Thursday, 2 January 2020

(10.04 am)

MR PENNICOTT: Sir, good morning. Prof Hansford, good morning.

Little did I know, when I stood here on 10 January 2019 wishing you Happy New Year, I would be doing exactly the same just one year later, but anyway, Happy New Year.

Before I move on, can I just publicly congratulate Prof Hansford on his recent honour announced in the New Year's Honours List in the United Kingdom. He was awarded a CBE, one of the highest honours obtainable in the United Kingdom -- the citation says "for services to innovation in civil engineering" -- and I congratulate him on behalf of the Commission, the Commission's legal team, and no doubt all of those in this room.

SEVERAL PEOPLE: Hear, hear.

COMMISSIONER HANSFORD: Thank you very much indeed.

MR PENNICOTT: Sir, I am looking around because I was told that representatives of Pypun and Atkins might be here this morning. Right, that's Atkins, behind the monitor. Nobody appears to be here from Pypun but no doubt we can just press on, having noted that particular point.

CHAIRMAN: Yes.

MR PENNICOTT: Sir, briefly and by way of recap, and

primarily for the purposes of public and press information, could I just I hope relatively briefly explain where we've been, where we are, and where we are going in the next couple of weeks.

Sir, you will recall that in January 2019, following closing addresses by the parties and the Commission's legal team, on 29 January 2019 to be precise, the Commission went away with a view to producing a report. For two primary reasons, that report, which I will come to in a moment, turned out to be an interim report. The two primary reasons for that were that when the Commission adjourned at the end of January 2019, there were several matters at that point in time still under investigation and consideration by the government and MTR. In particular, various opening-up and in-situ testing of the engagement lengths of coupler assemblies was taking place; the strength of partially engaged coupler assemblies was being tested; the structural adequacy of the top EWL slab to D-wall connections, also known as the construction joint, was also under consideration; and also, lastly, miscellaneous defects and in particular alleged shear link irregularities in the EWL slab were also being looked at.

So those matters were left, as it were, in the air at the end of January 2019.

Of further importance, of course, just before we adjourned in January, MTRC had proposed to government that a three-stage holistic study should be conducted on the EWL and NSL slabs and the diaphragm walls, to verify the as-constructed conditions and provide assurance on the structural integrity of the works. That holistic proposal, as it is known, was accepted by the government in December 2018, during the course of the Original Inquiry hearings.

Sir, so that's matters outstanding in terms of investigation. The holistic report had been notified, proposed and accepted. Then, of course, on 19 February 2019, when the Commission was in the process of preparing its interim report, the Chief Executive-in-Council approved and it was duly announced that the terms of reference of the Inquiry would be expanded or extended.

CHAIRMAN: Sorry to interrupt a second. Just in case of any misunderstanding, when the Commission originally adjourned, it was in fact to write an interim report, not a final report, because of the very matters which you have raised and which we took on board as being possibly and potentially relevant to a final report.

MR PENNICOTT: Indeed, sir, and I will --

CHAIRMAN: Sorry, just in case there was any

misunderstanding and I may have misheard earlier. Thank you.

MR PENNICOTT: Right. That's entirely right, sir. Then, as I say, to cap it all, the terms of reference were then expanded and issues concerning the North Approach Tunnel, the South Approach Tunnel and the Hung Hom Stabling Sidings were brought within the remit of the Commission, and that Extended Inquiry or COI 2 as sometimes it is called also was then kicked off.

Sir, on 25 February, as you have just indicated, the Commission did indeed submit an interim report to the Chief Executive on its findings and recommendations on matters covered by the original terms of reference, subject -- expressly subject -- to the various outstanding matters that I've just mentioned, and of course because of the extension or expansion of the terms of reference.

Indeed, sir, if one looks at the interim report, in the preface, the Commission stated that in the light of the extended terms and the outstanding matters it was the Commission's decision that it would be premature to publish a final report under its original terms at that time, certainly in respect of matters related to supervision, management and control systems, and a determination of the extended terms may require

significant amendments in the final report. That was the position as it stood in February last year.

Sir, continuing matters chronologically, the next thing that happened was that in the light of concerns raised in respect of the as-constructed NAT, SAT and HHS structures, on 15 May 2019 MTRC proposed that a two-part or two-stage verification study of the structures, those structures, be carried out. That proposal was also accepted by the government. So, come May of last year, we had the holistic report in the offing for the original part of the Inquiry and we had the verification report underway in relation to the NAT, SAT and HHS.

Sir, as you will recall, on 27 May 2019, the Commission resumed for the purpose of taking factual evidence in relation to the expanded part of the terms of reference. That factual evidence hearing concluded on 17 June 2019, and you heard from 33 factual witnesses during the course of that period.

Subsequently, and as directed by the Commission, the involved parties present at the extended part of the Commission, and indeed the Commission's legal team, submitted written closing submissions. That was on 19 July so far as the involved party were concerned and 26 July 2019 so far as the Commission's legal team is concerned. Can I respectfully remind the Commission

that no oral presentation of those submissions have yet been heard to date, and that is relevant to a point that I will mention in a moment.

Sir, on 18 July 2019, just as those submissions were being submitted to the Commission, MTR produced, published and submitted its holistic report and its verification report.

Sir, following the Commission's and the Commission's legal team's consideration of the holistic report and verification report, the involved parties were invited to indicate whether they wish to adduce any further expert structural engineering evidence in relation to the COI 1 outstanding matters and also in relation to the COI 2 matters, particularly in the light, obviously, of the contents of the holistic and the verification reports.

Leighton expressed their wish and desire to adduce structural engineering expert evidence, and as a consequence of that the Commission, acceding to that request, issued directions for, firstly, Leighton, in the person of Mr Nick Southward, to submit his reports to the Commission on COI 1 and COI 2 separately, by 30 September 2019. As it happened, that date was slightly extended until 11 October 2019.

At the same time, the Commission directed that MTR,

the government and the Commission itself, or the Commission's legal team, and its own independent expert, should serve reports responsive to Mr Southward's report by 6 December 2019.

Sir, further, following written and oral submissions from the involved parties, that is China Technology but in writing only, Leighton, government, MTR and the Commission's legal team, the Commission issued supplementary directions to the structural engineering experts.

Sir, I wonder if I can just remind you of those directions because it is relevant and important to the evidence that we will be hearing in the next few days. I wonder if we could get up on the screen AA2, tab 125, page 472.

Sir, these are the supplementary directions that were issued on 12 October 2019. It's paragraph 2 that is of particular importance, and they read as follows, so that everybody is a fully aware of the position:

"It is further directed, however, that in relation to the structural engineering expert evidence to be adduced pursuant [to] paragraph 1 above:

(a) the structural engineering experts should focus on whether the as-constructed works are safe and fit for purpose from a structural engineering perspective; and

only if they are considered not safe or fit for purpose that such experts should then provide their opinion on whether the suitable measures (as agreed in the holistic report or verification report or subsequently) are necessary for safety from a structural engineering perspective; and

(b) the structural engineering experts shall not be required to look into the question of whether the suitable measures (as agreed in the holistic report or verification report, or subsequently) are required for statutory or code compliance."

And so, sir, those were, as it were, the supplementary directions given to the experts when they were preparing their reports.

As it happened, Mr Southward had already effectively prepared his COI 1 and 2 reports as these directions effectively were being made, almost simultaneously, I think, as I recall. That led to a small number of redactions from Mr Southward's reports which I trust have not caused any material difficulties to either Mr Southward personally or Leightons generally. I don't think they have.

So, sir, I move on. Those were --

CHAIRMAN: Could you just, again, for the benefit of the press and the public at large, perhaps just expand very

slightly on those directions and why they were considered necessary.

MR PENNICOTT: Yes, sir. They were made, as I have indicated, against the background of submissions being made by the parties, and the issue, primary issue, with which the Commission was concerned was that it did not want to find itself making the type of determinations that might more appropriately be made in private litigation or private arbitration or some other form of dispute resolution procedure as between the various involved parties, that is between the government and MTR or MTR and Leighton or Leighton and other parties. And the Commission, as I understand it, was very exercised not to get involved in that sort of private dispute and wanted to focus very much, as required by its terms of reference, on the questions of safety and fitness for purpose and did not want to be drawn into matters of pure contractual compliance, statutory compliance, which it saw outside of the primary remit of safety and fitness for purpose.

CHAIRMAN: Thank you very much.

MR PENNICOTT: Sir, those were the directions so far as the experts are concerned and we will come back to that in a moment.

Meanwhile and just to complete the chronology, you

will recall that on 25 to 27 September 2019, the Commission heard independent statistical evidence from Dr Barrie Wells on behalf of Leighton and Prof Yin Guosheng on behalf of the government. Sir, at the moment, no final closing submissions have been made by any of the parties on that particular topic, but I will come back to that in a moment.

Sir, on 4 October, the Commission switched its attention to project management matters, and you heard on 4 October from a further Leighton factual witness, Mr Dean Cowley, general manager of Leighton, and also from Mr Steve Huyghe, the independent project management expert called on behalf of MTR.

On 8 October 2019, you heard from Mr George Wall, the Leighton independent project management expert, and then on 10 October 2019 you heard from the Commission's independent project management expert, Mr Steve Rowsell, and again no final submissions or closing submissions have been adduced by any of the parties or the Commission's legal team on those matters either.

Sir, as I indicated just a moment ago, on 11 October 2019 Mr Southward served and submitted his structural engineering expert reports on the COI 1 and COI 2 matters, and on 6 December, as directed, Dr Glover on behalf of MTR and Prof McQuillan on behalf of the

Commission submitted their COI 1 and COI 2 reports.

Then, on 10 and 12 December 2019, Dr James Lau, the government's newly appointed structural engineering expert, served his reports on COI 1 and COI 2 respectively.

Sir, in recent directions, that is on 16 December 2019, the Commission has directed that, firstly, the oral evidence of the structural engineering experts should commence today and, subject to one minor wrinkle which I will mention in a moment, for all that expert to be completed by Friday week, 10 January 2020.

Sir, I remain confident that that is readily achievable and certainly have not had any contrary indication from any of the other parties. Indeed, I would hope that we can do better than finish on 10 January. I rather hope we might better that by a day or two if we can.

Sir, secondly the Commission directed oral closing submissions to be heard on 22, 23 and 24 January. That is, however, subject to written closing submissions on the matters that I've already identified, that is the statistical evidence, the project management expert evidence and the evidence that we are about to hear over the next few days, written closings being submitted by the parties on 17 January -- that's an incentive to try

and finish as early as possible next week -- and then by the Commission on 20 January, as I say, covering those topics that I've touched on.

Sir, so far as the business of this week and next is concerned, the order of the witnesses, the experts, structural engineering experts, will be Mr Southward will go first, then Dr James Lau, followed by Dr Mike Glover and then followed by Prof Don McQuillan. Subject to any observations or protestations from behind me, the suggested proposed order of cross-examination is that, so far as Mr Southward, Dr Lau and Dr Glover are concerned, I will go first on behalf of the Commission. So far as Mr Southward is concerned, it will be myself, then the government and then MTR; so far as Dr Lau is concerned, it will be myself, then Leighton and then MTR; and then, as far as Dr Glover is concerned, it will be myself, the government and then Leighton. And so far as Prof McQuillan is concerned, obviously we will call Prof McQuillan, and then would suggest, although obviously they can fight it out amongst themselves if they wish, the government, Leighton and MTR to go in that order. I hope everybody has made a note of that.

CHAIRMAN: Sorry, could I again interrupt for the benefit of the public, and the press representing the public, that once the oral submissions are completed at or about the

end of January, absent any further new developments, that will be an end to the proceedings themselves, and it will then be for the Commission to prepare its final report, which is anticipated to be delivered to the Chief Executive within two months.

MR PENNICOTT: Yes, sir. My understanding is that it is at the end of March, towards the end of March --

CHAIRMAN: That's right.

MR PENNICOTT: -- that the final report is to be delivered. But so far as I am concerned and no doubt others in this room are concerned, 24 January, being the last day for closing submissions, the day before the first day of Chinese New Year, we will walk away at least with nothing else to do, at least not on the Commission.

CHAIRMAN: Thank you. I think that gives to everybody a good catch-up and puts everything into perspective for purposes of what we will now deal with. Thank you.

MR PENNICOTT: Yes, sir.

Sir, before I mention a couple of procedural matters which I am bound to do, could I also just draw your attention to this: that there has been a recent meeting of the structural engineering experts. On 20 December, just before Christmas, Prof McQuillan and Dr Glover met in London and had a videoconference with Mr Southward and Dr Lau in Hong Kong. The upshot of that meeting is

a joint statement, which again perhaps we could just have a quick look at, at AA2, tab 170, which I think is the typed-up version.

COMMISSIONER HANSFORD: This was a without-prejudice meeting?

MR PENNICOTT: It was a without-prejudice meeting, but the upshot is this agreement that I'm about to show you.

COMMISSIONER HANSFORD: Yes.

MR PENNICOTT: You will see the details that I've just rattled off. Without going through them again, the purpose:

"To discuss 'without prejudice' relevant issues ..."

If we could scroll down, please, the issues that were discussed were firstly the coupler connections and engagement issues. What it says there is:

"MG [Dr Glover], NS [Mr Southward] and DM [Prof McQuillan] agree that, on the basis of all the testing carried out to date, a partially engaged coupler assembly with a minimum of 7 threads (32 millimetres) satisfies the strength criteria.

MG, NS and DM agree that the permanent elongation tests carried out in the laboratories to date are more indicative of the 'bedding-in' of the threads of a partially engaged coupler assembly at low tensile load, rather than a measure of permanent elongation ie

'stretch'.

MG, NS and DM agree that there is an incompatibility with BOSA's inspection protocols and their intent to achieve a full butt-to-butt connection. Anything less than a full butt-to-butt will not pass the permanent elongation test eg 2 threads exposed will not pass the test.

MG, NS and DM agree that Highways Department's acceptance criteria, based on BOSA's criteria, therefore unwittingly sanction the use of partially engaged coupler assemblies because anything less than locked, full butt-to-butt coupler assemblies will fail the permanent elongation test.

JL [Dr Lau] disagrees with the above points ie only ful[ly] engaged couplers ie full butt-to-butt and locked should be used in the structural assessment."

Sir, we will be hearing some more evidence, I anticipate, about all of that in the not-too-distant future.

Sir, without reading all of this out, I just thought it would be appropriate to read that first point out, for reasons I will explain in a moment.

