

A. No this wouldn't be correct. The letter came with a, came with a facsimile cover sheet on the 2nd of Feb- on the 2nd of, of February.

Q. So is it your view that it would have been actioned on the 2nd even though on the 7th it was received clearly by mail and allocated separately?

A. Yes, I would, I would expect that the letter would have been received by facsimile on the 2nd of February and with an expectation from Mr Banks that there would be enough time for me to respond if I felt, felt the need to respond that afternoon.

Q. Now separately if I understand your paragraph 17 it was on the 1st or 2nd of February that Warren and Mahoney through Kerry Mason terminated your firm's engagement?

A. That's what it says. I, I can't be absolutely sure whether it was Kerry Mason that terminated the, that, our engagement but I did ask him the question whether there was anything else that he required of us at that point.

Q. So do we now have the sequence 31 January the draft report is sent, 1 or 2 February Warren Mahoney terminate your engagement, 2 February you have an exchange with Mr Banks about the matter?

A. Correct.

Q. Thank you. In paragraph 12 you refer to the structural drawings and you say that both Mr Hare and you were concerned about certain matters. Are we to take it from that that you also looked at the structural drawings?

A. No I hadn't.

Q. So it was your concern simply a reflection of applying your opinion to what Mr Hare reported?

A. Correct.

CROSS-EXAMINATION: MR REID – NIL

CROSS-EXAMINATION: MR MILLS

Q. Mr Wilkinson I just wanted to ask you a few questions about this issue of the ethical obligations of engineers under the IPENZ rules and your understanding of them and also your view of them personally. This is a matter that is of some interest and concern to the Commission I think. Now you say don't you that as far as you're concerned the first obligation that you had was to notify the original designer of the building, in this case Alan Reay Consultants of the structural defect that you'd found in the building?

A. Yes that is the obligation on the code of ethics.

Q. Yes. And your position is that once that's done that the obligations associated with this knowledge of this significant structural weakness that had been identified by Holmes Consulting Group passed to Alan Reay's firm?

A. That is correct as long as there's an acknowledgement that the, that the original designer acknowledges an issue and takes it up.

Q. Yes.

A. If he was, if he didn't acknowledge the issue then the, then the code of ethics requires that we take further action.

Q. And when you say that the original designer must acknowledge this, is there any particular form that acknowledgement needs to take?

A. It's certainly not written in the code of ethics.

Q. Mhm.

A. Any particular form.

Q. Yes.

A. I guess that it would come down to my confidence in knowing that the issue was understood and having a confidence that the original designer would take it forward to resolve it.

Q. Yes, so there's clearly no formal acknowledgement required because that didn't happen here, did it? There's nothing formally saying, “Yes we understand this issue that you’ve identified and we’ll fix it”?

A. No there was an acknowledgement, on the 2nd of February in response to the discussion that I had or Geoff Banks had with, with me. Mr Banks acknowledged that there was an issue or a possible –

Q. Yes.

A. – issue.

Q. Yes.

A. And I had confidence in Geoff Banks. I knew him well having worked with him on several projects.

Q. Yes so there's two limbs to it aren't there?

A. There are.

Q. One is an acknowledgement that the problem is recognised and that as you say was in writing in correspondence, but the second aspect of this ethical obligation which is an acknowledgement that the original designer will fix the problem. That wasn't done formally. That was really your judgment about how Mr Banks would be likely to deal with this based on your knowledge of him. Have I got that right?

A. Yes, yes.

Q. Now did you ever think that it was relevant that this attention that was being given to this issues both by your firm and by Alan Reay’s firm and the urgency around it was as I understand it really associated with the fact that there was an option to purchase and there was a concern that this issue be dealt with in a way that wouldn't jeopardise that sale?

A. No it didn't occur to be that at all.

Q. Right. Now what happened here you wouldn't have known it at the time I expect but you may know it now. If, if you don’t I’ll tell you, is that after this information that you had identified about the building was put into

the hands of Alan Reay's firm then one of the things that they did was to advise their insurer. Were you aware that, of that at the time?

A. I'm aware of it from the evidence yes.

Q. You've only been aware of it from the evidence in this hearing.

A. Only aware of it from the evidence.

Q. Now there's some indication in that in correspondence with the broker and the insurance company and the association of which I take it a lot of you structural engineers are members that there might have initially been the view that this information shouldn't be disclosed. What would your, let me put that differently. Do you recognise that when the design engineer that you've passed over this responsibility to, might be concerned about claims and that the issue then has to be run through their insurers that that might raise issues about whether, and to what extent the insured original designer might disclose the defect that you've identified?

A. I don't know whether I can answer that directly but in the letter of the 2nd of February from Mr Banks to me, I didn't – it was not unexpected to see that he didn't acknowledge the problem outright but talked about a possible issue.

1515

Q. Yes.

A. And that is the terminology that engineers would use if they're dealing with their insurer.

Q. Yes, and that language would be, presumably so that there wasn't a document that might end up or you didn't want it to end up admitting there was a problem?

A. That's right.

Q. Yes. Now you refer in your evidence to Mr Banks being alerted to this issue. I'm just interested to know whose obligation you thought this had become. Had you placed this obligation by conveying the information about the structural problem, had you placed it on Mr Banks, or had you placed it on Dr Reay, or had you placed it on his company, or was it on all three. Who did you think you'd passed the obligation to?

A. Well given that I knew Mr Banks pretty well and worked as colleagues, and I'd supervised a job that – a multi-storey job that he'd designed for Auckland and I'd employed him in his capacity in Cambridge Consultants, to do work for me on a project or for Holmes Consulting Group. I knew him well, I held him in high regard and I trusted him, so in telling, in discussing it with Geoff Banks I saw that I was confident that the issue would be dealt with and it was.

Q. Yes, and in terms of the way the IPENZ rules worked at that time, is it Mr Banks then that you regarded as being under that ethical obligation or was it Alan Reay Consultants, Dr Reay or was it Mr Banks that had now in your view assumed that IPENZ obligation? I'm just interested to know how this works at least as far as you're concerned. I'm not trying to pin anyone, I'm just interested to know your view of how this all works.

A. Well I see the ethical obligation would apply to ARC, Alan Reay Consultants, and also in discussing it with a fellow in those days, registered engineer, who is signed into the same code of ethics that I've signed into, I would expect that the issue would have been resolved by the senior person I was speaking to and if it couldn't be resolved that way then there'd be at least some kind of a signal to me back that I should then, it would then trigger a further response from me than trying to deal with the issue.

Q. I see. Okay so you'd expect Mr Banks to flag to you if there was a problem with the firm being prepared to deal with this?

A. If he was being pushed back and pushed back by others in the firm, then I'd expect I'd get some kind of a signal back.

Q. Yes. Now are you aware that – now let me take this in stages, did you regard that obligation that you had passed on to Mr Banks as one that required this issue to be dealt with expeditiously?

A. It's an issue of non-compliance. It's an issue of not complying with the code at the time. The building in these – terminology these days but not be 100% new building strength.

Q. Yes.

A. It wasn't an issue in relation to danger as in we were nowhere near a situation where the building could be regarded legally as dangerous in terms of the provisions of the, in those days it was referred as earthquake prone but in terms of the legislation at that time that was at a –

JUSTICE COOPER:

Q. Well that's not quite right. It was – the legislation distinguished between dangerous and earthquake prone buildings so bear that in mind. Buildings which were dangerous because they're about to fall over and –

A. That's right.

Q. - there were buildings that were earthquake prone because they might pose a risk in a moderate earthquake, so –

A. I think at that time –

1520

Q. Yes.

A. – the legislation was such that the terminology was earthquake risk and then it became earthquake prone was the new terminology in the 1991 Building Act. But in 1990 just before the Act came in I think the term at the time was earthquake risk.

