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Q. Now there's been reference to a document that Mr Bluck issued at some point in time as to the limits in the approval of plans and an indication  
5 that council staff should not themselves alter plans. Are you familiar with the document I mean?

A. I've seen it but I'd have to refresh myself.

Q. If you'd not seen it I wasn't going to get it brought up but if we could  
10 bring it up it's WIT.NICHOLS.0001.10. That's the document you were thinking of?

**WITNESS REFERRED TO DOCUMENT**

A. Hang on let me read it.

Q. Take as long as you like.

A. I've seen that as part of the documentation becoming available with the  
15 Inquiry. I don't know where I saw it but I have seen it but when I was at the Council I was not, I didn't see that. I wasn't given in that paper form but certainly the item number three was well understood and we certainly also did not amend drawings, always asked for the documentation to be provided from the consultant or applicant.

20

**JUSTICE COOPER:**

I'm taking it that this document or slide was current probably prior to 1991 –

**MR RENNIE:**

25 Certainly.

**JUSTICE COOPER:**

Because of its reference to NZS1900.

30 **MR RENNIE:**

Indeed Sir and Mr Nichols indicates that it goes back to his time which was in the eighties and of course there is two different ways I suggest of looking at this document and one is it's somewhat of a document in itself and the other is

simply being reflective of the way in which the Council operated at that time and it's the second leg of that that I'm going to go to because the witness hasn't the document at the relevant years.

**5 CROSS-EXAMINATION CONTINUES: MR RENNIE**

Q. And Mr Henry the question I have for you going back to the time when you were with Holmes Wood and then with Alan Reay Consulting Engineers you haven't seen that document but would your experience with dealing with the council in those years consistent with the terms of that document?

A. Yes it was yes.

Q. Now you may know that there have been several references. You may have even heard me quote one of them to the interaction between Mr Bluck and Mr Tapper.

A. Yes.

Q. In relation to decision making. Mr Nichols in paragraph 19 of his first brief you may have heard me quote that, talks of the particular CTV matter being perhaps, "Another of their fairly regular fracas". Do you recall them as regularly interacting in a way which could be called a fracas?

A. Well on those occasions that I mentioned earlier where Bryan Bluck would come to us as a result of complaint and that was in relation to the ARCL jobs that I referred to earlier. Those were the fracas I think, they were more than that, but they were very heated and I think they got worse. They escalated to the point where they had to be taken in hand by other senior staff.

Q. And in that sense are you pointing to something that went beyond strong debate to something which was less rational?

A. It was certainly beyond strong debate yes.

Q. And senior counsel assisting Mr Mills back in his opening in this enquiry spoke in relation to the CTV matter of a volcanic standoff between Mr



Bluck and Mr Tapper. Did you ever see any event which could be called a volcanic standoff?

A. I did.

Q. In relation to a particular consent matter or more generally?

5 A. Not, it wasn't general but the ones I witnessed were in relation to what I'd call impasse situations relating to the floor detail and connection detail primarily with those applications from ARCL and I think the degree of tension increased with the more of the delay and the greater the impasse.

10 Q. And did that relate to a difference of view between Mr Bluck and Mr Tapper as to the way in which slabs should be tied into columns and shear walls?

A. It related to the connection detail of floor to wall not columns. What did you say columns to shear walls?

15 Q. Slab –

A. Slab to wall.

Q. Slab to wall?

A. Yes essentially.

1557

20 Q. And was that resolved by the introduction of an additional angle bracket fixing of that connection?

A. It was resolved with an angle bracket. It went through a stage of what I think negotiation might be the term to use because I can't remember who introduced it and it wouldn't have been Graeme Tapper because he very much went to stand his ground and wait for the other person to –

25

Q. To adjust?

A. Yeah. I won't say, I'm not saying he wouldn't cooperate, but he didn't see it as his role to step forward and offer solutions but what happened was somebody, I don't think it was me either and not for the same reason but probably one of the other parties suggested the steel angle for this particular detail and it was a case of okay, we'll go with that so along came the detail from ARCL with the additional steel angle and attached to it was a condition that this was a requirement of the

30

Christchurch City Council and not the responsibility of ARCL which was like, as far as Graeme Tapper was concerned, we'll say highly unacceptable, whereas this was, the detail was like, just on the cusp of taking all the pressure off at that point and so I can categorically tell you but I think that triggered this, the maximum tension and argument between Bryan Bluck and Graeme Tapper. How it transpired exactly from there I'm not sure other than to say the permits or consents did get issued, the buildings got built, the, you know the (inaudible 15:59:17) went and everything flowed.

5

10 Q. Well it's probably not important to this enquiry because you're talking about a matter in the 1990s aren't you?

A. Correct.

Q. But I could show you documentation where from that point the angle brackets were included.

15

A. Yes, there was I think. It's all to do with the time which is vague, but what basically happened is I took over from both Graeme Tapper and Bryan Bluck in that building control engineer role with the Building Act and I think I was prepared to run with the angle because, you know, the thing couldn't fall off but there was still a remnant problem in the sense of the reinforcing connection and that is where in 1993 when we got the opportunity when Professor Park basically said, "Anything we can do to help with what you guys are doing," we said, "Yes, we've got this sort of disagreement or questionable anchorage detail," and he volunteered to have it tested which was good, by a PhD student and he did a number of different types of anchorages which were being used by ARCL and I think other consultants were – had similar details.

20

25

Q. I was going to say to you it was a wider debate between the structural engineers in practice and the Council as to what was the correct way to go.

