Page 1 Page 3 1 having regard to some fundamental matters which may well 1 Friday, 27 September 2019 2 2 (10.17 am)dictate the way forward in a way that is aimed at saving 3 CHAIRMAN: Yes. Thank you. 3 time and still meeting the terms of reference of the 4 Firstly, could I apologise for keeping everybody 4 Commission. 5 5 waiting. I thought that the matter might take just That sounds very general, and apologies to the 6 a minute or two before 10 am, but it took somewhat 6 public, but what I can say is that what was discussed 7 7 and what will still be discussed, in order to better longer than that. 8 8 fashion the way forward, will be formalised and made The fact of the matter is that there's a particular 9 point which is not one of evidence, it's one of the way 9 public in the next few days. So nobody is keeping 10 10 forward, and it is actually a point of some fundamental anything from the press or from the public, but, as 11 importance, in my view. I may be wrong, but I feel that 11 always in cases of this kind, initial ideas, initial 12 12 the matter by way of the Commission is worthy, at this concerns, have to be better formulated, they have to be 13 stage, of a brief discussion with all counsel, in 13 discussed, everybody has to have some commonality of 14 14 purpose, and we have to make sure that the terms of chambers, just to try and understand the way forward; 15 15 all right? I'll explain the position and seek your reference are being honoured, and once that is done then 16 assistance. 16 everything will be made known and both the press and the We were thinking of perhaps proceeding more formally 17 17 public will have a far better idea of where we are 18 by way of letters, questionnaires and the like and then 18 19 19 having a meeting maybe next week, but to be honest with So this is one of these situations where we just 20 you I feel that the sooner we get to grips with this, 20 need to get our house in order and then we will open the 21 21 door of that house to the press. perhaps, the better. All right? It may well dictate 22 22 how we proceed in the future. It may well save us time, Thank you. 23 23 and therefore cost. MR KHAW: May it please Mr Chairman, may I now call the 24 24 government's statistical expert, Prof Yin Guosheng. That all sounds a bit intriguing, no doubt, but what 25 I would like to do is just adjourn, shall we say --25 Page 2 Page 4 1 PROF YIN GUOSHENG (affirmed) 1 well, we'll just adjourn and then I will speak to 2 2 Examination-in-chief by MR PENNICOTT everybody in chambers, explain the concerns that we 3 3 Q. Thank you, Prof Yin. have, and then we can get an explanation in chambers, 4 off the record -- it's got nothing to do with any 4 We understand that for the purpose of this 5 commitment of evidence; it's all to do with how best to 5 Commission of Inquiry, you have submitted two reports, 6 one report for the Original Inquiry and one report for 6 proceed, that's all -- and then we can return and we can 7 7 hear from the professor. the Extended Inquiry. 8 8 If we can take a look at the two reports. The one Professor, I'm very sorry. I appreciate I'm keeping 9 you. You got here on time this morning. My apologies 9 regarding the Original Inquiry, it's item number 12, ER 10 10 item number 12; can you see that? The hard copy and for that. But hopefully we will be able to continue 11 with your evidence and complete it today. All right? 11 also the soft copy should appear in front of you. 12 12 Thank you very much indeed. If I can just take you to your first report. You 13 13 see your name at the top and also there's a signature on So where would be the best place to meet? Because 14 14 if it's in my chambers, it's going to be -page 2? 15 15 SECRETARY: The transmission room. A. Yes. 16 CHAIRMAN: All right. So we will meet next door in two or 16 Q. You confirm that that's your signature? 17 17 A. (Nodded head). three minutes. Thank you. 18 Q. Then the report actually consists of various pages. It 18 (10.21 am)19 19 goes all the way --(A short adjournment) 20 (11.18 am) 20 COMMISSIONER HANSFORD: Sorry, I think Prof Yin needs to be 21 CHAIRMAN: Just before we start, I think, for the benefit of 21 told that we can't take nods because they don't end up 22 22 on the transcript, so you have to say "yes" or "no", so the public, I should say just a couple of words, namely 23 23 that myself and Prof Hansford have met with counsel and it ends up on the transcript. 24 instructing solicitors in chambers, for the purposes of 24 A. Yes. Okay. 25 considering the best way forward for this Inquiry, 25 MR KHAW: For the purposes of the record.

	Page 5		Page 7
1	Thank you, Mr Commissioner.	1	Oral synopsis by PROF YIN GUOSHENG
2	You see that the report consists of various pages	2	WITNESS: Okay. Thank you very much. Mr Chairman,
3	and it goes all the way to page 20.	3	Mr Commissioner, good morning, everyone, I'm very
4	A. Yes.	4	honoured to come to this place to share with you my
5	Q. Then, after page 20, you see that you have also given us	5	statistical analysis about the whole investigation.
6	your CV?	6	My name is Guosheng Yin, I'm a professor and also
7	A. Yes.	7	the head of the department of statistics and actuarial
8	Q. First of all, you confirm that the contents of your CV	8	science at the University of Hong Kong.
9	are true and correct?	9	Next page, please. The question about this coupler
10	A. Yes.	10	connection, whether it's defective or non-defective is
11	Q. If we can then take you to the second report, that is	11	simply a "yes or no" question. So it's just like
12	for the Extended Inquiry, ER item number 4. Do you see	12	tossing a coin. You observe a head or observe a tail.
13	that?	13	So this kind of random variable follows what we call
14	A. Yes.	14	binomial distribution, and the equation in red here is
15	Q. Again your name appears at the top of page 1?	15	binomial distribution probability maths function.
16	A. Yes.	16	So we are interested in estimating p, so it's defect
17	Q. And there's a signature at page 3; do you see that?	17	rate in the whole structure, and the sample size is n,
18	A. Yes.	18	and the y is the number of defective coupler connections
19	Q. You confirm that that is your signature?	19	in the sample.
20	A. Yes.	20	Once we've estimated p, let's call it p-hat, based
21	Q. Now, in relation to these two reports, insofar as they	21	on our sample, and then we can construct a 95 per cent
22	contain factual matters	22	confidence interval, and it's given by the second
23	A. Yes.	23	equation on the screen, right here (indicating).
24	Q that you have outlined, you confirm that those	24	So we got this 95 per cent confidence interval, it
25	factual matters are true and correct?	25	basically shows at the bottom curve, you can see on the
	Page 6		Page 8
1	A. Yes.	1	left side and on the right side, they are 2.5 per cent.
2	Q. Insofar as they contain your opinions, do you confirm	2	That's basically the two tails of this bell-shaped
3	that they are your true and honest opinions?	3	curve, and in the centre is 95 per cent. So, basically,
4	A. Yes.	4	this is the most commonly used statistical confidence
5	Q. You have also prepared a response to Dr Wells' report,	5	interval, trying to characterise the variability of your
6	and in fact that has been uploaded to the bundle and it		
		6	estimator, which is called p-hat.
7	can be found at ER4.1.	7	estimator, which is called p-hat.  Next, please. But for this purpose of this
7 8	can be found at ER4.1. A. Yes.	7 8	estimator, which is called p-hat.  Next, please. But for this purpose of this investigation of this defective coupler rate, we are
8 9	can be found at ER4.1.  A. Yes.  Q. Do you see that?	7 8 9	estimator, which is called p-hat.  Next, please. But for this purpose of this investigation of this defective coupler rate, we are only concerned with the upper bound of this confidence
8 9 10	can be found at ER4.1. A. Yes. Q. Do you see that? A. Yes.	7 8 9 10	estimator, which is called p-hat.  Next, please. But for this purpose of this investigation of this defective coupler rate, we are only concerned with the upper bound of this confidence interval. That's basically I call "pu", represents
8 9 10 11	can be found at ER4.1.  A. Yes.  Q. Do you see that?  A. Yes.  Q. May I also confirm that your signature appears at the	7 8 9 10 11	estimator, which is called p-hat.  Next, please. But for this purpose of this investigation of this defective coupler rate, we are only concerned with the upper bound of this confidence interval. That's basically I call "pu", represents upper bound. So instead of we use a two-sided
8 9 10 11 12	<ul><li>can be found at ER4.1.</li><li>A. Yes.</li><li>Q. Do you see that?</li><li>A. Yes.</li><li>Q. May I also confirm that your signature appears at the first page of that response?</li></ul>	7 8 9 10 11 12	estimator, which is called p-hat.  Next, please. But for this purpose of this investigation of this defective coupler rate, we are only concerned with the upper bound of this confidence interval. That's basically I call "pu", represents upper bound. So instead of we use a two-sided confidence interval, we use one-sided, because we are
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8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	<ul> <li>can be found at ER4.1.</li> <li>A. Yes.</li> <li>Q. Do you see that?</li> <li>A. Yes.</li> <li>Q. May I also confirm that your signature appears at the first page of that response?</li> <li>A. Yes.</li> <li>Q. And it consists of several pages, up to page 16; right?</li> <li>A. Yes.</li> <li>Q. So you also confirm that the contents actually contain your honest and true opinions?</li> <li>A. Yes.</li> <li>Q. I understand that you have, for the purpose of today, prepared a synopsis.</li> <li>A. Yes.</li> <li>Q. I think you will be shown the synopsis on the screen.</li> </ul>	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	estimator, which is called p-hat.  Next, please. But for this purpose of this investigation of this defective coupler rate, we are only concerned with the upper bound of this confidence interval. That's basically I call "pu", represents upper bound. So instead of we use a two-sided confidence interval, we use one-sided, because we are only concerned with upper bound of the defect rate.  Next slide. So the first question we ask how many samples we need in order to have an accurate statistical estimation. So, basically, the sample size estimation problem and  CHAIRMAN: Can I just interrupt one thing?  A. Yes.  CHAIRMAN: We are talking about defects, and defects, I take it, are described numerically for you by the people who instructed you, in other words, what constitutes

	Page 9		Page 11
1	A. That's a definition from engineering.	1	process is you need to I have to discuss with
2	CHAIRMAN: That's right. So the engineers have given you	2	engineer what is kind of practical number, because if
3	a definition of what they consider to be a defect	3	the number is really, really high, it will endanger the
4	A. Yes.	4	whole structure.
5	CHAIRMAN: and you work from that?	5	COMMISSIONER HANSFORD: Of course.
6	A. Yes.	6	A. So, in the end, 84 is what we concluded, the sample size
7	CHAIRMAN: Thank you. So you yourself have not determined	7	84 is for each slab.
8	what is a defect in the first instance?	8	Next slide, please.
9	A. I don't. Thank you.	9	COMMISSIONER HANSFORD: Sorry, so 84 was determined as being
10	I'm a statistician, so my job basically is once the	10	the optimum number or the minimum number, was it, for
11	data being presented to me, I will carry out	11	the sample size? Because you said you determined you
12	a statistical analysis. I don't define what is called	12	looked at 50, you looked at 100
13	defects.	13	A. Yes.
14	So, at the designing stage, there is no information	14	COMMISSIONER HANSFORD: and you determined 84 to be
15	about how the defects would be, like what is the defect	15	optimal?
16	rate in the structure.	16	A. Yes. Let me tell you why we decided 84 eventually,
17	So what we did is we applied this binomial	17	because if you look at the first row, if zero failure,
18	probability, the same formula you saw in earlier slide.	18	then the maximum failure at 95 per cent confidence level
19	So basically we try to characterise pu, which is upper	19	is 3.5 per cent.
20	bound of the 95 per cent one-sided confidence interval	20	COMMISSIONER HANSFORD: Yes.
21	for the defect rate, and n is the sample size. So we	21	A. And this is low enough. What I mean by "low enough"
22	need to estimate how large n is. In order to estimate	22	because in statistics, we often have this 5 per cent
23	how large n is, we need to consider different scenarios.	23	significance level, or 5 per cent we consider is kind of
24	So basically next slide, please so we	24	threshold. So this is below 5 per cent, so we think if
25	considered different scenarios for y versus pu. So	25	there's zero failure, then 3.5 per cent is a good
23	Page 10	23	Page 12
	rage 10		rage 12
1	given the sample size of n equals 84, then if you	1	number
1 2	given the sample size of n equals 84, then if you observe zero failure in the sample, then that gives you	1 2	number.  COMMISSIONER HANSFORD: Whereas if you had used 50 it
2	observe zero failure in the sample, then that gives you	2	COMMISSIONER HANSFORD: Whereas, if you had used 50, it
2 3	observe zero failure in the sample, then that gives you the maximum failure rate at 95 per cent confidence	2 3	COMMISSIONER HANSFORD: Whereas, if you had used 50, it would have been higher than 3.5 per cent?
2 3 4	observe zero failure in the sample, then that gives you the maximum failure rate at 95 per cent confidence level, 3.5 per cent; okay?	2 3 4	COMMISSIONER HANSFORD: Whereas, if you had used 50, it would have been higher than 3.5 per cent?  A. Exactly, yes.
2 3 4 5	observe zero failure in the sample, then that gives you the maximum failure rate at 95 per cent confidence level, 3.5 per cent; okay?  If you observe one failure in the sample, then that	2 3 4 5	COMMISSIONER HANSFORD: Whereas, if you had used 50, it would have been higher than 3.5 per cent?  A. Exactly, yes.  COMMISSIONER HANSFORD: Okay. Yes.
2 3 4 5 6	observe zero failure in the sample, then that gives you the maximum failure rate at 95 per cent confidence level, 3.5 per cent; okay?  If you observe one failure in the sample, then that maximum failure rate would go up to 5.5 per cent. So it	2 3 4 5 6	COMMISSIONER HANSFORD: Whereas, if you had used 50, it would have been higher than 3.5 per cent?  A. Exactly, yes.  COMMISSIONER HANSFORD: Okay. Yes.  A. I think in my report, I had it.
2 3 4 5 6 7	observe zero failure in the sample, then that gives you the maximum failure rate at 95 per cent confidence level, 3.5 per cent; okay?  If you observe one failure in the sample, then that maximum failure rate would go up to 5.5 per cent. So it continues with the number, number of failures observed	2 3 4 5 6 7	COMMISSIONER HANSFORD: Whereas, if you had used 50, it would have been higher than 3.5 per cent?  A. Exactly, yes.  COMMISSIONER HANSFORD: Okay. Yes.  A. I think in my report, I had it.  COMMISSIONER HANSFORD: You did.
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2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	observe zero failure in the sample, then that gives you the maximum failure rate at 95 per cent confidence level, 3.5 per cent; okay?  If you observe one failure in the sample, then that maximum failure rate would go up to 5.5 per cent. So it continues with the number, number of failures observed in the sample, you can see on the right column the maximum failure rate in the population actually continues to go up.  COMMISSIONER HANSFORD: Sorry, Prof Yin, this is based on the sample size of 84?  A. Yes.  COMMISSIONER HANSFORD: Which you have already determined -A. Yes.  COMMISSIONER HANSFORD: by the previous method, as you explained on the previous slide?  A. Yes.  COMMISSIONER HANSFORD: So, once you've determined that the sample size is 84, you are now telling us this is what finding a number of failures in the sample means in terms of failure rate in the whole population?	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	COMMISSIONER HANSFORD: Whereas, if you had used 50, it would have been higher than 3.5 per cent?  A. Exactly, yes.  COMMISSIONER HANSFORD: Okay. Yes.  A. I think in my report, I had it.  COMMISSIONER HANSFORD: You did.  A. But I forgot exactly the number.  COMMISSIONER HANSFORD: I'm just trying to refresh my memory on the point.  A. Thank you.  Next slide, please. So we implemented a two-phase sampling scheme. Phase 1, we randomly select the D-wall panels and also the location within the selected panels.  So, at the bottom figure, you can see there are many, many panels, and they have various lengths, from 2.8 metres to 7.2 metres, and the width is constant at 1.2 metres. But the opening-up area is about 0.4 metres, so it's basically a small square, so that you can expose three couplers.  We also discussed: can we expose one coupler at each opening area? And basically the conclusion is you have

Page 15 Page 13 1 1 conclusion is it has to be a certain size to expose number to identify the location. If it's 2 2 three couplers. a two-dimensional plane, you need two random numbers, 3 Next slide, please. So once the panel is selected, 3 but now you are in the three-dimensional structure, so 4 the panel you look is a blue colour in the figure, and 4 you really need to think three-dimensional space. 5 5 the panel is quite big, so we need to determine where So, basically, we randomly select the panel, we 6 6 exactly we want to open this 0.4 metres square, and that randomly determine the reference point, that's the 7 7 location where you want to open it up, you randomly basically we need to generate another random number so 8 8 that we can select the location. And once we select select the layer. 9 9 that location, we will open that small square, try to So I have seen Dr Wells' report. He mentioned 10 10 expose three couplers. whether it's random or not -- first, in his calculation, 11 Next slide, please. Phase 2. Once you identify the 11 he treated panels as like couplers in terms of numbers. 12 12 site, there are multiple layers underneath the concrete. I will come back to this point later on. But then the 13 It varies from one to five, but here just a cartoon to 13 bottom, in red, the bottom point: although each panel is 14 14 show you, illustrate how the layer is going to be supposed to contribute three couplers, as I mentioned 15 15 earlier, if you happen to select a deeper layer, then selected randomly. 16 Suppose you open -- you select, randomly select the 16 there would be extra couplers come out. 17 level as a third layer. That's basically "site K" on 17 So, basically, even though we intended three 18 the far right-hand. I use the red colour to denote 18 couplers per panel, but some panels could have six, some 19 19 panels could have nine. So that's the point I want to selected layer. Suppose you select the third layer, so 20 people need to go there, open that area up, and it has 20 say. 21 21 Next, please. So once I got this data, I did this to expose the top two layers which are in colour green, 22 22 and those top two layers will be opened and will be plot. Basically, the y axis is engagement length, the 23 23 x axis is panel number. You can see "EWL" on the left, measured too. So, in a sense, even though our original 24 24 sample size was 84, but in the end we could end up with "NSL" on the right, and for each panel number, sometimes 25 a larger sample size because those extra layers, you 25 you could have multiple dots, you could have six dots, Page 14 Page 16 have to open it in order to go to the third layer. you could have three dots or even less than three dots, 1 1 2 2 Next slide, please. sometimes two dots. COMMISSIONER HANSFORD: Sorry, does that introduce any bias 3 3 So this is the data I just want to present to you. 4 A. No, it wouldn't introduce any bias, because all these 4 What I want to really focus here is, if you look at the 5 are being randomly selected. It's just sort of an extra 5 bottom at EWL panel, there are eight dots have zero 6 or bonus sample size goes into -- you know, sample size 6 engagement length, and on the right side, NSL, there's 7 7 estimation is always an estimate. no zero engagement length. COMMISSIONER HANSFORD: Yes. 8 8 Next, please. 9 A. Just as in any study, clinical trials or any study, you 9 COMMISSIONER HANSFORD: Sorry, sticking with that for the 10 10 need to determine how large your study will be, and moment, did you do any -- did you derive a mean from 11 that -- nobody can give you accurate: you have 100 11 that? Did you analyse all these data to look at what 12 people, you have to have 100 people --12 the mean was --13 COMMISSIONER HANSFORD: I understand that, but I just 13 A. Yes, I can. 14 wondered, by having additional samples in certain 14 COMMISSIONER HANSFORD: You can? 15 locations, does that introduce a bias? 15 A. I don't exactly remember but it should be around 16 A. No, I don't think so. 16 35 millimetres, because it depends on which panel you COMMISSIONER HANSFORD: Okay. 17 17 talk about. EWL, the mean is lower than the mean of 18 A. Next slide, please. 18 NSL, obviously, because those zero engagement lengths. 19 So whether this will result in a genuinely "random" 19 COMMISSIONER HANSFORD: Yes. 20 sample -- I've just gone through this two-phase sampling 20 A. So it's a very simple calculation. You can derive the 21 scheme. So we basically use the three randomly 21 22. 22 generated numbers to select each set of three couplers, COMMISSIONER HANSFORD: Yes. Okay. 23 and you imagine this is the three-dimensional space you 23 A. So this is just gives you a graphical look at the data. 24 24 are trying to draw random samples; this is not a single Next slide, please. Let's focus on these 25 line. If a single line, you can just use one random 25 unconnected couplers. So, in EWL sample, eight out of

Page 19 Page 17 1 1 90 couplers have zero engagement length. So, using the A. Perfect, yes, exactly. 2 COMMISSIONER HANSFORD: So it is? 2 formula I showed you earlier, we can come up with 95 3 3 one-sided confidence interval upper bound for A. So, no, it's (i) and (ii), this is passing criteria if 4 4 you use PAUT. unconnected coupler rate is 15.5 per cent. This is only 5 5 COMMISSIONER HANSFORD: Otherwise it's just "not less than using EWL slab data; okay? So this is basically 6 6 40 millimetres". unconnected coupler rate can be as high as 7 7 A. Yes, direct measurement. 15.1 per cent. And in the data, we have seen that some 8 8 Next slide, please. Based on this passing of the unconnected rebars only have one to two or three 9 9 criteria -to four threads, so clearly that's indicating some 10 COMMISSIONER HANSFORD: I'm sorry to keep interrupting you. 10 threaded ends were cut. 11 So let's come back to the engineering criteria for 11 A. That's fine, I like questions. 12 COMMISSIONER HANSFORD: You have referred to a gold standard 12 passing. So this criteria, basically, engineers' 13 definition: (i), you have a maximum of two full threads 13 several times. Well, you have referred to it today and 14 14 it was referred to in reference to your report exposed; (ii) -- this is "and", I put the "and" in blue, 15 15 vesterday, as thought that's a defined term. Is a gold so you must satisfy these two conditions simultaneously -- engagement length of the threaded 16 standard a defined term? 16 17 A. Okay, can we go to the previous slide? The third bullet 17 steel bar inside the coupler should be at least 18 40 millimetres, given there's tolerance of 3 millimetres 18 there, that's engineer definition. 19 19 COMMISSIONER HANSFORD: Yes, but you said "gold standard". for PAUT, which is ultrasonic technique, that's also 20 20 I'm just wondering why you call it "gold standard". an engineering issue, the equipment, the reading below 21 21 A. Because this criteria would possibly override the other 37 millimetres would be regarded as defective. 22 22 two. That's my understanding. And the third bullet is you don't use PAUT. You 23 COMMISSIONER HANSFORD: So does "gold standard" mean 23 basically direct measure. You have to have at least 24 24 overriding? 40 millimetres' engagement. 25 25 So that's the criteria given by the engineer A. In this case, you can think that way. Page 18 Page 20 definition. 1 COMMISSIONER HANSFORD: I'm just asking you what the term 1 2 2 Next slide, please. "gold standard" means. 3 3 COMMISSIONER HANSFORD: Sorry, so on this, you are A. "Gold standard" has different definitions. For example, 4 telling -- your understanding on the engineering 4 if you have high blood pressure, then there's 5 criteria is the passing criteria is (i) and (ii)? 5 a threshold, defined by the medical doctors, 130 above, 6 6 A. Yes. you will have hypertension; below -- so this is the gold 7 COMMISSIONER HANSFORD: Or (i) and the item underneath the 7 standard. I don't want to over-interpret the gold 8 8 standard here. This is just the rule people use, the 9 A. No, not "(i) and". The third bullet underneath is 9 common rule people use. That's my interpretation. 10 10 a gold standard, because that's actual. They really But this slide basically has nothing to do with me. 11 unscrew the bar and measure. 11 This is all --12 COMMISSIONER HANSFORD: So, if you do the one under the 12 COMMISSIONER HANSFORD: No, I'm not talking about the 13 line, you don't need (i) or -- you don't need (i)? 13 criteria. I'm talking about the term "gold standard", 14 14 A. Yes. The bottom one is direct measurement, it's the what the term "gold standard" means. 15 15 gold standard. A. You mean statistically? Because I'm a statistician so 16 My understanding is -- I'm a statistician -- they 16 I would interpret it from a statistical perspective, and 17 don't want to open every one. They want to use 17 if you are an engineer then you would have --18 ultrasound. Because if they open everything they 18 COMMISSIONER HANSFORD: It's just -- I don't necessarily 19 19 basically destroy the coupler connection, so they try to need to labour this point, but I've not seen in any 20 use ultrasound to do the measurement --20 documentation a statement, "The gold standard will be 21 COMMISSIONER HANSFORD: Which is point (ii) on here, not 21 this", so I'm just wondering where this term "gold 22 22 point (i). standard" has come from. 23 23 A. Yes. A. I can give you a simple example. For statistical 24 24 COMMISSIONER HANSFORD: Which is why I asked whether hypothesis testing, you have a null hypothesis versus 25 25 an option was (i) and the item below the line. alternative hypothesis. You calculate, test the

1 2	Page 21		Page 23
2	statistics, you obtain a p value. If the p value less	1	A. No, no, no. I'm not talking about the vertical
	than 0.05, we reject the null hypothesis. 0.5	2	couplers. Sorry.
3	I consider gold standard. Basically, it's the criteria	3	COMMISSIONER HANSFORD: I'm confused.
4	everybody uses to reject the null hypothesis.	4	A. Can you go to the next slide, please. So here
5	COMMISSIONER HANSFORD: So "gold standard" means the	5	(indicating), can you see this blue side, blue colour?
6	criteria everyone would use?	6	COMMISSIONER HANSFORD: Yes, of course.
7	A. Everyone would accept that, yes. That's a typical thing	7	A. That's the red coupler I'm talking about.
8	that's commonly used, most commonly used criteria.	8	COMMISSIONER HANSFORD: No, the couplers are sorry, where
9	That's my interpretation.	9	are the couplers?
10	COMMISSIONER HANSFORD: That's fine. We'll move on. Thank	: 10	A. Right here (indicating), the red, you see the arrow
11	you.	11	pointing down. Right here, can you see on your screen,
12	A. So based on the passing criteria in the previous slides,	12	this one (indicating)?
13	here's the result. The EWL, we have a total of 102	13	COMMISSIONER HANSFORD: I've got those two, yes.
14	samples, but only 90 give valid results. So 90 have	14	A. That's the coupler I'm talking about.
15	valid results and, out of 90, 25 are defective. In NSL	15	COMMISSIONER HANSFORD: But you said they are on the left
16	slab, a total of 99 samples, and out of 99 samples there	16	side and the right side?
17	are six missing data, so you end up with 93	17	A. I'm talking about okay, then you come to the zoom,
18	observations, and of this 93, 23 are considered	18	the zoomed picture. I'm talking about the coupler
19	defectives. Based on this data, the bottom two lines in	19	connection on the left.
20	red, for EWL defect rate, this upper bound 95 per cent	20	COMMISSIONER HANSFORD: I understand. So you are referring
21	confidence interval was estimated to be 36.6 per cent.	21	to just one coupler
22	For NSL, defect rate was estimated to be 33.2 per cent.	22	A. Yes.
23	Next slide, please. So, almost near the end of the	23	COMMISSIONER HANSFORD: but you're talking about threaded
24	opening-up exercise, a new situation arose. So we were	24	bar on the left side of it and threaded bar on the right
25	told that there are capping beam on the D-wall side and	25	side of it?
	Page 22		Page 24
1	there are couplers you can see there are couplers	1	A. Exactly, yes.
2	that are being exposed both left and right sides. So	2	COMMISSIONER HANSFORD: Now I understand.
3	this is a situation that is unforeseen. When we design	3	A. Sorry, I may have confused you. So that plot is just
4	the whole sampling procedure, and then this situation	4	a zoomed-in plot.
5	arises, what we are going to continue to do	5	COMMISSIONER HANSFORD: I understand.
-	re-formulate our statistical analysis.		COMMISSIONER HANGI ORD. I diddestand.
6		6	A. Next slide, please. So, for coupler, you have both left
7	COMMISSIONER HANSFORD: On your diagram there, you show	6	
	COMMISSIONER HANSFORD: On your diagram there, you show couplers on the left-hand side. You don't show couplers		A. Next slide, please. So, for coupler, you have both left and right side, you need to consider both sides are properly connected
7		7	A. Next slide, please. So, for coupler, you have both left and right side, you need to consider both sides are properly connected  COMMISSIONER HANSFORD: Yes.
7 8	couplers on the left-hand side. You don't show couplers on the right-hand side.  A. Which diagram?	7 8	A. Next slide, please. So, for coupler, you have both left and right side, you need to consider both sides are properly connected  COMMISSIONER HANSFORD: Yes.  A in order to consider the whole coupler is sound. So,
7 8 9 10 11	couplers on the left-hand side. You don't show couplers on the right-hand side.	7 8 9	<ul> <li>A. Next slide, please. So, for coupler, you have both left and right side, you need to consider both sides are properly connected</li> <li>COMMISSIONER HANSFORD: Yes.</li> <li>A in order to consider the whole coupler is sound. So, based on that argument, you can see, for the capping</li> </ul>
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Page 25 Page 27 1 rigorous calculation. The rigorous calculation is given 1 too, but not all of them. In fact, two panels in area A 2 in my report. But here I just want to explain 2 were included in the random draw, but none of them were 3 intuitively, loosely speaking. We look at the couplers 3 chosen by our random sampling procedure. And the list 4 on both sides. There are four possibilities. 4 of panels with couplers, after you remove all those 5 5 Left/right, both pass; left pass, right fails; left panels and the through bar are not accessible, the list 6 fail, right pass; or both fail. So four possibilities. 6 of panels were provided to me by engineers. 7 A coupler would be considered to be a sound coupler only 7 Next slide, please. So here, just to show you 8 for pass/pass. And that's why I have this bottom 8 area A, where is the mass concrete -- it's being circled 9 equation. You consider our previous calculation for 9 in the left, that's basically mass concrete, and that 10 EWL, the defect rate is 36.6 per cent. That is the 10 caused inaccessibility of those couplers. 11 defect rate only for one side. 11 Next slide, please. So this illustrates the random 12 Let's consider this defect rate also be used to the 12 sampling procedure. Indeed, you see we have the third 13 other side. Just presume on both sides you have the 13 column, "Works area", you can see "HKC" and "A", that's 14 same defect rate. Then the bottom equation basically 14 area A. They do have two panels in area A were put in 15 gives you -- it's not rigorous calculation but gives you 15 the draw but it was not selected, by random chance. 16 some sense that if you consider both passes as a pass, 16 Next slide, please. Here is another question, 17 then you would have 1 minus, the probability of pass, 17 whether we can extrapolate the estimates based on HKC to 18 times the probability of pass, on left and right sides. 18 area A. First, I was given that HKC and area A with 19 That would be a fail. So that's a probability of 19 capping beam have very similar configurations; same 20 failure. 20 contractor, so similar workmanship. In HKC, we had 21 So, based on that kind of argument, you can see why 21 11 samples. At the capping beam side, there were two 22 I could end up with 68.3 per cent. 22 failures. In the EWL slab side, there are seven valid 23 COMMISSIONER HANSFORD: But I'm seeing 59.8 per cent there. 23 observations, because there are four missing data. Out 24 A. That's very non-rigorous calculation, just for intuitive 24 of those seven valid observations that have PAUT 25 understanding, but in the detailed calculation it's much 25 results, two failed. That's why we use this data, Page 26 Page 28 1 more complicated than that. 1 combine both left side and right side of one single 2 2 COMMISSIONER HANSFORD: Okay. I understand. coupler, to calculate the combined defect rate, so we 3 3 A. So the number I want to report is 68.3 per cent. get this 68.3 per cent. 4 4 Next, please. As Mr Commissioner you have Okay, now the question is whether this result can be 5 questioned the sample size is rather small, whether the 5 extrapolated to area A. I think this question is more 6 calculation is reliable -- I totally buy the argument. 6 of an engineering question, but from a statistical point 7 7 So we went back to use another method, which is called of view I don't see why not. I just leave it. 8 bootstrap. Bootstrap is a widely used method to 8 Next, please. So Dr Wells back-calculated, trying 9 9 calculate the variance. So, if you look at the bottom to check whether our sample is a genuinely random 10 row on the table, if you apply bootstrap method, which 10 sample. He used 175 versus 62 panels. He considered 11 is different from what we originally used method, which 11 that's like a population of panels, versus 83/7 sample, 12 12 actually Dr Wells is concerned with because he was but those numbers are couplers. So, basically, he was 13 13 thinking the sample size is small, you are doing normal trying to calculate the ratio between no capping beam 14 approximation and you are using Delta method, that's 14 panels and capping beam panels, but he was thinking 15 fine. So we come back, we do the analysis using another 15 panels and couplers are the same thing. Okay? Then he 16 method, called bootstrap, and you can see the estimate 16 recalculated the whole thing in proportion, because 17 17 is rather very close. easier to visualise proportion. So basically he said in 18 Next slide, please. So there's another concern 18 the panel there are 26 per cent capping beams, and in 19 19 about why there's no samples in area A. So here's my the couplers there are only 8 per cent, and my 20 explanation. Some of the EWL top panels use through 20 understanding, based on his report, he had used Z-test 21 bar -- no couplers, no need to sample them, so they are 21 for sample proportion with normal approximation. That's 22 22 excluded from the random draw. The EWL bottom panels my understanding, as a statistician, of what he has 23 use couplers, but area A are blocked by mass concrete 23 24 infill between the two slabs, so the couplers are not 24 So although three couplers were intended to be 25 accessible and they were excluded from the random draw 25 chosen for each selected panel, but as I said earlier

