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<p>1 Thursday, 9 January 2020</p> <p>2 (10.03 am)</p> <p>3 PROF DON MCQUILLAN (on former oath)</p> <p>4 Further examination by MR PENNICOTT</p> <p>5 MR PENNICOTT: Good morning, sir. Good morning,</p> <p>6 Prof Hansford.</p> <p>7 Sir, if I may, I just have two very short topics</p> <p>8 that I'd like to raise with Prof McQuillan. One in fact</p> <p>9 is really just to identify a document, and the other is</p> <p>10 just to clarify something on one of his slides.</p> <p>11 Could we please look at slide 22 of Prof McQuillan's</p> <p>12 slides.</p> <p>13 That's not a good start.</p> <p>14 COMMISSIONER HANSFORD: The slides are built up, aren't</p> <p>15 they?</p> <p>16 MR PENNICOTT: They are.</p> <p>17 COMMISSIONER HANSFORD: Maybe it's that.</p> <p>18 MR PENNICOTT: It's internal page 11. That's it. Thank you</p> <p>19 very much. That's the one. It is 22.</p> <p>20 Prof McQuillan, it is really just the last point,</p> <p>21 the third point on this slide, that I wanted to ask you</p> <p>22 about. You say:</p> <p>23 "CEEK, however, have proved that if coupler contains</p> <p>24 grit and the bar is only partially engaged but rotated</p> <p>25 to refusal it will pass PET."</p>	<p>1 paragraph it says:</p> <p>2 "To further test this another set of samples was</p> <p>3 assembled, this time using broken concrete grit to</p> <p>4 partially fill the coupler prior to screwing in the</p> <p>5 bar."</p> <p>6 And so forth.</p> <p>7 If you go down to the next paragraph, it says:</p> <p>8 "By providing the grit infill in this set of trials</p> <p>9 therefore we enabled a tight fit for the shorter</p> <p>10 engagement as would be the case on site if there was</p> <p>11 some form of debris or other contamination in the</p> <p>12 coupler preventing full engagement. For this series of</p> <p>13 tests the permanent elongation measured was</p> <p>14 satisfactory."</p> <p>15 Is that the passage you're referring to in the CEEK</p> <p>16 report?</p> <p>17 A. That is it exactly, yes.</p> <p>18 Q. Thank you for that.</p> <p>19 Then, secondly, could I ask you -- with a degree of</p> <p>20 hesitation -- to look at slide 32. Yes, that's right.</p> <p>21 You will recall, during the course of your presentation</p> <p>22 yesterday afternoon, Prof McQuillan, that -- and we can</p> <p>23 go to the transcript and have a look at it; it might be</p> <p>24 easier to do it that way. So it's yesterday's</p> <p>25 transcript, page 151. You say:</p>
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<p>1 Could we just pick up a documentary reference for</p> <p>2 that so that we all know what you are talking about.</p> <p>3 Could we look at OU7/9743, please. We see there</p> <p>4 a letter of 23 August 2019, Prof McQuillan, from</p> <p>5 Leighton to MTR, enclosing an EIC report.</p> <p>6 If we can go over to the next page, please, we can</p> <p>7 see EIC writing, referring to the MTR holistic</p> <p>8 assessment and verification study.</p> <p>9 Then if we can go to the next page, please -- and</p> <p>10 one more, please; stop -- at the top of the page there,</p> <p>11 in the letter they say:</p> <p>12 "We refer to the report prepared by CEEK, Technical</p> <p>13 Review of Coupler Testing (rev B2) ... included in</p> <p>14 appendix A."</p> <p>15 Then if we could go, please, to page 9746 -- that</p> <p>16 doesn't look right. You need to pick up the CEEK</p> <p>17 report. That doesn't look right at all. Go back three</p> <p>18 pages, please. The CEEK report starts at -- appendix A,</p> <p>19 9751. That's the appendix A that's referred to. Then</p> <p>20 the CEEK report starts at 9752, over the page.</p> <p>21 Then if we could please go to page 9764, we see</p> <p>22 a heading, "Discussion of findings for elongation"; do</p> <p>23 you see that, Prof McQuillan?</p> <p>24 A. Yes.</p> <p>25 Q. You'll see in the third paragraph down, under that</p>	<p>1 "So looking first at Atkins stage 3, partially</p> <p>2 engaged coupler assemblies are ignored. This is</p> <p>3 unrealistic, and -- I've used the word 'hugely'</p> <p>4 previously -- it's hugely conservative, because the</p> <p>5 contribution of partially engaged couplers has been</p> <p>6 completely ignored. Yet Atkins might say</p> <p>7 apologetically, to their credit, make the point that</p> <p>8 partially engaged couplers do contribute to structural</p> <p>9 capacity. They say that a minimum of six threads is</p> <p>10 okay for ULS condition. That's failure. They say that</p> <p>11 a minimum of seven threads will satisfy the</p> <p>12 serviceability limit state criteria.</p> <p>13 Prof Hansford: It's the other way around on the</p> <p>14 slide.</p> <p>15 Answer: It's the other way around. Yes. I've got</p> <p>16 it wrong on the slide, actually. It should be six</p> <p>17 threads for ULS; it should be seven threads for SLS. My</p> <p>18 apologies for that."</p> <p>19 Now, we can look at the stage 3 report, but would</p> <p>20 you like to have a think about that and see whether it</p> <p>21 is in fact the wrong way around?</p> <p>22 A. It is. I must have been suffering stage fright at that</p> <p>23 point. It makes common sense that the lesser engagement</p> <p>24 of threads will take a lesser load, so that is obviously</p> <p>25 SLS. The greater number of threads is required for the</p>

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<p>1 higher strength required at ultimate limit state. So</p> <p>2 the slide was right. My apologies for misleading you.</p> <p>3 Q. The slide is right.</p> <p>4 COMMISSIONER HANSFORD: My apologies for causing the</p> <p>5 confusion.</p> <p>6 A. Thank you.</p> <p>7 MR PENNICOTT: Thank you very much, Prof McQuillan.</p> <p>8 Sir, I have nothing else.</p> <p>9 CHAIRMAN: Sorry, could I ask here, just to clarify in my</p> <p>10 own mind -- so that the six threads or however many</p> <p>11 threads for ultimate limit state, those threads will do</p> <p>12 what?</p> <p>13 A. So what we are saying is that to perform fit for purpose</p> <p>14 under normal, everyday conditions, we need a minimum of</p> <p>15 six threads. That has been proved by testing. But if</p> <p>16 the structures were ever subjected to the load at which</p> <p>17 they would fail, which is ultimate limit, a minimum of</p> <p>18 seven engaged threads would suffice.</p> <p>19 CHAIRMAN: All right. And Atkins are saying that they</p> <p>20 accept that to be a correct calculation?</p> <p>21 A. That comes from their report, that is right.</p> <p>22 CHAIRMAN: But they don't take them into account?</p> <p>23 A. No. They have been instructed to override that</p> <p>24 observation by imposing the strength reduction factors</p> <p>25 dictated by the holistic report.</p>	<p>1 Q. This morning, I only have a few matters I would like to</p> <p>2 discuss with you. Most of them are not really</p> <p>3 controversial; it's just to seek clarification.</p> <p>4 May I start with paragraph 19 of your first report,</p> <p>5 please. At the bottom, almost at the end of</p> <p>6 paragraph 19, you said:</p> <p>7 "On site, if a partially engaged bar is screwed into</p> <p>8 the coupler until resistance is met, the threads will</p> <p>9 still lock and, in my opinion, prevent initial</p> <p>10 slippage."</p> <p>11 Do you see that?</p> <p>12 A. Yes.</p> <p>13 Q. So am I right that this is an assumption on your part</p> <p>14 that on site the workers screw in the threaded bar until</p> <p>15 resistance is met? Is it an assumption on your part?</p> <p>16 A. I think it's based on the evidence we have already heard</p> <p>17 about the practical difficulties of workmen engaging</p> <p>18 these bars on site, and Dr Glover has stated his opinion</p> <p>19 on several occasions that these chaps are not trying to</p> <p>20 do a shoddy job, they're trying to screw in the bar to</p> <p>21 the best of their ability. They have no idea whether</p> <p>22 it's fully engaged or not.</p> <p>23 Q. But am I right in saying that we cannot be sure that for</p> <p>24 each and every bar, the workers screwed them in until</p> <p>25 resistance is met?</p>
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<p>1 CHAIRMAN: Okay. Good. Thank you very much. I understand</p> <p>2 now. Thank you.</p> <p>3 MR PENNICOTT: Sir, because Prof McQuillan, as it were,</p> <p>4 indicated that the slide was in fact correct, I didn't</p> <p>5 take him to the Atkins stage 3 assessment, which we</p> <p>6 would have looked at had there been a problem, but for</p> <p>7 the transcript and for everybody's reference, the Atkins</p> <p>8 stage 3 assessment is at OU6, starting at page 4026, and</p> <p>9 the relevant part for this purpose is at page 4138.</p> <p>10 CHAIRMAN: Yes?</p> <p>11 MR CHOW: Good morning, Mr Chairman. Good morning,</p> <p>12 Prof Hansford.</p> <p>13 Mr Chairman, this morning, I'm afraid I will have to</p> <p>14 disappoint my learned friend Mr Pennicott. Originally,</p> <p>15 I had 14 pages of questions prepared for Prof McQuillan,</p> <p>16 but as you are aware, yesterday I covered quite a lot of</p> <p>17 matters with Dr Glover and having reviewed my questions</p> <p>18 there are actually not many left. So I am trying to</p> <p>19 finish my questioning hopefully before the morning</p> <p>20 break.</p> <p>21 MR PENNICOTT: That doesn't disappoint me, that pleases me!</p> <p>22 COMMISSIONER HANSFORD: That's a form of sarcasm, I think</p> <p>23 Cross-examination by MR CHOW</p> <p>24 MR CHOW: Good morning, Professor.</p> <p>25 A. Good morning.</p>	<p>1 A. Even if that were to be the case, and assuming the two</p> <p>2 exposed thread criteria was met, I would refer you first</p> <p>3 of all to the evidence we have just gone over about the</p> <p>4 engagement of couplers or bars when there is grit</p> <p>5 contained in the coupler. The second situation is my</p> <p>6 slide, what is it, I can't really read that, 28, I think</p> <p>7 it is, if we could call that up, please.</p> <p>8 Q. Slide 28?</p> <p>9 A. Yes, please.</p> <p>10 Yes. So my postulation is that even if the workers</p> <p>11 do not manage to fully engage this bar, and even if</p> <p>12 there was a little bit of slack in the threads at the</p> <p>13 point where they are holding it and taking the weight</p> <p>14 off it, once they let that bar go, under its own</p> <p>15 self-weight, it is going to try and pull out of the</p> <p>16 coupler, and therefore any perceived slack in the</p> <p>17 threads would then be taken out of it, a bit the same as</p> <p>18 the grit.</p> <p>19 In both those situations there is no possibility of</p> <p>20 slack in the threads.</p> <p>21 Q. Right. Now, as you mention about your slide, perhaps</p> <p>22 it's a convenient moment that I further discuss with you</p> <p>23 on this. We have received evidence from the steel</p> <p>24 fixers who explained to us how they fixed the steel, and</p> <p>25 the Commission was told that what actually happened is</p>

