

HEARING RESUMES ON WEDNESDAY 1 AUGUST 2012 AT 9.30 AM

ALAN MICHAEL REAY (RE-SWORN)

5 **MR KIRKLAND:**

Firstly Sir in respect to one of the two addresses in Moorhouse Avenue. I've been provided those by Mr Mills.

JUSTICE COOPER:

10 I see that.

CROSS-EXAMINATION CONTINUES: MR KIRKLAND

Q. Dr Reay, I just want to re-track a couple of steps from yesterday to pick up the threads but in terms of the contact with Mr Harding in 1985, this is before he came across to you for the second time, he says in about
15 August 1985, "I was offered an opportunity to return to Alan Reay Consultants Limited. Alan advised me that since my earlier employment with this firm that he'd expanded the firm in order to design multi-storey buildings." Is that correct?

A. No the firm wasn't expanded for the purpose of designing specifically
20 multi-storey buildings.

CHECKING MICROPHONES

JUSTICE COOPER:

25 Q. So I think the answer was no the firm wasn't expanded for the purpose of undertaking multi-storey building designs. Is that – words to that effect Dr Reay?

A. Yes.

CROSS-EXAMINATION CONTINUES: MR KIRKLAND

- Q. Dr Reay, you were well aware of the experience that Mr Harding had from his work at Hardie and Anderson. Is that correct, the type of work he was doing there?
- 5 A. Well based on my experience at Hardy and Anderson.
- Q. This was 1973 to 1977 and it was mainly domestic work and single storey factories. Would you accept that?
- A. I understood him to say yesterday that he worked on some strengthening of brick buildings on the corner –
- 10 Q. As well.
- A. – of Manchester and – yeah they're not domestic, they're multi-storey, at least three level buildings.
- Q. And between 1978 and 1980 when he came to your firm for the first time, that was mainly low-rise buildings?
- 15 A. That's correct, yeah.
- Q. And at the Waimairi District Council you were – had a clear understanding of the type of work that Mr Harding undertook there?
- A. Yes I understand that, there was a management role coupled with some engineering.
- 20 Q. And in the main it was civil engineering as opposed to structural engineering?
- A. Yes, although he did some structural engineering associated with the pools I understand.
- Q. And also bridges and bridge maintenance?
- 25 A. Mmm.
- Q. And it was equally clear to you Dr Reay when he came to you he no experience with (1) ETABS?
- A. That's correct.
- Q. And secondly design in multi-storey buildings?
- 30 A. That's correct, except that he had experience in using the particular codes because they're the same codes that are used for the other buildings.

- Q. On the basis Dr Reay of (1) your knowledge of Mr Harding's experience and (2) his lack of experience on those two latter matters that I referred to, did you not think that it was incumbent upon you to supervise and review his work?
- 5 A. He was confident in what he did and the first job he did was actually a four level building which he had no problem at all undertaking and the codes that are used for that building are similar to the codes used for the multi-storey buildings. The only issue that I understood that was the one understanding and using ETABS.
- 10 Q. And the four storey building was that the Medical Accommodation building at 32 Cashel Street?
- A. Yes.
- Q. And that was the static method was used on that building. Is that correct?
- 15 A. I beg your pardon.
- Q. The static method was used on that building?
- A. Yes. That's correct.
- Q. Not ETABS. There's been a little confusion in Mr Harding's mind as whether it was the Westpac Tower building or the CTV building. Let's
- 20 assume that it was the Westpac – Westpark Tower building that he worked on first. That was within a period of two months after he commenced with you. Surely given his inexperience you were called on to supervise and review. He was only with you two months.
- A. Mr Harding's role was a senior role and he – that was a particular role
- 25 he wanted. He's reiterated that here that he wanted to deal with architects, builders and that sort of thing and in that role it was his responsibility to initiate with me any concerns that he has, it was not my role to go and supervise him as I would a graduate.
- Q. And as I understand the evidence in respect to the Westpark Tower
- 30 building, Mr Harding, there was a transition from John Henry to Mr Harding. Correct?
- A. Yes, at the end of the concept design stage I think that's where it was.

Q. And Mr Harding had the benefit of taking over ETABS calculations commenced by Mr Henry. Is that correct?

A. No, I don't think that's right. He redid the ETABS calculations, he didn't take them over, so he re-ran and re-analysed using ETABS is my understanding.

5

Q. And according to your memorandum, four months into the job Mr Harding is now commencing on the CTV building. Is that correct? This is March 1986?

A. I don't think that's right because I thought he joined the company in the late '85 so it wouldn't have been four months. The timing doesn't seem to be correct.

10

Q. The CTV building basically from your point of view Dr Reay, if I can put it this way, Mr Harding was flying solo. Is that a fair description?

A. Yes he was, he took responsibility for it.

15 0940

Q. You will be aware Dr Reay that Mr Harding has given evidence that in his view, that's Mr Harding's view, that without review as I think Mr Harding called it, he in his self-appraisal was of the view that he was not competent to do this building without your assistance. What do you say to that?

20

A. Well he says that now but he never approached me for assistance other, as he says, on one matter and I would have expected him to have turned down the job if that was an issue to him.

Q. I just want to talk about the interplay of the disciplines in the office. One example, I just want to make sure I'm accurate on this Dr Reay, would be a draftsman would take carcass drawings across to, to the engineer to discuss.

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A. I think it's more likely the engineer would go to the draftsman to discuss it.

30

Q. And by way of example the engineer would place the size and the placing of reinforcing on these plans. I'm just taking that as one example.

- A. The engineer would mark up the plan. It may include marking more than reinforcing.
- Q. I'm just, just as one example, and the point I'm making Dr Reay is that there is interplay between engineer and draftsman. The plans wouldn't work unless that happened.
- 5 A. I can't hear you I'm sorry.
- Q. There is interplay between engineers and draftsmen within the office.
- A. Yes, they work together.
- Q. Right.
- 10 A. The, the disciplines work together.
- Q. Mr Harding's evidence is that he had a reasonable belief that he was being reviewed in the office and he was being reviewed in three parts. The first part that he could come to you from time to time. What do you say to that, that your door was open?
- 15 A. My door was open, yes.
- Q. Yes and in a question from His Honour he did come to you on the one occasion I think you've referred to and that is when he couldn't get the ETABS system to work. I think the inter-storey deflections were excessive and he came and had a discussion about whether a south wall would be inserted in the south part of the structure. Is that correct?
- 20 A. I've recorded that I remember a discussion about the south wall but at the time I saw the south wall it was already on the drawing and with regard to the ETABS I have no recollection of him coming to me with a query on ETABS.
- 25 Q. And the second part of the, the belief that Mr Harding had Dr Reay is that you would go across the room and, and talk to the draftsmen and after doing so you would then go across and talk to Mr Harding about design issues.
- A. I don't agree with that. When I talked to the draftsmen it was about the jobs that they were working on for me.
- 30 Q. And the third part of Mr Harding's understanding was that you would talk to the draftsman and if he didn't, if you didn't go to Mr Harding you were happy and it was a form of implied review. Do you agree with that?

A. No I don't.

Q. Okay. So Mr Harding's reasonable belief Dr Reay is, in fact, a mistaken belief in your view?

A. That is, it is a mistaken belief.

5 Q. Can I please have document WIT.REAY.0005.20. Back to your time records Dr Reay. For the period March 1986, and I've taken down to July 1986, that's the 71 hours, and severed that out, that comes to a total of 238.7 hours for Mr Harding and 1.5 hours for you. Would you accept that that's probably from Mr Harding's point of view the majority of time that he was involved in design?

10 A. It would be the majority but it may have run on into August.

Q. August/September is, is time dealing with Council and permits and we come back to that later on but are you saying that you only appropriated 1.5 hours during that period?

15 A. That's correct, yeah.

Q. Mr Harding was on a salary at the time?

A. I don't recall whether it was a salary or an hourly rate.

Q. And it would be important for Mr Harding to record hours for salary budget purposes?

20 A. Yes just as it was for all staff.

Q. But if the client on this occasion was paying your firm's fee by way of a fixed charge it wouldn't be so important for you to record time, other than administrative time.

A. Yes it would have been.

25 Q. Why?

A. Because that way you know the total cost of undertaking the job and you need to keep track of job costs for the future.

Q. In paragraph 32 of your first brief Dr Reay you say in the first line, "There was no review procedure in place at that time." You still stand by that?

30

A. Yes I do.

Q. And given (1) your knowledge of Mr Harding's previous employment, (2) your knowledge that he had no knowledge of using the ETABS system

when he came to you and (3) he had no knowledge of design of multi-storey buildings do you not think this was a, not having a review was an inexcusable abdication of your responsibilities as a principal?

5 A. Not at all. In his senior role it was his responsibility to come to me with issues.

Q. I want to turn now Dr Reay to design issues. In paragraph 51 of your first brief you say in part, "Contrary to Mr Harding's belief I did not design the CTV building." Do you still hold to that?

A. Yes.

10 Q. And you go a step further in paragraph 25 of your composite brief. You say, I quote, "Despite what Mr Harding says I was not involved in the design of the project." Do you still remain with that belief?

A. Could you repeat that please?

0950

15 Q. Yes. This is paragraph 25 of your composite brief. You say "Despite what Mr Harding says I was not involved in the design of the project".

A. Yes, by that I meant in the design of the structure of the building, right, CTV building.

20 Q. Would you accept, Dr Reay, if I can put it bluntly, you and Mr Harding are coming from opposite sides of the bridge on this point? Do you understand what I mean by that?

A. Oh there's a difference of opinion.

Q. In his evidence Dr Reay, paragraph 11 of his main brief, he says Alan consulted with the client and the architect. Is that correct?

25 A. I have no recollection of that and I don't believe I did in terms of the design.

Q. If you did that would be the start or the commencement of the design process, do you agree with that?

A. Yes what I said was I related that to the design process.

30 Q. He goes on to say that you prepared the preliminary calculations and the concept design. What do you say to that?

A. Well I didn't and to have done it you would have to use ETABS as Mr Harding did when he did the preliminary design.

- Q. And arranged for the preliminary architectural drawings to be amended. You didn't do that either?
- A. I don't believe I did that, no.
- Q. You say you 'don't believe' you did that. You possibly could have done it?
- 5 A. I am sure I didn't.
- Q. He goes on to say in paragraph 12 "These drawings were then presented to me and Alan advised me of the reasons for the building layout shown on the drawings". Your response to that?
- 10 A. The discussion I had that I've recorded with Mr Harding was that he explained to me the layout of the building.
- Q. Paragraph 14, "It was agreed that the building could not be designed using the equivalent static method". Mr Harding's evidence was the words 'it is agreed' followed conversation with you. What do you say to that?
- 15 A. I think that was an assumption he made based on the data and the information from the Landsborough House job.
- Q. Paragraph 15, "Alan was aware that I had not used ETABS before" and he goes on to say "Accordingly, Alan provided me with a set of structural calculations and computer input and output sheets that had been prepared by his previous structural engineer". That's correct?
- 20 A. Yes, although originally I understood that was the Landsborough House information –
- Q. Yes.
- 25 A. – but it's more likely to have been, the first time he used it it's more likely to have been the Cashel Street building.
- Q. But these are calculations that were carried out by John Henry, is that correct?
- A. Yes they would have been.
- 30 Q. If you are giving these to Mr Harding are you not part of the design process, part of the team at the office?
- A. I wouldn't necessarily have given them to him. He was familiar with the office, the filing systems and he would have been more than capable of

going into the files and getting the information for himself for whatever job he wanted to look at.

5 Q. Paragraph 16, Mr Harding says “It was determined that the gravity elements and the seismic resisting elements for the CTV building were to be separated in the same way as for the template calculations”. Now his evidence was that the words ‘it was determined’, it was determined after discussion with you.

10 A. He would have taken that from the, and I wouldn't call them template calculations, he would have determined that from the design of the Landsborough House building as an appropriate way of designing the CTV building 'cos of the similarities.

Q. So his determination doesn't follow a conversation or discussion with you about this?

A. Not that I recall, no.

15 Q. But, again, an important design part of the building.

A. That decision is.

20 Q. Paragraph 18, and this is Dr Harding talking about following the ETABS computer run that found the inter-storey deflection was excessive. I think he tried to make the walls thicker but that didn't work. Then he says, in paragraph 18, “I recall discussing with Alan and I recommended that we should add an additional shear wall”. So you accept that conversation took place.

A. I have no recollection of that conversation. My recollection of the southern shear wall was after it was on the drawing.

25 Q. If Mr Harding, Dr Reay, is having problem with the ETABS program, which you accept he did not have experience with, who else has he got to go to in the office to discuss these matters with?

30 A. If he had problems with that he would have either had to go to one of the lecturers at the university who we arranged the access to the program through, or, as he has suggested, he could have gone to John Henry or some other engineer.

Q. Paragraph 20, Mr Harding says “The structural draughtsmen would have prepared carcass drawings for the building according to directions from Alan”. What do you say to that?

A. That’s not correct.

5 Q. Paragraph 21 – “Prior to the submission of the documents for a building consent Alan would review the drawings and calculations”. Is that correct?

A. No that’s not correct.

10 Q. He goes on to say, “In some cases Alan may re-design elements himself or refer them back to me for amendment or re-design”. Is that correct?

A. No.

15 Q. John Henry says, and I go back to paragraph 81, you’ll probably know that paragraph well by now, “He exercised” – this is you – “tight control of the office and was very much in charge of the projects”. I ask you again, Dr Reay, is that an accurate statement on the part of John Henry?

20 A. I exercised management control just as with Mr Harding and Mr Henry. Mr Henry designed the structures as per, as he saw appropriate. I didn’t tell him how to do it.

Q. This is management control as opposed to design control.

A. Yes.

25 Q. At paragraph 23, sorry 22, just before I finish there, “Alan would normally complete the design certificate as principal of the firm”. What do you say to that?

A. I think if there was a design certificate I would normally have completed it.

Q. You would normally complete it.

30 A. I would have normally completed it if there was one. There wasn’t always one.

Q. Now in that design certificate it’s my understanding that you were certifying or undertaking to the local authority that you had a reasonable

belief that the calculations in the drawings would comply with the Code.
Is that correct?

A. That's, yes it isn't exactly that but it's similar.

5 Q. Now would you sign a design certificate without checking the calculations and the drawings before they go off to the local authority?

A. It depends on what the project was, who'd worked on it and that would determine the extent of any review that I would make before signing a certificate like that.

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10 Q. Well I come back again Dr Reay, with an inexperienced engineer in ETABS multi-storey buildings, isn't this is the one project that you should have reviewed at the time of signing the design certificate, assuming you did so?

A. Well I don't believe there was a design certificate for that job.

15 Q. In paragraph 23, "any correspondence from the Christchurch City Council would normally be viewed by Alan upon receipt and then referred to me or to the draftsmen for action". Is that not being involved with the design process or is that statement wrong?

A. That statement I don't think is correct. The information that was relative
20 to the jobs that I was handling would have come to me and the ones relative to the jobs that David Harding was handling would go to him.

Q. I just want to ask this question and I – Mr Rennie has put this to you, or you've answered it in your further brief. This is paragraph 16 in Mr Strachan's evidence. I want to put this to you again or put it to you
25 Dr Reay. He says I recall that Alan Reay was involved in the process of preparing initial drawings which were submitted to the Council with the building permit application. Again what do you say to that?

A. That's not correct, we wouldn't have submitted the permit application for that project. It would have been submitted either by the architect or the
30 builder but I wouldn't have prepared them.

Q. He goes on to say, "I recall there was a rush to get the application in to the Council."

A. Can't comment on that.

Q. He's got that wrong as well?

A. I can't comment on that. It may have been a different job to this one.

5 Q. Can I please have document BUI.MAD249.0141. It's the wrong document but I'll deal with this document first. That's a document transfer form sending documents back to the local authority Dr Reay. That's in Mr Harding's handwriting. You accept that?

A. Yes.

Q. And you recognise that handwriting?

A. Yes.

10 Q. And recognise his signature at the bottom?

A. Yes.

Q. Can I now have please document BUI.MAD249.0141.14. You will recognise that letter that's been often referred to as the Tapper letter?

A. Yes.

15 Q. Mr Harding's evidence Dr Reay that the handwriting in the top right-hand corner of that letter is his. He's gone a step further and he has said that the handwriting on the left of the page where it says, and I assume that's the word received, a day or so after letter sent is your handwriting. What do you say to that?

20 A. I don't believe it is.

Q. But it could be yours?

A. There is a possibility but I don't believe it is. I've compared to the sort of writing I did back then, I've had a look at that and I don't believe it is mine.

25 Q. Well if it's not your handwriting and it's not Mr Harding's handwriting, could it be the handwriting of one of the draftsmen?

A. I couldn't answer that, but I understand this document came from the Council so it could be someone from the Council who wrote that on.

30 Q. In earlier evidence you have unequivocally said, and I can find it if I have to, that it's not your handwriting. Are you now saying that it possibly could be,

A. Well no, I still unequivocally say it is not my handwriting.

CROSS-EXAMINATION: MR MILLS

5 Q. Now Dr Reay, just a few preliminary matters I'd like to clear up with you before I come to more substantive issues. First of all this mention that was just made in response to a question from Mr Kirkland about the so-called Tapper letter and whose handwriting it might be, and you mentioned that you'd gone back and looked at some handwriting of your own done around about the same period. Would you please provide a sample of that to counsel assisting. We'd like to see that as well –

10 A. Mhm.

Q. If that could be done expeditiously, that would be appreciated. Now secondly again just picking up an issue that was raised yesterday in relation to the slightly vexed issue of time recording within your office, you mentioned at least in my hearing for the first time, that the time that 15 you have recorded on the various time records which have now been pulled together in the schedule that you've been taken to, is recording as I understand it what you described yesterday as recording on time specific tasks but you said that in addition there are administrative tasks and management tasks which are recorded elsewhere. Have I got that 20 accurately?

A. There is a different code –

Q. Yes.

A. – there's a specific code for the administrative type tasks.

Q. And am I understanding that correctly that the distinction between a 25 specific task so called and the administrative tasks / management tasks and I think you used both terms, would be that what you would record as a specific task against a particular client would be work that would be regarded as time for which that client could properly be billed, even if you weren't billing them?

30 A. It would include more than that. It would include if you had an initial discussion with a client about a job it would probably include that time as well.

Q. Yes.

A. Even though there was no opportunity in that case to bill it if nothing further happened.

1010

5 Q. Yes. Would it include general client development type work?

A. I would expect it to.

Q. So what would you then regard as being administrative and management tasks?

A. Organising the office to undertake a job, considering who might work on it or who's available perhaps to work on it.

10

Q. Right. So these are tasks which still in general terms could relate to a client but are not regarded as being specifically recordable against that client?

A. Yes. We regard them as related to jobs not clients.

15 Q. I see.

A. Because we'll have multiple jobs for one client for example.

Q. Yes all right. Now do you have accessible to you for the year 1986 these management time records?

A. Yes on the bottom of the records for the jobs there is a row of management time.

20

Q. All right and is that do you know included in the timesheets that have already been provided to counsel assisting?

A. I understand so.

Q. All right –

25 A. Well –

Q. Could you check please.

A. Well I don't need to because now I think about it you have the originals.

Q. And that would include this so-called recording of the management times?

30 A. Yes.

Q. And am I right that the code reference you gave to that was 9003?

A. Yes, that's my recollection.

Q. Okay.

A. It's a 9000 number.

Q. All right well we'll look at that ourselves and if it's not there then we'll let you know and presumably you can get it for us. It's the 1986 year we're interested in.

5 A. Yes.

Q. All right well we'll get that checked. Don't worry about that further for the moment. It is there – I'm being told it is there. All right thank you.

A. Because if you haven't got it I haven't.

Q. All right. Have you got your composite brief in front of you there?

10 A. Yes.

Q. Could I just ask you please to turn to paragraph 49 of your third brief. So it's the last 49. It's at page 17 of the composite brief. Do you have that in front of you?

A. Yes.

15 Q. Now you say there, "Finally, I note that Mr Henry has not notified Alan Reay Consultants Limited that he was reviewing Alan Reay Consulting Engineers' work as he was required to do under rule 53 of the Chartered Professional Engineer of New Zealand Rules." What's the purpose of that statement in this evidence you're giving to the Royal Commission?

A. The purpose is that he is obliged to, under the rules, to, to advise us.

20 Q. Are you suggesting that when a witness is subpoenaed by the Royal Commission that that witness is obliged to first tell you before accepting that instruction, that requirement, that he's been asked to review your work?

A. I understand it's a blanket rule of the, of the Institution.

25 Q. And the purpose of pointing this out in evidence you're giving to the Royal Commission?

A. I thought it was relevant that he'd failed to do that. Other people like Clark Hyland had the courtesy to advise us.

30 Q. Are you contemplating a complaint to the Institute about Mr Henry over this?

A. I haven't considered that at this time.

Q. Are you holding it out to him as a possibility?

A. I said I haven't considered it at this time.

Q. I'm asking you now, are you holding it out to him as a possibility?

A. It is unlikely.

5 Q. But you haven't ruled it out?

A. It is unlikely.

Q. Is that the message you're delivering to him, or seeking to deliver to him, that there's a risk that he might face a complaint?

A. I thought he might have –

10

MR RENNIE:

Sir, with respect this line of questioning is entirely inappropriate.

MR MILLS:

15 No it's not.

MR RENNIE:

The witness has filed a brief. The question was, "Are you seeking to deliver to ..." - what the witness has done is spoken to the Commission. The statement

20 is perfectly proper. It will be a matter for cross-examination in due course.

JUSTICE COOPER:

Mr Mills?

25 **MR MILLS:**

Well my view is it's entirely proper. The witness has put this in. The only matters that go into evidence are matters relevant. I want to know how the witness regarded this as relevant because on the face of it I can see no relevance to it at all other than a warning to a witness who has been

30 subpoenaed by the Royal Commission to give evidence about the fact that he has agreed to do that and I take that as a very serious matter.

JUSTICE COOPER TO MR RENNIE:

Q. Yes Mr Rennie have you considered that?

A. I have indeed considered that Sir and I've considered it in the context that the witness has filed, not this witness, Mr Henry, has filed a brief of evidence stating that he is expressing expert opinion and that he has
5 complied with the code of ethics requirement in respect of experts.

Q. Yes. What has that got to do with this matter?

A. Well part of that code Sir would require him to consult all persons and consider all relevant matters.

Q. Well what part?

10 A. Of the, of the ethical code Sir.

Q. Yes of the, of schedule 4?

A. Of the code for expert witnesses Sir. The contention –

Q. What provision of schedule 4?

A. It's the obligation to state that he's considered all relevant matters. I
15 can't immediately pick it up in terms of a paragraph reference Sir.