Page 31 Page 29 1 1 about the engagement length or PAUT. We just say, "How some deeper layers would inevitably expose those upper 2 2 many samples you have drawn and what is the proportion layers' couplers. So you basically could have more 3 3 couplers than what you intended to get. with capping beam versus without capping beam"? You 4 The last bullet is we do not expect the proportions 4 shouldn't delete those data first, then use that number 5 5 to compare with population. Is that clear? to match between the population and the sample. 6 6 COMMISSIONER HANSFORD: Yes. The bit I didn't understand Next slide, please. So let's redo the calculation, 7 use what Wells has argued: a total of 237 panels out of 7 was you said because you have already done data 8 62 panels with capping beam, actually there are only 29 8 processing --9 9 A. When I talk about data processing, I'm talking about panels in the draw. Out of 175 panels without capping 10 10 mean removing the missing data. That's all I mean. beam, there are only 168 in the draw. So the proportion 11 actually should be 29 divided by 29 plus 168, which is 11 COMMISSIONER HANSFORD: That's fine. It sounded more 12 technical than that. Thank you. 12 14.7 per cent. I'm using his argument, without 13 distinguishing panels or couplers, just for the sake of 13 A. Okay. 14 14 argument. Then Dr Wells' report, paragraph 4.7, he mentioned 15 15 "a major reason for defects is poor workmanship, then So we removed a lot of panels because either no 16 16 coupler, they use a through bar, or they cannot be defectives will probably be in clusters, and therefore 17 accessed due to the mass concrete. I think Dr Wells may 17 not independent". Then he argued: because it is not 18 not be aware of all these details so he couldn't do 18 independent, this would lead to higher rates of 19 19 a similar calculation. But anyway, a total of defectives in the sample than in the population, so any 20 102 couplers were sampled for the EWL slab. Among them, 20 results will necessarily be more conservative than 21 21 should be the case. 11 with capping beam. So what we should have done or 22 22 So I will visit the first point first, the paragraph what Dr Wells should have done is use 11 divided by 102, 23 23 in red first. instead of using 7 divided by 9. The reason is we 24 24 Next page, please. So I have done a permutation originally sampled 102 couplers due to their 12 missing 25 observations, so 12 couplers were removed because we 25 test to check the independence assumption. I don't want Page 30 Page 32 only have 90 valid observations. 1 to go into detail the four bullets below the table, but 1 2 2 So when you try to challenge whether a sample is I just point out the table, the meaning of the table. 3 3 genuinely random or not, you cannot do the data Basically the three numbers are p values. We are 4 processing and then compare the proportions. You have 4 doing hypothesis testing, to test whether the sample has 5 to use the originally sampled coupler, that's 102, and 5 clustered or independent. So, for EWL, p value is 6 11 out of 102 has capping beam, so you should use 11 6 greater than 0.05, so that basically indicates there is 7 7 divided by 102, which is 10.8 per cent. no clustering, at 5 per cent significance level. NSL is 8 So the red line there I point out, "Should not use 8 below 5 per cent; there's indication there is 9 the numbers after removing the missing data", because 9 clustering. Then I pull these two slabs together --10 10 COMMISSIONER HANSFORD: Sorry, why 5 per cent? I thought i after you remove the missing data, you have basically 11 11 was 3.5 per cent you were referring to. already done data processing. 12 Next, please. There's another point --12 A. 3.5 per cent is our upper bound. I'm doing hypothesis 13 COMMISSIONER HANSFORD: Sorry, can you just repeat that 13 testing, you compare p value against significance level, 14 14 point you just made? After removing -- or does that that's what I call gold standard. That's the most 15 commonly accepted threshold value for hypothesis 15 come up later? You said after removing the missing 16 data, you have already done data processing. I don't 16 testing. 17 understand. 17 COMMISSIONER HANSFORD: Right. 18 A. So while it combines the two slabs' data together, it 18 A. Basically, you think about it this way. You have 19 19 shows no clustering effects. I have four bullets here, a population, you want to get a sample, and you want to 20 see the population proportion and the sample proportion 20 I don't want to elaborate on that. Basically people can 21 are comparable. 21 go there to see how I did it. 22 22 COMMISSIONER HANSFORD: Yes. Next slide, please. Now I'm focusing on Dr Wells' 23 23 A. That's his whole argument. But in the sample, you second point. What if the data are indeed clustered and 24 24 should use the originally randomly drawn sample then you mistreat it as independent? What would happen? 25 regardless of data missing or not. We are not talking 25 Suppose the data indeed is clustered, then if you treat

data as independent, then you think you have more data than you actually have.  1		Page 33		Page 35
2 than you actually have. 3 Okay, that's the wording in red, 'you would think 4 you have more data than you actually have'. This would 5 underestimate the variance. I will explain all this if 6 you have a hard time to understand, but this would 6 underestimate the variance and thus give you a shorter 7 Then you can imagine if I have the ame number of do 8 confidence interval at 95 per cent, and in time the 9 upper bound of the 95 per cent confidence interval would 1 also underestimate the population one. 10 Next slide, please. So this, applically, I want to 11 illustrate the points in my previous slides. Look at 1 the top comer on the left. It's a sample size of 100 clustered data. But what you have done is you thin the sample size of say 80 of independent data. But what you have done is you thin the passes. On this, applically, I want to independent data. But what you have done is you thin the possible of the case. 15 should be the case. 15 coMMISSIONER ILANSFORD: But nevertheless. Prof Yin, you are saying this is academic because you have demonstrated there's no clustering? 21 A. Yes. I demonstrated in the data 22 COMMISSIONER HANSFORD: And therefore this is academic; this is not relevant? 22 commissioner please. Not, the previous slide, 24 please. Not, the previous slide, 25 please. Not, the previous slide, 26 please. Not, the previous slide, 26 please. Not, the previous slide, 27 please. Not, the previous slide, 28 please. Not, the previous slide, 29 please. Not, the previous slide, 29 please. Not this one. One more slide, 30 please. Not this one. One more slide, 31 please. Not this one. One more slide, 32 please. Not, the previous slide because the data to be 100 independent data, so you to have a narrower curve, on the right side, which is in red. So you restimate the variability. That woul	1	data as independent, then you think you have more data	1	independent data. This is clustered data. You imagine
3 Okay, that's the wording in red, "you would think 4 you have more data than you actually have". This would 5 underestimate the variance. I will explain all this if 6 you have a hard time to understand, but this would 7 underestimate the variance. I will explain all this if 6 you have a hard time to understand, but this would 7 underestimate the variance and thus give you a shorter 8 but they are all of distinct breeds, that gives you 9 upper bound of the 95 per cent, and in time the 9 upper bound of the 95 per cent, and in time the 10 also understimate the population one. 11 So my conclusion is, at the bottom, this will lead 12 to lower rates, not higher rates, lower rates of 13 defectives in the sample than in the population. Hence, 14 any results will necessarily be less conservative than 15 should be the case. 15 in Or Wells' conclusion 16 So my conclusion is exactly the opposite of 17 Dr Wells' conclusion. 18 COMMISSIONER HANSFORD: But nevertheless. Prof Yin, you are 19 saying this is academic because you have demonstrated 19 there's no clustering? 20 there's no clustering? 21 A. Yes. I demonstrated in the data — 22 COMMISSIONER HANSFORD: And therefore this is academic; this 22 is in or relevant? 23 A. One more slide, please. No, the previous one.  Page 34  1 COMMISSIONER HANSFORD: You said if there's clustering in findicated by the hypothesis testing result. 0.007 shows 28 significant result, that's indicating there are 29 clustering effects. In EWL, no statistical evidence for 29 clustering effects. In EWL, no statistical evidence for 29 clustering. But when I pull the two slabs' data 10 clustering than you. 20 cOMMISSIONER HANSFORD: Okay. 21 A. Yes, carely. Thank you very much. 3 Page 34  1 COMMISSIONER HANSFORD: Okay. 4 A. One more slide, please. No, the previous one.  Page 34  1 COMMISSIONER HANSFORD: Okay. 4 MR PENNICOTT: The other way. That's it. 4 Ves, exactly. Thank you very much. 5 A. Thank you look at the data. If you want to look at it 21 on how you look at the data. If you want to look at it	2			
4 you have more data than you actually have". This would 5 underestimate the variance. I will explain all this if 6 you have a hard time to understand, but this would 7 underestimate the variance and thus give you a shorter 8 confidence interval at 95 per cent, and in time the 8 pupper bound of the 95 per cent confidence interval would 9 upper bound of the 95 per cent confidence interval would 10 also underestimate the population one. 11 So my conclusion is, at the bottom, this will lead 11 to lower rates, not higher trates, lower rates of 12 to lower rates, not higher trates, lower rates of 13 defectives in the sample than in the population. Hence, 14 any results will necessarily he less conservative than 15 should be the case. 16 So my conclusion is exactly the opposite of 17 Dr Wells' conclusion. 18 COMMISSIONER HANSFORD: But nevertheless, Prof Yin, you are 19 saying this is candemic because you have demonstrated to please. No, the previous one.  Page 34 1 COMMISSIONER HANSFORD: And therefore this is academic; this is not relevant? 22 COMMISSIONER HANSFORD: You said if there's clustering indicated by the hypothesis testing result. 0.007 shows 28 significant result, that's indicating there are 29 clustering effects. It depends on the constraint of the data. If you want to look at it 29 clustering effects. It elepteds on the left. It is a samalogue to underestimate the meaning of clustering size. 29 clustering affects are clustering effects. It depends on the left. It is a sample size of independent data. It you want and prove the left. It has the twaits be also that the points in meaning to I do but they are all of distinct breeds, that give you and all of miders and the dogs.  Next slide, please. So this, graphically, I want to illustrate the points in my previous slides. Look at the top corner on the left. It's a sample size of 100 clustered data to be alou independent data. But what you have done is you thin this 100 clustered data to be 100 independent data, so you look at the arrow pointing down, that's	3			
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5 A. Yes, exactly. Thank you very much. 6 So, if you look at NSL, there's a clustering 7 indicated by the hypothesis testing result. 0.007 shows 8 significant result, that's indicating there are 9 clustering effects. In EWL, no statistical evidence for 10 clustering. But when I pull the two slabs' data 11 together, again shows no clustering effect. It depends 12 on how you look at the data. If you want to look at it 13 separately, this could be a relevant point. 14 COMMISSIONER HANSFORD: Okay. 15 A. Thank you. 16 COMMISSIONER HANSFORD: I understand. 17 underestimate the defect rate. Basically, the defect 18 rate, I'm talking about the 95 per cent confidence 19 rate, I'm talking about the 95 per cent confidence 10 rate, I'm talking about the 95 per cent confidence 11 interval upper bound. 12 Next, please. So another point about how do you 14 writings about how to handle missing data. 19 writings about how to handle missing data. 11 So using the mean value to impute the missing 12 observation would inflate the effective sample size, 13 because the data are missing, but you said, "I'm not 14 considering they are missing. I'm going to use the rest 15 of the data that are not missing, calculate the mean; 16 I use that mean to impute all those missing	4	MR PENNICOTT: The other way. That's it.	4	
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separately, this could be a relevant point.  13 because the data are missing, but you said, "I'm not 14 COMMISSIONER HANSFORD: Okay.  15 A. Thank you.  16 COMMISSIONER HANSFORD: I understand.  18 because the data are missing, but you said, "I'm not 19 considering they are missing. I'm going to use the rest 10 of the data that are not missing, calculate the mean; 11 I use that mean to impute all those missing	12	on how you look at the data. If you want to look at it	12	observation would inflate the effective sample size,
14 COMMISSIONER HANSFORD: Okay. 15 A. Thank you. 16 COMMISSIONER HANSFORD: I understand. 17 considering they are missing. I'm going to use the rest of the data that are not missing, calculate the mean; 18 I use that mean to impute all those missing	13	separately, this could be a relevant point.	13	because the data are missing, but you said, "I'm not
15 A. Thank you.  15 of the data that are not missing, calculate the mean; 16 COMMISSIONER HANSFORD: I understand.  15 of the data that are not missing, calculate the mean; 16 I use that mean to impute all those missing	14	COMMISSIONER HANSFORD: Okay.	14	considering they are missing. I'm going to use the rest
	15	A. Thank you.	15	
	16	COMMISSIONER HANSFORD: I understand.	16	-
17 A. Next slide, please. 17 observations." Clearly, you enlarge your sample size,	17	A. Next slide, please.	17	observations." Clearly, you enlarge your sample size,
Next slide, please. I'm not trying to amuse 18 because if you throw away those missing data you woul	18	Next slide, please. I'm not trying to amuse	18	because if you throw away those missing data you would
everyone here. I am trying to tell you what do I mean 19 have a smaller sample size. Now you impute those	19	everyone here. I am trying to tell you what do I mean	19	
by "clustered". Look at the dogs here. Some dogs, they 20 missing data, you would include those missing data in	20	by "clustered". Look at the dogs here. Some dogs, they	20	missing data, you would include those missing data in
21 are the same breed, like two dogs in the top corner, 21 your analysis, you would have larger sample size and	21	are the same breed, like two dogs in the top corner,	21	
five dogs are the same breed. This is what I mean by 22 thus a smaller variance.	22	five dogs are the same breed. This is what I mean by	22	thus a smaller variance.
23 "clustered data". "Clustered data" means the data are 23 There are several problems here. You use the same	23	"clustered data". "Clustered data" means the data are	23	There are several problems here. You use the same
correlated. Imagine if you have all these dogs are from 24 value to impute all missing data, you do not account for	24	correlated. Imagine if you have all these dogs are from	24	value to impute all missing data, you do not account for
25 different breeds, that's what I would consider as 25 variation in the missing data, because you are assuming	25	different breeds, that's what I would consider as	25	variation in the missing data, because you are assuming

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that all this missing data actually are equal, but the underlying true data, nobody knows; they could be very different. But you impute it using the same value again and again and again. Basically, you reduce the variability of the whole sample.

The third bullet here: deleting missing data gives valid results under the missing completely at random assumption. What do I mean by "missing at random assumption"? The missing data was caused by the PAUT results not obtainable, not obtainable because of engineering problem, maybe due to angles, smoothness of the surface, ultrasound problem. So it's not because of the data itself. It is because of something very irrelevant to the data itself.

I went to the Hung Hom Station site. I looked at the couplers. You have to make sure the coupler surface is very smooth and shiny, like a shoe, in order to have the PAUT results working. So, basically, all I'm arguing here is that deleting the missing data does not bias your sample and actually you should not impute the missing data using the mean value. Here at the bottom I give you a reference. I hope my counsel has please distributed this: "Reference: 'Three problems with mean imputation'." (Handed).

COMMISSIONER HANSFORD: Thank you.

those samples due to the reasons not related to the outcome is a valid statistical approach; it does not cause bias.

I give you another example. Suppose you are measuring toxicity level, and some of the patients cannot tolerate the toxicity so they drop out; you cannot take measurements on those subjects. That kind of missing data is not missing at random, because the missingness depends on the outcome. The outcome is toxicity level. If the toxicity level is too high, they all drop out. Then, if you throw away those missing data, that would cause the sample being biased.

So what I say if the missingness is unrelated to the outcome you are trying to measure, here it's engagement length, then throwing away missing data is a perfectly valid approach.

Next, please. There are a lot of discussions about whether you use continuous or discrete. So my understanding, the engagement length is indeed a continuous measurement, no doubt, but it's often critical to make a decision on pass or fail in practice.

I here give you several examples: US FDA makes a decision to approve or not approve a new drug. For blood pressure measurements, you need to decide if the patient has hypertension or not, based on continuous

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- A. So this, basically -- just one print, very simple:
- 2 "3 problems with mean imputation."
- The bullet points:
  - "-- Mean imputation reduces the variance of the imputed variables.
  - -- Mean imputation shrinks standard errors, which invalidates most hypothesis tests and the calculation of confidence interval."

The third bullet is actually quite irrelevant, is less relevant. Basically, it does not preserve the relationship, for example, correlation, but that's not relevant. The first two bullets are the most important points I want to point out.

Next, please. In Dr Wells' paragraph 4.11, he was talking about measurements were only taken if visual inspection is passed.

My understanding, visual inspection is to check whether couplers connected or not. If the coupler is not connected, you don't need to do PAUT. The engagement length is clearly zero. This is not a missing data. You have a valid data point, which is zero. Discarding those samples because PAUT results are unobtainable, for reasons unrelated to the potential outcome -- what is the potential outcome we are trying to obtain? That's engagement length. You throw away

- 1 measurement. Hypothesis testing, as I said earlier,
- 2 often based on 5 per cent significance level, you reject
- 3 or not reject null hypothesis. And cancer patients are
- 4 often calculated one-year survival rate, so basically at
- 5 one year the patient is dead or alive. The bottom one
- 6 is just my understanding. If, at the beginning, you
- 7 want to claim, "I'm going to use 33 millimetres' or
- 8 28 millimetres' engagement length for all the coupler
- 9 connections", would any contractor be accepted?
- 10 COMMISSIONER HANSFORD: I don't understand that final
- 11 bullet.
- 12 A. Okay. Let me elaborate. But anyway --
- 13 COMMISSIONER HANSFORD: Maybe that's not statistics.
- $14\,$   $\,$  A. That's not relevant. Let's move on. I don't want to
- spend too much time.
- 16 COMMISSIONER HANSFORD: I think that's somewhat contentious
  - that final bullet.
- 18 A. Okay. Next slide, please. Then there are also
- 19 continuous variables or multinomial. Why I choose
  - binomial distribution? First, binomial distribution has
- 21 minimum assumptions. It's simply "yes" or "no". And
- 22 binomial distribution can give us an exact method, and
- 23 I think exact method is very statistical jargon. "Exact
- 24 method", basically, you do not need to assume you have
- a huge amount of sample size, and this is the most

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- 1 commonly used variable, for example, patient response or
- 2 no response, dead or alive. If you choose multinomial
- 3 distribution, then you would involve more artificial
- 4 input. For example, you have pass, partially pass,
- 5 partially fail, fail. And where to choose those cut-off
- 6 points is getting messy.

7 Then why not choose continuous measurement? That's 8 one argument I have seen. Actually, if you use 9

continuous measurement itself, that requires some other

10 assumptions. For example, it's often assumed the data 11

follows normal distribution, which actually is hard to 12 establish. The data could be very skewed and

13 asymmetric.

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14 And also you have seen that EWL, the engagement 15 length, there are eight zeros. Those eight zeros are

very isolated from all the other measurements. They are

clustered around 40 above or below. But those eight

zeros would cause -- you need a mixture distribution,

not just a continuous distribution. You should treat

the eight zeros probably separately.

So I'm talking about even though you can dwell upon

22 continuous measurement to give you better results or

whatever, in the end you will encounter many other

24 challenges.

25 To give you one more example about the continuous

1 1 millimetre this way it's unsafe", unless you are

- 2 talking about drugs or something like that, but I'm
- 3 talking about a big building like this. Do you see the
- 4 point I'm making?
- 5 A. I understand. My research is in clinical trials, so
- 6 that's why I have a lot of medical examples here. Drugs
- 7 is serious hypothesis testing. You cannot approve
- 8 a drug that's not working because that would affect
- 9 many, many people's lives. It's the same issue here:
- 10 safety. Drugs is a safety issue too.
- 11 CHAIRMAN: But your function was to look at defectiveness --
- 12 A. Yes.
- 13 CHAIRMAN: -- or lack of defectiveness?
- 14 A. Yes.
- 15 Next, please.
- 16 COMMISSIONER HANSFORD: Sorry, just to follow up on the
- 17 Chairman's point -- defectiveness or lack of
- 18 defectiveness based on criteria, pass/fail criteria,
- 19 that you were given?
- 20 A. Yes.
- 21 COMMISSIONER HANSFORD: I understand.
- 22 A. Actually, I was provided the data already determined
- 23 defective or non-defective. I was provided an Excel
- 24 sheet, there's column "Outcome", yes/no/yes/no.
- 25 CHAIRMAN: That's right.

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1 A. So I have no right to say yes, it's wrong, or no, it's

- 2 wrong. I didn't do anything like that.
- COMMISSIONER HANSFORD: I understand. 3
- 4 CHAIRMAN: So you were told, "This is our determination of
- 5 what is defective or not, these are our samples, and you
- 6 must now do a statistical analysis that takes into
- 7 account the entirety of what we are looking at"?
- 8 A. Yes.
- 9 COMMISSIONER HANSFORD: So effectively, Prof Yin, you were
  - 10 given -- I don't know if this is the right term, but you
  - 11 were given binomial data? You were given pass or fail
  - 12
  - 13 A. I was given more than pass or fail data, because you saw
  - 14 the plot I plotted, I was given the engagement length
  - 15 too. So there are multiple columns. There's one final
  - 16 column that tells you pass/fail.
  - 17 COMMISSIONER HANSFORD: But you just told me somebody els
  - 18 decided whether it was defective or not.
  - A. Yes, that's what I was provided. All the Excel sheets 19
  - 20 has more than "yes" or "no". It has a column
  - 21 "Engagement length", it has panel number; it has more
  - 22. information than "yes" or "no".
  - 23 COMMISSIONER HANSFORD: Okay.
  - 24 CHAIRMAN: Sorry, I know we are holding you on this a little
  - 25 bit, but -- defective, as you say, is binomial in the

data. Continuous data are sensitive to outliers. Why

- 2 I say that? Suppose you have a very, very big number
- 3 out there. That will pull the whole mean towards that
- number. But for binary data, you don't. A very large 4
- 5 number, still class it as one.
- 6 COMMISSIONER HANSFORD: Sure.
- 7 A. That's it.
- 8 Next, please. There's also a lot of discussion
- 9 about the 95 or 90 per cent confidence interval.
- 10 CS2:2012 was quoted --
- 11 CHAIRMAN: Sorry to interrupt. When you are looking at --
- 12 just going back to be what you have just done, the
- 13 binomial, it must depend, would this be correct, on what
- 14 you are seeking to get statistics about, in the sense
- 15 that if you are seeking a statistic as to whether it is
- 16 defective or not, then that's simple enough. It's
- 17 considered defective or it's not.
- A. Yes. 18
- 19 CHAIRMAN: Pass or fail.
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- 21 CHAIRMAN: But if you are looking at something like
- 22 safety ---
- 23 A. Yes.
- 24 CHAIRMAN: -- then you may say that's more of -- it sits on
- 25 a continuum. In other words, you can't say, "If it's