Q. Well, I don't intend to debate with you about the law but anyway you are saying, you were using expression dangerous –

A. Yes.

Q. I just wanted to make sure you remembered that a dangerous building is one which is about to fall over?

A. Yes.

Q. Susceptibility to earthquakes is a separate issue now and then?

A. Yes.

CROSS-EXAMINATION CONTINUES: MR MILLS

Q. Well I don't imagine, I hadn't imagined I'd have to remind you of the language of the report. Perhaps I do, so let me just remind you of what

A. Yes.

Q. Now, does that not sit rather uncomfortably alongside the terminology you just used in saying that you didn't regard this as something that might, I can't remember quite how you put it, but suddenly fall over or however it was that you put that?

A. Yeah I mean there is was a big difference, there was a big difference at that time in 1990 for a building to be, considered to be earthquake prone. The load level was only about 10% code so we are not talking about – this building had strength well and truly beyond that even with the defect associated with the lack of tie, the diaphragms to the walls.

Q. So you regarded the issue of the technical definition of an earthquake prone building really giving you a level of comfort despite the fact that Mr Hare had said that in an earthquake this building could collapse?

A. In 100% code earthquake that is correct.

Q. Well he didn't say that he just said in the event of an earthquake?

A. Oh, I think he was meaning the earthquake that we designed the building for, that design a building for at that time.

Q. Well we didn't ask him this and I suppose what I am interested in is how you interpreted it, but are you saying that you looked at this, interpreted it that way and because of that you were not feeling any great obligation on Mr Banks to deal with this, with any sense of urgency? As I say I am interested in this not to put you on the spot but because how is it, now you were a director of Holmes, a major and important firm?

A. Yes.

Q. So how you were interpreting the IPENZ obligations is of interest?

A. Yes, yep. I think the context of earthquake prone. Can I just expand a little bit?

Q. Yes, please?

A. I mean here we have a situation where, in our built community we have a whole range of buildings with a whole range of different strengths and back in 1990 those buildings that were – so weak as to be earthquake prone as in only have one-tenth of the strength of an equivalent new building were then subject to Council policies to actually – to then come in and do some strengthening work over a long period of time.

Q. Yes?

A. So in the context of that, this being a brand new building with a defect, yes a serious defect, but it didn't actually put it anywhere close to that level of action where what we are – if you like the property community in New Zealand was coping with buildings that are dreadfully weak and giving them decades to actually get on and deal with the problem. So in the context of that there was not a situation of having to do something immediately. I was judging against that because that is only, the only sort of yard, one of the yardsticks we have in our industry.

Q. Would you apply or consider appropriate to apply to what is described here as a critical structural weakness in this building that had been identified?

A. Yes, the lack of the ties was definitely a critical structural weakness.

Q. And do I take it from what you have just said by referencing the length of time that the earthquake prone policies of the day allowed that buildings to be brought up to the minimum required standard that you would have felt that this obligation that you had passed across to Mr Banks, that that would have been satisfied by dealing with this over a similar timeframe?

A. No I'd say I would expected that it would be dealt with in a timely manner, but not urgently, not necessarily urgent.

Q. So when I tell you and you may well be aware of this, that it is not until about 20 months later and only as a result of being alarmed by a report in the press that the building had been sold that attention appears to have been given to this issue again by Mr Banks, that wouldn't cause you any concern?

A. No that's, I mean that in terms of rectifying, retrofitting buildings is moderately short in terms of a timeframe.

Q. And at the point of which this really appears to have got moving again, it was close to completed fit-out and there had been workmen working in that building doing the fit-out for some period of time with this critical structural weakness in it. Again that doesn't in your view in any way fail to comply with the obligations under the IPENZ ethical obligations to get these issues dealt with?

A. As long as the work – as long as the work was to be done in a timely manner and you know, I mean in this particular case I think in the context of these sorts of issue or raising an issue with a designer to have it acknowledged within a few days of when the issue was raised is great and to have the issue dealt with properly and closed out before the building was fully occupied is good as well.

Q. And the fact that it turned out at least in the approach that Mr Banks took to this, that it was a relatively quick and simple exercise to put these drag bars in. Does that have any bearing on your thinking about the timeliness in which this obligation can be expected to be met?

A. Yes, it was, you know, it was relatively straightforward to put in place a remedial detail.

Q. Yes, you don't think that that creates an obligation to do this much more expeditiously than 20 months later?

A. No I am comfortable with that timeline, that that issue was being dealt with, the issue was dealt with before the building was reoccupied or occupied for the first time.

Q. Permanently reoccupied?

A. Yes permanently occupied.

Q. Well that's interesting, thank you.

CROSS-EXAMINATION: MR ELLIOTT

Q. Just one question Your Honour thank you. Mr Wilkinson, if I was to invite the Royal Commission to make a recommendation that the law should provide or require an engineer who reviews a building and identifies an area of non-compliance with the current building code to

notify the territorial authority forthwith, can you suggest any reason why the Commission should not make that sort of recommendation?

A. Ah, I think it would be really great, that their recommendation is made although on a pragmatic basis in dealing with the many, many thousands of buildings in Christchurch currently that process is going on, but the load level at which the threshold is set is much lower than 100% NBS, or new building strength, as it is set at 33% new building strength.

JUSTICE COOPER:

No the question was about non-compliance with the building code.

CROSS-EXAMINATION CONTINUES: MR ELLIOTT

Q. So like this situation here, just – this report identified a vital area of non-compliance with current codes?

A. Right.

Q. My point is, if there was a law requiring an engineer to notify the territorial authority?

A. Right.

Q. If they become aware of that, is there any reason why you say that law should not be made?

A. No that would be great if that law was made.

CROSS-EXAMINATION: MR BIERRE – NIL

QUESTIONS FROM COMMISSIONER FENWICK – NIL

QUESTIONS FROM COMMISSIONER CARTER – NIL

QUESTIONS FROM JUSTICE COOPER:

Q. I don't suppose you remember the fee arrangement that was made when this job was commissioned?

A. I am sorry?

Q. I am sorry, I said I don't suppose you remember the fee arrangements when this job as commissioned by Buddle Finlay and Schulz Knight?

A. No not directly.

Q. Well would something like this have generally been done for a set fee or simply on an hourly rate?

A. Sometimes or most times it would be done for a set fee and that fee would be based on an estimate of time input.

Q. And so in carrying out a task such as this as a pre-purchase or what might be pre-purchase report, can I assume that you'd want to be thorough in the sense of picking up any significant structural issues?

A. Yes, the – one of the objectives is to try and pick up any gross errors, gross errors in the structural design and as Mr Hare said you know the process was to use approximate calculations there was no way would could repeat the full process of a peer review of the full process of design. So it was intended to actually pick up approximate, any gross errors and the quantum of work would be – I can't really tell you what the fee might be but I mean we would have allowed, for a project like that as a project director I would have normally allowed, probably about 30 hours of senior engineering time and probably about four hours of my time and set in place in providing support and reviewing the final report for signed off.

Q. Yes, so your input would come at the end once there was a final report?

A. Yes, absolutely, absolutely and in contrast that to the inputs for a full design.

Q. Yes?

A. Well you probably seen timesheets and so on or records of time but it would be, I am guessing that an engineer might spend between 300 and 600 hours on a job like this for the full process so our involvement was 30 hours. So by the very nature of that we can only look for the worst of the non-compliances, remembering of course that this particular building was brand new. So we were going in to it expecting that, you know, it should comply and we are trying to look and see whether we could find any areas where there were obvious problems.