Q. Well I can't, I can't find words in the schedule 4 which say even that but even if they did in context that would plainly be an obligation to state all relevant matters -

A. Indeed Sir.

20 Q. - in relation to the substance of what the evidence is going to be.

A. Correct Sir.

Q. To say that somebody has some extraneous ethical obligation that is going to affect his opinion in respect of evidence to the Royal Commission and then to say, to hold out the possibility that there might
25 be a complaint.

A. No Sir with respect that possibility was not held out. The brief of this witness simply observed that that particular step had not been taken.

Q. But for what purpose?

A. The rest of the proposition as to complaint is entirely a colouring Sir
30 which counsel assisting has put on in assailing this witness in respect of a matter which has not been undertaken and which as he's indicated would not be undertaken.

Q. No he hasn't said that at all.

A. I was about to say Sir except in the unlikely event that something emerged that indicated that it was a proper thing to do.

Q. So Mr Henry is to give evidence under threat of some complaint that might be made to a professional body about evidence that he's given to this Royal Commission?

A. No Sir I –

Q. And in case there's any doubt about that it is said in advance.

A. I'm sorry Sir, it is said in advance? I have not said it. This witness has not said it.

10 Q. This witness has –

A. There's no –

Q. – raised the issue about obligations under rule 53 of the Chartered Professional Engineers of New Zealand Rules.

A. Yes Sir which simply states that an engineer reviewing another's work is to consult with that engineer.

15 Q. Yes well what is the purpose of raising that matter before the Royal Commission?

A. Because Sir when we get to Mr Henry it will be pointed out that the whole of Mr Henry's brief has been created without such reference.

20 Q. So what? In terms of the subject matter of this enquiry?

A. Well that Sir will depend upon the answers that Mr Henry gives but the proposition which will be put will be that his work falls into error and is unreliable in consequence. Now if Your Honour wishes an assurance Sir that the witness may give evidence, that is to say, Mr Henry, free from any concern of any extraneous action I will obtain instructions which I am certain I can obtain immediately and give that assurance Sir because that was not the purpose behind the reference in the brief.

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DISCUSSION

30 CROSS-EXAMINATION CONTINUES: MR MILLS

Q. Now Dr Reay you were here yesterday weren't you?

A. For not all of the day, but I was here yesterday.

Q. Did you hear most of the examination of Mr Harding during the course of the day?

A. No. Certainly not the first part.

5 Q. It was the first, did you hear any of the questioning of Mr Harding by my friend Mr Rennie, your own counsel?

A. I can't specifically recall whether I heard it or not.

Q. Did you hear some of the questioning of him that I conducted?

A. Yes I think so.

10 Q. You think so. Would you agree with me that the, by the time we had heard all of Mr Harding's evidence in cross-examination by myself and by my friend Mr Rennie, that what that revealed was troubling in terms of his ability and competence to do the design work on the CTV building?

A. It didn't reflect the David Harding I knew 25 years ago.

15 1025

Q. But he was acknowledging the facts about events 25 years ago. Did you find what he acknowledged troubling in terms of the level of skill that he actually brought, leaving to one side what you may have thought he was bringing to it, was it troubling about the level of skill and competence he was actually bringing to bear on his design work on the CTV building?

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A. There was some areas that I was concerned about.

Q. What were those areas?

25 A. The, he mentioned the design of the connection between the diaphragm and the wall and there was also the issue of the design of the beam column joints.

Q. Have you reviewed the evidence that Professor Mander gave under cross-examination about the issues that caused him concern about the building?

30 A. No I haven't.

Q. You haven't read that? Are you not interested in what's going on in this hearing as it affects your firm and the CTV building?

A. Yes I am but I'm limited by time.

Q. So this isn't a priority for you in any way?

A. It is certainly a priority.

Q. But not such a priority that you're reading what your own expert has said about the structural design of that building?

5 A. I've read, not read listened to part of what he has said and other people in our office listened to parts of it and bring me up to speed on certain sections but not, this, I haven't studied the submission or questioning as a whole.

10 Q. And is the upshot of what you are aware of, including what David Harding said yesterday, are you troubled about the design quality of the CTV building that came out of your office?

A. I'm concerned about the two aspects that I've mentioned.

15 Q. Yes. And is it your view now that whatever your belief might've been at the time about David Harding's competence to design this building without supervision, that in fact he didn't have the required levels of competence and experience to do that adequately?

A. No I don't agree with that.

20 Q. So are you saying then conversely that despite the issues about the design of the building that have emerged, that you still believe that he was perfectly competent and capable of designing that building properly?

A. Yes I do.

25 Q. How then do you explain the significant number of concerns and criticisms that have emerged from various experts who have looked at this building, including Professor Mander who was your own witness? How do you explain that those have emerged from the design of this building?

30 A. The particular issues that I've mentioned, the first one is the potential issue of the connection of the floor diaphragms to the walls where there appears to have been an omission which was rectified in 1991. That is simply not following through load paths which is a fundamental part of structural engineering, and he was certainly capable and knowledgeable and able to have undertaken that work.

JUSTICE COOPER ADDRESSES THE WITNESS – SPEAK INTO THE MICROPHONE

CROSS-EXAMINATION CONTINUES: MR MILLS

5 1030

Q. Can I ask you then Dr Reay whether it's your position that you are pleased and proud to have your firm associated with the design of the CTV building?

10 A. I am concerned with regard to the two items that I have mentioned and I cannot understand how Mr Harding made the, undertook the work in the manner for those two items that he did.

Q. Did you hear the exchange yesterday between Commissioner Fenwick and Mr Harding about secondary elements in the building?

A. Yes I heard that.

15 Q. Did that cause you concern that Mr Harding apparently knew nothing about that provision?

A. Well it certainly seems strange to me, given that it's quite clear in the Code.

Q. Did it cause you concern that he acknowledged he was unaware of it?

20 A. I was surprised he was unaware of it.

Q. It didn't cause you any concern that he was designing the building with that apparent lack of knowledge of it?

25 A. Well my concern was limited because in the analysis that we've undertaken we don't believe that that is actually an issue in the design of the building.

30 Q. So in light of the evidence that you are aware of about the criticisms and concerns that have been expressed by various experts about the design quality of this building, do you still maintain your view that putting Mr Harding in a role where he was responsible, in your view at any rate, for the design of this building was a perfectly proper decision?

A. At the time yes.

Q. And in retrospect do you still think that was a proper decision to make him responsible for this building?

5 A. Well based on the fact that he was a 35 year old 10 year registered engineer who had considerable experience in structural design and had had a management role and understood responsibility I would, in the instance, do the sa-, expect him to perform as I did back then.

10 Q. So with the information that you've got now about the design issues with the building that have emerged in the course of evidence you'd make exactly the same decision again would you to give him responsibility for designing it?

A. Well I haven't seen anything that would cause me to do anything differently because of the experience and registration and all those things that he had.

15 Q. So is your answer to my question that you would make exactly the same decision about making him responsible that you made back in 1986?

A. Well it certainly, because of what I've heard, it has certainly made me think very hard about how I do actually apportion responsibility. We have many chartered engineers in the company now who I rely on in exactly the same way as I relied on Mr Harding.

20 Q. And so yes or no, Dr Reay, to my question about whether you would make exactly the same decision now as you made then about allocating responsibility for the design of that building to David Harding?

25 A. Well in today's climate and, not climate, in today's engineering sort of world, you might say, I would possibly not but looking back when I did allocate that responsibility at that time that was appropriate.

30 Q. But I've asked you whether, with the information that's come out in the course of this hearing about problems with the design of that building, of which you have acknowledged two, and you say that you are rather taken aback, to put it in my own words, about the fact that those two that you identified were made by Mr Harding. Taking that into account would you still make the same decision as you made back then and place this responsibility in the hands of Mr Harding?

A. Well yes I would but today we would have a peer review undertaken by an external peer reviewer.

Q. All right but back as to the decision you made then you would have made the same decision even with the knowledge you now have about things that appear to have gone wrong with that building?

A. And in the knowledge that there would be a peer review.

Q. The answer's yes isn't it? The answer's yes?

A. Yes in the knowledge there would be a peer review.

Q. Now you were asked some questions some time ago by my co-counsel, Mr Elliott, about issues that you might do differently and I wonder if we could just bring this up. It's from the transcript. I'd just like you to take a look at this and tell me whether there's been any change of your view on this.

WITNESS REFERRED TO TRANS.20120712.133

Q. Now it's at lines 13-16 and you'll see there that Mr Elliott was asking you about what you would do differently, and the question was "What exactly would you have done differently". "Well clearly I would have taken a greater role in the job if I was looking back now. At the time I didn't. Didn't see that as necessary for that particular building but clearly now, after what's happened, I would." Is that still your position or not?

A. No that is still my position.

Q. Now as I understand the evidence you've given, and some of it's been in response to cross-examination, it is that your view of your responsibility to Mr Harding and, ultimately, to the client for the product of this building and to, tragically, the users of this building was that you thought that you were available to him if he needed help. Is that the position?

A. I was available to him if he needed help.

Q. And he says, he may not put it quite this way, but he says that you, in effect, did give him initial guidance, and appropriate guidance I would have to say, on how to go about the work on the CTV building by directing him to the calculations for the Landsborough House. Now do

you agree with that, that that's what you did and that was appropriate and you were giving him guidance by doing that?

A. Yes I would have done that but it wasn't just the calculations. It would have been the entire job.

5 Q. And what do you include within that term 'the entire job'?

A. The drawings, specifications.

Q. Now he says he never saw the drawings. Did you check what was in that file before you recommended that he rely on it for developing the CTV design?

10 A. Well the drawings were there because the building wasn't built at that stage and eventually it was but he, he knew the office system, he knew where to find the drawings and I don't believe he would have looked at the calculations without actually looking at the drawings as well to see what the outcome of those calculations was.

15 Q. Right. Now he also says that the Landsborough House file that you directed him to included the input/output ETABS data for the Landsborough House work that Mr Henry had been doing. Did you, you knew, didn't you, that Landsborough House had used ETABS?

A. Yes I did.

20 1040

Q. And so in giving guidance to Mr Harding by referencing him to the Landsborough House work, you would have known that you were also giving him some assistance in how he would go about the ETABS work.

A. The purpose of – the primary purpose I would imagine was for the
25 ETABS but I can't recall that exactly what was said.

Q. Right.

A. I couldn't tell you whether that was the only job that he looked at.

Q. But it would have been a sensible form of guidance for you to be giving to him wouldn't it, to have said, "Here's Landsborough House. It's going
30 through the office right now, done by a very high quality structural engineer, Mr Henry and look at this, take guidance from it for working on the CTV building."

A. It was primarily for understanding the basis of the design, not to translate the design across into the CTV building.

Q. Yes, so I think he – I think that Mr Harding described it as being – that he was directed to it or given it by you for the purposes of using it as a design method template.

5

A. I wouldn't call it a template.

Q. And so what term would you use for it?

A. Well it's an example of a design process and drawings that are helpful in assisting understanding how one undertakes the work.

10

Q. Yes, all right. Now you've said in your brief, and I'll take you to it if you need me to, but I imagine this will be familiar to you, that the critical issue with deciding that somebody's responsible to carry out the design of a building, is that they have this critical knowledge about what they don't know. Remember saying that in your brief? I can take you to it if you'd like, the most important thing is that a person realises what they don't know.

15

A. That's correct.

Q. Yes, and then of course putting this in the context of Mr Harding, he would then have been able to come to you and say, "Look Dr Reay, I don't know what I'm doing here. I don't understand this. Can you give me some advice?" Is that the process that you were expecting him to follow?

20

A. I would have expected him to have investigated and understood the other jobs which he'd referred to. He had already undertaken one job at that time using ETABS so it was more of an extension of knowledge.

25

Q. That's Westpark I take it you're referring to it?

A. Yes. It was more of an extension than actually a fresh start on ETABS and I would have expected him to have done that first and then if he had any issues or concerns with regard to undertaking the work that at that point he would have advised me, not for me to assist him because I had not undertaken ETABS myself.

30

Q. Yes.

- A. But more to find out where he could go to learn more or if in fact he really had problems well then he would have told me he couldn't do the job.
- 5 Q. You agree with me that the danger of entrusting somebody inexperienced in the design of a particular type of building, here multi-storey using ETABS, is that they don't actually appreciate what they don't know?
- A. Well he was a registered engineer and part of the – of getting registered under the Engineers Registration Act is that you do know what you don't know and you know how to go and find it out and deal with it or whatever.
- 10 Q. Do you accept that is a process which potentially has in it the very significant problem that a person who is overconfident, could readily fail to appreciate what they didn't know?
- 15 A. Yes, from my knowledge of Mr Harding he was not that type of person.
- Q. And did you consider that in deciding whether he was an appropriate person to be given this level of responsibility?
- A. I had been involved and seen his work previously, and I was satisfied that he had a good understanding as a structural engineer of the design of structures.
- 20 Q. You agree with me that the level of expertise that Mr Harding had in multi-storey buildings using ETABS fell far short of that that Mr Henry had?
- A. It was certainly less than Mr Henry's.
- 25 Q. Yes but he was being asked effectively wasn't he to step into the shoes of Mr Henry and pick up the work that he'd previously been doing?
- A. He wanted to step into that position.
- Q. But that is what you were expecting him to do when you hired him in that role?
- 30 A. I wasn't expecting him to undertake the CTV building when I hired him.
- Q. But you – sorry.
- A. In fact there were no buildings really that we had to do when I hired him.
- Q. But he stepped into Westpark didn't he?

A. Yes because he wanted to.

Q. Yes, so you were in fact expecting him to pick up Westpark which Mr Henry had left part done. Is that not correct?

5 A. That was what he did. Mr Henry had started it, the project actually went nowhere for many months and then started up again and it was – so it wasn't a continuous process.

Q. But when he came he was expected to pick it up and take it forward?

10 A. He wanted to be involved in those projects and I accepted that he could and I considered that he had the ability to know whether he was capable of doing them or not.

Q. Do I take it then that your judgment on whether it was proper to entrust both Westpark and the CTV building to Mr Harding was fundamentally premised on the fact that he wanted to do that work?

15 A. No that wasn't the fundamental driver. It was one of the factors. The other factor was that I considered him to be a very competent structural engineer who understood his limitations and knew how to work through them.

20 Q. Now did you – when he came back to the firm did you quiz him at all on the understanding that he had that he would need to have to do these buildings?

A. No, when he came back to the firm he did some – a four storeyed building that we've talked about and he did other buildings and from that I judged that his level of competence if anything was greater than what it had been when he was previously with me.

25 Q. The point has already been put to you and you've acknowledged that it's correct, that the four storeyed building that you're talking about was done using the static design method, not ETABS?

30 A. Oh, that's correct, but it still has all the principles of structural design, transfer of forces from floors to walls and design of floors to the concrete code and all those things.

Q. But he was being put into a position in being giving guidance by reference to Landsborough House as a principal source of that

guidance. He was being put into a position where he was going to have to use ETABS wasn't he?

A. Well he didn't have to use ETABS but it was a definitely preferable system to use.

5 Q. Yes and you knew he was going to be using it because he was directed to the Landsborough House model or template or however we're going to describe it.

A. Yes, the purpose of directing him to it was for that reason.

10 Q. Yes. So – but we're in a position aren't we where other than Westpark and I'll just ask for a little more about that in a moment, he had not done ETABS, you had not done ETABS and the person with the expertise who had done ETABS was Mr Henry and he had left the firm. That's the position isn't it?

A. That's correct.

15 Q. Now Mr Harding when I asked him about his role with Westpark and showed him the documents from Westpark, which as you may recall if you were here initially handwriting by Mr Henry picked up subsequently by Mr Harding, that he thought that the ETABS work was underway initiated by Mr Henry before he came in on that. Are you disagreeing with that?

20 A. Yes. My understanding is that he subsequently set up input for another ETABS run and put it through the computer at the university and used the output in his calculations.

1050

25 Q. And given that that doesn't appear to have been Mr Harding's evidence what's the basis for your understanding which leads you to give that evidence?

A. It's in the, if you look in the calculations I believe you'll find it.

30 Q. So you have recently been back through the calculations for Westpark have you to look at that issue?

A. Yes I had a look to see because I was uncertain initially but I believe the, that there were two runs done, one by Mr Henry, an initial one, and then a further one by Mr Harding.

Q. Right. So Mr Harding would be correct then that the first time he had had to do ETABS on a building which had had no ETABS work done on it previously by someone else was the CTV building?

A. That would be correct.

5 Q. Yes. Do you accept that Mr Harding could very well have thought that you were overseeing the work that he was doing on CTV more than in fact you were?

A. No.

Q. Why do you say that so positively?

10 A. Because I recall making sure that he understood that the job was his responsibility, that I was not going to be. I didn't have the time to be available to assist him in depth and I didn't have the knowledge to assist him in depth. It was his responsibility to come up to speed on things like ETABS and that if he had said he couldn't do that then we would not have proceeded with the job.

Q. So when you said previously that you were available to him if he needed assistance, are you now saying that in fact there was very little assistance you could have provided him?

20 A. If he had asked me for assistance, for example, because he couldn't understand, he couldn't get, understand ETABS and make it work then I would have discussed with him the options that might have been available to us which would range from getting assistance, paying someone else to do it or not undertaking the work. That is the sort of assistance that I would have provided.

25 Q. But I take it you had made it clear to him that you expected him to be able to do this work on his own?

A. Effectively he was responsible for doing it.

30 Q. Yes. So from his perspective given that that was the direction he'd been given from you it would have been potentially seen as a bit of a failure by him if he hadn't been able to do it himself. Do you agree with that?

A. No I don't agree with that.

Q. A strong expectation he could do this himself?

A. I don't believe he would have considered it a failure.

- Q. I'll ask you again. Do you agree that you left him with a strong expectation that he could take responsibility for this building and do it himself?
- 5 A. It wasn't my expectation. He was the one who said that he wanted to do the job and believed he could accomplish it.
- Q. And you believed that was all correct and that he could.
- A. I had confidence in his ability, yes.
- Q. So you expected him to be able to do it properly?
- A. If he couldn't I expected him to come to me and tell me he couldn't.
- 10 Q. Provided he knew what he didn't know?
- A. I, he would have found out fairly quickly if he thought he, if he found he had difficulty doing it I believe.
- Q. I see. So the fact that he knew nothing about secondary elements and that was something he didn't know, that doesn't cause concern?
- 15 A. Well I can't understand that frankly.
- Q. And is that because it's so basic that you would have expected any competent structural engineer to have been aware of it?
- A. Well I would have expected him to have understood it at the time, yes.
- Q. Now on this question of design certificates I just want to bring up a document. It's BUI.CA5056.0001.15. You'll see this is the design certificate for Westpark. You'll agree with that won't you, that that's what's it is?
- 20 A. Yes it is.
- Q. Yes and you'll see that it's signed by you. You agree?
- 25 A. Yes.
- Q. And the, you were asked about the content of design certificates by my friend Mr Kirkland but you didn't have this document in front of you and I see looking at that that in particular that you have certified that the works defined above have been designed in accordance with sound and widely accepted engineering principles, that they have been designed to support the loads specified in NZS 4203:1984. Do you agree with that?
- 30 A. Yes.

Q. And then you go on, and this I think you'll agree is a personal certification, "... and further that I have ascertained to the best of my ability that the stresses and combinations of stresses and the various materials of construction under the above loads will not exceed the maxima to ensure the safety and stability of the structure if erected in accordance with these plans and specifications." Do you agree that's what it says?

5

A. Yes.

Q. Now that's the Westpark building into which Mr Harding was introduced when he came after John Henry had left isn't it?

10

A. Yes it is.

Q. And so on that building you agree that a level of scrutiny from you was being given which is why you were able to sign that design certificate?

A. Yes I would have had some scrutiny of that building particularly as that was one where I was the principal consultant for.

15

Q. Yes.

JUSTICE COOPER:

Q. That would include the computations that were done in respect of the building?

20

A. I would have reviewed the drawings and I would have reviewed the computations to the extent that I needed, considered I needed to at the time.

Q. Because the certificate says that, "I've supervised the design of and the computations for the building," doesn't it?

25

A. Yes, yes.

CROSS-EXAMINATION CONTINUES: MR MILLS

Q. And Mr Harding would have been aware that you were providing a design certificate?

30

A. I don't know.

Q. You agree with me that if he had known and if this document had been available it would have been put to him at the time, and it may need to

be, but that if he had been aware that that's what you were doing on Westpark that it would have been not unreasonable for him to assume that ultimately a similar process would be followed with the CTV building?

5 A. Not necessarily. The Westpark building was to be unit titled and my recollection is with unit title buildings the Council insisted on design certificates whereas they didn't necessarily if it wasn't a unit title building.

10 Q. Do I take it though that your firm did provide design certificates on buildings that weren't unit, unit title buildings?

A. We may have. I can't remember.

Q. Did you have no systems at all in place about when design certificates would be provided?

15 A. They would have normally only been provided if the Council asked for them.

Q. And was there a pattern to when the Council asked for them?

A. I think they asked for them when they didn't do their own reviews.

1100

Q. Was there any pattern to when they did their own reviews?

20 A. Not that I recall.

Q. So these various events that I'm asking you about back in 1986, by and large you don't recall very much do you?

A. Well I've recalled what I've said I can recall.

25 Q. Yes but you agree with me that on most issues you actually don't have a great recollection of what occurred back in 1986?

A. Well I wouldn't agree with that because that's just an all encompassing statement.

30 Q. All right, then I'll ask you some specifics about it. Just before I leave the Westpark, the question of the design certificate, it doesn't need to be brought up again. That was a building on which Mr Henry, as we've agreed, had done at least the starting work on that building?

A. Yes he'd done the concept design, well almost a developed design.

Q. Yes, so it was reasonably well advanced under his hands wasn't it?

A. Yes it was.

Q. Yes, and we've agreed he was much more experience than Mr Harding in that work?

A. Yes he was.

5 Q. But despite that there's been a level of scrutiny by you which is reflected in that design certificate?

A. Yes there would've been.

Q. Conversely with Mr Harding, with nowhere near the experience that Mr Henry had, is it your belief that you didn't provide a design certificate on the CTV building?

10

A. Well I don't believe there was one.

Q. And you're also saying I think that you didn't think that the level of scrutiny that you've given to Westpark as reflected in that design certificate was required for the CTV building?

15 A. I would've gained some confidence from reviewing the Westpark building in terms of Mr Harding which may have influenced me in relation to the CTV building.

Q. You don't remember whether it did but you think it might've?

A. Well it's, I think it, I can't say for certain about that one 26 years ago.

20 Q. Am I right that you would've described David Harding's role on CTV as being the project manager?

A. Within our office.

Q. Yes?

A. Yes.

25 Q. And within your office is it also correct to describe him as being the lead consultant on that job?

A. No, no, he was the structural engineer.

Q. And what does the term "lead consultant" mean within your office?

30 A. When you're responsible for the total job including appointing the architect, mechanical engineer, quantity surveyor et cetera.