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<p>1 the steel fixers will prepare what they call the "sifu"                  2 bar which is basically a distribution bar and this bar                  3 will be placed on spacer. This is how the steel fixers                  4 start to fix the reinforcement. Before they start to                  5 lay the bottom steel, they will put a grid of spacers                  6 and on top of it a distribution bar, and then on top of                  7 distribution bar they start to place the main                  8 reinforcement.                  9 So, in other words, the way they fix the steel                  10 reinforcement, the weight of the reinforcement would be                  11 taken up by the platform, because of the distribution                  12 bar and the spacer which sit on top of the platform.                  13 So when the worker first screws in a piece of                  14 perhaps 4 metres length of starter bar with a threaded                  15 end, in the first instance, when they start to leave the                  16 bar to hang on its own weight, this is when you say that                  17 there is some kind of slack which has occurred; right?                  18 A. I'm suggesting that's the point at which the slack is                  19 taken out of the assembly.                  20 Q. Right. But subsequently, after they have put in the                  21 remaining horizontal bar which sits on top of the                  22 spacer, when they start to tie this starter bar with the                  23 rest of the horizontal bars, would that operation                  24 release again the slack?                  25 A. No. In my opinion, it doesn't, and I'm very familiar</p>	<p>1 Q. My instruction is that at the moment, on top of the EWL                  2 slab, Leighton has already built another platform on top                  3 of it. In other words, the top of the EWL slab is                  4 covered up at the moment.                  5 I'm not trying to argue with you whether cracks have                  6 been caused by the partially engaged couplers. Just on                  7 the assumption that cracks actually are now caused by                  8 the partially engaged couplers, the fact that now the                  9 top of the EWL slab has been covered up by platform                  10 slab, do you agree that even if there are such cracks on                  11 top of the EWL slab, no one would be able to see it at                  12 the moment?                  13 A. So let me take that in stages. So the experts have had                  14 several opportunities in the past to actually visit                  15 site. When the track form that you're referring to had                  16 been removed to allow investigation of the situation at                  17 the top of the EWL slab -- so we've actually seen those                  18 occasions without the superficial concrete on top and we                  19 have not observed any cracks. It follows that I think                  20 Dr Glover, Mr Southward and myself, for all the reasons                  21 opined in our reports, believe that it's impossible for                  22 this type of cracking to manifest anyway because we're                  23 not expecting any slippage in these couplers, and so we                  24 don't believe that cracking is a possibility.                  25 Q. All right. Thank you.</p>
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<p>1 with the process of laying up the rebars you indicate.                  2 These starter bars in the bottom layer would be the                  3 first elements to be engaged. They probably don't have                  4 any spacers. Maybe they put a spacer onto the end of                  5 it, I don't know. Then, as you say, the rest of that                  6 layer is laid up and then they move to the one above it.                  7 So I don't think there's any possibility of the slack                  8 being taken out of it.                  9 Now, if you think again about the practical assembly                  10 of these starter bars on site, from previous evidence we                  11 know that unless the two or three workmen who are                  12 actually holding the weight of that 6 metre bar or                  13 4 metre bar, until they actually get the alignment                  14 100 per cent correct, they are unable to screw it in.                  15 So any slight misalignment, whether before engagement,                  16 during engagement, post-engagement, means that the                  17 threads cannot be slack.                  18 Q. All right. Thank you.                  19 Can I now move on to paragraph 21, where you mention                  20 that:                  21 "The inspections carried out to date have yielded no                  22 evidence of any such cracking."                  23 There we are talking about any cracking caused by                  24 the initial slip of the partially engaged couplers.                  25 A. Mmm.</p>	<p>1 The next topic I would like to move on to is in                  2 relation to the benchmark, because as I mentioned                  3 earlier, when I discussed with Dr Glover, at the moment                  4 it appears that different experts may refer to                  5 a different benchmark when it comes to the question of                  6 whether the structure is safe.                  7 I would like to discuss with you on this. If I may                  8 refer you to paragraph 50 of your first report. In                  9 paragraph 50 you said:                  10 "The term 'safety' implies that there is no risk of                  11 collapse to a structure when subject to the full loading                  12 regime to which is specified. A structure can, however,                  13 be safe and not code compliant and can therefore be 'fit                  14 for purpose' provided that durability and consequential                  15 longevity are not compromised."                  16 In paragraph 51, it said:                  17 "The Hong Kong Code of Practice, like any other                  18 'limit state' code, arrives at its minimum standard                  19 safety by applying markup factors to both materials ie                  20 concrete and steel, and also to the applied loadings to                  21 cater for uncertainties and variations et cetera. This                  22 means that if one was to design a structure 'to the                  23 bone' in compliance with code requirements, it would not                  24 only be safe but have a significant reserve capacity."                  25 Then in paragraph 54 you said:</p>

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<p>1 "In summary therefore it is acceptable to design                  2 from 'first principles' and, for example, to apply loads                  3 to which the structure will actually be subjected                  4 instead of 'building in' robust margins of safety by                  5 incorporating generically specified loads which will                  6 never be realised in practice."                  7 Now, if we read the three paragraphs together,                  8 am I right that as far as your opinion is concerned, the                  9 relevant benchmark will be if the structure is able to                  10 take up the expected loading, without applying the                  11 partial load factor and without applying the material                  12 factor of safety, as far as you are concerned, you would                  13 consider it as safe? Is that the relevant benchmark                  14 that you --                  15 A. That is simplifying it too much. There are two issues.                  16 So Dr Glover -- and there's no point going over all his                  17 ground because he has very admirably explained how the                  18 partial safety factors, and I make the same points, are                  19 to cater for those uncertainties. Then there's the                  20 question of loading which, as we explained yesterday in                  21 answer to the Commissioner's question, is a generically                  22 derived load -- for example, if one is designing                  23 a building structure for office use, one automatically                  24 looks at the Code of Practice or the British Standard                  25 for loading or the Eurocode and takes 5 kilonewtons</p>	<p>1 may not be as high as is specified in the code; is that                  2 right?                  3 A. Yes. I think that sums it up.                  4 Q. Paragraph 131 of your first report. Here we are dealing                  5 with the shear links, investigation of shear links. In                  6 paragraph 131 you said:                  7 "Arup opine that, because of the practical                  8 difficulties of threading the shear links down through                  9 the multiple layers of heavy slab rebar that the hooks                  10 are probably engaging on another layer of rebar further                  11 up in the slab soffit."                  12 If we go to Arup's report at page OU6/9612, please.                  13 This is part of Arup's report. Prof McQuillan, you                  14 referred to paragraph 2.6 at page 9611. However, in                  15 paragraph 3.3, just the next page -- let me check                  16 whether this is correct.                  17 A. That is actually the paragraph I was referring to.                  18 Q. All right. So do you agree that actually Arup does not                  19 rule out the possibility that perhaps there was no shear                  20 link? Because if you look at the second paragraph under                  21 paragraph 3.3, what Arup says is:                  22 "In the latter case this could be that the tabs are                  23 attached to a layer of rebar deeper into the slab, or                  24 the links were not installed."                  25 So the way I read Arup's report is Arup actually has</p>