1 2	Page 45		Page 47
	sense that you are told this measurement and that	1	is again, for CS2:2012, they have this manufacturer's
~	measurement for purposes of these statistics are to be	2	test and the purchaser's test. The whole purpose is
3	considered as amounting to a defective installation;	3	gatekeeping to reassure the quality of the rebar. This
4	right?	4	is very different from what we are doing here. Our goal
5	A. Yes.	5	for this whole project is trying to estimate the defect
6	CHAIRMAN: Which would be different, of course, but we are	6	rate of coupler connections. So it's a statistical
7	not talking about statistics here. If we go back to	7	inference problem, because we want to collect the sample
8	square one, if you turn around to a diligent workman	8	and infer the whole population. We are trying to do
9	on site and you say, "It's defective if it's	9	inference problem; it's not a quality reassurance
10	1 millimetre this way", he's probably going to turn to	10	problem.
11	you and say, "This is a rebar which is 4 metres long.	11	Also, you see, for CS2:2012, you have two layers of
12	It weighs X number of kilograms. It's got to be put	12	test, one is manufacturer's test, then you do on-site
13	into a coupler, and when you are putting in 1,000 of	13	purchaser's test. Then you can have a relaxed
14	them over a week, believe me, 1 millimetre is not going	14	confidence interval to 90 per cent. But here there's no
15	to make the blindest bit of difference."	15	reassuring some given defect rate has already been
16	So, in other words	16	estimated by another party.
17	COMMISSIONER HANSFORD: And on top of that he can't measure	17	So my point is, for CS2:2012, you have two layers of
18	1 millimetre.	18	test trying to ensure the quality of rebars. Here, we
19	CHAIRMAN: Yes, "and I can't measure 1 millimetre."	19	are trying to do a statistical inference. And the
20	This is not to try to undermine, it's just we are	20	bottom bullet is, in hypothesis testing, as I've said
21	looking at a specific you are looking at a dictated	21	again and again, p value would be calculated will
22	set of figures which you are told amounts to defective;	22	be I use "gold standard" here will be compared
23	right?	23	with gold standard 5 per cent significance level.
24	A. Yes.	24	That's basically trying to control the false positive
25	CHAIRMAN: And then you are told, "Please look at all our	25	rate at 5 per cent.
	Page 46		Page 48
1	samples and come up with indications of the degree of	1	CHAIRMAN: Sorry, can you help me I don't understand your
2	defectiveness, based on those samples," which is your	2	third paragraph:
3	job as a statistician?	2	
	A 37	3	"There is no such a layer corresponding to
4	A. Yes.	4	"There is no such a layer corresponding to 'manufacturer's test' in our case, and we are not
4 5	A. Yes. CHAIRMAN: Okay.		
		4 5	'manufacturer's test' in our case, and we are not
5	CHAIRMAN: Okay.	4 5	'manufacturer's test' in our case, and we are not reassuring some given defective rates"
5 6	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are	4 5 6	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to support the correctness of the figures given to you
5 6 7	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are simply around the context of why they may or may not be	4 5 6 7	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to
5 6 7 8	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are simply around the context of why they may or may not be classified as defective.	4 5 6 7 8	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to support the correctness of the figures given to you initially; they are just meant to  A. The whole slide here, I'm just trying to say 95 per cent
5 6 7 8 9 10 11	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are simply around the context of why they may or may not be classified as defective.  A. Yes.  CHAIRMAN: Yes, which is different.  A. Yes.	4 5 6 7 8 9 10	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to support the correctness of the figures given to you initially; they are just meant to  A. The whole slide here, I'm just trying to say 95 per cent confidence interval should be used instead of
5 6 7 8 9 10 11 12	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are simply around the context of why they may or may not be classified as defective.  A. Yes.  CHAIRMAN: Yes, which is different.  A. Yes.  CHAIRMAN: But then your argument would be, "If that's your	4 5 6 7 8 9 10 11 12	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to support the correctness of the figures given to you initially; they are just meant to  A. The whole slide here, I'm just trying to say 95 per cent confidence interval should be used instead of 90 per cent confidence interval.
5 6 7 8 9 10 11 12 13	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are simply around the context of why they may or may not be classified as defective.  A. Yes.  CHAIRMAN: Yes, which is different.  A. Yes.  CHAIRMAN: But then your argument would be, "If that's your case, give me a different set of initial figures."	4 5 6 7 8 9 10 11 12 13	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to support the correctness of the figures given to you initially; they are just meant to  A. The whole slide here, I'm just trying to say 95 per cent confidence interval should be used instead of 90 per cent confidence interval.  CHAIRMAN: I see. Okay. So now you are only talking about
5 6 7 8 9 10 11 12 13 14	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are simply around the context of why they may or may not be classified as defective.  A. Yes.  CHAIRMAN: Yes, which is different.  A. Yes.  CHAIRMAN: But then your argument would be, "If that's your case, give me a different set of initial figures."  A. Yes, and all those figures should come from engineer,	4 5 6 7 8 9 10 11 12 13 14	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to support the correctness of the figures given to you initially; they are just meant to  A. The whole slide here, I'm just trying to say 95 per cent confidence interval should be used instead of 90 per cent confidence interval.  CHAIRMAN: I see. Okay. So now you are only talking about confidence interval?
5 6 7 8 9 10 11 12 13 14 15	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are simply around the context of why they may or may not be classified as defective.  A. Yes.  CHAIRMAN: Yes, which is different.  A. Yes.  CHAIRMAN: But then your argument would be, "If that's your case, give me a different set of initial figures."  A. Yes, and all those figures should come from engineer, not from me.	4 5 6 7 8 9 10 11 12 13 14 15	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to support the correctness of the figures given to you initially; they are just meant to  A. The whole slide here, I'm just trying to say 95 per cent confidence interval should be used instead of 90 per cent confidence interval.  CHAIRMAN: I see. Okay. So now you are only talking about confidence interval?  A. Yes, I'm only talking about confidence interval right
5 6 7 8 9 10 11 12 13 14 15 16	CHAIRMAN: Okay.  COMMISSIONER HANSFORD: And the points we are raising are simply around the context of why they may or may not be classified as defective.  A. Yes.  CHAIRMAN: Yes, which is different.  A. Yes.  CHAIRMAN: But then your argument would be, "If that's your case, give me a different set of initial figures."  A. Yes, and all those figures should come from engineer, not from me.  CHAIRMAN: Exactly, so that becomes an engineering question.	4 5 6 7 8 9 10 11 12 13 14 15 16	'manufacturer's test' in our case, and we are not reassuring some given defective rates"  In other words, these figures are not meant to support sorry, your statistics are not meant to support the correctness of the figures given to you initially; they are just meant to  A. The whole slide here, I'm just trying to say 95 per cent confidence interval should be used instead of 90 per cent confidence interval.  CHAIRMAN: I see. Okay. So now you are only talking about confidence interval?  A. Yes, I'm only talking about confidence interval right here. And also I want to say the confidence interval
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	Page 49		Page 51
1	•	,	•
1	about the Monte Carlo method. As I said, we use the	1	MR SHIEH: Good morning, Prof Yin. I represent Leighton
2	bootstrap method which is the most popular approach to	2	Contractors (Asia) Ltd and I have a few questions for
3	estimate the variance. We also tried two different	3	you.
4	versions of the bootstrap, which gives very similar	4	A. Yes.
5	answers. That's it. Thank you very much.	5	Q. You probably know more about statistics than everybody
6	COMMISSIONER HANSFORD: Just on this slide, though,	6	in this room.
7	I imagine counsel for some of the parties may raise the	7	MR PENNICOTT: Put together!
8	point, but my understanding, Dr Wells said that	8	MR SHIEH: Together. Could I just set the scene? This is
9	bootstrap and Monte Carlo were addressing different	9	not an academic symposium
10	problems.	10	A. I understand.
11	A. No.	11	Q where people sit together and present papers on
12	COMMISSIONER HANSFORD: Well, that's what he said.	12	controversial topics.
13	A. Yes, but I disagree.	13	A. Yes.
14	COMMISSIONER HANSFORD: You disagree?	14	Q. You accept I'm not talking about any topics that we
15	A. Yes.	15	have been discussing, but in every respectable academic
16	COMMISSIONER HANSFORD: Okay.	16	discipline, and statistics is obviously one of them,
17	A. I think next slide is "Thank you"; right? I just want	17	there are bound to be areas where people take different
18	to make sure.	18	views on a legitimately controversial matter; do you
19	Examination-in-chief by MR KHAW (continued)	19	accept that?
20	MR KHAW: Just one question. If we can go back to your	20	A. Yes.
21	slide 17, where you talk about the samples in area A; do	21	Q. And you would accept that unlike primary facts such as
22	you remember?	22	which day of the week today is or how many fingers
23	A. Yes.	23	I have, very often, in questions of opinion, you can't
24	Q. Then you also mentioned and in fact we have also	24	insist that there must be a correct answer? As
25	heard evidence regarding the restrictions in area A.	25	a general proposition, do you accept that?
	Page 50		Page 52
1	A. Yes.	1	A. What do you mean, you don't have correct answer? There
2	Q. And that is because it's blocked by mass concrete infill	2	are many things you should have correct answer.
3	between the two slabs, as you have also mentioned here?	3	Q. Yes, but there are many things in respectable academic
4	A. Yes.	4	disciplines which are incapable of yielding a correct
5	Q. And, as a result, we understand that some panels in	5	answer, and that is why we have debates, we have
6	area A were actually excluded from the sampling process.	6	symposiums, we have seminars?
7	A. Yes.	7	A. No, I wouldn't say so. I think a lot of research can be
8	Q. May I just ask whether you were involved in the decision	8	carried out to determine what is correct or what is
9	regarding which panels should be excluded	9	wrong, or what is more appropriate and what is less
10	A. No.	10	appropriate.
11	Q from the sampling process in relation to area A?	11	Q. Can I now ask you something about let me start it
12	A. No. And the third bullet says:	12	this way. I would first like to engage with you on
13	"A list of panels with couplers were provided [to	13	something which is not your expertise. I would like to
14	me]."	14	engage with you on two topics. One, the binomial
15	Then I carry on the random sampling process.	15	approach. Two, acceptance criteria.
16	MR KHAW: Thank you. I have no further questions. The	16	First, binomial. To put it in the simplest possible
17	lawyers in this room may have some questions for you,	17	terms, a binomial approach is an exercise whereby every
18	and obviously the Chairman and the Commissioner may have		trial or every test would yield two possible outcomes
19	further questions.	19	A. Yes.
20	WITNESS: Okay.	20	Q pass/fail, yes/no, die/alive?
21	MR KHAW: Thank you.	21	A. Yes.
22	CHAIRMAN: Who should go?	22	Q. Or defective/non-defective?
23	MR PENNICOTT: Mr Shieh.	23	A. Yes.
24	CHAIRMAN: Mr Shieh.	24	Q. So that's binomial, two; right?
25	Cross-examination by MR SHIEH	25	A. Yes.
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- 1 Q. Multinomial would mean more than two possible outcomes?
- 2 A. Yes.
- 3 Q. Maybe pass/partially pass/fail?
- 4 A. Yes.
- 5 Q. Would academic grades be regarded as an example of
- 6 multinomial, A/B/C/D/E?
- 7 A. A good example, yes.
- 8 Q. Without saying pass/fail, because if it's including
- 9 pass/fail then there's an element of binomial in it, but
- 10 if you simply say A/B/C/D/E, that would be an example of
- 11 multinomial?
- 12 A. Yes.
- 13 Q. I think you have accepted this earlier on, from
- 14 questions from Mr Chairman, but let me just get it out
- of the way for the record. Let's imagine, if you are
- an administrator of a government, you may wish to design
- a scheme in order to help you decide whether to accept
- 18 certain applications; right? So you have to devise
- a scheme for you to tick the box: accept/not accept?
- 20 A. Okay.

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- 21 Q. And in a case like this, you may think that for
- 22 administration reasons you need binomial, and very often
- you would accept, would you not, that in terms of
- 24 helping administration, ease of administration, people
  - would tend to go for binomial approach?

- omes: 1 Q. In this case, you were presented with -- well, you are
  - preferring a binomial approach; is that correct?
  - 3 A. Preferring?
  - 4 Q. Over multinomial.
    - A. I think this word is emotional. I wouldn't say
  - 6 I prefer. I don't know what you mean by "preferring".
  - 7 As a statistician, I look at the problem. I take the
  - 8 most appropriate approach.
  - 9 Q. Let me just put it in another way. For couplers --
  - 10 because I'm homing in from general to specific, because
  - if you say the questions are too specific, let me just
  - 12 home in -- if they are too general, let me home in on
  - the specific.
  - 14 A. Okay.
  - 15 Q. Let's say, on the acceptance criteria that you have been
  - given, 37 millimetres or 40; right? Certain engagement
  - length, certain number of threads exposed.
  - 18 A. Yes.
  - 19 Q. If you fail to achieve that, it's regarded as
  - 20 "defective" or "fail"; right?
  - 21 A. Yes.

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- Q. Missing it by half a thread would mean a fail; correct?
- A. What do you mean?
- Q. Missing it by half a thread -- if it's three threads
  - exposed or two and a half threads exposed, then it's

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- .....
- A. I want to make sure I understand your question clearly. You want to put me in a hypothetical situation that I'm
- 3 the administrator or I'm the statistician?
- 4 O. Administrator.
- 5 A. I'm an administrator, I'm not a statistician?
- 6 Q. You're administrator, yes.
- 7 A. Then your question is to design a scheme to accept or
- 8 not accept?
- 9 Q. Yes. If you are an administrator, you have decided upon
- a scheme -- you want to design a scheme to help you
- 11 accept certain applications; right?
- 12 A. Yes.
- 13 Q. And this would be a typical example whereby a binomial
- approach would be used because it's easy to administer?
- 15 You have pass/fail, you have criteria that is easy to
- administer; would you accept that as a general
- 17 proposition? Or would you think this is outside your
- area of expertise?
- 19 A. No. I think there are a lot of factors need to be put
- in. I mean, this -- your question is too general to
- 21 give a specific answer.
- 22 Q. Okay. Good. I focus on more specific matters --
- 23 A. Okay.
- 24 Q. -- concerning the subject matter of this case.
- 25 A. Yes.

- a fail; correct?
- 2 A. Based on the criteria.
- 3 Q. Based on the criteria you're given.
- 4 A. Yes.
- 5 Q. If by PAUT measurement it's 36.5 millimetres engaged, it
  - would be regarded as a fail, based on the acceptance
- 7 criteria that have been given to you; correct?
- 8 A. Correct.
- 9 Q. You have no training yourself as to whether or not
- a 36.5 millimetre PAUT-measured engagement length could
- still provide structural support; correct?
- 12 A. Yes, I have no training.
- 13 Q. You have no training. So it is possible or it may not
- be the case, you just do not know; correct?
- 15 A. I have no expertise in engineering.
- 16 Q. Right. If you don't want to answer hypothetical
- 17 questions, then by all means tell us. If, as a matter
- of engineering, a 36 millimetre engaged or PAUT-measured
- 19 embedded length could still provide structural support,
- then the binomial approach would result in discarding
- such a rebar because it would be regarded as a failure,
- worth zero; do you accept that?
- 23 A. I want to understand your question clearly. So you said
- 24 if you have 36.5 millimetres' engagement length --
- 25 Q. Yes.

Page 59 Page 57 1 A. -- then what? 1 Q. So, in your task of providing statistical assistance to 2 2 Q. If, as a matter of science, as a matter of structural the government --3 engineering, a 36 millimetre engaged rebar still has 3 A. Yes. 4 capacity of load-bearing, for example --4 Q. -- and in providing your helpful report, it was not part 5 5 A. I don't know. This is beyond my expertise, as I said. of your remit or you did not regard it as part of your 6 responsibility to ask the person giving you the 6 Q. I know. That's why I'm fairly asking you -- I'm not 7 7 asking you to accept this to be the case -- I'm just instructions, "Hang on a second, you tell me to accept 8 8 asking you, if this is the case, then adopting X millimetres as an acceptance criteria. How about 9 a binomial approach would result in discarding a sample 9 stuff with less than X millimetres' embedded length; 10 10 which has some load-bearing capacity. isn't it a bit unfair to exclude them altogether?" You 11 Now, if you don't want to answer hypothetical 11 didn't raise these questions because these are things 12 12 questions, then just say so and I will move on. you had been given and you just had to proceed on the 13 A. Yes, please move on. 13 basis of what you had been given; is that correct? 14 Q. Because I would say it's a matter of common sense, but 14 A. I work in medical statistics extensively. I would not 15 15 if you -- so you don't want to answer this hypothetical challenge a doctor and say, "Systolic blood pressure 16 16 below 130, or above 130, you are being classified 17 A. I think all these are beyond my expertise. As you said, 17 hypertension, and below, no hypertension", that's 18 if it's a 36 millimetre engagement length, based on the 18 a medical decision. I have no right -- you see, 130, 19 19 criteria it doesn't meet, it's a fail. I follow the two why not 128 or 129? How about 131? It's not my 20 criteria -- actually, it's not I follow -- I was 20 expertise. 21 provided the data, already been following the two 21 Q. Thank you. I think we understand very clearly, loud and 22 22 criteria, the outcome. clear, as to the limits of your task and responsibility. 23 23 Q. But --A. Yes. 24 CHAIRMAN: Sorry, if I can interrupt here. That's why 24 Q. Thank you very much for that. 25 I emphasised at the beginning: the criteria you are 25 Can I ask you to look at your report. Page 58 Page 60 CHAIRMAN: Sorry, Mr Shieh, could I ask you -- I'm looking 1 given bears a label, and that label is "defective". 1 2 2 What that label means is a matter for the people who here, it's now just before 1.00, and if you think -- are 3 3 we going to finish by 1.00 or just after 1.00, do you have given you the material. That would be right, 4 wouldn't it? 4 think? 5 A. Yes. 5 MR SHIEH: I'm going to finish at least this topic before 6 CHAIRMAN: Exactly. So they have decided what constitutes 6 1.00, or even one more topic, depending on how quickly 7 7 "defective" and for what purposes it constitutes we go. 8 "defective". Your job is merely to look statistically 8 CHAIRMAN: Thank you. I appreciate that. 9 at the spread of that particular set of figures? 9 MR SHIEH: Prof Yin, in 3.2.2 of your report for the 10 10 A. Yes. holistic proposal -- for your holistic report -- it's in 11 CHAIRMAN: So it doesn't necessarily relate to load-bearing 11 COI 1 experts -- do you see that, 3.2.2? 12 or to -- it could relate to a time and motion study on 12 A. Yes, I see it. 13 workmanship, for example, or it could relate to the 13 Q. You say: 14 degree to which they meet certain required standards. 14 "In the design stage of the holistic proposal, 15 What you are given are figures that relate to 15 I verified the suggestion using a binomial analysis by 16 a definition called "defective". 16 MTRCL. I considered the binomial analysis appropriate 17 because it uses the minimum number of assumptions. From 17 A. Yes. CHAIRMAN: And that's it. 18 18 the statistical perspective, the fewer assumptions one 19 19 A. Yes. makes, the more desirable is the statistical analysis. 20 MR SHIEH: Thank you very much, because I'm trying to 20 More assumptions may introduce more uncertainty as some 21 eliminate certain matters which could not be drawn from 21 assumptions cannot be verified easily. If the 22 22 assumptions made are not entirely true, the conclusion the report. 23 CHAIRMAN: Yes. 23 drawn from the statistical analysis may no longer be 24 24 MR SHIEH: Let me follow up, Prof Yin. valid." 25 A. Yes. 25 Do you see that, 3.2.2?

Page 63 Page 61 A. Yes. 1 1 versus binomial versus continuous, have their strengths 2 2 and weaknesses; correct? Q. Then, at 3.2.3, you talked about the question of 3 3 partially engaged coupler connections; do you see that? A. Yes. 4 A. Yes. 4 Q. So you outline certain advantages of binomial; right? 5 5 Q. You say: A. Yes. 6 "If coupler connections with insufficient engagement 6 Q. Fewer assumptions, easier to operate? 7 can be allowed and taken into account in the design, 7 A. Yes. 8 multinomial analysis may be relevant." 8 Q. The disadvantages of multinomial or maybe continuous 9 9 Do you see that? would be it involves more assumptions and maybe more 10 10 complicated procedure; these are the kinds of -- you A. Yes. 11 Q. Now, there is a big "if" in this sentence; do you see 11 would regard them as disadvantages? 12 12 that? This sentence starts off with the word "If"; A. No. As you said, for every method you are going to 13 right? 13 choose, there are pros and there are cons. You have to 14 A. Yes. 14 value all the things holistically and take the most 15 15 appropriate and feasible approach. Q. "If coupler connections with insufficient engagement can 16 be allowed and taken into account in the design, 16 Q. Depending on what the ultimate user of the model wants 17 multinomial analysis may be relevant." 17 to achieve; correct? 18 A. Yes. 18 A. I don't know what you mean, the ultimate user -- what do 19 19 Q. But you have told us that the instructions that you had you mean? Who is the ultimate user here? 20 been given are that if it's insufficient engagement 20 Q. Who commissioned you in this exercise? 21 length, it is to be treated by you as a failure, 21 A. I was approached by the government. 22 22 correct, according to the acceptance standard that you Q. So depending on what use the government wants to make of 23 23 have been given? the statistical model, the government would decide 24 A. So let me clarify. There are a lot of discussions, 24 ultimately whether or not to go for a binomial model or 25 there are many meetings going on at HKU, and I remember 25 multinomial model or continuous model? Page 62 Page 64 A. No. The government don't decide. 1 all these discussions, multinomial analysis was raised 1 2 2 up, and we also put analogy just like A/B/C/D, like Q. Who decided it? 3 3 student grades. We discussed all these things and in A. HKU statistical team I led decided. And also we 4 4 discussed this with MTRC, and then we have lengthy the end we decided binomial approach is the most 5 appropriate and feasible approach. 5 discussion; we decided binomial is the most appropriate 6 Q. Because the government indicated that it was giving you 6 and feasible. 7 7 instructions on the basis that if certain criteria is You have to -- you see, I use "feasible". Maybe 8 met, then it is to be regarded as a fail; if not, if 8 other approaches, you can fantasise about it, you have 9 9 complicated model, but in the end it's not feasible. they are passed, then they are regarded to be 10 10 non-defective? Q. But I'm a bit puzzled, and I'm not going to labour on 11 11 this point any further because it could well come up to A. No. At that time, I don't even know the criteria. 12 37/40. I have no idea. But there is a continuous 12 a matter of argument, but -- so you are now telling us 13 13 variable. It's possible you have multinomial, you just that it is HKU's recommendation that binomial model is 14 put more cut-off points, below 30, below 20. You can 14 the most appropriate one to use out of multinomial and 15 have multiple categories. 15 continuous? 16 So I remember all these lengthy discussions, 16 A. No. I think you -- the decision using binomial approach 17 continuous random variable or multinomial or binomial. 17 is discussed among many different stakeholders. We 18 18 When we discussed, I have no idea, because all those have -- I don't remember all those people's names. 19 19 PAUT results were taken by professional engineers, not I had many, many meetings with many, many different 20 20 experts. I don't know who they are, where they come my responsibility. So, basically, as a statistician, if you tell me you have a continuous measurement, certainly 21 21 from. I know they are either from government or MTRCL 22 22 I would consider you can either classify multiple levels And after lengthy discussion, this is the consensus. 23 or two levels or use a continuous random variable. This 23 Do you understand? is all possible, under discussion. 24 24 Q. I will try it one more time and then I will move on. 25 Q. Different ways of treating data, let's say multinomial 25 You told us that it is not part of your training to

	Page 65		Page 67
1	decide upon what particular embedded length would give	1	A. No. As a layman I'm not an engineer you know,
2	rise to acceptable measure of structural safety;	2	I use a pen every day.
3	correct? It's not part of your training; you are not	3	COMMISSIONER HANSFORD: With a pen, I would agree with you.
4	an engineer, correct?	4	MR SHIEH: A coupler is different from a pen, but I'm not
5	A. I'm not an engineer.	5	going to argue with you.
6	Q. And you won't be able to tell whether or not, by failing	6	A. I know. But look, I can unscrew here, this is what
7	a sample with only 36 millimetres' engagement length,	7	looks like a coupler, I unscrew it, I don't unscrew
8	you would be discarding a sample which has some	8	halfway. Just as a layman, I don't consider this is
9	load-bearing capacity? It's not part of your training;	9	a good, sound screw-in exercise. I have to screw all
10	correct?	10	the way if I'm going to write with this pen.
11	A. Yes, I'm not an expert in engineering.	11	COMMISSIONER HANSFORD: This is a matter for
12	Q. And so you had to rely on someone else to actually tell	12	MR SHIEH: Professor, you understand have you given
13	you, "Look, forget about working out load-bearing	13	evidence before as an expert witness?
14	capacity. We are telling you that from our perspective,	14	A. No.
15	the government's perspective, 37 is acceptable but	15	Q. You understand that your task is to provide impartial,
16	anything less is not acceptable"? You have to rely on	16	objective assistance
17	what the government has told you in that regard;	17	A. Yes, I understand.
18	correct?	18	Q to the Commission and not try to act as an advocate
19	A. I wouldn't say government tells me. I don't know the	19	in favour of any particular party?
20	criteria is set up there, I believe that's engineering	20	A. Yes, I understand that. I signed
21	profession. I don't know whether it's government or	21	Q. The expert declaration?
22	MTR. I have no clue who are all the parties I have met.	22	A. I read all the codes and I understand.
23	CHAIRMAN: Let's put it this way: it's those who instruct	23	Q. Yes. Thank you very much.
24	you who will make that final decision? Well, no, you	24	In view of what you have said by way of answer,
25	as I understand it, they will come to you with the	25	I may not have anything to add on these two topics.
23	Page 66		Page 68
1	problem. They will tell you what they are looking for.	1	Sorry, Professor.
2	In this case, it is whether the installation of	2	COMMISSIONER HANSFORD: Can I take it one step further.
3	reinforcing bars into metal couplers were defective or	3	Prof Yin, if you're given a set of data, and through
4	not.	4	discussion a decision is made that the best form of
5	A. Yes.	5	analysis is binomial, does that then mean you must be
	CHAIRMAN: You will say, "What do you mean by defective?",	6	given the pass/fail criteria?
7	and they will say, "Well, we've got a set of figures,	7	A. No. All this discussion I was provided data
8	and it means, if it shows a screw on the outside and	8	COMMISSIONER HANSFORD: No, I'm sorry, I'm not saying that
9	certain screw depths on the inside, that's our defective	9	you had been. What I'm saying is if you take
10	figure", and you will say, "Okay, if you are just	10	a situation where you are given some data, and through
11	looking for defective/non-defective" well, no. "If	11	discussion a decision is made that the best form of
12	you are looking for defective on a statistical basis,	12	analysis of this data would be to use a binomial
		13	analysis, it would then be necessary to be given
13	dinomial I think will work the best, and is the most	10	
13 14	binomial I think will work the best, and is the most feasible because we can make it more complicated but it	14	
	feasible because we can make it more complicated but it becomes non-feasible"?		pass/fail criteria. That would be the next step that would be required in order to then be able to carry out
14 15	feasible because we can make it more complicated but it becomes non-feasible"?	14	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out
14 15 16	feasible because we can make it more complicated but it becomes non-feasible"?  A. Yes, I think it's fair to say that.	14 15	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out that analysis. Am I correct?
14 15 16	feasible because we can make it more complicated but it becomes non-feasible"?  A. Yes, I think it's fair to say that.  CHAIRMAN: So you make that final decision in the light of	14 15 16	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out
14 15 16 17 18	feasible because we can make it more complicated but it becomes non-feasible"?  A. Yes, I think it's fair to say that.  CHAIRMAN: So you make that final decision in the light of information given to you?	14 15 16 17	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out that analysis. Am I correct?  A. It depends. If you have a survival study, it's dead or alive. There is no criteria. Just dead or alive
14 15 16 17 18	feasible because we can make it more complicated but it becomes non-feasible"?  A. Yes, I think it's fair to say that.  CHAIRMAN: So you make that final decision in the light of	14 15 16 17 18	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out that analysis. Am I correct?  A. It depends. If you have a survival study, it's dead or
14 15 16 17 18 19	feasible because we can make it more complicated but it becomes non-feasible"?  A. Yes, I think it's fair to say that.  CHAIRMAN: So you make that final decision in the light of information given to you?  A. You know, I'm a layman in engineering field. My	14 15 16 17 18 19	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out that analysis. Am I correct?  A. It depends. If you have a survival study, it's dead or alive. There is no criteria. Just dead or alive COMMISSIONER HANSFORD: That's a very easy one, but we are
14 15 16 17 18 19 20	feasible because we can make it more complicated but it becomes non-feasible"?  A. Yes, I think it's fair to say that.  CHAIRMAN: So you make that final decision in the light of information given to you?  A. You know, I'm a layman in engineering field. My understanding is if you have a coupler, my	14 15 16 17 18 19 20	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out that analysis. Am I correct?  A. It depends. If you have a survival study, it's dead or alive. There is no criteria. Just dead or alive COMMISSIONER HANSFORD: That's a very easy one, but we are not talking about dead or alive. There's no pulse on
14 15 16 17 18 19 20 21	feasible because we can make it more complicated but it becomes non-feasible"?  A. Yes, I think it's fair to say that.  CHAIRMAN: So you make that final decision in the light of information given to you?  A. You know, I'm a layman in engineering field. My understanding is if you have a coupler, my understanding, the natural understanding, you've got to	14 15 16 17 18 19 20 21	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out that analysis. Am I correct?  A. It depends. If you have a survival study, it's dead or alive. There is no criteria. Just dead or alive  COMMISSIONER HANSFORD: That's a very easy one, but we are not talking about dead or alive. There's no pulse on a coupler, unfortunately.
14 15 16 17 18 19 20 21 22	feasible because we can make it more complicated but it becomes non-feasible"?  A. Yes, I think it's fair to say that.  CHAIRMAN: So you make that final decision in the light of information given to you?  A. You know, I'm a layman in engineering field. My understanding is if you have a coupler, my understanding, the natural understanding, you've got to insert this thing inside (demonstrating with a pen).	14 15 16 17 18 19 20 21 22	pass/fail criteria. That would be the next step that would be required in order to then be able to carry out that analysis. Am I correct?  A. It depends. If you have a survival study, it's dead or alive. There is no criteria. Just dead or alive  COMMISSIONER HANSFORD: That's a very easy one, but we are not talking about dead or alive. There's no pulse on a coupler, unfortunately.  A. Yes.