Q. So do I take it from that that on the CTV job there was no-one that you would describe within the office as the "lead consultant"?

A. That's correct.

Q. So you have a project manager but not a lead consultant on the CTV job?

A. He would've been called more the project engineer than the project manager I would've thought.

5 Q. Was there someone else who was the project manager for that job?

A. No.

Q. So what's the distinction that you draw between the project engineer and the project manager?

10 A. Well a project manager may not be an engineer, he may be just managing the whole job.

Q. You've said in your evidence, and if you want to look at it it's paragraph 26 of your composite brief, that John Henry was not, I better find it myself I think, well you said first of all, perhaps I'll just take you through this. You say at paragraph 26 that –

15

JUSTICE COOPER:

What page Mr Mills?

MR MILLS:

20 It is page 13 of the composite brief Sir, or page 14 on our numbering system.

CROSS-EXAMINATION CONTINUES: MR MILLS

25 Q. At paragraph 25, really the narrative on this begins with you responding to some evidence that Mr Henry's given and you're going through it paragraph by paragraph, and you see that, you say there, "Mr Henry states that he was very much in the driving seat during the structural design work for Landsborough House and you say it was Mr Henry's role to undertake the responsibility for the structural design and documentation of Landsborough House. He was not employed to project manage the job or take the lead consultant role as I understood

30 he had no experience in this role." And then he goes on and says that you were not closely involved in the work he was doing on Landsborough House and you say that you were the lead consultant on

Landsborough House. So again, coming back to this distinction, or these various distinctions that have been drawn about project managers, lead consultants, project engineers, you were the lead consultant on Landsborough but not on CTV?

5 A. That's correct.

Q. And the reason for being the lead consultant on Landsborough but not on CTV?

10 A. Well the client for Landsborough was Amuri Corporation at the time who employed myself to lead their projects and to procure the architect services in that directly through our company.

Q. So that's really what you're talking about when you use this terminology "lead consultant", that in effect you're sitting at the top of the tree and organising other professionals who are required to do the job?

A. Yes.

15 Q. Yes. And is that also the context in which you would describe yourself as the project manager?

A. Yes although I've never used the word "project manager" for myself. I prefer the word "lead consultant".

20 Q. And do I take it that that role of lead consultant is really the way in which you like to conduct your practice? Your preferred way of conducting your practice?

A. I've found it useful in terms of enabling us to integrate structural designs with architecture and that sort of thing, but I wouldn't say that it's an absolute preference.

25 Q. So from your perspective you had no preference between playing that lead consultant role and the situation we have with design build projects such as CTV where really somebody else is playing that role outside your firm? You have no preference between those two methods of working?

30 A. Well they vary a bit on that too because even when we're working for design-build contractors we quite often take the lead consultant role. But in the case of the CTV building we didn't.

Q. Yes, no I understand that. I'm just trying to get clear about the way you preferred to work, so let me ask it again. Is your preferred role on these projects to be the lead consultant?

5 A. Well no it depends on the project and the type of work it is, the degree of engineering within it, there's no set preference. You judge it job by job.

Q. So you were just as happy to be playing a secondary role as you were to be playing a primary role?

A. It's not something I've given any great attention to really.

10 1110

Q. I'm having trouble finding things because of the repetition of paragraph numbers in this composite brief, just bear with me a minute. I may have to come back to this.

THE COMMISSION ADDRESSES MR MILLS

15 CROSS-EXAMINATION CONTINUES: MR MILLS

Q. The issue is that Dr Reay you refer to your role on a design-build project as a diminished role and I'm interested in that choice of word. Now if I need to find it for you I'll have to do it over the break but do you accept that when you are involved in these design-build projects that your role, and I'm talking about your role personally, is a more diminished role than it is when you're in charge of the whole project as the lead consultant choosing the other consultants, managing the whole thing? Do you accept that relative to that that it's a diminished role?

20

A. (No audible answer 11.11.55)

25 Q. Is this being brought up because this is what I'm looking for? Oh thank you Mr Rennie, yes, "as a design-build contract the engineers role was potentially diminished".

A. Yes, yes it was.

30

Q. And would that have been a factor in feeling that this was an appropriate job for Mr Harding to take on because it didn't involve the complexity of needing a lead consultant?

A. No this is, this is in reference to site visits and inspections rather than the design of the building.

5 Q. Well there's two points being made there aren't there? Isn't it a general statement that as a design-build contract the engineer's role was potentially diminished and then the second point and a separate point about site visits?

A. No it's in specific relation to the site visits its not a general comment at the beginning.

10 Q. It's accurate though, isn't it, to say the engineer's role on a design-build contract is a lesser role, involves lesser functions, than if you are the lead consultant managing the whole process?

15 A. No I don't believe you can say that. In a design-build contract the engineer is more likely to be considering various options for the contractor looking at alternative methods and that sort of thing which may not be to the same extent when the contractor isn't involved in the design process.

20 Q. So the fact that this was a design-build job on the CTV building as opposed to one where your firm would have been in the lead consultancy role, had no relevance to your decision that this was an appropriate building for David Harding to take responsibility for?

A. I wouldn't remember now whether that was a factor.

Q. I see.

A. It may be a factor to some extent today but...

Q. But you have no memory of whether that influenced you at the time?

25 A. No.

30 Q. Now you have said quite specifically in paragraph 9 of your evidence – this is in the first statement, it's at page 2 – that most of the events – do you have that there – “Most of the events that are relevant to my evidence occurred around 26 years ago. I set out below the events as I remember them to the best of my recollection. The passage of time means that it is not possible to be precise about many of the events. While, for some reason, some details stand out, others do not”. And it's

been apparent from the questions I've been asking you that quite a number of details you don't remember any more. You agree with that?

A. Well I've said what I remember and don't remember.

5 Q. Now do you agree with me that in general the way that memory works, looking back 26 years, is that we tend not to remember routine things, things that happened in the ordinary course all the time? Those aren't the things that stand out in one's memory are they?

A. Um, you're telling me, I don't, I never –

Q. I'm asking you how your memory works really.

10 A. I remember jobs that I specifically work on, put time into and I can walk back into them and remember features and why we did certain things but I can only do it if I'm, I can't do it by remembering from drawings, I remember it from sites and activities, that sort of thing.

Q. So specific events stand out in that sense.

15 A. They wouldn't be necessarily specific but if I haven't worked on a job in the office and I walk onto a site some time later I'll have no, even if I've seen the drawings in the office, I won't be able to relate it.

JUSTICE COOPER:

20 Time for another sound warning I'm afraid.

CROSS-EXAMINATION CONTINUES: MR MILLS

A. Sorry Sir.

25 Q. So your memory works on the basis of jobs that you've worked on and then you will remember things from those jobs you worked on when you refresh your memory about them. Is that what I'm hearing?

A. Yes that tends to be the case.

Q. Now, of course, CTV was not a job that you worked on, was it?

A. No it wasn't.

30 Q. So you agree that that would largely explain why your memory of events around the CTV building isn't, I'm not trying to be critical here, but isn't great?

- A. Memory of the physical aspects of the job, if I haven't, hadn't worked on it wouldn't be, you know I wouldn't have a good recall of them.
- Q. Now on the other hand what for you was a job that you didn't work on was for Mr Harding the first multi-storey building using ETABS that he had ever been solely responsible, for wasn't it?
- 5 A. He was responsible for the Westpark Tower as well.
- Q. It was already underway – we've agreed that – so let me put the question again. CTV building was the first multi-storey building involving ETABS that he had ever been solely responsible for, correct?
- 10 A. That he had commenced on the project.
- Q. Yes and in that sense he had sole responsibility for the CTV building.
- A. Yes.
- Q. Now in those circumstances where we have got David Harding having a firm memory of a number of events around the CTV building and you not having worked on that building at all on your own evidence anyway, would you agree that Mr Harding's memory is likely to be better on this job than yours?
- 15 A. Not necessarily with specific to the way it was worked in the office and what was undertaken and that sort of thing.
- 20 Q. You agreed with me, as I understood it, that your memory really works in relation to projects on which you have worked.
- A. Yes but I thought you were referring to the physical aspects of those projects.
- 1120
- 25 Q. Yes and what are you now referring to?
- A. I'm talking about the management of the jobs in the office.
- Q. But if for example Mr Harding remembers that you gave him the Landsborough House file to work from, and I take it you're now not disagreeing with that, but he'd be likely to remember that because that involved this important project for him. Do you agree with that?
- 30 A. Oh, I'd agree he would remember the Landsborough House file being delivered to him.

Q. Now I think you've also said in your evidence that you don't recall who the structural draftsman was that was allocated to the CTV job. That's correct isn't it?

A. Yes, I have no memory of which of the two draftsmen it was.

5 Q. Yes and again you'd expect Mr Harding to remember who he worked with on this project that was significant for him?

A. Given that he worked with both those draftsmen in different jobs I wouldn't be as certain as that.

10 Q. But you wouldn't set up your view on who he worked with against his on this I take it, other than by reference to a record?

A. Well that's right, the record and Mr Harding initially saying he believed it was in fact Terry Horn that he worked with.

15 Q. All right, and do I take it that before the time records were located you wouldn't have had any memory that you had some time on the CTV building in February of 2006?

A. No, I wouldn't have known what time I spent on the building.

Q. Now I think you're also saying that you don't recall any direct dealings with Williams Construction on this project. Is that your evidence?

20 A. Yes it is. I may have had an initial contact with them. I think at that time they were still building the Aged People's Welfare building where I would have had an involvement of some sort with them.

Q. But you don't have any specific recollection of involvement with them on CTV I take it?

A. No I don't.

25 Q. Have you looked at the evidence that has been given by Mr Tony Scott or will given?

A. I've had a brief look at it yes.

30 Q. Well let me bring it up now so you can have more than a brief look at it. There's both an initial brief and then a supplementary one so I'll bring up the first one first, and it's WIT.SCOTT.00041.3. Now if we just go back I think a page. You'll see there that beginning at paragraph 11 Mr Scott describes the process by which he came to your firm and I'll just give you a moment to read that and I wonder if we could get both that and

the next page put up at the same time. Thank you. So I'll just read it out for the transcribers.

"Williams Construction engaged Alun Wilkie of Alun Wilkie Architects as the architect and Alan Reay Consultants as the structural engineer.

5 They were to prepare and design preliminary structural drawings for pricing. Mike Brooks was responsible for liaising between Prime West and Alun Wilkie Architects. I was responsible for liaising with David Harding of Alan Reay Consultants to obtain preliminary structural details for pricing."

10 And then he says in the next paragraph, talking about the \$100,000 allowed for the architectural and engineering design work. He says:

"This was only available after the feasibility of the project was established. The preliminary work was done by Reay and Wilkie".

And that's a personal reference as I understand it.

15 "... on a no job no fee basis. They were retained to help put together a proposal for the building in order to see whether a feasible and fundable design could be developed. The aim was to spend as little as possible until feasibility was confirmed. All of this was prior to the building permit being issued.

20 "I put together prices for the building at an early stage based on structural sketches from Alan Reay and preliminary layout plans and elevations from Alun Wilkie."

It talks about his original cost plan and where that got to and then paragraph 14:

25 "On 3 April 1986 my cost plan was submitted to Prime West as a preliminary estimate of \$2.45 million plus GST based on A2 architectural drawings and A4 structural sketches and subject to building consent approval."

30 Now having read that do you recall having any discussion with Williams and it would have been I imagine particularly with Tony Scott as the QS on the job, about this initial agreement, that preliminary work would be done on a no job, no fee basis.

A. I have no specific recollection of it but it doesn't surprise me that that was the basis.

Q. So you accept that it could well be correct?

A. Yes I believe it was.

5 Q. And if there was going to be a discussion of that kind and an agreement of that kind with your firm, you would be the one who would have made that decision I take it?

A. Yes but whether I made it direct with Tony Scott or through David Harding –

10 Q. Yes, no –

A. – I wouldn't remember.

Q. Well then I'll take you to the supplementary brief and that is same reference except it's WIT.SCOTT.0002.1 and I want you to go to probably it's the first page, it's paragraph 2 to 6 that I'm interested in.

15 Now you'll see there again he talks about the relationship with David Harding and he says beginning at paragraph 2:

“My first contact with David Harding was in the course of the CTV building project. Michael Brooks and I had decided to invite Alan Reay to participate in the design team for what was to be Prime West's first development project in Christchurch. Williams Construction had had previous dealings with Alan Reay Consultants where Williams was the successful, [I think it should be successful] tenderer. One of these was the Aged People's Welfare building on Cashel Street.

20
25 “We liked the presentation that Alan Reay made to Williams for the CTV project in terms of presentation content, the standard of his drawings and his willingness to provide preliminary structural sketches for preliminary estimates without charge.”

30 Then he goes onto say that David Harding was the engineer we principally dealt with and that theme continues on down there and you'll see at paragraph 5, he says:

“As David Harding was the only engineer from Alan Reay Consultants I had direct dealings with, I do not know what role Alan Reay personally

played in the project because Alan Reay was the project engineer of the practice I assumed that –

A. Principal engineer.

Q. Sorry.

5 A. Principal engineer.

Q. Oh, yes, "... was the principal engineer of the practice I assumed that he had an oversight role in the calculations and structural drawings that David Harding presented but I have no direct knowledge of this."

10 Now this reference in the – in paragraph 3 to the presentation that was made after he says that Michael Brooks and Tony Scott had decided to invite you to participate in the design team, influenced it appears by the previous dealings with your firm, on the Aged People's Welfare building, where he says that you made a presentation to Williams and they liked it. Do you have any memory of that?

15 A. I don't recall making a presentation of the sort I would think that that referred to today. I suspect it was simply a meeting.

1130

20 Q. Right. But you think that there may well have been a meeting of that kind which Mr Scott has described as a presentation but you don't put it in quite such elevated terms which would have involved in substance the kind of issues that he's talking about there?

A. The only issues that would have been discussed I imagine would be to do with whether we were prepared to do some preliminary work on a "no job, no fee basis" but that would be about it.

25 Q. Yes.

A. They knew what our work was like.

Q. Yes.

JUSTICE COOPER:

30 Are you going to put paragraph 6 there to Dr Reay?

MR MILLS:

Well yes I should do that.

CROSS-EXAMINATION CONTINUES: MR MILLS

Q. I'm not sure whether is still contentious or not. I think it might have dropped away but perhaps just before we do take the break Dr Reay can you look at paragraph 6. My understanding is that the initial suggestion that you made that you thought David Harding had brought the CTV contract to your office, that you're no longer maintaining that view?

A. No, no I'm not.

Q. Yes. All right. Thank you Dr Reay.

10 **HEARING ADJOURNS: 11.31 PM**

HEARING RESUMES: 11.46 AM

CROSS-EXAMINATION CONTINUES: MR MILLS

15 Q. Dr Reay can you just turn please to paragraph 25 of your composite brief and the numbering in the top right-hand corner, the red numbering it's page 4, just in case that paragraph number comes up more than once in the brief itself?

20 **WITNESS REFERRED TO PARAGRAPH 25 OF COMPOSTIE BRIEF OF EVIDENCE**

Q. Have you got paragraph 25 in front of you?

A. Um...

Q. You'll see that you deal there with what you say you did and didn't do on the design of the project, and I know this has been canvassed several times but again just to be sure that there's a full understanding of this I just want to go through this briefly. I take it that what you're accepting you were involved in with CTV was checking the quality of the client. That's the first thing you acknowledge you were responsible for? Checking the quality of the client?

A. Yes.

Q. And then ensuring that the contractor had the knowledge and experience to undertake the work proposed?

A. Yes.

5 Q. And then you say you verified that the engineer, in this case David Harding, considered himself capable and prepared to commit, correct?

A. Yes.

10 Q. Now you then say that you would also have ensured an appropriate draughtsman, and I note that you then go on in paragraphs 26, 27, 28 and 29 with putting your evidence in terms of what you would have done or what you expected would have been done. Now do I take it that what you're saying in those paragraphs where you're putting it in that way means that it's not based on specific memory of having done that, but
15 rather based on your standard practice of how you would've done it and you're assuming you would've done that here as well?

A. That's correct.

20 Q. I just want to take you now Dr Reay to some evidence that was given yesterday I think. Unfortunately I don't think it's loaded into the system yet. So I'll have to, I can tell you I don't have transcript references but I can say that it's from yesterday and it's my cross-examination of Mr Harding –

JUSTICE COOPER:

25 What time?

MR MILLS:

30 And it's at page 48 of what I've got. There's no timing on it but it's at page 48 of the raw transcript that I was given last night. I can't find it from that. All right well I'll just have to labour through it I'm afraid, I'm sorry.

CROSS-EXAMINATION CONTINUES: MR MILLS

Q. So the reference is it begins at page 48, I can't give you a line reference but it's about the middle of the page and it begins with me asking Mr Harding the following question Dr Reay.

5 "I said to him, now when Dr Reay put you in charge of the design work for the CTV building I just want to confirm with you what at least in your view was the status of the design work that had already been done before it was given to you, are you with me? Now, am I right that by the time it came to you the decision had already been made elsewhere that
10 at least the architectural design of the building was to be based on the Contours building".

Now do you recall that when you had your discussion with Williams and the initial discussion with them, that reference was made to the design of the CTV building, the architectural design being based on the
15 Contours building?"

A. No.

Q. And his answer to that was, "Yes, that decision was made before it came to me." And I then asked him, "And that included a requirement for round exterior columns," and he said, "Yes, that decision was made
20 before it came to me."

Now were you aware that a decision had been made that there would be round exterior columns in the CTV building –

A. No.

Q. – before David Harding became involved?

25 A. No.

Q. Then I asked him:

"Where did the decision come from to make the interior columns in the CTV building round as well as the exterior columns?" and he said, "Well normally they would all be the same because of the contractor who had
30 an input to the design being a design build project, he wouldn't want to have two different kinds of form work."

And he went on about that. And then I said to him:

“So is it your recollection that the decision on round columns both in the exterior and the interior was one that had been made before it came to you?” And he said, “Yes.”

Now again were you aware of that?

5 A. No.

Q. Then I asked him about the layout of the floor plan and the location of the north shear wall outside the floor plan of the building and I said to him:

“Was that already established when it came to you?”

10 And again he said, “Yes.”

Now did you see the floor plan of the building at any stage before Mr Harding was put onto this job?

A. I don't believe so, no.

15 Q. So you were never aware that this building had a single shear core, at least at the original stage, which depended upon the, what's now been referred to as the north shear core sitting outside the frame of the building?

A. No I've said that the first drawing I saw, that I asked David Harding about, had the south shear wall on it.

20 Q. So that's the very first time you had seen a plan of the layout of the frame of the building?

A. Yes.

25 Q. Then I asked him, “The east-west direction of the beams, that decision made before it came to you?” and he said, “It's possible.” Now do I take it that you would've certainly been aware of that at the point at which Mr Harding was showing you the issues around the south coupled shear wall. Would that be right?

30 A. No I wouldn't have. It was only the shear wall layout that I was concerned with and I wouldn't have asked him about the beams at that time and I wouldn't have known if they were even on the drawing.

Q. Would he not have shown you a drawing when he was wanting to get your advice on the southern shear wall?

A. Well my recollection is different to his. That southern shear wall was there when I asked – when I discussed the job with him because I was particularly interested in the shear wall layout.

Q. And when you say it was there, do you mean it was on the drawings?

5 A. It was on an architect's drawing as I recall.

Q. It was an architect's drawing not an engineer's drawing?

A. That's correct.

Q. And yet his evidence was that he was the one who came up with the, or came to the view that a southern shear wall was required because the torsionality being revealed by his early ETABS runs was unacceptable?

10

A. Yes I can only assume that he did that and by, and then the architect became aware of the requirement and put it on his drawing.

Q. But at the point at which Mr Harding first came up with the proposal, or first came to the conclusion that there was a need for some shear wall on the southern wall as well as the north wall, he had, he had a different southern shear wall in mind to the one that ultimately was used. You're aware that that's his evidence aren't you?

15

1156

A. Yes I wouldn't have looked particularly for what type of shear wall it was. I would have been interested in that there was a shear wall inside.

20

Q. But he says to you that he came up with a proposal which was based on the need for a shear wall on the southern side of the building as a result of the ETABS analysis and he spoke to you about it and he was told, he believes after you must have consulted with the owner and/or architect, that it could be done but only if it was reduced in size, made a coupled shear wall and kept inside the outer visual image of that external staircase.

25

A. That might have been the process that he remembers but I wasn't involved in the actual process of putting that south shear wall on the southern side. I recall asking him about what the shear wall layout was and he showed me and at that time it was already a wall on the southern side but what type of wall or length I don't know.

30

Q. Do you think it's possible that Mr Harding's evidence might be correct that he approached you to discuss this issue?

A. He may have discussed it with the builder.

5 Q. I'm asking you whether you think it's possible that he's right that he raised the issue with you?

A. No, no, I don't, okay, I don't think it is because I wouldn't have felt the need to ask him what the shear wall layout was because I would have known in principle what it was.

10 Q. So this is one of the few issues that you specifically recall about this building that you say you initiated an enquiry of him to ask him about the shear wall layout?

A. Yes.

Q. And at that point are you also saying that the drawings that you were shown were architectural drawings not structural engineering drawings?

15 A. Yes I believe, yeah they were architectural drawings.

Q. And the basis on which you feel you can be so confident about that?

A. Well it was an important issue to me as to the shear wall layout and I didn't want to find that he was about to progress with something that was going to be a problem.

20 Q. So you're saying that you were completely unaware that he was having problems with the ETABS analysis and that had led him to the conclusion that there needed to be a southern shear wall?

A. Yes I was unaware of that.

25 **JUSTICE COOPER:**

Q. What was your concern about it?

30 A. Oh it was a bigger floor plate building than Landsborough and my concern was that it wasn't designed as for Landsborough which I thought was getting near the limit for having a shear core without a wall on the opposite side of the building.

Q. So your concerns were related to structural issues rather than the utility of the structure for the client's purposes?

A. Yeah it was solely a structural issue.

CROSS-EXAMINATION CONTINUES: MR MILLS

Q. And because it was solely a structural issue did you feel the need to raise this with Mr Harding because you weren't entirely confident about his ability to make that decision?

5 A. No I just thought that that was a major item in terms of building design that I should check.

Q. So when you said previously that you had fully allocated responsibility to him, subject only to you having an open door if he had concerns, that's actually not entirely accurate I take it?

10 A. Well I've always said that I asked him about this, the shear wall layout and it wasn't advice I was giving him at that point it was just me checking that, in fact, there wasn't something strange happening that he'd been asked to do.

Q. In which case you would have given him advice.

15 A. I would have.

Q. And the position of the shear walls and their significance. Was the importance of that because you knew this was a gravity only building shear wall supported?

20 A. Not necessarily. It wouldn't have made any difference really. It was just the fact of the building being larger than Landsborough I didn't think we should be repeating Landsborough so I just made sure that we weren't doing that.