30

A. It was, I mean the real issue is how hard one pushed it. I mean as I was saying earlier when it had a 120 thick panel there and took 30 mm out, and tried to anchor the bar on what was left, others were using 150 millimetre thick and not using a rebate and so that would be more

acceptable and so it was pushed to the limit and hence that was – what was driving the sort of unhappiness, uncertainty with its safety so we got that done and surprisingly whereas if would have used the code you would have got an anchorage length (inaudible 16:01:24) down of maybe up to 200 millimetres for those reinforcing rods. They actually fully anchored off and for a 12 millimetre bar 115 millimetres and so it was possible to use the detail with a 10 millimetre bar and more of them so –

5

Q. That was the outcome of the testing you were referring to?

10

A. The outcome of the testing so that started to happen but shortly afterwards I think ARCL, once that was done that was the total end of it, it was solved and there was no disagreement at that point.

Q. Yeah.

15

A. And as a result ARCL redesigned that fixing. I think they got Opus to help and they designed a sort of quite an ingenious sort of a double U shaped hook thing and brackets that went into the (inaudible 16:02:15) and hooked over and it became almost like another one of ARCL's sort of patented systems and that enabled the walls to go up, the floors to butt up and have their sort of hook arrangement.

20

Q. And to meet the code requirements?

A. And I left at that time and I think it was Murray Mitchell at Opus who was assisting them.

25

Q. Thank you. Now you may have heard Mrs Tapper when she gave her evidence speaking of Mr Tapper's concern and I'm not going to go to the main content of that but she made a reference that she initially thought it might have been due to a personality clash between Dr Reay and Mr Tapper. Was that your perception of the relationship in the time that you were at the Council?

A. It was, yes.

30

Q. And as a consequence of that did ARCL frequently deal with the Council through other members of the firm than Dr Reay such as Mr Banks for example?

A. When I was there it was Geoff Banks and Grant (inaudible 16:03:25).

Q. Yes and they had the primary role working around the personality issue that Mrs Tapper referred to?

A. When I came along there was definitely a conscious effort to shift the onus off Graeme Tapper dealing directly with Alan Reay Consultants and which is where I say he'd brought me in as a sort of intermediary position so I was effectively carrying out the same work under instruction with other people on the receiving end who I think were effectively receiving the same instructions in a similar sense from Alan Reay and I say that because their responses were of the same ilk and in my view they were – I worked with Geoff Banks for several years and I was at university with him and that was not his nature to respond in that manner from my understanding of him.

Q. Now just going to move from the Council matters to a small number of questions about Landsborough House which you discussed in your evidence. Am I right that that was the first four storey plus gravity frame building that you designed?

A. Landsborough House?

Q. Mmm.

A. No that was, no that was – I'd done a number before that.

Q. A number that had actually gone to construction or just design?

A. The ones that had gone to construction were – when I say design this as part of a group?

Q. Yes.

A. Canterbury Savings Bank which is Westpac. That was a 13 storey building.

Q. That's at the time you were at Holmes Wood?

A. Holmes, yeah. The AA Centre in Wellington which is 14 storeys, the Union House building in Auckland was 12 storeys base isolated, Fletcher Challenge House in Lambton Quay which was 21 storeys which Andy Buchanan and Russell Poole had done and I helped to finish that one off. Waring Taylor, Featherston Street in Wellington five storeys. There's probably some others.

Q. But those are the ones that come to mind and they were Holmes Wood stage?

A. They were Holmes Wood, yeah.

5 Q. So the difference then was simply that when you came to Alan Reay Consulting Engineer and did Landsborough House instead of the team, you were doing it by yourself?

A. Essentially yes, oh yes.

Q. And did you find that a difficult transition?

10 A. Well as I said before it was lonely really, I, yeah, it wasn't, certainly wasn't that happy about it. I mean I coped with it, you know you aren't unenthusiastic I suppose but –

Q. It wasn't what you expected?

A. It wasn't what I expected no.

15 Q. Could we have WIT.JACOBS.1001.4 please. I'm not sure whether you've had an opportunity to consider Mr Jacobs' evidence?

A. I haven't seen anything no.

Q. I'm just going to ask you one question when we have it up on the screen. If you have a look at paragraph 12 please and you'll need to read paragraph 11 and then go to paragraph 12.

20 1607

A. Yes okay I've read it.

Q. My question about Landsborough is that if Dr Jacobs is correct in that proposition do you agree the same criticism would apply to Landsborough?

25 A. The operative word there is "practicable", and that was, that had a huge amount of flexibility on it. Practicable doesn't mean to say, it means possible, practicable is interpreted as how it can be fitted to the situation and still work essentially because there's so much different requirement for what people wanted but I mean obviously what it's indicating is not, try and get it symmetrical if you can.

30

Q. So from your view Landsborough would meet 3.1 on symmetry?

A. Yes.

- Q. Does it then follow that CTV building would similarly meet 3.1, sorry 3.11 on symmetry.
- A. Look put it this way I wouldn't challenge the design of the building on that clause myself. Even though its intent is clear, as I say, there's a fair amount of leeway was given in those days to the word "practicable."
- 5 Q. And if we could just go over two pages please to 1.6. This is in relation to columns and you will see that, again this is Dr Jacobs commenting on the columns in the CTV building. You'll see that he first states the code provision and then goes to paragraph 16 and I'm just going to ask you to
- 10 read that to yourself and then ask whether you consider the same criticism would apply to Landsborough.
- A. Paragraph 16?
- Q. Yes.
- A. Okay you want my comment on that?
- 15 Q. Yes. Well the question was, does the same criticism or proposition apply to Landsborough?
- A. I have to give you a more detailed answer than a yes/or there.
- Q. I'm not asking you for a yes/no, I'm asking you to put it the way you'd wish to put it.
- 20 A. I mean the first thing here is that, I mean these paragraphs can all look very well if they're taking out of the context but the context is that the buildings, these buildings, the fundamental premise is that their gravity load structure is protected by stiff shear walls and whilst that holds there's not a problem. If your walls aren't stiff or the building's flexible
- 25 for other reasons, say because it twists a lot, then suddenly, yes, the beams and the columns are vulnerable and if there's excess load on them over and above what they were originally intended for which was very little then they're brittle and the structure's in trouble. So the key thing is the walls must be of a requisite stiffness and that's what the
- 30 designer needs to satisfy himself with, with this type of design.
- Q. Now lastly Mr Henry but lastly I'm afraid involves several questions. You may know that in response to your brief of evidence Mr Harding

replied to a number of the points in your brief. Have you had the opportunity to consider those?