There is further agreement between Dr Glover, Mr Southward and Prof McQuillan on various matters concerning shear link reinforcement and utilisation.

If we could scroll down, please.

Unfortunately, again:

"[Dr Lau] does not agree with the other experts generally. He is concerned that there may not be any shear links in areas where shear reinforcement is required."

We will need to explore that, I daresay, with Dr Lau in due course.

Then, thirdly, the experts discussed the horizontal construction joint or the CJ.

"All four experts [this time] agree that this is a solely a workmanship issue.

[Dr Glover, Mr Southward and Prof McQuillan] agree that nothing needs to be done but it would be prudent, from a public perspective, to remediate the two locations where poor workmanship has been identified.

[Dr Lau] disagrees and considers the workmanship defects must be rectified by retro-installing vertical steel dowel bars."

Sir, pausing there, if I may, and as a slight aside to what is stated in the joint statement. You may have seen in Mr Southward's report and indeed in Prof McQuillan's report that not only did they say that nothing needs to be done, other than to remediate the two specific locations where poor workmanship has been

identified, they go on further to say, that is Mr Southward and Prof McQuillan, that there is a potential downside, a potential detrimental effect, of carrying out these proposed dowel bar works. I'm not sure yet where Dr Glover stands on that particular point but no doubt, when I ask him, he will no doubt tell us.

So there is a concern, as I understand it, from at least two of the experts, possibly three, that the carrying out of certain of these suitable measures could be, as I understand it, a threat to the safety and fitness for purpose of the top of the EWL and the diaphragm wall. Quite how one quantifies that threat at the moment I'm not entirely sure, but I mention that point because it does seem to me that it is a point that the Commission may have to look at in the context of safety and fitness for purpose.

As an adjunct to those observations, I am aware from the weekly reports that the MTRC have been helpfully providing to the Commission as to the progress of the suitable measures works that the dowel bar works, if I can call them that, have commenced. How far they have got is somewhat opaque. We are told they have progressed to something like 8 to 9 per cent. What that actually means in practical terms, I have no idea, and it may be that we may need to find out about that, but

that's perhaps looking ahead a little further.

Sir, could I then go back to the joint statement. The experts also discussed matters concerning the COI 2 structures, and you will see there what's been agreed in relation to the HHS trough walls, the coupler connections and the engagement, and then also, at 5, the SAT NSL shear capacity, again agreement largely between Dr Glover, Mr Southward and Prof McQuillan, and disagreement from Dr Lau.

Sir, finally on the experts -- and I'm not sure whether it's all yet been signed up -- but anyway, if we go to ER1, COI 2, tab 15, there is a supplementary joint statement that has been signed in the last day or two which might just be worth looking at. You will see there it's a supplemental memorandum of agreement. The experts are identified. The purpose is stated. Then the summary statement reads as follows:

"MG, NS and DM agree that the as-built COI 1 and COI 2 structures are safe and fit for purpose.

[Dr Lau] disagrees with the above and is of the opinion that without the implementation of suitable measures the as-built COI 1 and COI 2 structures are neither safe nor fit for purpose."

Sir, that is, as it were, an addendum or supplement to the main body of the joint agreement.

Sir, what would have happened at this stage is that I would have sat down and invited Mr Shieh to call Mr Southward, his expert -- what would have happened. Unfortunately, last evening, at about 7 o'clock, whilst I was having dinner, Leightons served upon us, or upon those instructing me, two things. First of all, Mr Southward's slides for his proposed presentation to the Commission this morning, with an indication that it would take Mr Southward something of the order of 50 minutes to an hour to make that presentation. I have no problem with that at all and I imagine the Commission will not have either. It seems to me that Mr Southward was invited to produce his reports first, and to some extent he is, I think, in his slides, responding to certain matters that have been raised by the other experts. Secondly, Mr Southward is the first expert, as it were, to go this morning, and it would be quite helpful for the Commission and for everybody for Mr Southward to, as it were, set the groundwork for the principal issues. So I have no problem with extending the time to Mr Southward so that he can go through his presentation as he wishes.

CHAIRMAN: Does anybody have any concern about that?

MR PENNICOTT: It appears not.

CHAIRMAN: There is no concern shown and, Mr Southward, you

can please proceed.

MR PENNICOTT: Sir, the only slight wrinkle to that observation is this. The second thing that Leighton served last evening was a witness statement from a Mr Chow Kai Fat. He is a site supervisor, he tells us, of Leightons, and he is currently managing the day-to-day running of all works on site, he tells us in his short witness statement.

It appears from his witness statement that very recently, on 30 December, that he was asked by one of Leighton's in-house lawyers and Mr Jonathan Kitching, Leighton's project director from whom the Commission has heard previously, to find some coupler assemblies and produce those coupler assemblies to Mr Southward for the purposes of Mr Southward expressing various views which he has done in his slides. I say expressing certain views. What Mr Southward has done is incorporated into his slides photographs of the couplers found/obtained by Mr Chow, not only found and obtained by Mr Chow but couplers that have been cut, Mr Chow explains to us, longways, along the long side, as it were, of the couplers, and one can see from Mr Southward's photographs, or some of them, the rebar being screwed into, as it were, the cut couplers.

It strikes me -- I don't know how my learned friends

for MTR and the government feel about this -- that it would be inappropriate for Mr Chow's witness statement simply to be put into evidence and, as it were, taken as read. My own view is that I would like to ask Mr Chow some follow-up questions to his witness statement, to provide information to the Commission as to the precise circumstances in which he was asked to obtain these further samples, one or two other questions about the provenance and where these samples were found, the cutting process that took place, who did the cutting, where was it done, and so forth, and also of course to establish from him, as he says in his witness statement, that these are in fact BOSA couplers. It seems to me quite important that one has some evidential basis, factual evidential basis, for what is in Mr Southward's slides.

So I would invite the Commission, subject to any views that my learned friends behind me have, before we proceed with Mr Southward, that we invite Mr Chow, who I understand from Mr Shieh is here, to go into the witness box, and I and anybody else who wants to ask him some questions may have that opportunity, and of course the Commission itself.

CHAIRMAN: Again, any concerns at that suggested procedure?

MR BOULDING: Sir, so far as MTR is concerned, we only saw

this witness statement for the first time this morning, so of necessity we would reserve our position, certainly until I've had an opportunity to discuss it with my clients.

But the immediate question I would ask, and I ask the question to Mr Southward through you, sir, is: are the samples still available for inspection?

MR PENNICOTT: Sir, my understanding, although Mr Shieh will probably be in a better position to inform us, is that the samples are in the building, but precisely where they are I do not know.

CHAIRMAN: In other words, if you want to have a physical inspection, then arrangements can be made for you to do that immediately or at a time that's suitable to you.

MR BOULDING: Thank you very much.

MR KHAW: Mr Chairman, Mr Commissioner, my position in relation to Mr Chow's evidence is similar to Mr Boulding's, given the time available to us.

The only point that I wish to mention at this stage is that Mr Southward's presentation slides have certainly contained some further particulars in relation to the points addressed in Dr Lau's report. I also haven't had a chance to discuss the new points with Dr Lau, and I do not wish to disrupt the present arrangement, if Mr Southward wishes to do the

presentation this morning, but I may need some time to discuss those further points with Dr Lau after the presentation.

CHAIRMAN: Yes. Good. Nothing else? Thank you.

MR PENNICOTT: Sir, on that basis, I don't know if Mr Shieh could help us as to where precisely the samples are, but it does seem to me that probably the most appropriate procedure would be for myself, Mr Boulding and Mr Khaw at least, and possibly Prof McQuillan, and Dr Glover if he's here, and perhaps, I don't know if Dr Lau is here, for us to actually go and have a look at these assemblies, and I may want to form a view as to whether you, sir, and Prof Hansford should also have a look at them. I understand they are pretty heavy. Certainly the rebar is about half a metre long or so, and apparently, Mr Shieh tells me, at least one trolley has been broken trying to bring them into the building already. Sir, I don't know if that can be arranged first. Then, having carried out that inspection, I suggest we get on with Mr Chow straightaway after that inspection; once Mr Chow has finished, we proceed with Mr Southward, he can make his presentation; perhaps I could then ask any questions I have of Mr Southward. I would imagine by the time we finish that, a good part of the day will have gone by anyway. Then we can assess

Mr Khaw's position at that point.

CHAIRMAN: That sounds sensible to me, provisionally at least. That is subject to what comments may come from other counsel.

MR BOULDING: We are content with that proposed course of action, sir.

CHAIRMAN: Good. I think what we will do then -- obviously Mr Chow has to give his evidence first. Obviously on the slides, the physical material that he has brought to court today is going to be central. So what we will do is we will adjourn and, Mr Pennicott, you can let us know when you are ready to proceed.

MR PENNICOTT: Yes.

CHAIRMAN: Because we can't give you a specified time, and we know you will get about it as soon as possible.

MR PENNICOTT: Of course, sir, yes.

CHAIRMAN: But we will make it, so that everybody at least is in a position that they are not going to be called back in two minutes -- it's now 10.50 -- that we will adjourn until at least 11.30.

MR PENNICOTT: Yes, sir.

CHAIRMAN: Then thereafter we will return when you say that all the parties are ready.

MR PENNICOTT: Yes, sir. Thank you very much.

CHAIRMAN: Okay? Good. That will on the basis that we are

going to call Mr Chow first.

MR PENNICOTT: Yes, sir.

CHAIRMAN: Thank you.

(10.50 am)

(A short adjournment)

(11.57 am)

CHAIRMAN: Sorry, just before we commence, myself and Prof Hansford were given the opportunity of going downstairs and meeting with the experts to have a look at the couplers and the rebars and to understand the context in which the issue is going to be aired before the Inquiry.

Obviously, things were said during that time. Anything said, however, by any of the experts was said merely to put matters into context and have been accepted only on that basis. So anything said downstairs has no evidential value whatsoever and will not be taken into account by the Inquiry.

Thank you.

MR SHIEH: Mr Chairman and Mr Commissioner, Mr Chow Kai Fat is now in the witness box, so I now call Mr Chow as Leighton's witness.

The witness statement, I understand, has not yet found itself into the bundles, but I understand that it has been served and it should be available as a loose

copy.

MR PENNICOTT: It's on the screen.

MR SHIEH: It's on the screen, yes.

So, Mr Chow, you are giving evidence in English or Cantonese?

MR CHOW KAI FAT (affirmed in Punti)

Examination-in-chief by MR SHIEH

Q. Thank you, Mr Chow. Please be seated.

There is a witness statement in front of you now, in hard-copy format, and I think it should also be displayed on the computer monitor in front of you, so you can choose to look at whatever version there is.

Is there anything wrong with the headphones? You can hear my question?

A. Yes.

Q. This is a document entitled "Witness statement of Chow Kai Fat"; that's correct, yes?

A. (Nodded head).

Q. When you give an answer, you need to actually say something. You can't just nod. This is your witness statement; correct?

A. Okay, yes, correct. 正確。

Q. Your signature is on the second page; you can see that, that's your signature?

A. 係，正確。

Q. Are you happy to put forward the content of this witness

statement as your evidence in front of this Commission?

A. 係。

Q. Now, this document is written in English and it has no translation clause. I take it that you understand the content written in English but you prefer to speak in Cantonese in these proceedings; correct?

A. 冇錯。

Q. Thank you. I will sit down now and other lawyers for other parties may ask you some questions, and the Chairman and Mr Commissioner may also ask you questions, and after they have done so, if I think it necessary, I will have follow-up questions to ask you; right? So please continue to be seated and answer their questions.

WITNESS: 好。

Examination-in-chief by MR PENNICOTT

MR PENNICOTT: Mr Chow, good morning.

A. Good morning.

Q. My name is Ian Pennicott and I am one of the counsel to the Commission and I'm going to ask you some questions first, before anyone else does.

A. Okay.

Q. Mr Chow, you tell us in paragraph 3 of your statement that you joined Leighton as a senior foreman in September 2015. Is it the case that you have been working on the Hung Hom Station Extension project since that date?

A. 唔係。
Q. Can you tell us when you actually started working on the Hung Hom Station Extension project?
A. 2018年1月1號。
Q. All right. Was that then as a senior foreman?
A. 當其時係supervisor。
Q. Right. Because you say in paragraph 4 of your statement that you assumed the role of site supervisor for the whole site from 5 June 2018. Is that right?
A. 係，冇錯。
Q. Right. So, from the beginning of 2018 up to 5 June 2018, what was your role?
A. 都係supervisor。
Q. Okay. Before the beginning of 2018, did you have any involvement at all on the Hung Hom Station Extension project?
A. 冇。
Q. You say that your role now, as I understand it -- paragraph 5 of your witness statement -- is to manage the day-to-day running of all works on site. Do you see that, and is that accurate?
A. 正確。
Q. We know, Mr Chow, that there are certain works being carried out on the site which have been labelled "suitable measures". Are you aware of that?

A. 知道。
Q. Does your role extend to managing those suitable measures?
A. 包括部分。
Q. Which part?
A. 人手安排。
Q. Right. Does it involve supervising or managing the different types of suitable measures that are going on, that is in the different areas, in area A, in areas B and C?
A. 包括。
Q. Right. Does it include the works to the top of the east slab and the diaphragm wall, where vertical dowel bars are to be inserted?
A. 包括。
Q. Right. I may come back to that in a moment.

Now can we just focus on your witness statement. You say at paragraph 6:

"On Monday 30 December 2019, I was asked by Brent Stowers (in-house legal counsel for Leighton) and Jonathan Kitching (project director) to identify whether there was any threaded rebar available on site ..."

Pausing there, when you say you were asked, how were you asked? In a telephone conversation, by an email, face-to-face; how were you asked?

A. 面對面。

Q. Can you think of any particular reason why you were asked to carry out this task as opposed to anybody else?

A. 我諗應該係我管理緊個地盤，所以佢直接搵我會比較方便。

Q. All right. Was this the first time you had been asked to do such a thing, that is to find and identify some threaded rebar?

A. 係。

Q. Right. When you say you were asked to identify whether there was any threaded rebar available, when you were asked that question, were you aware that there was such rebar available on the site?

A. 係有嘅。

Q. Right. So you had seen it about during the course of your working days over the last couple of years; is that right?

A. 呢個我提供嗰個鐵係喺--鎖咗喺士多裏面嘅。

Q. And you were aware that it was in that store area; is that right?

A. 係，知道。

Q. Right. So you didn't have to go hunting around the site for it; you knew that there was some there?

A. 唔需要，係，正確。

Q. All right. You used the words "whether there was any threaded rebar available on site". Were you also asked

to locate coupler assemblies?