25 Q. And is it correct that this question about the shear walls, where they were, the size of them and other related factors, for you that was an issue of primary significance in the design of this building?

A. What I said is the location of a wall on the southern side. The actual extent of that wall would have been determined eventually by an ETABS types analysis.

30 Q. But it is the one issue that you attached enough significance to, you say, to initiate your own enquiry of Mr Harding about what he was doing?

A. Yes.

Q. Now there's a number of other matters that Mr Harding said were decided before the building responsibility was handed to him and I think

I got to the question of the beams and you said, no, you weren't aware of that, and then I asked him about the exterior spandrels and he said yes that decision had been made before it came to me. Again I take it you weren't aware of that?

5 A. No.

Q. And then I asked him about the mixture of pre-cast and in situ concrete work in the building, had that been decided. Yes he said it had been decided. Again you're unaware of that?

A. I wasn't involved in that decision.

10 Q. And do you also say that you had no involvement at all during the course of the project about what parts of the building would use pre-cast concrete and which parts would be poured in situ?

A. I had no involvement in that.

Q. I asked him then whether the overall decision that the building would be a shear wall supported gravity frame building, had that decision already been made. Yes he said and, again, I take it you were not aware of that?

15

A. No.

Q. And then I asked him about the decision to use Fletcher Brownbuilt HiBond flooring. Had that decision already been made before it was given to him. Yes, he said, it was. And, again, you had no knowledge of that?

20

A. No involvement.

Q. Now let me ask you in 1986 did you have any particular relationship of any kind with Fletcher Brownbuilt?

25

A. They were a client of the firm.

Q. An important client?

A. They were.

Q. And as a client you would be keen to encourage the business relationship with them?

30

A. I never pushed any client's products.

Q. But if you had a choice of product and one was a client's product and one was a non-client's product you don't think there'd be a natural inclination to use the client's product?

5 A. Only if it was equal or better and, in that case, I don't believe there was any alternative at that time to the product from Dimond's Fletcher Brownbuilt in terms of that flooring.

Q. And when did you become aware that a HiBond Fletcher Brownbuilt flooring was going to be used?

10 A. I wouldn't have been aware of that in the early stages. I certainly wasn't involved in the decision.

Q. So when you just said that you thought there was no alternative but to use the Fletcher Brownbuilt HiBond flooring, when did you reach that conclusion?

15 A. I'm talking about the use of a metal deck system in terms of alternatives. There certainly were other alternative flooring systems, such as the rib system used on Landsborough, and if I'd been making the decision I would have used the rib system.

JUSTICE COOPER:

20 Q. Dr Reay your voice is dropping again. I understand the equipment we started with has been tested and it's been shown to be working and the problem is that you're speaking too softly. Now I've tried several times to get you to speak up. I'm not sure what more I can do. Can I suggest to you that you're having an argument with somebody and you really
25 want to shout and we'll see how that goes.

A. Yes sir.

CROSS-EXAMINATION CONTINUES: MR MILLS

30 Q. Did I misunderstand then what you were saying a moment ago when you said that you didn't think there was any alternative but to use a steel flooring system?

A. Yes you did misunderstand.

Q. All right then do away with that misunderstanding by telling me what I should have understood.

5 A. Those metal deck systems, the only one I understand that was available at that time was the Fletcher Brownbuilt one. The alternative floor systems that could have been used are one of the type that was used in Landsborough which was a concrete rib system with a timber in-fill and a topping, concrete topping.

Q. And you say that would have your preference.

10 A. That's what I would have used. That's what was used in both Landsborough and Mair Astley.

Q. Do you recall when you became aware of the fact that a metal deck system was being used?

A. No I don't.

1206

15 Q. I see. All right well that's the list of things that Mr Harding says were all determined before the building came to him and before he was given responsibility for it and so I take it you're saying that although those decisions were already made that you weren't aware of any of them.

A. That's correct.

20 Q. And some of them would have relevance to the performance of that building? Size of columns?

A. They would need to be reviewed as part of undertaking the design of the building.

Q. And who was going to do that review?

25 A. Well that would have been David Harding in doing the work.

Q. And if the design and decisions on those various elements of the building that I just ran through weren't made by you is it your view that they were probably made by the contractor?

30 A. Well I would have thought the contractor in conjunction with David Harding, just as they would have dealt with that shear wall that David Harding wanted in the same manner.

Q. Yes. All right. Now again just not, really just to be fair to you there were questions asked yesterday about the culture within your firm at the time

A. Yes.

5 Q. Now do you accept that if evidence is given by Mr Henry and Mr Horn about the culture within the firm and it is consistent with what Mr Harding says about the culture within the firm that that might at least be correct as far as your staff perceived the culture?

A. I wouldn't necessarily agree with that, no.

10 Q. So do you think that all three of those individuals, if they give common evidence on this, you just dismiss it and say it's wrong?

A. No it might have been, they might have had a perception but I don't think that necessarily they were representative of the, of the view there.

15 Q. I see and the evidence that's being given on the culture within your firm is there any of it that you agreed with? Did you listen to that evidence. Did you hear it being given?

A. Yes but I don't remember it well enough to ...

20 Q. All right. Let's see if I can, again it would be, it's a little difficult without the transcript. I'll do what I can on this. We do have it now. Good. It's at, the page I want at least in this version is page 34. I understand it might be a little different in the one that you're in. Yes, okay, so this will be the same referencing. If you go down Dr Reay about two-thirds of the way down you'll see, it says:

25 "So first of all I want to ask you some questions about the evidence you've given under cross-examination, principally about the culture at Alan Reay's firm when you were there and I'm going to put a series of points to you and, again, if we can get yes or no and then some modification if need be that would help. So first of all the practice within that office during the time you were there was to build no greater than
30 necessary in terms of the strength of the buildings?" Mr Harding said, "Yes."

Your comment on that?

A. The response I gave in questioning was that the code standards were minimum.

Q. Yes.

5 A. And that that was not the only criteria for designing buildings. The other criterias such as buildability, safety during construction, were all factors that needed to be taken account of.

Q. But do you accept that taking the issue of building no greater strength than was necessary in terms of the code, would that accurately describe the culture?

10 A. No because the code is a minimum.

Q. All right and then Mr Harding said in response to me, I said to him, "You could not design above the code requirements or, to use the colourful language you used, you would get your hand smacked." "Yes," he said.

A. That's not correct.

15 Q. And if we can go to the next page.

Question: "Dr Reay made his reputation by making buildings no stronger or more expensive than necessary in your view," and he said, "Yes."

20 A. The basis of the building design was minimum code standard but I always viewed the material content as of lesser importance than buildability and efficiency of construction and those out-weighted, out-weighted whether you put in one size mesh or another size mesh. So it's not, that is not true in terms of the philosophy.

25 Q. All right and then I asked him, "If you did design a building stronger than Dr Reay considered necessary you would be asked to justify that," and he said, "Yes." Do you agree with that?

A. If I found people designing things that I thought looked like they were just guessing and adding reinforcing or concrete I would ask them to justify it to ensure that they were actually designing what they were doing and not guessing what they were doing.

30 Q. All right and then I asked him, "And if you couldn't justify it then you would go back to whatever the requirement was that Dr Reay considered appropriate?" Answer, "Yes."

I assume you'd agree with that?

A. No that's not correct because if in fact they did the work on it and could show that it was an important feature then it would be included.

Q. But he's saying if you couldn't justify it to you then you would go back to whatever the requirement was that Dr Reay considered appropriate. Is that not correct?

5

A. No if they couldn't justify it they would then re-design to what was appropriate.

Q. Not what you were telling them was appropriate?

A. That's correct.

10

Q. Right and, well the next one, it's a subjective point from Mr Harding so I won't ask you about that, and then I asked him a question about the culture in relation to whether the code was a maximum or a minimum and I take it your answer to that is?

A. The code's a minimum.

15

Q. Yes and then I asked him further down, "The culture was that you didn't build beyond the code," and he said, "That's correct."
But you're disagreeing with that?

A. Well yes there would be many buildings that had materials that exceeded the code for practical reasons, for buildability reasons.

20

Q. Yes, all right. I think that's all I need to take you to. I just in fairness needed to take you through the various points that are being said about the culture of the firm.

A. Thank you.

25

Q. Now just one other I see and I can, if it could just be brought up again momentarily. It's on page 36 and down towards the bottom of the page you'll see that paragraph, or the question beginning:

"Now it's in that sense, and I put to him a point that Professor Mander had given in evidence where he drew a distinction between liberal and conservative approaches to the code".

30

And I asked him:

"Was the culture that you experienced during your time at Alan Reay's firm one that if there was room for varying interpretations of the code that the interpretation that minimised cost and minimised the nature of

the detailing that was required, that would be the preferred route,” and he said, “Yes, I think that would apply to all engineers,” and I said to him, “I’m not asking about all engineers, I’m just asking about your experience at Alan Reay’s firm and I take it you’re saying it applied there,” and the answer was, “Yes.”

5

Your reaction to that?

1216

A. Well I don't really understand this expression of liberal and conservative approaches.

10 Q. Yes. You agree there are parts of the code where structural engineers disagree on the correct interpretation of the code provisions?

A. There are parts of that.

Q. Yes, and the point I take Professor Mander to be making is that in those areas where there may be a debate among structural engineers about the way to interpret the code, that some structural engineers take a liberal approach by which I understood him to be saying that you would use it in a way that enabled you to do more things under the code and others would take a conservative approach where they would in effect read down and treat as more onerous really the requirements of the code. Now in that framework do you have a cultural view on that yourself because Mr Harding is saying on that choice your culture in your firm was at the liberal end of that spectrum?

15

20

A. No I don't agree with that. It depends on the type of job that one's undertaking.

25 Q. All right.

A. And how applicable certain code clauses are to that job.

Q. Now just a few minor things I just need to run through with you. The first one is during the period around the design of the CTV building so it's 1986, so the period around that '85, '86, was anyone in your firm a regular attendee at what is now called the New Zealand Society of Earthquake Engineer conferences, I think back then it was the New Zealand National Society of Earthquake conferences.

30

A. Engineers.

Q. Engineers rather, were you or anyone in your firm regular attendees at their conferences?

A. I don't recall.

Q. Did your firm receive bulletins from the society on a regular basis?

5 A. Receive –

Q. Bulletins from the New Zealand Society for Earthquake Engineers. Were you a subscriber?

A. I don't recall.

10 Q. How about the journals from the Concrete Society? Do you recall whether you were a subscriber to that?

A. Well we're a subscriber now to all those journals but I can't remember when we started being a subscriber.

15 Q. In several paragraphs in your evidence you refer to the possibility of there being additional calculations or drawings to those which it is said Mr Harding had done for CTV and I can take you to all of it if you like but I imagine you recall saying that and just for reference paragraph 23 is one of them, you say "I also note that the full extent" –

JUSTICE COOPER:

20 What page?

MR MILLS:

Page 14 Sir.

CROSS-EXAMINATION CONTINUES: MR MILLS

25 Q. You say there, "I note that the full extent of Mr Harding's calculations is not known," and there's another reference at paragraph 31. It must be a doubled up 31 again I think.

JUSTICE COOPER:

30 I have not found it yet.

MR MILLS:

It is page 14, the paragraph, it's continuing to the top of that page, you will see the last, second to last sentence, "I also note that the full extent of Mr Harding's calculations is now known. There may well be significant further calculations which have not been retained." Do you have that? It is on the
5 screen now.

JUSTICE COOPER:

I see now.

CROSS-EXAMINATION CONTINUES: MR MILLS

10 Q. Now in relation to that, you also say at paragraph 31 of your first
statement of evidence and this on our reference number in the top right-
hand corner is page 5, and you'll see you say there, "I cannot be certain
that these calculations or drawings represent the full set of calculations
15 or drawings which are no longer on ARCE's or the Council's files."

Now in relation to those statements Mr Harding makes no such claim,
has not asserted there's anything other than what we've got. This is just
surmise on your part I take it, you're not pointing to anything specific?

A. No I just would have expected some preliminary calculations to have
20 been done. Quite often when you're designing a building you might
decide to go and design some particular aspect to check it out to see
how it's fitting into the overall –

Q. Yes.

A. – there would be – I would have expected that there may have been
25 those sort of calculations but I've got – I can't specifically say that I knew
there were any more.

Q. All right, I just wanted to clarify that with you.

JUSTICE COOPER:

30 Q. Can I just make sure I understand that and what I think is probably the
context. You're saying are you that before you produce the finished
calculations if I may put it that way, which are submitted with a building

permit or consent application, you would have expected to see some preliminary workings which would have preceded that full set of calculations?

5 A. Yes if Mr Harding had, for example had concerns about the shear wall system he may have well done some preliminary calculations for the shear walls.

Q. But is the possible absence that you're talking about is at that front end stage as it were rather than in the detailed calculations which we do have.

10 A. Well he could be part way through the calculations and decide he wants to investigate some particular aspect and detail, whether it's the floor system or whatever and he might do some preliminary calcs on that to make sure that it's going to work.

15 Q. Yes. But – well then putting this another way even if the timing is not necessarily as I've put it, you're not identifying something that would be contrary to the position set out in the calculations that it appears were submitted to the Council?

A. I don't think it would be contrary to, it would just give an indication of the thought process behind the design and calculations that we had.

20 **CROSS-EXAMINATION CONTINUES: MR MILLS**

Q. Yes, well that resolves the point that I was concerned about so thank you. Now paragraph 56 of your evidence and this is page 7 on our little red numbering system. You observed that there are differences between the set of the drawings that ARCL has in its records compared to Council's records. We've now been provided with the drawings and I assume that you've looked at them in making this statement here about those drawings and the differences between them?

25

A. I've had someone in the office go through and do it.

Q. And would you accept that really the differences that emerge from the comparison of those two sets of drawings are extremely minor?

30

A. I wouldn't say extremely minor but they're minor.

1226

- Q. Paragraph 59, same page on our numbering system, you make the comment that traditionally ARCE did not include a design review and as a small firm relied on the Council review process. Now you were very familiar with the Council review process in 1986 when the CTV building was being built, weren't you?
- 5 A. Whatever the process was yes.
- Q. Yes whatever the process was you would have been familiar with it. Yes are you agreeing with me? Whatever the process was you certainly would have been familiar with it.
- 10 A. I would have known what it was yes.
- Q. Now were you aware, and I don't know whether you saw this when it was brought up, I think, yesterday, that Mr Bluck had issued an internal memorandum in which he made it clear to the staff in the building department that ultimately it was the structural engineer's decision that was to be accepted and relied upon and the Council was not to be doing the design itself. Were you aware that that was the view of the department at that time, 1986?
- 15 A. No I wasn't made aware of that.
- Q. So that comes as a surprise to you does it?
- 20 A. Yes it does.
- Q. Did you think at this time then the CTV building was being put in for permitting that one reason you didn't need to be concerned about any issues with Mr Harding was because the Council would do the job for you if there was anything that needed to be picked up?
- 25 A. Well the Council were reviewing the buildings. I don't understand that document that Mr Bluck issued. There were times when the Council would have insisted we do things a certain way and that would be totally inconsistent with that.
- Q. Would that be principally Mr Tapper who would be insisting?
- 30 A. Not necessarily no.
- Q. Was he included in those who would be insisting?
- A. He could have been, could have been, I couldn't be absolutely sure.

Q. Did you have engagements with Mr Tapper where he was insisting that things be done in a particular way?

A. Oh there would have been.

5 Q. So you agree that he was a person who, at times at least, would be insisting that things be done his way?

A. He would, unless you convinced him otherwise he would expect it to be done his way.

10 Q. And do you read Mr Bluck's memorandum as really taking a rather different view to that and saying it's really for the structural designer to ultimately make the decisions on the design?

A. Well it's a different position to that which when a Council engineer insists that you do things a certain way or include certain materials but I guess what Mr Bluck's getting at is he doesn't want his people doing that, he just wants them reviewing the work.

15 Q. Just a couple of points in your response to Mr Henry's brief that I need to take you to. You, can you just turn to paragraph 14 of your composite brief, and it's page 12 on our numbering system, and look first at paragraph 14 and then before I ask you a question I'll also get you to look at 19. You'll see that you say there in response to Mr Henry "It is not correct to state, as Mr Henry does in paragraph 48, that I was committed to an offset configuration for Landsborough House. As principal consultant it was my role to ensure all options were considered". And then at paragraph 19, over on the next page, you say "At paragraph 63 of his evidence Mr Henry states that I was dismissive of his concerns about the Landsborough House building. I was not dismissive of Mr Henry's concerns. I was aware he had appropriately discussed his concerns with Professor Paulay and I advised him that I was satisfied with the solutions agreed". Now would you accept that your management style with your staff can be quite forceful?

20

25

30 A. No I don't consider that my management style is forceful.

Q. Do you think that what, that you could well be perceived by staff as being dismissive of some of their issues even though you don't mean to be?

A. Do you mean then or now?

Q. Then.

A. Well I don't think I've changed significantly and people don't seem to take that view about me now.

5 Q. Well Mr Henry certainly will say that he thought you were dismissive of that but he can deal with that when he gives his evidence. Paragraph 32 of your evidence, it's at page 15 on our numbering system. Am I correct to read what you're saying there is in part criticism of Mr Henry where you say "Secondly, Mr Henry notes that the shear wall design for
10 the two buildings was sufficiently different". Sorry the first point really is the one I should have picked up. "First, he states that it was unlikely his calculations were sufficiently detailed for a first time designer to be able to adequately understand the design process", and then you say "In respect of Mr Henry's first point a design engineer's calculations should
15 include reference to decisions made on experience. The concept of the design should have been summarised in the calculations". So are you saying that you would have expected those decisions based on experience to be part of the Landsborough House file?

A. I would have expected it.

20 Q. But I take it that you've already acknowledged that you didn't check what was in that Landsborough House file before you passed it on to Mr Harding for him to use?

A. I don't recall whether I checked it or not.

25 Q. Now, finally, I just want to ask you a few more questions about the time sheets.

WITNESS REFERRED TO BUI.MAD249.0477.5

30 Q. Now as I understand the way these are done there's a running hourly total for each of the authors and yours is on that left-hand side. This is not the only page for February but this is the page which, as I understand it, is giving the total time for the month which is then recorded, as it is there, as 88¼ hours for you for February. Is that a correct reading of it?

A. Yes.

- Q. And I think you're also aware because you dealt within your evidence that the first month in which you have recorded any time on the CTV building is February where I think you had two hours. Do you agree with that? I'll take you to it if I need to. Yes it is there. 2503 is the numbering there. You see it's actually right at the bottom there just above the total hours.
- 5 A. Oh yes, yes.
- 1236
- Q. Two hours in February. So that's the first month when you had an involvement in CTV and it's a total of 88¼ hours, two hours on CTV. Then can I take you to the timesheets for March which is at page 10 on our numbering system and you'll see there it says 119½ hours. Is that correct?
- 10 A. Yes.
- 15 Q. So that's your total client related work for that month. Is that what you've told us?
- A. Yes, there doesn't appear to be any administration time in that.
- Q. Yes. Then can I take you to the time record for April and that's at page 16 and am I correct that the total number of hours recorded for you for April is 112?
- 20 A. Yes.
- Q. And then if I could go to page 19 which is the cumulative total for May, your total number of hours there are 202¾?
- A. Yes.
- 25 Q. Now we've checked through, given your advice that we could pick up the administration or management time. We've gone through and found that for the months of January, February, March, April there's no management time recorded for you. Do you accept that?
- A. Yes that's recorded under 9003 there.
- 30 Q. Correct.
- A. Whereas there's no 9003 in the previous ones is there?

- Q. No that's right. Our checking of it said that there was no management administration time recorded in the months of January, February, March, April. Are you prepared to accept that just for the moment?
- A. Well yeah I suspect that there was. It just isn't in here.
- 5 Q. Well that's the question I asked you before about, where would we find the management time and your response was it would be here or it wouldn't be anywhere I think –
- A. Yeah.
- Q. – was essentially what you told me. You agree with that?
- 10 A. It was but it's ...
- Q. Yes. All right. Now let's back track over that. So the timesheet records are showing your first involvement with the CTV building, two hours in February.
- A. Yes.
- 15 Q. And we've seen the hours that were involved and the totality of the work that you were doing and I think you'd agree with me would you that none of those monthly hours look to be massive?
- A. In terms of my time?
- Q. Yes.
- 20 A. No. They're not, as, as recorded there.
- Q. Yes. Well in paragraph 23 of your evidence, and this is page 4 on our numbering system. Do you have that?
- A. This is the composite statement?
- Q. Yes, yes and the red numbering up in that top right-hand corner. You'll see it's point 4. It's being brought up now. What I'm drawing your attention to is that you say there, "At the time that the CTV building came in," and this is on the time records February, "I was fully engaged on other projects and would not have had the time to take on this job." Now that's not supported by the time records is it?
- 25
- 30 A. No the time records though wouldn't include some of my activities that I had.
- Q. Such as?

A. At that time I was developing and researching some work on developing further the Fletcher Brownbuilt building system that I'd developed and I did spend a lot of time on that that I wouldn't have –

5 **JUSTICE COOPER:**

Q. Could you speak up please.

A. Yes.

Q. You've said at that time you were, you spent time developing Fletcher Brownbuilt building system and –

10 A. I wouldn't have recorded time on that. That was a personal type of project to me in that we got royalties for what they sold so I used to try and develop new systems.

Q. I see.

A. And that would, there would have been quite a bit of that happening at
15 that time.

CROSS-EXAMINATION CONTINUES: MR MILLS

Q. And did that include work on their Brownbuilt Hibond flooring?

A. No. It's nothing to do with it.

Q. So do we take it from that then that you still maintain that you were so
20 fully engaged on other projects at the time that the CTV building came in, timesheet indicating that was February 1986, that you wouldn't have had time to take on the CTV job?

A. That's correct.

Q. And you're saying that's because of this unrecorded time that was
25 particularly involved with Fletcher Brownbuilt?

A. That, at that time, yes.

Q. So it must follow from that then that the time records are not an accurate and comprehensive record of what you are doing at any particular time during the working day?

30 A. That, in terms of that particular job that's right.

CROSS-EXAMINATION: MR ELLIOTT

Q. Dr Reay the last time you gave evidence you said that you had not studied the drawings closely and also you said that you had not read Professor Mander's brief, at that time. Do you recall that?

A. Yes.

5 Q. And you've just said in response to Mr Mills that you've not reviewed Professor Mander's questioning at all. That's right isn't it?

A. I've seen a limited amount of it, that's all.

Q. So you've been limited as to time you said.

A. Yes.

10 Q. And yet yesterday you were able to cite Mr Strachan's exposure to chemicals affecting his memory, weren't you?

A. Yes.

Q. That information seemed to have been at your finger tips.

A. That's because I read Mr Strachan's brief some time ago and I was concerned at what I read and that's why I remembered it.