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<p>1 a square metre.                  2 We all know from research being currently carried                  3 out at University of Cambridge and Bath that even if you                  4 were to get hundreds of people standing with their arms                  5 aloft, crammed into that space, you're probably never                  6 going to generate more than 1 kilonewton per square                  7 metre.                  8 So that's what I'm basically alluding to. The codes                  9 generically specify loadings way in excess of what the                  10 structure is ever going to be subjected to. Dr Glover                  11 is coming at the actual partial safety factors, where he                  12 has explained, and he used the illustration of the                  13 3 metre slab where if there's a slight variation in the                  14 soffit levels one can actually measure that, go back                  15 into the partial safety factors, reduce them.                  16 So that explains my concept.                  17 Q. I see.                  18 A. But if you go back to the illustration in my slide, and                  19 we don't need to call it up, of the simple beam analogy,                  20 that beam has a specific point at which it is going to                  21 fail when you apply a certain amount of load to it.                  22 Q. As I understand what you say, basically, for you to                  23 decide whether a structure is safe, you would expect                  24 that at least some sort of factor of safety has to be                  25 taken into consideration, although the factor of safety</p>	<p>1 not ruled out the possibility that perhaps no shear link                  2 has been installed in that location.                  3 Now, would you rule out this possibility?                  4 A. I'm not sure of the question. I'm agreeing with Arup.                  5 I'm concurring with --                  6 Q. But as far as you're concerned, when we see no shear                  7 link after opening-up, would you rule out the                  8 possibility that no shear link was actually installed by                  9 Leighton at that location?                  10 A. Again, I'm not sure of what you're asking me, because                  11 the preponderance of evidence that we've seen to date,                  12 including the massive amount of photographic records,                  13 show that it's impossible for shear links not to be                  14 present. I'm not sure if that's the question you're                  15 asking me.                  16 Q. My question actually is more precise. At the location                  17 where opening-up shows that no shear link appears --                  18 A. Yes.                  19 Q. -- would you rule out the possibility that at that                  20 particular location no shear link was actually installed                  21 by Leighton?                  22 A. I would say it is highly improbable that no shear links                  23 were installed at those locations. I would think most                  24 likely they were installed but we have been unable to                  25 see them.</p>

Page 17	<p>1 Q. I see. So you would agree with me that the whole</p> <p>2 opening-up exercise would be a waste of money because</p> <p>3 even if we don't find any shear links, one can safely</p> <p>4 assume that there were shear links there?</p> <p>5 A. It's a very prudent way to go about assessing</p> <p>6 a situation, and we have been decrying the fact that in</p> <p>7 other areas, like the HHS trough walls, no opening-up at</p> <p>8 all has been carried out. So you must always look for</p> <p>9 the evidence. It doesn't mean you are always going to</p> <p>10 find it, simply.</p> <p>11 Q. So, to be prudent, you would recommend that if we can't</p> <p>12 find any trace of shears link after the removal of the</p> <p>13 concrete cover, one should at least attempt to further</p> <p>14 dig into the inner layer to make sure that there are</p> <p>15 shear links there; right?</p> <p>16 A. Provided that what we are doing is not detrimentally</p> <p>17 affecting the structure.</p> <p>18 Q. Okay.</p> <p>19 A. It's a question of balance, isn't it?</p> <p>20 Q. Of course, yes.</p> <p>21 I would like now to move on to the construction</p> <p>22 joint. You now say that the installation of a dowel bar</p> <p>23 on top of diaphragm wall --</p> <p>24 CHAIRMAN: Sorry, can I just ask again, just to</p> <p>25 understand -- as far as the shear links are concerned in</p>	Page 19	<p>1 CHAIRMAN: That helps me. Thank you. So in fact Dr Lau is</p> <p>2 looking at limited areas that were critical from the</p> <p>3 point of view of --</p> <p>4 MR CHOW: Structural.</p> <p>5 CHAIRMAN: -- structural integrity, and has said in those</p> <p>6 areas only, because there's no actual evidence of shear</p> <p>7 links properly installed, let's work on the basis that</p> <p>8 in these limited areas, even though there's evidence</p> <p>9 elsewhere of them being installed, we will work on the</p> <p>10 assumption in these areas that they have not been</p> <p>11 installed at all --</p> <p>12 MR CHOW: Yes, this is my understanding.</p> <p>13 CHAIRMAN: -- and we will take remedial steps to make good?</p> <p>14 MR CHOW: Yes.</p> <p>15 A. May I add to that, please?</p> <p>16 Q. Sure.</p> <p>17 A. I think I have to defend Mr Southward's position on</p> <p>18 this, because had the openings been carried out in</p> <p>19 accordance with the originally intended method</p> <p>20 statement, they would have been opened up to an area of</p> <p>21 1 metre by 1 metre. The L shape -- and I think he's</p> <p>22 proved it quite adequately that they did not detect them</p> <p>23 simply because the opening-up of the soffit was not to</p> <p>24 the area that could have been.</p> <p>25 Q. Right. I'm sure, Prof McQuillan, you still recall that</p>
Page 18	<p>1 the areas to which you make reference, there are</p> <p>2 photographs, as I understand it, which show shear links.</p> <p>3 Whether they are fully engaged or not, we don't know,</p> <p>4 but they are there, in a number of areas and those areas</p> <p>5 include, by reference to locale and so, the areas under</p> <p>6 consideration. So we've got photographs of them. Does</p> <p>7 that not of itself indicate that if people were actually</p> <p>8 threading them down, the likelihood is they would have</p> <p>9 completed the installation of those shear links, and</p> <p>10 that that would indicate that there -- there may have</p> <p>11 not been complete installation but there was</p> <p>12 nevertheless fairly extensive installation?</p> <p>13 MR CHOW: Mr Chairman, Dr Lau, as far as I understand, his</p> <p>14 concern is -- he is not sure whether at the critical</p> <p>15 locations shear links were there. Now, we know that</p> <p>16 today the area where remedial works have to be carried</p> <p>17 out is very limited, so Dr Lau is only concerned with</p> <p>18 the critical locations.</p> <p>19 Given the fact that some of the opening-up shows</p> <p>20 that no shear link appears after the concrete was</p> <p>21 exposed, when it comes to the critical locations, to</p> <p>22 play safe, then one should not assume that shear links</p> <p>23 were there. It is my understanding that this is really</p> <p>24 the underlying rationale for the recommendation made.</p> <p>25 It's out of prudence.</p>	Page 20	<p>1 yesterday, when I discussed with Dr Glover, I showed him</p> <p>2 two photos of the honeycomb area which is much bigger</p> <p>3 than 1 metre by 1 metre. While the design required</p> <p>4 shear links to be spaced at I believe 150 millimetres,</p> <p>5 but over the whole area of 2-point-something metres by</p> <p>6 2 metres, only one shear link is found. What is your</p> <p>7 answer to that?</p> <p>8 A. I think Dr Glover explained it very admirably when he</p> <p>9 told you that in that particular location there was</p> <p>10 a lot of lapping of the heavy rebar in the bottom. So,</p> <p>11 in other words, you were reducing again the opportunity</p> <p>12 for the shear links to actually penetrate that bottom</p> <p>13 layer.</p> <p>14 Q. So you are suggesting, because of the difficulty, we can</p> <p>15 still assume that shear links were placed?</p> <p>16 A. I would say so. I would say they are probably -- as he</p> <p>17 has done, opined that they have been located in a area</p> <p>18 above the ones that we have seen.</p> <p>19 Q. But the two photos that we have looked at together, we</p> <p>20 are looking at honeycomb which is almost 300 millimetres</p> <p>21 deep into the slab.</p> <p>22 A. Yes.</p> <p>23 Q. So?</p> <p>24 A. I can't answer that.</p> <p>25 Q. Thank you.</p>