1	Page 69		Page 71
	made, or it would appear, after the decision is made	1	COMMISSIONER HANSFORD: Okay.
2	that binomial analysis would be used that's what	2	A. It's a natural approach.
3	I think you are telling us?	3	COMMISSIONER HANSFORD: I'm happy with that?
4	A. Yes, after.	4	A. Defective/non-defective, the most used example in
5	COMMISSIONER HANSFORD: After. So step 1, if I'm	5	statistical class, in any course in statistics, flip
6	understanding this correctly tell me if I've got this	6	a coin, very simple. So this is the most natural
7	right is receipt of data. Step 2 is discussion about	7	approach. It arises right from the beginning.
8	this data and decision about what's the best form of	8	If you give me a project like this, the first thing
9	analysis, and the decision was taken, through	9	I think is binomial.
10	discussion, that the best form is probably binomial.	10	COMMISSIONER HANSFORD: But in order to do binomial,
11	Actually, let me remove the word "probable" because	11	a decision then needs to be taken on the criteria for
12	that's not a statistical word. So the best form of	12	heads or tails, doesn't it, pass or fail, black or
13	analysis is binomial. Then step 3 is, therefore, we	13	white?
14	need pass/fail criteria, and that was then given by	14	A. Okay. The first time I was approached to assist to
15	engineers. Is that correct?	15	investigate the whole thing is they talk about the
16	A. No. You said step 1 is receiving the data.	16	coupler was cut or not cut.
17	COMMISSIONER HANSFORD: Yes.	17	COMMISSIONER HANSFORD: That sounds binomial to me.
18	A. No. Before we receive the data, we already have	18	A. Yes.
19	lengthy, lengthy discussions.	19	COMMISSIONER HANSFORD: That's different to engagement
20	COMMISSIONER HANSFORD: Okay.	20	length.
21	A. Before I see any data	21	A. There's a whole lot of allegations going on, because
22	COMMISSIONER HANSFORD: That's fine.	22	before opening-up we have no idea what is going on.
23	A. The data was provided at the end, in the end of the	23	I have no idea. I don't know whether it's cut or not
24	whole thing.	24	cut or engagement length. There is no information why I
25	COMMISSIONER HANSFORD: Okay. So step 1 is a discussion		was approached first to see this whole problem. So cut
	Page 70		Page 72
1	about what data will ultimately be received.	1	or not cut then
2	A. That's fair to say.	2	COMMISSIONER HANSFORD: So if the data provided to you is
3	COMMISSIONER HANSFORD: Step 2 is a discussion about that	3	"cut or no cut", it's clearly binomial?
4	data that will ultimately be received and therefore what	4	
		l .	A. Yes.
5	is the best form of analysis of that.	5	A. Yes.  COMMISSIONER HANSFORD: But if the data that's provided to
5 6	is the best form of analysis of that.  A. Yes.		
	·	5	COMMISSIONER HANSFORD: But if the data that's provided to
6	A. Yes.	5 6	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it
6 7	A. Yes.  COMMISSIONER HANSFORD: And the decision is made the best	5 6 7	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?
6 7 8	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that,</li> </ul>	5 6 7 8 9	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to
6 7 8 9 10 11	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that, we need to be given a pass/fail criteria, but that has</li> </ul>	5 6 7 8 9	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to tell the patient, "You have hypertension, I'm going to
6 7 8 9 10 11 12	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that, we need to be given a pass/fail criteria, but that has to come from the experts, who are the engineers, so</li> </ul>	5 6 7 8 9	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to tell the patient, "You have hypertension, I'm going to prescribe you the medicine."
6 7 8 9 10 11	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that, we need to be given a pass/fail criteria, but that has</li> </ul>	5 6 7 8 9 10 11	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to tell the patient, "You have hypertension, I'm going to prescribe you the medicine."  COMMISSIONER HANSFORD: So therefore someone, in that case
6 7 8 9 10 11 12	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that, we need to be given a pass/fail criteria, but that has to come from the experts, who are the engineers, so that's then provided.</li> <li>A. I think let me clarify a little bit. Actually the</li> </ul>	5 6 7 8 9 10 11 12	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to tell the patient, "You have hypertension, I'm going to prescribe you the medicine."  COMMISSIONER HANSFORD: So therefore someone, in that case a medically qualified person, has to give you
6 7 8 9 10 11 12 13	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that, we need to be given a pass/fail criteria, but that has to come from the experts, who are the engineers, so that's then provided.</li> <li>A. I think let me clarify a little bit. Actually the binomial came at the very beginning.</li> </ul>	5 6 7 8 9 10 11 12 13	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to tell the patient, "You have hypertension, I'm going to prescribe you the medicine."  COMMISSIONER HANSFORD: So therefore someone, in that case
6 7 8 9 10 11 12 13 14 15 16	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that, we need to be given a pass/fail criteria, but that has to come from the experts, who are the engineers, so that's then provided.</li> <li>A. I think let me clarify a little bit. Actually the binomial came at the very beginning.</li> <li>COMMISSIONER HANSFORD: Okay.</li> </ul>	5 6 7 8 9 10 11 12 13 14 15 16	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to tell the patient, "You have hypertension, I'm going to prescribe you the medicine."  COMMISSIONER HANSFORD: So therefore someone, in that case a medically qualified person, has to give you a hypertension or non-hypertension cut-off point, a criteria?
6 7 8 9 10 11 12 13 14 15 16 17	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that, we need to be given a pass/fail criteria, but that has to come from the experts, who are the engineers, so that's then provided.</li> <li>A. I think let me clarify a little bit. Actually the binomial came at the very beginning.</li> <li>COMMISSIONER HANSFORD: Okay.</li> <li>A. Because</li> </ul>	5 6 7 8 9 10 11 12 13 14 15 16 17	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to tell the patient, "You have hypertension, I'm going to prescribe you the medicine."  COMMISSIONER HANSFORD: So therefore someone, in that case a medically qualified person, has to give you a hypertension or non-hypertension cut-off point, a criteria?  A. Yes, that cut-off criteria is 130.
6 7 8 9 10 11 12 13 14 15 16 17	<ul> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And the decision is made the best form is binomial.</li> <li>A. Yes.</li> <li>COMMISSIONER HANSFORD: And step 3 is, in order to do that, we need to be given a pass/fail criteria, but that has to come from the experts, who are the engineers, so that's then provided.</li> <li>A. I think let me clarify a little bit. Actually the binomial came at the very beginning.</li> <li>COMMISSIONER HANSFORD: Okay.</li> <li>A. Because</li> <li>COMMISSIONER HANSFORD: That's fine, but that doesn't change</li> </ul>	5 6 7 8 9 10 11 12 13 14 15 16 17	COMMISSIONER HANSFORD: But if the data that's provided to you is there are different engagement lengths, is it still clearly binomial?  A. As I said, even if you give me a continuous measurement engagement length, I use the blood pressure example, the blood pressure is a continuous measurement. You have to tell the patient, "You have hypertension, I'm going to prescribe you the medicine."  COMMISSIONER HANSFORD: So therefore someone, in that case a medically qualified person, has to give you a hypertension or non-hypertension cut-off point, a criteria?  A. Yes, that cut-off criteria is 130.  COMMISSIONER HANSFORD: Yes, yes, but in the case here, you
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	Page 73		Page 75
1	cut"?	1	or any strength reduction to be applied to be
2	A. Yes, you see, the data I have to explain this.	2	an adequate coupling? Has anyone at any stage told you
3	I design clinical trials. You design clinical trials,	3	that the strength or the load-bearing capacity could be
4	you don't see the data. You eed to plan out the whole	4	a continuous bear a continuous proportion with the
5	problem right at the beginning.	5	length of the embedded coupler, and asked you to advise
6	COMMISSIONER HANSFORD: I understand.	6	on an appropriate model on that basis?
7	A. How many samples you need, what if this happens, then	7	A. There are a lot of discussions about engagement length.
8	what do you do? The same situation here. I was	8	For example, if you choose I think we talk about 35,
9	approached, I don't know exactly what's going on, cut or	9	30 I don't remember. You know, there are so many
10	not cut.	10	discussions, so many possibilities to choose where you
11	COMMISSIONER HANSFORD: But when you do the clinical data	. 11	want to cut not cut, cut-off values on the engagement
12	you are not told "dead or not dead", are you?	12	length. There are a lot of discussions about that.
13	A. No, toxicity or non-toxicity, response or no response.	13	CHAIRMAN: All right. Can I just ask this. There were
14	COMMISSIONER HANSFORD: Okay.	14	a lot of discussions about this, and at the end of the
15	A. If you do a phase 2 trial, this patient responds or does	15	day, what was determined was that two criteria would be
16	not respond, binary data.	16	used, right, the ones you have already set out, and
17	COMMISSIONER HANSFORD: Okay.	17	there would not be a continuum of criteria? In other
18	A. And there are other possibilities but then you have to	18	words, if it's 35, it's okay; if it's 36, it's getting
19	discuss all the things in advance, before you see the	19	dangerous; if it's 38, oh dear; and if it's 40,
20	data. The trial needs to be designed before the trial	20	everybody run?
21	starts collecting the data.	21	COMMISSIONER HANSFORD: Or the other way around.
22	COMMISSIONER HANSFORD: Yes.	22	CHAIRMAN: Or the other way around.
23	A. Like sample size needs to be calculated before I even	23	A. You confused me. The other way around.
24	look at any	24	CHAIRMAN: Do you see the point I mean?
25	COMMISSIONER HANSFORD: So before collection of any data	25	A. Yes.
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	Page 74		Page 76
1	here, the decision was, whatever data comes, the method	1	Page 76 CHAIRMAN: In other words, at the end of the day, you were
1 2		1 2	
	here, the decision was, whatever data comes, the method		CHAIRMAN: In other words, at the end of the day, you were told, "These are the criteria, binomial criteria, we wish to use to determine the measure of defectiveness.
2	here, the decision was, whatever data comes, the method of analysis that would be used would be binomial?	2	CHAIRMAN: In other words, at the end of the day, you were told, "These are the criteria, binomial criteria, we
2 3	here, the decision was, whatever data comes, the method of analysis that would be used would be binomial?  A. You know what, I think, as I said earlier, there are	2 3	CHAIRMAN: In other words, at the end of the day, you were told, "These are the criteria, binomial criteria, we wish to use to determine the measure of defectiveness.  Now, what defectiveness is is for us. What use we put it to is for us. How good it is in the broader world
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2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	here, the decision was, whatever data comes, the method of analysis that would be used would be binomial?  A. You know what, I think, as I said earlier, there are a lot of things you need to pre-specify before you observe the data, otherwise you manipulate the whole analysis.  COMMISSIONER HANSFORD: I understand.  A. Like the confidence interval, 95 per cent, 5 per cent is significance level, you need to pre-specify before you even see anything. And once you see the data, you change it, it's very dangerous. You could manipulate the data to do something that you want the data to tell you. As a statistician, that's what we are trained for.  MR SHIEH: Can I follow up on this? Right at the outset or indeed at any stage and this is a question of fact, not a question concerning any statistical expertise; I'm asking you as a question of fact has anyone at any stage told you that, "Look, the problem is different engagement lengths may give rise to different load-bearing capacities"? If it inserted  40 millimetres, then it's very strong; if it's 37, it's a little bit strong; if it's 35, it's still a bit	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	CHAIRMAN: In other words, at the end of the day, you were told, "These are the criteria, binomial criteria, we wish to use to determine the measure of defectiveness.  Now, what defectiveness is is for us. What use we put it to is for us. How good it is in the broader world and how useful it is in the broader world is for us.  Your job now is to take these two measurements and to work out a set of statistics to show how those measurements, or the level of their pervasiveness in this particular exercise; right?  A. I was not even involved in those criteria. As I said, I was provided with the data, with the column "pass or fail" already. There's one column, it's called "pass or fail"; it's given already.  COMMISSIONER HANSFORD: With respect, I don't think we are talking about that. I think we are talking about in the discussion stage.  You've told us that there was a lengthy discussion stage, with people from government and MTR, and you don't even know who everybody was, and during that stage you weren't provided with data, you weren't provided with sheets that said "defective"/"not defective". You

	Page 77		Page 79
1	COMMISSIONER HANSFORD: And that's the bit we're talking	1	discussed with you or given you instruction that "There
2	about.	2	is the behaviour of metal is that it's all gradually
3	A. Okay.	3	fading out and not an abrupt cutting off at a certain
4	COMMISSIONER HANSFORD: That's the stage we're talking	4	length"? Has anyone told you that and asked you to
5	about. So, during this stage, we're trying to	5	design?
6	understand how the decision was reached that it should	6	A. That's common sense. I don't even need people to tell
7	be binomial, and Mr Shieh has just asked about whether	7	me. I understand. I have a physics major, masters'
8	there was discussion about different engagement lengths	8	degree in physics. I understand. It's a gradual
9	and the contribution that given engagement lengths might	9	process. I don't need people to instruct me or to tell
10	have to structural integrity, how that could be	10	me. That's a common-sense thing.
11	analysed, whether there was any discussion of that	11	Q. So nobody told you to devise a scheme to take into
12	nature.	12	account the behaviour of embedded threads depending on
13	MR SHIEH: At all. Can I just follow on from	13	how many millimetres have been embedded?
14	Prof Hansford's question, because otherwise the focus of	14	A. You see, if you enter that zone, talking about
15	the question could well be lost. So let me ask this	15	engagement or residual, what kind of association you are
16	question	16	talking about? It's linear, non-linear? It's getting
17	COMMISSIONER HANSFORD: Sorry about that, Mr Shieh.	17	into a very complicated discussion.
18	MR SHIEH: No, it's my question the focus of which has been	18	COMMISSIONER HANSFORD: That would be for the engineers
19	lost	19	A. Exactly. That's why
20	COMMISSIONER HANSFORD: Okay.	20	COMMISSIONER HANSFORD: No, no, no, sorry. What they do
21	MR SHIEH: because just now I was asking you this	21	with the data or the analysed data would then be for the
22	question and I will repeat it. At the planning stage	22	engineers.
23	we are not talking about even before you received the	23	A. I know, yes.
24	data, at the planning stage, when you planned whether to	24	MR SHIEH: But what I'm asking is: has anyone actually told
25	use binomial or whatever nomial or continuous in the	25	about that kind of information and asked you to design
	Page 78		Page 80
1	instructions or the education process that had been	1	a scheme accordingly? I know it's complicated. Maybe
2	given to you in this area, have you been told I'm not	2	it's because it's so complicated nobody has told you,
3	talking about exact words, my focus is not on the exact	3	but I'm asking a question of fact.
4	words, my focus is on the idea has anyone told you,	4	A. No. As I said, I don't even need people to tell me.
5	"Look, the behaviour of metal is such that the deeper	5	I understand. This is common sense. Even as
6	you embed, the stronger it is, but then there is	6	statistician, if you give me engagement length, I would
7	a gradual fading out, until, if you completely	7	automatically think, okay, first, whether you can use it
8	disconnect, then there's no force, but there's" let's	8	as a continuous variable or if you want to classify into
9	say, for example, not precise words, don't catch me on	9	different levels, just as you described, it's
10	precise words so let's say if it's 40, then it's very	10	a common-sense thing.
11	strong; if it's 35, it's less strong but still quite	11	Q. But nobody actually gave you the data and some
12	strong; 32, a little strong but still okay so can you	12	calculation such as if it's 40 then it's X load-bearing
13	design a best scheme to work it all out, would you do	13	strength; if it's 38 then it's a little bit less
14	binomial or multinomial or continuous? The same thing	14	nobody gave you that kind of information; correct? It's
15	of this nature taken place. Don't tell me there's been	15	a question of fact. Did anyone give you that kind of
16	lots of discussions, I know about that already, don't	16	information and ask you to design a scheme or a plan
17	give me that answer. Has anyone discussed with you the	17	a model?
18	behaviour of screws according to different embedded	18	A. It was this is September; right? It was last year.
19	length? I'm talking about that sort of specificity.	19	I don't remember who gave me or who didn't give me.
20	That is the focus.	20	I cannot recall.
		21	Q. Thank you very much. Can I ask you one last question
21	I'm not asking you I repeat one more time; I'm		
22	sure you are an intelligent man I'm not asking you	22	before we break for lunch?
22 23	sure you are an intelligent man I'm not asking you whether there have been discussions. We know there have	22 23	before we break for lunch? A. Yes.
22	sure you are an intelligent man I'm not asking you	22	before we break for lunch?

1 A. Yes. 2 Q. If you set a pass mark at 80 per cent, you are going to 3 get more failures than if you set your pass mark at 4 S0 per cent; correct? 3 A. Yes. 4 S0 per cent; correct? 5 A. Yes. 6 Q. So whether someone fails or passes very often depends on how high you set the pass mark; correct? 7 A. Yes. 9 MR SHIEH: Thank you very much. 11 Professor. We are going to adjourn mow for lanch, but 12 you will he required no return to give your evidence, to 13 finish your evidence, this afternoon. My apologies for that. 13 Trinish your evidence, this afternoon. My apologies for that. 14 that: 15 You should be told, all witnesses are told, whether evidence, to 16 expert witnesses or not, that you mustan't shart 21 debating what you said or didn't say, what you should be put in the "fail' category; correct!" A. Yes. 16 expert witnesses or not, that you mustan't shart 21 debating what you said or didn't say, what you should be put in the "fail' category; correct!" A. Yes. 20 CILAIRANA: Or-viously you can sit with people, have lunch. talk about whatever you like, but you mustan't shart 21 debating what you said or didn't say, what you should do is to assign the mean value of the other known samples to it as assign the mean value of the other known samples to it as assign the mean value of the other known samples to it as assign to the other known samples to it as assign the mean value of the other known samples to it as assign the mean value of the other known samples to it as assign the mean value of the other known samples to it as assign to the fail, this is Dr Wells in so hear with a sample which of your age, and if it is assigned, a sample with on a gree with or not agree with?  14 That the can be assigned as a sample with the described length; our earn of it do you age with or not agree with?  15 A. Yes.  16 Page 82  17 You should be told, all witnesses are told, whether the put in the "fail' category; correct?"  28 WITNESS: Yes.  29 Page 82  20 I was going to say 2.30. Tappreciate it's 1.20 already and the age of		Page 81		Page 83
2 Q. If you set a pass mark at 80 per cent, you are going to get more failures than if you set your pass mark at 4 S0 per cent; cornect?  5 A. Yes.  6 Q. So whether someone fails or passes very often depends on how high you set the pass mark; cornect?  7 how high you set the pass mark; cornect?  8 A. Yes.  8 A. Yes.  9 MR SHIEH: Thank you very much.  10 CHARRMAN: All right. Good. Thank you very much.  11 Professor. We are going to adjourn now for lunch, but 12 you will be required to return to give your evidence, to 13 firmsh your evidence, this aftenoon. My apologies for 14 that.  15 You should be told, all witnesses are told, whether expert witnesses or not. hat you mustan't discuss your evidence over funchrime with anybody.  17 with State of the thing of the pass mark; cornect?  18 WITNESS: Yos.  19 CHARRMAN: Obviously you can sit with people, have lunch.  10 tild about whatever you like, but you mustan't start debetaing what you said or differ say, what you should 22 say, or anything like that. Okay?  20 WITNESS: Okay, yes.  10 CHARRMAN: All right. 230. Thank you very much.  11 It was going to say 2:30. Lappreciate it's 1.20 already but 1 think we should start at 2:30.  12 A. Yes.  13 GHARMAN: All right. 230. Thank you very much.  14 I was going to say 2:30. I appreciate it's 1.20 already but 1 think we should start at 2:30.  14 I was going to say 2:30. Thank you very much.  15 A. Yes.  16 Q. I will have the model that you have designed, a sample with the discarding out defective or non-defective rate; correct?  17 A. Yes.  18 A. Yes.  19 Q. In fact, you and Dr Wells have both given your in the proceed to examine the model that you have designed; a separated it is visually unconnected, if by visual inspection it is not connected, if by visual inspection it is not connected, if would be part in the "fail" category; correct?  20 Q. For the embedded length; correct?  21 A. Yes.  22 O. A dif you encounter difficulty in conducting PAUT measurement, you would regard that as an invalid specimen or sample; correct?	1	A. Yes.	1	a non-defective one and therefore it is biased.
3 get more failures than if you set your pass mark at 3 6 Q. So whether someone fails or passes very often depends on 1 how high you set the pass mark; correct? 3 A. Yes. 4 Nes. 5 MR SHIEH: Thank you very much. 10 CHAIRMAN: All right. Good. Thank you very much. 11 Professor. We are going to adjourn now for lunch, but you mit any tody. 12 you will be required to rearm to give your evidence, to finish your evidence, this afternoon. My apologies for that that. 13 finish your evidence, this afternoon. My apologies for that that. 14 that. 15 You should be told, all wimesses are told, whether evidence, to finish your evidence, to finish your evidence over Inturchine with anybody. 16 CHAIRMAN: All right. Good of didn't say, what you should be told all wimesses are told, whether evidence, to finish your evidence over Inturchine with anybody. 16 CHAIRMAN: Obviously you can sit with people, have lunch, 20 talk about whatever you like, but you mustn't start 21 debating what you said or didn't say, what you should 21 say, or anything like that. Okay? 23 WITNESS: Okay, yes. 24 UTINESS: Okay, yes. 25 WR PENNICOTT: I don't know how Mr Shieh is getting on but 25 war finish you will be discarded if in six visually and you required to be connected, it would be the finish we should star at a 2.30. 24 Law say of anything like that. Okay? 25 WR PENNICOTT: I don't know how Mr Shieh is getting on but 25 war finish. A yes. 26 (2.40 pm) 27 Law spoing to say 2.30. I appraciate lifs 1.20 already but I think we should star at 2.30. 38 CHAIRMAN: All right, 2.30. Thank you very much. 40 Lill with a we should star at 2.30. 41 Law spoing to say 2.30. Thank you very much. 42 Law spoing to say 2.30. Thank you very much. 43 Law spoing to say 2.30. Thank you very much. 44 Lill with a we should star at 2.30. 45 CHAIRMAN is all right, 2.30. Thank you very much. 46 CA Pam. 47 Page 84 48 CHAIRMAN is all right, 2.30. Thank you very much. 49 Law spoing to say 2.30. I appraciate lifs 1.20 already to topic of micking values; right? 40 Lill with we should	2		2	
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16   expert witnesses or not, that you mustn't discuss your   16   vidence over lunchtime with anybody.   17   vidence over lunchtime with anybody.   18   witnesses or not, that you mustn't start   18   witnesses. Yes.   18   by PAUT   20   CHAIRMAN: Obviously you can sit with people, have lunch, talk about whatever you like, but you mustn't start   20   debating what you said or didn't say, what you should   21   A. Yes.   22   say, or anything like that. Okay?   22   23   say, or anything like that. Okay?   22   24   CHAIRMAN: Mr Pennicott?   24   25   WITNESS: Okay, yes.   25   Page 82   Page 84   27   Was going to say 2.30. I appreciate it's 1.20 already   26   but I think we should start at 2.30.   27   28   28   29   29   29   29   29   29	15	You should be told, all witnesses are told, whether	15	A. Yes.
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19 CHAIRMAN: Obviously you can sit with people, have lunch, 20 talk about whatever you like, but you mustn't start 21 debating what you said or didn't say, what you should 22 say, or anything like that. Okay? 22 Q. —on the embedded length; correct? 23 WITNESS: Okay, yes. 23 measurement, you would regard that as an invalid specimen or sample; correct? 24 CHAIRMAN: Mr Pennicott? 25 MR PENNICOTT: I don't know how Mr Shieh is getting on but 25 A. Yes. 26 Page 82 Page 84 1 Iwas going to say 2.30. I appreciate it's 1.20 already 25 but I think we should start at 2.30. 26 CHAIRMAN: All right. 2.30. Thank you very much. 27 A. Yes. 28 Page 84 1 (1.23 pm) 4 Q. It would not be taken into account in working out 28 defective or non-defective rate; correct? 3 A. Yes. 4 Q. It would not count as one of — it would not be counted 28 part of the denominator; correct? 4 A. Yes, correct. 7 Q. Dr Wells' opposition is that, in doing so, you are 28 disregarding a specimen which potentially could pass, 29 reasonably quickly. 9 because it is connected. It could very well be 40 millimetres embedded, but you don't know, so you discard it or whether you take it into account but 38 aspiral or whether you take it into account but 38 aspiral or whether you take it into account but 38 aspiral or whether you take it into account but 39 A. Yes. 19 Infact, you and Dr Wells have both given your 19 Infact, you are discardi it or whether you take it into account but 39 A. Yes. 19 Infact, you are discarding a specimen which potentially you don't know. It could be a pass or could be a fail. This is 20 exactly what I said. What I mean is you are 30 discarding a value to it. You have given your views on it. 18 Infact, you are discarding those samples because PAUT 19 A. Yes. 19 Infact, we is that by discarding a sample which 20 Infact, we is that by discarding a sample which 21 Infact, we is that by discarding a sample which 21 Infact, we is that by discarding a sample which 22 Infact, we is that by discarding a sample which 22 Infact, we is that by disca	18		18	-
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13 that? 14 opinion 15 A. Yes. 16 Q on how to treat an invalid sample, whether or not you 17 discard it or whether you take it into account but 18 assign a value to it. You have given your views on it. 19 A. Yes. 10 Q. I think what I can do is just to put to you what 20 Dr Wells has said and invite your comment. 21 Dr Wells' view is that by discarding a sample which 22 visually is connected to a coupler, because you have 23 difficulty in measuring the embedded length, you are 14 A. It's also potentially a fail, potentially you don't 16 A. It's also potentially a fail, potentially you don't 17 A. It's also potentially a fail, potentially you don't 18 know. It could be a pass or could be a fail. This is 18 exactly what I said. What I mean is you are 19 discarding you cannot obtain PAUT result, not because 18 underlying outcome pass or fail of the engagement 19 length. You are discarding those samples because PAUT 20 results cannot be obtained, for reasons that's 21 irrelevant to the outcome. 22 For example, I was told by the engineer, "You need 23 to make the surface of the coupler smooth, very smooth, 24 shining, and the angle of the device has to be properly	12	A. Yes.	12	
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15 A. Yes.  16 Q on how to treat an invalid sample, whether or not you 17 discard it or whether you take it into account but 18 assign a value to it. You have given your views on it. 19 A. Yes. 19 length. You are discarding those samples because PAUT 20 Q. I think what I can do is just to put to you what 21 Dr Wells has said and invite your comment. 22 Dr Wells' view is that by discarding a sample which 23 visually is connected to a coupler, because you have 24 difficulty in measuring the embedded length, you are 25 know. It could be a pass or could be a fail. This is 26 exactly what I said. What I mean is you are 27 discarding you cannot obtain PAUT result, not because 28 underlying outcome pass or fail of the engagement 29 length. You are discarding those samples because PAUT results cannot be obtained, for reasons that's 20 irrelevant to the outcome. 21 irrelevant to the outcome. 22 For example, I was told by the engineer, "You need to make the surface of the coupler smooth, very smooth, shining, and the angle of the device has to be properly	14	opinion	14	A. It's also potentially a fail, potentially you don't
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discard it or whether you take it into account but assign a value to it. You have given your views on it.  18 assign a value to it. You have given your views on it. 19 A. Yes. 19 length. You are discarding those samples because PAUT 20 Q. I think what I can do is just to put to you what 21 Dr Wells has said and invite your comment. 22 Dr Wells' view is that by discarding a sample which 23 visually is connected to a coupler, because you have 24 difficulty in measuring the embedded length, you are 25 discarding you cannot obtain PAUT result, not because 26 underlying outcome pass or fail of the engagement 27 results cannot be obtained, for reasons that's 28 irrelevant to the outcome. 29 For example, I was told by the engineer, "You need 20 to make the surface of the coupler smooth, very smooth, 21 shining, and the angle of the device has to be properly	16	Q on how to treat an invalid sample, whether or not you	16	exactly what I said. What I mean is you are
assign a value to it. You have given your views on it.  18 underlying outcome pass or fail of the engagement  19 A. Yes.  19 length. You are discarding those samples because PAUT  20 Q. I think what I can do is just to put to you what  21 Dr Wells has said and invite your comment.  22 Dr Wells' view is that by discarding a sample which  23 visually is connected to a coupler, because you have  24 difficulty in measuring the embedded length, you are  18 underlying outcome pass or fail of the engagement  19 length. You are discarding those samples because PAUT  20 results cannot be obtained, for reasons that's  21 irrelevant to the outcome.  22 For example, I was told by the engineer, "You need  23 to make the surface of the coupler smooth, very smooth,  24 shining, and the angle of the device has to be properly	17	discard it or whether you take it into account but	17	•
19 A. Yes.  19 length. You are discarding those samples because PAUT 20 Q. I think what I can do is just to put to you what 21 Dr Wells has said and invite your comment. 22 Dr Wells' view is that by discarding a sample which 23 visually is connected to a coupler, because you have 24 difficulty in measuring the embedded length, you are 25 length. You are discarding those samples because PAUT 26 results cannot be obtained, for reasons that's 27 irrelevant to the outcome. 28 For example, I was told by the engineer, "You need 29 to make the surface of the coupler smooth, very smooth, shining, and the angle of the device has to be properly	18	assign a value to it. You have given your views on it.	18	underlying outcome pass or fail of the engagement
Dr Wells has said and invite your comment.  21 irrelevant to the outcome.  22 Dr Wells' view is that by discarding a sample which 23 visually is connected to a coupler, because you have 24 difficulty in measuring the embedded length, you are 25 irrelevant to the outcome. 26 For example, I was told by the engineer, "You need 27 to make the surface of the coupler smooth, very smooth, shining, and the angle of the device has to be properly	19	A. Yes.	19	length. You are discarding those samples because PAUT
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visually is connected to a coupler, because you have 23 to make the surface of the coupler smooth, very smooth, 24 difficulty in measuring the embedded length, you are 23 to make the surface of the coupler smooth, very smooth, 24 shining, and the angle of the device has to be properly	21	Dr Wells has said and invite your comment.	21	
visually is connected to a coupler, because you have 23 to make the surface of the coupler smooth, very smooth, 24 difficulty in measuring the embedded length, you are 23 to make the surface of the coupler smooth, very smooth, 24 shining, and the angle of the device has to be properly	22	Dr Wells' view is that by discarding a sample which	22	For example, I was told by the engineer, "You need
24 difficulty in measuring the embedded length, you are 24 shining, and the angle of the device has to be properly	23	visually is connected to a coupler, because you have	23	
25 discarding a sample which potentially could be 25 aligned." It's tedious work to do this measurement and	24	difficulty in measuring the embedded length, you are	24	shining, and the angle of the device has to be properly
	25	discarding a sample which potentially could be	25	aligned." It's tedious work to do this measurement and

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you know the concrete makes those couplers dirty, it's 1 2 hard to clean that. So this reason is not related to

3 the outcome.

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So my statement is discarding those missing values is valid approach. Imputing those missing values using the mean value is invalid approach. I showed you this document, one-page document. There are three points that telling you it's invalid approach.

- Q. Prof Yin, two points to follow up. One, your proposition is it is acceptable to discard results which are not obtainable for reasons unrelated to the potential outcome; right?
- 13 A. Yes.
- 14 Q. But what I'm suggesting to you is in the situation that 15 we are concerned with, in the model of testing, the 16 disregarding is for a reason related to the potential 17 outcome because, by the time you decide to discard 18 an unreadable sample, it has already passed the visual 19 examination, so it is something which is not a clear 20 fail; it is something which has the potential of 21 passing. So it is disregarding a sample which is on the
- 22 potential pass side of the situation. 23 A. It's also a potential fail. You don't know. This is my 24 point. This is a very well-known statistical fact: you
  - should not impute mean value to the missing data. This

causing any bias.

Q. Thank you, Professor. I think Dr Wells disagrees with you on the basis that it is a discarding on a ground related to the potential outcome, but you have made your position clear.

My next point is the handout you produced, the

document called "3 problems with mean imputation". I just came across this this morning after you handed it out. Within the limited time available -- the author referred to a previous article when he showed how to use SAS to perform mean imputation. Do you see that first sentence?

13 A. Yes, I see.

- 14 Q. So mean imputation is something of a known procedure in 15 statistics, according to this; correct?
- 16 A. For simplicity.
- 17 Q. Yes. But he says there are three problems and then he 18 tried to explain what he regards to be the problems;

19 correct?

20 A. Yes. Correct.

> Q. So it's an accepted procedure in statistics. This author regards there to be some problems, but it does not mean that it is in all cases inappropriate to apply it for analysis purposes. It doesn't say so.

25 A. It listed three obvious problems with this approach, and

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is a very well-known statistical fact.

- Q. But it is not a clear fail; right? If it's a complete disconnect, then it would simply be dumped into the "fail" pile; correct?
- 5 A. Yes.
- 6 Q. So it is not a clear fail, it has the potential of 7 passing, and you are disregarding the probability of it 8 passing?

A. It's also a potential fail. As I said, we have no idea. Let me give you an example. When -- you cannot discard missing data. I will give you a very simple example. Suppose you are measuring toxicity level of a patient, and the patient is treated by the drug, and some patients, their toxicity level is just so high, they cannot tolerate anymore; they drop out of the study, and you cannot get measurement of their toxicity level. So, by discarding those samples, you actually underestimate the toxicity level because those potentially missing data actually have very high toxicity level.

20 So that's what I mean. If you discard samples for 21 22 reasons related to the outcome, you cannot discard them. 23 If you discard samples missing because of reasons unrelated to the potential outcome, it's a perfectly 24 valid statistical approach to discard them, without 25

these three problems, in my view, statistically speaking, are serious problems. I would rather discard those missing data without causing any statistical problem to the analysis.

If you impute like this, you are actually causing bias. As he said here, first, you reduce the variance, which I shouldn't. Second, you shrink the standard error, so that invalidates your calculation of the confidence interval, which is our key point here, confidence interval. That's the second point right

Q. By applying a mean value to the missing specimen, it actually provides, in crude layman terms, a best guess, a best estimate, as to the likely value in that sample; do you accept that?

In other words, rather than taking that out of the denominator and enumerator, you put that in as part of a denominator, and for the value you just attribute a best guess, based on the mean of the other known values?

A. Yes. Just reflect what you said: it's the best guess. It's not your data. You are imputing something that's not there. That's your guess. And that guess caused a lot of problems listed here.