Q. Were you surprised at the problem you found?

A. Sorry beg your pardon?

Q. Were you surprised at the problem you found?

A. Yes, yes, I was. It's fairly fundamental that, well it is absolutely fundamental that there is a load path between the floors which have all the mass of the building and the supporting walls. If there is no connection there then it is just a – it is a missing link in the chain and yes it is tenuous and can lead to what was described in the report as potential for failure.

QUESTIONS ARISING: ALL COUNSEL – NIL

HEARING ADJOURNS: 3.33 PM

HEARING RESUMES: 3.49 PM

MR HANNAN CALLS

TREVOR WILLIAM ROBERTSON (SWORN)

Q. Mr Robertson, your name is Trevor William Robertson and you're a senior principal engineer with Sinclair Knight Merz?

A. I am.

Q. Would you please read your brief of evidence from paragraph 2?

A. I hold the position of senior principal of Sinclair Knight Merz (SKM) working in the role of principal structural engineer for New Zealand. I have previously been, at various times, structural section manager and buildings operation centre manager, both with SKM New Zealand. However, I have recently elected to concentrate my career on the technical side of engineering and move away from line management.

I hold a Bachelor of Engineering (Civil) with Honours.

I am a chartered professional engineer (CPEng) and registered as an international professional engineer.

I am a fellow of IPENZ and a member of the Association of Consulting Engineers.

I am also a member of the New Zealand Structural Engineering Society, otherwise known as SECOC, the New Zealand Society for Earthquake Engineering, the Timber Design Society, and the New Zealand Cement & Concrete Association.

Earlier in my career I founded the Auckland Structural Group and through this was also on the founding committee of SESOC for which I previously served on the management and executive committees for about a decade. I was president for three years and have recently been made a life member.

I have forty years' experience as a structural engineer with projects ranging through multi-storey buildings, major stadiums and major industrial installations. This work has involved all the usual engineering materials including concrete, timber and steel. Throughout my career I have always maintained a strong interest in earthquake engineering and I've been involved in a number of significant building strengthening projects.

Twice I have been appointed by IPENZ as a member of an Ethical Complaints Investigating Committee. The first of these was in or about the early to mid-1990s, the second being in this current year. This involvement reinforces that I'm fully aware of the IPENZ code of ethics and I have been throughout my career, including the time relevant to the present proceedings.

I confirm that I have read the New Zealand High Court Code of Conduct for Expert Witnesses and that my evidence complies with the code of conduct requirements.

I have had no prior involvement with the CTV building nor any other Christchurch building prior to the earthquake sequence.

Scope of evidence.

I have been instructed by DLA Phillips Fox on behalf of Holmes Consulting Group Limited to provide independent expert evidence on issues relevant to the ethical conduct and reporting obligations owed by engineers. In particular I have been asked to comment on the following:

(1) The ethical conduct and reporting obligations owed by engineers when undertaking a routine review of a building for a prospective purchaser, as at 1990.

(2) Whether having discovered an area of possible non-compliance with the code of the day, a reviewing engineer acted reasonably in reporting the matter to the original designer.

(3) Whether, in light of the reviewing engineer being satisfied that the original designer had accepted responsibility and intended to take the necessary steps to remedy the issue, it owed any additional ethical conduct or reporting obligation to report a possible non-compliance with the design codes of the day to any additional third party.

Q. Now I'll just pause you there.

MR HANNAN:

Your Honour I wonder we might take paragraph 13 as read?

JUSTICE COOPER:

Seems like a good idea to me.

EXAMINATION CONTINUES: MR HANNAN

Q. Yes, so if you'll continue reading please at paragraph 14?

WITNESS CONTINUES READING BRIEF OF EVIDENCE FROM PARAGRAPH 14

A. I'm asked to comment on the ethical conduct and reporting obligations owed by engineers when undertaking a routine review of a building for a prospective purchaser as at 1990.

The ethical code under which professional engineers in New Zealand conduct themselves is the IPENZ Code of Ethics, as provided by IPENZ current to the time under consideration. The Code of Ethics applicable to members of IPENZ as at 1990 was the IPENZ Code of Ethics dated 5 July 1989. My evidence says as attached but I take it that –

1555

JUSTICE COOPER:

We have it.

EXAMINATION CONTINUES: MR HANNAN

A. The IPENZ code applicable as at 1990 states, "Each member shall so conduct themselves as to uphold the dignity, standing and reputation of the institution and of the profession." The code then sets out 17 sub-rules or sub-clauses in clarification as to how the underlying requirements can be achieved.

With respect to the conduct and reporting obligations owed by an engineer when undertaking a routine review of a building for a prospective purchaser as at 1990 it is sub-rule 8 that best defines the obligations. Some guidance on the interpretation of reporting obligations can also be obtained from sub-rule 9.

WITNESS REFERRED TO ENLARGEMENT OF DOCUMENT

In the normal course of events if an engineering review of an existing building finds nothing untoward other than normal maintenance issues and the review concludes that the building is compliant with the codes and rules applicable at the time it was designed, then the reviewing engineer should report to its client who engaged the engineer and to that client alone, unless directed by that client to distribute the findings to other parties. To do otherwise runs the risk of the engineer inadvertently disclosing matters that may be confidential to its client which would be in breach of sub-rule 11 of the IPENZ code.

When undertaking a routine review of a building it may be that the codes applicable at the time of design may have been superseded and hence the building may not comply with the codes current at the time of review. While the engineer would be prudent to draw its clients attention to this fact, there is no obligation on the engineer to report this information further as with the passage of time every building in New Zealand will in due course become out of date with respect of current design codes and this is the situation that society accepts. In the event that the engineer reviewing a building discovers or determines that there is a feature of

the design that appears to be non-compliant with the design codes under which it was designed and particularly where this non-compliance may be critical to or at least compromise the building's integrity the engineer must consider how the matter should be handled in relation to IPENZ code sub-rule 8 with particular reference to its responsibilities to the public interest.

In terms of the IPENZ code as applicable in 1990 the reviewing engineer would act properly in my opinion if he or she undertook the following steps:

(1) To discuss the matter with their superiors within their own employment (assuming that that hierarchy existed).

(2) To alert and report to their client as to the discovery of its implications.

JUSTICE COOPER:

Q. And its implication?

A. Sorry?

Q. And its applications.

A. And, and sorry, and its implications, correct.

EXAMINATION CONTINUES: MR HANNAN

A. (3) Advise the original designer if known and still in business of the discovery and the importance or implications. And implications.

(4) Be informed as to whether the designer accepts responsibility for attending to the matter.

Whether the reviewing engineer has any further obligations to report the matter differently or to other parties is very dependent on the outcome of the reporting just described.

The responsibility for the structural integrity of the building consistent with codes and development of engineering knowledge at the time of the design lies with the engineering designer. If that designer, on being alerted to a possible deficiency in its design, takes appropriate action, or confirms it is going to take appropriate action to address the deficiency,

then I believe that the review engineer has fulfilled his or her responsibilities to the public interest. The responsibility thereon rests entirely with the original design engineer.

For confirmation as to whether this is a reasonable interpretation of sub-rule 8 I turn to sub-rule 9.