A. 因為佢--據我鎖咗喺士多裏面嗰啲，佢已經係組裝咗，所以其實係咁嘅樣，就攞番出嚟。

Q. Okay. You say in paragraph 7 of your witness statement that you located ten coupler assemblies in a laydown yard on site. So the store room that you've just referred to was in this laydown area, was it?

A. 係，冇錯。

Q. That was a general storage area that stored all sorts of materials for use on the site; is that right?

A. 係，但係會上鎖嘅。

Q. Okay. And the ten coupler assemblies in the laydown yard that you located, was that all of them, that's the totality of the rebar and the coupler assemblies in that particular store room; is that correct?

A. 唔係，仲有剩。

Q. Okay. So how many others?

A. 三十套。

Q. Okay. Why did you pick these particular ten?

A. 我冇特別揀嘅，純粹隨機選擇攞嘅咋。

Q. Right. So you say there are 30-odd sets and you picked these ten at random. Okay. Does that --

CHAIRMAN: Sorry, could be 30-odd sets left now that he's taken them at random.

MR PENNICOTT: Yes.

Is that right?

A. Yes.

Q. So 30 sets still left in the store room?

A. 正確，正確。

Q. Then what happened, as I understand it, was two -- you say in your witness statement -- coupler assemblies, is that right, were chosen to give to Mr Southward; is that right?

A. 正確。

Q. Now, who chose those two coupler assemblies? Was it you or somebody else?

A. 我。

Q. Right. Again, what was the basis of your choice? Was it entirely random or were there other considerations?

A. 隨機。

Q. Okay. When you say the coupler assemblies consisted of two pieces of threaded rebar, each about 50 centimetres long, do you mean that a 50 centimetre, approximately, long rebar was fitted into each end of the assembly, the coupler assembly, or just one end?

A. 係，裝咗，兩邊都裝咗。

Q. Right. Had you any idea where those assemblies had come from?

A. 係喺BOSA絞完牙，車番返嚟，跟住我哋keep咗喺士多度for test嘅。

Q. Okay. You say in your witness statement at paragraph 8

that the coupler assemblies were excess to requirements for the project and had not been tested by the HOKLAS lab.

How did you know they had not been tested?

A. 因為有測試嗰批就攞走咗㗎喇，呢一批係擺喺度，因為當其時絞嘅時候絞多咗，咁咪擺喺度，就話如果有其他測試，先至攞去用。

Q. Okay. How did you know they were manufactured by BOSA, Mr Chow?

A. 因為當其時我哋車鐵過去BOSA嗰面，跟住佢再完成咗之後，就我哋車番返嚟，跟住keep咗喺士多。

Q. You, as I understand it from your answers a moment ago to my questions, indicated that you joined this site at the beginning of 2018; is that right?

A. 正確。

Q. Are you suggesting that from that date or after that date, orders were placed for this rebar and the couplers to BOSA by Leighton, in 2018 and 2019?

A. 嗰批鐵係喺2019年車嚟地盤，跟住再車去BOSA嘅。

Q. So your evidence is that the batches that you identified, the ten samples that you chose and then the two coupler assemblies that you chose had been delivered by BOSA to Leighton in 2019; is that right?

A. 正確。

Q. And how do you know that, Mr Chow? Were you involved in the ordering and taking delivery of those samples?

A. 我冇參與落訂單，送貨嚟到嘅時候，我哋會--佢有張單畀番我哋，咁就畀番相關工程師，所以知道係喺嗰度車番過嚟。

Q. Okay. Can you help me with this. In 2018 and in 2019, what type of work was Leighton carrying out that would require or might require these coupler assemblies and the threaded rebar?

A. 18年？呢個真係唔清楚。

Q. Right. Let's focus on 2019. You told us that these samples were delivered in 2019, if I've understood that correctly. what I'm trying to find out from you is why were Leighton ordering BOSA coupler assemblies and threaded rebar in 2019? What were they going to use them for?

A. 據我所知，訂番嚟係要做一啲測試。

Q. Any particular type of testing that you can think of?

A. 測試嗰面我冇參與。

Q. All right.

Mr Chow, if one looks at the coupler assemblies, is there anything on them that indicates that they are indeed BOSA coupler assemblies as opposed to any other manufacturer?

A. 如果係BOSA嘅螺絲帽，佢個牙裏面係會--係平衡嘅。

Q. So your evidence is because the threads are parallel, they must be BOSA; is that right?

A. 據我了解，個答案係，但係當其時亦都係人和送番嚟嘅囉。

Q. Right. Mr Chow, sorry to press you on this, but are you sure that those coupler assemblies and the samples of rebar that we've now all seen weren't there for some time, perhaps a number of years, stretching back to perhaps 2014, 2015 and 2016?

A. 唔會，因為當其時送貨係我親自睇住人搬入去。

Q. And your evidence is that they were delivered, so far as you can recall, for the purpose of testing only, not for actual physical use in the works; is that right?

A. 正確。

Q. Okay. You say in paragraph 9 of your statement you met with Brent Stowers, who's the in-house legal counsel to Leighton, and he asked you to disassemble the coupler assemblies, and I assume what you mean by that is the two that you had randomly chosen; is that right?

A. 正確。

Q. And that meeting also took place on 30 December; is that correct, Mr Chow?

A. 正確。

Q. You go on to say that he, that is Mr Stowers, "asked me to arrange for two of the couplers to be cut in such a way that the threaded rebar inside the couplers would be visible, which I did", and indeed we've all now seen the two coupler assemblies that were apparently cut.

Who cut them, Mr Chow?

A. 我自己。
Q. Using what tool?
A. 鎅機。
Q. Right. And that was a machine that, what, Leighton had available to them on site?
A. 正確。
Q. Was anybody else involved in the cutting or just yourself?
A. 工人幫手扶住個螺絲頭，即係嗰個牙。
Q. Right. And we've seen this morning the cut couplers. How did you decide how much to cut out? It looks as though about perhaps 15 or 20 per cent of the circumference has been cut out. How did you decide how much to cut out?
A. 係Brent同我講話約莫咁嘅size。
Q. When you say he told you the approximate size, you mean he told you roughly how much to cut out; is that right?
A. 係，冇錯。
Q. When he originally -- he or Mr Kitching -- asked you to identify the rebar and the couplers, did they ask you to identify them by any particular size?
A. 40mm.
Q. Right. And indeed the ones you found were indeed 40 millimetres?
A. 係。

Q. In the samples that are downstairs, the ten, they are all 40 millimetres, I think, are they?

A. 係，冇錯。

Q. In the perhaps 30-odd that are not here but are still in the store room, are they all 40 millimetres or are they of different dimensions?

A. 全部都係40。

Q. Once you had done the cutting, you gave -- or you made arrangements, you say, for the rebar and the cut couplers to be transported off site to Mr Southward; is that right?

A. 係，冇錯。

Q. The original request that you say was made by Mr Stowers and Mr Kitching was made on 30 December; is that right?

A. 正確。

Q. This witness statement that you've signed is dated 30 December. We can see that from the second page. Do you see that?

A. 正確。

Q. So did all of this happen on Monday?

A. 正確。

Q. When you went to the store room and located and then chose the rebar and the couplers, did Mr Stowers or Mr Kitching accompany you, or did you go on your own?

A. 我自己。

Q. Okay. None of your colleagues at all?
A. 有，有同事幫手。
Q. Okay. Those were just labourers, were they, assisting?
A. 正確。
Q. All right. So once you'd located the rebar and the couplers, you, what, then made a call to Mr Stowers or to Mr Kitching saying, "Look, I've got these materials, now what do you want me to do with them?" Is that really how it came about?
A. 係，正確。
Q. Okay. That's when you got the instruction to cut them, the coupler assemblies?
A. 我就叫我準備十支，跟住就我就安排咗車，就車番去寫字樓，佢就話畀我聽「你跟住呢個size幫我切兩個就okay喇。」咁。
Q. Okay. Could I then just ask you a few more questions about a point I touched on earlier, which is suitable measures. Can I ask you to be shown bundle OU9, tab 352, page 11332. You can either look at it in hard copy, Mr Chow, or on the screen, whichever you find easier.

This is, at 11332 -- I don't know if it's a document you've seen before -- a contractor's submission form. Are you generally familiar with Leighton's contractor submission forms, Mr Chow?
A. 一般，唔係話好熟悉。

Q. Right. This, as is happens, is sending a method statement. If you look on the left-hand side, you will see it says, "Document title" -- you see Mr Kitching's name and then underneath "Document title", "HUH -- method statement for suitable measure works"; do you see that?

A. 係，見到，見到。

Q. It's going to Mr Fu at MTR.

A. 係。

Q. Then if we go to the next page, please, 11333, we see a list of names there, some of which are familiar to us or at least one of which is. You see at the top there, Mr Chow, it says "Construction method statement", and then "Preparation sign-off" and a list of names there, with dates and signatures. Then "Review sign off", we see three other positions mentioned -- safety manager, construction manager and superintendent -- and I imagine Oscar Chow is not you, it's just another Mr Chow; is that right?

A. 呢個係我。

Q. Oh, it's you? Right. Even better.

So what role did you play in the preparation of this construction method statement, Mr Chow?

A. 我係要睇番，同安全部同埋經理夾番到底個方法可唔可行。

Q. Right. So you, amongst others, that is Mr Bobby Chan

and Mr Holden, who we have heard from previously, you were reviewing what had been prepared by others, checking it, and making sure that you were happy with the content; is that right?

A. 正確。

Q. If we could go over the page to 11337 -- that's it -- we see a little organisation chart there, Mr Chow; do you see that?

A. 見到。

Q. So you were identified here as the superintendent?

A. 正確。

Q. If we could go back a page to 11336, we have a basic programme for the carrying out of certain of the suitable measures works; do you see that, Mr Chow?

A. 睇到。

Q. This is something that you would have reviewed at the time that you were looking at and considering and reviewing this document; is that correct?

A. 正確。

Q. We can see that the sequence is "Setting out", then "Preparation works", then "Trim the mass concrete", "Scan and check the alignment of reinforcement bar", "Expose the top layer of reinforcement bar", "Coring holes for dowel bar installation", "Inspection of depth and spacing of drilled holes", and then "Dowel bar

installation".

Then pausing there. This is, I understand it, Mr Chow -- I would be grateful if you could confirm it -- a description and a programme in relation to the vertical dowel bars that are to be installed at the EWL slab and the top of the diaphragm walls; is that correct?

A. 正確。

Q. If we go, please, to page 11340, we see a heading, 6.2, "Typical procedure for the 200 thick RC slab of suitable measures (detail 1)", and then underneath the diagram we see a seven-stage process up to that point, and then a list of the panels into which the vertical dowel bars are to be inserted. Do you see that, Mr Chow?

A. 睇到。

Q. There are 22 panels listed there, take it from me, and there's one that's missing, which is EH49, making 23 panels in all.

Are you with me, Mr Chow?

A. 係，冇錯。

Q. Right. Then if we go over the page to 11341, one sees the rest of the stages set out so far as those works are concerned; do you see that?

A. 見到。

Q. Mr Chow, if then you would be good enough to go to or be

shown page -- in the same bundle -- 11375, but it's a new document.

Mr Chow, just to explain -- I'm not suggesting you've seen this document before -- the Commission has received on a weekly basis from the MTR an update as to how the suitable measures works is progressing. Do you understand?

A. 明白。

Q. Okay. So this is the status as of 25 December, Christmas Day, 2019.

If you would be good enough, please, to be shown page 11380, we see highlighted in green 20 of the 23 panels into which the dowel bars are to be inserted, and then in yellow three not yet commenced, making up the 23 panels; do you see that?

A. 睇到。

Q. You will see that the green is described in the box at the bottom as "In progress"; do you see that?

A. 見到。

Q. If you would be good enough, please, to go back to page 11378, a couple of pages earlier -- that's it -- you will see there, under "HUH & SAT", and then item 2, do you see that, "EWL -- suitable measures (area A, B and C)"; do you see that, Mr Chow?

A. 見到。

Q. Then the status/completion percentage on the right-hand side is stated to be 8.7 per cent; do you see that?

A. 見到。

Q. Mr Chow, going back to 11380, if you're able, could you please explain to the Commission, first of all, with regard to the panels that are identified there in green, what progress has actually been made with these works that are to lead to the insertion of the dowel bars? I mean how much work has actually been done on any of these panels?

A. 個石屎就已經鑿開咗，見到面嗰浸鐵嘅，而家個狀況，綠色嗰啲。鑽窿落去裝dowel bar就而家仲係鑽緊窿，據我所知，就未--即係唔係話綠色嗰啲就係裝晒dowel bar，係未嘅。

Q. Right. Let's take this in stages. In relation to the green ones, preparatory works have been done, chipping away the concrete has been done -- for all green ones; is that right?

A. 唔係所有綠色都鑿晒，有啲係未鑿晒，但係鑿緊。

Q. Understood. So it's either been done or it's in progress on the green ones, I see. And in relation to certain of them, some coring has been done, is that right, some core drilling has been done?

A. 係，部分。

Q. And that coring or drilling process is currently proceeding?

A. 正確。

Q. So if I were to go there today and look at some of these panels, I would see that drilling going on; is that right?

A. 正確。

Q. And Leightons have a sub-contractor doing that drilling work; is that right, or are you doing it yourselves?

A. 分判商。

Q. And presumably the works of the sub-contractor are being carefully monitored and supervised by yourselves, by Leighton?

A. 冇錯。

Q. And are MTRC also involved with the monitoring and supervision of these works that are going on?

A. 正確。

Q. Are both Leighton supervisors and MTR supervisors in constant attendance when these works are proceeding?

A. 全日都喺度，持續。

Q. Okay.

We saw reference earlier, in that method statement I showed you, Mr Chow, to scanning the alignment of the reinforcement bar; do you recall that? We can go back to it, if you like, at 11336. You see the fourth item down, "Scan and check the alignment of reinforcement bar"; do you see that?

A. 見到。
Q. Who is doing that scanning work, Mr Chow?
A. MTR.
Q. When this work is being done, Mr Chow, are you able to answer this: is the general condition of each of the construction joints that are being exposed being checked or being observed and checked and photographed?
A. 唔係好明。
Q. There's exposure, as I understand it, of the rebar, the top level of the rebar, by chipping away of the concrete?
A. 係。
Q. And that should enable one, at least those that are qualified, to look at and check the general condition of the construction joint; is that right?
A. 正確。
Q. And so do you know whether that process of checking is being carried out, and if so by whom?
A. 呢個唔清楚。
Q. So you don't know whether the question is being asked whether in fact the dowel bars are required if the construction joint itself, when inspected, looks to be in a satisfactory condition?
A. 冇錯，因為呢個要等工程師回覆。
Q. Right. When you say "the engineer" you mean MTRC?