The mean value imputation is used sometimes for

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	Page 89		Page 91
1	simplicity. Statisticians sometimes use invalid method	1	A. Yes.
2	for simplicity sometimes, because, if you don't have the	2	Q you open up the first layer, you see three couplers
3	best solution, you can come up with an approximate	3	already
4	solution, rather than no solution.	4	A. Yes.
5	But here we have a solution, by discarding those	5	Q and you take those three couplers into account?
6	samples, and that's a perfect solution.	6	A. Yes.
7	Q. Right. I think we have put and understood each other's	7	Q. So that's why it adds up to more than 84; that's what
8	position and can I just move on to the next topic	8	you say?
9	A. Sure.	9	A. Exactly.
10	Q and that is the question about randomness.	10	Q. You also make the point, I think correct me if I am
11	A. Okay.	11	wrong that different panels have different lengths so
12	Q. Dr Wells' point you know his point concerning at the	12	they may contain different number of couplers
13	number of panels and the proportion between the panels	13	A. Yes.
14	with capping beams details and without	14	Q is that your additional point?
15	A. Yes.	15	A. Yes.
16	Q comparing with the proportion between the ultimate	16	Q. So you are suggesting, are you not, that the number, the
17	specimens you know the point he is making?	17	original number, of 237, should not how should I put
18	A. I know, yes.	18	it one should not place weight on this initial number
19	Q. Therefore I call that a randomness point. His point is	19	of 237 in assessing the proportion of the ultimate
20	that upon drawing the specimens and seeing the ultimate	20	samples; are you suggesting that?
21	outcome, and upon seeing this disproportionality or	21	A. What do you mean, "put weight"? Can you be more
22	disparity in the proportion, one ought to pause and	22	specific?
23	reflect whether anything has gone wrong or one ought	23	Q. Can I show you the way Dr Wells has put it.
24	then to revisit the procedure one has taken? That is	24	A. Yes.
25	the limit of what he was proposing?	25	Q. It is Dr Wells' report at paragraph 4.2, internal
	Page 90		Page 92
1	A. Yes.	1	page 4.
2	Q. It is something which should raise eyebrows and cause	2	At paragraph 4.2, he said:
3	you to pause and think and reflect; that is the point he	3	"Sampling is a difficult subject"
4	is making?	4	And paragraph 4.3, he said he quotes from
5	A. Yes.	5	a document called the "capping beam document". This is
6	Q. As I understand you to be saying in the slides that you	6	a document supplied, I think, by the MTR to explain in
7	have produced, you said sometimes, if you go deeper	7	greater detail how the MTR the details of the
8	A. Yes.	8	sampling conducted by the MTR on those panels in which
9	Q although every panel, if chosen, you examine three	9	capping beams are present; right? And MTR explained the
10	couplers	10	formula that was adopted to work out the rate of defects
11	A. Yes.	11	and also the strength reduction factor; right?
12	Q but if it's buried a few layers down, are you	12	A. Yes.
13	suggesting that, under your methodology, you don't just	13	Q. You are aware of that document?
14	examine the chosen bottom layer, you also look at	14	A. I'm not aware of this document.
15	couplers in the layers above the chosen bottom layer; is	15 16	Q. But anyway, the document actually sets out what is
16	that what you are saying?		called the Formula, capital F. You are aware of
17 18	A. Yes, because in order to reach the third layer, you have	17 18	a concept called the Formula, which is a formula used to
18	to open up the first layer. That's the data already exposed. You shouldn't throw away valuable data.	19	calculate the strength reduction factor for those panels with capping beam details?
17	CAPOSEU. I OU SHOUIUH I UHOW AWAY VAIUADIE GALA.	17	with capping beam details:
20	•	20	Δ I'm not aware of capital F. I don't know what you are
20	Q. So you are saying, in the methodology, if for example	20 21	A. I'm not aware of capital F. I don't know what you are talking about
21	Q. So you are saying, in the methodology, if for example upon phase 2 that's phase 2; phase 2 is to decide the	21	talking about.
	Q. So you are saying, in the methodology, if for example		_ · · · · · · · · · · · · · · · · · · ·

 $Q. \ \ The \ document \ entitled \ "D-walls/platform \ slab \ connections$ 

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via capping beams".

Q. If in phase 2 it was decided that the drawing of lots or

the random process, it comes out "the third layer" --

Page 95 Page 93 1 those panels were excluded before we started the random 1 A. Can I see this document, please? 2 draw. That's one point. So that's numbers should not 2 Q. Yes. It is in the opening-up bundle at 9805. 3 3 A. Okay. be used. 4 Q. You can see: 4 Second --5 Q. Should not be used? 5 "From the construction record (out of a total of 237 6 A. Those numbers -- used --6 D-wall panel), 175 ... are without capping beam details 7 7 Q. You mean 175 and 62, those numbers should not be used by (type a) and 62 ... are with capping beam details ..." 8 8 Do you see that? Dr Wells for comparison? 9 A. You should exclude those panels that have already been 9 A. Yes, at the bottom. 10 10 Q. This is the proportion relied on by Dr Wells to begin excluded from the beginning. 11 with. 11 And a second point, I think his calculation is 12 invalid because he used 90. That basically 83, type A; 12 A. Okay. 13 Q. So he says, under the original drawings, 237, and 13 7, type B. These numbers are not original number of 14 14 samples we drew from the population, because those there's a certain proportion of 175 versus 62; yes? 15 15 numbers are the valid PAUT results by removing those A. Yes. 16 Q. Dr Wells went on to say -- if you look at the results at 16 missing data. So what he would do, in a more craft (?) 17 way is use 102 as the sample size, and the 11 as the 17 4.4 of the report --18 A. Yes. 18 number of samples with capping beam, because that's the Q. -- he said: 19 19 sample we took from the job, before doing any missing 20 "A random sample of size 90 found 83 type A ... and 20 data removal. 21 Q. Yes. Focusing on your first reason -- in other words, 21 7 type B ..." 22 22 the 237 -- you know the 237 figure? Do you see that? 23 23 A. Yes. A. Yes. 24 O. Which breaks down into 175 and 62. 24 Q. He says there's a certain proportion between the actual 25 specimens drawn? 25 A. Yes. Page 94 Page 96 1 A. Yes. 1 Q. That figure, you say, should not be relied upon because 2 Q. And you told me that you understood Dr Wells' point to 2 that figure does not reflect the actual population that 3 3 be that there is a kind of disparity between the is available for picking, because some of those panels 4 4 proportions between the type A and type B details in the have been excluded; correct? 5 drawings; right? 5 A. Yes. 6 6 Q. Can I then ask you to look at the opening-up bundle, 7 7 Q. Within the 237, there is 175 versus 62, but in the page 9805. 8 8 actual specimens drawn it's 83 versus 7. This document then sets out to explain the 9 9 You understand his point? "Estimation of overall proportion of failed couplers 10 A. But his point -connections via capping beams at EWL", and there Q. You may not agree with his point. I'm just asking you followed a series of calculations. Take a look at that. 11 whether you understand this to be point he's making. 12 You have seen this calculation before; right? 13 A. You're right --A. Yes.

- 10 11 12 13
- 14 Q. He is comparing the proportion?
- 15 A. Yes. I understand.
- 16 Q. What you're trying to say is that you shouldn't really
- 17 rely that much on the proportion of 175 versus 62,
- 18 because that may have no bearing on the number of
- 19 specimens drawn. Is that the point you are making?
- 20 A. I have several points. First, you use 175:62 as
- 21 a population, the number of panels. First, some of
- 22 these panels are not in the random draw. They are even
- 23 not in the random sample process, because of two
- 24 reasons. Either a through bar was used, or there was
- 25 mass concrete made those couplers inaccessible, and

- 14 Q. I think you spoke to this calculation in your report?
- 15 A. Yes.

- 16 Q. It has been referred to as the Formula, capital F, but
- 17 you may not be aware of that terminology, but leave that
  - to one side. You are aware of this formula; right?
- 19 A. Where is the capital F?
- 20 Q. It's not referred to in this document, that's why
- 21 I might have confused you.
- 22 A. I see.
- 23 Q. But you are familiar with this process of calculation,
- 24 Prof Yin?
- 25 A. Yes.

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paragraph 4.2.3.

O. Yes.

Q. Yes.

page 20, you can start from page 19 and read on to

A. So we had the formula at the bottom, and that moves on

to the next page. You can see the pB1-hat equals to 2

page 20. So this is the calculation at EWL. So

over 7, pB2-hat equals 2 over 11.

Page 99 Page 97 1 1 Q. It ultimately gets to page 9807. A. So we've got pB-hat equals to 41.56. 2 O. Yes. 2 A. Yes. 3 3 Q. Which is the strength reduction factor of A. Then we move on to 4.2.5. 4 4 Q. Yes. 68.29 per cent; yes? 5 5 A. Yes. A. Try to calculate the variance of pB-hat. You don't need Q. So, basically, these few pages work out the derivation, 6 6 to worry out how that formula, where that comes from. 7 7 how the final strength reduction factor of Through some algebraic manipulation, you get this 8 8 68.29 per cent was reached; yes? variance, and then you plug in those numbers, pB1-hat 9 9 A. Yes. and pB2-hat, you will get this number of 0.0264. 10 10 Q. Now, in this process, the starting point, at 9805, under You move on to the next equation. You see that 11 the heading "Estimation of overall proportion of failed 11 0.6829. There's no involvement of Qa or Qb which you 12 12 couplers connections via capping beams at EWL", is mentioned in this document, OU9805. This 237 is never 13 actually the ratio that we worked out was in the 237, at 13 involved in my calculation. 14 14 Q. Yes, but if you look at that chunk at 4.2.5: the bottom of 9805. 15 15 A. Yes. "Using the delta method and after some algebraic 16 Q. You start off -- now, I don't pretend to understand the 16 manipulation, the variance of pB is given by ..." calculation, I only know what numbers have been taken 17 A. Yes. 17 18 into account -- the starting point of this calculation 18 Q. Is that number of 237 and the components not buried in 19 19 there somewhere? Because otherwise why, in the earlier of working out 68.29 per cent is first of all you look 20 20 document I showed you, which shows exactly the process at 237 being the total population of drawings of panels, whereby the 0.6829 is worked out, it actually started 21 and then 175:62. You then work out two quantities, 21 22 22 called Qa and Qb. Qa and Qb then gets fed into various off with 237? Why is the purpose of doing all that? 23 23 formulae, over the next page, with p and then various A. That's exactly the point I'm trying to make. I did not 24 24 use Qa and Qb. If you look at my derivation, step by things. Then it goes on and on. 25 If you look at the bottom of 9005, Qa is 0.7384; 25 step, there is no Qa and Qb involved, and this document Page 98 Page 100 1 yes? Qb is 0.2616; correct? Do you see that? 1 I am not aware of, I told you already, I have no idea 2 A. Yes. 2 about this F, Formula or whatever. So based on this 3 3 Q. These are derived from the very number of 237 and the thing, I think they are trying to do a different 4 two numbers of 175 and 62; yes? 4 calculation from a different perspective. I simply want 5 So 0.2616 actually features subsequently, in the 5 to tell you this. You could reach the same conclusion 6 middle of 9806? 6 through different angles, because there is not just one 7 7 A. Yes. perfect way to get the right answer. I cannot tell you 8 8 Q. Immediately above "Result with 95 per cent confidence in detail how this whole thing being worked out, because 9 9 the symbol used in this OU9806 is not a mathematical interval". So that 0.2616 was utilised. 10 10 Without actually understanding the magic of all symbol. 11 these formulae, the short point I want to make is the 11 For example, Qa, capital Q, small a, we don't use 12 very formula that was used to derive the 68.29 per cent 12 this kind of notation. It makes a mathematician very 13 13 itself started with the 237 and the proportion within hard to read. This uses two letters. If you look at my 14 that 237, which you just told us should not be relied 14 documents, I don't use this kind of notation in 15 15 upon. derivation. Like pB1, what is that? You see p-hat B. 16 A. Yes. That's what I said. 16 He uses all these double letters trying to -- or even 17 So let me explain. If you look at my report, 17 sometimes three letters, to denote one symbol, which

makes a statistician very hard to understand what he was

So I don't want to get into detail about how these

calculations. I want to inform you that my derivation

where this 237 came from. Until you pointed out this

I just took from Wells' calculation. He mentioned

does not involve Qa or Qb -- actually I don't even know

document, I had no idea where this number comes from.

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trying to do.

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## Page 101

- 1 something, probably this capping beam document, but
- 2 I don't have this document. And then based on his
- 3 number I tried to work out his reasoning, and I found
- 4 there are some flaws --
- 5 Q. You mean you were not given the very document upon which
- 6 the MTR purported to justify its calculation of the
- 7 strength reduction factor?
- 8 A. I simply say I don't have these capping beam documents
- 9 you mentioned here. Where is that? Dr Wells -- where?
- 10 Yes, here. You see, this 4.3, UO9805, this whole thing,
- 11 I don't know this document, and frankly speaking, there
- 12 are so many documents, I just have no time to go through
- 13 them. I have no time. I have to do teaching, I have to
- 14 do research, I have to publish papers. No time to dig
- 15 into so many things. This is my point.
- 16 Q. Are you telling us you were unable to understand why, in
- 17 the capping beam document, they actually started off
- 18 with --
- 19 A. I understand. Until you pointed out to me now, I cannot
- 20 understand immediately. I have to read through to
- 21 derive it. Then I can verify whether it's correct or
- 22 not. I need time. But it's not I'm not capable of
- 23 understanding this. I just don't have time right now.
- 24 Q. So, at the moment, you can't assist us as to why that
- 25 document had started off with the 237 figure and the

- 1 which number corresponding to Qa and Qb.
  - 2 Q. No, I'm just saying, in 4.2.5 and 4 -- yes, under 4.2.5,
  - 3 you had a number of references to Delta method and 4 algebraic manipulation, and then further down, normal 5 approximation, and then upper bound?
  - 6 A. Yes.

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- Q. Amidst all this, you are sure that you have not utilised that proportion?
- 9 A. No, it's very clear. If you look at what is the pB1-hat 10
- and pB2-hat, it's given right above. PB1-hat is 2 11
- over 7, PB2-hat is 2 over 11, and that variance is
- 12 simply plug in these two numbers. And you see there's
- 13 number 7, there's number 11, that's a sample on the
- 14 capping beam side. Why is the capping beam side and the
- 15 other is slab side? That's just a sampling size.
- 16 Because you have a 7, therefore missing value, you
- 17 should throw them away and -- look, it's very simple.
- 18 I just don't see where is the Qa and Qb, where those
- 19 numbers -- in my formula I don't have those.
- 20 Q. Anyway, you have told us that you have only seen the
- 21 capping beam document for the first time today and
- 22 within the short time available -- I'm not asking you to
- 23 do it now, you've just told us that you can't
- 24 immediately work out why that document, with that
  - number, came up to that -- I'm not going to press you on

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- 1 proportion, and after having gone through a certain
- 2 process came out to exactly the number that you worked
- 3 out?

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- 4 A. Yes, I did not use those numbers. That's the number
- 5 I came up. And I don't know who did all these things,
- 6 eventually they used Qa/Qb, they got this number. What
- 7 do you want me to say?
  - Q. It's just that if you have not seen it before, then
- 9 I can't press you on that. I'm just putting down
- 10 a marker that the very author of the holistic report,
- 11 who worked out the 68.29 percentage, actually started
- 12 off with that number.
- 13 A. Yes, but if you look at my report, I had a very much
- 14 simpler approach to get that number, and I only have
- 15 half a page of derivation. This one drags on two pages.
- 16 Q. Are you sure, in none of the hidden methods that you
- 17 had -- because in working out a sum, you sometimes use
- 18 formula or assumptions or some basic underlying
- 19 methodology which is not written out in numerical form.
- 20 You're sure that in those underlying formulae or methods 20
- 21 that you use, it has not involved utilising 237 and
- 22 the proportion of 175 versus 62?
- 23 A. Yes, I'm sure. I can go through with you again. You
- 24 can point out which number it is that Qa and Qb from
- 25 page 19. I laid out line by line. You can point out

- that because this is not a statistical quiz of wanting you to do a derivation.
- 2 3 A. Oh, you know what, I can tell you now -- just look at
- 4 OU9806, the bottom, "Result with 95 per cent confidence
- 5 interval". You first calculate the "Variance (p-hat)",
- 6 and that "Variance (p-hat)", you keep going down and
- 7 then you see "Variance (pb-hat)". You see, that
- 8 "Variance (pb-hat)" I believe is my "variance of pB-hat"
- 9 in 4.2.5. You see, that's exactly the same kind of
- 10
  - formula we use. We've got the same number, 0.0264.
- 11 I got 0.0264.
- 12 So, basically, my understanding is all the
- 13 calculation above, basically, from this 237 and keep 14 going down until "Variance (p-hat)", those are something
- 15 else, not pB. My understanding here, "pB" means the
- 16 probability of failure at capping beam. That's my
- 17 understanding, that's where the "pB" comes from,
- 18 "pB-hat"; that's basically my derivation, "pB-hat". So 19 all the derivations above, above with the "Variance

  - (p-hat B)" is something else. So from this point, at
- 21 the bottom, until the rest, if you look at that it does
- 22 not involve Qa and Qb at all. It is the same
- 23 derivation.
  - Q. But Qa and Qb was utilised to derive a certain other value which was then fed into the ultimate equation;

24

	Page 105		Page 107
1	correct? Otherwise, there's no point going through all	1	two things. I did one thing.
2	of that.	2	COMMISSIONER HANSFORD: So that I can just understanding
3	A. But you know, as you said, I don't exactly know all	3	this and who is the "he" we're referring to here?
4	these derivations at this moment. I can verify for you	4	A. I don't know. Who wrote
5	later.	5	COMMISSIONER HANSFORD: It's appendix 2.
6	Q. Anyway, let's not	6	MR SHIEH: This document, appendix B to a response given by
7	A. This becomes a	7	the MTR.
8	Q. Purely as a matter of intuition, you say that figure	8	COMMISSIONER HANSFORD: Yes.
9	should not be relied upon, but in the very formula the	9	MR SHIEH: We can trace the origin of it, because this is
10	MTRC gave us, that was the starting point.	10	a response to because what happened was the holistic
11	Now, you've shown me your calculation which did not	11	report was not very informative as to how the
12	appear to utilise that number, and I was wondering	12	60-odd per cent strength reduction percentage was given,
13	whether, as part of the process in a certain technique	13	and we asked for some information, and we were given, as
14	that you have used, maybe you have utilised it, but it's	14	part of the information given to us, this capping beam
15	unfair for me to put it to you immediately now. Perhaps	15	document.
16	we will move on. If anything	16	I can supplement information. My learned junior is
17	A. No, okay. I just spotted one thing. Come back to	17	checking.
18	OU9806.	18	COMMISSIONER HANSFORD: No, I mean, it's also and maybe
19	Q. Yes.	19	it's a duplication; I'm not sure it's also appendix 2
20	A. If you look in the middle, the two lines above "Result	20	of the MTR's report on statistical analysis.
21	with 95 per cent confidence interval", two lines above,	21	MR SHIEH: Yes.
22	you see:	22	COMMISSIONER HANSFORD: That's where it is, appendix II.
23	"From the result of investigation, p-hat b1 equals	23	MR SHIEH: Yes.
24	2/7, and p-hat b2 equals 2/11".	24	COMMISSIONER HANSFORD: I just wondered who the author would
25	Those are the numbers given. Then you can plug	25	be.
	Page 106		Page 108
1	those numbers into the bottom equation, "Variance (p-hat		MD CHIEH. Colitio on MTD document and it may be by "be"
	1	1	MR SHIEH: So it is an MTR document, and it may be by "he"
2	b)". With those two numbers, you can immediately solve	2	he is referring to the notional author within MTR.
2	b)". With those two numbers, you can immediately solve this whole thing. There's no Qa involved and no Qb		
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3 4	b)". With those two numbers, you can immediately solve this whole thing. There's no Qa involved and no Qb involved. You can solve this "Variance (p-hat b)" immediately, you get 0.0264, and that is what I have done in my report.	2 3 4 5 6	he is referring to the notional author within MTR.  COMMISSIONER HANSFORD: Yes. Maybe my question was a bit rhetorical, but yes.  MR SHIEH: Can I then move on to the next point, which is a reasonably short one, hopefully. You know the point
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10 A. Yes. 11 COMMISSIONER HANSFORD: The bit I don't understand is wher you pool them together, the conclusion is there's no 12 evidence of clustering. If there's been clustering in 13 A. Yes. 14 NSL; there's been clustering. 15 A. You are right, but if you think about this, the data being pooled together, the clustering effect in NSL, after pooling them together, probably being diluted and the statistical evidence becomes weaker. So you see the p value actually lies right between these two p values. 16 So p values give you the stress of the statistical evidence, how strong the clustering is. There's evidence of clustering or no evidence of clustering? 10 just follow what I did and try to verify whether it's correct or wrong. 11 COMMISSIONER HANSFORD: The bit I don't understand is wher you have I did and try to verify whether it's correct or wrong. 12 MR SHIEH: Prof Yin, can I move on to deal with area A. 13 A. Yes. 14 Q. You accept that the strength reduction rate for area A was worked out by a process of extrapolation, because area A itself has no yielded no specimen; correct? 16 It extrapolated from data obtained from other areas; correct? 18 A. You can call it extrapolation, but on the other hand, because area A was involved in the random sample, two panels from area A was inside the pool, but we did not choose them by the random process. So you can either	8	-	8	-
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23 When you pool them 23 say it's extrapolation, or I don't even say	22		22	
ı	23			
24 COMMISSIONER HANSFORD: I'm thinking of "clustering" in 24 extrapolation. I would say, okay, first area A and HKC		- 1		
25 a common-sense term and you are thinking of "clustering" 25 have similar configurations. This is based on my	25	a common-sense term and you are thinking of "clustering"	25	have similar configurations. This is based on my