WITNESS REFERRED TO ENLARGEMENT OF SUB-RULE 9

I turn to sub-rule 9 which gives guidance as to what steps a member should take where their advice is overruled or disregarded. The obligations set out in sub-rule 9 is to make the person overruling or neglecting that advice aware of the possible consequences of that action. Even in this circumstance the sub-rule does not indicate that the engineer should go further. That is not to say that I believe that that would be the end of such a matter. I believe that where the reviewing engineer's advice is overruled or disregarded by the original design engineer under that circumstance an engineer would consider advising an authority such an authority possibly being IPENZ itself.

However sub-rule 9 is not in my opinion applicable to the situation under review as it is apparent that the reviewing engineer in this instance had good cause to believe the original design engineer did treat the advice seriously and did intent to take action on it.

The relevance of sub-rule 9 is that it would be clearly not be a greater obligation on an engineer where its advice is accepted and where it is not. Thus, I believe, a reviewing engineer who advises the original design engineer of a potential deficiency and has good cause to understand that the design engineer does treat their advice seriously and does intend to take action on it, has acted reasonably within the Code of Ethics and does not carry a further reporting obligation.

The second question:

I am asked to comment on whether having discovered an area of possible non-compliance with the code of the day the reviewing engineer act reasonably in reporting the matter to the original designer.

I believe that HCG as the reviewing engineers could not properly carry out its commission to its client if it did not raise the matter with the original designer. It needed to do so in order to complete its review of the building.

In the first instance HCG was supplied with only limited structural drawings through Alun Wilkie Architects. From these limited drawings HCG was able to advance its investigation including calculations, sorry including calculations, a significant distance but it also determined that there seemed to be no information on the drawings available concerning the connection of the floor diaphragms to the structural walls.

Clearly to close out this apparent omission and indeed to carry out a proper review of the whole structure, HCG needed a comprehensive set of structural drawings and it appeared that these would be available only through the office of Alan Reay Consultants.

In that HCG had already detected a potential problem it was quite reasonable of them to raise this issue with the original designers as there was always the possibility that the omission had been closed out subsequent to the initial drawing issue and corrected by a variation to the construction contract. Indeed Alan Reay Consultants initially believed that this may have in fact happened.

It was quite apparent to HCG as verified by the 1990 documents I have viewed that Alan Reay Consultants did take the matter seriously and was taking steps to address the matter and this would have been clear to HCG.

On the third question:

I'm asked to comment on whether, in light of HCG being satisfied that the original designer had accepted responsibility and intended to take the necessary steps to remedy the issue, it owed any additional ethical conduct or reporting obligation to report the non-compliance with the code of the day to any additional third party.

1605

In particular I am asked should HCG have reported the matter to Christchurch City Council?

I believe that HCG, through its representatives, acted reasonably and in accordance with the IPENZ Code (applicable as at 1990) by leaving subsequent action as the responsibility of the original designer. I believe that other responsible and experienced engineers would've acted in the same manner.

I don't believe that HCG had an obligation to "police" the subsequent actions of Alan Reay Consultants, nor to report the matter to any third party, eg, Christchurch City Council or IPENZ. HCG received a very clear confirmation that Alan Reay Consultants took the matter seriously and HCG observed them to be taking steps to further investigate and/or resolve the matter promptly, primarily through the site investigation being conducted. HCG also received a letter from Alan Reay Consultants (dated 2 February 1990) clearly indicating that they were proceeding to fully investigate the matter and its solution.

Thus HCG's situation was not a circumstance contemplated by the IPENZ Code sub-rule 9, as HCG's advice had quite clearly been taken by the original design engineer and indeed been actioned. It is clear to me that HCG was not in an obligation greater than would have applied if the response had been one where sub-rule 9 applied.

CROSS-EXAMINATION: MR BIERRE – NIL

CROSS-EXAMINATION: MS SMITH - NIL

CROSS-EXAMINATION: MR RENNIE

Q. Were you present in Court when Mr Hare gave his evidence?

A. I was.

Q. You will have heard his answers in relation to whether he told Alan Reay Consultants Limited that the Holmes Group instructions had been terminated or not?

A. I heard that question and answer.

Q. And the answer was to the effect that he did not believe he had told Mr Banks that the instructions had been terminated?

A. Correct.

Q. It was also apparent from his evidence, both written and oral, that Holmes Consulting Group were engaged in the design of a remedial method using drag bars?

A. I don't recall him advising Alan Reay Consultants of that.

Q. No, no, I'm not suggesting that. That in the first couple of weeks of February in 1990, on the instruction of their client, Holmes Consulting Group were engaged in developing a remedy using drag bars?

A. It's sufficient for cost purposes, yes I do recall that.

Q. Yes. So that where a matter has been brought to an engineer's attention by an engineer who is in fact still working on the solution and never tells the other engineer that they have withdrawn from that. What then do you consider would be the duty of the original engineer in those circumstances?

A. I would believe that it is entirely their, still their responsibility. First of all they understood that Holmes were doing a pre-purchase, anyway a review. The responsibility for the design remains with the designer regardless and I can only interpret as I believe my own company or myself would interpret it, that we have found if a problem with a building has been identified we would take that on our own shoulders to action it all the way through.

Q. Well that's a matter of practice, but as I understand it that's not quite what we're talking about. We're talking about compliance with the Institute's requirements for conduct aren't we?

A. Um…

Q. We've got the difference between the rules and best practice?

A. Okay, my understanding is that Holmes Consulting Group had advised them, albeit verbally. They received response back. They arranged to meet at the building when investigations were being undertaken to find out whether reinforcing in fact had been installed. And subsequently they received a letter on the matter. So as I said in my evidence, they

had good cause to believe their advice had been taken seriously and that therefore they had no further obligation to report.

1610

Q. Where they had, however, an obligation to their client to design a remedial solution, is it your view that they should then have taken that remedial solution to the original designer for approval?

A. Absolutely not.

Q. So is it the position on your analysis that there could then be two separate groups of engineers each designing a solution in isolation to the other?

A. Absolutely. The Holmes one was done for budgeting purposes. The responsibility for the design lay with the designer. He may well have come up with a totally different solution. As it happened it was a very similar solution but that was not necessarily going to be the case but that is still his responsibility.

Q. Now in paragraph 1 of your brief, sorry paragraph 21 of your brief, you analyse a series of circumstances as to the responsibilities of the parties that you nominate. Do you see that?

A. Yes.

Q. Here we have a situation, however, where Holmes Consulting Group were not instructed for the owner of the building and that's not a circumstance that you analyse in paragraph 21 is it?

A. Let me just, I don't think that's contrary to what I've got in my evidence. He, his client is the client who's engaged them and they in fact did advise their client, they did advise the designer. They may not necessarily have known who was the owner of the building. I don't believe they have any obligation to an owner. It may have even been a multi-party owner.

Q. Well leaving aside speculations about the owner the Holmes Consulting Group were instructed on behalf of the Canterbury Regional Council as appears on the face of their documents to carry out what they themselves describe as a pre-purchase report. Do you understand that?

A. Correct, yes.

Q. And on the basis of Mr Wilkinson's evidence that involved a structural assessment. Do you accept that?

A. Yes.

Q. Now Holmes ascertained that there was this actual or potential design defect in the building. I say potential because there was an investigation as to whether additional reinforcing had been installed at the time of construction. It was not actually feasible for Holmes or its client, the consultants and the Canterbury Regional Council to do anything to the building unless the building was purchased by the Canterbury Regional Council. Do you follow that?

A. That's correct, yes.

Q. You can't repair somebody's building just because you think it's a good idea.

A. Yeah, I quite agree.

Q. So the missing element in your analysis in paragraph 21 is the actual owner of the building which in this particular case was the receiver of a failed 1980s development company. What do you say the obligation of each of the engineers was to tell the receiver?