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<p>1 A. He has told you that, in any event, in that particular                  2 location the stresses are not critical.                  3 Q. Right. I will move on, actually.                  4 Now, the construction joint. What happened is -- my                  5 instruction is that as of yesterday, 26 holes out of                  6 a total of 47 have been cored on site, you know, the                  7 dowel bar to be installed on top of the diaphragm walls,                  8 to remedy the effect of a gap in the construction joint.                  9 Do you know what I am talking about?                  10 So in terms of progress of work, more than half of                  11 the core has been done so far.                  12 I'm not trying to argue with you whether dowel bar                  13 is necessary from a structural point of view, because it                  14 is water under the bridge already. Works are being                  15 carried out as of today. I'm more concerned with                  16 whether there is a risk of causing structural damage by                  17 the installation of the dowel bars.                  18 Now, have you had a chance to look at the latest                  19 method statement proposed by Leighton for the                  20 installation of dowel bars?                  21 A. This is the one that was presented to the Commission                  22 recently?                  23 Q. Yes.                  24 A. Yes.                  25 Q. You recall that the latest proposal from Leighton is</p>	<p>1 machine starts to cut into the reinforcement?                  2 A. That is my opinion, based on my experience.                  3 Q. Is it possible there are other types of machine, coring                  4 machine, which would enable the workers to appreciate                  5 when the coring operation gets in touch with the                  6 reinforcement?                  7 A. It's highly possible but I have not encountered such                  8 a machine.                  9 Q. All right. My instruction is that during the coring of,                  10 as I mentioned, the 26 number of cores on site, there                  11 was an occasion when reinforcement was encountered, and                  12 the worker actually, you know, doing the coring                  13 operation, was aware of that and stopped, so no                  14 reinforcement was cut on that occasion.                  15 Of course, technically this is not in evidence but                  16 this is the instruction that I obtained this morning.                  17 Another piece of fact that I believe is relevant in                  18 deciding whether there is a real risk of cutting                  19 reinforcement by the coring operation is that you will                  20 recall, Prof McQuillan, that actually in this particular                  21 job or in this particular project, Leighton has actually                  22 installed a lot of drill-in bars already. Do you recall                  23 that?                  24 A. Yes. There's a significant difference between drilling                  25 to install grouted dowel bars and coring, from my</p>
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<p>1 that when the core drilling machine crashed with any                  2 reinforcement, then Leighton will stop and then seek                  3 further instruction from MTR? Do you recall --                  4 A. I did.                  5 Q. -- there's a step like that?                  6 Do you agree with me that Leighton is a very                  7 experienced international construction contractor?                  8 A. Yes.                  9 Q. You would also agree with me that MTR has a lot of very                  10 experienced professional staff to supervise Leighton's                  11 work?                  12 A. No question.                  13 Q. No question about it, yes. Can we assume or rely on                  14 Leighton and MTR, that when they propose a method                  15 statement with a step like that, they know what they are                  16 doing?                  17 A. They may know what they are doing. I have presented                  18 evidence to the contrary, that when actually a coring                  19 machine is employed it cannot differentiate between hard                  20 aggregate in the concrete and steel rebar.                  21 Q. So what you are saying is that on the basis of that                  22 occasion that you witnessed in the UK, what you are                  23 saying is that what Leighton and MTR have proposed in                  24 its method statement actually does not work because in                  25 actual operation the worker will never know when the</p>	<p>1 experience.                  2 Q. Right. But your concern is the coring operation. Your                  3 concern is because this coring operation will not be                  4 able to realise when reinforcement is encountered, so                  5 there is a risk of cutting the reinforcement inside the                  6 concrete?                  7 A. Yes.                  8 Q. What I am saying is, during the first round of our                  9 Inquiry, we looked at a lot of problems that Leighton                  10 encountered with the couplers after the couplers were                  11 exposed by the high-pressure water jets, and to remedy                  12 that situation Leighton actually put in a lot of                  13 drill-in bars so as to compensate for the loss of the                  14 couplers?                  15 A. Of course.                  16 Q. And these drill-in bars would actually drill through the                  17 surface of the diaphragm wall; right?                  18 A. Yes.                  19 Q. You would no doubt agree with me that in terms of the                  20 quantity of reinforcement, the vertical reinforcement of                  21 the diaphragm wall are the 50mm diameter, closely                  22 spaced --                  23 A. Yes.                  24 Q. -- spaced 150 millimetres apart. So in terms of risk,                  25 if there is really a risk of cutting the reinforcement</p>

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<p>1 during the coring operation, there would have been much</p> <p>2 greater risk for that particular operation when Leighton</p> <p>3 installed drill-in bars on the surface of the diaphragm</p> <p>4 wall?</p> <p>5 A. You are actually using two different terms. You are</p> <p>6 using the term "drilling" which I am informed applied to</p> <p>7 the retro-installation of the type of bar you are</p> <p>8 talking about in the D-walls, and you are using the term</p> <p>9 "coring", and all I'm saying, based on my experience --</p> <p>10 and I may be wrong, you might have a magic machine in</p> <p>11 Hong Kong that detects steel when you are coring at</p> <p>12 depth -- in my experience, coring is a riskier operation</p> <p>13 than is drilling.</p> <p>14 But I'm not even sure why we are debating this,</p> <p>15 because we are agreed, all four experts are agreed, that</p> <p>16 dowel bars were not necessary.</p> <p>17 Q. As I mentioned earlier, because the work is now being</p> <p>18 carried out on site, the government is more concerned</p> <p>19 with whether there is a real risk of causing structural</p> <p>20 damage to the structure.</p> <p>21 A. Okay. I have expressed my reservations. If someone</p> <p>22 wants to turn a blind eye, that's fine. All I did in my</p> <p>23 report was raise the possibility that the steel at depth</p> <p>24 could be damaged. That's all I'm saying. If government</p> <p>25 wants to plough on, ignore that sort of precautionary</p>	<p>1 COMMISSIONER HANSFORD: I think I just heard the contrary</p> <p>2 point from Prof McQuillan, that -- I don't think that's</p> <p>3 correct, what you've just said. Sorry, I was just</p> <p>4 making the simple observation that if the experts are</p> <p>5 telling us there's a risk here, and that the work is not</p> <p>6 required, it seems to me, just from a commonsense point</p> <p>7 of view, that the best solution is to stop the work.</p> <p>8 MR CHOW: But we have gone so far as to produce a holistic</p> <p>9 proposal. The work has been ongoing for some time. As</p> <p>10 I am standing here, my observation is that unless we are</p> <p>11 sure that there is a real risk of causing structural</p> <p>12 damage, it will be a difficult decision to make to stop</p> <p>13 the work at the moment.</p> <p>14 But, as I have just submitted to the Commission, my</p> <p>15 instruction is that there were occasions when</p> <p>16 reinforcing bar was encountered and the worker on that</p> <p>17 particular occasion knew that reinforcement was</p> <p>18 encountered and he stopped, and this is in line with</p> <p>19 Dr Lau's evidence.</p> <p>20 A. Okay. Can I just rewind, Mr Chow?</p> <p>21 Q. Sure.</p> <p>22 A. What three of us have said, in any event -- all four</p> <p>23 experts agree that this is purely a workmanship issue,</p> <p>24 we should strike it off the list, but because the public</p> <p>25 have been told already that remedial works are to be</p>