A. I have, yes.

5 Q. Yes. Well Mr Harding's counsel, Mr Kirkland, is, as I think you've already been told is not here today, and I want you to understand that in putting Mr Harding's responses to your brief I am doing that so you may deal with the issues. I'm not necessarily indicating that the party that I represent agrees with the statement, if you follow the difference.

A. Okay, yep.

10 Q. Now the first reference is in reply to your paragraph 97 of your brief, and you may want to turn to paragraph 97 –

A. Okay.

15 Q. And in his reply [the reference Sir is WIT.HARDING.0001A.4 but I'm not suggesting it needs to be put up] Mr Harding says, "I agree that the performance of the south coupled shear wall was critical in protecting the gravity system against horizontal loading. As stated in my main evidence I believe that the substantially undamaged condition of the coupling beams in the south shear wall is evidence that this wall performed its function satisfactorily". Would you agree with that?

20 A. Well I, I don't, I don't agree on the basis that, from what I've seen I can't believe or convince myself that the south coupled shear wall wasn't damaged. I think it was damaged but I, in saying that, there is, it's questionable how much damage because of the way that the remnants were moved around.

25 Q. Yes. The difficulty is if we don't have the forensic opportunity to examine the ruins. That's really the problem isn't it?

A. But I make my comments on the basis that I have had the opportunity to inspect other buildings with coupled shear walls in them.

Q. Yes.

30 A. Three or four and I've seen the type damage they have after, also June the 13<sup>th</sup> of top of February 22 and December the 23<sup>rd</sup> and how it changes and some of Canterbury, Westpac has got very little damage in the coupling beams, only at level 2, 3 I think where the structure

became somewhat, had an extra opening and disturbed the pattern. Other buildings I've seen a range of damage and what I saw in the CTV building was not the pictures that have been shown by Frost and, I'm sorry, the Australian –

5 Q. Dr Heywood.

A. Yeah they indicated that there wasn't any damage from, when the wall was laying down and I think, well, okay, were they looking in the right places, was the wall actually bent like that and squashed all the cracks shut, was it hairline cracking which later after moving the pieces around  
10 became weak and opened up, because the photographs that really, strangely, coincidentally I just took on my home one day when I'd been in the red zone show classic cracking of the coupling beams at level 2 and some of the shear cracking in the side panels, also classic cracking near the base. I got out Professor Paulay's scale model test he did and  
15 you can hold the two together and look at them and you can see the same crack patterns. Now someone suggested well maybe that was from a contractor moving it around but, but you know to crack one of those panels either side of the door you need like a 1000 kilonewtons to crack them and to get that sort of load into them you've got, you'd have  
20 to drop it from a massive height onto solid concrete and on a particular angle so that you can lift the thing up and move it around and you won't crack those sides. You might twist the coupling beam and you might wreak damage that was there in a final sense to open it up, make it look worse but my judgment, strong sense from what I've seen and also  
25 particularly that the damage is limited to the lower two storeys because this has also been a very strong feature that that's where all the damage happens and I know from designing them that there is like a bulge in the shear diagram. The top drops off very quickly and so you get this big bulge and stresses around level 2 and 3 and the top storeys which are  
30 usually sort of put in for a practical nature, all the same, they become over-strength and so they don't get subjected to the bigger forces. So there's a concentration around levels 2 and 3. That's where the cracking's happened. That's where it was on what I saw in the



remnants. So my own view subject to, you'll never know how much they got moved around, is that I think it did suffer yielding damage in that area.

- 5 Q. Just some small points arising out of your answer. Firstly you said the December 23 earthquake. Did you mean the December 26 earthquake? The Boxing Day earthquake?

**JUSTICE COOPER:**

Or were you referring to the earthquake at the end of last year?

10

**MR HENRY:**

Yes, end of last year.

**MR RENNIE:**

- 15 I'm sorry. Thank you Sir.

**CROSS-EXAMINATION CONTINUES: MR RENNIE**

A. The building standard had been through the whole lot of the earthquakes, yeah.

- 20 Q. Yes. The second thing is you made a demonstration with your hands which of course won't make it into the transcript. When you put your hands together and pressed down were you indicating the wall being under compression at that time and closing up the cracks?

A. Yes I have looked back at the photographs to see -  
1617

- 25 Q. I'm just trying to make sure that what you were describing –

A. Yes.

Q. – is fairly recorded?

- A. Yes the wall folded, the south wall folded over a collapsed floor of that level one and then laid sort of flat and I questioned whether the wall was  
30 flat or sagging in which case it would close all cracks, or whether it was hogging and bending the other way or both and in which areas and so what I'm really saying it's possible that the people inspecting when it

was first fallen may not have been aware of cracks because of the way the wall had sagged and therefore didn't see them.