15

Q. Do you consider it's more important to identify ways to criticise evidence than to assist the Commission in working out why the building failed?

A. No that's not true.

Q. My questions today for you are about the design of the building. Next week I think you're coming back to discuss code compliance, so I just want to make one or two points in anticipation of that evidence. You've said last time as well that you have huge empathy for the families of those who died. I can tell you that there are some upset people listening to your evidence and upset that you haven't apparently read all of the relevant documents and I can tell you what the families of those who died would appreciate which is that when someone who has made an error comes to the Royal Commission and volunteers it willingly, without any obfuscation. So when you return to give evidence on code compliance on their behalf I invite you to volunteer to the Commission the areas of non-compliance with this building. Will you do that?

25

30

A. As far as I am able I will.

Q. And to ensure that you're in a position to do that will you ensure that you read personally the drawings?

A. Yes I will.

Q. And will you satisfy yourself, as I think you'll find, that when you compare the two sets of drawings there are no differences in the detailing of the columns, or the beam column connections. Will you check that please?

5

A. Yes.

1246

Q. And will you also look in particular at the manner of connection between the floor diaphragms and the north core?

10 A. I will look at that. That may be beyond my expert knowledge but I will do what I can.

Q. I'll raise one issue with you now because Mr Rennie asked the question of Mr Harding and you made a comment earlier on which I think indicates that you are aware of one particular area of non-compliance in relation to the beam column joints. Is that right?

15

A. Yes I consider that there is insufficient transverse reinforcing in the joint.

Q. So that's a reference to section 9.4.8 of NZS3101, isn't it?

A. I couldn't, I couldn't answer that off the cuff.

Q. ENG.STA0016.70 please?

20 **WITNESS REFERRED TO SLIDE**

Q. Enlarge section 9.4.8 please. This refers to the confinement in beam column connection doesn't it?

A. Yes.

Q. And this was the clause that Mr Rennie put to Mr Harding yesterday wasn't it?

25

A. I didn't hear that.

Q. And the clause ends, "In no case shall a stirrup tie spacing in the joint core exceed 10 times the diameter of the column bar or 200 millimetres, whichever is less." Now do you agree that 9.4.8 comes from the non-seismic section of section 9?

30

A. Yes it does.

Q. And so the 200 millimetres would be a minimum requirement. That's right isn't it?

A. That's correct.

Q. And the spacing between the bars, the spirals was 250 millimetres wasn't it, according to the diagram, according the drawings?

A. Yes it was.

5 Q. So that is a clear and agreed evidence, area of non-compliance?

A. Yes it is, it's, although it's slightly complicated by the fact that you couldn't actually build the reinforcing the way it was drawn, and how that got resolved I don't know, but I doubt that it solved this problem.

10 Q. Thank you, doctor. Mr Rennie asked you about the computer disk that I asked you about last time?

A. Yes.

15 Q. This was the disk containing documents relating to the CTV building, the position with that, this disk is that some time after the February earthquake, after 115 people had died and presumably after the Royal Commission had been announced it was thrown away, is that right?

A. It was disposed of with the rest of the disks.

Q. But your evidence is that documents were transferred to a hard drive before it was thrown away?

20 A. Yes.

Q. How do you know that?

A. Well because I was responsible for doing it.

Q. Did you do it?

A. Yes.

25 Q. And did you verify the same documents that appeared on the hard drive were the same as the ones on the disk?

A. Yes I did.

Q. Did you check them document by document?

A. Yes.

30 Q. Referring now to the evidence of the last two and a half days in which you and your former employee have been debating who was responsible for what, we can agree that you were the principal of the firm weren't you?

A. Yes I was.

Q. You made the decision to take the CTV job on?

A. Yep, the final decision was mine.

Q. And you could've said no?

5 A. That's correct.

Q. And you took the profit from the job?

A. I wouldn't know.

JUSTICE COOPER:

10 Q. Well who else would have?

A. Sorry Sir?

Q. I said well who else would have?

A. Oh, no all I meant was I don't know whether the job made a profit or not, that's all.

15 **CROSS-EXAMINATION CONTINUES: MR ELLIOTT**

Q. Whatever profit that may have been you would've taken as the principal of the firm?

JUSTICE COOPER:

20 Q. Or the loss, that's the point your making is it?

A. Or the loss, yes, yes, whatever.

CROSS-EXAMINATION CONTINUES: MR ELLIOTT

Q. I refer you to WIT.REAY.0003.10?

WITNESS REFERRED TO SLIDE

25 1251

Q. If paragraph 52 could be enlarged please? You say, "I recall that at the stage that Mr Harding received the architect's drawings I asked him what the structural lateral load system was. He said it was a core structure on one side and shear wall system on the other. I would have asked to see the plan layout and recall noting that I considered the design a more stable layout than the Landsborough House design."

30

Firstly that plan layout which you would have seen would have indicated to you that the north core stood outside of the envelope of the building wouldn't it?

5 A. It may have. That wouldn't have been something that I particularly took note of.

Q. And it would have been evident to you that there was an area allowed within the north core lifts and stairs. That would be right wouldn't it?

A. Yes but I may not have taken note of that. My particular interest was in the southern wall.

10 Q. And it would have been evident to you that the areas in which a lift well and stairs were located would have been voids?

A. If I'd looked for it yes.

Q. In discussing with Mr Harding what the structural lateral load system was, it would have been inevitable that you would have discussed the fact that this was to be a gravity only column arrangement. That's right isn't it?

15 A. No it's not.

Q. Well the columns weren't intended to carry any lateral load were they?

A. No but at the time I asked about that I was solely interested in the shear wall layout, not in the columns.

20 Q. Well you would have satisfied yourself that the walls were to carry all of the lateral load wouldn't you?

A. Well only in principle. There was no calculations discussed.

Q. And it would have followed from that in principle position, that columns were not to carry any lateral load, they were to be gravity only. It must follow mustn't it, doctor?

25 A. Not necessarily because the columns and beams could have been designed to the ductility if that was the chosen system. As it happens it wasn't.

30 Q. Well it wasn't because you agreed that it wouldn't be. That's right isn't it?

- A. I would have if it – if the design was satisfactory I would have agreed that it would have been undertaken in the same principle as say Landsborough House.
- Q. Which was a gravity only –
- 5 A. Which was a gravity only column beam system.
- Q. The paragraph says that you considered the design of the CTV a more stable layout than the Landsborough House design, so evidently you had enough information before you to make that conclusion, agreed?
- A. It was based on the coupled shear wall, instead of being incorporated with a core as at Landsborough, it was incorporated in the opposite of
- 10 the building and I think I've said that and that in itself meant that it was a more stable arrangement.
- Q. I think you used the words earlier on, "You didn't want this to be another Landsborough, or not another Landsborough". You used those words
- 15 didn't you?
- A. Yes, that was in relation to the fact that this building had a larger floor plate than Landsborough and I considered that Landsborough really was in terms of a torsion tube building was as large as I would have preferred it to be.
- 20 Q. Did you pass on those concerns to Mr Harding or do you not recall?
- A. I don't recall.
- Q. You must have given him the Landsborough House file mustn't you?
- A. No he could have – I could've just said to him, look you'll get all that information from whatever the file number was and he could have got
- 25 have got it himself.
- Q. But the file number would have been identifiable as Landsborough House wouldn't it?
- A. Yes. We would call it that or call it the file number.
- Q. I see so –
- 30 A. They're just filed by – if you're looking for files you go by the number.
- Q. You referred him to Landsborough House though as a file he should look at?
- A. Yeah.

- 5 Q. Given that the north core was located outside of the envelope of the building and that there were voids within the lift well and stairwell, this was just something Mr Harding would have had to deal with in terms of designing connections between the diaphragms and the north core isn't it?
- A. Well resolving it as part of the design yes.
- Q. So he would have just had to apply whatever skills and experience he had to that problem?
- A. Yes.
- 10 Q. Similarly on the basis the building was to be designed with gravity frames only, Mr Harding would have had to just deal with the consequences of that decision as best he could, agreed?
- A. No, it's really – it's not like that. He would have gone through and established whether that system was going to be appropriate and would work for that building, and if it was not going to comply with the code, then he couldn't do it.
- 15 Q. It would have been an inevitable consequence of it being gravity only that he would apply non ductile transverse reinforcement details for the columns wouldn't it?
- 20 A. No, you can't decide it's gravity only until you've done the analysis.
- Q. We'll come back to the analysis, but just in terms of your involvement, if the Royal Commission finds that the placement of the north core and the south walls were in some way flawed as to where they were, there would be no doubt that you personally endorsed the decision to place them where they were placed. Agreed?
- 25 A. No not necessarily, I only had an overview of it. I wouldn't have gone through it in detail and in fact again until the analysis is done you can't actually make that decision.
- Q. And if the Royal Commission finds that any or all of the columns and/or beam column connections should have been designed for ductility, there can be no doubt that you were personally satisfied that they should be gravity only, agreed?
- 30 A. The not should be, but could be.

Q. Well you've said to me last time you gave evidence that this gravity only shear walls system would not have been different, so you associate yourself with that don't you, you personally endorse it?

A. You'll have to explain to me what your question is.

5 Q. Transcript 20120712.133 – “Do you think if you had been more closely involved the decision to build the building on the basis of north shear core and the south wall as being the primary seismic resisting elements, and column –

10 **JUSTICE COOPER:**

Do you want this displayed? It is quite a long quotation so it's probably fairer to do so.

CROSS-EXAMINATION CONTINUES: MR ELLIOTT

Q. It's transcript 20120712.133, line 29 please. The question Dr Reay was,
15 “Do you think if you had been more closely involved the decision to build the building on the basis of north shear core and the south wall as being the primary seismic resisting elements, and columns being designed non seismically might not have happened,” and the next page, “No, I don't believe in principle that would necessarily have changed because I
20 was aware that the building had that northern shear core in it, southern shear wall. The building that had been designed by another staff member previously was Landsborough House and it was probably more torsionally sensitive than actually the CTV building was and it was designed on the basis of elastic columns.” So putting to one side
25 whether or not you and Mr Harding had discussed it at the time, even if he had, it appears that you would have said, “That's fine, go ahead with gravity only columns.”

A. Well no this is an answer after the event in a sense, because I say you have to do initial design and analysis to conclude that the gravity only
30 column system is acceptable.

Q. Thank you doctor, we'll return to the analysis that Mr Harding should have done after the adjournment.

HEARING ADJOURNS: 1.01 PM

HEARING RESUMES: 2.15 PM**CROSS-EXAMINATION CONTINUES: MR ELLIOTT**

Q. Dr Reay I refer you to a section in the Code now NZS3101. It's
ENG.STA.0016.28. If we can just start by highlighting the bottom left-
5 hand part of that please which starts with the heading Secondary
Structural Elements. The position is, Doctor, the columns were treated
as secondary elements. That's right isn't it?

A. Yes.

Q. Now just note a couple of parts of this clause. Just the question of
10 whether or not they were, in fact, secondary elements will be a question
for the Commission and will be a question which we will need to explore
more thoroughly during the Code compliance section. Just in passing
we can see there that secondary elements are those which, firstly, do
not form part of the primary seismic force resisting system and then if
15 we can go up to the first paragraph in the next column, the top of the
right-hand column please, begins "are assumed" or "are assumed not to
form such a part and are, therefore, not necessary for the survival of the
building as a whole under seismically induced lateral loading". Again,
without debating the merits of that your position is that the columns
20 satisfy those criteria, that's right isn't it?

A. Yes, that's correct.

Q. And then we move down to clause 3.5.14.3 and if we can highlight that
first section and paragraph A please. Are you aware that Professor
Mander referred to this as a loophole?

25 A. No I wasn't.

Q. Now I just want to consider the implications of this particular clause in
terms of the design of the building. We see there under 3.5.14.3, Group
2 elements shall be detailed to allow ductile behaviour and in
accordance with the assumptions made in the analysis. So the starting
30 point is that if the columns were secondary elements and group 2

elements they shall be detailed to allow ductile behaviour – that's right isn't it?

A. I'm sorry I didn't hear that.

5 Q. The starting point there, according to this clause, is that if the columns were secondary elements and if they were group 2 elements they shall be detailed to allow ductile behaviour unless they fell into one of the categories below.

A. Yes.

10 Q. Then look at clause A, which says additional seismic requirements of this Code. Now in the case of columns the additional seismic requirements of the Code would be the seismic provisions as to, for example, transverse reinforcement of columns. Would that be right?

A. It could be yes.

15 Q. So those additional seismic requirements of the Code need not be satisfied, it says, when the design loadings are derived from the imposed deformations v -delta specified in NZS4203. Now we'll be discussing v -delta and its implications during code compliance. For present purposes I think you can confirm that delta is the displacement or deformation of the primary elements due to earthquake loads.

20 A. Effectively yeah.

Q. And V is the modification factor by which deformations are multiplied as specified in NZS4203. Is that right?

A. Yep.

25 Q. Now the deformations, delta, they can be calculated by the equivalent static force analysis or by dynamic analysis. Is that your understanding?

A. Yes or spectral modal analysis yep.

Q. And the spectral modal analysis is, in effect, in this case, ETABS, is that right?

A. Well the ETABS is used for both.

30 Q. Mr Harding, in fact, instigated an ETABS analysis didn't he?

A. Yes.

Q. And that must have produced values for delta, is that right?

A. Yes he would have.

- Q. It is true isn't it that a building which was exposed to earthquake shaking greater than design level could experience deformations greater than V-delta.
- A. Yes.
- 5 Q. And, in fact, the CTV building would have experienced deformations greater than v-delta on the 22nd of February.
- A. Well it's assumed that it did.
- Q. Looking back at that paragraph A it goes on to talk about the assumptions of elastic behaviour so I think what you would interpret that to mean is that if the columns remain elastic at v-delta there is no need for the additional seismic requirements to be met. Is that right?
- 10 A. That's my understanding.
- Q. Now you heard evidence yesterday didn't you that Mr Harding did not know about this clause. You heard that?
- 15 A. Well that was the impression I got yes.
- Q. Well that's what he said.
- A. Mmm.
- Q. And you accept that don't you?
- A. Well he says that now. I don't know whether he knew more at the time, whether his memory's faded, I don't know.
- 20 Q. And Mr Harding did not do any calculations to determine if the columns were elastic at v-delta did he?
- A. That's what he said.
- Q. So if, in the design of this building, the columns did actually remain elastic up to v-delta that would have been a fluke wouldn't it?
- 25 A. Well not necessarily a fluke. It could be that the various assumptions that he made tended to cancel out and deliver what was close to the answer.
- Q. But not if he hadn't carried out any calculations in relation to the elasticity of the columns.
- 30 A. Well I'm not sure what he did.

- Q. What you have done now, I take it, is to enlist your current employee, Mr Latham, to carry out an analysis of the elasticity of the columns after the event, is that right?
- A. Yes that's right.
- 5 Q. And he will give expert evidence about this for you will he?
- A. Yes.
- Q. How many buildings has he designed under NZS3101:1982 or 4203:1984?
- A. Has he designed?
- 10 Q. Has he designed.
- A. None, he's not old enough.
- Q. How long has he been practising?
- A. He's been practising for two and a half years.
- Q. We compare columns on the one hand detailed under the seismic detailing provisions in NZS3101 and, on the other hand, detailed without those seismic detailing provisions. Would you agree, firstly, that the non-ductile columns would be prone to brittle failure?
- 15 A. It would be more prone to failure than the ductile column under displacement.
- 20 Q. And to avoid doubt we can define failure as buckling with a total loss of load carrying capacity?
- A. Oh it could be a shear failure.
- Q. So prone to either form of failure.
- A. Mmm.
- 25 Q. And would you agree also that once the non-ductile columns, once their elastic limit is reached their failure would be swift when exposed to ongoing load.
- A. Oh no, no, they would survive beyond the elastic limit.
- Q. But not nearly as far as for ductile columns.
- 30 A. No.
- Q. So your position in relation to this clause we have here is that the columns would only be required to be ductile if they were not elastic at v -delta. Is that right?

A. That's correct based on that clause.

Q. So v-delta is a knife's edge isn't it, on one side of which the columns must be ductile, on the other side not ductile.

A. Well the Code is like that all the way through, there's got to be limits.

5 1425

Q. Treating the columns as secondary elements, assuming that they'll be elastic up to v-delta and making them non ductile on that basis. That's consistent isn't it with designing the building to the very brink of the code?

10 A. No.

Q. I'll point you to a letter that you sent to the Department of Housing and Building: BUI.MAD249.0195A.11. Can you identify this as the attachment to a letter that you signed and sent to the Department of Building and Housing commenting on the draft Hyland Smith report?

15 A. Yes back in December.

Q. And I'm just referring to the row which has 86 BCR. Just highlight that first comment, 'it is important.' I'll read that out, this is a quote from the Hyland report, "It is important to recognise that the expectation of design standards and construction is that even if the attainment of the maximum drift levels there should still be a low probability of collapse occurring." That was what was in the report, and the right-hand column there is your comment, isn't it?

20

A. Yes.

25

Q. And your comment is that the code of the day which you quote and the current code you say, "Do not require checks beyond the design basis earthquake. The expectation of design standards is that there is a low probability of collapse at maximum drift levels and this lack of checking in the design codes is a serious deficiency. We understand some overseas earthquake codes now require these type of checks." By maximum drift levels there you're talking about drift levels exceeding drift levels which would occur in a design basis earthquake?

30

A. I think that's what we're referring to there.

- Q. It's implicit in what you say there that when considering the requirements of the code you feel there is no obligation to consider the impact on the building of an earthquake producing shaking above design level.
- 5 A. The work we've done on the CTV building is review work. It's not recommendations for future design.
- Q. I'm asking you just about your comment on the interpretation of the code there and my question to you is, it is implicit in what you've said there, isn't it, that when considering the requirements of the applicable code
- 10 there was no obligation on you to consider the impact on the CTV building of an earthquake producing shaking above design level?
- A. No there wasn't.
- Q. So you agree that it was implicit?
- A. It's implicit but there's no requirement to check beyond the design level.
- 15 Q. Does it follow from that then that if the effect of your design is that people are exposed to the risk of injury or death in an earthquake producing shaking above design level that's really no concern of yours.
- A. No the code is meant to deliver an outcome that buildings are able to withstand higher than – the design earthquake loads but that's inherent
- 20 in the code, it's not something that you actually check for and the suggestion that we were making when we put in that recommendation was that as with some overseas codes I think the Canadian one they do have a requirement in some cases to check for the maximum credible earthquake or whatever they might refer to it as.
- 25 Q. I put a comment to Professor Mander when he was here, a comment which had been made by Professor Paulay. Just in relation to Professor Paulay, is he a person do you think who knows, knew what he was talking about when it came to the design of buildings?
- A. Well he's one of the authors of this code, this concrete code that we're
- 30 talking about.
- Q. The comment I raised with Professor Mander was that a designer should be determined to tell the structure what to do and that was a comment Professor Mander agreed with. Do you agree with that?

A. I'd have to see the context in which that's all presented to answer that.

Q. Well it was presented in the context of the paper on the design of walls which was part of the seminar that Mr Harding attended and which you were not at, but it seems to me that it's a general principle and so can I
5 ask you to comment on that as a principle. Do you agree in principle that a designer of a building should be determined to tell the structure what to do?

A. It's not something that I can relate to I'm sorry.

Q. I see. Well Professor Mander gave expert evidence to the Royal
10 Commission at your instigation and he said that the hierarchy of strength in the CTV building comprised from the strongest to the weakest walls followed by beams followed by columns followed by beam column connections. Would you agree that the hierarchy of strength in a building must be a consequence of the design approach
15 adopted by the designer?

A. I would expect it to be.

Q. The evidence suggests and I think you would agree that the beam
column connections of the CTV building disintegrated on the 22nd of
February?

20 A. They – there is evidence that they were not intact after the collapse.

Q. And the columns also obviously failed to perform their intended function,
didn't they?

A. Well that's not necessarily clear.

Q. Well if their intended function was to keep the floor slabs apart they
25 clearly failed, didn't they?

A. Yes but that could be a function of joint failure rather than column failure
for example.

Q. Well considering what Professor Mander has said, and considering what
we've just discussed about the evidence of failure, it's clear isn't it that
30 those parts of the building which were as a result of the design the
weakest, failed, didn't they?

A. You can have that hierarchy but it actually depends on the loading as to
which will actually fail, under one loading condition you may get one

element failing. Under a different loading condition you could get another element failing.

Q. Yes but it's evident that those parts which were weakest by design did fail on the 22nd of February didn't they?

5 A. Yes but you don't know which is weakest in terms of the loading.

Q. So on the 22nd of February the building in fact performed in exactly the way it was designed to perform?

A. It performed in the way that the – from the – whatever the earthquake loading and displacements were that drove it. That is not necessarily the way it was designed to perform.

10

1435

Q. Just looking back at clause 3.5.14 which is ENG.STA00016.21, sorry .28. You can highlight the whole clause, 3.1.14.3 right down to the bottom of the column please. Dr Reay you would agree that there were important criteria within that clause which determined whether the columns should be elastic or designed with limited ductility or full ductility?

15

A. Yes there was.

Q. And you would agree that ductility requirements would've needed to be met if the elasticity criteria we discussed earlier was not satisfied?

20

A. That's correct.

Q. I'm just going to summarise the position based on the evidence we've heard about the evolution of the design of this building. Mr Harding, firstly, was calculating building deformations using ETABS which he'd only used once before, do you agree?

25

A. Yes.

Q. Mr Harding did not carry out any calculation to determine whether the columns remained elastic at v-delta, you agree?

A. My understanding is he assumed that the limiting deflection was going to provide a satisfactory solution.

30

Q. So you agree that he did not carry out any calculations to determine if they would remain elastic at v-delta, don't you? The answer's yes?

A. Well he said that he didn't.

- Q. Mr Harding, as you've already agreed, was not even aware of clause 3.5.14, and you've given evidence that he knew NZS3101 better than you at that time haven't you?
- A. Yes.
- 5 Q. Your firm, however, proceeded to design this building with gravity only columns didn't it?
- A. Yes.
- Q. And there was no peer review within your firm?
- A. No.
- 10 Q. And there was no design certificate prepared when the design was completed?
- A. I believe not.
- Q. When explaining the state of affairs to the families of the 115 people who died, I'd like to tell them how you characterised this state of affairs, for example, "Dr Reay gave evidence that this was an unacceptable state of affairs." How would you characterise this state of affairs?
- 15 A. It is, the design appears not to have been carried out correctly, however in the end result we do believe that it complies with that clause.
- Q. By reference to the matters I've just raised about how this design came into existence, on behalf of the families of those who died it's right, isn't it, that the way this building was designed is an utter disgrace?
- 20 A. I wouldn't term it that, but the methodology used was not satisfactory, but the end result as it happens was compliant.
- Q. According to Mr Latham, is that right?
- 25 A. Yes.