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<p>1 advice, if Leighton prove on site that they have</p> <p>2 a methodology for doing that successfully -- I'm not</p> <p>3 even interested and I don't think the Commission is</p> <p>4 interested either.</p> <p>5 Q. The government is certainly interested because, as</p> <p>6 an administration body of the Buildings Ordinance, we</p> <p>7 need to ensure --</p> <p>8 A. Sure.</p> <p>9 Q. -- that no further structural damage is caused by the</p> <p>10 remedial works so I'm afraid I have to continue to</p> <p>11 discuss with you on this subject.</p> <p>12 A. If my advice is ignored, so be it.</p> <p>13 COMMISSIONER HANSFORD: I think Prof McQuillan makes</p> <p>14 an interesting point that if the concern is regarding</p> <p>15 damage, why isn't the work stopped?</p> <p>16 MR CHOW: Prof Hansford, of course I don't have any formal</p> <p>17 instruction on that, but as I see it, drill-in bar is</p> <p>18 not a new thing in Hong Kong.</p> <p>19 COMMISSIONER HANSFORD: I'm not talking about the drill-in</p> <p>20 bar. I thought I'm talking about the coring at the</p> <p>21 construction joint.</p> <p>22 MR CHOW: Prof Hansford, as I understand it, every time we</p> <p>23 need to install drill-in bar we need to core the</p> <p>24 concrete, so a similar operation would have been carried</p> <p>25 out. Unless I am told -- I stand to be corrected.</p>	<p>1 carried out, we should allay their concerns as far as</p> <p>2 possible.</p> <p>3 All we suggested was that at the few locations that</p> <p>4 were originally identified, that some token gesture</p> <p>5 should be made. What I am saying, what Dr Glover is</p> <p>6 saying, what Mr Southward is saying, the method that</p> <p>7 would cause least risk would be simply to drill the</p> <p>8 smaller diameter holes, in accordance with Leighton's</p> <p>9 method statement, and just pressure-inject a bit of</p> <p>10 grout; that's all that's needed.</p> <p>11 There seems to be this determined, head in the sand</p> <p>12 approach to install dowel bars, which were designed --</p> <p>13 and we've explained it all both here and in the original</p> <p>14 hearing -- for a completely different purpose. The</p> <p>15 structural dowel bars -- sorry, the vertical dowel bars</p> <p>16 were intended to fulfil a structural remediation</p> <p>17 solution, which is not required here, so why go to the</p> <p>18 possibility of damaging the structure, even, to install</p> <p>19 those dowel bars when they're not necessary?</p> <p>20 It seems to me just that someone is digging their</p> <p>21 heels in to make a point, "We must have these dowel bars</p> <p>22 at all costs even though they are not necessary."</p> <p>23 That's my view on it.</p> <p>24 Q. Yes. Actually, I take your point already, but it is not</p> <p>25 the point that we need to discuss this morning. We need</p>

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<p>1 to discuss whether there is a real risk of causing</p> <p>2 further structural damage --</p> <p>3 A. Again, I just repeat that I raised it in my report</p> <p>4 simply to flag that it's riskier than a drilling</p> <p>5 operation and therefore so be it if you want to pursue</p> <p>6 it.</p> <p>7 MR PENNICOTT: With respect, whilst of course I'm not</p> <p>8 stopping Mr Chow asking the questions, whether this is</p> <p>9 the right forum to debate whether or not there is</p> <p>10 a risk, one would have thought the government and the</p> <p>11 MTR have been on notice about this problem, the risk,</p> <p>12 since at least 11 October, when Mr Southward served his</p> <p>13 report, because Mr Southward was the first person to</p> <p>14 identify, chronologically, that there may be a risk.</p> <p>15 As I think I said in opening, quite how one</p> <p>16 quantifies the risk, I'm still not sure, but clearly</p> <p>17 we've got at least two and probably three renowned</p> <p>18 experts saying there's a risk, and how one, as I say,</p> <p>19 looks into that question and comes to a conclusion about</p> <p>20 the magnitude of the risk -- well, that's probably not</p> <p>21 really a matter for the Commission.</p> <p>22 COMMISSIONER HANSFORD: I don't think it is necessarily</p> <p>23 a matter for the Commission, but it would seem rather</p> <p>24 odd that this risk is there and the Commission -- and it</p> <p>25 appears that no steps are being taken to eliminate this</p>	<p>1 down.</p> <p>2 MR CHOW: Prof McQuillan, can I ask one further question on</p> <p>3 this. If the dowel bar has to be installed, would you</p> <p>4 have any recommendation in terms of steps and procedures</p> <p>5 to further reduce the risk?</p> <p>6 A. My stand says it's not required so forget about it;</p> <p>7 don't do it.</p> <p>8 Q. All right.</p> <p>9 A. It's actually introducing -- it's introducing something</p> <p>10 which was raised in terms of structural strengthening,</p> <p>11 and this is by way of repetition for emphasis, and that</p> <p>12 is being -- that concept is being continued, if you</p> <p>13 like, under the smokescreen or under the guise of</p> <p>14 injecting a bit of grout to fix a potential gap in</p> <p>15 a horizontal joint deep down into the D-wall.</p> <p>16 So it's not necessary.</p> <p>17 Q. Okay.</p> <p>18 CHAIRMAN: And is what Leightons have said some time ago.</p> <p>19 A. I see that. Thank you.</p> <p>20 MR CHOW: Prof McQuillan, just to finish off this topic, can</p> <p>21 I ask you to look at your report back in January, the</p> <p>22 last report, where -- I think it's ER1, tab 3, and</p> <p>23 internal page 42.</p> <p>24 You recall that you have prepared this diagram on</p> <p>25 the top?</p>
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<p>1 risk.</p> <p>2 MR PENNICOTT: No. As I said in the words of opening that</p> <p>3 I made last Thursday, I raised this point because it is</p> <p>4 a safety/fit for purpose issue potentially for the</p> <p>5 Commission.</p> <p>6 COMMISSIONER HANSFORD: It is.</p> <p>7 MR PENNICOTT: But quite how one takes it forward, other</p> <p>8 than to say there is a risk, I'm not really sure.</p> <p>9 MR SHIEH: Can I just add, as to when people should be put</p> <p>10 on notice, at least so far as the MTR is concerned and</p> <p>11 by implication the government, can I ask the Commission</p> <p>12 to look at opening-up bundle page 3393. That is</p> <p>13 a letter from Leighton to MTR, dated as early as August</p> <p>14 2019.</p> <p>15 If I can ask you to look at 3394, under the heading</p> <p>16 "Gap in construction joints between EWL slab and</p> <p>17 D-wall", paragraph 9:</p> <p>18 "We are concerned that your proposed 'suitable</p> <p>19 measure' to construct a new reinforced concrete</p> <p>20 structure with dowel bars across the joint is</p> <p>21 unnecessary from an engineering perspective. The</p> <p>22 proposed methodology involves significant destruction of</p> <p>23 the as-constructed concrete which may ultimately be</p> <p>24 detrimental to the structure."</p> <p>25 So at that stage a marker has already been laid</p>	<p>1 A. Yes.</p> <p>2 Q. Actually, this diagram was borrowed by Mr Southward, and</p> <p>3 Mr Southward reproduced it in his slide.</p> <p>4 A. I remember that, yes.</p> <p>5 Q. If we then scroll down to paragraph 100, where you say:</p> <p>6 "The internal stresses at the top of wall</p> <p>7 construction joint are all of a compressive nature. The</p> <p>8 diagram illustrates why no tension or shear can occur at</p> <p>9 the interface. Any tendency for a shear force to</p> <p>10 develop across the interface would be resisted by the</p> <p>11 'clamping' action of the EWL and OTE slabs which bear</p> <p>12 against the D-wall."</p> <p>13 Do you see that?</p> <p>14 A. Yes.</p> <p>15 Q. And your position remains the same?</p> <p>16 A. Absolutely. It has been more than advocated by both</p> <p>17 Mr Southward and Dr Glover that there are enough</p> <p>18 vertical dowel bars crossing that construction joint, in</p> <p>19 the form of the original diaphragm wall main</p> <p>20 reinforcement. The addition of this little dowel bar,</p> <p>21 if I remember Mr Southward and Dr Glover correctly, adds</p> <p>22 another 1 per cent to the amount of steel crossing that</p> <p>23 joint.</p> <p>24 So yes, I maintain my position, and you will recall</p> <p>25 that in my evidence in the original hearing</p>



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<p>1 I recommended that an FEA analysis was carried out to</p> <p>2 put this issue to bed once and for all. Well, there</p> <p>3 have been many FEAs carried out and every single one has</p> <p>4 concluded that that joint has no stress worth talking</p> <p>5 about.</p> <p>6 Q. So in that case, no doubt you would agree that even if</p> <p>7 there is no shear reinforcement within that region, it</p> <p>8 would still be okay?</p> <p>9 A. Yes. So what I think you are asking is if in the event</p> <p>10 of shear reinforcement being cut in the diaphragm wall</p> <p>11 is not a disaster, I would probably agree, but let's not</p> <p>12 go there. It's not necessary.</p> <p>13 Q. Okay.</p> <p>14 I would like to move on to my last topic, the design</p> <p>15 of the trough wall, the collision load. Last night,</p> <p>16 I realised something new which I have to confess I was</p> <p>17 not aware of when I discussed the trough wall with</p> <p>18 Dr Glover yesterday. I have looked at AECOM's design of</p> <p>19 the trough wall.</p> <p>20 A. Mm-hmm.</p> <p>21 Q. You remember you have mentioned a number of mitigation</p> <p>22 factors?</p> <p>23 CHAIRMAN: Sorry, I don't mean to cut across you</p> <p>24 mid-thought, just so I can catch up. In my layman's</p> <p>25 terms, is there anything wrong with the design? Because</p>	<p>1 CHAIRMAN: All right.</p> <p>2 MR CHOW: But as I just realised last night --</p> <p>3 COMMISSIONER HANSFORD: Sorry, what you understand is</p> <p>4 correct.</p> <p>5 MR CHOW: I just want to explore a little bit further with</p> <p>6 you regarding the particular mitigating factors in</p> <p>7 relation to the actual speed or reasonable speed that</p> <p>8 one would expect when a train gets into the siding area.</p> <p>9 Last night, when I looked at AECOM's design,</p> <p>10 I realised that this particular mitigating factor has</p> <p>11 already been taken into account by AECOM. If I may,</p> <p>12 I would like to refer to a few paragraphs, just to make</p> <p>13 sure you have the same understanding as me.</p> <p>14 If I may first go to MTRC's requirement in relation</p> <p>15 to the impact load, at bundle OU9, page 11138, please.</p> <p>16 A. Can I just make it clear while you're finding this:</p> <p>17 that's not my proposal. All I am doing is pointing out</p> <p>18 that this is one of Dr Glover's mitigating factors. So</p> <p>19 I can't really comment on the validity of this.</p> <p>20 Q. I understand, but as I failed to realise this when</p> <p>21 I discussed with Dr Glover, I would like --</p> <p>22 A. I see.</p> <p>23 Q. -- you to take a look to see whether my interpretation</p> <p>24 is correct.</p> <p>25 If you look at, first of all, paragraph 4.4.12.4,</p>