Q. The third point is you referred to some photographs that you yourself took.

5 A. Yes.

Q. Am I right that they were photographs of the CTV building?

A. Yes they were remnants which were laying on the site. I was in there a lot in the red zone and I used to drive past and I saw the remnants there as I did on other occasions, went and had a look and the shear wall, I think there was three segments were laying there, and marked up with spray paint and I photographed them in thinking, okay the forensic boys have been here and they recorded all this but I'm going to have a photo anyway because it's interesting and I was quite surprised that no other photographs like that turned up in any evidence that I've seen and why was I the only one that had photographs of it.

10

15

Q. And are those photographs that you've relied on in your evidence?

A. In the sense I've just described.

Q. But they're not as I understand it presented by you as part of that evidence is that correct?

20 A. You mean in my written evidence. No the evidence is talking about it from the design point of view. In other words whether the building collapsed or not this was the situation I see or saw.

Q. Do you feel your photographs have captured relevant matters? Do you think the Commission would be assisted by them being available?

25 A. They are available. They've got numbers on them and all. I think they have been shown by, it might have been one of your colleagues actually. He said he challenged Mr Frost's evidence with it.

Q. Now going on with Mr Harding's response to your paragraph 99 I'm at now and his response was to your paragraph 99 that it's noted that the shear core is connected to the floor diaphragm by reinforcing from the walls and by the connection of the floor beam. The concrete slabs surround more of the core but the type of reinforcement connection is

30

the same as the CTV building and it does not include drag bars. Do you agree with that?

5 A. Yes I think what he's trying to say there is that there wasn't drag bars in Landsborough House therefore it was okay that I didn't have them. The Landsborough House connection was by a different, well it is a different system. It had a spanner effect is the best way for the layperson's point of view to describe it and it didn't have drag bar reinforcing coming out of the main wall under the slab and at that time that era that was how the floor diaphragms were viewed essentially that they, we have a lot of reinforcing crossing between the walls and the slab which clamped on with shear friction and there was a bearing factor of the floor topping bearing against the walls so that if you imagine you're trying to undo the wheel nut on your car and you put a spanner on it, an open spanner it wants to slip off and round the corners. If you welded that spanner on it won't come off. That is like the same effect as having the reinforcing crossing from the slab through the walls into the slab on the other side. Landsborough House had that gripping effect like that and there was a bearing effect on the ends of the main wall which if you do the numbers which I have done to back check it because when I saw it I thought anyway it works.

20 Q. You just described what I was about to ask you which is that your spanner is an open spanner and not a ring spanner and the effect is achieved by it encircling the shear wall rather than being fixed directly to it?

25 A. A ring spanner is much, much better which was what you have when you move it into the diaphragm. To have the open spanner as I say you get the slipping off the nut effect.

Q. Yes.

30 A. But it's like as I say weld the spanner onto the nut with the bars crossing and that stops it happening. For the north-south direction on Landsborough there's heaps of reinforcing for that. On the east-west according to my calculations that the equivalent of that welding is also plenty for the torsion. The direct force is taken by the bearing on the

end of the wall. No today you wouldn't do that and I know that was the message we used at Holmes in several jobs but definitely today you would put a collective beam in there to poke right into that wall and make sure it went in.

5 Q. And are you saying in essence to Mr Harding's response though that he failed to understand that that was how the Landsborough system worked?

A. I maybe didn't realise the tongue of slab poking into the toilet area is what he's meaning with the similar connection. He means I believe that  
10 he's got reinforcing starters out of the walls and the slab and that's like the welding a nut on. This tongue sticking out I think it was a reasonable for the east-west load it had a reasonable chance for a load that moved uniformly, concentrically as if there's no twisting but as soon as the twisting effect came on then there is a, well put it in another  
15 layman's terms like a claw hammer effect where the drag ties are being ripped out, like a claw hammer pulling out a nail and that's where the things start to depart wildly from what Landsborough House is. There's more to it than that but in a general sense I think it gets the picture across.

20 Q. Now you know that Dr Reay also replied to sections of your brief in his brief of evidence and you considered those I take it.

A. I didn't quite catch that sorry.

Q. Do you know that Dr Reay also replied to your brief?

A. Yes I've seen that.

25 Q. You've seen that. I think we've covered maybe two exceptions everything that he raised and I just ask you to turn to paragraph 100 of your brief.

A. Yes.

Q. Probably if you just look at 100 and 101 you refer to the location of the  
30 gravity beams in Landsborough House and the CTV building?

A. Yes.

Q. And Dr Reay says the code has no requirement regarding gravity beam alignment. Do you agree with that?

A. No there's no contesting that, nothing to contend there.

Q. He says because the buildings are approximately square this potential benefit is not significant. One benefit of the floor beams located as they were on the line of the north-south shear walls is that they could also act as drag bars in the north-south direction would you accept that?

5

A. Well I agree that the beams being located there does create that opportunity. In fact there was some reinforcing from those beams into the shear walls with a drag bar effect, but the sentence before that what was that about?

10

Q. The code has no require, sorry I've read that. Because the buildings are approximately square this potential benefit is not significant.

A. That doesn't really make sense to me because as I've said in evidence it's clear that if you have the beams running at right angles to the critical direction for torsion then you have eliminated the frame action in the critical direction so that there are no beams acting in the, in the primary sense of the frame action. There are no beams actually on those columns to put the forces into them that are actually are the problem.

15

Q. And at paragraph 105 you state there were no floor beams to restrain the columns in Landsborough House?

20

A. In the east-west direction which is what Dr Reay has left off.

Q. Right. He says that he disagrees with you and says there were beams and they restrained the columns in the north-south direction so in fact what you've just put maybe reconciled to what Dr Reay says.