RE-EXAMINATION: MR RENNIE

- Q. Dr Reay can you imagine that you are shouting at me when you answer the questions please?
- A. Certainly.
- 30 Q. You may recall that Mr Harding, the reference is transcript 30 July, page 120 Sir at line 19 said the following of work in your office when he was there, "Alan had a very loud voice, so did Terry, and if anyone was

having Alan talk to them everybody in the office could hear that conversation.” Do you recall that?

A. Yes.

Q. Do you accept that’s a correct description then?

5 A. No.

Q. Could you try and meet that standard now?

A. Well I’m trying to but not succeeding.

Q. Thank you. You were asked, it was put to you that, “Mr Harding stepped into the shoes of Mr Henry, was the way my friend put it to you.

10 You recall that?

A. Yes.

Q. Mr Henry will have had terms of engagement up to the time that he resigned from your firm?

15 A. He would've had some terms of engagement but I couldn't tell what it was.

Q. Salary, hours, that sort of thing?

A. Oh, it'd be a 40 hour week.

Q. Was Mr Harding engaged on the same terms as to salary and other benefits?

20 A. I believe so, yes.

Q. In relation to Mr Harding’s level of remuneration, how would that compare with Mr Henry’s?

A. I think it was significantly more than Mr Henry’s.

1440

25 Q. And on that basis was there a reason for that?

A. Well Mr Harding had had more experience post-registration and he'd had some management experience at the Waimairi Council.

Q. In relation to the engagement of him did you undertake that?

A. Beg your pardon?

30 Q. In relation to the engagement of him did you undertake that?

A. Yes.

Q. Can you recall what Mr Harding’s expectations were as to the terms on which he would start?

- A. Yes his, his main terms were that he took a responsible role from the beginning and that he, and the he had an opportunity to liaise and deal with the architect or builder et cetera associated with the project.
- Q. In asking for direct engagement and a salary at the level described did he refer to his Waimairi experience as relevant?
- 5 A. I don't recall directly.
- Q. Now next in relation to a question about ETABS you referred to a person using ETABS going to a lecturer at the university who would arrange access to the program. Do you remember saying that?
- 10 A. Yes.
- Q. Could you just explain what you were referring to there as a process?
- A. The, it was usually Dr Carr at the university that we made arrangements through to access programs and to get access to the university computer.
- 15 Q. So did the university offer a commercial service or was it something more informal than that?
- A. I don't think it was a directly commercial service. It was available through the civil engineering department.
- Q. As you understand it was it possible to access ETABS at the university at that time without dealing with a lecturer or through a lecturer?
- 20 A. I am not certain.
- Q. In relation to Mr Harding's use of ETABS on which he's given evidence do you know which person or persons at the university would have been involved?
- 25 A. I understood it was Dr Carr.
- Q. Thank you. Can we have BUI.MAD249.0010A. This is a, as you can see Dr Reay a series of documents from the microfiche produced by the Christchurch City Council. Have you seen this before?
- A. I'm uncertain if I've seen this one.
- 30 Q. Can we focus on the document top left please. Does this appear to you to be an application for a building consent?
- A. Yes.

- Q. Can we enlarge just the top quarter of that please. It's a little hard to read but does the date appear to be something like 17/7 1986?
- A. Yes.
- 5 Q. And it refers to 249 Madras Street and the Prime West Corporation. Do you see that?
- A. Yes.
- Q. Now if we can scroll down, lower down, to get to the signature part. Who is the applicant?
- A. It's Alun Wilkie Associates.
- 10 Q. And if we now go back up to the higher part please. You will see there that the application is said to be made, it's immediately below the first lot of handwriting, according to locality, plan and detailed plans, elevations, cross sections and specifications of building deposited herewith in duplicate. Do you see that?
- 15 A. Yes.
- Q. As at July 1986 do you have any record of your firm having drawings of the nature that would be described by such words?
- A. I don't believe that the work that we had was available in a standard that was suitable at that time.
- 20 Q. We can go to the microfiche's projection but I can tell you that the plans which are later on appear to be later plans in terms of their first drawing date from Alun Wilkie and one structural plan from September. So do you know what plans Mr Wilkie may have sent to the Christchurch City Council in July to initiate the consent process?
- 25 A. No.
- Q. You'll recall the timing in relation to the hours worked on the project, the sheet that you produced as at page 20 of your brief in front of you?
- A. Yes.
- Q. As at 17 July - if you just want to turn to that sheet, it's the last page of your brief – what level of work had been undertaken by each of you and
- 30 Mr Harding in relation to this?
- A. Mr Harding had completed most of his work but the drafting had only started in July.

Q. If the permit application was running ahead of the structural design, can you account for how that could have happened?

A. They must have submitted the design without the structural drawings.

Q. They being?

5 A. Alun Wilkie & Associates.

Q. Thank you.

JUSTICE COOPER TO MR RENNIE:

Q. Can we just go back to the microfiche for a moment?

10 A. Certainly Sir, BUI.MAD249.0010A.

Q. And if we can blow up the same, top left. Thank you.

A. So should Your Honour need to come back to that in the future for any purpose that document is separately in the documents BUI.MAD249.0141.8.

15 Q. Thank you.

A. I went to the microfiche Sir because one can eventually disentangle the date of the permit application by looking at the associated documents which are triggered.

RE-EXAMINATION CONTINUES: MR RENNIE

20 Q. Now Dr Reay you were asked a number of questions about the use of ETABS in relation to the CTV building. Do you recall that?

A. Yes.

Q. Now in terms of the design sequence you have the static analysis followed by the creation of the computer model of the building followed
25 by the ETABS exercise. Is that the correct sequence?

A. Yes although the static analysis may be part of the computer -

Q. It may be done in parallel?

A. Yes.

1450

30 Q. And the outcome of the ETABS analysis being to determine whether in this case the building could be designed on the basis of a gravity slab and structural shear wall basis?

- A. Well yes, initially the period of the building would be determined, if it was a spectral analysis, but otherwise yes.
- Q. Now you've acknowledged to my friends that two matters of the design of the CTV building of concern to you are the beam column joints and the shear slab connection issue, do you recall that?
- 5 A. Yes.
- Q. Is each of those two matters something which would be designed after the ETABS analysis was complete?
- A. Yes.
- 10 Q. Speaking first of the beam column joints, Mr Harding coming to design those joints would be designing them for a gravity model?
- A. Yes.
- Q. Is the ability to use or not use the ETABS process relevant to the carrying out of that design?
- 15 A. It is in part because the distortion occurring to those columns drives the design of the columns and the joints.
- Q. In terms of your concern about the joints, do you see any feature of them which suggests that the design was impaired by an inability to use ETABS?
- 20 A. No.
- Q. Moving next to the shear slab connection issues. Is ETABS of relevance in the design of those connections?
- A. Well the use of it provides the forces that have to be transmitted, a basis for the forces transmitted between the floors and the walls.
- 25 Q. And having identified those forces and moving to the design of the connections themselves, does ETABS play any further part in that design?
- A. No.
- Q. In terms of the concerns that you have about those connections, and the work done by Mr Harding, are the deficiencies explained in some way
- 30 by a failure to understand the use of ETABS?
- A. No.

Q. You said to my friends that at the outset in relation to the CTV project you were concerned to ask about the shear wall layout because you said the shear wall layout was, "An important issue to me," do you recall saying that?

5 A. Yes.

Q. Why did you regard that as important?

A. Because I was concerned to ensure that there wasn't excessive torsional response within the building.

10 Q. And was that an issue which you identified independently of any ETABS analysis?

A. Yes. Yes.

Q. And in relation to the concept of a gravity structure with shear walls, did you consider that to be a possible design approach at the time?

A. Yes I would've.

15 Q. And your main reasons for thinking that were?

A. That it had proved to be a successful design for the Landsborough House building and I considered that it could well be appropriate for other buildings provided the code limits were met.

20 Q. Now my friends asked you about recent work done by Mr Latham of your office in relation to the 1986 requirements for a design?

A. Yes.

Q. Do you recall those questions? It was put to you that Mr Latham has two and a half years post-registration experience, is that correct?

A. Post-graduation experience.

25 Q. Post-graduation experience, do you see that as a legitimate criticism of his ability to do those calculations?

A. No.

Q. And your reason for that?

30 A. The, I've seen the work he's done and he had followed the code of the day meticulously and he's had a, he's also had a review outside our office on the work.

1455

- Q. And this was, do I have it right, a replication of what a designer could do for a gravity and shear wall design in 1986 following the code?
- A. That's correct.
- Q. So in that sense his work is how comparable to Mr Harding's design?
- 5 A. I haven't compared the two.
- Q. Well put it this way, has he replicated Mr Harding's design or has he arrived at one of his own?
- A. No, he's arrived at his own analysis. It's not so much design as analysis that he's carried out.
- 10 Q. The statement by Mr Harding was put to you by my friends that in your office in 1986 you could not design above the code rights or you'd get your hand smacked. Before Mr Harding had said that had you heard that suggestion before?
- A. No.
- 15 Q. Can you recall any occasion in 1986 or 1985 which could have justified such a statement being made?
- A. No.
- Q. Do you recall ever reprimanding or taking action against any employee for using a design which was above code limits?
- 20 A. No unless there was a very good reason for doing it, no.
- Q. By, to be clear because I think your answer may be ambiguous, unless there was very good reason for doing what?
- A. Sorry, you better ask me the question again.
- Q. Can you recall any occasion in 1986 or 1985 when you reprimanded or
- 25 took other action against an employee for designing above code limits?
- A. No.
- Q. Can you think of any justification for making such a statement, Mr Harding making such a statement?
- A. No I can't.
- 30 Q. In relation to a question from my friends as to the selection of materials you referred to the selection of mesh size on works and you indicated a practice in your firm at that time of selecting a particular size of mesh. Do you recall that?

A. Yes.

Q. What was the significance that you intended to convey in relation to the matter of mesh size?

5 A. Just in precast panel construction many other companies used 665 mesh. We used 663. 663 is actually a heavier mesh than 665.

Q. What was your using that mesh, was it cost or some other reason?

10 A. It was buildability and simplicity. There was less extra reinforcing to be added and it was a simpler process but it result in more material per square metre of panel than what the other system, the alternate system did.

Q. Was cost any issue in relation to that design choice?

A. No it wasn't a significant issue.

15 Q. Now you were asked some questions about the timesheets and could we have please BUI.MAD249.0477 and if we can go to May please. Sorry I can't give you a page number, Mr Palmer may be able to but it's, the page number, sorry the page number is .19. Now it was put to you that this was the first month in the sequence where a 9003 code appears. You recall that?

A. Yes.

20 Q. If you look three lines up from the bottom of that page are you the only person who has attributed time in that month to a 9003 code?

A. No there is other people who have time on that code.

Q. Indeed on that page is there any person who has not coded time to that code?

25 A. No there isn't.

Q. If we go back please to page .16 which is April. Is there a 9003 code in April?

A. No.

30 Q. And could we now please go to .24 which is June. Again same question, 9003, has each person except I think Brenda allocated time to 9003?

A. Yes they are.

Q. So in relation to the recording of office time as opposed to client chargeable time does this indicate a practice change in 1986?

A. Yes it does appear to.

Q. You now recall the circumstances of that or why it was done?

5 A. No.

Q. Now my friends, I think particularly Mr Elliott, asked you about a question about your reference to calculations which had not been located. Do you recall that exchange?

A. Yes.

10 Q. And you referred to calculations early in the stage of the evaluation and the design process and reply. You recall that?

A. Yes.

Q. Speaking of the calculations which went to the Council in support of the structural plans are you suggesting that there are any parts of those calculations which have not been located?

15

A. No I think that that was a complete set in terms of what was sent to the Council.

Q. And in terms of the Council having granted a building consent can we reach a conclusion about whether the Council regarded them as being complete?

20

A. Well assuming they looked at them they would they, they must have considered they were complete.

Q. Now my friend Mr Elliott asked you some questions about reading expert reports. You recall that?

25

A. Yes.

Q. In expert evidence. He put a request to you that you read that evidence before next week. Do you recall that?

A. Yes.

Q. And you indicated you're willing to do that.

30

A. Yes.

Q. Is there any particular reason why you have not up until now read such material?

A. Well my lawyer has suggested that it would be better if I didn't as it would mean that my evidence that I have given wasn't tainted by knowledge from other people.

Q. And was that practice in fact followed by you?

5 A. Yes.

JUSTICE COOPER:

Except presumably in the case of Mr Latham's evidence?

10 **MR RENNIE:**

Yes indeed. I was referring to the matters put to him, Professor Mander and the related experts Sir, yes. I'm not suggesting that it applies to every witness Sir.

RE-EXAMINATION CONTINUES: MR RENNIE

15 Q. So in terms of the expert evidence that those persons gave do you consider that you've altered your own evidence in any way to align to that expert evidence?

A. No I haven't.

20 Q. Now I'm asking if we could go to BUI.MDO195A.011 and I know that doesn't sound right but that's what was on the document. Sorry it's the one that we had before which was from the comments in December Mr Elliott asked about. The reference I copied off the screen was BUI.MDO195A.011. I know it's not logical. Yes. Yeah that's what I was given 0195A.011. That's it. Thank you. Dr Reay the, this was a
25 document originated in December 2011?

A. Yes.

Q. Its purpose was what?

A. In response to the draft report from the Department of Building and Housing.

30 Q. And the section on the right-hand side is the commentary from your firm?

A. Yes.

Q. And the section on the left-hand side is a quotation from the draft report sent to you for comment. Is that correct?

A. Yes.

5 Q. In reading the right-hand side as a comment on the left-hand side is that correct, correct to read it as a comment on the left-hand side?

1505

A. "It is important to recognise that the expectation of design standards and construction is that even at the attainment of the maximum drift levels there should still be a low probability of collapse occurring."

10 Q. That was that the report said?

A. Yes.

Q. The right-hand side you make your response. You don't need to read it aloud, just look at it please.

A. Yes.

15 Q. You refer to overseas earthquake codes which now requires that type of check?

A. Yes.

Q. Did you consider you were referring to those codes favourably or unfavourably?

20 A. Well I was, or we were considering, referring to them favourably.

Q. And in the previous sentence you refer to the lack of checking in the design codes as a serious deficiency. Is that correct?

A. Yes.

Q. What was your purpose in identifying that deficiency?

25 A. Well to suggest that in future codes consideration be given to including a check for the maximum credible earthquake.

Q. Did you intend any part of this statement to be part of your explanation or response to the criticisms of the CTV building?

A. No.

30

QUESTIONS FROM COMMISSIONER FENWICK:

- Q. The Westpark building which you checked the calculations and the drawings there in terms of signing off the building. Roughly how long would it take you to have checked a building of that size do you think?
- 5 A. I'm sorry I'm having difficulty hearing.
- Q. Well the purposes of the design certificate, you checked the Westpark building?
- A. Yes.
- Q. How sort of long would it take you to take the – to have carried out that check on the building, on the drawings and the calculations?
- 10 A. I wouldn't know now.
- Q. Is it likely to have been a day or two or an hour or two?
- A. I'd be guessing. It's clearly more than an hour or two and I wouldn't expect it to be more than a week.
- 15 Q. So somewhere between an hour or two and a week?
- A. Yes.
- Q. For a nine storey fairly regular building?
- A. Yes.
- Q. But you didn't make any such check obviously on the CTV building because you felt quite confident that its – in its design?
- 20 A. Well I felt confident in the process that I was using, yes.
- Q. You made some comparisons between the CTV building and the Landsborough House building, I just wonder if we could have a look at some of those quickly just to get the comparison between the two. So the comments are on WIT.REAY.0002.3, and the next one I want to come up not immediately is BUI.MAD249.0530.0, is that coming shortly. So you comment at the top we don't need this bit enlarged, "I've reviewed the structural drawings" and the calculations for Landsborough House are generally designed as similar to the CTV building so for the purposes of this you've also looked at the CTV building presumably, I don't know if you looked at the calculations but you certainly looked at the drawings?
- 25
- 30 A. Yes I've just looked at them in a general comparison.

Q. So that the first comment is Landsborough House is eight levels, CTV is six levels?

Q. Yes.

Q. And the CTV plate is 40 percent larger. Can we have, sorry I'm
5 changing this now, the BUI.MAD249.0530.2 rather than .1. So we have Landsborough House on the right of that diagram and the CTV on the left, and the CTV you'll see you've got the north wall, north wall complex and the south wall which is coupled and the Landsborough House you've got the shear core so they're fairly different, but I think you'd
10 agree with me the Landsborough House, the shear core is a very much higher torsional resistance than the north wall, partially compensated for by the south wall there. Do you agree, the core itself has very much more resistance in terms of torsion, it also has a higher flexural strength?

15 A. Yes it is more resistant until yielding occurs in the coupling beams and then I believe it is less, we're referring to Landsborough House.

Q. Well the coupling beams will yield won't they but they don't lose stiffness in their – outside the inelastic range, I mean that's the property of the coupling beams isn't it that they don't degrade nearly to the same extent
20 as a normal beam. That's correct isn't it?

A. Yes that's correct.

Q. So they actually retain their stiffness quite well except in the phases when they're yielding, correct?

A. Yes when they are yielding they, yeah.

25 Q. So I mean there's a lot of difference when one compares it, the core actually gives you quite a high compact resistance doesn't it? You agree?

A. Yes prior to the coupling beams yielding I agree.

Q. Yes and once the coupling beams stop yielding they don't degrade so
30 you've got that high stiffness again?

A. Again yes.

Q. More so than you'd get out of a wall being subject to reversing flexure?

A. Yes possibly.

- Q. The next comment you have got is – no, the other aspect which we can look at here is that under seismic actions in the north-south direction with the Landsborough House detail, the beams run into the walls, not a perfect detail at the junction but the beams run into the walls so they can transfer the inertial forces into the walls directly can't they?
- 5 A. Yes I've commented on that.
- Q. Yes and those are back-up there in that you've got the continuous reinforcement from the floor going into the walls and because the core is inside the building you've got that shear transfer capability between the slabs and the walls. That correct?
- 10 A. Yes.
- Q. Which is quite high. In the CTV building the beams run in the opposite direction, correct?
- A. Yes.
- 15 Q. And the only area where you can transfer forces into the walls is through the drag bars which were added and by flexure and direct tension in the bay between the wall on line C and the next wall adjacent to it, I think it's the wall CD, that's in the men's toilet area, that's the only tie there isn't it there apart from the drag bars?
- 20 A. Yes.
- Q. So it's a very different arrangement isn't it and this one is quite dependent on that – the strength of a very limited area which is reinforced with mesh and a few additional 12 millimetre bars. It's a critical area isn't it?
- 25 A. That's correct.
- Q. So that the two are very different in that respect?
- A. In that sense yes.
- Q. Can we go back to the .1 please in the same series. So if we look at the floors, now in the CTV building you've commented in your text it was bondek but I think it was hibond?
- 30 A. Yes.
- 1515

- Q. It was a 400 millimetre, sorry a 200 millimetre in situ concrete on top of the hibond, I think that that was slightly less than that?
- A. Yes total depth.
- 5 Q. Total depth, that's right, yes. Now that was propped when it was put in, and then the props were removed so it becomes a composite concrete steel member?
- A. Yes.
- 10 Q. Now of course the character of that, incidentally it was designed to the limit wasn't it, I mean it slightly exceeded the allowable span I think on the recommended tables, my reading of the tables, it was right at the limit of the span that that Bondek could work?
- A. I haven't, I haven't studied those.
- Q. So this becomes a competent section and when the props are removed the member acts as a composite unit, that correct?
- 15 A. Yes.
- Q. And it will creep as a composite member, as the concrete comes under stress so it will, the concrete will creep, correct?
- A. Yes.
- Q. And when the concrete shrinks it will, the water will dry from the top surface, so the top surface will shrink more than the bottom, is that correct?
- 20 A. Initially yes.
- Q. And so the effect of that redistribution will be, what would you expect it to be Dr Reay?
- 25 A. Well there'll be some sagging between beams.
- Q. Yes, so it's likely to be quite a hump isn't there above the beams due to that type of construction, that correct?
- A. I don't know without working it out.
- Q. Can I lend you a calculator, would you like to work it out?
- 30 A. No.
- Q. Well it will sag quite appreciably by my calculations.
- A. That right?

- Q. You don't have to check those, you can check them yourself later on if you wish. So one would expect some settlement of that slab to the extent you would get some gradient there. Would you get the same situation with the Landsborough House detail where they used these pretension stem beams with timber infill and I think it was a 75 millimetre concrete topping on top of that, would that also sag?
- 5
- A. Yes it would.
- Q. Well I'm going to ask you about that again because it's pre-stressed and with time it becomes a composite member when the concrete sets. If it's pre-stressed which way is it going to deflect with time?
- 10
- A. In our experience they sag.
- Q. Right, I would normally expect them to go up.
- A. No the difficulty is with those is that the, is there's usually significant shrinkage in the topping, partly because it's thin and probably fairly wet and we've had significant problems at times with those floors actually sagging.
- 15
- Q. Okay, I'll take your word for it, but that's not my experience but I'll take your word for it. You've used them in Christchurch where I haven't. The reinforcement in the CTV building was 664 mesh which gives you quite a low steel percentage but it was higher than the 665 mesh which was used in the Landsborough House building?
- 20
- A. Yes.
- Q. And they both had additional bars across the joints to restrain movement at the joint zones. But the lower proportion of reinforcement would have, could have adverse effects in terms of crack control, you've got to raised small proportion of reinforcement, is that correct?
- 25
- A. (no audible answer 15:18:56)
- Q. Two hundred millimetre thick as against the 100 millimetre, sorry 75 millimetre thick slab?
- 30
- A. Yes, that's correct.
- Q. So there was a potential there for limited cracking, limited crack control?
- A. (no audible answer 15:19:13)

- Q. Let's look at the columns, I'll summarise those. First of all there's the diagram at the bottom, and on the left-hand side you can see the CTV where there was the 250 round spiral 6 millimetre bars, which on the drawings was at any rate shown going through the beam column joints, and I think Mr Harding said there was no reinforcement in there and I'm sure he was right because I don't know how you would've fitted it, but you agree it would've been very, very difficult to fit that spiral into the joint zone?
- 5
- A. It could've been slid down into the joint zone before the top beam reinforcing bars were drawn through.
- 10
- 1520
- Q. Yes, you'd have to get your hand down through a mesh of reinforcement to do it, because those bars are turned in aren't they at the end, so it certainly would, theoretically it's possible but you might've had to have a rather thin arm to do it, but yep I agree it might have been possible. The evidence is, I think, there's no steel there. For some unknown reason we've got the wrong version of this drawing up and I don't know quite how that happened but that drawing, shown on my detail, shows reinforcement in the joint zone.
- 15
- A. Yes.
- 20
- Q. Got the same number. So the joint zone in the Landsborough House had four 10mm ties in the joint zone.
- A. Yes.
- Q. And through the joint zone there was a lap of two H24 bars, lapped side by side, and there were two 20mm bars in addition placed through the shell beams which went right through that joint zone.
- 25
- A. Yes.
- Q. So it's a well tied in joint zone. It's got some joint zone reinforcement, do you agree?
- 30
- A. Yes.
- Q. If you look at the CTV joint zone you have two 28mm bars bent up and anchored in the middle of the joint zone, so there's an overlap, I think it's

about 160mm between the two, and, in effect, there's no joint zone reinforcement, would you agree?