1 understanding. 2 Q. You were told so by MTR? 3 A. Yes, engineer said we have similar configurations, same contractors, probably similar workmanship, and since are A already inside the pool, even though no sample were drawn, but it's inside the sample pool. So it may not be extrapolated. It's just an estimate for urcu A and HKC together. 3 Q. Yes, Now, can lask you to look again at the capping beam of the certapolated. It's just an estimate for urcu A and HKC together. 4 Q. Yes, Now, can lask you to look again at the capping beam of the certapolated. It's just an estimate for urcu A and HKC together. 5 Q. Yes, Now, can lask you to look again at the capping beam comment that was produced by the MTR. Again, copening-up bundle, page 9810. 4 A. Yes. 5 Q. That's the result of the measurement for the EWL slab. To you see that give rise to the famous two defects result, do you see that? 5 Q. Yes, Now cove defects. Then the total sample for analysis - to the slab side, there are seven; do you see that? 5 Q. Yes, Now defects. Then the total sample for analysis - to the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right? 5 Q. Peysically, you talk about the same I1 chanks - you are availing about the same I1 spors, but then on one side and therefore discarded; correct? 6 Q. Yes, Now for this capping beam side, as and therefore discarded; correct? 7 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide? 8 We have on the screen? 9 MR SHIER: Yes, this is the measurement, because if you look at the bottom right hand corner, you see "Total sample for analysis", one says "IT; the other says"? 10 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide? 11 capped the same I1 spors, but then on one side and therefore discarded; correct? 12 commissioner in the same I1 spors, but then on one side and therefore discarded; correct? 13 commissioner in the same I1 spors, but then on one side and therefore discarded; correct? 14 commissioner in the same I1 spors, but then o		Page 113		Page 115
2 Q. You were told by the engineers? 3 A. Yes, engineering. 4 Q. You were told by the engineers? 5 A. Yes, engineering were drawn, but it's inside the pool, even though no sample were drawn, but it's inside the pool, even though no sample were drawn, but it's inside the sample pool. So it may not be extrapolated. It's just an estimate for area A and HKC together. 5 Q. Yes, Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810. 6 Q. Yes, Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810. 6 Q. Yes, Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810. 6 Q. Yes, two defects. Then the total sample for analysis — 100. 7 Oy think if the result of the measurement for the EWL slab. To you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects resu	1	understanding.	1	defective.
3 A. Yes, engineering. 4 Q. You were told by the engineers? 5 A. Yes, engineer said we have similar configurations, same contractors, probably similar workmanship, and since area A already inside the pool, even though no sample were drawn, but it's inside the sample pool. So it may no be extrapolated. It's just an estimate for area A and HKC together. 4 and HKC together. 5 Q. Yes. Now, can lask you to look again at the capping beam document that was produced by the MTR. Again, jou are asking an engineering problem; right? 5 A. Yes, or this capping beams for all data, it's not my expertise. 6 Q. Yes. Now, can lask you to look again at the capping beam document that was produced by the MTR. Again, jou are asking an engineering problem; right? 7 A. Yes. 10 Q. Yes. Now, can lask you to look again at the capping beam side, then you have failure, but here we have 10 to 11 and yet very not for this capping beams in the capping beams side, all or a valid, for the slab side four are invalid so you get seven; that's correct, right?		=		
4. Ves. engineer said we have similar configurations, same contractors, probably similar workmanship, and since area A already inside the pool, even though no sample were drawn, but it's inside the sample pool. So it may not be extrapolated. It's just an estimate for area A and IIKC together.  10. Q. Yes. Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810.  11. Q. Yes. Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810.  12. A. Yes.  13. Q. That's the result of the measurement for the EWI. Alab. Do you see that gave rise to the famous two defects result; do you see that?  14. A. Yes.  15. Q. That's the result of you see that?  16. A. Yes.  17. Q. Yes, two defects. Then the total sample for analysis—1 think it's the same 11 that's picked, but then for the capping beam side, all are valid, for the slabs side four are invalid so you get seven; thoy ou see that?  18. A. Yes.  19. Q. Physically, you talk about the same 11 chunks — you are invalid so you get seven; thoy are severed; of you see that?  20. Physically, you talk about the same 11 chunks — you are invalid so you get seven; thoy are saying that it could be because it's a longer thread to begin with, and therefore discarded; cornect?  21. A. Yes.  22. A. Yes.  23. Q. Physically, you talk about the same 11 chunks — you are a saying that it could be because it's a longer thread to begin with, and therefore discarded; cornect?  23. A. Yes.  24. A. Wes.  25. Q. Physically, you talk about the same 11 chunks — you are a saying that it could be because it's a longer thread to begin with, and therefore discarded; cornect?  25. A. Yes.  26. Q. Physically, you talk about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid.  27. A. Yes.  28. A. Wes.  29. MR SHIEH: We are talking about the same 11 spots, but since the sales side, four readings are invalid, so there's only and	3		3	
A. Yes, engineer said we have similar configurations, same contractors, probably similar workmanship, and since area A already inside the pool, even though no sample were druwn, but it's inside the sample pool. So it may not be extrapolated. It's just an estimate for area A and HKC together.  10 and HKC together.  11 Q. Yes. Now, can Jask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810.  13 opening-up bundle, page 9810.  14 A. Yes.  15 Q. That's the result of the measurement for the EWL slab. To you see that gave rise to the famous two defects result do you see that govern it have two defects result do you see that?  16 Do you see that gave rise to the famous two defects result do you see that?  27 A. Yes.  28 Q. That's the result of the measurement for the EWL slab. In this from the capping beam side there are 11. For the slab side, there are seven; do you see that?  29 A. Yes.  20 Q. Hink it's the same 11 thut's picked, but then for the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right?  20 Q. Physically, you talk about the same 11 chunks you are stulking about the same 11 spots, but then on one side at lift are valid, on the other side, four are invalid.  21 A. Yes.  22 Q. Physically, you talk about the same 11 spots, but then on the screen?  23 Q. Physically, you talk about the same 11 spots, but then on the screen?  24 A. Yes.  25 Q. Physically, you talk about the same 11 spots, but then on the screen?  26 A. Yes.  27 Q. Physically, you talk about the same 11 spots, but then on the screen?  28 Q. Physically for the slab side, four are invalid, and therefore discarded; currect?  29 MR SHIEH: We are taking about the same 11 spots, but since every spot has two sides, on the capping beam side, as every spot has two sides, on the capping beam side, as every spot has two sides, on the capping beam side, as every spot has two sides, on the capping beam side, as every spot has two sides, o	4		4	-
area A already inside the pool, even though no sample were drawn, but it's inside the sample pool. So it may not be extrapolated. It's just an estimate for area A and HKC together.  Q. Yes. Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810.  A. Yes.  Q. That's the result of the measurement for the EWL slab. Do you see that?  Do you see that?  A. The bottom formula?  Q. Yes, wo defects. Then the total sample for analysis - I think from the capping beam side there are 11. For the slab side, there are exvert, do you see that?  A. Yes.  Q. Physically, you talk about the same 11 that's picked, but then for the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right?  Page 114  A. Yes.  Q. Physically, you talk about the same 11 spots, but then on one side and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the sline we have on the screen?  MR SHIEE! Yes, this is the measurement, because if you look at the bottom right-hand comer, you see "Total sample number for analysis", one says "11", the other says, "7".  MR SHIEE! We are talking about the same 11 spots, but since wervery spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid, on there's only saven.  Can I then invite you to look at the defects are two.  Can I then invite you to look at the defects are two.  Can I then invite you to look at the defects are two.  Can I then invite you to look at the defects are two.  Can I then invite you to look at the defects, the you can have do millimetres embedded. A yess.  Commissioner Hansford:  A. Yes.	5	A. Yes, engineer said we have similar configurations, same	5	
8 expertise. 9 not be extrapolated. It's just an estimate for area A and HKC together. 10 Q. Yes. Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810. 114 A. Yes. 125 Q. That's the result of the measurement for the EWI. slab. 126 Do you see that gave rise to the famous two defects result; do you see that? 127 result; do you see that? 128 A. The bottom formula? 139 Q. Yes, two defects. Then the total sample for analysis — 1 think from the capping beam side there are 11. For the slab side, there are seven; do you see that? 129 A. Yes. 120 I think it's the same 11 that's picked, but then for the capping beam side, all are valid, on the theris side, four rare invalid so you get seven; that's correct, right? 120 Physically, you talk about the same 11 chunks — you are alking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct? 130 Physically, you talk about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct? 131 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide all 11 are valid readings, but on the slab side, four readings are invalid, so there's only at the bottom right-hand corner, you see Total sample in number for analysis, one says "11", the other says "7". 131 COMMISSIONER HANSFORD: Ves. 132 MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin ancecpus, all 1 are valid readings, but on the slab side, four readings are invalid, so there's only at the defects are two. 132 This the corner seems force. 133 The corner of the same of the same of the same of the sale state. The same of the same of the same of the same of the sale state. The same of the same	6		6	
not be extrapolated. It's just an estimate for area A Q. Yes. Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opining-up beam document that was produced by the MTR. Again, opining-up beam document that was produced by the MTR. Again, opining-up boundle, page 9810.  14. A. Yes. 15. Q. That's the result of the measurement for the EWL slab. The poyous cet that gave rise to the famous two defects result; do you see that? 16. The bottom formula? 17. Q. Yes, two defects. Then the total sample for analysis result; do you see that? 18. A. The bottom formula? 19. Q. Yes, two defects. Then the total sample for analysis result; do you see that? 21. Think if she same 11 that's picked, but then for the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right? 22. A. Yes. 23. Q. I think if's the same 11 that's picked, but then for the capping beam side, all are valid, for the slab side four are invalid, so you get seven; that's correct, right? 24. A. Yes. 25. Q. Physically, you talk about the same 11 chunksyou are all that revalid, on the other sade, four are invalid, all 11 are valid, on the other sade, four are invalid, at the bottom right-hand corner, you see "Total sample the number for analysis", one says "11", the other says "7". 26. COMMISSIONER HANSFORD: Sorry, Mr Shitch, is that the slide that the bottom right-hand corner, you see "Total sample the number for analysis", one says "11", the other says "7". 27. COMMISSIONER HANSFORD: Ves. 38. Was HIEH: We are talking about the same 11 spots, but on the sab side, four readings are invalid, so there's only seven. 39. RSHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Vin ancectps, all 11 are valid, on the other says "7". 39. COMMISSIONER HANSFORD: Ves. 39. COMMISSIONER HANSFORD: Yes. 39. COMMISSIONER HANSFORD: Yes. 39. COMMISSIONER HANSFORD: Yes. 39. COMMISSIONER HANSFORD: Yes. 39. COMMISSIONER HANSFO	7	area A already inside the pool, even though no sample	7	not for this capping beam; for all data, it's not my
and HKC together.  Q. Yes. Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810.  A. Yes.  Q. That's the result of the measurement for the EWL slab. The bottom formula?  A. Yes.  A. The bottom formula?  I think from the capping beam side there are 11. For the slab side, there are seven; do you see that?  A. Yes.  Q. Yes, two defects. Then the total sample for analysis — 1 think from the capping beam side, all are valid, for the slab side four capping beam side, all are valid, of the other side, four are invalid so you get seven; that's correct, right?  Page 114  A. Yes.  Q. Physically, you talk about the same 11 chunks — you are all sling about the same 11 spots, but then on one side all 1 are valid, on the other side, four are invalid.  A Nes.  COMMSSIONER HANSFORD: Sorry, Mr Shich, is that the slide at the bottom right-hand corner, you see "Total sample unumber for analysis", one says "11", the other says "7".  COMMSSIONER HANSFORD: New, we have on the screen?  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping heam side, as PoProf Yin accepts, all 1 are valid readings, but on the slab side, four readings are invalid, so there's only at the defects are two.  Can I then invite you to look at the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, dis recent control of the capping beam side, the green column, "Number of exposed threads," 10 to 11 = look at the first icm, 10 to 10 1 exposed threads, it's not defective. Then further down, 24 to 10 11 at you capped threads, it's not defective. Then further down, 24 to 10 1 lexposed threads, it's not defective. When it gets 2 to 10 10 1 lexposed threads, it's not defective. Then further down, 24 to 2 yes.  I the slab side, there are surening the analysis in the slab side four are invalid. The same invalid. The same invalid and in the same 11 spots, but since every spot has two sides, on the capping b	8	were drawn, but it's inside the sample pool. So it may	8	expertise.
11 Q. Yes. Now, can I ask you to look again at the capping beam document that was produced by the MTR. Again, opening-up bundle, page 9810.  14 A. Yes. 15 Q. That's the result of the measurement for the EWL slab. In 2 Dyou see that gave rise to the famous two defects result; do you see that gave rise to the famous two defects result; do you see that? 16 Dy ogo see that gave rise to the famous two defects result; do you see that? 18 A. The bottom formula? 19 Q. Yes, two defects. Then the total sample for analysis 20 I think from the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right? 20 A. Yes. 21 Q. I think it's the same 11 that's picked, but then for the capping beam side, all are valid, for the slab side four as talking about the same 11 chunks you are 141king about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct? 22 A. Yes. 23 Q. Physically, you talk about the same 11 chunks you are 141king about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid so you get seven; that's correct, right? 24 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7". 25 COMMISSIONER HANSFORD: Okay. 26 MR SHIEH: We the is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7". 26 COMMISSIONER HANSFORD: Okay. 27 COMMISSIONER HANSFORD: Okay. 28 Prof Yin accepts, all 11 are valid, so there's only see". 39 Commissioner that the defects are two. 30 Commissioner that the defects are two. 31 A. Yes. 32 Commissioner that the defects are two. 33 and therefore discarded; correct? 34 A. Yes. 35 Commissioner that the defects are two. 36 Commissioner that the defects are two. 37 A. Yes. 38 Commissioner discarded; correct? 38 A. So the 80 millimetres. 38 A	9	not be extrapolated. It's just an estimate for area A	9	Q. I'm just curious that all along we have been hearing two
beam document that was produced by the MTR. Again, 13 opening-up bundle, page 9810. 13 opening-up bundle, page 9810. 15 Q. That's the result of the measurement for the EWL slab. 16 Do you see that? result: do you see that? result: do you see that? 16 A. Yes. 17 Q. Yes, two defects. Then the total sample for analysis — 12 I think from the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right? 19 Q. Physically, you talk about the same 11 chanks — you are talking about the same 11 spots, but then on one side at latherefore discarded; correct? 20 Q. Physically, you talk about the same 11 chanks — you are talking about the same 11 spots, but then on one side at therefore discarded; correct? 21 A. T can give you my understanding. We have two types of rebars. 22 Q. Yes. 23 A. One type of rebar is 40 millimetres, the other type of rebar is 80 millimetres. 24 A. So the 80 millimetres. 25 Compine beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right? 26 A. Yes. 27 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide was a to the screen? 28 We have on the screen? 39 MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "IT", the other says "T". 28 COMMISSIONER HANSFORD: Okay. 30 MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as 10 to	10	and HKC together.	10	exposed threads or more than two exposed threads, then
13 opening-up bundle, page 9810. 14 A. Yes. 25 Q. That's the result of the measurement for the EWL slab. 16 Do you see that gave rise to the famous two defects 17 result; do you see that? 28 A. The bottom formula? 29 Q. Yes, two defects. Then the total sample for analysis — 20 I think from the capping beam side, there are 11. For 21 the slab side, there are seven; do you see that? 22 A. Yes. 23 Q. I think it's the same 11 that's picked, but then for the 24 capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right? 25 Page 114 26 A. Yes. 27 Q. Physically, you talk about the same 11 chunks — you are 1alking about the same 11 spots, but then on one side 11 trave valid, on the other side, four are invalid. 29 A. Yes. 30 Q. Physically, you talk about the same 11 thunks — you are 1alking about the same 11 spots, but then on one side 11 lar evalid, on the other side, four are invalid. 31 and therefore discarded; correct? 40 A. Yes. 41 I are valid, on the other side, four are invalid. 42 and therefore discarded; correct? 43 A. Yes. 44 A. The Name of the capping beam side, and therefore discarded; correct? 45 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide 7 to 4 the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7". 46 A. Yes. 47 COMMISSIONER HANSFORD: Okay. 48 SHIEH: We are talking about the same 11 spots, but since 14 every spot has two sides, on the capping beam side, as 15 Prof Yin accepts, all 11 are valid, so there's only seven. 49 COMMISSIONER HANSFORD: Ves. 40 Com I then invite you to look at the defatils. Look at the capping beam side, the green column. "Number of exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down. 40 I that situation, we apply the two exposed threads a to 11 it are valid, so there's only seven. 41 COMMISSIONER HANSFORD: Ves. 42 A. Yes. 43 Commissioner discarded correct? 44 Commissioner discarded correct? 45 Commissioner disca	11	Q. Yes. Now, can I ask you to look again at the capping	11	you have failure, but here we have 10 to 11 and yet
14 A. Yes. 15 Q. That's the result of the measurement for the EWL slab. 16 Do you see that gave rise to the famous two defects 17 result; do you see that? 18 A. The bottom formula? 19 Q. Yes, two defects. Then the total sample for analysis— 20 I think from the capping beam side there are 11. For 21 the slab side, there are seven; do you see that? 22 A. Yes. 23 Q. I think it's the same 11 that's picked, but then for the 24 capping beam side, all are valid, for the slab side four 25 are invalid so you get seven; that's correct, right? 26 A. Yes. 27 Q. Physically, you talk about the same 11 chunks—you are 28 talking about the same 11 spots, but then on one side 29 all all 11 are valid, on the other side, four are invalid at the bottom right-hand corner, you see "Total sample" 20 I mumber for analysis", one says "11", the other sups "7". 21 COMMISSIONER HANSFORD: Okay. 22 N. Yes. 23 Q. Physically, you talk about the same 11 spots, but since every spot has two sides, on the capping beam side, as 15 Prof Yin accepts, all 11 are valid readings, but on the seven. 24 A. The bottom right-hand corner, you see "Total sample curve ypot has two sides, on the capping beam side, as 15 Prof Yin accepts, all 11 are valid readings, but on the 16 slab side, four readings are invalid, so there's only see. 25 COMMISSIONER HANSFORD: Yes. 26 A. Yes. 27 COMMISSIONER HANSFORD: New 19 Prof Yin accepts, all 11 are valid readings, but on the 16 slab side, four readings are invalid, so there's only see. 28 COMMISSIONER HANSFORD: Yes. 39 MR SHIEH: We are talking about the same 11 spots, but since 19 Prof Yin accepts, all 11 are valid readings, but on the 20 Prof Yin accepts, all 11 are valid readings, but on the 21 Prof Yin accepts, all 11 are valid readings, but on the 22 Prof Yin accepts, all 11 are valid readings, but on the 23 Prof Yin accepts, all 11 are valid readings, but on the 24 Prof Yin accepts, all 11 are valid readings, but on the 24 Prof Yin accepts, all 11 are valid readings, but on the 24 Prof Yin accepts, all 11 are valid re	12	beam document that was produced by the MTR. Again,	12	A. I can give you my understanding. We have two types of
15 Q. That's the result of the measurement for the EWL slab. 16 Do you see that gave rise to the famous two defects 17 result; do you see that? 18 A. The bottom formula? 19 Q. Yes, two defects. Then the total sample for analysis 20 I think from the capping beam side there are 11. For 21 the slab side, there are seven; do you see that? 22 A. Yes. 23 Q. I think it's the same I I that's picked, but then for the 24 capping beam side, all are valid, for the slab side four 25 are invalid so you get seven; that's correct, right? 26 A. Yes. 27 Q. Physically, you talk about the same 11 chunks you are 28 talking about the same I 1 spots, but then on one side 29 all 11 are valid, on the other side, four are invalid, 29 and therefore discarded; correct? 20 A. Yes. 21 COMMISSIONER HANSFORD: Sorry, Mr Shich, is that the slide 22 every spot has two sides, on the capping beam side, as 23 Prof Yin accepts, all 11 are valid, so there's only 24 seven. 25 COMMISSIONER HANSFORD: Sery. 26 MR SHIEH: We are talking about the same I spots, but since 27 every spot has two sides, on the capping beam side, as 28 MR SHIEH: We are talking about the same I spots, but since 29 can then bottom right-hand corner, you see "Total sample 30 the bottom right-hand corner, you see "Total sample 31 number for analysis", one says "11", the other says "7". 32 COMMISSIONER HANSFORD: Okay. 33 The side I have never seen before. 34 all 11 are valid, on the other side, four are invalid, 35 and therefore discarded; correct? 36 A. Yes. 37 COMMISSIONER HANSFORD: Sorry, Mr Shich, is that the slide 38 we have on the screen? 39 MR SHIEH: We are talking about the same I spots, but since 30 every spot has two sides, on the capping beam side, as 31 Prof Yin accepts, all 11 are valid, so there's only 32 seven. 33 Q. Think it's the maceurement, because if you look 34 the bottom right-hand corner, you see "Total sample 45 all 11 are valid, on the other says "7". 46 COMMISSIONER HANSFORD: Okay. 47 Sex. 48 Com Whereas that can go to 84. That's my understanding; ther	13	opening-up bundle, page 9810.	13	rebar.
16 Do you see that gave rise to the famous two defects result; do you see that? 17 result; do you see that? 18 A. The bottom formula? 19 Q. Yes, two defects. Then the total sample for analysis 20 I think from the capping beam side there are 11. For 21 the slab side, there are seven; do you see that? 21 the slab side, there are seven; do you see that? 22 A. Yes. 23 Q. I think it's the same 11 that's picked, but then for the 24 capping beam side, all are valid, for the slab side four 25 are invalid so you get seven; that's correct, right? 25 Page 114 26 A. Yes. 27 Page 114 28 Page 114 29 A. Yes. 20 Q. Physically, you talk about the same 11 chunks you are 24 talking about the same 11 spots, but then on one side 3 all 11 are valid, on the other side, four are invalid, 4 all that so be; otherwise there is no chance you can have 40 millimetres there. But 3 anyway, it's just a simple calculation. I have no 2 expertise on all this definition of "defective" or 3 mon-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. 29 MR SHIEH: Yes, this is the measurement, because if you look 4 at the bottom right-hand corner, you see "Total sample of analysis", one says "11", the other says "7". 21 COMMISSIONER HANSFORD: Okay. 22 MR SHIEH: We are talking about the same 11 spots, but since 2 every spot has two sides, on the capping beam side, as 2 Prof Yin accepts, all 11 are valid, so there's only 3 seven. 31 MR SHIEH: But the defects are two. 32 O. Can the invite you to look at the details. Look 2 at the capping beam side, the green column, "Number of 2 exposed threads", 10 to 11 - look at the first item, 10 2 to 11 exposed threads, 10 to 11 - look at the first item, 10 2 to 11 exposed threads, 10 to 11 - look at the first item, 10 2 to 11 exposed threads, 11 to 18, it becomes defective. Then further down, 24 to 17 to 18, it becomes defective. Then further down, 24 to 17 to 18, it becomes defective. Then further down, 24 to 17 to 18, it becomes defective. Then further down, 24	14	A. Yes.	14	Q. Yes.
17 result; do you see that? 18 A. The bottom formula? 19 Q. Yes, two defects. Then the total sample for analysis 20 I think from the capping beam side there are 11. For 21 the slab side, there are seven; do you see that? 22 A. Yes. 23 Q. I think it's the same 11 that's picked, but then for the 24 capping beam side, all are valid, for the slab side four 25 are invalid so you get seven; that's correct, right? 26 A. Yes. 27 Q. Physically, you talk about the same 11 chunks you are 28 talking about the same 11 spots, but then on one side 29 and therefore discarded; correct? 20 A. Yes. 21 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide 20 at the bottom right-hand corner, you see "Total sample 21 mumber for analysis", one says "1", the other says "7". 22 COMMISSIONER HANSFORD: Okay. 23 MR SHIEH: We are talking about the same 11 spots, but since 24 every spot has two sides, on the capping beam side, as 25 COMMISSIONER HANSFORD: Yes. 26 CAMISSIONER HANSFORD: Yes. 27 COMMISSIONER HANSFORD: Okay. 28 MR SHIEH: We are talking about the same 11 spots, but since 29 Can I then invite you to look at the defects. 20 Can I then invite you to look at the defective. When it gets 21 the spot of the say and the capping beam side, as 22 to 10 to 18, it becomes defective. Then further down, 29 Can I then invite you to look at the first term, 10 20 to 17 to 18, it becomes defective. Then further down, 20 to 17 to 18, it becomes defective. Then further down, 21 to 17 to 18, it becomes defective. Then further down, 22 to 10 to 18, it becomes defective. Then further down, 24 to 12 two threads that can go to 88, and 40 can have on to tester are two different types of rebars. That's why you can seave tolerance can go to 44. That's my understanding; there tolerance on many threads on som synthreads with an ever we wo many threads on som synthreads use passing that it could be because it's a longer thread to begin with, it that the side for the are are two	15	Q. That's the result of the measurement for the EWL slab.	15	A. One type of rebar is 40 millimetres, the other type of
A. The bottom formula?  Q. Yes, two defects. Then the total sample for analysis 21 I think from the capping beam side there are 11. For 22 the slab side, there are seven; do you see that? 23 Q. I think it's the same 11 that's picked, but then for the 24 capping beam side, all are valid, for the slab side four 25 are invalid so you get seven; that's correct, right?  Page 114  A. Yes.  Q. Physically, you talk about the same 11 chunks you are 3 talking about the same 11 spots, but then on one side 4 all 11 are valid, on the other side, four are invalid, 5 and therefore discarded; correct? 5 and therefore discarded; correct? 6 A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide 8 we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look 3 tar the bottom fight-hand corner, you see "Total sample 4 covery spot has two sides, on the capping beam side, as 4 revery spot has two sides, on the capping beam side, as 5 Prof Yin accepts, all 11 are valid, so there's only 6 COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look 2 at the capping beam side, the green column, "Number of 2 exposed threads," 10 to 11 - look at the first item, 10 2 to 11 exposed threads, it's not defective. Then further down,  18 Condissioner and spit, and the capping beam side, as 2 to 11 think from the capping beam side, as 2 to 11 that's picked, but then for the 2 to 12 the slab side, four reading, see there are so many threads cant. That's why you can see there are to different types of rebars. That's why you can see there are to different types of rebars. That's why you can see there are to different types of rebars. That's why you can see the capping beam side, able for the slab side four the same 11 that's picked, but then for the sease see it not all the secanse it's a longer thread to begin with, it may be a type B to begi	16	Do you see that gave rise to the famous two defects	16	rebar is 80 millimetres.
19 Q. Yes, two defects. Then the total sample for analysis — 19 two threads that can go to 88, and 40 can have one 1 think from the capping beam side there are 11. For 20 the slab side, there are seven; do you see that? 21 are two different types of rebars. That's why you can see there are so many threads out. 22 are two different types of rebars. That's why you can see there are so many threads out. 23 Q. I think it's the same 11 that's picked, but then for the 23 are invalid so you get seven; that's correct, right? 25 are invalid so you get seven; that's correct, right? 26 transpile beam side, all are valid, for the slab side four 24 it could be because it's a longer thread to begin with, it may be a type B to begin with? 27 that simple calculation. Thave no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no chance you can have 40 millimetres there is no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". This table I have never seen before. 30 Q. Okay. But from your educated guess, the reason why—the high number for analysis", one says "11", the other says "7". 11" with; correct? 30 Q. Okay. But from your educated guess, the reason why—the high number of exposed threads which are not defective could be because the rebar was longer to begin with; or creek? 31 I are valid, so there's only seven. 31 I are valid, so there's only seven. 31 Get and the defects are two. 32 Q. Okay. But from your equestion again? You said the larger number of exposed threads — 4 Q. Okay. But from your equestion again? You said the larger number of exposed threads — 4 Q. Okay. But from your equestion again? You said the larger number of exposed threads — 4 Q. Okay. But from your equestion again? You said the larger number of exposed threads — 4 Q. Okay. Surpassed threads — 4 Q. Okay. But from your equestion again? You said the larger number of exposed threads — 4 Q. Okay. Surpass	17	result; do you see that?	17	Q. Yes.
1 I think from the capping beam side there are 11. For the slab side, there are seven; do you see that? 2 A. Yes. 3 Q. I think it's the same 11 that's picked, but then for the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right?  Page 114  A. Yes. 2 Q. Physically, you talk about the same 11 chunks you are talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes. 2 Q. Physically, you talk about the same 11 chunks you are talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes. 5 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide to mumber for analysis," one says "11", the other says "7". COMMISSIONER HANSFORD: Okay.  MR SHIEH: Yea re talking about the same 11 spots, but since every spot has two sides, on the capping beam side, at every spot has two sides, on the capping beam side, as Pro Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Pro Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads". 10 to 11 look at the first item, 10 exposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down, 24 to 17 to 18, it becomes defective. Then further down.	18	A. The bottom formula?	18	A. So the 80 millimetres actually can have a tolerance of
the slab side, there are seven; do you see that?  A, Yes.  Q I think it's the same 11 that's picked, but then for the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right?  Page 114  A. Yes.  Q If there are many threads out.  Page 115  A. Yes.  Q Physically, you talk about the same 11 chunks you are talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid.  A Yes.  A Yes.  A Yes.  A It has to be; right? It has to be, otherwise there is no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report.  This table I have never seen before.  We have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as every, so has two sides, on the capping beam side, as every.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads", 10 to 11 look at the first item, 10 capping beam side, the green column, "Number of exposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down, 24 capping beam side, the green column, "Number of exposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down, 24 capping beam side, the green column, "Number of exposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down, 25 capping the amount of the capping beam side, as the capping beam side, as the capping beam side, the gre	19	Q. Yes, two defects. Then the total sample for analysis	19	two threads that can go to 88, and 40 can have one
22 A. Yes. 23 Q. I think it's the same 11 that's picked, but then for the 24 capping beam side, all are valid, for the slab side four 25 are invalid so you get seven; that's correct, right? 26 Page 114  1 A. Yes. 2 Q. Physically, you talk about the same 11 chunks you are 3 talking about the same 11 spots, but then on one side 4 all 11 are valid, on the other side, four are invalid, 5 and therefore discarded; correct? 5 (2 A. Yes. 6 A. Yes. 7 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide 8 we have on the screen? 9 MR SHIEH: Yes, this is the measurement, because if you look 10 at the bottom right-hand corner, you see "Total sample 11 number for analysis", one says "11", the other says "7". 12 COMMISSIONER HANSFORD: Okay. 13 MR SHIEH: We are talking about the same 11 spots, but since 4 every spot has two sides, on the capping beam side, as 5 Prof Yin accepts, all 11 are valid readings, but on the 16 slab side, four readings are invalid, so there's only 17 seven. 18 COMMISSIONER HANSFORD: Can I then invite you to look at the details. Look 21 at the capping beam side, the green column, "Number of 22 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down, 25 see there are so many threads exposed, you are saying that it could be because it's a longer thread to begin with; 26 it club be because it's a longer thread to begin with; 27 it may be a type B to begin with? 28 it may be a type B to begin with? 29 Page 116  A. Yes.  1 A. It has to be, right? It has to be, otherwise there is no chance you can have 40 millimetres there. But 20 anyway, it's just a simple calculation. I have no 21 expertise on all this definition of "defective" or 22 one than the same 11 spots, but and the slide 23 out of 11; I did my calculation shown in my report. 24 This table I have never seen before. 25 Q. Okay. But from your educated guess, the reason why— 26 the high number of exposed threads — 27 A. Can you repeat your question again? You said the larger number of exposed thr	20	I think from the capping beam side there are 11. For	20	tolerance can go to 44. That's my understanding; there
Q. I think it's the same 11 that's picked, but then for the capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right?  Page 114  A. Yes.  Q. Physically, you talk about the same 11 chunks you are all 11 are valid, on the other side, four are invalid.  all 11 are valid, on the other side, four are invalid.  A. Yes.  Q. Physically, you talk about the same 11 chunks you are all 11 are valid, on the other side, four are invalid.  A. Yes.  Q. Physically, you talk about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid.  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide of at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but one the severy spot has two sides, on the capping beam side, as every.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as every.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads coriteria, you remember criteria, you rememb	21	the slab side, there are seven; do you see that?	21	are two different types of rebars. That's why you can
24 capping beam side, all are valid, for the slab side four are invalid so you get seven; that's correct, right?  Page 114  A. Yes.  2 Q. Physically, you talk about the same 11 chunks you are alkling about the same 11 chunks you are all 11 are valid, on the other side, four are invalid, at the effective?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as the result of the same than the defective only seven.  COMMISSIONER HANSFORD: Ves.  Page 114  A. It has to be; right? It has to be, otherwise there is no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report.  This table I have never seen before.  Q. Okay. But from your educated guess, the reason why—the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Commissioner Hansford begin with; correct?  A. Yes.  COMMISSIONER HANSFORD: Okay.  But from your equestion again? You said the larger number of exposed threads —  13 mumber of exposed threads —  24 every spot has two sides, on the capping beam side, as  14 Q. 10 to 11 exposed threads —  25 A. Yes.  COMMISSIONER HANSFORD: Yes.  Can I then invite you to look at the details. Look  26 A. Yes.  Can I then invite you to look at the details. Look  27 A. Yes.  28 Q. Whereas earlier on, when we discussed the acceptance criteria, you remember —  29 C. The more than two and must be 40 millimetres embedded.  20 A. Yes.  21 Tot 18, it becomes defective. Then further down,  22 L. That it is not dequal to begin with, it may be a type B to begin with, corner is manufactive. The number of	22	A. Yes.	22	see there are so many threads out.
Page 114  Page 114  Page 115  A. Yes.  Q. Physically, you talk about the same 11 chunks you are 1 talking about the same 11 spots, but then on one side 3 talking about the same 11 spots, but then on one side 3 talking about the same 11 spots, but then on one side 4 all 11 are valid, on the other side, four are invalid, 4 expertise on all this definition of "defective" or 5 "non-defective". I was given the number 2 out of 7, 2 out of 11; 1 did my calculation shown in my report.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide 8 we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look 10 at the bottom right-hand comer, you see "Total sample 10 defective could be because the rebar was longer to begin with; correct?  COMMISSIONER HANSFORD: Okay. 12 A. Can you repeat your question again? You said the larger number of exposed threads very spot has two sides, on the capping beam side, as 14 every spot has two sides, on the capping beam side, as 15 even. 17 A. Yes. 18 Q. Whereas earlier on, when we discussed the acceptance criteria, you remember 20 Can I then invite you to look at the first item, 10 22 A. Yes. 21 to 11 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down, 24 scenario; correct?	23	Q. I think it's the same 11 that's picked, but then for the	23	
Page 114  Page 116  A. Yes.  Q. Physically, you talk about the same 11 chunks you are talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: We are talking about the same 11 spots, but since werey spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look 2 exposed threads, it's not defective. When it gets 2 no chance you can have 40 millimetres there is no chance you can have 40 millimetres there is no chance you can have 40 millimetres there is no chance you can have 40 millimetres there is no chance you can have 40 millimetres there is no chance you can have 40 millimetres there is no chance you can have 40 millimetres there is no chance you can have 40 millimetres there is no chance you can have 40 millimetres there is no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads Q. 10 to 11 exposed threads Q. Other as a proper in the proper in	24	capping beam side, all are valid, for the slab side four	24	it could be because it's a longer thread to begin with,
A. It has to be; right? It has to be, otherwise there is no chance you can have 40 millimetres there. But alking about the same 11 spots, but then on one side  1 all 11 are valid, on the other side, four are invalid,  2 and therefore discarded; correct?  3 and therefore discarded; correct?  4 A. Yes.  5 and therefore discarded; correct?  5 "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report.  7 TOMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide  8 we have on the screen?  9 MR SHIEH: Yes, this is the measurement, because if you look  10 at the bottom right-hand corner, you see "Total sample  11 number for analysis", one says "11", the other says "7".  12 COMMISSIONER HANSFORD: Okay.  13 MR SHIEH: We are talking about the same 11 spots, but since  14 every spot has two sides, on the capping beam side, as  15 Prof Yin accepts, all 11 are valid readings, but on the  16 slab side, four readings are invalid, so there's only  17 seven.  18 COMMISSIONER HANSFORD: Yes.  19 MR SHIEH: But the defects are two.  10 Can I then invite you to look at the details. Look  20 Can I then invite you to look at the details. Look  21 at the capping beam side, the green column, "Number of  22 exposed threads", 10 to 11 - look at the first item, 10  22 exposed threads, it's not defective. When it gets  24 to 17 to 18, it becomes defective. Then further down,  24 to 17 to 18, it becomes defective. Then further down,	25	are invalid so you get seven; that's correct, right?	25	it may be a type B to begin with?
2 Q. Physically, you talk about the same 11 chunks you are 3 talking about the same 11 spots, but then on one side 4 all 11 are valid, on the other side, four are invalid, 5 and therefore discarded; correct? 6 A. Yes. 7 COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide 8 we have on the screen? 9 MR SHIEH: Yes, this is the measurement, because if you look 10 at the bottom right-hand corner, you see "Total sample 11 number for analysis", one says "11", the other says "7". 12 COMMISSIONER HANSFORD: Okay. 13 MR SHIEH: We are talking about the same 11 spots, but since 14 every spot has two sides, on the capping beam side, as 15 Prof Yin accepts, all 11 are valid readings, but on the 16 slab side, four readings are invalid, so there's only 17 seven. 18 COMMISSIONER HANSFORD: Yes. 19 MR SHIEH: But the defects are two. 20 Can I then invite you to look at the details. Look 21 at the capping beam side, the green column, "Number of 22 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down, 29 no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or non-defective". I was given the number of "non-defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  9 Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  10 A. Can you repeat your question again? You said the larger number of exposed threads 14 Q. 10 to 11 exposed threads 15 A. Yes.  16 Q counted as not defective? A. Yes.  17 A. Yes.  18 Q. Whereas earlier on, when we discussed the acceptance criteria, you remember 20 A. Yes.  21 Q no more than two and must be 40 millimetres embedded. 22 exposed threads, it's not defective. When it gets 23 Q. In that situation, we apply the two exp		Page 114		Page 116
talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample mumber for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  COMMISSIONER HA	1	A. Yes.	4	
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number for analysis", one says "11", the other says "7".  11 with; correct?  12 COMMISSIONER HANSFORD: Okay.  13 MR SHIEH: We are talking about the same 11 spots, but since 14 every spot has two sides, on the capping beam side, as 15 Prof Yin accepts, all 11 are valid readings, but on the 16 slab side, four readings are invalid, so there's only 17 seven.  18 COMMISSIONER HANSFORD: Yes.  19 MR SHIEH: But the defects are two.  10 Can I then invite you to look at the details. Look 11 at the capping beam side, the green column, "Number of 12 exposed threads", 10 to 11 look at the first item, 10 13 with; correct?  14 A. Can you repeat your question again? You said the larger 15 number of exposed threads 16 Q. 10 to 11 exposed threads 17 A. Yes. 18 Q. Whereas earlier on, when we discussed the acceptance 19 criteria, you remember 20 Can I then invite you to look at the details. Look 21 A. Yes. 22 A. Yes. 23 to 11 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down, 24 scenario; correct?	3 4 5 6 7	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?	2 3 4 5 6	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why
12 COMMISSIONER HANSFORD: Okay.  13 MR SHIEH: We are talking about the same 11 spots, but since 14 every spot has two sides, on the capping beam side, as 15 Prof Yin accepts, all 11 are valid readings, but on the 16 slab side, four readings are invalid, so there's only 17 seven. 18 COMMISSIONER HANSFORD: Yes. 19 MR SHIEH: But the defects are two. 19 Can I then invite you to look at the details. Look 20 at the capping beam side, the green column, "Number of 21 exposed threads", 10 to 11 look at the first item, 10 22 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down, 25 Can I defective. Then further down, 26 Can I defective. A. Can you repeat your question again? You said the larger 16 number of exposed threads 17 A. Yes. 18 Q. 10 to 11 exposed threads 18 Q counted as not defective? 19 A. Yes. 20 Whereas earlier on, when we discussed the acceptance 21 criteria, you remember 22 A. Yes. 23 Q. In that situation, we apply the two exposed threads 24 scenario; correct?	3 4 5 6 7 8 9	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look	2 3 4 5 6 7 8	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not
MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads", 10 to 11 look at the first item, 10 every spot has two sides, on the capping beam side, as  14 Q. 10 to 11 exposed threads 15 A. Yes.  16 Q counted as not defective?  17 A. Yes.  18 Q. Whereas earlier on, when we discussed the acceptance criteria, you remember 20 A. Yes.  21 Q no more than two and must be 40 millimetres embedded. 22 exposed threads", 10 to 11 look at the first item, 10 22 A. Yes.  23 to 11 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down,  24 scenario; correct?	3 4 5 6 7 8 9	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample"	2 3 4 5 6 7 8 9	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin
14 every spot has two sides, on the capping beam side, as 15 Prof Yin accepts, all 11 are valid readings, but on the 16 slab side, four readings are invalid, so there's only 17 seven. 18 COMMISSIONER HANSFORD: Yes. 19 MR SHIEH: But the defects are two. 10 Can I then invite you to look at the details. Look 21 at the capping beam side, the green column, "Number of 22 exposed threads", 10 to 11 look at the first item, 10 23 to 11 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down, 26 A. Yes. 27 Q. 10 to 11 exposed threads 28 Q. 10 to 11 exposed threads 29 Q counted as not defective? 20 Q counted as not defective? 20 Q counted as not defective? 21 Q counted as not defective? 22 A. Yes. 23 Q. Whereas earlier on, when we discussed the acceptance criteria, you remember 29 Q no more than two and must be 40 millimetres embedded. 20 A. Yes. 21 Q no more than two and must be 40 millimetres embedded. 22 A. Yes. 23 Q. In that situation, we apply the two exposed threads 24 scenario; correct?	3 4 5 6 7 8 9 10	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".	2 3 4 5 6 7 8 9 10	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why -the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?
Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads", 10 to 11 look at the first item, 10 exposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down,  Land Yes.  A. Yes.  Results A. Ye	3 4 5 6 7 8 9 10 11 12	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.	2 3 4 5 6 7 8 9 10 11	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger
slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads", 10 to 11 look at the first item, 10 exposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down,  16 Q counted as not defective? A. Yes.  20 Whereas earlier on, when we discussed the acceptance criteria, you remember 20 A. Yes. 21 Q no more than two and must be 40 millimetres embedded. 22 A. Yes. 23 Q. In that situation, we apply the two exposed threads 24 scenario; correct?	3 4 5 6 7 8 9 10 11 12 13	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since	2 3 4 5 6 7 8 9 10 11 12	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads
17 A. Yes. 18 COMMISSIONER HANSFORD: Yes. 18 Q. Whereas earlier on, when we discussed the acceptance 19 MR SHIEH: But the defects are two. 19 Can I then invite you to look at the details. Look 20 A. Yes. 21 at the capping beam side, the green column, "Number of 22 exposed threads", 10 to 11 look at the first item, 10 23 to 11 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down, 26 A. Yes. 27 Q no more than two and must be 40 millimetres embedded. 28 A. Yes. 29 Q. In that situation, we apply the two exposed threads 20 Scenario; correct?	3 4 5 6 7 8 9 10 11 12 13 14	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as	2 3 4 5 6 7 8 9 10 11 12 13 14	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads
COMMISSIONER HANSFORD: Yes.  18 Q. Whereas earlier on, when we discussed the acceptance criteria, you remember Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads", 10 to 11 look at the first item, 10 cexposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down,  20 A. Yes. 21 Q no more than two and must be 40 millimetres embedded. 22 A. Yes. 23 Q. In that situation, we apply the two exposed threads cerposed threads criteria, you remember 20 A. Yes. 21 Q no more than two and must be 40 millimetres embedded. 22 A. Yes. 23 Q. In that situation, we apply the two exposed threads cerposed threads criteria, you remember 20 A. Yes. 21 Q no more than two and must be 40 millimetres embedded. 22 A. Yes. 23 Q. In that situation, we apply the two exposed threads cerposed	3 4 5 6 7 8 9 10 11 12 13 14 15	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the	2 3 4 5 6 7 8 9 10 11 12 13 14 15	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads A. Yes.
19 MR SHIEH: But the defects are two. 20 Can I then invite you to look at the details. Look 21 at the capping beam side, the green column, "Number of 22 exposed threads", 10 to 11 look at the first item, 10 23 to 11 exposed threads, it's not defective. When it gets 24 to 17 to 18, it becomes defective. Then further down, 26 Titleria, you remember 27 A. Yes. 28 Q no more than two and must be 40 millimetres embedded. 29 A. Yes. 20 A. Yes. 21 Q no more than two and must be 40 millimetres embedded. 22 A. Yes. 23 Q. In that situation, we apply the two exposed threads 24 scenario; correct?	3 4 5 6 7 8 9 10 11 12 13 14 15 16	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads A. Yes.  Q counted as not defective?
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to 11 exposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down,  23 Q. In that situation, we apply the two exposed threads scenario; correct?	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads A. Yes.  Q counted as not defective?  A. Yes.  Q. Whereas earlier on, when we discussed the acceptance criteria, you remember A. Yes.
24 to 17 to 18, it becomes defective. Then further down, 24 scenario; correct?	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads A. Yes.  Q counted as not defective?  A. Yes.  Q. Whereas earlier on, when we discussed the acceptance criteria, you remember A. Yes.  Q no more than two and must be 40 millimetres embedded.
	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads", 10 to 11 look at the first item, 10	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads A. Yes.  Q counted as not defective?  A. Yes.  Q. Whereas earlier on, when we discussed the acceptance criteria, you remember A. Yes.  Q no more than two and must be 40 millimetres embedded. A. Yes.
25 In specimen number 6, it 8 15 to 16. Then it 8	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads", 10 to 11 look at the first item, 10 to 11 exposed threads, it's not defective. When it gets	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads A. Yes.  Q counted as not defective?  A. Yes.  Q. Whereas earlier on, when we discussed the acceptance criteria, you remember A. Yes.  Q no more than two and must be 40 millimetres embedded.  A. Yes.  Q. In that situation, we apply the two exposed threads
	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	talking about the same 11 spots, but then on one side all 11 are valid, on the other side, four are invalid, and therefore discarded; correct?  A. Yes.  COMMISSIONER HANSFORD: Sorry, Mr Shieh, is that the slide we have on the screen?  MR SHIEH: Yes, this is the measurement, because if you look at the bottom right-hand corner, you see "Total sample number for analysis", one says "11", the other says "7".  COMMISSIONER HANSFORD: Okay.  MR SHIEH: We are talking about the same 11 spots, but since every spot has two sides, on the capping beam side, as Prof Yin accepts, all 11 are valid readings, but on the slab side, four readings are invalid, so there's only seven.  COMMISSIONER HANSFORD: Yes.  MR SHIEH: But the defects are two.  Can I then invite you to look at the details. Look at the capping beam side, the green column, "Number of exposed threads", 10 to 11 look at the first item, 10 to 11 exposed threads, it's not defective. When it gets to 17 to 18, it becomes defective. Then further down,	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	no chance you can have 40 millimetres there. But anyway, it's just a simple calculation. I have no expertise on all this definition of "defective" or "non-defective". I was given the number 2 out of 7, 2 out of 11; I did my calculation shown in my report. This table I have never seen before.  Q. Okay. But from your educated guess, the reason why the high number of exposed threads which are not defective could be because the rebar was longer to begin with; correct?  A. Can you repeat your question again? You said the larger number of exposed threads Q. 10 to 11 exposed threads A. Yes.  Q counted as not defective?  A. Yes.  Q. Whereas earlier on, when we discussed the acceptance criteria, you remember A. Yes.  Q no more than two and must be 40 millimetres embedded.  A. Yes.  Q. In that situation, we apply the two exposed threads scenario; correct?