A. 係，冇錯。

Q. All right. Are you aware, Mr Chow, from your own involvement in the process, of a photographic record being taken of the exposure of the rebar?

A. 有。

Q. Right. They are taken by Leighton and MTR; is that right?

A. 正確。

Q. All right. Just to make sure I've understood this, as at the moment, Mr Chow, no dowel bars have actually been inserted in any of those panels that we looked at; is that correct?

A. 正確。

MR PENNICOTT: Okay. Thank you.

COMMISSIONER HANSFORD: Can I ask one question here, Mr Chow. This programme on the screen here shows 13 days' activity in total. When do you expect this work to be completed on all of these 23 panels?

A. 預計係去到4月尾。

COMMISSIONER HANSFORD: The end of April?

A. Yes.

COMMISSIONER HANSFORD: Which is much longer 13 days.

A. 因為喺鑽窿嗰度可能會有啲問題，如果種到鐵嘅話，就要等地鐵再答番個方法會係點做。

COMMISSIONER HANSFORD: Okay. And when do you expect the

first dowel bar to be inserted?

A. 應該今個月尾。

COMMISSIONER HANSFORD: Thank you.

MR PENNICOTT: Sir, I have no further questions at this stage. Thank you very much.

CHAIRMAN: Is it agreed who should follow?

MR PENNICOTT: I'm not sure it is, sir.

CHAIRMAN: Mr Khaw?

Cross-examination by MR KHAW

MR KHAW: Mr Chow, I represent the government. Just a few questions for you.

You told us, when you answered Mr Pennicott's questions, that you started to work for the Hung Hom Extension project in January 2018; is that right?

A. 正確。

Q. So am I correct to say that you never actually took part in or witnessed any of the actual coupling connection works which were carried out on the site; is that correct?

A. 正確。

Q. Again, in answer to Mr Pennicott's question, you told us that when you were asked to locate the coupler assemblies -- that is what you told us in your witness statement -- when you were asked to locate the coupler assemblies, there was no need for you to hang around because you knew where they had been placed. Do you

remember that?

A. 正確。

Q. That is because you took care of the deliveries of such coupler assemblies which were made in 2019; is that correct?

A. 正確。

Q. So you had records as to how many coupler assemblies were actually delivered at that time; am I correct?

A. 正確。

Q. If we take into account all you have managed to locate, ie those which were delivered to the court today and also those that are still left in storage, they constituted the total amount of the coupler assemblies which were delivered at that time, in 2019; is that right?

A. 你講喺士多裏面嘅總數就等如佢當日送嚟嘅總數？

Q. Yes.

A. 唔等如。

Q. So some coupler assemblies which were delivered in 2019 were placed elsewhere?

A. 唔係，佢攞咗去lab.吖嘛。

Q. Yes. That actually relates to the next question that I wanted to ask you.

Now, you told us that the reason why coupler assemblies were delivered to the site in 2019 was

because it was necessary to carry out some testing, even though you are not able to tell us the details of such testing.

A. 正確。

Q. Now, who told you about the need to carry out any testing?

A. Ian，即係公司同事。

Q. Did he mention anything about the reason why such testing was required?

A. 我冇問。

Q. You know about how many coupler assemblies were sent to the lab for testing?

A. 唔記得。

Q. When you located those coupler assemblies in the storage on site, they were all assembled; right?

A. 正確。

Q. Then back to the last topic that Mr Pennicott discussed with you -- now, you told us about the stages in relation to the work for the suitable measures, ie the installation of dowel bar.

A. 記得。

Q. And you told us that you were responsible for supervising such works on site.

A. 我唔係全日，但係部分時間。

Q. You have also told us that some drilling process had

already taken place.

A. 係。

Q. Now, presumably the dowel bars would be placed on top of the D-walls; is that correct?

A. 正確。

Q. If a rebar is encountered during the drilling process, would the workers stop the work immediately and wait for the engineer's instruction?

A. 會。

MR KHAW: I have no further questions.

CHAIRMAN: Thank you.

MR BOULDING: No questions from us. Thank you very much, sir.

CHAIRMAN: Thank you very much.

Re-examination by MR SHIEH

MR SHIEH: A few questions in re-examination.

Mr Chow, you remember being shown an organisation chart in the opening-up bundle, at 11337.

A. 係。

Q. You can see, under William Holden, there is "Site agent: Jeffrey Chan", and it then branched out into "Superintendent", that is you.

A. 冇錯。

Q. And senior engineer Man Sze Ho, and then each have people reporting to them; right? So you have people

under you and Man Sze Ho has "Engineer" under him; do you see that?

A. 見到。

Q. Also you remember being asked earlier this morning about your role in the suitable measures and you were asked whether you were involved in managing the suitable measures; you remember that?

A. 記得。

Q. My question to you is this: looking at this chart, and also remembering the question that you were asked about your role, would you say you are on the engineering side of the matter or you are really on the foreman, you know, workers' management side of the matter on the site?

A. 管理工人。

Q. Your position is a T1; you are a T1, correct?

A. 係，正確。

Q. So you wouldn't call yourself an engineer?

A. 係。

Q. It's correct that you wouldn't call yourself an engineer?

A. 正確。

Q. Thank you.

At [draft] page 38 of the transcript, you were asked about the rebars that you looked up in the store room.

That was when Mr Pennicott, in front of me, asked you questions, and he asked you whether or not, when you were asked to identify rebars or couplers, whether you were asked to identify them by any particular size, and your answer was 40 millimetres. Do you remember that?

A. 記得。

Q. I just want to clarify with you that when you refer to 40 millimetres, is that simply a generic, colloquial way of describing those couplers, or was it a matter of measurement, that you measured them and they were 40 millimetres?

A. 當其時冇度過嘅，但係我哋統稱就叫做40mm。

MR SHIEH: Thank you very much. I have no further questions.

COMMISSIONER HANSFORD: Can I just ask a question, Mr Chow. Are you referring to the diameter of the bars? When you talk about 40 millimetres, do you mean 40 millimetres diameter; is that what you mean?

A. 係，冇錯。

COMMISSIONER HANSFORD: Thank you.

MR PENNICOTT: Sir, unless anybody else has any questions, or you or Prof Hansford have any more questions --

CHAIRMAN: No. I have no questions. Thank you.

Thank you very much indeed. Your evidence is completed and you can go now.

There is always the possibility that you may be

recalled, if something should arise, but if so you will be contacted. Okay? Thank you for coming today and thank you for your assistance.

WITNESS: Thank you.

(The witness was released)

CHAIRMAN: Good. So we are now sitting at 1 o'clock, almost to the minute. Mr Southward, I'm not going to ask you to fill in that minute. I think if we were to start with you immediately after lunch.

MR PENNICOTT: Yes, sir.

CHAIRMAN: And are we returning to our normal routine of 2.30?

MR PENNICOTT: Yes.

CHAIRMAN: Is there any reason why we should start earlier today, perhaps? I don't know.

MR PENNICOTT: No, sir. I mentioned this morning, during the course of some opening observations, the issue regarding the installation of the dowel bars and the view that Prof McQuillan and Mr Southward take about the wisdom of carrying out those works.

CHAIRMAN: Yes.

MR PENNICOTT: The reason I wanted to take the opportunity of Mr Chow being here was to ask him some questions about how far that work had got.

CHAIRMAN: Yes.

MR PENNICOTT: I'm bound to say I got a bit further than

I thought I was going to get, when he told me that he was indeed Oscar Chow on the organisation chart and that he was indeed involved. It's a matter, perhaps -- if I could raise it now, those instructing my learned friends and indeed the experts themselves may want to reflect upon the point over lunch, and I've discussed this very briefly with Prof McQuillan and I appreciate that this might be very short notice for the MTRC, but I do wonder whether if these works are going on at the moment, as Mr Chow has described, whether there might be some benefit in the experts visiting the site, perhaps on Saturday, without interrupting our hearing, if they thought it might be of some use and benefit.

As I say, I've discussed that with Prof McQuillan. I think in principle he thinks it might be helpful, just to see what's going on, how all this is being done in practice, rather than just reading the words on the method statement. But, sir, I just raise it. I'm not positively putting it forward at the moment. Perhaps others might want to have a think about that, and perhaps we'll see where we get to.

CHAIRMAN: All right. So it's a matter that perhaps the relevant parties, the experts, could consider over the lunchtime and maybe discuss with those who instruct them and see where we go.

MR PENNICOTT: Yes, and I will further reflect upon it as

well, with Prof McQuillan.

CHAIRMAN: Good. Certainly on behalf of the Commission, it's a matter which would obviously be better if it could be sorted by perhaps an actual site visit so that then the parties can see: is there any possibility of damage or is there not? Or rather -- to put it better -- has any damage been exhibited already or not?

MR PENNICOTT: Yes. I think my concern is -- and that's why I'm saying this with a heavily hesitating voice -- that yes, we have the method statement. I assume that that's all been approved by the government, and indeed it was a condition of approval that a method statement be produced, which it has been, it would appear. But we don't actually have any factual evidence about what has in fact happened to implement that method statement. I think that's my concern, that Prof McQuillan and Mr Southward have expressed doubts about the wisdom of carrying out this work, and they may -- and obviously I can ask Mr Southward about this in due course and no doubt Prof McQuillan will express his views and perhaps Dr Glover as well -- but we don't know whether any problems have in fact been encountered or whether in fact it's all plain sailing and there's nothing to worry about. We simply don't know.

I just wonder whether we could perhaps -- it's not terribly satisfactory, but through the agency of the

experts just find out a bit more about what has actually happened and what is happening.

CHAIRMAN: Yes. Good.

COMMISSIONER HANSFORD: I think that's right, Mr Pennicott, and I think we can probably go a bit further than that. Two of the experts have expressed concerns based on the method statement, but what we'd like to know is: do they have concerns based on the actual work?

MR PENNICOTT: Yes. Anyway, some food for thought and perhaps we can have an exchange of views later.

CHAIRMAN: Yes. Thank you very much indeed. Would 2.30 --

MR PENNICOTT: Yes. 2.30.

CHAIRMAN: Thank you. 2.30.

(1.03 pm)

(The luncheon adjournment)

(2.36 pm)

MR SHIEH: Mr Chairman and Mr Commissioner, we now have Mr Nick Southward in the witness box as Leighton's expert witness.

Mr Southward, welcome back.

MR NICHOLAS JOHAN SOUTHWARD (sworn)

Examination-in-chief by MR SHIEH

Q. Mr Southward, for the purpose of this part of the Inquiry, you have made two expert reports, one for the purpose of COI 1 and another for the purpose of COI 2; do you remember that?

A. Yes.
Q. You also have an executive summary of both your reports; correct?
A. Correct.
Q. Let me just take you to the bundles, just to identify them. For your report for COI 1, it's in the part 1 bundle, expert report bundle, item 14.1. That is a document entitled:

"Commission of Inquiry
Original hearing
Structural engineering expert report".

And can you confirm that this is the report that you compiled?
A. That is the report.
Q. Can we then turn to item 14.8, please. This is a document entitled "Executive summary of expert reports for the Original Inquiry and the Extended Inquiry". So, jumping ahead, we haven't gone to the expert report for the Extended Inquiry yet, but since we are in the same bundle it's a convenient place to pick this document up. This is your executive summary for both reports; correct?
A. Yes.
Q. Then, for your expert report for COI 2, the Extended Inquiry, can you look at the bundle for the Extended Inquiry, the expert report bundle for COI 2. It's

item 10.1. This is:

"Commission of Inquiry

Extended Inquiry.

Structural engineering expert report".

So that is your COI 2?

A. Yes.

Q. For the purpose of this part of the Inquiry, you have prepared some sides for the purpose of explaining and illustrating your views; correct?

A. Correct.

Q. I am now going to invite you, hand the floor over to you, so that you could present those slides.

A. Okay. Thank you.

Presentation by MR SOUTHWARD

So, Mr Chairman, Prof Hansford, thank you for allowing me to be here again and giving me the opportunity to present my views on the topics and issues raised in the extended hearings of this Commission of Inquiry.

Next slide, please. This presentation summarises some of the key points in my two expert reports submitted to the Commission last October. In those reports, there are five key areas that I'm going to highlight, as follows: the couplers and the whole or partial embedment of their threaded ends and their resulting suitability; the presence or not of shear

links in the station slabs and the resulting impact on the structure; the diaphragm wall construction joint and the effect of any workmanship defects on its performance; the stability of the trough wall upstands in the HHS area; and, finally, the shear strength of the NSL slab in the SAT area of the project.

Next slide, please. In November 2016, some testing was carried out on partially engaged couplers, testing that was subject of much discussion the last time I was here. Although those tests clearly proved that a coupler with a six-thread engagement satisfied the static tension test requirement of withstanding a tension stress of 329MPa, with failure in the parent bar, further tests were carried out in February and April 2019 by the MTR. These subsequent tests showed that seven threads were able to withstand the static tension test requirement of 529MPa, with failure in the parent bar.

But the February 2019 tests also included six-thread embedment tests. These proved that six threads were sufficient to withstand the static tension test requirement of 529MPa, showing a minimum failure stress of 565MPa, but the failure occurred in the coupler and not the parent bar.

The test also showed that the failure stress for the cyclic tension and compression tests with six threads

was a minimum of 556MPa, with failure again in the coupler. So again that test was more than the 529 limit.

On the basis of those six-thread tests, I can say with confidence that partially connected couplers that have six threads are suitable for use in the works.

Next slide, please. So why can I say this, and does it matter that failure did not occur in the parent bar for a six-thread embedment? I can say this because the smallest failure stress of 556MPa in the coupler is typically 2.7 times the typical stress in the reinforcement at the design scenario of the ultimate limit state, and I explain this as follows.

The typical ULS design stress in reinforcement bars is 400MPa. This is for grade 460 reinforcement. This means that when you design reinforcement, you limit the stress in that reinforcement to 400MPa. But we know, from all the work the consultants have done, that the design has typically at least 50 per cent spare capacity. So this means the actual stress in the reinforcement bars is typically 200MPa at the design ultimate limit state. Thus, 556 divided by 200 equals 2.7. This is therefore the additional safety factor on top of the safety factors already included in the ultimate limit state design.