A. Well for Holmes Consulting Group none at all. That's providing the design engineer was clearly accepting and not rejecting their advice. For the design engineer he clearly had to take some action to, well both investigate and ultimately correct the situation which he could only do through the owner of the building, or by advising the owner.

Q. Are you aware that throughout the period that we're talking about the building was unoccupied except for, you may have heard my friend Mr Mills referring to some work, people doing a fitout at a later stage. Did you know that?

A. No I knew that the majority of floors were unoccupied but that two of them on the evidence I saw was that they'd been occupied. If they were occupied by a fitout well that's not within my knowledge.

Q. So the building on the available evidence is not shall we say tenanted and then in 1991 it is reported in the *Christchurch Press* that the building

has been sold to a new owner and the original design company, Alan Reay Consultants Limited, then informs that owner of the defect in the building. Would you agree that that was a correct discharge of an engineer's duties?

A. Yes if, if the matter hadn't been resolved and corrected prior to that.

Q. Well the drag bars were installed subsequent to Alan Reay Consultants Limited informing the new owner. Were you not aware of that?

A. Not until today.

Q. No. So to be clear on the basis that that's the sequence that was a proper action in terms of proper conduct of engineers in your view?

A. Yes, yes under that circumstance. I personally believe that the matter should have been corrected at a faster timeframe than that contrary to the previous witness but in that it hadn't that would then be the right obligation.

Q. In paragraph 34 of your evidence you address the question of the obligation to tell the Council.

A. Yep.

Q. Did you know before hearing Mr Hare today that he had personally gone to see the Council's chief engineer Mr Bluck?

A. I had previously read Mr Hare's statement of evidence, yes.

Q. Yes but did you know that they'd actually had a meeting at which he had specifically asked what the Council knew of defects with the building?

A. I knew that he'd had a meeting and he'd, yes, to enquire as to whether the Council had any knowledge of defects, yes.

Q. Have you previously seen the note that Mr Hare made of the defects which Mr Bluck told him about?

A. Yes.

Q. You have seen that?

A. Yep. I, I think so.

Q. So having had that meeting Mr Hare would know that the Council was unaware of this design defect. You agree?

A. I think it would be reasonable that they would be able to believe they would be unaware even before the discussion because otherwise it would not have got a building permit.

Q. I think you've missed the point of my question. I'm saying that Mr Hare, as a result of the meeting, would know that the Council did not know of the defect.

A. Correct.

Q. So I put it to you in those circumstances Holmes Consulting Group should have told Mr Bluck of the defect which was found having themselves sought Mr Bluck's assistance in the matter.

A. Well I don't know that they sought assistance in that particular aspect of that matter but, and I'm also a little unclear on quite the sequence in relation to the investigation that he, that Alan Reay Consultants were carrying out on, on site, whether this was before or subsequent to that but he, they had reported it to Alan Reay and that's where the responsibility lay in my opinion.

Q. Well it's apparent that the matter was notified to Alan Reay Consultants Limited a very short period of time after the meeting with Mr Bluck. We may not have an exact date but it's a matter of a day or days and is it your view that although Mr Bluck had no knowledge of this matter Mr Hare and Holmes Consulting had no obligation to tell him even though they'd engaged with the Council about it?

A. Certainly it would be quite improper for him to raise it with the Council at the time if he had not in fact informed Alan Reay at that time. That is the first line. After that –

JUSTICE COOPER:

Just a minute. It may not be apparent to the witness but isn't the evidence that at the time when Mr Hare spoke to Mr Bluck he was not himself aware of the problem that he subsequently discovered?

MR RENNIE:

That's correct Sir.

JUSTICE COOPER:

Yes.

MR RENNIE:

I put it on the basis that within a day or two he had become aware of it because he saw Mr Bluck I think, from memory, on the 29th of January and on the 31st of January he wrote a report disclosing the defect.

JUSTICE COOPER:

Yes.

MR RENNIE:

I don't think we can do better than that in terms of time.

JUSTICE COOPER:

No well it wasn't apparent to me that the witness appreciated that.

MR RENNIE:

I acknowledge Sir that there may have been that doubt and I'll simply put it again.

CROSS-EXAMINATION CONTINUES: MR RENNIE

Q. Let's assume that on the 29th of January neither Mr Bluck nor Mr Hare knew of the defect.

A. Okay.

1620

Q. And on that day Mr Bluck supplies his list of known issues about the building to Mr Hare. On the 30th or 31st of January 1990 Mr Hare becomes aware of the issue. Is it your proposition that neither he nor Holmes Consulting Group had any responsibility then or afterwards to tell the Council?

A. That is correct. At the time that he saw Mr Bluck he only had limited drawings so had identified that it was a possible problem. When he went to Alan Reay Consultants office and was able to look at the completed drawings he raised it with them and they still believed that it is, there was a possibility that in fact it had been corrected during so at that point it was still only a possible defect not an established defect. To be reporting it to the Council at that point certainly would be inappropriate and subsequent of that they received both the site investigation they partook in or witnessed the site investigation, they received the letter of 2 February and therefore the responsibility lay entirely with Alan Reay Consultants to report to the Council and indeed if the defect was confirmed or couldn't be, actually be disproved and remedial work was required then in fact they would be seeking a building permit.

Q. And your basis for that interpretation is solely your interpretation of the Institute's code?

A. Yes my entire evidence is my opinion.

Q. Of what the code is –

A. Of the code.

Q. Yes.

A. And also what I, how I believe reasonable and responsible engineers behaved in 1990 and subsequently.

Q. Let us assume for the moment that you are right about the code, would you accept that the outcome that we've just discussed is not an outcome in the public interest and the code should be changed?

A. Yes if that's – a similar question that was put to an earlier witness. I would also think that a clarification or something more definite than the, or even the current code of ethics has in place, would actually be beneficial. The point I would make though, it is a defect in relation to the code of the time of design not the current code.

Q. Are you saying that the provisions of the current code differ and would produce a different result?

A. I think the substance of the current code is essentially the same as it was in 1990. It is four pages long, compared with one. It does use stronger language in describing outcomes but I think the obligations it sets are not very different.

Q. Would you accept that one of the risks which is well recognised in risk analysis is an ambiguity where there are two persons involved and each person thinks the other is responsible for the matter?

A. That such a situation can exist, yes.

CROSS-EXAMINATION: MR MILLS

Q. Well I will try not to cover ground that has been covered but this is the expert who has been put forward on this issue I think there are some issues I ought to explore with him. And again Mr Robertson this is not for the purpose of pointing a figure but rather trying to get the best understanding possible of how this works and to take advantage of your knowledge of IPENZ ethics rules.

First thing I just want to get a further view from you on is this question of the timeliness within which one would have expected Alan Reay's firm to have taken steps to deal with this critical structural weakness that was identified in the building and I think you said while you were being cross-examined by my friend Mr Rennie that you didn't altogether agree with what Mr Wilkinson had said on that timeline. What is your own view on that issue as in ethical obligation arising out of the IPENZ rules?

A. I think I agree with him when he said it wasn't a matter of urgency but I don't consider 21 months to be proceeding expeditiously.

Q. What would you consider proceeding expeditiously on these facts?

A. Well I think certainly in the circumstance of this building where the majority of building, floors sorry, were unoccupied, that alone would have triggered a good opportunity to do the work with minimum disruption of people in the building. So that's quite perhaps a bit aside from nevertheless you have got to do it anyway. I haven't analysed it but I would think, three to six months.