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<p>1 my understanding is that this is essentially a coupler</p> <p>2 problem and that what you've done is you've said because</p> <p>3 we're assuming a coupler problem, we're assuming</p> <p>4 a reduction, and therefore the design becomes</p> <p>5 problematic. In other words, if the couplers have been</p> <p>6 put in correctly on your basis, there would be no</p> <p>7 problem with the design; all would be fine. But the</p> <p>8 assumption of non-compliance in fully fitting the</p> <p>9 couplers requires a reduction assessment, and that then</p> <p>10 moves on to look at the integrity of the trough wall.</p> <p>11 MR CHOW: Mr Chairman, this is a correct understanding of</p> <p>12 the position, yes.</p> <p>13 CHAIRMAN: Right. So then, just so that I understand it, we</p> <p>14 are talking about a design problem that didn't exist at</p> <p>15 the time it was designed? It's a design problem that</p> <p>16 now manifests itself?</p> <p>17 MR CHOW: No. It is not my intention. The reason why</p> <p>18 I would like to discuss with Prof McQuillan on the</p> <p>19 design is in relation to the suggestion that perhaps</p> <p>20 there are mitigating factors, and one of those</p> <p>21 mitigation factors is that the train was running at</p> <p>22 a much slower speed, and that would be helpful and</p> <p>23 relevant because by suggesting that there is mitigating</p> <p>24 factors, the experts seem to suggest that there is</p> <p>25 further reserve or further safety factors.</p>	<p>1 it's part of MTRC's requirement in relation to the</p> <p>2 design of an impact load. What it says here is:</p> <p>3 "Station platforms edges shall be designed to</p> <p>4 withstand a nominal load of 1,000 kilonewtons [which is</p> <p>5 about 100 tonnes] acting horizontally and normal to the</p> <p>6 edge of the platform slab edge over a length of</p> <p>7 2.2 metres in conjunction with all factored permanent</p> <p>8 loads."</p> <p>9 If you may then go to look at the relevant part of</p> <p>10 AECOM's design, at bundle DD18.</p> <p>11 A. Sorry, I'm confused, because a minute ago you were</p> <p>12 talking about low train speeds. This is a collision</p> <p>13 load that we are talking about.</p> <p>14 Q. Yes, I'm coming to that.</p> <p>15 A. All right.</p> <p>16 Q. This is the impact load requirement set out in MTRC's</p> <p>17 New Works Design Manual. We will come to --</p> <p>18 A. I have no knowledge of the correlation between the two,</p> <p>19 by the way.</p> <p>20 Q. Yes. Let's take a look at AECOM's report. Bundle DD18,</p> <p>21 page 18494, please. Starting from paragraph 1.2.1 -- or</p> <p>22 perhaps the page before. That's right. This is part of</p> <p>23 AECOM's design report, explaining its consideration and</p> <p>24 how it applies the requirement and what modification</p> <p>25 that AECOM has adopted.</p>

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<p>1 Under paragraph 1.2.1 it says:</p> <p>2 "Railway structures shall be designed for accidental</p> <p>3 impact loads as per [MTRC's New Works Design Manual]</p> <p>4 clause 4.4.12.3 to 4.4.12.5, clause 13.4 and Hong Kong</p> <p>5 Building (Construction) Regulation ..."</p> <p>6 COMMISSIONER HANSFORD: Sorry, you said those two clauses</p> <p>7 are not applicable to the siding?</p> <p>8 MR CHOW: Yes. And in 1.2.2 -- this is the siding we are</p> <p>9 talking about:</p> <p>10 "Trains within HHS are running at a low speed and</p> <p>11 under control, thus the likelihood of the subsequent</p> <p>12 chance of colliding with a column is very low. Railway</p> <p>13 collision loads as per [the design manual] ... are not</p> <p>14 applicable for this siding.</p> <p>15 It has been confirmed with the Operations Division</p> <p>16 at commencement of the project that the operating speed</p> <p>17 on the launching track in the depot will not be higher</p> <p>18 than 25 kilometres per hour. In accordance with</p> <p>19 'Fundamentals of Railway Track Engineering-2003' ... the</p> <p>20 impact force on a structural element resulting from</p> <p>21 train collision varies linearly with the impact speed.</p> <p>22 If the design collision load of 1,250 kilonewtons is</p> <p>23 specified for train speed of 80 kilometres per hour,</p> <p>24 then the design collision load for train speed of</p> <p>25 25 kilometres per hour can be reduced to approximately</p>	<p>1 the load, instead of being applied at right angles,</p> <p>2 should be applied at an acute angle, and that would</p> <p>3 cause a huge amount of mitigation.</p> <p>4 The other factor that Dr Glover raised is that this</p> <p>5 particular -- and I haven't checked it, by the way; I'm</p> <p>6 taking his word -- that the loading specified is for</p> <p>7 a full train set. He is advocating that because the</p> <p>8 train is running empty, that the live load of passengers</p> <p>9 can also be discounted.</p> <p>10 So I don't think anybody is arguing about the low</p> <p>11 speed. We're acknowledging that the train enters the</p> <p>12 sidings at low speed.</p> <p>13 Q. What I'm trying to get your confirmation is in view of</p> <p>14 what AECOM has considered, one would -- am I right in</p> <p>15 thinking that the fact that the train would be running</p> <p>16 at a much slower speed and as a result would have less</p> <p>17 serious consequences has already taken been taken into</p> <p>18 account in AECOM's design consideration?</p> <p>19 A. Sorry, I'm still not sure what the question is, because</p> <p>20 we have all acknowledged the train will be running at</p> <p>21 low speed. AECOM have applied the loading in the way</p> <p>22 that they're told to apply it.</p> <p>23 Q. No. The design manual says it's 1,250 kilonewtons, and</p> <p>24 in consideration of the fact that the train getting into</p> <p>25 the siding would be at a slower speed they reduce it to</p>
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<p>1 400 kilonewtons by linear interpolation."</p> <p>2 Then paragraph 1.2.4:</p> <p>3 "Collision loads will be considered at ultimate</p> <p>4 limit state only using the appropriate partial load</p> <p>5 factors."</p> <p>6 Now, the work AECOM did in its design is AECOM has</p> <p>7 already taken into consideration the fact that the</p> <p>8 running speed of the train inside the depot, the siding,</p> <p>9 is lower, and because of that AECOM has already taken</p> <p>10 a much lower design load for the purpose of the design</p> <p>11 of the trough wall.</p> <p>12 A. Mm-hmm.</p> <p>13 Q. So, when it comes to the mitigating factor saying one</p> <p>14 should not expect the train to be running at full speed</p> <p>15 when it gets into the HHS, because these further</p> <p>16 mitigating factors have already been taken into account</p> <p>17 by AECOM?</p> <p>18 A. I don't think that's what Dr Glover was suggesting in</p> <p>19 his report. What Dr Glover was suggesting was that if</p> <p>20 there is to be a collision by the train at low speed,</p> <p>21 this particular -- the way the force -- the load is to</p> <p>22 be applied is specified as being directly at right</p> <p>23 angles to the trough wall; okay? What Dr Glover is</p> <p>24 saying is that that in reality cannot happen because the</p> <p>25 train is striking at a glancing angle; okay? Therefore</p>	<p>1 400 kilonewtons for the design.</p> <p>2 A. So? And they have proved that the thing is safe.</p> <p>3 What's the question? I'm lost, sorry.</p> <p>4 Q. Let's move on to the question of whether -- because we</p> <p>5 are talking about two separate mitigating factors. One</p> <p>6 mitigating factor is Dr Glover suggests that the actual</p> <p>7 train speed that one would expect inside the siding</p> <p>8 would be slower; all right? This is one mitigating</p> <p>9 factor. The other mitigating factor suggested is that</p> <p>10 when collision happened, it would not act perpendicular</p> <p>11 to the wall; right?</p> <p>12 A. Yes, I understand that.</p> <p>13 Q. So let's focus on this second mitigating factor.</p> <p>14 A. Okay.</p> <p>15 Q. Do you accept that it is quite common in structural</p> <p>16 engineering for the design of continuous wall, the</p> <p>17 loading which is usually specified would be a loading</p> <p>18 acting perpendicularly to the plane of the wall? Do you</p> <p>19 agree with me or not?</p> <p>20 A. That is the only way Dr Glover has explained that</p> <p>21 a dynamic loading can be applied in a quasi-static way.</p> <p>22 Q. Do you agree with my question --</p> <p>23 A. It is a simplification, if you like.</p> <p>24 Q. Do you agree with me, as a common practice for the</p> <p>25 purpose of designing a continuous wall, the design code</p>