So, given the huge additional factor of safety, that

is additional to all the load and material factors already included in the design process. It really does not matter that the failure mechanism of the six-thread coupler was that of coupler failure. It is proven to safely take the actual load applied to it, so therefore these couplers can be used in the works and their use does not make the station unsafe.

Next slide, please. My report states that the Atkins design for the station required that some couplers in the diaphragm walls were subject to a ductility requirement. These couplers were located in marked "ductility zones" in a detail shown on the design drawings.

So Leighton have analysed all of the drawings available at the time of construction of the D-walls and slabs. They have found that none of these drawings showed "ductility zones" across the slabs, with the exception of drawings for the NSL area A. These drawings also did not specify the use of ductile couplers in any other way.

Dr Lau -- and I must apologise for using "Mr" in my slides -- appears to disagree and has stated that couplers are specified on certain drawings that were submitted to BD. However, I must point out that the drawings that he relies upon were prepared after construction of the diaphragm walls. They also only

show the use of vertical ductile couplers in the diaphragm walls.

It follows, therefore, that my report is accurate in saying that ductile couplers were not structural required in the slabs. I do understand, however, that ductile couplers were used throughout the project for convenience.

Next slide, please. So the Buildings Department do not require non-ductile couplers to be cyclic tested. Therefore, as the couplers in the slabs are not structurally required to be ductile, there is no requirement for any cyclic testing to be carried out on them. Furthermore, because at the location the couplers are used there is no stress reversal, all the couplers are either permanently in tension or permanently in compression. And the permanent loads in these couplers are typically 85 to 90 per cent of the total load applied in the couplers in the design condition.

So these couplers do not experience any stress reversal and certainly not the level of stress reversal used in the cyclic testing method. That's why the cyclic testing is irrelevant.

Next slide, please. Dr Lau has criticised me in his report for not including a serviceability limit state check on the partially engaged couplers. But I must advise that acceptance of the coupler connections that

are not butt-to-butt will not compromise the serviceability and the long-term durability of the station or the slabs within which they are in. The reason I can say this is that the exposure condition of the Hung Hom Station is one of a mild and dry environment. The internal environment of the station is classified by the Hong Kong Code of Practice in table 4.1 which I have extracted on this slide, and it classifies all internal environments as exposure condition 1.

Next slide, please. So what are the implications of this exposure condition? The Hong Kong Code of Practice requires structures to be designed to the ultimate limit state loading conditions, and that, I explain: you take the actual loading, times a load safety factor, and compare that against the structural elastic capacity and a material safety factor. If you do this, the Hong Kong Code of Practice does not require a check at the service limit state. Instead, it adopts a "deemed to satisfy" approach, provided that rules on minimum reinforcement areas and maximum reinforcement spacing are met.

So the Hong Kong Code of Practice does not require you to calculate crack widths explicitly. They are deemed to be acceptable by virtue of the fact that the structure will perform adequately at the ultimate limit state.

Next slide, please. So the Hong Kong Code of Practice recognises the proven concept that crack width does not affect long-term durability in mild and moderate exposure conditions. This is recognised in other international design codes, such as the American AASHTO LRFD code which is used for the design of structures in America. The Hong Kong Code of Practice states that in a mild exposure condition, ie exposure condition 1, the limit on crack width of 0.3 that the structure is deemed to comply with is only relevant in terms of acceptable appearance, and it states clearly that the crack width has no influence on durability. So that phrase is underlined in red on the slide.

Acceptable appearance means that that visible cracking will not be ugly or would not cause undue alarm of the condition of the structure to the viewer.

Next slide, please. Therefore, cracking at working loads is allowed by the Hong Kong Code of Practice to occur. There is no evidence that some couplers not being butt-to-butt has impacted on the structure. However, even if cracks are exacerbated by some percentage of the couplers not being butt-to-butt, there is no durability limit on the crack widths in the EWL/NSL slabs at the coupler locations.

In terms of acceptable appearance, for all of the area B and area C coupler locations, the slabs are

covered with trackwork concrete and therefore any cracks that occur would not be visible. For area A, also some part of area A between gridline 0 to 2, there is also trackwork concrete covering the coupler locations.

Next slide, please. In terms of deformation, the partially engaged couplers cannot compromise the deflection behaviour of the slabs. The slabs will deflect as originally intended. This is because not all of the couplers are partially engaged. It is accepted that 63 per cent of the couplers are fully engaged, as no strength reduction factor is applied to them; ie the 63 per cent comes from the 100 per cent of couplers minus the 37 per cent of couplers that are discarded by the MTR. So these 63 per cent of bars will perform normally and so limit the deflections of the slab to the anticipated levels. This is certainly evidenced by the performance of the slabs to date under load. They have not deflected by any excessive amount.

Next slide, please. Because crack widths and long-term durability are not an issue, the permanent deformation tests of partially embedded couplers are not relevant, in this instance.

The performance of the couplers and their ability to withstand the ultimate limit state loadings is not compromised by any permanent deformation of the coupler assembly.

Prof McQuillan, Dr Glover and I all agree that the permanent deformation exhibited in the test results of the partially engaged couplers is a sign of the "bedding-in" of the threads rather than a deformation of the coupler assembly itself.

Next slide, please. On the issue of the BOSA couplers and their installation methods, BOSA has a clear instruction that two visible threads was the acceptable installation tolerance. This slide shows an extract of their instruction manual, and the image on the right shows a coupler with the limit of two visible threads exposed outside the coupler.

So what does this mean inside the coupler? Next slide, please. With two visible threads, the bars cannot physically be butt-to-butt. The photo on the right is of a 40 millimetre diameter coupler assembly. The bottom bar is the parent bar, ie that bar in the diaphragm wall, and this bar has been fully wound into the coupler, so all the threads are engaged and the coupler is locked against it. The top bar is the continuation bar, ie that bar that goes into the slab, and this has been screwed into the coupler until two visible threads are showing outside the coupler, exactly like the picture in the BOSA instruction manual on the left.

You can see from the photo that there is a clear gap

in the middle and the couplers are not butt-to-butt.

I must also add here that these bars and their threads are 44 millimetre long threads, threaded bars. There were no threaded bars longer than that in the samples that we have that you saw downstairs, and these bars, the threaded lengths are the same lengths as the typical threaded length bar that was used on site. And the 44 millimetre length is a typical length that is used with the 88 millimetre long couplers. Yes, that's right.

Next slide, please. This slide shows the same coupler assembly but with a tape measure showing the dimensions of the embedment, which is 44 millimetres on the left and 37 millimetres on the right. So this means that the government pass criteria of 37 millimetres from the phased array ultrasonic testing results in a gap in the coupler when the bars are not butt-to-butt.

Next slide, please. In fact, even with the embedment criteria of 40 millimetres, shown here to be 40 millimetres on both sides of the coupler, there is still a gap in the coupler and the bars are not butt-to-butt.

Next slide, please. On the issue of the shear links, this hinges on two key items: were the shear links installed and, if they were not, then what is the impact on the structural design of the structure?

Next slide, please. On the topic of their installation, the limited opening-up investigations carried out by MTR found shear links of a size equal to or greater than 12 millimetres diameter in 12 of the 18 locations. The fact that shear links were not exposed in every location by the MTR is to be expected, in my view, given the limited nature of this exercise. It does not prove that there were no shear links in those locations.

Next slide. Dr Lau has criticised figure 6 in my report, where I showed that it was possible to completely miss the shear links using the slot approach of the MTR. In my sketch, I showed two orthogonal shots that were approximately 150 millimetres wide, within which no shear links were visible, in a sample that clearly has shear links outside of the slots.

Next slide, please. Dr Lau comments that the slots should have been wider, at 200 millimetres. So there are two issues here. First, the photographic records of the shear investigation do not provide any dimensions, so I am not clear where he has obtained the measurements shown in the photographs which are repeated in his report.

Second, even at 200 millimetres wide, a slot may not pick up shear links due to the construction tolerances in bar placement. As you can see here in the photograph

on the right of the slide, which has been drawn with an approximately 200 millimetre wide slot superimposed on the same photograph, there are no shear links visible within the red boundary lines of this slot. That is because the bars are not spaced at exactly 150 millimetres; there is always some tolerance in the placement of those bars.

Next slide, please. The investigation states that no shear links were found in locations HZ1, 5, 8, 10, 14 and 16. The image on the slide is a plan of the station structure showing all the locations where the investigation was carried out.

A further criticism in the MTR's holistic report was that the shear bars found did not match the dimensions and spacings required in the design drawings. In the eyes of this Commission, and for the purposes of structural safety, this should not be a relevant criticism, because the standard should have been to check against the shear link requirements of the updated stage 3 assessment design calculations. These showed a maximum of T12 at 300 centres, which is often much less than required on the original design drawings.

But we can be confident that these shear links were installed by Leighton. The following slides are of Leighton's pre-concreting progress photographs of the project at each of these HZ locations, each photo

clearly showing the presence of shear links in the slab reinforcement.

So this first slide is of the HZ01 area. I hope you can see, but there are shear links -- you can see the top of the shear links bending over the longitudinal rebar, and they occur in all of that photograph. So the HZ location is in this bay.

Next slide, please. This is of HZ05, and again you can see those shear links in this photograph quite clearly.

Next slide. This is HZ8 and 10, both of which were actually in the same bay, and here again you can see the tops of all of the shear links.

Next slide. These photographs were taken inside the reinforcement cage, so it's a 3 metre-deep slab, someone has gone inside the slab, they have taken the photographs; all those vertical bars are the shear link bars.

Next slide. Then this -- not to sort of bore everyone but this shows more photographs of some of the other locations, and again in every single one of those photographs the shear links are present.

Next slide, please. So Atkins' stage 3 assessment calculations used to determine the requirements for suitable measures for missing shear links, by their own admission, are conservative. Atkins did not include for

the correct tensile steel areas, for shear capacity enhancement from the compression loads in the slab, and the actual as-constructed concrete strengths. EIC included these omitted factors in their calculations and, even if all the shear links are ignored, they found they only needed strengthening in 2.5 square metres of all the station slabs.

Next slide, please. Arup's more considered calculations did not find any requirement for suitable measures due to missing shear links, ie Arup found that the design strength of the slabs in shear is large enough to resist the shear forces without considering any shear reinforcement in the slabs.

Next slide, please. EIC have considered the actual strength of the concrete in the station structure rather than the originally intended "design" strength of 40MPa. The actual strength has been determined by reference to the 28-day cube test results taken on site for every batch of concrete. There are over 6,000 individual concrete cube test results, and those are just the ones that I was sent.

These tests gave a statistical strength of over 60MPa which was then used in the calculations.

Next slide, please. Dr Lau does not accept the use of enhanced concrete strength for the following reasons. He says the concrete in the structure will actually be

weaker than that in the test cubes. He says that it is only acceptable to use the originally designed concrete strength.

Next slide, please. The design of the concrete in the structure is done using a weaker concrete than that of the test cubes. This is an established precedent of reinforced concrete design and is recognised in the Hong Kong Code of Practice. This diagram shows a plot of the relationship of stress and strain in the constituent concrete material. It's not relevant except that it shows that in the design calculations, the 28-day cube strength is factored by 0.67 to reflect the difference in relationship between cube strength and the strength of in-situ concrete. This concrete strength which is factored by 0.67 is then further reduced by a material safety factor of 1.5. So the actual concrete in the structure is considered in design to be substantially weaker than the cube tests, and this is catered for in all the design calculations.

Next slide, please. Dr Lau says that as Leighton had ordered grade 40 concrete from their supplier, they are only allowed to use grade 40 in the design calculations. So I've gone back to look at the original cube test results that verify the strength of the grade 40 concrete mixes. These are the tests that were done at the time when the concrete mixes were originally

designed, well before construction. There are many mixes, so shown here is just a sample of four of them, but all exhibit a strength well in excess of the 60MPa used by EIC in their calculations. The trial mix cube test results are similar to the site cube test results, so the use of 60MPa as design strength for the in-situ concrete is confirmed.

So, in essence, we could simply strike off the words "grade 40" on the original test result sheets and replace those words with "grade 60", and the report sheet would still be valid. If this was the case, then I'm sure Dr Lau's objections would not be valid.

Next slide, please. In the experts' meeting of 20 December, Prof McQuillan, Dr Glover and I agreed that it is possible to consider the effect of the age of concrete, now typically three or four years old, and its effect on the concrete strength. Concrete goes stronger as it ages. When it is first created, it's a liquid and thus has no strength. When it's one day old, it's set but is very weak. When it is seven days old, it is a bit stronger, and we design based on a 28-day strength, which is even stronger, but it can get a lot stronger than this.

Next slide, please. There are many references in other international design codes on this increase in strength, but concrete in Hong Kong is different to that

in Europe or the USA due to its constituent components, so the Hong Kong Structures Design Manual provides the best reference for the effect of age on Hong Kong concrete strength; the Hong Kong Structures Design Manual being the equivalent of the Hong Kong Code of Practice, and it is used for the design of highway structures, bridges and roads.

So, on this slide, it is an extract of the rate of growth of strength of the concrete, and it shows that when concrete is 360 days old, it is typically 20 per cent stronger than its 28-day strength. This is shown on this logarithmic scale plot which is extracted from the Hong Kong Structures Design Manual. This means that it will be possible to use 72MPa in the EIC calculations instead of 60.

Next slide, please. There was also much debate in the holistic report about the shape of the shear links and the shorter length of the end of the link compared to that specified in the Hong Kong Code of Practice. Concern was raised by the MTR on the shape of the as-constructed shear links that were discovered in the opening-up locations. The tab length here is less than specified in the Code. Prof McQuillan, Dr Glover and I agree that this does not affect the structural shear strength of the structure, given the over-provision of the shear links compared to the design requirements.

Next slide, please. Both Atkins and Arup have performed extensive non-linear, cracked section finite element analysis on the diaphragm wall and the EWL slab construction joint region. This analysis, plus the Atkins/AECOM hand calculations and the strut-and-tie analysis confirm my own findings in January 2019 that the joint is safe and can withstand the loadings. All the analyses demonstrate that the level of stress at the Hong Kong joint is low. This low stress means that any construction defects at the joint will not adversely affect the performance of the joint.

Next slide, please. This slide shows an extract of the Arup and Atkins FE analysis. This is a plot of the resulting stress distributions in their model, Arup on the left and Atkins on the right. Both of these plots show low stresses in the region of the horizontal construction joint at the top of the D-wall. But these analyses did not consider the presence of a defect at the top of the diaphragm wall at the construction joint.