25

A. Well what I'm saying they were to the east-west direction when you put that in there it makes sense. Yes there were beams in the north-south direction. I think I said the building was concentric. No torsional problems in the north-south direction and the walls are very stiff in the north-south direction such that, I mean it's hard to say without, to show you without the ETABS output. The deflections were not a problem in that direction so that we're only worried about the east-west where there are no beams.

30

Q. He proposes that the torsional, sorry try again he proposes that the beam floor system had torsional strength which would could induce actions in the columns in the east-west direction?

1627

5 A. Yes that is a secondary action. It's probably in the order of about 10 percent of the forces that you would get from a frame being in that direction. What he's trying to say is that here's your column, here's a frame, here's a beam coming in like that and this column being that way, that this action is going to twist that beam and that beam is going to resist. Well by inspection from my experience in working out torsions in beams, my view is that's not a problem. When I saw that I did a calculation to double check it and I got the cracking torque of the beam to be about 20 kilonewton metres versus the actual gravity bending load moments of more than like 300 so it's that sort of order, in other words 10 once the beam cracks it loses any stiffness. The only way that torsion can really get in there, anything to resist that, is by the topping slab from the floor which is relatively thin and only the – you know, there's not the – I'm trying to say there's very little then to create that torque in my view. If someone was to do a rigorous analysis of that I'd be surprised if they 15 could come up with a different answer.

20

Q. Through the matters that we've been discussing you've referred to the information sources that you used for presenting your evidence. We identified that you didn't have discussions of any significance with Mr Harding or with Alan Reay Consultants Limited. Did you have discussions with Dr Hyland or Mr Smith or any other persons from the DBH team? 25

A. I had discussions with Dr Hyland and I got the information from him that I mentioned.

Q. And were you satisfied that from the DBH team you were able to obtain the information that you needed for giving your evidence? 30

A. They supplied whatever I asked for, is that's what you mean?

Q. Yes.

A. Yeah.

Q. There's really two strings to that of course, one is did they give you what you asked for, and do you consider that everything you got was all you needed?

5 A. The point of asking for that information was, I was trying to put myself in the shoes of I'd just done the analysis and I wanted to check the certain things which are, you know, part of the – part of what you do. The first thing is the base shears and every design that I did, the first thing was to get the base shears, a plan of those where they all go in a building to make sure they add up in both directions and the second thing is what are the deflections and Clark Hyland gave me that information.

10

Q. And can you confirm that you did not at any time ask Dr Reay or Alan Reay Consultants Limited for any information?

A. That's correct.

Q. And therefore by extension that you were not refused any information?

15

A. Ah definitely, no correct, yes.

#### **CROSS-EXAMINATION: MR LAING**

Q. Good afternoon Mr Henry. Yesterday you talked about the advent of the Building Act 1991 and you made reference to producer statements and then I think you went on to talk about design certificates and I'd just like to ask you a few questions around the two regimes. I think you came to the Council round the time the Building Act 1991 came into force. Is that right?

20

A. Yes.

Q. And you were obviously heavily involved in setting up some new systems for the Council?

25

A. I was yes.

Q. Can you explain to me what the role of a producer statement was from there onwards. Was it always required by the Council for a structural design?

30

A. Basically yes. Would have to be a very small design not to get one.

Q. Yes, and so typically for a large commercial building there would be a producer statement that dealt with the structural design and the issue of compliance with the then building code. Would that be correct?

A. Yes.

5 Q. And when you got such a producer statement, what role did you then have in terms of checking the – any documents, the plans, the specifications, any calculations?

A. Well it'd depend on the building and who designed it. Every time you would have looked at the documents including the drawings. We may have asked for the calculations, they may have been supplied and  
10 depending on what we were looking at, that could vary.

Q. Yes, but for a, say a multi-storey commercial office building you would look at that producer statement to make sure that it covered the relevant design structural code requirements, but you'd also do some, obviously  
15 some additional checking as well. Is that right?

A. You'd make sure the producer statement said what it was supposed to say about the building.

Q. Yes.

A. And, yeah actually the – what was the question after that?

20 Q. I'll re-phrase the question for you. So you would have received a producer statement, you would look at it to make sure that it covered the various design structural documents, make sure it covered the right ambit of documents, but you'd also look at the plans, the specifications and calculations if you had them. Is that the process?

25 A. We'd definitely look at all those things. Whether the calculations were supplied or not was a different matter. I think there was a period there where the calculations were not compulsory with a building application, and although it didn't matter, we'd soon ask for them but some consultants put them in anyway.

30 Q. Right. And so can I just now contrast the situation before the Building Act came into force. I'd just like you to use your own knowledge and experience as a consultant from the mid-eighties to when the Building Act came into force. You – I think you said yesterday that when you



were at Holmes that design certificates were the norm to be provided to the Council?

A. Yes, actually look if you won't mind if I just go back a wee bit, because when you said just to contrast, that was before the Building Act.

5 Q. Yes.

A. What I was – I can see what you're trying to get at. The procedures with what we would ask for and what we would do with that information got more stringent as things went along under the Building Act and that – that was over the period of 92 to 95 when I was there, and this was part of the reviewing process that was going in place, so a big building that came in it ended up there would be quite definite requirements to supply information for an external reviewer. So that built up, is the best answer and so before that the process was there maybe calculations, there may not, may ask for them, may not but you would always expect a design certificate.

15

Q. Yes.

A. If not you'd ask for that definitely. The idea was to get the design certificate, that was the key piece of information that, or that was the statement that connected the responsibility to the consultant.

20 Q. Yes, so there was obviously importance in terms of the producer statement as being the consultant's sign off and certification that there was compliance with the building code?