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<p>1 could usually express the design loading as a certain</p> <p>2 value acting perpendicular to the plane of the wall; do</p> <p>3 you agree with me or not?</p> <p>4 A. Yes, of course, and no one is disputing that.</p> <p>5 Q. All right.</p> <p>6 A. And even with that taken into account, the design has</p> <p>7 been proved to be safe. All Dr Glover is saying is that</p> <p>8 the factor of safety in that wall, the reserve of</p> <p>9 strength, is so much more -- is so greater if you take</p> <p>10 these other factors into consideration, even in</p> <p>11 a qualitative way.</p> <p>12 Q. Right. So given that you agree with me that as a common</p> <p>13 practice the specified load would always be a load</p> <p>14 acting perpendicular to the wall for the purpose of</p> <p>15 design, there is nothing wrong with MTRC's requirement</p> <p>16 for impact loads to be a certain value acting</p> <p>17 perpendicular to the wall; do you agree with me or not?</p> <p>18 A. Absolutely, and the designer has to comply with the</p> <p>19 client's requirements.</p> <p>20 Q. Right. And this does not suggest, at the time of</p> <p>21 collision, the collision would be acting perpendicular</p> <p>22 to the wall; do you agree with me or not?</p> <p>23 A. That's the point I'm trying to make, and Dr Glover is</p> <p>24 trying to make, that the train would be striking the</p> <p>25 wall at a glancing angle.</p>	<p>1 If I refer to the American Code used by</p> <p>2 Mr Southward, the AASHTO --</p> <p>3 A. Yes.</p> <p>4 Q. -- now, do you agree that AASHTO is an organisation that</p> <p>5 deals with highway structures in America?</p> <p>6 A. I do, yes.</p> <p>7 Q. So the particular part of the AASHTO referred to by</p> <p>8 Mr Southward actually deals with the design of</p> <p>9 a parapet?</p> <p>10 A. Which in effect this is, because it's trying to contain</p> <p>11 vehicular impact.</p> <p>12 Q. And for that particular requirement the load specified</p> <p>13 was also a load acting perpendicular to the parapet?</p> <p>14 A. I have no problem with this concept at all.</p> <p>15 Q. So one would expect on a highway, when the car hits the</p> <p>16 parapet, of course no one can guarantee the car would</p> <p>17 hit at a right angle to the parapet, and nevertheless</p> <p>18 the load specified for the design of the parapet is</p> <p>19 something acting perpendicular to the parapet?</p> <p>20 A. Let me repeat. What we have, as Dr Glover explained, is</p> <p>21 a very dynamic situation. It's dynamic loading. It's</p> <p>22 not a static force that's being applied. It's something</p> <p>23 that is being applied by a moving train, a moving</p> <p>24 vehicle, and the codes cannot simulate that. You would</p> <p>25 have to do a very sophisticated computer modelling</p>
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<p>1 Q. Right.</p> <p>2 A. Sorry, just to follow that, the load therefore -- the</p> <p>3 impact -- when I use "impact", I'm using it in the sense</p> <p>4 of the effect on the trough wall is much less severe.</p> <p>5 Q. So what is stated in MTRC's design code is simply: you</p> <p>6 have to design the wall on the assumption that there is</p> <p>7 a force at a certain level acting perpendicular to the</p> <p>8 wall. The design code doesn't say this force</p> <p>9 corresponds to the force acting at an angle, when the</p> <p>10 train collides with the wall.</p> <p>11 A. I still don't get the question, sorry. Can you rephrase</p> <p>12 it in a different way for me?</p> <p>13 Q. Yes. You are suggesting, at the time of the collision,</p> <p>14 the train will not hit the wall perpendicularly?</p> <p>15 A. I agree.</p> <p>16 Q. And you are trying to suggest that if one assumes that</p> <p>17 a force is applied perpendicularly to the wall for the</p> <p>18 design, it is unreasonable because at the time of the</p> <p>19 collision, the train will not hit the wall at the right</p> <p>20 angle?</p> <p>21 A. I agree, but despite that fact, the designer has applied</p> <p>22 it in the way that is specified, and leaving aside any</p> <p>23 potential issue with the couplers, the wall is safe,</p> <p>24 full stop.</p> <p>25 Q. Okay. This is beside the point.</p>	<p>1 exercise to evaluate the exact loading. The codes are</p> <p>2 playing safe by applying the load as specified at right</p> <p>3 angles to the wall. There are a lot of situations like</p> <p>4 that in life.</p> <p>5 MR CHOW: Thank you very much, Prof McQuillan.</p> <p>6 Mr Chairman, Prof Hansford, I have no more</p> <p>7 questions.</p> <p>8 CHAIRMAN: Good. Thank you very much.</p> <p>9 Mr Shieh?</p> <p>10 Cross-examination by MR SHIEH</p> <p>11 MR SHIEH: Good morning, Professor.</p> <p>12 A. Good morning.</p> <p>13 Q. May I start off by congratulating you for taking up the</p> <p>14 presidency of the institution.</p> <p>15 A. Thank you.</p> <p>16 Q. Just one question. Do you remember a slide presented by</p> <p>17 Mr Southward in relation to the classification of the</p> <p>18 environment under the code?</p> <p>19 A. I do.</p> <p>20 Q. He was of the opinion that the environment of the</p> <p>21 interior of the Hung Hom Station, the part of the EWL</p> <p>22 slab that we are concerned with, falls within the</p> <p>23 description of "mild"; do you remember that?</p> <p>24 A. I do.</p> <p>25 Q. Do you agree with that classification?</p>

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<p>1 A. I do, and I think that appeared in one of my slides, at                  2 least. It has to be a mild environment. There's no                  3 rainfall penetrating that enclosure. In fact, any time                  4 we visited the station, it's quite hot and sticky in                  5 there, in a sense. He makes the point, Mr Southward,                  6 that the constant movement of trains is causing air                  7 changes, so it has to be a mild environment. It's no                  8 different from your own house.                  9 MR SHIEH: Thank you very much.                  10 I have no further questions.                  11 CHAIRMAN: Thank you.                  12 Mr Boulding?                  13 Cross-examination by MR BOULDING                  14 MR BOULDING: Yes. Good morning, Prof McQuillan. I just                  15 have one question. I wonder if we could look at your                  16 slide 79.                  17 Yes, that's the one. You say:                  18 "Having reviewed areas A, HHS and SAT (NAT was not                  19 in question) I am satisfied, without any doubt, that:                  20 -- the structures are safe and fit for purpose                  21 as-is".                  22 We are all very comforted by that, but then you go                  23 on to say:                  24 "-- there is no reason why the station should not be                  25 opened to the public".</p>	<p>1 "Let's not go there, it's not necessary." However, we                  2 are going there, because, as I understand it, this dowel                  3 work is continuing, and therefore I understand that your                  4 view is there is a risk of cutting some of this shear                  5 reinforcement in the coring exercise; is that correct?                  6 A. That's right.                  7 COMMISSIONER HANSFORD: So for me two questions arise from                  8 that. One: does that affect your opinion on safety and                  9 fitness for purpose?                  10 A. I think I've already, in answer to Mr Chow, opined --                  11 and it's not something I've looked into in depth -- but                  12 I should have thought that if it's only cutting a shear                  13 link, it will not have a hugely detrimental effect on                  14 the structural integrity.                  15 COMMISSIONER HANSFORD: Right.                  16 A. I think, when I raised this in my report, it was purely,                  17 "There could be a problem here, there could be damage                  18 caused." I think that letter from Leighton comes at it                  19 in a slightly different way. They weren't so much                  20 mentioning the cutting of reinforcement. They were                  21 mentioning the vibrational and detrimental effects to                  22 the concrete. So there are two issues.                  23 COMMISSIONER HANSFORD: Okay. And the second issue or                  24 question that arises from that for me -- we spoke                  25 yesterday about the need for long-term visual</p>
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<p>1 Now, by way of clarification I am right in thinking,                  2 am I not, that notwithstanding the fact that structures                  3 are safe and fit for purpose, it's still necessary to                  4 ensure that the works are code and contract compliant in                  5 order to obtain the requisite approval from the relevant                  6 authorities for the completion of the works and the                  7 subsequent commercial operation of the Shatin to Central                  8 Link?                  9 A. I made that comment purely on the basis of the                  10 directions of the Commission. So I'm coming at it from                  11 the point of view: if it's safe, fit for purpose, it                  12 could theoretically be opened to the public. I do                  13 recognise, however, and it's not part of my brief, that                  14 there is a certification process to be complied with.                  15 MR BOULDING: Thank you for that clarification. No further                  16 questions.                  17 Questioning by THE COMMISSIONERS                  18 COMMISSIONER HANSFORD: I have two questions.                  19 A. Sure.                  20 COMMISSIONER HANSFORD: I'm hesitant on both of them. The                  21 first one goes back to the construction joint and the                  22 second one is about the proper connection of couplers in                  23 the future.                  24 So, on the construction joint, we've had a long                  25 discussion this morning, and I think you just said,</p>	<p>1 monitoring.                  2 A. Yes.                  3 COMMISSIONER HANSFORD: I think your answer was, or your                  4 view, on one of your later slides was -- it's not this                  5 slide but it was one of your slides -- that with the                  6 suitable measures being installed --                  7 A. It should be the next slide.                  8 COMMISSIONER HANSFORD: Let's look at the next slide.                  9 A. It's missing.                  10 COMMISSIONER HANSFORD: It can't be that one. It's the one                  11 before then.                  12 A. I think the next slide is missing.                  13 COMMISSIONER HANSFORD: Right. But what you told the                  14 Commission yesterday was that --                  15 A. Sorry, it appeared on my presentation version, that's                  16 what it was.                  17 COMMISSIONER HANSFORD: Yes, yes, I know. Are we going to                  18 search for it? Let's search for it.                  19 So your final point was:                  20 "... if enhancement/strengthening work is                  21 implemented there is no justification for monitoring                  22 because the structures are even safer than                  23 as-constructed".                  24 A. Yes.                  25 COMMISSIONER HANSFORD: Given the risk of damage to some of</p>