Next slide, please. So to demonstrate that a gap at the construction joint has no impact on the performance, I carried out a much simpler linear elastic FE analysis. This analysis has a physical gap right at the top of the construction joint, which is pointed out on the slide.

Next slide, please. Dr Lau objects to this analysis, saying that as a linear elastic analysis it is

not representative of the behaviour of the joint. But it's not meant to be representative of the behaviour of the joint. It is only meant to demonstrate that there is no change in stress distribution and that the critical stresses are at the base of the slab in the diaphragm wall. As you can see here, in these two plots of stress distribution, on the left is the model with the gap at the top of the diaphragm wall, and on the right is the same model but with no gap. You can see that there is little difference in terms of stress distribution in these two models, and the main stress concentrations are at the base of the EWL slab, away from the construction joint. And these stress distributions are similar to the stress distributions of the Atkins and Arup analysis.

Next slide, please. Dr Lau is also concerned that any gap between the top of the diaphragm wall and the EWL slab would lead to a path for corrosion and adversely affect the long-term durability. There is no path for corrosion. The construction joint region is fully encapsulated by concrete. As shown in the sketch on this slide that I have extracted from Prof McQuillan's report of January last year, no water can possibly get into the construction joint area because it is surrounded by concrete under compression, causing a tight seal, and the top surface of the EWL

slab is itself covered with track slab concrete. It is a very mild, non-corrosive environment.

Next slide, please. The HHS trough walls have also been a key issue. These walls were constructed using coupled vertical reinforcement at the base of the walls. The vertical reinforcement is what provides the strength resistance of these walls to the case of a train derailment and the subsequent collision of that train with these walls. The MTR have applied a strength reduction factor of 35 per cent to the reinforcement, because of the presence of the couplers, and as a result the calculation method used by their consultant AECOM demonstrated that the trough upstand walls were not strong enough to resist the collision loads.

I have checked the strength of the as-built upstand walls using the yield line theory. This is a well-established and proven method that is referred to in the Hong Kong Code of Practice, but it is not your typical design engineer's approach to the design of slabs.

Next slide. The traditional approach is to design the wall as a vertical cantilever, with the load spreading down at 45 degrees to the base of the wall, mobilising more of the base of the wall than where the load is applied. This was AECOM's approach.

Next slide, please. My approach was to use yield

line theory, in which the way the wall would actually fail is modelled. Looking at this 3D sketch, you can visualise the top corner of the wall breaking off along the diagonal line. This is how the wall would actually fail and it would not fail at the base, as is assumed with the traditional approach. This yield line analysis shows the wall is safe, even if the MTR's proposed strength reduction factor as set out in the holistic report is considered, and that strength reduction factor could even be increased and the wall would still be okay.

Next slide, please. Dr Lau states in his report that for this yield line approach to be valid, shear reinforcement should be provided. His opinion appears to be based on his interpretation of the wording in the commentary to the AASHTO LRFD code, which is repeated here on the slide. But his interpretation is not correct.

Next slide, please. What this wording means is that the trough walls must also be checked for its shear capacity. In other words, the yield line analysis is only to be used for the bending or flexural effects of the applied loading. It does not mean that stirrups and ties must be provided for the yield line analysis to be valid.

Now, stirrups and ties are the American word for

shear links. There's a shear force in the wall. If the concrete is not strong enough to take that shear force by itself, you put in shear links, or in America you put in stirrups and ties; same thing.

The shear force in the wall has of course been checked and it is less than the shear capacity, and no shear stirrups or diagonal ties are needed, which is a similar finding to that of AECOM. So the HHS trough walls are adequate and do not need strengthening.

Next slide, please. This brings us to our last topic, that of shear in the SAT/NSL slab. I'm afraid that Atkins are not correct to suggest that suitable measures are necessary to strengthen the NSL slab in the SAT area. This is because Atkins have been conservative in their calculations, and they have also ignored the beneficial effects of shear links in the design calculations.

Next slide. Shear links were of course installed in the NSL slab of the SAT area. These photographs are of the SAT area and the NSL slab, and the shear links are clearly visible in the photographs in this slide. Again, you can see the tops of the shear links as they come over the reinforcement.

Next slide, please. These are some more photographs showing the shear links in the slabs, and you can see them quite clearly in the two photographs at the bottom

of the slide.

Next slide, please. So, in my view, Atkins have been too conservative in their design analysis of the SAT area. The SAT area varies in dimensions. The width, the spacing of the internal walls and the external walls vary and the thickness of the NSL slab varies along its length. This image has been extracted from the Atkins design drawings and it shows a plan of the SAT area, and you can just about see the varying width. I'm sorry for not finding a clearer image of the plan of the area.

But Atkins have done their assessment using only a 2D strip or frame analysis of the five individual different sections along the length of the SAT. 2D analysis, by definition, will not take account of the 3D effect of load distribution, ie a concentrated train load from a wheel will actually spread longitudinally throughout the slab and therefore reduce its effect on any one particular point.

These two sketches on the slide show a very crude example of the beneficial effect of 3D analysis. On the left, the load from the train wheel is seen to be spreading down into the slab at 45 degrees in both directions, thereby engaging a large amount of slab to resist its effect. On the right, the same wheel load is taken only by the 1 metre strip that is assumed in the

Atkins analysis. The 1 metre strip is shown by the dashed lines, and the slab outside of this area is ignored.

Next slide, please. So this is a plot of the computer model used by Atkins to design one of their five 2D strip models, and this model was used for the design of the slabs and the wall in this area. One of the main elements with this 2D approach is that they did not model the correct way in which the NSL slab was built. The NSL slab was cast on the ground, so it is supported by the ground, but there is no support given to the slab in their computer model. Therefore, the effect of loading on the slab will be grossly overestimated in the structural analysis, as the analysis assumes the slab to be free-spanning between each side wall and not in fact constantly supported by the ground.

Next slide, please. Notwithstanding this conservatism, EIC have worked within the confines of the Atkins analysis, but have considered the 3D effect by accounting for a load redistribution from the NSL slab upwards to the roof slab. This is a valid design approach and simply reflects the concept of moment redistribution that is allowed by the design codes. But the main reality is that Atkins' analysis is over-conservative as the soil below the slab has not

been considered, especially considering that the soil is of limited thickness above the rock, and if such soil was considered then no shear failure would be observed.

So when I say "limited thickness", if you look on the slide showing a cross-section of the SAT area, below the bottom of the slab you can see some rough lines, and that's highlighted as the inferred rockhead. So you've got this layer of soil that's probably 2 metres thick that is completely constrained with concrete above, concrete on each side, and rock below. So this soil can't go anywhere; it's completely contained, so it can't settle and it will always therefore provide support to the NSL slab.

COMMISSIONER HANSFORD: Just to be clear -- sorry to interrupt you -- are you referring to the dotted line at the bottom there? Is that presumed to be the top of the rock?

A. Unfortunately, I don't have a thingy, but yes, it's that dotted line.

COMMISSIONER HANSFORD: It's got some question marks marked on it, or are they number 2s? Perhaps they are number 2s, are they?

A. No, I think that's just the line type that they have used.

COMMISSIONER HANSFORD: I see.

A. I mean, it says "inferred rockhead".

COMMISSIONER HANSFORD: Yes. Thank you.

A. So that soil is trapped completely.

Next slide, please. So, to conclude my presentation, let me sum up as follows. Partially engaged couplers of six or more threads can safely take the applied loading. Partially engaged couplers do not compromise the long-term durability of the structure due to the mild environment within which they are in. Partially engaged couplers do not compromise the serviceability of the structure in terms of performance and deflection. Partially engaged couplers are therefore safe and fit for purpose for use in the works.

Next slide. The updated calculations show that the structure does not require shear links to withstand the applied loadings. In my view, it is absurd to consider that shear links were not installed in the works on the basis of a limited investigation, when shear links were found in 66 per cent of the locations, and the photographic evidence clearly shows links to be installed in all locations. The slabs are therefore strong enough to resist all applied shear loadings and are safe and fit for purpose for use in the works.

Next slide. All the consultants -- Prof McQuillan, Dr Glover and I -- agree that the design of the as-constructed diaphragm wall joint is safe. I have demonstrated that a gap in the construction joint makes

no difference to its performance and is therefore safe. The gap, if present, cannot compromise the durability of the structure. The as-constructed joint is therefore safe and fit for purpose for use in the works.

Next slide, please. The HHS trough walls can withstand the applied ULS train collision loads, even if the couplers in the wall are partially engaged. The walls are proven to withstand the train collision loads, even if a 35 per cent strength reduction factor is applied to the coupler connections, via the use of yield line theory. The walls are therefore safe and fit for purpose for use in the works.

Next slide, please. No reliable conclusion can be drawn from the Atkins analysis of the SAT area due to the conservatism in the analysis method and the lack of slab support. It is absurd to consider that the shear links were not installed in the works on the basis of the limited investigation, when shear links were found in 66 per cent of the locations, and the photographic evidence clearly shows links to be installed. With the presence of shear links, there is no overstress issue, even considering the conservative Atkins analysis. The SAT area is therefore safe and fit for purpose for use in the works.

Finally, the structures that were considered by this Commission of Inquiry in both the hearings last year and

now are safe and fit for purpose in their as-constructed condition.

CHAIRMAN: Thank you.

MR SHIEH: Thank you, Mr Southward. You have been through this process before and I take it that you will be familiar with what comes next. Counsel for the Commission, followed by other parties, and also Mr Chairman and Mr Commissioner, may have some questions for you, and after that I may have some follow-up questions for you in re-examination. So could you please kindly remain seated while others ask questions of you.

WITNESS: Sure.

Examination by MR PENNICOTT

MR PENNICOTT: Mr Southward, good afternoon.

A. Good afternoon.

Q. I had or rather we had between us prepared a number of questions for you, and as you have been going through your slides I've been ticking off the answers to most of them, or at least I think I have.

The first point I was going to discuss with you was Dr Lau's views about ductility crack width, durability and deformation, and it seems to me that you have covered those in some of your earlier slides.

So, unless there is anything more you want to say about those particular topics, I will move on from that.

The second point, however, I think I do just need to clarify with you. In your reports, both for the COI 1 and COI 2, you adopt a threshold of 28 millimetres for the embedded length of threaded rebar into the couplers, and I think you do that on the basis of what you describe as your engineering judgment. Is that right?

A. Yes. I mean, the 28 millimetres comes from the six threads. Six threads is the key thing.

Q. Yes. Now we know, in the joint statement that you signed up to with the other experts, that yourself, Prof McQuillan and Dr Glover take the view that a 32 millimetre engagement would ensure that all the relevant strength tests are met and passed; is that right?

A. Yes. By default, if I consider that six threads is acceptable, then certainly seven are.

Q. Right. So you haven't changed your mind about the 28 millimetres?

A. No.

Q. It's just, by default, 32 will certainly do it?

A. Yes. I agreed with that statement because it is correct. Seven threads are adequate.

Q. Understood. That's helpful.

In COI 2, you point out, and I think we all know, that no physical investigation work has actually been carried out in the HHS area, but a 35 per cent reduction

factor has been adopted based upon the coupler testing results in respect to the NSL slabs.

A. (Nodded head).

Q. As I've understood it, your view is that there is insufficient similarity between the two areas, that is the HHS area and the NSL slabs, to, as it were, apply the reduction factor from one to the other; is that correct?

A. That is correct, yes. They are completely different.

Q. Right. That remains your view?

A. Yes.

Q. In what sense would you describe them as wholly dissimilar? Why are they not similar?

A. Because, in the EWL slab, the bar diameter is 40 millimetres. The bars are typically 6 metres long when they are installed into the couplers. A 6 metre long 40 millimetre diameter bar is very heavy.

Q. As we found out this morning.

A. As you found out, and this morning we were only lifting half a metre long bars.

Q. Yes.

A. So you have a much longer bar which takes several men to hold, and then a line and thread into the coupler. The coupler itself is blind. When I say that, you can only see the front face of the coupler, you can only see a hole. You can't really see its alignment. You can't

see the outside surface of the coupler to know at what orientation to align the bar as you screw it in. And then, because it's so heavy, as you screw it into the coupler, there will be friction between the threads of the bar and threads of the coupler, and the more you screw it in, any misalignment of the bar, say a guy is holding the bar and it's heavy, he gets a bit tired, he may droop a bit, that droop will then bind up the short bit of thread that is screwed into the coupler, so it's going to get more difficult to thread the bars in.

So although I've not personally done this task, I can imagine it's a bit tricky.

In the HHS area, the bar diameters were 25 millimetres, so that is more than half the full length -- the 25 millimetre bar weighs less than half of a 40 millimetre diameter bar. The couplers were just above the base slab, the couplers were standing proud of the base slab in plain air, so the starter bar was there, the guys would come along, screw the 250 millimetre coupler onto the bar, and then get their 25 millimetre bar, which was 1 metre or 2 metres tall, so the guy could probably lift that bar up by hand and then just place it down on to the top of the coupler and thread it in. He can see the whole coupler, he can see the orientation of that coupler, he can see the bar below, so I imagine it must be much easier for him to

screw that bar in. I have to say I've not done that particular task but in my opinion it must be easier.

Therefore, in my opinion, the two physical acts are completely different.

COMMISSIONER HANSFORD: Just to add to that, would the effect of gravity make a difference as well. If you are inserting the bar vertically, does that make it easier to install?

A. I don't know. I don't know. I guess it might help, but I guess on the other hand, if it was a really heavy bar, it might push against -- if you had a vertical T40 bar that was 6 metres long, its pure weight might bind against the threads and make it harder. But with a 25 millimetre bar that you can physically hold and move up and move down, it would have to be easy to do.

COMMISSIONER HANSFORD: Thank you.

MR PENNICOTT: So, in essence, Mr Southward, then, it's really very different working conditions and the inherent different tasks involved in the two operations?

A. I believe so, yes.

Q. Okay. The next topic I was going to look at with you was the yield line analysis which again Dr Lau has made some observations or criticisms about which I think you've now sought to address in various of your slides that we've just gone through. Again, I'm not going to spend time on that.

Just one specific point, to make sure I've understood it. You've made reference to and Dr Lau has also referred to the American Association of State Highway and Transportation Officials document, and I think you say that in your analysis, your yield line analysis, you've adopted the design rules from that particular code or document; is that right?