A. Definitely, in fact asking for the calculations was – at times there was a feeling it was taking on board more liability than was necessary because if you asked for the calculations, it would be assumed that you would actually review them and the Council would pick up liability because of that. So to an extent, I can't remember the times exactly, it was more of a case of get the – if it looks all right, drawings okay, get the producer statement and away you go, 'cos don't look too deep, don't get into trouble basically.

30

Q. Yes, thank you for that. Now if we just go back to the situation prior to the Building Act under the Building Bylaws and if you could, if I could just ask you to recall your practice or Holmes' practice at the time that

roundabout the CTV building was built and did I understand your evidence, did I understand your evidence correctly to say that it would be the norm for Holmes to provide a, or any other consultant of the day to provide a design certificate to the Council?

5 A. Yes that was normal.

Q. Could I get you to look at a document please BUI.CAS.056.0001.15 please. Can you see that all right?

A. Yes.

1637

10 Q. And that's a document relating to the Westpac, Westpark Tower.

A. Yes.

Q. But is it Cashel Street?

A. Mmm.

15 Q. Is that the sort of document that you would have provided to the Council, in IPENZ form?

A. ACENZ form.

Q. ACENZ form. Sorry.

A. That's correct, yes.

Q. So that's a typical document that would be provided?

20 A. They came in a book, a standard book supplied I think by ACENZ with carbon copies and whatnot.

Q. Yes. So was it the situation that that form of design of certificate was volunteered by the firms that you worked for or was it only provided if it was requested?

25 A. No it was supplied as a matter of course. If it wasn't it would be an oversight or something like that or a job in a hurry whatever but I don't think that, even that would have been reality really.

30 Q. Yes and clearly the Council would place some importance on that document as being the design professionals' sign off on the questions of compliance with the relevant standards?

A. Definitely. Absolutely.

Q. Yes and I think that one is actually designed by Dr Reay.

A. Yes.

Q. Thank you. Now just coming to the vexed question of the relationship between Mr Bluck and Mr Tapper. Now –

**JUSTICE COOPER TO MR LAING:**

5 Q. Mr Laing just, I'm sorry if you're moving on, tell me because I don't know. Was the provision of a design certificate – I'm asking Mr Laing this question really – is the Council's case that provision of design certificates was mandatory?

A. No, the, the – when I open the Council's case I will take you through the  
10 building bylaw 105 from 1985.

Q. Yes.

A. And that clearly states that, well there are some circumstances where a design features report could be requested and otherwise you could provide calculations or provide a form of design certificate. So they  
15 were alternatives.

Q. All right.

A. So I'm not suggesting to this witness that they, that was mandatory.

Q. No, no I wasn't, I wasn't suggesting that you were. I was just curious as to what the position was.

20 A. No.

**CROSS-EXAMINATION CONTINUES: MR LAING**

Q. So if I can just turn to this relationship and obviously you saw these people in two different roles. Prior to you going to the Council you were a structural engineer working in Christchurch and you saw them, you  
25 saw them at that time obviously?

A. Saw them, saw who, the?

Q. Mr Bluck and Mr Tapper.

A. Yes.

Q. You saw them at meetings of engineers?

30 A. Yes, yes.

Q. What was your involvement with them on any buildings that you were designing? Did you have any direct involvement?

- 5 A. Jobs like the Parkroyal and Price Waterhouse Centre I had involvement, making arrangements for design-build staged consents and that meant agreeing that we would give documentation up to a certain level or point sufficient for them to see that, say, the foundations had been, the building had been thought through. In other words we'd give foundation details and details to level 1 and then we'd give carcass for the rest of it and they would trust us to finish the design off accordingly.
- Q. And do I take it they dealt with you in a professional manner and you had no –
- 10 A. We, I think we did it in writing. I think we agreed the stages and it was quite formal, yep.
- Q. Did you ever receive a letter of the kind that Mr Tapper wrote to Alan Reay requesting further information or –
- 15 A. Not of that, I just don't think I did. I don't recall. He may have sent a letter asking for something. It could vary widely what he'd ask for. He might ask for better drawings or more drawings. When I say better, if you gave him some, say for a staged consent he wanted to see more but even then I'm, I'm floundering a bit to really say that would even be definite. I can't remember receiving any letters like that.
- 20 Q. At that stage you, you were not aware of, you did not see any evidence of personality clashes between Mr Bluck and Mr Tapper at that stage of your career?
- A. I didn't have any idea about that until I entered the building and shouldered it.
- 25 Q. Well maybe we could just come to that and I appreciate you've answered a lot of questions on this topic already but just looking at the respective roles of Mr Tapper and Mr Bluck clearly ultimately, I won't perhaps use the word buck but ultimately Mr Bluck was the chief building design engineer wasn't he and ultimately in terms of the, he had
- 30 to, ultimately he was the one who had to take responsibility for any decision that was made. Would that be correct?

- A. Well in the sense that he was the manager and had the title I think of building and (inaudible 16:42:58) engineer I think ultimately it was his responsibility, yes.
- Q. Yes and so if there was deadlock whether it was with Alan Reay or  
5 some other consulting engineer that was his role wasn't it?
- A. If there was what?
- Q. If there was disagreement between Mr Tapper and a consulting engineering ultimately Mr Bluck as being the person in charge of the building control unit had to make that decision didn't he?
- 10 A. Yes I'd say so.
- Q. Yes. Thank you. Could I just take you back to the Tapper letter of 27 August.
- A. Yes.
- Q. I just want to ask you a few questions about that. That's  
15 WIT.HENRY.0001.79. Now I think you've already said that the matters that Mr Tapper was raising in this letter were the things that you had some concerns about as well.
- A. Well I, I agree that I would have concerns about other things in that letter. What I didn't say is I had a concern about other things as well.
- 20 Q. No and that letter was written clearly before the Council had received any calculations?
- A. Yes.
- Q. So it must have been a review based on the plans and specifications that had been received to date.
- 25 A. It must have been, yep.
- Q. That seems to follow doesn't it?
- A. Yep, must have been, yep.
- Q. And would it be fair to say that Mr Tapper has done a thorough job in going through the plans?
- 30 A. I would say he had a really good look through and, yeah that, that, because he hasn't, the big structural issues there that he's picked up are the diaphragm connections in the columns. Whether or not he has

perceived anything beyond that is not clear from that letter but he's certainly had a darn good look at it.