Q. I take it that you are familiar with the facts that are involved here and the way in which the Holmes report put the seriousness of the issue, that that identified?

A. Yes.

Q. I don't need to bring that to your attention?

A. No I have read the reports.

Q. Yes. And do you agree with Mr Wilkinson who agreed with me that this is properly described as a critical structural weakness in the building?

A. Yep.

Q. And we know now if we didn't know it before, that an earthquake can strike at any time and what the report was saying was this building could simply tear apart and collapse and would collapse fast?

A. Yep.

Q. So how does one judge this in terms of, you have sat you said on two ethics issues for IPENZ, one in the 1990s, another one this year I think is your evidence. Would this be regarded as a breach of the IPENZ code of ethics do you think that it took 20 months after this issue was identified before it was attended to?

JUSTICE COOPER:

Just a minute, Ms Smith.

OBJECTION: MS SMITH (16:26:45)

MS SMITH:

(inaudible 16:26:45) been put to the witness because we don't have clarity over the evidence in terms of the period of delay and the reasons for that.

JUSTICE COOPER:

All right, well Mr Mills that may be a fair point so you can put it on a conditional basis presumably.

MR MILLS:

I think we do have clarity around the period I accept that we don't necessarily have an understanding of the reasons for that at least not a full understanding.

JUSTICE COOPER:

Is that right Ms Smith?

MS SMITH:

There's actually no evidence at all in terms of the reasons for the delay and who (inaudible 16:27:24) so I am happy for it to be put on that basis.

JUSTICE COOPER:

I thought you were implying that there was insufficient evidence of the extent of the delay.

MS SMITH:

No –

JUSTICE COOPER:

Just the reasons?

MS SMITH:

No, the point I am making is that we understand the period of the delay but we do not understand the reasons for that, for example if the owner had not progressed the work, we don't know.

JUSTICE COOPER:

Yes, so there may be reasons for the work not being progressed which have nothing to do with ethical obligations or their breach, is that what you are saying?

MS SMITH:

Well the question that I understand is being put the witness is why weren't the works progressed, but surely information and actions by an owner might have an impact on how an engineer might progress matters.

JUSTICE COOPER:

All right, well Mr Mills you have heard that discussion.

MR MILLS:

I did and I accept that and I thought it was to be put on two limbs that we didn't know the period of time and I understand that it is simply a matter of the reasons and I acknowledge that that must be correct, so it is probably difficult for Mr Robertson to give a view on this other than what he has given and just standing here now I can't actually think of a way of putting it to him that would lead to a very meaningful response I think.

CROSS-EXAMINATION CONTINUES: MR MILLS

Q. Now, you were also asked some questions by my friend Mr Rennie about the issue of reporting to the Christchurch City Council, do you remember he put it to you in the context of the meeting that Mr Hare had with Mr Bluck and accepting for the moment that it would have been premature for Mr Hare to have said anything to Mr Bluck at that point, which was your position I think. Do you think there would be circumstances in which it would be an actual breach of the IPENZ ethics rules for an engineer who becomes aware of a critical structural weakness in a building to not report it to a local authority?

A. Can I ask you to just to put the question again?

1630

Q. I accept what you have said here for the purposes of the question, that it was premature for Mr Hare to have raised with Mr Bluck when he met with him this issue about a critical structural weakness. I am interested in the way you think the IPENZ ethic rules work in terms of when there might be an obligation to report knowledge of a critical structural

weakness to a local authority, and I put it to you conversely, as could you imagine it ever being a breach of the ethics rules to not report a critical structural weakness to a local authority?

A. I don't think the rules as they stood then were actually tight enough in that respect and I believe and I said in my evidence that nevertheless, even though it says they should just make that party aware, it's not the way I believe I or other responsible engineers would behave. If you're, so the circumstance I believe you're putting to me would be where you believe that the matter is not being taken seriously or has been disregarded, even if it was taken seriously and that nobody was doing anything about it. Under those circumstances I don't believe my action would actually be to raise it with the Council, at least not in the first instance, but to raise it with IPENZ.

Q. And how would you expect IPENZ would deal with that?

A. Um, well they would advise whether they were going to continue with the matter and raise it further, in which case you may become a witness to them or whatever. Or if, or IPENZ would advise, you know, that's up to you. Now if it's up to you then the Council certainly would be the next body to whom I'd turn.

Q. Do you see a difficulty with an obligation on an engineer who becomes possessed of this knowledge about a critical structural weakness, conveying it to a Council when the engineer may have become aware of that information through a client who itself has declined to disclose that information further? In other words it's effectively been received in a situation of confidence, how would that be dealt with?

A. I contemplated that because I think there is conflict between the various sub-rules. To me the obligation to the public interest ultimately would take precedence. There is a clause about not disclosing confidential information so I don't think, having had the client say, "Well I'm not going to do anything further," then I think the engineer's first step would be to tell that client, "Well under these circumstances I feel obliged to raise it with the Council." I think he should at least give his client that

opportunity and I don't know what other sort of answer he might get to that but then he would raise it with either IPENZ or the Council.

Q. So even where it might be a breach of confidence which could lay that engineer open to actually a legal claim for breach of confidence unless they could raise one of the broad public interest exceptions to confidence, you say that there could be an obligation to report that to the Council?

A. There could be a circumstance under which that obligation arose where ultimately the public safety was the issue.

Q. In your experience is that an issue that's ever come before IPENZ for consideration?

A. I wouldn't have any idea.

Q. You see we've actually got a potential example of that pretty close to the situation that I'm putting to you on the facts here, because you said in response to a question from Mr Rennie that the obligation here would've been to report to the owner, and effectively the owner here was the receiver. Do you remember saying that?

A. No I think that he would report to the engineer, the design engineer and the design engineer would report to the owner is what I believe I said.

Q. Okay, I may have misheard you.

JUSTICE COOPER:

It was Mr Rennie's proposition.

MR MILLS:

Yes it was.

JUSTICE COOPER:

That the engineer becoming aware of the defect might have an intended obligation to report the matter to the owner.

CROSS-EXAMINATION CONTINUES: MR MILLS

Q. Yes and if the, if it was reported to the design engineer and the engineer who had become aware of this issue, who conveyed it to the design engineer but concluded the design engineer wasn't taking it seriously, again the next step would have been the receiver would it, on the facts here?

A. Um, no well –

Q. Or is it IPENZ first?

A. – well I would've gone, my own action would've been to raise it with IPENZ.

Q. I see, but as far as the original design engineer, that obligation would be to convey it to the receiver?

A. Yes.

1635

Q. Now you're no doubt aware that the first obligation of a receiver is to the debenture holder?

A. I'm not that familiar with receivership rules.

Q. Well I can tell you that this issue has – actually was explored with KPMG and that was precisely the response that was given that the first obligation of the receiver is to the debenture holder which raises a question about the adequacy of a – of the design engineer reporting it to the owner in those circumstances. Now I mention that only because you say that you think there are some difficulties with the interpretation of the IPENZ ethical rules. To me they seem to be – to have a significant number of unresolved conflicts in them and contradictory obligations. Do you agree with that characterisation?

A. Yes I said as much under –

Q. Yes. Now on this question of conveying the information to the original designer and placing it on the original designer, my understanding of what Mr Wilkinson said is that at least for practical purposes he regarded Mr Banks as being the one that he was placing the obligation on. Now you know from the facts here that Mr Banks in fact was not the original designer, don't you?

A. Yes, well not the original engineer -

Q. Yes.

A. - but the designer was Alan Reay Consultants.

Q. Yes, so when you talk about the obligation under the IPENZ rules being on the – giving rise to an obligation by the reviewing engineer to report to the original designer, who in your view is that original designer here for those purposes?