A. That's correct, yes.

Q. And you've adopted that approach, as I understand it, because you believe that gives a more robust analysis?

A. Yes, and that is the approach that the Americans would use for the design of bridge parapets. So parapets on the side of bridges that are designed to contain the traffic, those parapets must be designed correctly, and the yield line approach is therefore specified in the American code as a way to design those parapets. And those parapets are very similar in job description to the HHS trough walls --

Q. To the trough walls, yes.

A. -- which are containing collision loads.

Q. I see. And the point that I think you've addressed -- well, the point that Dr Lau sought to make was that it only applies to walls with the provision of stirrups and ties/shear links; is that right? Is that the criticism as you understood it?

A. Yes. I think that is a misunderstanding of the wording.

The wordings -- if you want to go to the slide, we will look at --

Q. Yes.

A. I don't know how to --

Q. I tried to number them as we were going through. We are on about 45, I think. Yes, at 44, "Yield line approach", that's it. Is it that one?

A. Yes. This wording is in the commentary to the AASHTO code. So the AASHTO code is written in a format that on each page, on the left side is the rules, and on the right side of the page is a commentary which explains what the rules are and how they work. So CA13.3.1, that is from the commentary side, because it has a C, and it says:

"The yield line analysis shown in figures C1 and C2 includes only the ultimate flexural capacity of the concrete component."

So that's saying that you only use that method to cater for flexural bending effects. You've still got shear force to be dealt with. There is still a shear force. In any type of design, you have bending and shear, and you've got to cater for both aspects. So the yield line caters for the bending, the flexure, and then you've got to look at shear.

So this is just a statement that says:

"Stirrups and ties should be provided to resist the

shear and/or diagonal tension forces ..."

So it says you should provide ties to resist the shear force. In this case, the concrete by itself is strong enough to resist the shear force, so shear ties are not required.

Q. Are not necessary.

A. This is what the other consultants found. I've done that check as well but there's no issue.

Q. Okay. So, as you said at the outset, it comes really to an interpretation of those words?

A. Yes.

Q. Also, in connection with shear links more generally, you, Dr Glover and Prof McQuillan have agreed in the joint statement that when retro-analysing a structure, the Concrete Code allows the safety factors to be reviewed, that is the safety factors that are built into the Code to be reviewed, to use actual loads and actual material properties, as I understand it. Is there, in your view, an opposite conclusion that can be reached from the codes, or is it as clear as it can be that that is perfectly acceptable?

A. Well, the design codes are written so you design -- when you design a structure, and you typically design a structure before it's built, so at the time of design there's not even a contractor on board, you have no idea what type of concrete the contractor will use, where he

sources it from, where he's going to get his reinforcement from; you don't know any of that. So you just, as a practising engineer, use the rules in the design code which are unified to consider every possible scenario. And, as you saw, there are lot of conservatisms included in the design code to account for what the contractor might do when he comes to build it.

Q. Yes.

A. So the design code is really for pre-construction work.

Q. Can I, just so that I make sure I've understood the criticism that Dr Lau is making of this particular point and your answer to it, can we look at a passage in Dr Lau's report, please. That's in ER2, that's the Original Inquiry, tab 17, paragraph 79.

Could you, as it were, read that to yourself. You've obviously read this report --

A. Yes, I have.

Q. -- probably more than once.

If we could scroll down, please. Four lines from the top there, Mr Southward, what Dr Lau says is:

"The higher concrete strengths obtained from laboratory tests on concrete cubes should not be relied on for the determination of the actual concrete strength in the structure. Strengths obtained from concrete cube tests are always (in fact inevitably) higher than the actual concrete strengths of the structure. It is

because the concrete cube samples were separately compacted and cured in on site curing tank under ideal conditions before they were tested. Thus, the results can only be used as a means of quality control. They do not represent the actual concrete strength in the structure."

What would your observations be in relation to that particular point that he makes?

A. "Strengths obtained from concrete cube tests are always (in fact inevitably) higher than the actual concrete strengths of the structure."

That is not inevitable at all. There are many, many occasions when I've had a contractor ring me up and say, "I want to strip the formwork for this particular piece of concrete, and the cube tests that we've got give us an average of 39MPa when we're supposed to have 40, and therefore, what do we do?" So, certainly, it's not inevitable at all.

The concrete cube samples are separately compacted and cured on site in a curing tank -- that is what happens. That is how it's done. That is the method of quality control, the BS standard or the specification which tells you how to take cubes, tells you to do it this way, and that's how -- you're not -- when you're doing these tests, you're not -- you know, you can't replicate the conditions of the in-situ concrete,

because the two items are completely different. You've got a large room full of concrete over there. You're just taking a little sample, making a square and testing that.

Now, some people use squares. Other people use strengths -- make cylinders, and a square and a cylinder, when you test those two -- if you use exactly the same mix for a square and a cylinder, and you test them for strength, the strength of one will be different to the other. I think there's a correlation of about 20 per cent, I think, and in fact off the top of my head I can't remember which is stronger than the other. I think the cylinder is weaker than the cube.

So there is the same concrete that's showing completely different strengths, because of its size. So the two things are separate, which is why, when we do design calculations, these cube strengths or cylinder strengths are factored downwards by that relationship factor, to take account of the fact that the concrete in the structure will be weaker.

Q. Right. Could we scroll down a bit, please, on the paragraph.

Again, Mr Southward, just so I've understood it, the last couple of sentences here in the same paragraph, Dr Lau says:

"As a structural engineer, I do not agree to the use

of the cube strength results in design check. The cube strength is higher than the strength of the concrete in the structure."

Do you agree or disagree with that last proposition?

A. What I say is that the testing of the cube is going to give you a different result than testing of the concrete in the structure, because of the shape of the cube. I don't agree with the second-last sentence -- "I do not agree to the use of the cube strength results in design check" -- I think it's completely valid to do that because I know that the design calculations take account of that relationship.

Q. All right. Thank you.

Could I ask, please, for the joint statement to be put up on the screen. Thank you. Could we go to point 5, please. We are still on the topic of shear capacity, but we are dealing with the SAT area here, and it's recorded that Dr Glover, yourself and Prof McQuillan agree:

"... as per '2' above, there is adequate shear capacity", in the SAT area. "In the one potential 'hotspot' identified by EIC, failure cannot occur because of the load redistribution in the three-dimensional structure. The 'hotspot' is in an area where only nominal/minimum shear reinforcement is needed."

Then:

"[Dr Lau] generally disagrees because of his concern that there may be no shear links present."

Forget about that point for the moment.

"As for the 'hotspot' the shear failure would be 'brittle' and load redistribution cannot occur."

What is your understanding, if you have one, of Dr Lau's description that the failure would be brittle? Do you know what he means by that?

A. I can imagine he means that -- I mean, a brittle failure is one that will happen without warning. That is what a brittle failure is.

Q. Okay. And is he right that -- is that the type of failure that you would expect in this hotspot?

A. I can't imagine that the structure would actually fail in that area, because -- the opinion on whether or not the failure occurs is based on extremely conservative analysis, so, you know, it's a question of goalposts that -- a very conservative analysis has been done and we're talking about whether a failure will happen because of that conservative analysis. The reality is that shear failure cannot occur because there is all that soil below the slab that is -- confined soil that is stopping the slab from occurring. If you take those goalposts where they are, the shear failure where they occur, if you move the goalposts by saying, "Actually,

let's look at this properly, let's take account of the three-dimensional analysis", then the shear failure wouldn't occur. If you kept the goalposts there and said, "But there is actually shear reinforcement in there", then again the failure wouldn't occur.

So it's a bit of a non-issue, in my opinion.

Q. Okay. All right.

Sir, I've reached the point now where I wanted to ask Mr Southward some questions about the construction joint and the dowel bar issue. It was brought to my attention over lunch that the method statement that I asked Mr Chow some questions about this morning is not, apparently, the up-to-date, current method statement. I have been told that the MTR have given us the up-to-date one, which is dated 13 December 2019, and I think the previous one was about 19 November. I am told that there are some differences, and indeed one particularly potentially important difference between the two method statements. The second current method statement, I'm told, runs to 58 pages. It's been emailed to the Commission while we've been sat here listening to Mr Southward this afternoon, and I've not yet had an opportunity of looking at it and I imagine perhaps not many others have either. I am happy to press on and ask my few questions of Mr Southward, and then if necessary come back to it later, if I need to,

or we can just pause now and I can go away and have a look at the method statement, the new method statement. Unfortunately, I just couldn't tell you how long that's going to take. I just don't know, without seeing it.

CHAIRMAN: We are of the view that you should press on.

MR PENNICOTT: Yes, thank you, sir. I'd be happy to.

Could we go to your report for the COI 1, and could we look, please, at paragraph 8.5.

I appreciate you were writing this back on 11 October or signing this off on 11 October.

A. Yes.

Q. And really what I need to find out from you is whether anything has moved on or changed since that date. You're discussing here, as I understand it, the proposed suitable measures at the top of the D-wall.

A. Yes.

Q. And you are referring to the holistic report, and then you say, in the last paragraph on this page:

"The report does not define these 'suitable measures' in detail, but I understand from discussions with the MTR at the site visit on 21 September 2019 that the work involves installing 25 millimetre diameter bars, vertically at 600 millimetre centres, to provide reinforcement continuity between the D-wall and the EWL slab through the construction joint."

Now, pausing there, has any of that detail changed, to your knowledge?

A. I am not aware -- I have not seen the method statement, so I'm not aware of any -- that is, as far as I know, what they are doing.

Q. Right. So you thought at the time 25 millimetre diameter bars or dowel bars at 600 millimetre centres and that remains your state of knowledge?

A. Yes.

Q. And you've not seen even -- you were presumably looking at the method statement as we were looking at it with Mr Chow this morning; is that right?

A. That's the first time I've seen any of that document.

Q. Okay. Could we press on in this report. You have a heading "What is the effect of carrying out the suitable measures?" You say:

"The provision of these dowel bars is clearly meant to provide additional horizontal shear strength across the construction joint."

Then, without reading all the rest of it out, essentially what you conclude is that given that that's only going to provide additional reinforcement across 2.2 per cent of the joint, then it's really not --

A. No, the extra reinforcement that they are providing is 2.2 per cent of the total amount of reinforcement crossing that joint.

Q. Right, and therefore, you say, that's negligible and what's the point?

A. Yes.

Q. Okay. Again, your state of knowledge on that detail has not changed?

A. No.

Q. If we could then move down, please, "Is there any justification for carrying out the suitable measures"? In short, no. If we could just scroll down. Stop there, please. In the third bullet point you say:

"The detailed work of Atkins, Arup and AECOM showed that the shear links in the D-wall played an important part in the strength capacity of the D-wall/EWL slab connection. If vertical bars are to be drilled into the top surface of the EWL slab and then downwards into the D-wall, there is a significant danger that the horizontal shear link bars might be cut by the action of the drilling."

Then if we could skip to the penultimate sentence of the next paragraph:

"There is no possible way", you say, "to ensure that the shear link bars will not be cut during the drilling and it will be purely down to luck if none are damaged. Therefore, this is a significant risk and one which I do not recommend is taken."

Do you remain of that view, Mr Southward?

A. I've not seen the method statement so I don't know how they are doing it, but if you are drilling into a slab, and you've got reinforcement that's several hundred millimetres down, you've got no way of telling where that reinforcement is before you drill. So, once you start to drill it, as soon as you hit it, you hit it. You may not necessarily cut it but you've hit it. So, I mean, it cannot be good to hit reinforcement.

Whether that reinforcement is necessary or not is another question, and that's what I don't know, but reinforcement was used in the design calculations.

Q. Right. Is there, to your knowledge, any way of avoiding this problem of hitting the reinforcement as you are drilling? Is there a way around it? Can a method be developed to avoid that occurring?

A. I don't know.

COMMISSIONER HANSFORD: There was reference this morning in the cross-examination of Mr Chow to scanning. What was that about? Is it possible to scan that, to locate that reinforcement in some way?

A. As far as I know, not to that depth, no. You have the EWL slab going over the top.

COMMISSIONER HANSFORD: Yes.

A. You have two layers of T40 reinforcement bar with a cover of 40 millimetres.

COMMISSIONER HANSFORD: Yes.

A. So you can scan the top surface of the slab to locate where that reinforcement is.

COMMISSIONER HANSFORD: Yes.

A. Then I imagine they would chip off the cover to expose the bars.

COMMISSIONER HANSFORD: Yes.

A. Then they will have got the gap between the bars where they can drill down. Then they've got to drill down at least 200 millimetres to get to the top of the construction joint, and then they've got to drill down into the diaphragm wall by the amount that the anchorage of these dowel bars is, and I don't know what the dimension is, but you saw the sketch this morning with the blue line going down.

COMMISSIONER HANSFORD: Yes.

A. So I don't know how deep it goes. But I don't believe it's possible to scan and locate a reinforcement bar that's 400 millimetres down inside a body of concrete.

COMMISSIONER HANSFORD: So the reference to "scanning" is likely to be a reference to the top bar?

A. I imagine so, but again I can't say that with confidence.

MR PENNICOTT: Sir, therein lies one of the problems. I am instructed that the "scanning" has been deleted from the latest method statement, and that's one of the reasons I need to go and have a look at it.

COMMISSIONER HANSFORD: Yes.

MR PENNICOTT: But apparently the "scanning" has gone, as it were.

COMMISSIONER HANSFORD: But we are hearing that scanning may not --

MR PENNICOTT: That may be the reason it's gone. We just don't know.

COMMISSIONER HANSFORD: Okay. Thank you.

MR PENNICOTT: Anyway, that's all I wanted to ask Mr Southward. Thank you very much.

Perhaps we could have a coffee break.

CHAIRMAN: Yes.

MR PENNICOTT: Ten minutes?

CHAIRMAN: Ten minutes. Thank you.

(4.08 pm)

(A short adjournment)

(4.26 pm)

Cross-examination by MR KHAW

MR KHAW: Good afternoon, Mr Southward. I represent the government.

If I may first discuss with you some preliminary or what we call conceptual issues of the analysis that you have conducted.

Obviously we all know that one of the questions posed by the Commission for the experts on structural engineering is to consider whether the as-constructed

structure is safe and fit for purpose from a structural engineering perspective.

Am I correct in saying there is no such textbook definition on what is safe and what is fit for purpose from a structural engineering point of view; is that correct?

A. I'm not aware of a textbook definition of that, no.

Q. Right. And according to your analysis, it seems to me that if we look at your paragraph 6.7, the last bit of your 6.7, while you were talking about coupler connections, you say, if I may quote:

"Safe in this context means that the use of the partially engaged coupler assemblies will not endanger the structure, or cause it to suffer distress. It means that the structure will be able to operate as intended by the designer, to withstand the design loads within the designed elastic range of the structure and will allow the structure to achieve its required design life."