Q. Yes at that stage he only had the benefit of the structural drawings but not the calculations in support of it.

5 A. Yes, yep.

Q. And at that stage at least what he's signalling on page 2 at the top there, that's in relation to S15 & 16 are the sort of concerns that, or matters that you obviously thought of as well.

A. Yes.

10 Q. Now I'd just like to go onto a different topic and my friend Mr Rennie has already referred to a Mr Nichols who's going to give evidence and could I have WIT.NICHOLS.0001.2 please and just for explanation Mr Henry Mr Nichols worked for the Christchurch City Council between 1978 and 1984 so obviously well before you were there.

15 A. Yeah.

Q. Could I ask you to look at, go to the next page and look at paragraph 11, it's 1.3, and could I ask that the last sentence in paragraph 11 be highlighted, expanded.

A. Yes that's about –

20 1647

Q. I'll read it to you, "During the period I worked with Bryan I was aware that his acknowledged expertise was being utilised by his periodic appointment as a committee representative, responsible for the preparation number of New Zealand standard bylaw documents." Were you aware that Mr Bluck had that involvement?

25

A. I was yes.

Q. Yes, and would you accept that statement there that he had a knowledge expertise?

30

A. What I think is that as happened with me there also people, on code writing committees, wanted input from local authority engineers so they were getting the full picture of what they were doing because the local authority engineers come into contact with so much of what's going on in the town, and all the different engineering methods and so there's

5 great value in having someone like Bryan Bluck on a committee like that  
but what I would – and whilst Bryan had, he had really good  
fundamental understanding of buildings and structures, like anybody  
who doesn't do the hands on day to day design the nuances and  
intricacies of the code are just not encountered and so I have indicated  
10 this earlier in my evidence, you can know the fundamentals, you can  
know what to look for but if it comes down to the nitty gritty of which  
code clauses will match up and what to use, if you're not doing that  
intensely on a regular basis then it's just another thing and you can't go  
there, and that's what I'm really saying that Bryan wasn't involved to that  
level of degree. We had expertise to adjudicate it in that detail but he  
could stand back, he could say that floor diaphragm doesn't look like it's  
connected properly to me but I wouldn't have expected him to say, for  
15 example on the CTV building that south coupled shear wall looks soft, I  
wouldn't expect that at all. He just wouldn't have had that sort of  
variance.

Q. But that's something you think that Mr Tapper would have been able to,  
or obviously did have?

20 A. I think he would have been suspicious about it but he wouldn't – I don't  
think he would have done enough of that sort of design to probably pick  
the significance of it, I would say.

Q. Would the problem really have been at the time that this form of design  
was fairly new?

25 A. No not at all. This type of shear wall protected gravity load system had  
been going on for, I mean the Holmes ones that I talked about earlier  
and I think 1977 was the earliest one and there's probably more before  
that, the idea of if you provide just the st..., earthquake resistance in the  
shear walls and you have the secondary column and beam system  
that's not new, no.

30 Q. Not new by itself but for a design that's applicable to the CTV building  
was clearly one that was perhaps if I could use the words not in the  
ordinary?

A. Absolutely not in the ordinary at all.

Q. And that for a Council engineer might be quite challenging to unravel?

A. I agree.

Q. And just coming back though to the time when you were there, clearly when there was some dispute and maybe with Alan Reay, it may have  
5 been with somebody else, but when it came to debating that dispute, that was something that you would have put your own expertise, undoubted expertise into wouldn't it?

A. I did contribute yes.

Q. And you would put your views obviously to Mr Bluck before any decision  
10 was going to be made?

A. Yeah, I would say my recollection is that he definitely knew what was going on, if not the detail.

Q. So somebody like Mr Bluck, he had a good working knowledge of design and obviously compliance, but ultimately one of the merits of that  
15 sort of debate would be that people like you could contribute to that debate and deal with some of the real fundamentals in the –

A. Yes.

#### **RE-EXAMINATION: MR MILLS – NIL**

#### **QUESTIONS FROM COMMISSIONER FENWICK:**

20 Q. There are two points. Just quickly the first one, in the 1980s what would you have assumed in terms of the stiffness of the ground, flexibility of the ground under a shear wall. What would have been the standard code?

A. The standard was in my experience was to assume that it was rigid. We  
25 didn't do any special analysis of the ground stiffness except for, I remember we did it for – we used ReMoKo, a university programme, I think it was the Union house building, remember doing the base isolation.

Q. Is that the building in Auckland on the waterfront? Is that the building in  
30 Auckland Mr Henry?



A. Yes, that's – it was a specialist thing to include the ground stiffness and not standard.

5 Q. The question relates to the south wall. We did actually send out a minute to different groups and asked the engineers to look at it and it won't have gone to you but I was interested to get the reactions of how that south wall would have performed as a coupled shear wall. We did get a response from Professor Mander and I don't know, you've probably did not see his response.