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- 1 Q. So that's why I asked you why suddenly here we jump to
- 2 10 to 11?
- 3 A. As I said, there are two types of bars. As far as
- 4 I understand, this is possibly the longer threaded bar,
- 5 88 millimetres. But again this is not my expertise.
- 6 I don't think I'm in a position to answer why there's
- 7 a defect, not defect.
- 8 Q. But following our logic, if you factor in the existence
- 9 or the possible existence of type B bars --
- 10 A. Yes.
- 11 Q. -- so you allow for more exposed threads, the question
- 12 then arises why does that logic not feed into the
- 13 acceptance criteria for the other bars?
- 14 A. For type A or --
- 15 MR KHAW: If I may just interrupt, if Mr Shieh is comparing,
- 16 for example, the 10 to 11, "Number of exposed threads",
- 17 under the column of "Capping beam side", with for
- 18 example 44.5 millimetres, that comparison may not be
- 19 meaningful, because, one, it's under the column of
- 20 "Capping beam side". Another is the "EWL slab side".
- 21 So you are not comparing apples to apples.
- 22 MR SHIEH: Well, I can only work on this document, because
- 23 the other curiosity about this document is, Prof Yin --
- 24 help me if you can, but if you can't, just tell us -
  - for the capping beam side, the test criteria, the

- 1 A. What do you mean "feature"?
  - 2 Q. 2 over 7, it featured as part of the equation that you
  - 3 used to derive the strength reduction factor; correct?
  - 4 A. What's the meaning of "feature"?
  - 5 Q. It appeared in the equation.
  - 6 A. Okay, yes, of course.
  - 7 Q. 2 over 7; correct?
  - 8 A. Yes.
  - 9 Q. Now, you would accept that seven is a relatively low
  - 10 number of specimens?
  - 11 A. When you say "relative", relative to what?
  - 12 Q. The total number of couplers in the entire EWL slab.
  - 13 A. The total number of EWL slab is 90; right?
  - 14 Q. Mm-hmm.
  - 15 A. It's 90, and now you have seven, and on the other side
  - 16 you have 2 out of 11.
  - 17 Q. Yes. The question I have is this. You accept that this
  - 18 problem about couplers appearing in a panel with capping
  - 19 beam details is something that the workmen stumbled
  - 20 across as and when they did the opening-up; correct?
  - 21 A. That's what I was told.
  - 22 Q. That's what you were told.
  - 23 A. Yes.

25

- 24 Q. So, at the planning stage, you know, when you were
  - theoretically planning all this --

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- Page 120
- 1 passing criteria, seemed to be the number of exposed
- 2 threads; right? Because if you look at the green
- 3 column, "Capping beam side", "Number of exposed
- 4 threads", "10-11", "10-11", and then you look at the 5
- other green column on the right-hand side, "Status for
- 6 statistic analysis": "Not defective", "Not defective"?
- 7 A. I see that.
- 8 Q. So it seems that for the capping beam side rebars, the
- 9 pass/fail criteria utilises number of exposed threads;
- 10 yes?

- A. Yes. 11
- 12 Q. Whereas if you look at the slab side, the criteria seems
- 13 to be enhanced PAUT engagement length.
- 14 A. Yes.
- 15 Q. Do you understand why that is so?
- 16 A. I don't know. I'm not an engineer.
- 17 O. Yes.
- 18 A. I'm sure some professional engineer did the test and
- 19 they came up with the number. I was given the number.
- 20 Q. Okay. Let me just ask you a question standing back. In
- 21 the calculation of the strength reduction factor, let's
- 22 look at your formula that you took us to just now. The
- 23 number two, number of defects 2 --
- 24 A. Yes.
- 25 Q. -- over 7 featured quite a lot; right?

- 1 A. Yes.
- 2 Q. -- the model had not taken into account the need to
- 3 separate between, "For couplers in panels with capping
- 4 beam details, let's do it this way, let's do the
- 5 sampling one way; for those in panels without capping
- 6 beam details, let's do the sampling some other way" --
- 7 this was actually not taken into account at the original
- 8 planning stage; correct?
- 9 A. Yes.
- 10 Q. My question is this. Is it not possible for the purpose
- of working out the strength reduction factor not to zoom 11
- 12 in and highlight the strength reduction factor
- 13 attributable to those panels with capping beam details?
- 14 Rather, you look at the entirety of the EWL panel
- 15 couplers as a whole? That's the question.
- 16 A. I don't get what you are asking.
- 17 Q. If you zoom in on the capping beam locations --
- 18
- 19 Q. -- and you look at 2 defectives over 7 --
- 20 A. Yes.
- 21 O. -- that faction would stick out and be factored into the
- 22 equation that you used to derive the 60-odd per cent?
- 23
- 24 Q. Whereas if you don't just single out the panels or the
- 25 couplers, on the locations with capping beam detail, as

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Q. Do you understand?

A. I understand perfectly, yes. I understand what he was

capping beam side -- okay, capping beam side -- the

other side is the slab side. I think what he was trying

to say, on the slab side, you have more samples, but on

the capping beam side you don't. Capping beam side --

trying to say. So, basically, on one side, which is

Entir	re Inquiry (Original and Extended)		Day 05
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1	a stand-alone population, you simply group those	1	I forgot, seven is on the capping beam side or 11? 11
2	couplers as part of the couplers in the entirety of the	2	on the capping beam side? Okay. Thank you.
3	EWL slab, you could very well get a completely different	3	So capping beam side, you have 11 samples. That's
4	result; do you accept that?	4	it. You cannot enlarge that sample size any more. But
5	A. Please help me to understand your question.	5	he had some valid argument, "Okay, on the slab side you
6	Q. Mm-hmm.	6	use seven only. Why don't you use all the slab side
7	A. So what we did here is we take capping beam alone and	7	couplers?" Actually, what I did, I did as what he said,
8	try to work out the capping beam the couplers	8	and the results reduced a certain extent, but not much.
9	involved in the capping beam side, what is the defect	9	I did do what he said. I don't have the results here.
10	rate, and originally we had this calculation for EWL and	10	But because, you see, Dr Wells did a whole lot of
11	NSL, because the other side of the coupler was embedded	11	calculations, and I could verify some of the
12	in the D-wall. You don't open the other side of the	12	calculations by his suggestion, and actually I did this
13	coupler. You only open one side of the coupler and look	13	kind of sensitivity analysis, what I call.
14	at whether it's properly installed. But it happens that	14	But using two out of 11 and two out of seven,
15	for the capping beam, both sides were exposed. Then	15	because we consider the capping beam section is special,
16	I was approached immediately, what kind of statistical	16	somehow different from the other side of the EWL, and
17	method could be used. It basically opened another can	17	whether this is a valid approach or not, I think you
18	of worms and we derived the probability formulas and we	18	have to put an engineering consideration into this
19	said, okay, the capping beam, we focus on capping beam	19	problem. On the engineering side, the engineers, they
20	alone, and that's the formula we used and we derived	20	say, "You should treat them separately."
21	this 68.3 per cent.	21	COMMISSIONER HANSFORD: Is that what they did say? Did they
22	<u></u>	22	say you should take them separately?
23	his paragraph 4.40, of Dr Wells' report.	23	A. Based on my calculation, clearly we already agreed,
24	A. Okay. Yes.	24	otherwise I wouldn't do this two out of seven, two out
25	Q. 4.40(b)	25	of 11. Clearly, we had agreement that this would be
	Page 122	Ė	Page 124
		١.	_
1	A. Okay.	1	treated as a separate population, because this capping
2	Q he said:	2	beam is you had two sides of the coupler, not like
3	"It is not clear why data relating to the EWL	3	D-wall, you only have one side exposed.
4	slab side does not also use the main EWL data set, as	4	Now, certainly you can have argument, pool them
5	doing so would greatly increase the confidence in the	5	together. But even if you pool them together, on
6	results as well as overcoming some of the mistakes made		capping beam side, all the samples you have is 11.
7	(by assuming a large sample approximation, when the	7	That's the only sample you have.
8	sample size was actually very small)"	8	COMMISSIONER HANSFORD: I'm not sure what's so special about
9	A. I understand what he is talking about.	9	the capping beam side.
10	Q. You understand. That's the point I'm making.	10	A. I don't either. I don't know what's so special about
11	A. Of course I understand. Then what is your question?	11	the capping beam.
12	Q. What do you say about his complaint, about not taking	12	COMMISSIONER HANSFORD: To my mind, it's about screwing in
13	into account the EWL data set as well? In other words,	13	bars into couplers, irrespective of where they are.
14	why zoom in on the number of couplers in locations with		MR SHIEH: Except that in a normal case, you screw one side;
15		15	in a capping beam situation, you screw the other side,
16	in that location as some kind of a separate population,	16	so I don't know.
17	to do your sum about 2 over 7?	17	A. Yes, I totally agreed with you, I tried to look up
18	A. Yes. Let me explain.	18	capping beam on Google, tried to view some YouTube. It
4 ~	0 5 1 10	110	1 61 1

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doesn't help me.

input.

CHAIRMAN: That's a pretty dangerous thing!

A. It doesn't help me, so I have to rely on the engineer's

nobody thought somehow this should be a special

MR SHIEH: Thank you very much. But at the planning stage

population, some special formula should be derived to

1	Page 125		Page 127
	cater for two separate populations; it wasn't there at	1	A. Pretend. Even though you pretend to do this, strictly
2	the planning stage, correct?	2	speaking, this is not correct.
3	A. Yes.	3	Q. But you are saying it's loose, not rigorous, just
4	Q. Just now, you said, in addressing a possible layman	4	a cross-check?
5	reaction, why 60-odd per cent, so big, and then you try	5	A. Not even a cross-check. This just tries to help
6	to do some kind of a cross-check by utilising the	6	non-statisticians understand why there's 68, such
7	30-odd per cent strength reduction factor for EWL and	7	a large number. This is not even cross-checking because
8	NSL?	8	this calculation is wrong from the beginning. I'm
9	A. Yes.	9	talking about wrong. Do you know why? Because 36.6 is
10	Q. You used a factor of 1 minus 30-odd per cent, and then	10	not the defect rate. It's the upper bound of the defect
11	multiplied by the other bracket, 1 minus 30-odd	11	rate of the 95 per cent confidence interval.
12	per cent, and then 1 minus, I think?	12	If you recall, in Wells' report, basically you have
13	A. Yes, exactly. Good memory.	13	a stated mean defect rate plus 1.645 times standard
14	Q. I haven't got the slide here, but to save time I'm not	14	error. There's a non-linear transformation there based
15	going to call that up. You remember which slide we're	15	on the normal curve. That's where 1.645 comes from.
16	talking about?	16	You have this kind of non-linear transformation.
17	A. Yes, I remember.	17	So that's why I say this whole calculation is just
18	Q. But that cross-check is only valuable if the underlying	18	for laymen to have a sense why it can go up as
19	30-odd per cent holds good. In other words, if	19	68.3 per cent. This is not even cross-check.
20	30-odd per cent	20	Q. Thank you.
21	A. 30 what?	21	Can I move on to my final topic. There's one point
22	Q. "30-odd".	22	in the verification report about the untested rebars
23	A. "30-odd"?	23	A. Okay.
24	Q. 30-odd per cent strength reduction for EWL and NSL.	24	Q that I wish to talk about with you.
25	COMMISSIONER HANSFORD: "30-odd" means approximately 30	. 25	A. Yes.
	Page 126		Page 128
1	MR SHIEH: Yes, 30-something per cent.	1	
_	A. You should tell me exactly the number.	_	Q. Can you look at your report, at 6.3.2. That's for the
2	•	2	Q. Can you look at your report, at 6.3.2. That's for the verification, that's in COI 2.
3	MR SHIEH: It doesn't matter. Because for both NSL and EWL	2	
	MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.	2	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.
3	MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.  A. Yes, 30-something.	2 3	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:
3 4	<ul><li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li><li>A. Yes, 30-something.</li><li>Q. But if for every 30-something per cent it gets knocked</li></ul>	2 3 4	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification
3 4 5	<ul><li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li><li>A. Yes, 30-something.</li><li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting</li></ul>	2 3 4 5	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the
3 4 5 6 7 8	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple</li> </ul>	2 , 3 , 4 , 5 , 6 , 7 , 8	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed
3 4 5 6 7 8 9	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> </ul>	2 3 4 5 6 7 8 9	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS
3 4 5 6 7 8 9	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> <li>A. Of course.</li> </ul>	2 3 4 5 6 7 8 9	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS laboratory were used as a reference. Over the past
3 4 5 6 7 8 9 10 11	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> <li>A. Of course.</li> <li>Q. So the value of this cross-check is only as good as the</li> </ul>	2 3 4 5 6 7 8 9 10	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS laboratory were used as a reference. Over the past 9 years"
3 4 5 6 7 8 9 10 11 12	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> <li>A. Of course.</li> <li>Q. So the value of this cross-check is only as good as the underlying percentage of the strength reduction factor</li> </ul>	2 3 4 5 6 7 8 9 10 11 12	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS laboratory were used as a reference. Over the past 9 years"  That was 2010 to 2019; right?
3 4 5 6 7 8 9 10 11 12 13	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> <li>A. Of course.</li> <li>Q. So the value of this cross-check is only as good as the underlying percentage of the strength reduction factor applicable to the EWL slab and the NSL slab; correct?</li> </ul>	2 3 4 5 6 7 8 9 10 11 12 13	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS laboratory were used as a reference. Over the past 9 years"  That was 2010 to 2019; right?  A. Yes.
3 4 5 6 7 8 9 10 11 12 13 14	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> <li>A. Of course.</li> <li>Q. So the value of this cross-check is only as good as the underlying percentage of the strength reduction factor applicable to the EWL slab and the NSL slab; correct?</li> <li>A. That part of the calculation is trying to explain to</li> </ul>	2 3 4 5 6 7 8 9 10 11 12 13 14	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS laboratory were used as a reference. Over the past 9 years"  That was 2010 to 2019; right?  A. Yes.  Q. " about 110,000 rebar samples were tested at MTRCL's
3 4 5 6 7 8 9 10 11 12 13 14 15	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> <li>A. Of course.</li> <li>Q. So the value of this cross-check is only as good as the underlying percentage of the strength reduction factor applicable to the EWL slab and the NSL slab; correct?</li> <li>A. That part of the calculation is trying to explain to laymen why 68 per cent seems to be a high number how,</li> </ul>	2 3 4 5 6 7 8 9 10 11 12 13 14 15	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS laboratory were used as a reference. Over the past 9 years"  That was 2010 to 2019; right?  A. Yes.  Q. " about 110,000 rebar samples were tested at MTRCL's laboratory and out of which 55 samples failed the test.
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3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> <li>A. Of course.</li> <li>Q. So the value of this cross-check is only as good as the underlying percentage of the strength reduction factor applicable to the EWL slab and the NSL slab; correct?</li> <li>A. That part of the calculation is trying to explain to laymen why 68 per cent seems to be a high number how, why you can come up with 68 so I mentioned clearly it's not rigorous, it's loosely speaking, gives you intuitive reason, and as I said, EWL, we estimated yes, it's right here.</li> <li>Q. Yes, 1 minus 0.366.</li> <li>A. Yes. You see EWL defect rate is 36.6 per cent.</li> </ul>	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS laboratory were used as a reference. Over the past 9 years"  That was 2010 to 2019; right?  A. Yes.  Q. " about 110,000 rebar samples were tested at MTRCL's laboratory and out of which 55 samples failed the test. These 55 samples are divided into two groups, ie samples with a bar diameter equal to or greater than 16 millimetres and samples with a bar diameter of less than 16 millimetres. For the former group, the worst case failure gives a tensile strength reduction of 4 per cent, ie the measured tensile strength of the
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3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	<ul> <li>MR SHIEH: It doesn't matter. Because for both NSL and EWL it's 30-something per cent.</li> <li>A. Yes, 30-something.</li> <li>Q. But if for every 30-something per cent it gets knocked down to, let's say, 10 per cent, then the resulting number would change. That's a matter of simple arithmetic.</li> <li>A. Of course.</li> <li>Q. So the value of this cross-check is only as good as the underlying percentage of the strength reduction factor applicable to the EWL slab and the NSL slab; correct?</li> <li>A. That part of the calculation is trying to explain to laymen why 68 per cent seems to be a high number how, why you can come up with 68 so I mentioned clearly it's not rigorous, it's loosely speaking, gives you intuitive reason, and as I said, EWL, we estimated yes, it's right here.</li> <li>Q. Yes, 1 minus 0.366.</li> <li>A. Yes. You see EWL defect rate is 36.6 per cent.</li> <li>Q. Yes.</li> <li>A. Let's just pretend to take this 36.6 per cent, apply</li> </ul>	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	verification, that's in COI 2.  At paragraph 6.3.2  A. Yes.  Q. In fact, this section starts at 6.3.1:  "As explained in section 4.3 of the verification report, in order to determine the effect of the 7 per cent of untested rebars on the completed structures, the testing records of MTRCL's HOKLAS laboratory were used as a reference. Over the past 9 years"  That was 2010 to 2019; right?  A. Yes.  Q. " about 110,000 rebar samples were tested at MTRCL's laboratory and out of which 55 samples failed the test. These 55 samples are divided into two groups, ie samples with a bar diameter equal to or greater than 16 millimetres and samples with a bar diameter of less than 16 millimetres. For the former group, the worst case failure gives a tensile strength reduction of 4 per cent, ie the measured tensile strength of the worst case is 4 per cent less than the design tensile strength. For the latter group, the worst case failure
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- 1 4 per cent and 13 per cent strength reductions represent
- 2 the worst case scenario of the 55 failed samples. They
- 3 are the extreme failure cases by tests and were not
- 4 derived from any statistical analysis. I note that
- 5 these two strength reduction factors were used in the
- 6 structural review, by assuming that the said reduction
- 7 factors apply to all rebars used in NAT, SAT and HHS, in
- 8 order to assess if the completed structures could
- 9 accommodate such strength reduction.
- 10 This is a sensitivity analysis by plugging in the
- 11 worst case scenario based on the information from past
- 12 experience rather than a statistical analysis."
- 13 Do you see that?
- 14 A. Yes, I see it.
- 15 Q. So, basically, what's happening is one wants to find out
- 16 the significance of the 7 per cent untested rebar.
- 17 A. Yes.

1

- 18 Q. So one says, for the past nine years, the entirety of
- 19 all bars tested by MTR, for whatever project, whatever
- 20 manufacturers, let's lump them together. There were
- 21 55 failures so let's assume that the untested rebars are
- 22 going to be -- the fate of the 7 per cent untested
- 23 rebars would more or less follow the worst-case scenario
- 24 demonstrated by this result, 55 out of 110. It's based
- 25 on an assumption; correct?

2

5

8

- 1 Q. So two categories; right? One would be greater than or
  - equal to 16, and the other would be less than 16; right?
- 3 Two families; right?
- 4 A. Yes. Yes.
  - Q. So, within each family of failures, you pick the worst
- 6 case; is that what has been done? You pick the worst
- 7 example for each family; correct?
  - A. I think this is in the verification report.
- 9 Q. Yes. Let's look at that. 4.3 of the verification
- 10 report.
- 11 A. Yes, this is in the verification report.
- 12 Q. Yes. Let's look at that. BB16, page 9977. 4.3.2.
- 13 It's actually similar to what you have said in your
- 14 report.
- 15 A. Yes.
- 16 So this is exactly -- I'm copying what they were
- 17 saying.
- 18 Q. Yes.

22

- 19 A. I claim this is not a statistical issue.
- 20 Q. You assume that the 7 per cent untested rebars for this
- 21 project would be -- you are assuming that the untested
  - 7 per cent has a quality equal to the worst case
- 23 situation of the failed cases within the past nine
- 24 years. Is that what you're saying?
- 25 A. I think what I was -- just trying to repeat what is

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- A. Based on what assumption?
- 2 COMMISSIONER HANSFORD: 55 out of 110,000, Mr Shieh.
- 3 MR SHIEH: Yes, 55 out of 110,000.
- COMMISSIONER HANSFORD: The transcript says 55 out of 110.
- 5 MR SHIEH: 110,000.
- 6 So it was assuming that the untested 7 per cent of
- 7 the rebar has attributes or qualities which are
- 8 comparable to the rebars that have been tested by the
- 9 MTR for the past nine years, forming that 110,000
- 10 population for sample?
- 11 A. Yes. My understanding, the 7 per cent untested rebars,
- 12 that basically means untested after the 7 per cent
- 13 rebars being delivered to the site. So my understanding
- 14 is there is CS2:2012 clearly states there's
- 15 manufacturer's test, there is the purchaser's test.
- 16 That's basically on-site delivery test. And this
- 17 7 per cent is after the batch delivered on site but they
- 18 didn't test this 7 per cent. And based on this
- 19 laboratory test, there are 110,000 rebars tested in the
- 20 past nine years and 55 samples are defective.
- 21
- 22 A. Yes, that's all the information.
- 23 Q. And, of those defective samples, they are of different
- 24 diameters?
- 25 A. Yes, that's --

- 1 written in the verification report.
- 2 Q. Yes.
- 3 A. And I emphasise this is not a statistical problem, there
- 4 is no statistical model.
- 5 Q. I know. There are 55 failed samples out of 110,000
  - samples tested by MTRC's laboratory; yes?
- 7 A. Yes.