So presumably the two major elements in your analysis of the question of safety would be whether it is of sufficient strength and whether it is durable; is that correct?

A. Whether it's safe, whether it's durable, whether it will perform satisfactorily.

Q. Yes.

A. So it's more than more than two aspects.
Q. Obviously different engineers may have different ideas on what parameters should be adopted for the purpose of assessing the issue of safety; would you agree?
A. Safety is a matter of common sense; right?
Q. Yes, absolutely.
A. That whole -- those four lines, that's just basic common sense.
Q. Yes. Now, you have had a chance to look at Dr Lau's analysis regarding his parameters for the purpose of assessing safety. If I can just very briefly take you to his paragraph 26, internal page 9 of his COI 1 report, where he sets out four aspects that he would look at for the purpose of discussing the concept of safety, namely stability, rupture of section, robustness and also ductility.

Pausing here, I would like to know whether you find any of these factors irrelevant for the purpose of assessing the question of safety, from your point of view?
A. I mean, "irrelevant" is a strong word. If you look at the term "robustness", a structure can be safe, durable, it will stand up, yet it may not necessarily be robust, because "robust" is to do with how much more safe it is compared to the design criteria. I wouldn't say that's irrelevant.

Q. I don't think you would have any problem with the factors of stability and rupture of section; would you agree?
A. Can you just scroll up to them?
Q. Of course.
A. Yes, I don't have a problem with that.
Q. And what about ductility, which is item (d) here?
CHAIRMAN: Sorry, could we just go back to --
MR KHAW: Yes, of course.
CHAIRMAN: Just up a little tiny bit. That's it, "Stability -- whether there is overturning of structure or buckling of individual members", individual parts of the structure, a layman might put it, "under the worst combination of different types of design ultimate loads." Okay. In other words, "stability" means it must be able to remain stable and as an integral structure under a combination of different types of design loads that place an ultimate stress on them?
A. Yes, I mean in this scenario, stability is not an issue, because the stability of the structure is provided by the ground that it's buried within. It's not going to fall over. It can't. But generically, for a building, stability is an issue; you wouldn't want it to blow over because of the wind.
CHAIRMAN: Yes. I think Dr Lau says stability is not a problem in this case.

A. Yes.
CHAIRMAN: So then we move on to rupture. Okay. I think we all understand that, perhaps in a biological sense as much as anything else, but part of the body being torn, or something like that.
A. That would be like the EWL slab, the whole platform slab sort of breaking, which isn't a problem.
CHAIRMAN: Okay.
And robustness? So, if it's robust, then the collapse or rupture or breaking or breaking away of any minor part, if I'm with you, or any small part, is not going to cause disruption of the whole. Is that --
A. Yes, I guess if you had a four-legged stool and you took away one of those legs, a four-legged stool is robust because you took away one of those legs and the three-legged stool will still be stable.
CHAIRMAN: Yes.
A. But if you took away one of the three legs of the stool remaining, then the stool would fall over.
CHAIRMAN: It would be less robust.
A. So robustness is not an absolute requirement for the stability and strength and ductility of a structure. Robustness is an added extra.
CHAIRMAN: Okay.
A. So, I mean, Dr Glover spoke about robustness last time, and in fact I believe he was involved in Ronan Point.

He mentioned this last time. So he might be the best person.

CHAIRMAN: So would it be correct then to say that to ensure safety, you identify a number of necessary instances of the integrity of a structure, just to make sure that those various aspects render the structure safe?

A. Yes. I mean, when the design engineer does his job, he designs every element of the structure so that each element can withstand the design loadings and therefore as a whole the structure is therefore safe.

CHAIRMAN: Yes. And safety of course needn't go to the mortality of the structure. It needn't be just a collapse. It could be, for example, a very high roof in a major international airport with bits falling off it, landing on the heads of passengers doing some duty-free shopping. That would be -- we cannot open it up because the roof is not safe, bits are falling off it.

A. Yes. That is because bits on the roof have ruptured, have broken, and then they've fallen off, so --

CHAIRMAN: That's a safety issue too --

A. Yes.

CHAIRMAN: -- so it covers a great wealth of matters then. Is there in fact a difference between safety and fit for purpose? Because if you are busy selling Scotch whisky at a duty-free price, so you tell everybody, and bits of

plaster are falling down and killing shoppers, then it's clearly not fit for purpose.

A. If we look at it from the station perspective, if the platform slab -- I'm not saying -- this won't happen, of course, but just hypothetically speaking, if the platform slab was designed to be only 200 millimetres thick, say, but using super-super-strong steel and super-strong concrete such that it was able to span between the diaphragm walls, that very thin slab would be very flexible. So, once the weight of all the trains came on to that slab, the slab would deflect. If the slab deflects downwards, the train sitting on the tracks, because the slab deflects downwards, the train would then fall off.

CHAIRMAN: So not fit for purpose in those circumstances.

COMMISSIONER HANSFORD: But still safe.

A. Safe because the structure is not falling over but the outcome is not fit for purpose because the product is not good enough for use.

CHAIRMAN: Thank you, because I think the layperson may throw in: are we debating in fact two things that are the same and differentiating them? But I can see the differentiation now. Thank you very much. It helps me.

A. Just to clarify, the platform slab is 3 metres thick, so it is very stiff and very strong and will not deflect.

CHAIRMAN: Yes. I recall that being said very early on.

Thank you.

Sorry, Mr Khaw.

MR KHAW: Thank you.

Now, obviously there are differences between the concept of safety and also the concept of fitness for purpose that you've just discussed with Mr Chairman.

But also would you agree that the concept of safety, to a certain extent, overlaps with the concept of fitness for purpose?

A. Yes, sure. I think one is a subset of the other.

Q. Yes. An obvious example: if a structure is not considered safe for ordinary use, then it can hardly be regarded as fit for purpose, since one of the obvious purposes of having that structure is that it has to be safe for occupation, for continuous use; you would agree?

A. (Nodded head).

Q. Yes.

As an engineer, would you agree that in assessing whether a structure is fit for purpose, it's necessary to consider the purposes that it intended to serve as per the client's requirements?

A. Yes, insofar as the remit of an engineer goes; that the client will want a structure or a building or whatever to cover many things. The engineer is only tasked with making sure that that building can be built and is safe

when it's built.

Q. Right. If we can look at Dr Lau's discussion on the concept of fitness for purpose. It's again in his COI 1 report, internal page 13, where he has listed a number of factors relevant to the concept of fitness for purpose.

If we can have a look at paragraph 39, where he has referred to durability, which is obvious:

"A durable structure must meet the requirements of strength and stability throughout its intended design working life ..."

Which is consistent with what you have also said under paragraph 6.2 that we have just seen.

And other factors that Dr Lau has outlined, including deformation, fire resistance, cracking, vibration and fatigue -- would you consider those factors relevant to the question of fitness for purpose in general?

A. All of those elements are factors to be considered, yes.

Q. Thank you.

Apart from the parameters that we have to look at in considering the questions of safety and fitness for purpose, the next question is obviously the safety factor or what we call the level of safety required for the relevant parameters.

In your report, apart from the Hong Kong Code, the

HKCoP, the Hong Kong Code of Practice for Structural Use of Concrete, the 2004 version, you have also referred us to the codes of different countries, including the American design code which is used for design of infrastructure in the States, and also the British Standards, some of which have been superseded by the Eurocodes.

Am I correct in saying that the codes that you have referred to, to a certain extent, reflect different safety standards or requirements in different countries; would you agree?

A. No, I don't think so. I think all structures -- all codes are written with the intent of making sure that the end product is safe.

Q. Yes.

A. You know, a structure can either be unsafe or it can be safe. So the codes -- the difference between the codes is that they use different ways to get there.

Q. Yes.

A. But the resulting thing, the resulting product, is something that either is safe or unsafe.

Q. Yes.

A. I mean, the resulting product is something that is safe, of course.

Q. Yes. You have just told us that all codes are written with the intent of making sure that the end product is

safe, so obviously you agree that the requirements under the code are intrinsically linked with the question of safety; that you would not dispute, right?

A. I don't think so, no. I wouldn't dispute that.

Q. If I can then move on --

CHAIRMAN: Sorry, could I ask this, because this in some respects is quite an important point. The issue becomes one of legislatures, statutory bodies and/or commissions in various countries, may be more or less conservative than each other, may have different histories, may have histories, for example, of warfare, may have histories of seismic problems, and may therefore determine within the parameters of their culture, their history, their conservative attitudes and the like what in fact amounts to a matter being safe and fit for purpose within their jurisdiction. Would you agree with that rather long-winded statement?

A. I'm just trying to decipher it.

CHAIRMAN: You see, what I'm saying, effectively, perhaps speaking as a lawyer here, but you have issues of what is objectively safe and what is objectively fit for purpose; okay? But when we start to move into an area of law or regulations in different parts of the world, in different jurisdictions, some of the bodies that determine those issues may be more conservative than others; right? Some may be more conservative because of

their history. I just wonder to what extent you can look at a requirement in legislation, of whatever nature the legislation is, as constituting objective evidence of what is safe.

Obviously, you can assume it will be, but is it the minimum of safety level? Is it because they are very conservative, they have a history of warfare and loss, et cetera, et cetera, that they are now making safe something extra-safe?

A. No, I don't think the codes deliberately go out to make things extra-safe. Wherever they are, by and large, the assessment of how strong reinforced concrete is is the same. The load factors by and large are similar. What does change between jurisdictions is loading, so, for example, in Australia, there is very, very heavy vehicle loads that are much heavier than vehicle loads in Hong Kong, because in Australia they have those massive articulated three-truck things which they don't have here. So the codes reflect -- the codes are adapted for the local conditions. But the product of those codes is the same wherever -- it's the same structure, it's the same -- you know, designed with the same materials. The inherent safety factors on that finished design will be the same.

CHAIRMAN: Okay. Let me put it this way, because it's just been worrying me slightly. You wouldn't therefore

accept that a commission in country A would, for its own purposes and in its own culture, define what is safe and fit for purpose in a way that the same commission in country B would do? You think they would both reach the same conclusion?

A. Yes.

CHAIRMAN: Okay.

A. As I said, probably the only thing that really changes is the loading, that each jurisdiction might require to use. But from that point, yes, like earthquakes and stuff, some countries have earthquakes, some countries don't, and so --

CHAIRMAN: Okay, but leaving aside seismic activity and odd things like that, and perhaps the fact that you are likely to be involved in warfare or something, leaving that aside, if therefore, on your statement, it appears in our building code that you should do X, then that itself is sufficient to say that's what defines safety?

A. Yes. As an example, I've designed structures all over the world, and basically they are all the same. There might be a few minor differences, but essentially a structure designed in country A could be transported and built in country B, and you would follow the codes for country B for that country A structure, and you would end up with the same thing.

COMMISSIONER HANSFORD: Your point about the loads being

different is quite important. For instance, if you designed a station for country A that had heavy snow, and then built it in country B where it never snows, the roof would be rather over-designed, but that's an issue of loading.

A. Yes.

COMMISSIONER HANSFORD: I believe that's happened, actually, in places, where the snow loading on structures in the tropics because the design was bought from Europe. Just a little anecdote.

CHAIRMAN: So on your basis, then, if the necessary regulatory requirements here state X, Y and Z, that's what defines safety, and if you don't follow that, then it's not safe?

A. No, I mean, because you can design structures that don't precisely follow the code. I mean, reinforced concrete beam can withstand a certain amount of load, and no matter where that beam is in the world, it's still going to withstand that same amount of load. A beam safe in country A is going to be safe in country B.

CHAIRMAN: Yes. I understood what you were saying earlier really was that different commissions in different countries, they will, at the end of the day, pretty much come up with exactly the same results as to what is safe and what is fit for purpose.

A. Yes.

CHAIRMAN: And if you are looking to determine what is safe and what is fit for purpose, in those circumstances, the easiest way to do so is to look and see whether there's compliance with the relevant codes?

A. I think compliance with the codes covers a broader topic than whether a structure is just safe or not. A code may say, "We want to have this particular detail in this way", but another code elsewhere won't have that same peculiar requirement, but yet the one without that peculiar requirement is still safe. So you could take the one without the peculiar requirement, take it here, where there is that peculiar requirement, so okay, there is a conflict, but it doesn't mean that what is built is not safe.

COMMISSIONER HANSFORD: That's a very good example, is it not, of something being safe but not being compliant, because of that peculiar requirement?

A. Yes.

CHAIRMAN: I think that's what I'm trying to -- in my own head, to see -- because to me it would seem if you say a window in a particular jurisdiction must be of a minimum size to allow for air, that's got very little to do with safety or even necessarily fit for purpose. It may be able to do whatever you need, fit for slightly different, but there are all sorts of impositions for different reasons.

But if we go down to the question of safety and fit for purpose then, again you would say you would have to look at what the provisions are and weigh that against the objective reality, engineering reality?

A. Yes.

CHAIRMAN: I'm sure this has been debated hundreds of times elsewhere, and as a layperson in this area, it's a little difficult to try and find a clean and clear pathway that leads to the answer.

All right. Thank you.

Sorry, Mr Khaw.

MR KHAW: Perhaps if I may just ask one more question on this issue.

Would you agree or would you not agree that the partial factors of safety adopted in different countries are different, obviously?

A. Within approximate tolerance, I would say they are more or less the same. There's just different ways of approaching -- different ways of using these factors, but by and large the safety factors are very similar.

MR KHAW: I'm moving to another topic, which actually arises from Mr Southward's PowerPoint presentation today, which I probably would need to further discuss with Dr Lau. I wonder whether I can continue tomorrow on that point?

CHAIRMAN: Yes, of course. We're almost at 5 o'clock. Yes. 9.30 tomorrow?

MR KHAW: Okay.

CHAIRMAN: Thank you very much indeed.

MR PENNICOTT: 10 o'clock.

CHAIRMAN: 9.30 or 10.00?

COMMISSIONER HANSFORD: 10.00. We've been away for so long, you've forgotten.

CHAIRMAN: I've been sitting on other things in the interim period where we start a little earlier. All right.

10 o'clock tomorrow morning. And just a gentle reminder: obviously, as you are aware, you are not able to discuss the substance of your evidence with anyone until your evidence is complete.

WITNESS: Of course.

CHAIRMAN: Thank you very much.

(4.58 pm)

(The hearing adjourned until 10.00 am the following day)

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