A. Alan Reay Consultants.

Q. Yes. I take it your position is that the obligations that we're talking about here under the IPENZ rules are not triggered by subsequent information that might emerge about a building that was code compliant at the time, but where state of knowledge within the engineering profession develops so that there is then suddenly an awareness that a particular type of design is now identified as being a critical structural weakness. That doesn't in your view trigger any obligation on the original designer to go and take any reporting steps over that, and to make that tangible there've been issues coming out of the Royal Commission process, for example about the stairs issues in the Forsyth Barr, a question of diaphragm connections which is what we're talking about here in part, those may now be seen as giving rise to critical structural weaknesses which weren't seen that way originally. Does that trigger any obligations at all on the original designer?

A. Yes, yes, well it can do, it was going to depend on whether you're meaning, he becomes aware it's – that the codes have just changed and moved on, which happens progressively throughout society, or through time, or whether it is a particular critical issue and I can certainly think of cases where there have been critical issues discovered, where knowledge – engineering knowledge has taken a quantum jump.

Q. Yes.

A. And actions have been taken in that regard.

Q. And do you think that there is an ethical obligation on the original designer as that designer becomes aware of new information coming forward, that does identify that a building previously designed does have

a critical structural weakness in it. Does that trigger any ethical obligation?

A. I don't believe it triggers an obligation to trawl back through your archives to check whether such a situation may have existed. Therefore you are relying pretty much on the knowledge of the senior partners or senior personnel of the company involved to think back, and think, oh yes we did do that. If that situation arose and it would depend somewhat on the nature of the, whatever the issue was, there can be circumstances where they may say to our client, look, engineering knowledge has advanced. This is something that is applicable to your building. This would be the implication and then obviously there's going to be discussion between him and that owner as to what the next steps are and where it goes.

1640

Q. But no obligation under the ethical rules even though the original designer does become aware and does remember – I did that building, I'm now aware that what I did there has turned out to be a critical structural weakness, has caused failures in other buildings – doesn't trigger any ethical obligation to re-engage with the current owner I take it?

A. Again it's going to be a matter of degree. The subject of hollow core slabs has come up in this proceeding, not today –

Q. Yes.

A. – but from what I've followed –

Q. Yes.

A. – which is something that research has determined has a problem.

Q. Yes.

A. Now I don't believe that every building in New Zealand that has hollow core slabs has suddenly been reviewed or pulled out of their archives by the relevant engineers. Nevertheless it is a matter that engineers focus on and sometimes not what the design engineer but it may be as a result of a pre-purchase agreement or whatever it is that triggers it and those sorts of things do get reviewed, yes.

Q. Yes. I think I'm hearing from you as you talk about these issues that you don't think the current, and I would have said 1990 and then asked you separately about current but I think you agreed with Mr Rennie that in substance there's really not much difference between them, that's right isn't it?

A. The language is stronger but I think the obligations are pretty similar.

Q. Yes and am I hearing from you as you talk about these issues that you don't think that those current ethical rules are entirely satisfactory in relation to the issues we've been talking about?

A. With, with regard to an obligation to report further –

Q. Yes.

A. – I was relating that to the question that was actually put to a previous witness –

Q. Yes.

A. – that I would support that there is, I would welcome a tightening up of the rules. Now quite what that tightening up might say –

Q. Yes.

A. – is for the future to determine, but myself I can see that there is a rule about what you do if your advice is neglected or rejected.

Q. Yes.

A. And even that I think is weak because all it says is you make them aware of the implications.

Q. Yes.

A. And that by, because it says no more it implies that's all you've got to do.

Q. Yes, yes and based on the position you hold in the engineering profession and the networks that you have, have you any feel for whether that would be widely supported within the engineering profession, some revisiting of these IPENZ rules to deal with those issues more specifically?

A. I'm not currently on the SESOC Committee with respect to structural engineering but, yes, I believe the profession as a whole would like any ambiguity removed and to have a, a fairly clear set of guidelines. Now I

realise that the code of ethics applies not just to structural engineering, it's all fields of engineering and therefore to write up something absolute that's going to work in all circumstances would be a very difficult and probably a lengthy document which is not what we would welcome.

Q. Yes.

A. I think something more than four pages will then not get absorbed by the engineering practitioners as a whole but yes something that tightens up on what your obligations are under those sorts of circumstances, I think the professional would, as a whole, would not shy away from it.

Q. All right. Thank you very much.

JUSTICE COOPER ADDRESSES MR REID

CROSS-EXAMINATION: MESSRS HANNAN AND ELLIOTT – NIL

QUESTIONS FROM COMMISSIONERS FENWICK AND CARTER – NIL

QUESTIONS FROM JUSTICE COOPER:

Q. Just in relation to your paragraph 21.4. In that paragraph you've listed the steps which if taken would mean the engineer was acting properly. 21.4, "Be informed as to whether the designer accepts responsibility for attending to the matter." That's quite a significant stage it seems to me listening to your evidence because at that point the reviewer has advised the person that he or she thinks is responsible and got the assurance that that person is appraised of the matter. Now wouldn't it follow from that that duties of reporting, whether it be to the Council or any other affected third person, would be the responsibility of the designer who has taken on board the issue?

A. Yes, yes it's the responsibility of the original designer in my view.

Q. And the person who, the reviewer who has fulfilled his duty at that point is entitled to say exactly that.

A. Yes I believe that in right to be informed I was more excluding the opposite where he's told to go and mind his own business.

Q. Yes well reaching a view based on reasonable grounds that the matter is being, has been understood. Now then I would have thought that the original designer who conveys that impression then has a correlative duty to actually take appropriate action in relation to the matter. Is that a fair comment?

A. Well I think to not do so would be negligence.

Q. Now what if there's no money to remedy the problem? What happens then?

A. Well obviously he can talk to his insurers but apart from that it doesn't alter the situation whatsoever.

Q. Yes.

A. You've got a defect, it needs correction, obviously if the owner says, well I'm not going to let you into my building that might be more of an obstacle than the money side, but money isn't part of the equation.

Q. If there's a delay whether for lack of money or for some other reason the duty of the reviewing engineer could hardly spring up again after that period of delay could it?

A. No and I believe I said they didn't, Holmes did not have a duty to police subsequent action or maybe I didn't relate that particularly to Holmes but in any circumstance the reviewing engineer does not have an obligation to police whether it's happening.

Q. So 21.4 was a sort of handover?

A. It's a passing of the baton.

Q. Yes. All right.

QUESTIONS ARISING - NIL

WITNESS EXCUSED

JUSTICE COOPER ADDRESSES COUNSEL

1650

MS SMITH CALLS

GEOFFREY NIGEL BANKS (SWORN)

Q. Mr Banks you can confirm that your full name is Geoffrey Nigel Banks?

A. I can.

Q. And do you have your brief of evidence in front of you?

A. Yes I do.

Q. Could I get you to read that from the second line of paragraph 1 please.

A. Certainly.

WITNESS READS BRIEF OF EVIDENCE

A. My only involvement with the CTV building was in the early 1990s. The building was not known as the CTV building then although for simplicity I will refer to it as the CTV building. I simply knew the building as 249 Madras Street.

My involvement occurred in a relatively brief period 22 years ago. I have not retained an intimate knowledge of all matters relating to the CTV building and the calculations in light of the time that has elapsed since my involvement and the many building projects that I have been involved with since. It was some weeks after the collapse that I realised I had undertaken work on the CTV building, and that was around the time I was contacted by Dr Hyland who was investigating for the DBH.