Page 49	<p>1 the shear reinforcement in the coring for the</p> <p>2 installation of these dowel bars, is that still your</p> <p>3 opinion or would you be of the view that there should be</p> <p>4 some long-term visual monitoring?</p> <p>5 A. Not if these dowel bars are successfully installed.</p> <p>6 It's making everything more robust. Is that your</p> <p>7 question, sorry?</p> <p>8 COMMISSIONER HANSFORD: My question is whether your view is</p> <p>9 that long-term monitoring is still required.</p> <p>10 A. Purely the necessity for a more stringent form of</p> <p>11 monitoring is greatly diminished if these enhancement</p> <p>12 works are carried out. But even if they were not to be</p> <p>13 carried out, I stick with my original opinion. We know</p> <p>14 a lot more about these stations than we did at the</p> <p>15 original hearing. So I'm thinking, as Dr Glover, we</p> <p>16 only need to visually monitor.</p> <p>17 COMMISSIONER HANSFORD: No, I understand that in</p> <p>18 a generality. I'm just wondering, if damage is caused</p> <p>19 by this coring, whether you have a view that long-term</p> <p>20 monitoring would be required?</p> <p>21 A. It's a difficult question, that. Any damage should be</p> <p>22 obvious as they are doing it, I would suggest.</p> <p>23 COMMISSIONER HANSFORD: Right.</p> <p>24 A. If they successfully go ahead and grout in these dowel</p> <p>25 bars, I don't see that there is a problem. I think the</p>	Page 51	<p>1 friction between the male threads and the female</p> <p>2 threads?</p> <p>3 A. As the workers try to screw the bar in, I make the point</p> <p>4 unless it's 100 per cent perfectly aligned and the</p> <p>5 weight is supported by the workers, there will always be</p> <p>6 a frictional resistance, which will be diminished if one</p> <p>7 were to lubricate the inside of the coupler. That's the</p> <p>8 only point I'm making.</p> <p>9 COMMISSIONER HANSFORD: I understand. Thank you very much.</p> <p>10 MR PENNICOTT: Sir, just one topic, if I may, just to see if</p> <p>11 I can tease out a bit more information about the coring</p> <p>12 process for these dowel bars.</p> <p>13 Further examination by MR PENNICOTT</p> <p>14 Q. Prof McQuillan, in your slides yesterday, you showed us</p> <p>15 a photograph of a core taken on a project in the UK,</p> <p>16 I think.</p> <p>17 A. Yes.</p> <p>18 Q. Just looking at that -- I don't know what the material</p> <p>19 was that you were coring through there.</p> <p>20 A. What you see, the grey is the heavy concrete with the</p> <p>21 hard granite aggregate that we have in places in the UK.</p> <p>22 Q. All right. When Leighton or their sub-contractors who</p> <p>23 are doing this coring work at the Hung Hom Station at</p> <p>24 the moment, would you expect them to be able to produce</p> <p>25 cores of this nature?</p>
Page 50	<p>1 strength, if anything, is enhanced.</p> <p>2 COMMISSIONER HANSFORD: Okay. Thank you.</p> <p>3 My second issue relates to recommendations that we</p> <p>4 might be making regarding the future proper connection</p> <p>5 of couplers.</p> <p>6 A. Sure.</p> <p>7 COMMISSIONER HANSFORD: You very helpfully gave us your</p> <p>8 views on this. And of course the Commission -- let me</p> <p>9 just make clear -- won't be prescribing a way of</p> <p>10 installing couplers. That's a matter for the</p> <p>11 manufacturers and the designers. But we may well be</p> <p>12 recommending that it's looked at.</p> <p>13 A. Sure.</p> <p>14 COMMISSIONER HANSFORD: But am I right that there's</p> <p>15 a reliance on the dry friction between the male and the</p> <p>16 female threads in the couplers for --</p> <p>17 A. That should --</p> <p>18 COMMISSIONER HANSFORD: -- the resistance against the</p> <p>19 elongation?</p> <p>20 A. There will always be a resistance when screwing a male</p> <p>21 thread into a female coupler and, as I say, from the</p> <p>22 analogy of motor mechanics, it's recommended that one</p> <p>23 lubricates the male threads to make sure that the</p> <p>24 friction is diminished and one gets a truer result.</p> <p>25 COMMISSIONER HANSFORD: So we are not mobilising the dry</p>	Page 52	<p>1 A. Absolutely. The coring machine will extract the core,</p> <p>2 which should be available for inspection.</p> <p>3 Q. That was my next question. So presumably, if they can</p> <p>4 extract the cores, they will be able to see, by</p> <p>5 inspection, whether or not a piece of steel has been cut</p> <p>6 and is included in the core?</p> <p>7 A. Correct.</p> <p>8 MR PENNICOTT: Thank you very much. I just wanted to make</p> <p>9 that clear.</p> <p>10 CHAIRMAN: Thank you. I think that completes the evidence.</p> <p>11 Professor, thank you very much indeed.</p> <p>12 The evidence of all the experts has been of real</p> <p>13 assistance to us and we can't emphasise that enough.</p> <p>14 Not only that but there has been an ability on the part</p> <p>15 of everybody to reduce it all down to a level which is</p> <p>16 accessible to people who don't belong to the same</p> <p>17 fraternity. Thank you.</p> <p>18 (The witness was released)</p> <p>19 MR PENNICOTT: Sir, that is the conclusion of the evidence,</p> <p>20 I hope, he says touching some wood.</p> <p>21 CHAIRMAN: We did that last time!</p> <p>22 MR PENNICOTT: Sir, I think the position is this, that we</p> <p>23 adjourn now.</p> <p>24 CHAIRMAN: Yes.</p> <p>25 MR PENNICOTT: The involved parties have been invited to</p>

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<p>1 produce further written closing submissions by I think</p> <p>2 Friday, 17 January. Having received those, the</p> <p>3 Commission's legal team will produce some further</p> <p>4 closing submissions on Monday, 20 January, and we will</p> <p>5 re-convene for closing submissions on 22 to 24 January.</p> <p>6 What, I can tell my learned friends behind me, will</p> <p>7 happen probably this afternoon is an email will go out</p> <p>8 just reminding everybody about the position on closing</p> <p>9 submissions and inviting everybody to give an indication</p> <p>10 as to how long they would like in terms of the time</p> <p>11 required to make the oral presentations of those</p> <p>12 submissions, so that we can then devise a timetable for</p> <p>13 the three days that we have set aside.</p> <p>14 CHAIRMAN: These oral submissions go back a way of course?</p> <p>15 MR PENNICOTT: They incorporate the closing submissions that</p> <p>16 have already been produced in relation to the factual</p> <p>17 evidence on the second part of the Inquiry, which</p> <p>18 obviously were served back in July, and of course my</p> <p>19 learned friends all have an opportunity of making oral</p> <p>20 submissions about those submissions, and that will</p> <p>21 include not only those present today but I think</p> <p>22 certainly Wing &amp; Kwong -- perhaps not Atkins -- and</p> <p>23 Pypun. So we may have more people here in the closing</p> <p>24 submission stage than are here this morning.</p> <p>25 COMMISSIONER HANSFORD: Can I just raise a couple of points</p>	<p>1 will have heard that and no doubt they will let us know</p> <p>2 or let you know.</p> <p>3 MR BOULDING: Yes. Professor, I assume you're prepared to</p> <p>4 take that from the bar table and you wouldn't want any</p> <p>5 sort of confirmation by way of a witness statement or</p> <p>6 anything like that?</p> <p>7 COMMISSIONER HANSFORD: Absolutely not.</p> <p>8 MR BOULDING: All right.</p> <p>9 CHAIRMAN: Good. Thank you, everybody. We are adjourned</p> <p>10 then until the commencement of the final oral</p> <p>11 submissions. Thank you all very much.</p> <p>12 MR PENNICOTT: Thank you, sir.</p> <p>13 (11.30 am)</p> <p>14 (The hearing adjourned until 10.00 am</p> <p>15 on Wednesday, 22 January 2020)</p>
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<p>1 related to the closing submissions, just questions</p> <p>2 really.</p> <p>3 Last time, the closing submission from MTR very</p> <p>4 helpfully gave us progress that had been made against</p> <p>5 the Turner &amp; Townsend recommendations. Things have</p> <p>6 moved on since that last closing submission. I think</p> <p>7 the tribunal would find it very helpful if that could be</p> <p>8 brought up to date in this closing submission.</p> <p>9 MR PENNICOTT: Again my learned friend Mr Boulding will have</p> <p>10 heard that and I'm sure is about to give you an answer.</p> <p>11 MR BOULDING: Yes, Professor. We accept that will be very</p> <p>12 helpful. You will probably not be surprised to hear</p> <p>13 that already some work has been carried out on our</p> <p>14 submissions, and I can confirm that that point, if not</p> <p>15 exhaustively covered, has been covered.</p> <p>16 COMMISSIONER HANSFORD: Thank you very much.</p> <p>17 And a similar point. In the Commission's interim</p> <p>18 report, there were some recommendations, some</p> <p>19 recommendations for MTR and some recommendations for</p> <p>20 government.</p> <p>21 MR PENNICOTT: Yes.</p> <p>22 COMMISSIONER HANSFORD: I think again the Commission would</p> <p>23 find it helpful to be told what progress has been made</p> <p>24 against those recommendations in the interim report.</p> <p>25 MR PENNICOTT: Yes. Again, both Mr Boulding and Mr Khaw</p>	<p>1 INDEX</p> <p>2 PAGE</p> <p>3 PROF DON MCQUILLAN (on former oath) .....1</p> <p>4 Further examination by MR PENNICOTT .....1</p> <p>5 Cross-examination by MR CHOW .....6</p> <p>6 Cross-examination by MR SHIEH .....44</p> <p>7 Cross-examination by MR BOULDING .....45</p> <p>8 Questioning by THE COMMISSIONERS .....46</p> <p>9 Further examination by MR PENNICOTT .....51</p> <p>10 (The witness was released) .....52</p>