A. I saw some of it. I can't remember what he said about that.

10 Q. Yes.

A. Well, yes, yes he reckoned the base yielded didn't he, he reckoned the base yielded.

15 Q. Not quite but the point I'm putting is you've got a wall with five or six coupling beams in it and you've got axial load on that wall. Now the strength, if the strength of the coupling beams is high, if the shear you can transfer across those coupling beams is higher than the total axial load, acting on that part of the wall and the tension force and the reinforcement at the bottom of the wall, can that wall act as a coupling beam? Is that a point you've considered, well could those diagonal members actually yield, you with me? It's rather hard to visualise.

20 A. Yeah, I'm totally not with you actually but are you meaning, are you talking about or trying to take account of the contribution of axial load to the hold down?

25 Q. Split the beam down the middle so you go through the coupling beams and from the coupling beams you can calculate how much shear can be transferred. Now if the shear's got to be transferred, if you've got compression on one side of the coupling beam and you've got tension on the other, then the shear, if the force has got to be – if the shear strength is more than the axial load and the tension force at the bottom, then if the shear strength is greater than that then it's not going to act as a coupling beam. The shear reinforcement cannot – the diagonal reinforcement cannot yield can it?

30

A. So you mean that's effectively the coupling beams are over designed compared to tensile hold down?

Q. Yes.

A. Yes, they can't act as coupling beams, of not yielding coupling beams.

5 Q. Right, well that was my – that was – I'm trying to get people to look at it and comment on that. When I did it, it looked marginal but I mean I wanted someone to confirm that because you can make different approximations and so on.

A. Yes.

10 Q. Can we have BUI.MAD249.0493.2 please. So this is what I was trying to get at and this is probably a feature which doesn't appear in our standards but I was just curious as to whether it might have been a problem in the CTV. Now my calculations may be wrong, they are very crude but as far as I could see the coupling beams were marginal. But if  
15 you look at that when the compression member is always stronger than the tension because there is concrete confined and there's concrete rounded, while in tension you've only got the reinforcement so when you rock it to one side, you get what we call is elongation.

A. Right.

20 Q. Diagonal becomes longer and you'll be familiar with that and then you realise that those coupling beams are lined up with floor slabs so if you've got elongation in the coupling beams, something has to give in the floor slab.

A. Yeah.

25 1657

Q. So would you agree with me those floor slabs actually might strengthen those coupling beams?

A. Yes I would and we didn't use to account for that.

30 Q. Yes that's right. I mean that's something that's just come out in the last, it's taken a long time for the engineering profession to recognise it. It came out 30 years ago but they're recognising it now.

A. And it would have a disproportionately greater effect in the upper storeys where the forces were less which may be another reason why I haven't

seen cracking up there but at the bulge in the shear forces they're at level two.

5 Q. Yes of course the problem here is that you're restraining those elongations actually they're something to the bottom walls too. They start acting in a different manner actually. The whole wall becomes stronger but –

A. Frame action going.

Q. That's right. It's very different and the strains in the reinforcement are very different.

10 A. Clarke Hyland he did say that he thought that the wall had acted more as a cantilever shear wall and he was indicating that he thought the block wall had sort of in part caused that which I didn't see enough strength in that block wall to do that but what you're saying makes more sense.

15 Q. It's just a posture of the mind and I was hoping to get some feedback. I mean you might be interested to just look at it and I'd be interested in your comments to see. The fact that that wall was stronger than intended I don't think would have helped but I'd be interested in your reaction. I'm only putting it out as you might just like to consider that particular point.

20 A. I think what we found in our calculations at Eliot Sinclair was that by reducing the demand on the wall and therefore corresponding the, reducing tensile requirement at the base of the wall for reinforcing steel that the stiffness dropped almost linearly at the same rate and my own view is that it's the softness of that wall as opposed to its strength that's the issue and for example the capacity of the wall due to just the weight of the load, the gravity load is about six or 7000 kNm and the start position for the static load of .77 period I think was about 28,000 kNm for design and that was about a quarter but in the end I think the capacity was about 12,000 kNm of a design and Clarke Hyland calculated a capacity along those lines. Actually that is another piece of information I'm sorry I didn't remember before. I did ask him for that.

30 He's had it in his report and I was comparing the stiffness of the north

- end and the south end is like 168,000 kNm on the north core and 12 on the south which is an extraordinary difference but it wasn't as bad as that because I think the north core rocked about half that but it was still enough to make a disparate difference but what I'm really getting at is
- 5 by reducing the demand on the wall and therefore reinforcing content of those values the crack value right at the base was something like about a third of what assumed when it was inputted into the ETABS program and my view is that the softness of the wall is what made the building susceptible to deflections –
- 10 Q. There's another point and I'm sorry to drag on just I see it's getting to 5 o'clock but there's one other you would be familiar with Professor Paulay's coupled walls and how they perform. I mean the thing that's remarkable about them when you displaced a coupling beam yield but when it stops yielding it retains a lot of its stiffness.
- 15 A. I mean, that's the thing about the land of the –  
 Q. I mean it's beautiful and that was the critical issue –  
 A. (overtalking 17:01:29).  
 Q. So that's important I mean if it degrades and stuff you're in trouble so it doesn't so it always (inaudible 17:01:33) and retains it. Now if of course
- 20 the wall is yielding at the bottom it's not acting like a coupling wall. Do you agree it's actually going to degrade in stiffness?  
 A. Yes and get either classic flutations at the hinge at the base.  
 Q. There's another aspect which comes in there which would not be fair to people who have not studied Professor Pauley's coupling systems.
- 25 Thank you.

#### **QUESTIONS FROM COMMISSIONER CARTER:**

- Q. I'd like to ask you some questions about the forensic examination that Mr Frost and Dr Heywood carried out, and are you familiar with their observations?
- 30 A. I did watch as much as I could of that.  
 Q. The thing of interest to me and to us is the dynamic analysis is an analysis that looks at the progressive behaviour of the structure as it





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