- 8 Q. Those 110,000 samples could come from any project, of
- 9 any manufacturer; right?
- 10 A. I don't know.
- 11 Q. You don't know?
- 12 A. Yes.
- 13 Q. Fine. Basically, is it the purpose of the exercise,
- 14 first of all, to say within these 55 failed cases, let's
- 15 say this many belong to this diameter and that many
- 16 belong to the other diameter, so you divide them into
- 17 two families, correct, according to diameter; yes?
- 18 A. Clearly that's what is written here, yes.
- 19 16 millimetres is the threshold.
- 20 Q. Yes. And from each family, basically, the exercise --
- tell me, because you said so in your report and I'm 21
- 22 asking whether this was in fact what was done -- that
- 23 is, for diameter of 16 or above, you go back to look at 24
- the failed cases of 16 or above, and you look at the 25 worst case out of those failed cases and check how many

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1	per cent strength reduction that adds up. Is that the	1	MR PENNICOTT: Sir, I have a few questions. It probably
2	exercise performed?	2	won't take more than five minutes or so, so if we can
3	A. No. I didn't do this exercise. I simply repeat what is	3	ask the transcript writers to bear with us, perhaps we
4	written in the verification report, and I said this is	4	can just plough on, unless you really
5	not a statistical issue. That's all I said.	5	CHAIRMAN: Yes, that sounds best.
6	Q. Okay. So somebody decided to assume that the 7 per cent	6	Would that be all right?
7	untested rebars would be of a quality equivalent to the	7	COURT REPORTER: Yes.
8	worst example of the failed cases tested by the MTR in	8	MR PENNICOTT: Thank you.
9	the past nine years?	9	WITNESS: Excuse me, because I think I want to go to the
10	A. Yes, but I just as a layman, about all this rebar	10	restroom.
11	testing or whatever being written in this paragraph, I'm	11	CHAIRMAN: Sorry.
12	just wondering why those 7 per cent never been tested.	12	WITNESS: Is that okay? I will come back right away.
13	It's clearly saying manufacturer's test, purchaser's	13	CHAIRMAN: Ten minutes.
14	test, why those 7 per cent not tested, and now you want	14	WITNESS: Thank you very much, Chairman.
15	to do back-calculating. Again, all this	15	(4.08 pm)
16	back-calculating performed by Dr Wells, it's not so	16	(A short adjournment)
17	meaningful. He was trying to back-calculate whether the	17	(4.20 pm)
18	random sample is genuinely random. I can tell you any	18	Examination by MR PENNICOTT
19	sample can be a valid random sample. If I toss a die,	19	MR PENNICOTT: Thank you, sir.
20	you observe ten 6s ten times 6 numbers, it's a rare	20	Good afternoon, Prof Yin.
21	event but it may occur. You do Mark 6, any number can	21	A. Good afternoon.
22	come out. It's a valid random sample.	22	Q. My name is Ian Pennicott. I'm one of the counsel to the
23	The only difference, probably the chance is slim to	23	Commission. Thank you very much for coming along to
24	observe those rare events, but you can't question	24	give evidence to the Commission. I don't think that's
25	whether it's random or not random.	25	been said to you by anybody yet.
	Page 134		Page 136
ı			
1	So I think all this back-testing or back-calculating	1	Prof Yin, I just have a few questions for you.
1 2	those probabilities, it's not meaningful. It's just my	1 2	Prof Yin, I just have a few questions for you.  A. Okay.
	those probabilities, it's not meaningful. It's just my understanding.		Prof Yin, I just have a few questions for you.  A. Okay.  Q. And they really all relate to one particular topic.
2	those probabilities, it's not meaningful. It's just my understanding.  Q. You are not here to ask me questions.	2	Prof Yin, I just have a few questions for you.  A. Okay.  Q. And they really all relate to one particular topic.  A. Okay.
2 3	those probabilities, it's not meaningful. It's just my understanding.  Q. You are not here to ask me questions.  A. Okay.	2 3	Prof Yin, I just have a few questions for you.  A. Okay.  Q. And they really all relate to one particular topic.  A. Okay.  Q. Which is the combined defective rate in relation to the
2 3 4 5 6	those probabilities, it's not meaningful. It's just my understanding.  Q. You are not here to ask me questions.  A. Okay.  Q. But I can answer you by telling you that the reason why	2 3 4 5 6	Prof Yin, I just have a few questions for you.  A. Okay.  Q. And they really all relate to one particular topic.  A. Okay.  Q. Which is the combined defective rate in relation to the capping beam coupler connections, a matter that Mr Shieh
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	Page 137		Page 139
1	Q. What they say is, at paragraph 15:	1	Q. If we could go, please, to page 26703, paragraph 18.
2	"Broadly speaking, the statistical analyses adopted	2	What Mr Ng says in paragraph 18 and Mr Ng gave
3	in stage 2b of the holistic report include:	3	evidence earlier this week, Prof Yin he says this:
4	(1) Binomial statistical analysis; and	4	"As set out in paragraph 15 of the COI stat
5	(2) The Formula" capital F, a point mentioned	5	report" that's the one in paragraph 15 I took you to
6	earlier by Mr Shieh "(as defined at paragraph 43	6	just a moment ago "broadly speaking the statistical
7	below)	7	analyses adopted in the holistic report include: (i)
8	to cater for the different situations as	8	binomial statistical analysis; and, (ii) Prof Yin's
9	explained below."	9	suggested Formula (the 'Formula')."
10	Do you see that, Prof Yin?	10	Do you see?
11	A. Yes.	11	A. Yes.
12	Q. Can we then go to paragraph 43 perhaps paragraph 42,	12	Q. Perhaps I may be forgiven for thinking that Mr Ng was
13	just to get the introduction to this. The report says:	13	telling us that appendix II that we looked at a moment
14	"In mid-June 2019" I'm reading from the bottom of	14	ago, in the report, was in fact your calculation, but as
15	page 17, Prof Yin, paragraph 42.	15	I understood your answers to Mr Shieh, you have not
16	A. Okay.	16	you certainly weren't, you say, responsible for
17	Q. "In mid-June 2019, MTR proposed using binomial analysis		preparing that document, indeed I think you said you had
18	to calculate the defective rate for each of the EWL slab	18	never seen it before; is that right?
19	side and the capping beam side coupler engagements,	19	A. I never seen this document before, but the calculation
20	followed by a probability analysis to calculate the	20	as he said I suggested but, you see, I didn't prepare
21	combined reduction factor. The task force group	21	anything here. Maybe some suggested how to calculate
22	commented that MTRC's proposed analysis was not	22	that I explained and he worked out the detail. I don't
23	acceptable from a statistical perspective."	23	know. I wouldn't use this kind of symbol in my
24	Then the more important part, 43:	24	derivation. You look at my derivation, it's very
25	"Eventually, a formula as shown in appendix II (the	25	mathematical. This is very like English writing, like
	Page 138		Page 140
1	'Formula') was shared with MTR, which MTR understood	1	essay writing. I wouldn't use three letters to denote
2	came from the government's statistical advisers and	2	one symbol. So this whole thing here, the appendix,
3	would account for: (i) the combined defective rates of	3	I probably explained to him how you are supposed to do
4	the coupler connections at both the slab side and the	4	the calculation, but I didn't write the whole thing.
5	capping beam side; and, (ii) the small sampling size at	5	Q. All right. We've seen, Mr Shieh took you to it, that in
6	the capping beam area."		Q. I'm iight. We've seem, i'm simen toon you to it, that in
7	the cupping beam area.		your report for the Commission you have set out your
l '	Do you see that?	6 7	your report for the Commission you have set out your calculation, and we've looked at that
8	Do you see that?  A Yes	7	calculation, and we've looked at that.
8	A. Yes.	7 8	calculation, and we've looked at that.  A. In my report?
9	A. Yes.  Q. If you go to what's described as appendix II it's in	7 8 9	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.
9 10	<ul><li>A. Yes.</li><li>Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you</li></ul>	7 8 9 10	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.
9 10 11	A. Yes.  Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you will see there, on a document that is probably now	7 8 9 10 11	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.  Q. That's right.
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9 10 11 12 13 14 15	<ul> <li>A. Yes.</li> <li>Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you will see there, on a document that is probably now familiar to you because it was shown by Mr Shieh to you earlier, albeit in a different place; do you see that, Prof Yin?</li> <li>A. Yes.</li> </ul>	7 8 9 10 11 12 13 14	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.  Q. That's right.  A. And I verified everything in my report, calculated.  Q. Of course you've got your calculation in your report and
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9 10 11 12 13 14 15 16 17	<ul> <li>A. Yes.</li> <li>Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you will see there, on a document that is probably now familiar to you because it was shown by Mr Shieh to you earlier, albeit in a different place; do you see that, Prof Yin?</li> <li>A. Yes.</li> <li>Q. So it's the one that has the combining calculation, if I can call it that</li> </ul>	7 8 9 10 11 12 13 14 15 16	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.  Q. That's right.  A. And I verified everything in my report, calculated.  Q. Of course you've got your calculation in your report and that makes no reference to the 237 and the split between 175 and 62, there's no reference to Qa and Qb?
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9 10 11 12 13 14 15 16 17 18	<ul> <li>A. Yes.</li> <li>Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you will see there, on a document that is probably now familiar to you because it was shown by Mr Shieh to you earlier, albeit in a different place; do you see that, Prof Yin?</li> <li>A. Yes.</li> <li>Q. So it's the one that has the combining calculation, if I can call it that</li> <li>A. Okay.</li> </ul>	7 8 9 10 11 12 13 14 15 16 17	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.  Q. That's right.  A. And I verified everything in my report, calculated.  Q. Of course you've got your calculation in your report and that makes no reference to the 237 and the split between 175 and 62, there's no reference to Qa and Qb?  A. Yes.  Q. Did you ever you've obviously clearly had a discussion with MTR
9 10 11 12 13 14 15 16 17 18	<ul> <li>A. Yes.</li> <li>Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you will see there, on a document that is probably now familiar to you because it was shown by Mr Shieh to you earlier, albeit in a different place; do you see that, Prof Yin?</li> <li>A. Yes.</li> <li>Q. So it's the one that has the combining calculation, if I can call it that</li> <li>A. Okay.</li> <li>Q but a document produced, it is said, at this stage by</li> </ul>	7 8 9 10 11 12 13 14 15 16 17 18	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.  Q. That's right.  A. And I verified everything in my report, calculated.  Q. Of course you've got your calculation in your report and that makes no reference to the 237 and the split between 175 and 62, there's no reference to Qa and Qb?  A. Yes.  Q. Did you ever you've obviously clearly had a discussion with MTR  A. Clearly, yes.
9 10 11 12 13 14 15 16 17 18 19 20	<ul> <li>A. Yes.</li> <li>Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you will see there, on a document that is probably now familiar to you because it was shown by Mr Shieh to you earlier, albeit in a different place; do you see that, Prof Yin?</li> <li>A. Yes.</li> <li>Q. So it's the one that has the combining calculation, if I can call it that</li> <li>A. Okay.</li> <li>Q but a document produced, it is said, at this stage by MTR.</li> </ul>	7 8 9 10 11 12 13 14 15 16 17 18 19 20	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.  Q. That's right.  A. And I verified everything in my report, calculated.  Q. Of course you've got your calculation in your report and that makes no reference to the 237 and the split between 175 and 62, there's no reference to Qa and Qb?  A. Yes.  Q. Did you ever you've obviously clearly had a discussion with MTR  A. Clearly, yes.  Q about this formula. Did you ever supply them with
9 10 11 12 13 14 15 16 17 18 19 20 21	<ul> <li>A. Yes.</li> <li>Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you will see there, on a document that is probably now familiar to you because it was shown by Mr Shieh to you earlier, albeit in a different place; do you see that, Prof Yin?</li> <li>A. Yes.</li> <li>Q. So it's the one that has the combining calculation, if I can call it that</li> <li>A. Okay.</li> <li>Q but a document produced, it is said, at this stage by MTR.</li> <li>A. Yes.</li> </ul>	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.  Q. That's right.  A. And I verified everything in my report, calculated.  Q. Of course you've got your calculation in your report and that makes no reference to the 237 and the split between 175 and 62, there's no reference to Qa and Qb?  A. Yes.  Q. Did you ever you've obviously clearly had a discussion with MTR  A. Clearly, yes.  Q about this formula. Did you ever supply them with an actual formula, or did you just discuss the
9 10 11 12 13 14 15 16 17 18 19 20 21 22	<ul> <li>A. Yes.</li> <li>Q. If you go to what's described as appendix II it's in the same file, towards the end, right at the end you will see there, on a document that is probably now familiar to you because it was shown by Mr Shieh to you earlier, albeit in a different place; do you see that, Prof Yin?</li> <li>A. Yes.</li> <li>Q. So it's the one that has the combining calculation, if I can call it that</li> <li>A. Okay.</li> <li>Q but a document produced, it is said, at this stage by MTR.</li> <li>A. Yes.</li> <li>Q. Could you then please be shown the witness statement of</li> </ul>	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	calculation, and we've looked at that.  A. In my report?  Q. Yes, in your report.  A. Yes, I had my own calculation.  Q. That's right.  A. And I verified everything in my report, calculated.  Q. Of course you've got your calculation in your report and that makes no reference to the 237 and the split between 175 and 62, there's no reference to Qa and Qb?  A. Yes.  Q. Did you ever you've obviously clearly had a discussion with MTR  A. Clearly, yes.  Q about this formula. Did you ever supply them with an actual formula, or did you just discuss the parameters of it and how to do it?

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- I don't know, the whole afternoon to discuss the whole 1
- 2 thing. I explained it on the board, what you are
- 3 supposed to do, and then that's what he did.
- 4 Q. Right. Okay. But your evidence to the Commission --
- 5 and you've said this a couple of times now so I'm sorry
- 6 for repeating it -- but you never carried out
- 7 a calculation that utilised the 237, the 175, 62, and
- 8 the Qa and Qb; that's not your approach?
- 9 A. That's not my approach. Let me clarify again: using Qa
- 10 and Qb in this derivation is for different purpose.
- 11 I sort of understand what he was trying to do. He was
- 12 trying to compute an overall defect rate, overall, and
- 13 what I did, in my report, is focusing the capping beam
- 14 only.
- 15 Q. Right.
- 16 A. And I had a computer code, programmed everything,
- 17 verified all the results. You can check whether they
- 18 did the same thing too.
- 19 Q. When you were asked to look at this combined
- 20 calculation, were you ever given any indication as to
- 21 what the purpose of that calculation was?
- 22 A. Yes. My understanding is, as I said, a coupler would
- 23 function if both ends butt-to-butt, and now you have
- 24 four possibilities: both sides pass, one side passes,
- 25 one side fails, or vice versa, or both sides fail.

- 1 contractor, similar workmanship, that's all the
  - information I have. How close they are, I don't know.
- 3 Q. I understand your position, Prof Yin, and I just want to 4 press you a little bit further on it --
- 5 A. Okay.

2

- 6 Q. -- just to see how genuine this is an engineering manner
- 7 rather a statistical matter, and I think you have fairly
- 8 said, at least on a couple of occasions now, that as you
- 9 view it, it's primarily an engineering matter; would you
- 10 agree with that?
- 11 A. Yes, I agree with that.
- 12 Q. Can I ask you to be shown your slide 20.
- 13 A. Okay.
- 14 Yes.
- 15 Q. Perhaps the first thing to note is the heading,
- 16 Prof Yin.
- 17 A. Yes.
- 18 Q. You say "Possible" --
- 19 A. And question mark.
- 20 Q. -- and you have a question mark.
- 21 A. Yes.
- 22 Q. That's right. As I think you have just indicated, this
- 23 is a question that has been perhaps running through your
- 24 mind --
- 25 A. Yes, I've been thinking about it.

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- 1 That's my understanding. And to calculate the failure
- 2 rate for coupler with both sides being considered, you
- 3 have to go through this kind of probability derivation.
- 4 Q. Were you ever told how this calculation might be used in
- 5 terms of extrapolating the results to area A?
- 6 A. No. I was not aware of this at all.
  - Q. Right. To be fair to you, Prof Yin, in your reports to
- 8 the Commission, you make no reference to the
- 9 extrapolation exercise to area A. However, in your
- 10 slides this morning --
- A. Yes, I remember. 11

7

- 12 Q. -- you do make reference to it.
- 13 A. Actually, what I put there is -- because this has been
- 14 going on, discussed so many times, about area A no
- 15 coupler, why, whether you can being extrapolate -- I've
- 16 been thinking all these days should we extrapolate or
- 17 whether you call it an extrapolation? It's more
- 18 an engineering problem. They can decide if they want to
- 19 extrapolate it or not. But if you ask me as
- 20 a statistician whether I would agree with extrapolation,
- 21 I would say so. Even though it's more engineering
- 22 problem, you can discuss with engineers whether --
- 23 because they know the structure more than I do. There
- 24 are two things I really have no idea. I only been given
- 25 the information they are similar configurations, same

- 1 Q. That's fine. So far as the words in red are concerned,
  - 2 Mr Shieh I think asked you about one or two of these
    - matters, but when you say, for example, "similar
  - 4 configurations", you mean similar configurations of the
  - 5 rebar and the coupler connections; is that what you
  - 6

3

- 7 A. "Similar configurations", yes, you can think that way.
- 8 Q. "Same contractor" -- perhaps you mean the same
  - sub-contractor, the sub-contractor responsible for
- 10 installing the rebar?
- A. Yes. I was given this kind of information. I don't 11
- 12 know. I couldn't verify this.
- 13 Q. Right. You say "similar workmanship".
- 14 A. Because of same sub-contractor.
- 15 Q. Okay. What other factors might be important, do you
- 16 think? The same actual workers doing the work?
- 17 A. Let me put it this way. If you, suppose, need a kidney
- 18 transplant, you need to find someone who has a lot of 19 similarities to you in order for this transplant to be
- 20 working. I'm using medical example again. So you've
- 21 got to find someone who matches your body so that your
- 22 immune system would not kick that thing out, because
- 23 there is a danger thing that thing does not work in your
- 24 body and the patient would die very quickly.
- 25 Q. Yes.

Page 147 Page 145 1 1 A. So that's called a GvHD, graft versus host disease, today. 2 2 people will die in a couple of weeks if that thing is Perhaps I will first provide you with the background 3 not accepted by the body. 3 regarding your discussion with Mr Shieh and then I will 4 So similar, basically, you -- how to say -- you find 4 ask you to clarify a few points. 5 5 some people who are the same blood type, similar A. Okay. 6 6 genetics, all these things similar, and then you can do Q. Now, you recall that before our lunch break today you 7 7 a successful donor transplant. were asked by Mr Shieh regarding who decided the 8 8 Q. In a nutshell, Prof Yin -- perhaps it's just a matter of binomial analysis; do you remember that? 9 9 common sense -- the more similarities you can find the A. Yes. 10 10 more likely it is that the extrapolation is justified? Q. Then you were also asked about what information was 11 A. Yes. 11 actually placed before there was a decision on 12 12 Q. All right. Now, you've referred to similar a binomial analysis; do you remember that? 13 configurations, same sub-contractor, similar 13 A. Mm-hmm. 14 14 Q. Now we all know that in terms of the results regarding workmanship. What about if I told you that the work, 15 15 the relevant work, that is the connections in area A and the tests for coupler connections, we have this 16 area HKC were carried out a year apart, would that be 16 classification of only two types of results: pass and 17 17 fail. relevant, or is that not a statistical matter? 18 A. I think it's not a statistical matter. It's just 18 A. Yes. 19 19 a common-sense matter. I think anybody can have their Q. I just want you to clarify this. If you can take a look 20 20 at your own report, first report. own view. This is not a -- statistical matter, you have 21 to give me the numbers and I do the calculation for you. 21 A. Okay. 22 22 If you give me a sentence everybody can interpret it Q. If I can ask you to take a look at page 17, 23 23 differently. I need the actual number and then I can paragraph 3.2.2. 24 24 A. Okay. program it and do calculation for you. But if you just 25 ask me a very general, broad question, I don't think it 25 Q. Here you said: Page 146 Page 148 1 is a statistical question. 1 "In the design stage of the holistic proposal, 2 2 Q. We were looking for similarities and one similarity I verified the suggestion using a binomial analysis by 3 3 MTRCL." might be they were carried out at roughly the same time. 4 4 Pausing here, I think we have seen evidence That might be another factor. And I'm just indicating 5 to you that as a matter of fact, the area A work was 5 elsewhere that the binomial analysis was proposed first 6 carried out in May and June 2015, and the HKC work was 6 by MTR; right? 7 carried out in July and August 2016, over a year later. 7 A. Yes. 8 I just wondered whether you had any view as to whether 8 Q. So that you have no dispute about; right? 9 9 that might be relevant. A. Yes. 10 10 A. I cannot answer this question. I don't know. Q. But you said you verified the suggestion using 11 a binomial analysis by MTRCL. So, at the time when you Q. All right. So ultimately, Prof Yin -- my last question, 11 12 12 really -- you are, as I understand it, content -- you were doing your verification for the suggestion of this 13 13 have asked yourself the question, you have put a few binomial analysis, were you actually given this 14 thoughts down --14 information, namely the information that the results 15 A. Yes. 15 will be classified into two types, pass and fail only? 16 Q. -- and ultimately you are prepared to leave this matter 16 Were you given to understand that at that time? 17 to the engineers? 17 A. You mean based on the criteria, based on the two 18 18 criteria? I was not given any criteria. 19 MR PENNICOTT: Thank you very much. I have no further 19 Q. Right. Let's not talk about the details about the 20 20 criteria first. questions. 21 Re-examination by MR KHAW 21 A. All right. 22 22 MR KHAW: Prof Yin, it's been a long day for you. I only Q. 37 or 40mm, et cetera. Let's not talk about that. 23 23 have two questions --A. Okay. 24 A. Okay. 24 Q. Just the classification of pass and fail. Leaving aside 25 Q. -- which arise from Mr Shieh's discussion with you 25 the details of the criteria.

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2

14

15

22

- A. Okay. 1
- 2 Q. That piece of information, ie pass and fail, the end
- 3 result will only be that classification. That piece of
- 4 information, was it given to you at the time when you
- 5 verified whether binomial analysis should be used or
- 6 not, or afterwards?
- 7 A. I don't quite get the question, because binomial is
  - about "yes" or "no", pass or fail. That's what binomial
- 9 means.
- 10 O. Yes.

8

- 11 A. Just like you ask me a question "yes" or "no", I have to
- 12 say "yes" or "no". That's binomial. So we've been
- 13 using binomial for the whole day in this courtroom. So
- 14 binomial is a very standard approach, and for me to look
- 15
- at the problem, the first natural approach for me is
- 16 binomial approach, and I have already stated so many
- 17 advantages about why we use it. If we try to use
- 18 multinomial, continuous outcome, things could become
- 19 complicated, even become infeasible.
- 20 Q. Right. So, at the time when you were considering the
- 21 suggestion of a binomial approach, were you actually
- 22 given the details regarding the acceptance or rejection
- 23 criteria?
- 24 A. No.

1

25 Q. Thank you.

- 1 A. It's not dramatic.
  - Q. Can you recall the --
- 3 A. I cannot recall the exact number, but I can tell you
- 4 this. First, Dr Wells' argument is reasonable. He says
- 5 the sample size is small and I use normal approximation.
- 6 His argument is reasonable so I went back and used the
- 7 bootstrap. As I said, I used the bootstrap and verified
- 8 the answer would be very close, so it's kind of
- 9 reassuring my own calculation.
- 10 Secondly, I also did some sensitivity analysis by 11 using all the EWL data, on the EWL slab side, and the
- 12 other side use capping beam side, still two out of 11.
- 13 I did this calculation, I don't recall exactly the
  - number, but the number is not dramatically decreased.
  - Actually, he, Dr Wells, is correct in the sense that
- 16 if you have a larger sample size, certainly you have
- 17 higher accuracy. That's very much common sense in 18 statistical perspective.
- 19 Q. Now, in terms of the verification that you have done, 20
- the calculation you have done, by taking into account 21 the entire EWL slab data, would you be able to tell, in
  - terms of some degree of magnitude, the percentage? Is
- 23 it possible?
- 24 A. It's possible. If you allow me to use my -- look at my 25
  - laptop, my laptop has the result. Am I allowed to check

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- The next question is about one part of Dr Wells'
- 2 report. If you could take a look at his report, his
- 3 report for the Original Inquiry, page 11,
- 4 paragraph 4.40.
- 5 A. Okay.
- 6 Q. I think Mr Shieh took you to subparagraph (b); do you
- 7 remember?
- 8 A. Yes.
- 9 Q. It says:
- 10 "It is not clear to me why data relating to the EWL
- 11 slab side does not also use the main EWL data set, as
- 12 doing so would greatly increase the confidence in the
- 13 results as well as overcoming some of the mistakes made
- 14 (by assuming a large sample approximation, when the
- 15 sample size was actually very small) ..."
- 16 Do you remember that?
- 17 A. I remember, yes.
- 18 Q. I think, in answer to Mr Shieh's question in this
- 19 regard, you told us that you had in fact carried out
- 20 verification or carried out calculations --
- 21
- Q. -- on the basis of the entire EWL slab date for the EWL 22
- 23 slab side; right?
- 24 A. Yes.
- 25 Q. Then you told us that the difference was minimal?

- that result? 1
- 2 Q. If you can, please.
- 3 CHAIRMAN: Certainly.
- 4 A. Okay. Let me open my laptop and I can tell you right
- 5
- 6 How do you want me to show the result to everyone?
- 7 Can this be shown to other people? Because I've found
- 8 the table I produced.
- 9 CHAIRMAN: You can just tell us what the result is for the
- 10 moment, and those who want to have a look --
- 11 MR PENNICOTT: Show it to Mr Khaw first. (Handed).
- 12 A. But I think he may have a hard time to understand all my 13 notations.
- 14 MR KHAW: I'm sure.
- 15 A. It's just a table for myself --
- 16 MR PENNICOTT: Presumably, you have been teaching him a bit!
- 17 A. Do you need me to help you understand?
- 18 CHAIRMAN: Mr Khaw, would you like the professor to assist
- 19 you for a moment?
- 20 MR KHAW: It would be helpful, I'm sure.
- 21 A. I can explain the numbers a little bit to you and then
- 22
- 23 COURT REPORTER: You need to speak into a microphone, any
- 24 microphone.
- 25 CHAIRMAN: Any microphone.

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1	A. Okay. So look at the top row. It's "2", "7", "2",	1	next Friday.
2	"11". That's our original calculation; right? So this	2	MR PENNICOTT: That's correct, sir. Yes, when we will
3	second row is "25", "90", "2", "11". The number dropped	3	commence the hearing of the further project management
4	from 68.3 per cent to 56.1 per cent. If I use 90	4	experts' evidence.
5	couplers as the total sample size, 25 failures on the	5	CHAIRMAN: Yes. Good. Thank you.
6	EWL slab side.	6	Further to what happened this morning, the
7	If I further use 183, 48 failures, it will keep	7	meeting
8	dropping to 54.4 per cent. So, basically, the defective	8	MR PENNICOTT: Yes, sir.
9	rate dropped from 68.3 per cent to 56.1 per cent.	9	CHAIRMAN: I unfortunately won't be here for a little
10	For the 12 points	10	while. I have a conference in Singapore to go to on
11	COMMISSIONER HANSFORD: Sorry, was it 54.4 or 56.1?	11	Monday, but if you could perhaps, Mr Pennicott, when you
12	A. 56.1.	12	have time, if you have time, perhaps speak directly to
13	COMMISSIONER HANSFORD: What was the 54.4?	13	Mr Boulding, Mr Khaw and others, just to see what would
14	A. That's if I combine all the samples, including I think	14	be an advisable way forward from your perspective.
15	NSL as well.	15	MR PENNICOTT: Yes, sir.
16	This is EWL. If I combine EWL and NSL, all samples	16	CHAIRMAN: And bearing in mind Leightons of course.
17	together, they will be further drop, but the drop is to	17	MR PENNICOTT: Of course.
18	54.4.	18	CHAIRMAN: It's important that no party is prejudiced.
19	So this is basically trying to verify Dr Wells'	19	MR PENNICOTT: Yes. We will try and put something very
20	argument, "Why don't you combine all these samples	20	briefly in writing over the weekend or early next week.
21	instead of just using 11?"	21	CHAIRMAN: Thank you.
22	MR KHAW: So 56.12, that is the result we get after taking	22	MR PENNICOTT: Which we may circulate to everybody, and then
23	into account the EWL slab entire data; right?	23	we will decide the best way forward in terms of
24	A. 56.1, yes, EWL entire data. That's basically 90	24	formalising the position.
25	samples, 25 failures.	25	CHAIRMAN: Good.
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1	COMMISSIONER HANSFORD: And 54.4 if you then add the NSL	1	MR PENNICOTT: Sir, could I just mention, in relation to the
2	data; is that correct?	2	project management experts, I think I've been keeping up
3	A. Yes.	3	with the emails that have been going to and fro today,
4	COMMISSIONER HANSFORD: Would it be helpful please tell	4	but my understanding is that Mr Huyghe, the MTR's
5	me if it wouldn't if we had a print-out of that page?	5	project management expert, is producing a further report
6	MR PENNICOTT: We can certainly ask for a print-out of that	6	which I think he's just been given another day's
7	page, yes.	7	extension to produce, which I think will be therefore
8	COMMISSIONER HANSFORD: Thank you.	8	tomorrow evening.
9	MR KHAW: I was about to suggest that, yes. I think we will	9	CHAIRMAN: Yes.
10	make the arrangements.	10	MR PENNICOTT: And we are expecting a joint statement from
11	MR PENNICOTT: Not necessarily now.	11	the experts I think now, again with a further extension
12	COMMISSIONER HANSFORD: Not immediately, no.	12	being granted, on either Wednesday but it might
13	MR KHAW: I have no further questions.	13	Thursday it's either the 2nd or the 3rd, I've
14	CHAIRMAN: I'm just thinking of the print-out. It could be	14	forgotten but the middle of next week.
15	done by the professor and he can arrange to deliver.	15	CHAIRMAN: All right. Have we cleared up the difficulty
16	MR PENNICOTT: I'm sure the government can arrange for it to	16	with Mr Wong, I think it is?
17	be done, sir.	17	MR PENNICOTT: No, we don't need to concern ourselves with
18	CHAIRMAN: Yes, or maybe it can be done this afternoon here.	18	that at the moment.
19	I don't know if you have anybody capable of doing it.	19	CHAIRMAN: Good. Thank you very much indeed.
20	MR KHAW: Yes.	20	Professor, thank you very much. I know we held you
21	CHAIRMAN: Good. Thank you.	21	this morning, but you have been of really great help.
′)′)	Mr Pennicott, anything further	22	Thank you very much indeed. I just hope it hasn't been
22	MR PENNICOTT: Not from mo gir	122	
23	MR PENNICOTT: Not from me, sir.	23	too much of a strain for you today. But thank you.
	MR PENNICOTT: Not from me, sir.  CHAIRMAN: this afternoon? Good.  I think then that we are adjourned through until	23 24 25	WITNESS: Thank you.  CHAIRMAN: Good. Anything further?

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1	(The witness was released)
2	MR SHIEH: There is an outstanding witness from Leighton who
3	was stood over from Monday.
4	CHAIRMAN: Mr Cowley, yes. I thought we were going to
5	include him with
6	MR PENNICOTT: We are, and I apologise to Mr Shieh that
7	I forgot that. I can speak to him about logistics. On
8	the assumption of course that Mr Cowley is available
9	next Friday, I certainly would suggest that we call him
10	first, but obviously that's subject to Mr Shieh telling
11	us that he's available.
12	CHAIRMAN: All right.
13	MR PENNICOTT: Perhaps I can have a word with Mr Shieh abou
14	that when we break.
15	CHAIRMAN: Of course. Yes. Thank you very much indeed.
16	Anything further? Good. Thank you all very much
17	indeed. So we are adjourned until 10 am 10 am?
18	MR PENNICOTT: Yes.
19	CHAIRMAN: 10 am next Friday. Thank you.
20	(4.55 pm)
21	(The hearing adjourned until 10.00 am
22	on Friday, 4 October 2019)
23	on mady, 1 decoder 2017)
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