A. Yes.

5 Q. Do you accept that the Landsborough House joint zone is actually a good deal more solid construction, less likely to degrade under cyclic loading than the CTV joint zone?

A. Yes I would agree with that.

10 Q. We go to the columns. One of the criteria for the performance of columns is the area of confined concrete as against the area of unconfined concrete isn't it?

A. Yes.

Q. The bigger the area of unconfined concrete the greater the drop in load capacity when spalling occurs.

A. Yes.

15 Q. As you will see the ratio there would you agree is better with the Landsborough than it is with the CTV.

A. Yes –

Q. Landsborough's 0.68 and the CTV is .585.

A. Yes it is.

20 Q. The confinement reinforcement, I've talked about confinement reinforcement in the potential plastic hinge zones which is two times the beam depth, the column depth from each beam column joint and the Landsborough that proportion of reinforcement is 0.43 percent and in the CTV building is one-fifth of that is 0.089 percent.

25 A. Yes.

Q. So you agree the Landsborough columns are appreciably more robust.

A. Yes they are.

Q. You didn't check or did you check the drawings for the Landsborough in the calculations before that went in?

30 A. I don't recall.

QUESTIONS FROM COMMISSIONER CARTER:

Q. The only question that I have for you is the practice of checking. Is it correct to assume that with the submission of the design certificate the very specific nature, the wording of the responsibility for that person who signs the design certificate is actually likely to encourage them to make sure they've done the checking that's expected?

A. Yes.

Q. In regard to your own practice at the time I think you noted there was no set procedure on checking processes in the office so if you were not required to submit a design certificate in those instances were you more inclined to rely on the check that was done by the local authority?

A. Yes that's correct but it, for quite a bit of the time in that period I was the only engineer in the practice which is why I relied on the Council checking procedures.

15 QUESTIONS FROM JUSTICE COOPER:

Q. Dr Reay when you originally employed Mr Harding for the first time he came to you from Hardie and Anderson, am I right?

A. Yes I believe he did.

Q. He's given evidence of having carried out a variety of work at that firm, designing domestic buildings and foundations, site levelling surveys, stormwater design and structural design of single storey factories, offices, warehouses and school buildings and a bit of structural strengthening of brick buildings and testing of fibreglass structures. Now he then came to you and the work he seems to have been involved in also involved residential buildings and single or two storey industrial and commercial buildings, particularly he told us, in relation to pre-cast concrete construction. Now what in that background made him a suitable person to be designing the CTV building?

A. I assumed that he had undertaken similar work as I did when I was at Hardie and Anderson. He spent more time there than I did and I was surprised when I read what I have in his evidence as to what he said he did and that was not what my impression was of him at the time. The

other thing he has said is that he did strengthening work when asked on some brick buildings at the corner of Manchester and Bedford Row and those brick buildings on each side of each corner are of either at least three storey buildings so it's a different scale to what's –

5 Q. Well they were presumably unreinforced masonry buildings not designed to be ductile.

A. No but the strengthening work on them would be quite challenging.

Q. Well did you, you spoke of your impression. Are you saying you didn't make specific enquiry of him before you employed him for the first time as to what he'd been doing?

10

A. Well it's so long ago I can't remember. It's over 30 years ago now. But I considered that he'd had a greater length of training at Hardie and Anderson than, in fact, I had had.

Q. Well you were familiar anyway with the work that he performed when he was with you for the first time.

15

A. Yes.

Q. What was there in that work that made him a suitable person when he was re-employed to design the CTV building?

A. The, at the time I employed him the second time the CTV was not on, you know, not known about so I was weighing it up against the other, the buildings that I did have at that time and that included the four storey apartment building and the Broadway building, for example, that he did that included using the Concrete Code and the Loadings Code and my impression of him was that he was quite competent in doing that.

20

25 Q. So when he was employed by you between 1978 and May 1980 you say he designed a four storey building?

A. No, no, he did that just before he started with me in 1985.

Q. This is the building that you got him to work on whilst he was still at Waimairi District Council.

30

A. Yes that's correct.

1530

Q. Well what, leaving that on one side, presumably the work that he did for the Council which had a civil engineering emphasis would not have

equipped him in terms of experience to design the CTV building would it?

A. Not on its own but he did work on the Cashel Street building which had already been partly designed and I felt that he handled that satisfactorily.

5

Q. The Cashel Street building being the –

A. Westpark.

Q. Westpark. So was that the main reason you gave him the – or you agreed to him carrying out the design for the CTV building? Was that the most relevant experience if I may put it that way?

10

A. Well no it was a combination of the work he'd done previously as well, it isn't just one building.

Q. But the work that he'd done previously was nothing like the work that he then embarked upon was it for the CTV building?

15

A. Not in terms of scale but in terms of concrete design.

Q. Well in terms of the challenges that needed to be met from a design point of view, how would you say, anything that he'd done up to that point was equivalent?

A. Well from my point of view we continually face challenges in what we do and it's a question of whether we can resolve the issues and satisfactorily to the design projects that we do and every day there is something different.

20

Q. Did you appreciate then that it would be a challenge for him to design the CTV building?

25

A. Oh yes, it was something that was a greater challenge than he'd had previously but I relied on his own judgement as to whether he was able to undertake it.

Q. And what gave you confidence in that judgement?

A. Well previously when he'd worked for me he had handled jobs very well in my opinion.

30

Q. But the jobs were nothing like this one?

A. No but he handled Westpark Tower which gave me confidence.

- Q. Do you stand by your evidence that Mr Harding would have been involved in seeking the fee for the design work on the CTV building?
- A. No I've accepted that if he said he didn't, he didn't.
- Q. Your firm has now expanded from what it was in those days hasn't it?
- 5 A. Yes it has.
- Q. And you're one of what, four principals?
- A. Yes there's six shareholders I think it is.
- Q. You have a process within the firm in which drawings leaving the firm for the purposes of obtaining building consents are checked by one of the
- 10 principals?
- A. Yes the structural designs are checked by a chartered engineer.
- Q. Well one of the principals or one of the shareholders?
- A. Yes, it's either a shareholder or a director.
- Q. And how long has that procedure been the practice of the firm?
- 15 A. Over the last two or three years. Prior to that any significant jobs we would either arrange for the Council to arrange a peer review or we would arrange a peer review.
- Q. And that system that you've just described, when was that instituted?
- A. Twelve to 15 years ago.
- 20 Q. So late '90s, 2000 something like that?
- A. Yes late '90s I think.
- Q. Why was that procedure instituted?
- A. It was brought in as part of ensuring that the projects which were being undertaken by not just a principal in the firm but staff members were
- 25 adequately checked. It was the result of increasing staff numbers that made us decide to do it.
- Q. Why didn't you have a similar procedure in place in 1986?
- A. Well those sort of procedures didn't exist then in the same way, there weren't the companies around specialising in peer reviews and the
- 30 Council was – had good engineers and they used to do it as part of the building permit process.
- Q. Sometimes?

A. Well they may have done it all the time but we didn't know. It was only – it was visible to us sometimes.

5 Q. You said in answer to a question by Mr Rennie that the work that Mr Latham has carried out to ascertain compliance of the CTV building with the relevant standard has been reviewed outside your firm. Who by please?

A. It's been sent to Dr Arthur O'Leary in addition to other reviews, that I understand are occurring.

Q. Do you mean persons other than Dr O'Leary are reviewing them?

10 A. I beg your pardon.

Q. Are you slightly hard of hearing?

A. Yes.

Q. Is this something's that happened recently or ...

A. It happens through using skillsaws and chain saws Sir.

15 Q. Yes, I see. Is this part of the reason you speak softly Dr Reay?

A. Could be.

Q. So when did this problem arise?

A. Oh, it's not a significant problem.

Q. No, all right. So who else is reviewing this work apart from Mr O'Leary?

20 A. Well I understand that Mr Lou Robinson has been asked to review it by counsel assisting. That's my understanding.

Q. No, well – this is the calculations that Mr Latham has done for the purposes of checking compliance with the standard?

A. Mmm.

25 1540

QUESTIONS ARISING: MR MILLS

30 Q. And I'm just curious to know Dr Reay why the staff in your firm it turns out are recording what's described as management or administration time. Right across that sheet that I think my friend Mr Rennie took you to it was showing management/administration time being recorded not just for you as the principal but for a significant number of other staff. What

would they be doing that would qualify as management or administration time worth recording as 9003 time?

A. Yes I was wondering that myself when I saw it.

5 Q. You're the principal of the firm. You must be the only one who knows surely.

A. I think if they were doing plan printing they may put it down to that. If they were doing messages that sort of thing, assisting with the general administration but yes beyond that I don't, I don't remember.

10 Q. So do I take it from that answer that there could be work which in a sense was client related but nonetheless was regarded as being attributable to 9003 time?

A. Yes it wouldn't have been client related. That would have still gone down into the job number.

Q. Wouldn't printing plans be related in some way to a client file?

15 A. Not directly in that the cost of, I think the plans in those days included the, the labour cost and the printing. So you wouldn't want to double up on it.

Q. But in an indirect sense that would be related to something that was being done for a client I take it?

20 A. Yes but already charged for and the plan printed out.

Q. Yes, no I understand that.

A. Yes.

25 Q. But in terms of was there a client related file in doing some of these things that we're talking about would you agree with me that it appears there was?

A. Yes there could have been that and it could have been people helping others with various things, something that somebody didn't understand or something like that.

30 Q. Yes and now you're going to go and have a look at all the 9003 time your people are recording are you?

A. Well we don't have that system any more but I do wonder if someone's burying something.

FURTHER QUESTIONS FROM MR RENNIE:

Q. In 1986 how many engineers in the firm?

A. Two.

Q. In the late '90s approximately?

5 A. Six, seven.

Q. And today?

A. Twelve, 13, something like that.

WITNESS EXCUSED

HEARING ADJOURNS: 3.43 PM

10

HEARING RESUMES: 4.02 PM**MR MILLS CALLS****5 JOHN MALCOLM TERRENCE HENRY (SWORN)**

Q. Your full name is John Malcolm Terrence Henry?

A. Yes.

Q. You are a resident of Christchurch and an associate and project leader (structural) with Eliot Sinclair in his Christchurch office?

10 A. Yes.

Q. You have a Bachelor of Engineering Degree with First Class Honours from the University of Canterbury?

A. Yes.

Q. You are a chartered professional engineer?

15 A. Yes.

Q. And Mr Henry, you're appearing as a result of being issued with a summons by the Royal Commission requiring you to appear?

A. Yes.

20 Q. Could you please pick up your, just to confirm, you have prepared a written statement of evidence?

A. Yes.

Q. Which you've signed?

A. Yes.

Q. And which you have in front of you?

25 A. Yes.

Q. Could I ask you then please to start reading that statement of evidence at paragraph 2?

30 A. I was contacted by counsel assisting the Royal Commission and asked to meet to discuss my knowledge of issues the Royal Commission was examining in relation to the collapse of the CTV building. Following a meeting with counsel I was advised that I would be required to provide

evidence and I would be receiving a summons. I have subsequently been served with a summons.

5 The evidence I have been asked to provide the Royal Commission relates principally to the following matters.

a) My period of employment by Alan Reay Consulting Engineer from its mid to late 1984 to late 1985.

Q. So you want to make an amendment there I take it?

A. Yes.

10 Q. And am I right that that amendment is as a result of Dr Reay giving you more detail or stating some more detail about your period of employment there?

A. Yes.

Q. Yes. All right, you are at, "While I was not employed?"

15 A. While I was not employed there at the time the CTV building was designed and had no involvement in it, I did the structural calculations for the eight storey Landsborough House during the period I worked for Alan Reay. I had been told by a Mr David Harding, and this was also being confirmed by counsel assisting, that he – that's David Harding –
20 did the calculations for the CTV building and the design features of that building were modelled on Landsborough House. I have also been advised by counsel assisting that David Harding says he was given a copy of the structural calculations for Landsborough House to use as a template for the method of how to design a building using the ETABS
25 system.

b) The calculations done my David Harding for the CTV building. I have been asked to review these and comment on where and how they differ from the Landsborough House calculations and the significance of these differences. I have also been asked to give evidence on the ETABS
30 system and its use in the design of the CTV building.

c) The design principles used for multi-storey shear wall buildings designed in the 1980s and the relevant structural detailing used in their construction.

d) The way the Christchurch City Council building consent process worked during my time there, and in particular the different roles played by Bryan Bluck and Graeme Tapper in the consents process and my knowledge of how Alan Reay personally and how Alan Reay Consultants Limited dealt with the building consent process and with Bryan Bluck and Graeme Tapper.

5

Q. Continue on thanks, at paragraph 4?

A. Although most of my evidence involves matters of facts, because some of my evidence involves matters of opinion I have been shown the code of conduct for expert witnesses. I have been advised that expert witnesses giving evidence to the Royal Commission are required to comply with this code.

10

I confirm that I've read the code and I agree to comply with it. I believe that the opinion evidence I give is all within my area of expertise.

15

Q. Yes just go ahead. You're now going to deal with your professional engineering experience?

A. Yes. From 1972 to 1975 I trained as a structural draughtsman with architects and engineers Griffith Moffat and Partners in Christchurch. During that period I attended Christchurch Polytechnic to gain NZCE Civil in 1975.

20

In 1976 I went overseas and worked as a structural draughtsman detailing industrial buildings, first in Durban for structural engineers Horne and Glasson and then in Johannesburg for LSC Brunette, a Zimbabwean based firm.

25

In 1977 I returned to New Zealand to carry on my structural engineering studies. I attended the University of Canterbury from 1978 to 1979 and gained a Bachelor of Engineering degree with First Class Honours. I continued to work with Griffiths Moffat and Partners as a trainee engineer between studies.

30

I studied structural design under both Professor Park and Professor Paulay who were regarded as leading structural engineers with international reputations. I would explain the relevance of the relationship I developed with Professor Paulay later in my evidence.

I also studied the structural dynamics of buildings under Dr Athol Carr where I learnt the fundamental principles of dynamic analysis for buildings as part of the third professional year course.

5 After graduating from the University of Canterbury I was employed by Holmes Wood Poole and Johnstone which for clarity I will refer to as Holmes Wood. This is the predecessor firm of Holmes Consulting Group.

10 During this time I worked on many significant building projects. I was also trained in the use of the ETABS program for designing multi-storey buildings. Prior to this time all of the buildings I had worked on were designed by hand methods as commercial computers or software that could carry out design work were not invented or available.

15 I became a registered engineer in 1982 and a member of the Institution of Professional Engineers in 1983.

1610

Q. I take it you just made a correction there from institute to institution.

A. Yes.

Q. Thank you.

20 A. In 1984 I left Holmes Wood to join Dr Alan Reay's firm which was then called Alan Reay Consulting Engineer. Dr Reay is now the principal of Alan Reay Consultants Limited which I will refer to as ARCL. I will refer to the two firms by this name as I'm not aware of anything relevant to my evidence that's affected by which one of the Alan Reay firms I am referring to.

25 I had been well mentored at Holmes Wood which had enabled me to become a registered engineer in 1982. However while the experience I received at Holmes Wood was outstanding I felt that it was time for a change and I was attracted to an advertisement from ARCL for a structural engineer which I thought would give me the opportunity for further advancement. Alan Reay indicated to me during my interview
30 that there was a possibility of a future partnership in the firm.

5 In 1985 I left ARCL and went to work for Dick Cusiel to help analyse the United Building Society in High Street. This is now the Holiday Inn building. Dick Cusiel offered me part of his office space which enabled me to also work on my own projects. During this time I became a member of the Association of Consulting Engineers New Zealand.

10 I worked from the Lovell-Smith Cusiel office for about 18 months before Brian Wood from Holmes Wood asked me to come back to help with Parkroyal Hotel design which I did. This offered further career advancement. I worked there primarily as the engineering manager until 1990 when the firm restructured as Holmes Consulting Group 1991.

Q. I take it you've got another little change do you in paragraph 18 about the number of years?

15 A. Yes that's, it's during those nine years there.

Q. Thank you.

A. First at Holmes Wood and then at Holmes Consulting Group I worked on several large building projects. This included the Parkroyal Hotel, the Price Waterhouse Centre, the Antarctic Centre and the strengthening and base isolation of Parliament Buildings and the General Assembly Library.

20

25 After I left Holmes I established my own practice. During this period I worked mainly on the Port Hills Gondola building but also on a number of small residential projects.

In 1992 I joined the Christchurch City Council Building Control Department.

Q. So you want to insert the word "control" in there do you?

30 A. Yes.

Q. Thank you.

A. Initially I helped to work out how the Council building control processes could transition from the Local Government Act to the new Building Act.

5 This took about a year and during that time and for a while afterwards I worked alongside Graeme Tapper and Bryan Bluck reviewing engineering design building consent applications. Later after they retired I took up the role of building control engineer and building consents manager.

10 After leaving the Council I worked at MWH as senior engineer and group leader from 1996 to 2002. This involved structural and civil engineering projects.

I became a chartered professional engineer in 2003 and since 2003 I have worked for Eliot Sinclair where I am employed as an associate to the firm carrying out a wide range of civil and structural engineering projects in Christchurch.

15 Q. I'm just going to ask you to pause there Mr Henry before you go on. I just want to take advantage of the experience you've had in a number of firms over the years and firms of different sizes. I'll just ask you some questions about your experience of supervision in those firms which is an issue in which the Royal Commission has some interest. So if I just
20 take you back over the various firms that you've referred to and first of all it's Griffith Moffat and Partners where you began and where you returned after you came back from South Africa. What was your, what was the size of that firm?

A. It was about 30 staff altogether of which about seven or eight were in
25 the engineering department.

Q. And how many senior engineers at the time that you were there, or the two times you were there?

A. There was the one partner, that was Ian Drewett. He was the senior engineering structural partner and then there was two other sort of, one
30 intermediate/senior, the other intermediate.

Q. Yes and I take it in the usual manner that seems to be the case with engineering firms there also would have been structural draftsmen?

A. Yes there were four structural draftsmen.

- Q. All right and your experience both as a, in your early days, your first iteration there and then subsequently your experience of the way in which the more senior people supervised the work of the less experienced people. Can you comment on that at all?
- 5 A. Well the, there was a senior draftsman checks the drafting work, the intermediate engineers checked his work and the engineering work was basically continually reviewed, would be the best word for it, by discussions within the office which was small and you could always hear them all.
- 10 Q. And that discussion would include the senior engineers would it?
- A. Yep. It would include anyone who was on the job usually but Ian Drewett was very, very fussy, conservative man. He, he wanted it right, yeah, so he would discuss things thoroughly with the engineers.
- Q. Yes. All right turning next then to your time at a rather different firm –
- 15 Holmes Wood Poole and Johnstone. How many engineers were there when you were first there in this 1980 to 1984 period. Do you remember?
- A. There was, the staff there was around 20, yep, two partners, something like four associates, maybe as many again engineers, three or four
- 20 engineers including myself and the rest were draftsmen and tracers.
- Q. Yes all right. Now the same question really I just put to you again. What was your experience there of the way in which the more senior people supervised the work of the less senior and experienced people?
- A. Well they had quite a, quite a rigid drafting system. Rigid's perhaps not
- 25 the word for it, a very established drafting system with senior draftsmen that controlled the drawings, and on the engineering side there was, essentially the partners would, would control their own jobs and that would go down through the associates to the engineers and, like myself, and the associates tended to spend more time with the engineers on a
- 30 day-to-day basis reviewing their work but at any time the directors would join in. This was all in the office usually too, public discussions around the desk but the jobs themselves when they were finished went through quite a, an established checking process where the draftsmen checked

the work, the engineers checked their structural component, it was all colour coded and signed off and at the end of the job all the tracings would be fanned out on the desk and signed off by the director and it was completed.

5 Q. When you say it was colour coded what is that a reference to?

A. Well green for right, red for correction.

Q. I see.

A. Blue for add something in type of thing, yep.

10 Q. I see. So a formalised system by colour coding for recording whether things were finished or needed something more done to them?

A. That would be on the drawings. They'd go back to the, to the team who would then correct, yep.

Q. Yes all right.

A. Yep.

15 Q. Now then your period at Lovell-Smith Cusiel. Same questions really. Size of that engineering practice at the time you were there?

A. It was small. Dick Cusiel running it had two senior draftsmen, very senior draftsmen and I was really working alongside Dick for about six months. I didn't have the same degree of time to get into his processes but it, the best way of putting it I advised Dick and we had lots of sessions thrashing out the fundamentals of the building, put it that way. That was that building, the United Building Society. It was big and it was difficult due to its, nature of the structure.

20

Q. This is the United Building Society building?

25 A. Yep, yeah. You know it was that sort of in the office type reviewing again.

Q. So you were reviewing each other's work to some extent were you?

A. Yes he was the lead designer. He, he was very much a hands-on technical person. That's what he wanted to do. I came in specialist for the analysis on ETABS and helped with the, basically sort out the fundamentals. There was a number of issues in the lower, lower frame of that building that had to be over-strength on the upper frame.

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1620

Q. Yes.

A. And that's what I did.

Q. And then you go back again to what is now Holmes Consulting Group, 1986 to 1991. Is the supervision procedures that you experienced then the same as they were before? Is there anything you'd like to add about it during that period?

A. They were similar, it was all getting bigger and faster because of the sort of building boom leading up to the '87 crash and they also had expanded with multi offices throughout the country so there was a tighter control put on to formalising that checking process. We actually had a stamp made up so that people could actually write their name in it and sign it which made quite a big difference but otherwise it was, yeah it was pretty much the same.

Q. And would I be right in understanding the stamp and signing process made a difference because it sheeted home accountability?

A. Absolutely, definitely did, yep.

Q. Then you go between 1996 and 2002 to Montgomery Watson Harza. Same questions really – the size of the practice and your supervision experience there?

A. Well this is a corporate firm now which was quite a lot different to all the others being your more private type practices so it had over the top of it like a corporate body that ran the thing and because of that ISO 9002 procedures were formally in place with a quality control manager and with that the whole process was documented with it was like a booklet to set the job up, control booklet with review status set out in it which people followed for big and large projects – there was two different types – because they had offices throughout the country as well so the system had to be quite disciplined. But then, in your own corner, like my group, the structural group, we had our own processes for checking which, in my area, I just carried over a similar one to Holmes and used that.