My evidence is to the best of my recollection. I am able to remember some matters and in other cases I have relied on documents produced at the time to aid my recollection. These documents have been provided to me by counsel assisting the Royal Commission and by Dr Reay. The purpose of having accurate file notes and calculation records is to ensure an engineer including the engineer who created the original record can come back years later and know that they can rely on there being an accurate record available for examination or review. I'm conscious however that some things may have occurred outside of that essential written record and that the record is also not complete. For example I have asked for copies of my diaries and timesheets as these would have contained records of meetings and conversations that

I had at that time. I have been advised by Dr Reay's lawyers that these no longer exist which is understandable given the passage of time.

Before going into the detail of my evidence I want to acknowledge that the CTV building is now the cause of anguish and heartbreak for a large number of people. I am deeply saddened by the terrible loss of life and many injuries the collapse as a result of the collapse of this building. I cannot know the grieve it has caused the families and friends of those who died and to those who were injured. I do not know why the collapse occurred and like all those involved I look to this inquiry to consider all the issues and to help ensure nothing like this could happen again.

I graduated from the University of Canterbury in 1980 with a Bachelor Degree (first class honours) in Civil Engineering. I am a chartered professional engineer and a professional member if IPENZ.

I studied at university under Professors Bob Park and Tom Paulay who were world experts in seismic design of concrete structures at that time, and Nigel Priestley who has given expert evidence. I can recall graduating with the latest copy of the concrete code NZS3101. Just on that point I think it may have been called 3101P at that time, which the university had a significant involvement with and with the book 'Reinforced Concrete Structures' written by Park and Paulay my impression at that time was that the University of Canterbury was at the forefront of reinforced concrete design for earthquakes.

I have been practising as a structural engineer for some 30 years. My experience covers a wide range of buildings from houses to low rise commercial buildings to a number of high rise projects. Most of that experience relates to the design of new buildings although I did design some strengthening of older buildings such as parts of the Arts Centre in Christchurch.

I worked as a structural design engineer with Holmes Wood Poole and Johnston now Holmes Consulting Group from around 1982 to 1986. I designed low rise commercial and public buildings and a number of

multi-storey buildings in the Auckland CBD. Much of that work was under the direction of Russell Poole, a senior director of the firm. Those buildings were mostly constructed using reinforced concrete frames but some would have had shear cores. I can recall one building was the Stock Exchange Tower in Queen Street but can't recall the specifics of all the building names and types.

I left Holmes in 1987 to start a new practice Cambridge Consulting Engineers with another engineer. CCE undertook the design of a number of low rise commercial buildings.

Alan Reay Consultants Limited, ARC, was formed in 1988 providing a new corporate entity which continued the work of Alan M Reay Consulting Engineer, Dr Reay's former practice. I was invited by Dr Reay to join ARC late in 1988 after CCE had worked as sub-consultant for him on the Duty Free building in Cathedral Square. I was aware that Dr Reay had a PhD in seismic design and a strong reputation in the commercial building sector. I was employed at the end of 1988 and became a director on 31st of March 1989 and subsequently a shareholder. I remained at ARC for 13 years until late 2002 when I left and formed Structex. At, at the time I started in 1988 ARC was undertaking a range of work but the dominant project type was low rise commercial and industrial buildings, (that is one or two storeys high). However, I do recall doing construction monitoring on the Heatherlea apartment high rise building in Deans Ave.

The CTV building.

I had no involvement in the original design or construction of the CTV building as that occurred prior to my joining the firm. It was designed by Dr Reay's previous practice Alan M Reay Consulting Engineer not by ARC.

In 1990 I undertook work to investigate a particular aspect of the building that was thought to be deficient following a review by Holmes which I refer in more, which I refer to in more detail later. I designed

retrofit works which were undertaken in 1991 (the retrofit works). I designed the retrofit works to the standards at that time.

My recollection is that it was principally Dr Reay and I involved in matters relating to the retrofit work. My role was focused on the more detailed aspects while Dr Reay had an oversight role. As I was relatively new in the company and also new to the building I liaised with Dr Reay throughout my involvement.

I recall Dr Reay telling me that David Harding has done the calculation, had done the calculations for the original design. I have recently read John Hare's evidence that this was Mr Harding's first design of this type of building.

Q. Mr Banks I think you said John Hare's evidence in fact it was John Henry's evidence.

A. I'm sorry, John Henry's evidence.

Q. Continue at line 3 of paragraph 15 please.

WITNESS CONTINUES READING BRIEF OF EVIDENCE

A. At the time of my involvement I cannot recall being briefed on Mr Harding's experience with this type of building.

Mr Harding had left ARC just before I started and to my knowledge Dr Reay was the only engineer in the firm at that time with knowledge of the CTV building.

In terms of retrofit work sketches CD 1, CD 2 and CD 3 ((referred to in more detail later) were prepared by one of the drafting technicians. I undertook all calculations. Although Dr Reay may not have specifically reviewed the calculations he would have been aware of the remedial works I designed.

The Holmes Report.

In late 1990 I became aware that Holmes was looking at the CTV building, sorry in late January 1990 I became aware that Holmes was looking at the CTV building as part of due diligence being conducted by a prospective purchaser. I'm not clear exactly when my involvement began although it is likely to be around 29 January 1990 as that is the

date of my initial calculations. I may have been introduced to one of Holmes' engineers when they came to ARC to inspect the files but I cannot specifically recall that.

I recall receiving a copy of the Holmes Report dated January 1990. It refers to me being available for comment on aspects of the design. I do not recall commenting but I do remember having discussions with Mr Wilkinson of Holmes sometime later about the concerns raised and the remedial solution required. I did not receive the version of the Holmes Report which is included in the material before the Royal Commission; that is, the version which includes calculations and notes prepared by John Hare and a memo from Grant Wilkinson dated 1 February 1990. I did not receive those documents at the time. I know that because they post-date my initial calculations and they were also not included in the Holmes Report on the ARC file forwarded to me last year by Dr Reay.

1700

Q. Mr Banks, if I can just stop you there just to clarify that those calculations are the ones that we were talking with Mr Hare about this morning which included his design of the drag bar?

A. Yes that's correct.

Q. If you can continue on please.

A. Also if I had seen them at the time I would have likely reviewed the calculations undertaken by John Hare as opposed to undertaking my own. Other than those additional documents the reports are identical. I was provided with a 10 typed pages concluding with section 7 condition report.

Q. Mr Banks, if we can just bring that report up and have a quick look at it, MAD249.0130.1, and this is the report that you're referring to?

A. Yes it is.

Q. When you received this report was there anything to suggest to you that the report was in draft or it was incomplete in anyway?

A. No, my recollection is that it was just simply this report and I've heard Mr Hare referred to a covering fax cover sheet calling it a draft but I don't believe I saw that, and it certainly wasn't in the ARC file.

Q. I think Mr Banks, Mr Hare was saying that that draft, that fax cover sheet was in fact when the report was sent to his client –

A. Yes.

Q. – not to ARC itself, and in your discussions with either Mr Hare or Mr Wilkinson subsequently, did they ever indicate to you that their work on the building, or this report was incomplete in any way?

A. I can't recall that specifically. Look it may have been raised but certainly I didn't make a note of it, it didn't register in the ongoing work I was involved with. Clearly I rang Mr Wilkinson on the 2nd of February and again Mr Hare on the 14th of February which I doubt I would have done if I'd been told that they were no longer engaged.

HEARING ADJOURNS: 5.02 PM

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