Q. And now at Eliot Sinclair where you are currently an associate. Again size of the engineering practice and the supervision and training structures within that firm. Can you comment on that?

5 A. There's about 60 people all up in the engineering and structural department there's seven engineers and four draughtsmen. I think it's the CAD that makes the draughtsmen less these days because it's so much more efficient when less numbers and their process is very much, I think it's probably the most intensive firm I've been in for where the directors become, you know, completely involved in the work. They're
10 hands-on directors so the process is continuous. It's quite normal for the structural director I work with, John Brodie, he'll just come and sit at your desk and get right alongside, or whoever it is, and you go through it blow by blow until he's happy and that's basically what we all do.

Q. And to what extent has it been your experience in each or any of these
15 firms that you've just been describing for design certificates to be used?

A. Oh that's completely normal yes.

Q. And when it is used who would sign off the design certificate?

A. Well, you mean for all of those or now?

Q. Well for the time you were at each of those firms, those that were using
20 design certificates routinely. Are you saying that all of those firms that we've just been through would routinely use design certificates in your experience there?

A. Yeah a design certificate was basically standard for finishing any job off. It would be a small job that didn't have one. The design certificate was
25 actually called a design certificate up until the Building Act came along and then it got lost and it got called a Producer Statement with no legal standing but councils continue to accept them in the same vein. But it's basically signing off a design certificate was an area which only the partners or the directors. Well they weren't directors then they were
30 basically partners or owners signed them off back in the old days. I mean you weren't allowed to sign a design certificate basically. It just wouldn't have been possible. I mean Holmes were very very particular about that. I don't know that even the associates signed them there.

That was their quality control. That was their way of saying the job's finished, I'm happy with it.

Q. And did that also apply in the smaller firms that you've described?

5 A. Definitely, yes more so. It wasn't the case at Montgomery Watson Harza because being corporate they're relying on the principals of the firm. See I was a principal there as a shareholder so I had signing rights for design certificates or producer statements they were then.

Q. Yes but they were invariably signed off by the senior people in these firms?

10 A. Yeah you had to be a principal basically.

Q. Yes, yep, all right thank you for that and you're now, I think, at paragraph 23.

15 A. I now address in more detail my structural design experience in the period leading up to and during which the CTV building was designed. This section of my evidence also deals with my knowledge of structural engineering practice for Christchurch multi-storey buildings during this period.

20 Before I joined Holmes Wood the firm had designed a number of shear core buildings in Christchurch during the 1970s. They had built up a considerable experience and knowledge base to work from. These included 58 and 64 Kilmore Street, each four and six storeys which form part of the ECAN complex and the Spicer House building next door at 329 Durham Street, which is five storeys.

25 All three of these buildings had a seismic structure consisting of either central shear walls or a shear core offset to one side, adjoining a long shear wall running at right angles along the outside of the building. In the design of these buildings, in order to resist torsional effects, Holmes Wood had taken steps to counteract the eccentric nature of the shear walls by placing additional walls either on the opposite sides or on the ends of the building.

30

I have been carrying out assessments and reporting on earthquake damage to these three buildings over the past year and in the course of

doing so I have reviewed the structural drawings and their design. I now see these designs as part of a progression in the developing expertise of Holmes Wood into which I was introduced in 1980 when I joined the firm. I have seen the extent of structural damage to these buildings and how they performed in terms of the principles and assumptions used in their design.

5

All three of these buildings were designed using the same underlying structural premise for the design of the seismic structure in relation to the gravity load carrying elements. This is the same premise I am now aware the CTV building used, as did the other buildings I will refer to in my evidence. The principle is that the shear walls are designed to carry all the seismic load of the building leaving the columns and beams to carry only the gravity loads or building weight imposed on them. The design of the gravity load system is, therefore, simplified because the reinforcing requirements are a lot less compared with those required for seismic loading. The premise underlying this design method is that the stiffness or inflexibility of the shear walls prevents the relatively flexible columns and beams from excessive deformation under seismic loading and thereby from suffering significant seismic forces and stresses. However, with this premise, if excessive deflections do occur in a major seismic event the gravity load system is vulnerable to overloading and possible collapse.

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This is a critical design principle which recurs throughout my evidence. For ease of description I will refer to it as the “shear wall protected gravity load system”.

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In this type of system the beams typically run in one direction along the building sometimes, but not always, with an enclosing beam around the perimeter of the building. The joints between the beams and columns are simply reinforced with minimal reinforcing, very much less than if seismic loadings were included in their design. Column reinforcing is also simple and minimal, usually 10mm ties at 250 or 300mm centres.

30

It has been helpful and educational for me to see that although the three eccentric Holmes Wood buildings I’ve mentioned have suffered damage

and cumulative degradation to the point that they are not economical to repair, their shear walls have performed reasonably as expected to provide the assumed protection to the gravity load system with moderate cracking damage to some of the beam column joints and/or spalling of cover concrete within some end regions of the columns. The beam column joints in these buildings had similar detailing to the CTV building in that the bottom reinforcing bars were turned upwards and terminated in the joint with light enclosing ties. The column ties were R10 at 250mm centres.

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10 1630

During my time with Holmes Wood I overlapped with Andrew or Andy Buchanan as he was called, now Professor Buchanan at the University of Engineering, Engineering School, sorry University of Canterbury Engineering School. He was an associate of the firm and I worked under his supervision on the Canterbury Savings Bank building which is now known as the Westpac Centre at the corner of High and Cashel Streets. This was a 13 storey building with a poured concrete shear core in the centre of the building that was designed and built between 1980 and 1983. The design was done in 1980 and there was a two year construction period. The structure was symmetrical and did not involve any significant eccentricities. In that respect the analysis in design was simplified.

15

20

This was my first experience of a shear core building utilising the shear core, sorry shear wall protected gravity load system. My role involved carrying out the computer analysis of the shear core structure using the software program called ETABS on the University of Canterbury mainframe computer facilities. This was the only computer available at the time of doing the job.

25

Q. Capable of doing the job I think.

30

A. Pardon.

Q. You just missed out the word capable.

A. Sorry. Yes, at the time capable of doing the job, yes.

A. ETABS is a program that I believe was developed at the University of California, Berkeley in the 1970s for the purpose of analysing multi-storey buildings in three dimensions taking into account the higher modes of vibration which influence the response of a structure under seismic loading. The program enables the designer to determine the building response, deflections and member forces with a level of accuracy that was impossible using hand calculation methods.

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The early versions of ETABS did have limitations modelling wall elements which was achieved using panel elements joined together with virtual frames. The results like any computer work were only as good as the input data which included assumptions that needed to be borne in mind during the design process. For example the properties of the beam column and panel elements needed to be assessed in terms of the degree to which they would crack under earthquake loading. The degree of cracking selected and assigned to some elements could significantly affect the deflection results. This sort of sensitivity could be tested using the ETABS model.

20

ETABS was not user friendly in those days. All data was input using punched cards that were processed at the University of Canterbury. The information was supplied for punching handwritten on sheets with rigid formatting. A single digit in the wrong place could cause the analysis to fail mid-way or could produce rubbish output. Once the model did run successfully some basic checks were carried out to make sure that the model was running sensibly.

25

These checks included checking the sum of the shears at the base of the building against the total input load, checking that the building period of vibrations were as expected and checking the deflections for any irregularities that would signal any misbehaviour.

30

Once the Westpac building was analysed I carried out the design of the shear core under the mentorship of Andy Buchanan and Russell Poole which involved Andy sitting with me for about an hour each day to go through the steps involved.

In those days a 13 storey building was a major project in Christchurch utilising a major part of the office resources and involving constant overview and involvement from the senior partners and associates. Drawings were prepared by hand along with fully detailed bending schedules for the reinforcing bars.

5

For a shear wall protected gravity load system building the structural design process typically proceeded along two parallel paths: the design of earthquake resisting elements and the design of the gravity load carrying elements. These could generally be designed independently of each other because as I've already said, the gravity load carrying elements such as the floor beams and columns did not have enough stiffness to attract significant earthquake loadings and therefore could be omitted from the earthquake analysis. Stiffness is a structural term that measures the amount of force that it takes to deflect the structural element. So a big wall has much greater stiffness than a thin column.

10

15

My experience of working with Andy Buchanan on the Westpac Centre job and the experience I gained set me on the path to designing several multi-storey shear core buildings at Holmes Wood, although some of these did not proceed past the preliminary design stage. Two of the buildings I worked on had significant eccentricities due to the configuration of the shear walls.

20

The first of these buildings was a 14 storey building in Wellington next to the Plimmer Steps. I did the structural design work under the supervision of Russell Poole. At the time the building was called the AA Centre. The structure included an eccentric shear core to carry a seismic loading together with a perimeter frame that provided supplementary torsional resistance to counteract the eccentricity of the shear core. This was a complex structure due to the interaction of the shear core with the perimeter frame which greatly complicated the design.

25

30

In my experience the structural design and construction of multi-storey shear core buildings is complex. The reinforcing detailing is typically complicated in the lower storeys which are designed to yield under

5 earthquake loading. Special elements called coupling beams are often used to dissipate seismic energy. The diagonal reinforcing for these adds more complexity to the detailing and design. I mention this because the CTV building utilised a coupled shear wall on the south side. I will come back to this issue in the course of my evidence.

10 In 1984 I joined ARCL. There were no other engineers in the office apart from Alan Reay. Tilt slab buildings were Alan Reay's specialty and in this field he was clearly a very prominent designer. The systems he had developed for tilt slab buildings were very efficient with regard to the use of materials and ease of construction.

15 In the mid 1980s about the time I went to ARCL the Christchurch CBD was beginning to see quite an increase in multi-level development. These buildings were usually reinforced concrete structures utilising shear walls. They required both experience and a relatively high level of expertise in design compared with the more usual low rise tilt slab buildings in which Alan Reay had specialised.

20 Alan Reay told me at the time of my job interview that he had a couple of multi-storey jobs in the pipeline and I understood from discussions with him that my expertise was needed for these jobs. As far as I was aware the only multi-storey buildings ARCL had done prior to my arrival were Ibis House at 183 Hereford Street and possibly the Kamahi Towers apartment building in Carlton Mill Road. I think these were both 1970s concrete block structures, however concrete block was no longer 25 an option for multi-storey building in the 1980s because it could not be made ductile in a practicable way for earthquake loadings.

Q. You're going to deal in that now in detail with Landsborough House.

30 A. A) The design work – after I commenced work at ARCL Alan Reay confirmed that he had the job for what is now known as Landsborough House and also had the job for what is now called the Aged Concern building. This is on the corner of Cashel Street and Cambridge Terrace. Landsborough House is an eight storey building on the north-west corner of Gloucester and Durham Streets.

Q. We might just bring that up, so interested people can have a look at it. There it is there I think, we've seen it once before but that is the Landsborough House building I take it. That is the Landsborough House?

5 A. That's it, yes, yes.

Q. Thank you.

A. When I was shown the preliminary layout for Landsborough House, I was surprised at the configuration of shear walls. There was a single wall along the north side adjoined by several short interior walls at right angles alongside the services area. The configuration was eccentric to the north side of the plan to the extent that it was immediately apparent to me that it would not be a workable solution. I do not know how this configuration was arrived at because I have no involvement with the design up to that point.

10
15 Q. Can I just dwell on that momentarily. Do I take it that you were shown the preliminary layout by Dr Reay?

A. Yes.

1640

Q. And do you have any, or was it your assumption that that work had, that initial preliminary layout you're describing had been generated within the Alan, within Alan Reay's firm?

20 A. Well, assumption, I'd –

Q. Or to put it more neutrally, did you have any view on where this original preliminary layout plan had been generated?

25 A. Yeah I can't say for sure. It was presented to me by Alan Reay. I think the architect was there. I assumed they'd either thought it up together or Alan Reay had thought it up. I didn't really come into it at that point.

Q. Yes, all right, so you're at paragraph 48?

A. My immediate reaction was to suggest an alternative structure using a closed shear core as close to the centre of the building as possible. As was typical with all eccentric core buildings, the reason for the offset configuration is to maximise the amount of lettable open floor area by moving the services core and associated structure to the side, instead of

30

the optimum position in the middle of the building. I would've preferred to have the shear core in the centre of the building, but it was clear to me that Alan Reay was committed to an offset configuration. As a compromise solution, after I'd done my preliminary calculations, I proposed that the shear core be offset on the middle of the north side but still within the walls of the building.

5

Q. And again I just ask you to pause briefly because this issue about your statement that it was clear to you that Alan Reay was committed to an offset configuration. Dr Reay's taken issue with that. So what is it that led you to take this clear message that Dr Reay was committed to an offset configuration?

10

A. Well I suggested straight away, I said it won't work, and put a shear core in the middle and basically he just wouldn't accept it, rejected it.

Q. Thank you, paragraph 49?

15

A. The final decision on this configuration was subject to testing by computer analysis using the ETABS program because the eccentricity was large. It was a code requirement to carry out this type of analysis for eccentric buildings more than four storeys high.

20 **MR MILLS:**

Now you've got the reference there. We have gone to this several times. Would it be of any assistance to the Commission to have Mr Henry go through those provisions or are you happy for him to just move on?

25 **JUSTICE COOPER:**

I think, bearing in mind this is going to be focused on next week, we're probably happy for him to move on are we?

EXAMINATION CONTINUES: MR MILLS

Q. Then pick it up with, "Throughout my evidence..." please?

30

A. Throughout my evidence, unless I need to refer to one or other of the two relevant New Zealand standards specifically, I will use the term "code" to refer to both NZS4203:1984 which is the code of practice for

general structural design and design loadings for buildings, and NZS3101:1982 which is the code of practice for the design of concrete structures.

5 This requirement of an ETABS analysis was because with eccentric buildings it was the only means of accurately determining the likely response to the building to earthquake loading. It was also best practice at the time for determining the building deflections and design forces which could not be accurately assessed by hand methods.

10 The task of carrying out the ETABS analysis was delegated to me by Alan Reay and I carried it out in the same manner as I had done at Holmes Wood using ETABS on the University of Canterbury computer. The first objective of the analysis was to determine if the structure had sufficient stiffness to limit the horizontal displacements or inter-storey drifts of the building to within the limits given in the code. This is the
15 stage where the designer can gauge if the underlying design premise of a shear wall protected gravity load system remains valid. The deflection of the building is a function of the size, number and arrangement of the structural elements. If the analysis showed that the inter-storey drifts were too great then either the member sizes would be increased or the
20 elements would be rearranged.

The results of the ETABS analysis of Landsborough House showed that the structural model worked but the corner deflections were at or near the maximum code drift limits for the east-west or eccentric direction of loading.

25 At that time the ETABS analysis did not provide output results that could be used directly to interpret the deflections of the building.

1645

This was an important limitation on its use. The program was basic without the modern graphics features that provide ability to readily
30 interpret the deflection output. Using the ETABS results to determine the deflection of a building required both experience in the use of ETABS and an understanding of the design of multi-storey shear core buildings. For example at that time the ETABS deflections of the

building were given in their single location at the centre of mass for each storey. The raw deflection data was given for the two horizontal x and y directions, or the north and east in the case of the CTV and Landsborough which are both aligned the same way. The rotation of the building about its vertical axis was also given at the centre of mass which is usually near the middle of the building, the middle of a building of uniform plan. However, the maximum earthquake deflections are normally at the corners of the building where twisting due to any eccentric effects is at a maximum.

5

10 Q. Now I'm just going to ask you to, and I'll bring it up for you, to have a look at a provision in the commentary to the code and just get your view on whether this is giving any guidance on this issue of corner deflections. So it's ENG.STA.0018.53. Now that's the -

15 **COMMISSIONER FENWICK:**

43 not 53.

MR MILLS:

Yes it's 53 that we're looking for. I didn't think it looked like what I was looking for. Thank you Commissioner.

20

EXAMINATION CONTINUES: MR MILLS

Q. Well in fact that's a whole different numbering system. So it's ENG.STA0018 and I want 53 not 47. Right that's in front of you now. I wonder, could we enlarge the commentary which is that left-hand column, first paragraph under C3.4.71. I'll just give you a moment to read that Mr Henry and then ask you if you regard that as having any, as being relevant to the point you've just been making about corner deflections.

25

A. That's, that's definitely an alert to what I'm talking about and working out the corner deflections is, is part of what that's getting at, yep.

30

Q. And so am I right that the point it's making first and foremost is that horizontal torsion effects are difficult to estimate and then going on to

A. Yes.

5 Q. All right thank you. You're at paragraph 54.

A. At that time calculation of the corner deflections required additional analysis to determine the centre of rotation of the building which is not at the centre of mass when the structure is eccentric. It is only after the centre of rotation has been determined that the corner deflections can be calculated.

10

It was essential to calculate the inter-storey drifts and be satisfied with the proposed structural configuration before proceeding with detailed design. This was the procedure that I learned at Holmes Wood.

15

Before commencing detailed design and as part of my review of the concept design for the shear core structure for Landsborough House I also sought an overview comment from Professor Paulay at the University of Canterbury. I remained concerned about the proposed eccentric configuration of the shear walls and I wanted his opinion on the fundamental configuration with regard to the eccentricity and possible torsional effects. I was not looking for a detailed review.

20

I especially wanted Professor Paulay's opinion because I considered he was an expert on torsional issues and building layout and reinforced concrete shear walls. I was aware from his lectures that in certain cases, depending on the torsional stiffness of the whole system the response of some structural configurations can cause unexpectedly poor performance once ductile yielding has commenced under earthquake loading. Ductile yielding of structural elements is a key factor in limiting earthquake forces in buildings but although the earthquake load is limited the deflection of the building is not. The energy dissipation occurs as a result of the building deflecting at the same time yielding the reinforcement. The more yielding and displacement the more energy dissipation. The design code utilises this aspect to dissipate seismic energy by controlled ductile yielding of the

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reinforcement in the selected elements such as the base of the shear wall and diagonal reinforcing beams in coupled shear walls.

The next – it's a bit remote but the next part's c. The 1984 Loadings Code. The 1984 Design Loadings Code determined the ability of a structure to dissipate energy by yielding by the structural type factor "S".

JUSTICE COOPER:

Q. Defined, in the first line you read "determined" but the word is "defined" and that's what you mean isn't it?

10 A. Sorry, yes, defined the ability of a structure –

Q. Thank you.

A. Yep.

EXAMINATION CONTINUES: MR MILLS

15 A. The commentary to the Loadings Code clause C 3.4.2(b) on page 42 of NZS 4203 at 1984 explains that the S factor takes into account the ability of the structural type to dissipate energy in a number of cycles on the assumption that the bulk of the chosen energy dissipation members in all of the principal resisting elements of a given structural type will participate in the dissipation of seismic energy.

20 The structural type may refer to individual elements if they vary throughout the building or to the building as a whole if a uniform structural system is used. For uniform response and yielding of the building under earthquake loading a uniform structural type in the direction of loading under consideration would be ideal. However it is not always possible to have a uniform system. Combinations of structural types were common and the code made some provisions for that.

25 Clause C 3.4.2(b) of the commentary outlines a method for dealing with differing S values but warns first as at –

30 Q. It warns that.

A. Sorry, warns that as at 1984 this method was not fully researched and therefore should be used with prudence particularly for buildings over three storeys high.

5 Professor Paulay had mentioned in his lectures the example of a building with a wall on each end and otherwise little torsional resistance which could lead to the majority of the yielding occurring on one of the walls. I had a clear recollection of him saying this. The yielding demand is primarily made of the first wall to yield rather than being shared between the two walls. This becomes more pronounced if there is
10 unequal stiffness between the two walls. I will come back to this issue because it is my opinion that this example applies to the configuration of the north and south shear walls of the CTV building.

Professor Paulay did not raise any such fundamental issues with regard to Landsborough House but he did comment on the eccentricity of the
15 building and a possible loss in stiffness and consequent increase in deflections arising from cracking of the shear walls under earthquake loading.

1655

I was aware of this possibility and I had used reduced properties in the
20 ETABS analysis to take account of loss of stiffness due to cracking in the relevant structural elements. This was my normal practice but Professor Paulay still cautioned me about this issue.

d) Remaining concerns over the Landsborough House design.

25 I discussed my concerns and Professor Paulay's caution with Alan Reay. He was dismissive of this aspect and we proceeded with the design. While I thought the design for Landsborough House was at the limit of acceptability I believed that it met the Code deflection requirements and, as a result, I accepted that the design would proceed.

30 Q. I'm just going to ask you to pause there briefly. Dr Reay has taken issue with your description of what he said to you as being dismissive of this aspect, which I take it to be a reference to Professor Paulay's caution is it? Is that what you're saying he was dismissive of?

A. That's right, yep.

Q. Is there anything in particular which makes you feel that it is correct to describe his reaction as dismissive?

5 A. Well I thought it was a reasonable way of putting it without going into a lot of detail. He really wasn't, didn't show any indication of picking up on it or taking it any further.

Q. Was there anything in particular that he said to you that led you to say he was dismissive?

10 A. Well there was. I mean it was quite a tricky situation really. In fact I really was quite surprised, more than surprised when he did comment at the time and I think because of that I still remember it quite clearly that it sticks with me, yeah it was.

Q. And what was that?

A. Well it was basically what would he know about it?

15 Q. What would he know about it and the he that's being referred to is?

A. Pardon? Oh Professor Paulay, yeah.

Q. I see and why did you think he was saying that?

20 A. Well I, at the time the best interpretation I could put on it was that he saw like an academic ideal sort of a statement versus, you know, practical, day-to-day practitioner's world where, you know, you've gotta get on with the job and that's all very well being like a theoretical type comment but, yeah, that's how I viewed it.

Q. And you have a clear memory that that's what was said to you?

A. Oh yeah it was a shocker really, yep.

25 Q. All right you're at paragraph 64.

30 A. My concern was whether the gravity load system would be adequately protected by the shear walls. I took heed of Professor Paulay's comments when it came to detailing of the column hoop reinforcing in the end regions of the columns. I detailed the column tie reinforcing with a reasonable provision for some ductility demand in the end regions of all the columns just in case deflections greater than those calculated in the ETABS analysis occurred in an extreme earthquake event.

JUSTICE COOPER:

Now Mr Mills this is probably a logical place to stop this isn't it.

MR MILLS:

5 Yes it probably is.

MR RENNIE:

Sir, just before the Commission breaks, my friend has just led some evidence that was not put to Dr Reay and I would simply ask that at a later point I'm
10 able to have Dr Reay respond to that.

JUSTICE COOPER:

When he comes back.

15 **MR RENNIE:**

Yes, I'm not objecting to the evidence per se, Sir, simply when he comes back I'd reserve the right to do that, Sir.

JUSTICE COOPER:

20 Yes that will be appropriate.

MR MILLS:

And just to avoid any possible criticism of myself it was put in issue by Dr Reay saying it wasn't dismissive and I asked him specifically about that point.

25 **HEARING ADJOURNS: 5.00 PM**

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